NUREG-1437
Supplement 62

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 62

Regarding License Renewal of Diablo Canyon Nuclear Power Plant, Units 1 and 2

Final Report

Office of Nuclear Material Safety and Safeguards

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United States Nuclear Regulatory Commission
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Regarding License Renewal of Diablo Canyon Nuclear Power Plant, Units 1 and 2

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) prepared this supplemental environmental impact statement in response to an application submitted by Pacific Gas and Electric Company to renew the operating licenses for the Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon), for an additional 20 years. This supplemental environmental impact statement evaluates the environmental impacts of the proposed action and the alternatives to the proposed action. The alternatives evaluated in detail were the replacement power alternatives of purchased power and renewables combination, which were determined to be commercially viable, and the no-action alternative. The NRC staff's recommendation is that the adverse environmental impacts of license renewal for Diablo Canyon are not so great that preserving the option of license renewal for energy-planning decision-makers would be unreasonable. This recommendation is based on:

- the analysis and findings in NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants
- the Environmental Report submitted by Pacific Gas and Electric Company
- the NRC staff's consultation with Federal, State, Tribal, and local agencies
- the NRC staff's independent environmental review
- the NRC staff's consideration of public comments received during the scoping process and on the draft supplemental environmental impact statement

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Background

By letter dated November 7, 2023, Pacific Gas and Electric Company (PG&E) submitted an application to the U.S. Nuclear Regulatory Commission (NRC, the Commission) to issue renewed operating licenses for Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon), for an additional 20-year period (PG&E 2023-TN9822).

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 51.20(b)(2) (TN10253), the renewal of a power reactor operating license requires preparation of an environmental impact statement (EIS) or a supplement to an EIS. In addition, 10 CFR 51.95(c) (TN10253) states that, in connection with the renewal of a power reactor operating license, the NRC shall prepare an EIS, which is a supplement to the Commission's NUREG-1437, Revision 2, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Final Report*, dated August 2024 (LR GEIS) (NRC 2024-TN10161).

Upon finding PG&E's application acceptable for docketing on December 19, 2023 (88 FR 87817-TN9999), the NRC staff began the environmental review process described in 10 CFR Part 51, "*Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*" (TN10253), by publishing a Notice of Intent to prepare a supplemental environmental impact statement (SEIS) and to conduct scoping for Diablo Canyon license renewal. Thereafter, the NRC staff:

- conducted two public scoping meetings: one held virtually on February 1, 2024, and one held in-person on February 8, 2024, in San Luis Obispo, California
- conducted virtual and onsite audits during the weeks of March 18, 2024, March 25, 2024, and June 24, 2024
- reviewed PG&E's environmental report (ER) (PG&E 2023-TN9822) and compared it to the LR GEIS
- consulted with Federal, State, Tribal, and local agencies
- conducted a review of the application following the guidance set forth in NUREG-1555, Supplement 1, Revision 2, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Operating License Renewal, Final Report*, dated August 2024 (NRC 2024-TN10251)
- conducted two public meetings to receive comments on the draft SEIS: one meeting held virtually on November 14, 2024, and one held in-person on November 20, 2024, in San Luis Obispo, California
- considered public comments received during the scoping process and on the draft SEIS

Proposed Federal Action

PG&E initiated the proposed Federal action by submitting an application for license renewal for Diablo Canyon, for which the existing licenses (DPR-80 and DPR-82) include the expiration dates of November 2, 2024 (Unit 1), and August 26, 2025 (Unit 2) (PG&E 2023-TN9822). The NRC's Federal action is to decide whether to renew the licenses for an additional 20 years. The regulation in 10 CFR 2.109 (TN6204), "Effect of Timely Renewal Application," specifies that if a licensee of a nuclear power plant files an application to renew an operating license at least 5 years before the expiration date of that license, the existing license will not be deemed to have expired until the NRC completes its safety and environmental reviews, and makes a final decision about whether to issue a renewed license. On March 2, 2023, the NRC issued to PG&E an exemption from this rule stating that if PG&E submits a license renewal application less than 5 years prior to expiration of the existing licenses but no later than December 31, 2023, and if the NRC staff finds it acceptable for docketing, the existing licenses will be in timely renewal under NRC regulations until the NRC has made a final determination on whether to approve the license renewal application (88 FR 14395-TN9998). As noted above, PG&E submitted the license renewal application for Diablo Canyon by letter dated November 7, 2023, and the NRC found that application acceptable for docketing on December 19, 2023, and, therefore, the Diablo Canyon licenses are in for timely renewal under NRC regulations until the NRC has made a final determination on whether to approve the license renewal application.

Purpose and Need for the Proposed Action

The purpose and need for the proposed action (renewal of operating licenses) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating licenses to meet future system generating needs, as such needs may be determined by State, utility, system, and, where authorized, Federal (other than NRC) decision-makers. This definition of purpose and need reflects the Commission's recognition that, absent findings in the safety review required by the Atomic Energy Act of 1954 (TN663), as amended, or in the environmental review required by the National Environmental Policy Act of 1969 (TN661), as amended, that would lead the NRC to reject a license renewal application, the NRC has no role in the energy-planning decisions of power plant owners, State regulators, system operators, and, in some cases, other Federal agencies as to whether a particular nuclear power plant should continue to operate (61 FR 28467-TN4491; NRC 2024-TN10161).

Environmental Impacts of the Proposed Action

This SEIS evaluates the potential environmental impacts of the proposed action (renewal of operating licenses). The environmental impacts of the proposed action are designated as SMALL, MODERATE, or LARGE. As established in the LR GEIS, Category 1 issues are those that meet all the following criteria:

- the environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics
- a single significance level has been assigned to the impacts (except for offsite radiological impacts of spent nuclear fuel and high-level waste disposal and offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste)
- mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation

The designations are defined as follows:

- **SMALL:** Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource

- **MODERATE:** Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource
- **LARGE:** Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource

For Category 1 issues, no additional site-specific analysis is required in this SEIS unless new and significant information is identified. Site-specific issues (Category 2) are those that do not meet one or more of the criteria for Category 1 issues; therefore, an additional site-specific review for the non-generic issues is required, and the results are documented in this SEIS. Chapter 3 of this SEIS presents the process for identifying new and significant information.

On August 6, 2024, the NRC published a final rule (89 FR 64166-TN10321) revising its environmental protection regulations in 10 CFR Part 51. Specifically, the final rule updated the potential environmental impacts associated with the renewal of an operating license for a nuclear power plant for up to an additional 20 years, which could either be an initial license renewal or a subsequent license renewal. The LR GEIS was also revised, and as an update to the 2013 LR GEIS (NRC 2013-TN2654) the 2024 LR GEIS (NRC 2024-TN10161) provided the technical basis for the final rule. The 2024 LR GEIS specifically supported the revised list of environmental issues and associated environmental impact findings for license renewal contained in Table B-1 in Appendix B to Subpart A of the revised 10 CFR Part 51. For the NRC staff, the final rule became effective 30 days after its publication in the *Federal Register* and thereafter the staff considers the new and modified issues, as applicable, in its license renewal SEISs. Compliance with the final rule by license renewal applicants is not required until 1 year following publication in the *Federal Register* (i.e., license renewal ERs submitted later than 1 year after publication must be compliant with the final rule).

Neither PG&E nor the NRC staff identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the LR GEIS. This conclusion is supported by the NRC staff's review of PG&E's ER and other documentation relevant to PG&E's activities, the public scoping process, and the findings from the site audits conducted by the NRC staff. Therefore, the NRC staff relied upon the conclusions of the LR GEIS for all Category 1 issues applicable to Diablo Canyon license renewal.

Table ES-1 summarizes the Category 2 issues relevant to Diablo Canyon license renewal and the NRC staff's findings related to those issues. If the NRC staff determined that there were no Category 2 issues applicable for a particular resource area, the findings in the LR GEIS, as documented in Appendix B to Subpart A of 10 CFR Part 51 (TN10253), are incorporated for that resource area.

Table ES-1 Summary of NRC Conclusions Relating to Site-Specific Impacts of License Renewal at Diablo Canyon

Resource Area	Relevant Category 2 Issue	Impact
Groundwater Resources	Radionuclides released to groundwater	SMALL
Terrestrial Resources	Non-cooling system impacts on terrestrial resources	SMALL
Aquatic Resources	Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	SMALL

Table ES-1 Summary of NRC Conclusions Relating to Site-Specific Impacts of License Renewal at Diablo Canyon (Continued)

Resource Area	Relevant Category 2 Issue	Impact
Aquatic Resources	Effects of thermal effluents on aquatic organisms (plants with once-through cooling systems or cooling ponds)	SMALL
Federally Protected Ecological Resources	Endangered Species Act: federally listed species and critical habitats under U.S. Fish and Wildlife Service jurisdiction	May affect but is not likely to adversely affect California red-legged frog, California condor, California least tern, Hawaiian petrel, marbled murrelet, short-tailed albatross, and southern sea otter. No effect on other federally listed species or critical habitats identified. See Section 3.8.4.1 of this SEIS.
Federally Protected Ecological Resources	Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction	May affect and is likely to adversely affect green sea turtle, loggerhead sea turtle (North Pacific distinct population segment [DPS]), leatherback sea turtle, and Pacific olive ridley sea turtle (Mexico's Pacific Coast breeding population and all other populations). May affect but is not likely to adversely affect black abalone, gray whale (Eastern North Pacific DPS), and humpback whale (Central American DPS and Mexico DPS). May affect but is not likely to destroy or adversely modify critical habitats of the black abalone and humpback whale. No effect on other federally listed species or critical habitats identified in Section 3.8.4.2 of this SEIS.
Federally Protected Ecological Resources	Magnuson-Stevens Act: essential fish habitat	No more than minimal adverse effects on the designated essential fish habitat of all life stages of coastal pelagic species complex, euphausiids (krill), groundfish, and highly migratory species.
Federally Protected Ecological Resources	National Marine Sanctuaries Act: sanctuary resources	May affect but is not likely to destroy, cause the loss of, or injure sanctuary resources of the proposed Chumash Heritage National Marine Sanctuary.
Historic and Cultural Resources	Historic and cultural resources	The proposed action would not adversely affect historic properties under the National Historic Preservation Act of 1966 or historic and cultural resources under the National Environmental Policy Act, as amended.

Table ES-1 Summary of NRC Conclusions Relating to Site-Specific Impacts of License Renewal at Diablo Canyon (Continued)

Resource Area	Relevant Category 2 Issue	Impact
Human Health	Microbiological hazards to the public	N/A[(a)]
Human Health	Electromagnetic fields (EMFs)[(b)]	Uncategorized (Uncertain Impact)
Human Health	Electric shock hazards	SMALL
Greenhouse Gas Emissions and Climate Change	Climate change impacts on environmental resources	See Section 3.15.3.2.3 of this SEIS.
Cumulative Effects	Cumulative effects	See Section 3.16 of this SEIS.

DPS = distinct population segment; EMF = electromagnetic field; SEIS = supplemental environmental impact statement.

(a) As discussed in Section 3.11.3 of this SEIS, Diablo Canyon utilizes a once-through cooling system that intakes and discharges to the Pacific Ocean. This area is not accessible to the public so further review is not warranted and continued operation is not expected to result in adverse effects to the health of the public.

(b) This issue was not designated as Category 1 or Category 2 and is discussed in Section 3.11.6.1 of this SEIS.

Severe Accident Mitigation Alternatives

Since the NRC staff has not previously considered severe accident mitigation alternatives (SAMAs) for Diablo Canyon in an EIS or related supplement or in an environmental assessment, 10 CFR 51.53(c)(3)(ii)(L) (TN10253) requires that PG&E submit, with the license renewal application, a consideration of alternatives to mitigate severe accidents. SAMAs are potential ways to reduce the risk or potential impacts of uncommon, but potentially severe, accidents. SAMAs may include changes to plant components, systems, procedures, and training.

The NRC staff's review and evaluation of PG&E's analysis regarding SAMAs and the staff's independent analyses are documented in Appendix F, "Environmental Impacts of Postulated Accidents," to this SEIS.

Alternatives to the Proposed Action

As part of its environmental review, the NRC staff relied on the description of alternative sources of replacement energy in Appendix D of the LR GEIS (NRC 2024-TN10161). The alternatives analysis in this SEIS is consistent with NEPA Section 102(2)(C)(iii), which requires a detailed statement on "a reasonable range of alternatives to the proposed agency action, including an analysis of any negative environmental impacts of not implementing the proposed agency action in the case of a no action alternative, that are technically and economically feasible, and meet the purpose and need of the proposal." Environmental impacts of replacement energy alternatives were evaluated as a consequence of the no-action alternative of not implementing the proposed action.

The NRC staff considered 14 replacement energy alternatives to the proposed action and eliminated 12 from detailed study due to technical, resource availability, or commercial limitations that are likely to exist when the Diablo Canyon operating licenses expire. Two replacement power alternatives were determined to be available and commercially viable:

- purchased power
- renewables combination

As a consequence of not implementing the proposed agency action in the case of the no-action alternative, the environmental impacts of these two alternatives, along with the no-action alternative, are evaluated in detail in this SEIS.

Recommendation

The NRC staff's recommendation is that the adverse environmental impacts of license renewal for Diablo Canyon are not so great that preserving the option of license renewal for energy-planning decision-makers would be unreasonable. This recommendation is based on:

- the analysis and findings in the LR GEIS
- the applicant's ER
- the NRC staff's consultation with Federal, State, Tribal, and local agencies
- the NRC staff's independent environmental review
- the NRC staff's consideration of public comments received during the scoping process and on the draft SEIS

ABBREVIATIONS AND ACRONYMS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
µg	microgram(s)
µS	microsievert(s)
%	percent
ac	acre(s)
AC	alternating current
ACC	averted cleanup and decontamination costs
ACHP	Advisory Council on Historic Preservation
AD	Anno Domini
ADAMS	Agencywide Documents Access and Management System
ADV	Atmospheric Dump Valve
Æ	Applied EarthWorks, Inc.
AEA	Atomic Energy Act of 1954, as amended
AFW	Auxiliary Feedwater
ALARA	as low as is reasonably achievable
ANS	American Nuclear Society
AOC	averted offsite property damage costs
AOE	averted occupational exposure
AOSC	averted onsite costs
APE	area of potential effect or averted public exposure
ARMP	1980 Archaeological Resources Management Plan
ASME	American Society of Mechanical Engineers
BMP	best management practice
BP	before present
BTA	best technology available
CAA	Clean Air Act of 1963
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CCC	California Coastal Commission
CCIC	Central Coast Information Center

CCR	*California Code of Regulations*
CCRWQCB	Central Coast Regional Water Quality Control Board
CDF	core damage frequency
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CET	containment event tree
CFR	*Code of Federal Regulations*
cfs	cubic foot/feet per second
CH_4	methane
cm	centimeter(s)
CO_2	carbon dioxide
CO_2eq	CO_2 equivalent
COE	cost of enhancement
CWP	circulating water pump
CWS	circulating water system
CZMA	Coastal Zone Management Act of 1972
dB	decibel
dBA	a-weighted decibel
Diablo Canyon	Diablo Canyon Nuclear Power Plant, Units 1 and 2
DOE	U.S. Department of Energy
DPS	distinct population segment
DSM	demand-side management
EDG	Emergency Diesel Generator
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	environmental impact statement
ELAP	Extended Loss of AC Power
EMF	electromagnetic field
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ER	environmental report
ESA	Endangered Species Act of 1973
ESU	evolutionarily significant unit

F&O	facts and observation
FC	candidate for Federal listing
FE	Federally endangered
FLEX	Diverse and Flexible Coping Strategies
FMP	fishery management plan
fps	feet (foot) per second
FR	*Federal Register*
FT	Federally threatened
ft	feet (foot)
ft^2	square feet (foot)
ft^3	cubic foot/feet
FWS	U.S. Fish and Wildlife Service
GHG	greenhouse gas
gpm	gallon(s) per minute
GPP	Groundwater Protection Program
GWP	global warming potential
ha	hectare(s)
HP	High Pressure
hr	hour(s)
Hz	hertz
ICM	Interim Compensatory Measures
IM	impingement mortality
in.	inch(es)
IPCC	Intergovernmental Panel on Climate Change
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISFSI	independent spent fuel storage installation
kg	kilogram(s)
km	kilometer(s)
km^3	cubic kilometer(s)
km/h	kilometer(s) per hour
KPDS	key plant damage state
kV	kilovolt(s)

lb	pound(s)
Leq	equivalent sound intensity level
LERF	Large Early Release Frequency
LIP	local intense precipitation
LLRW	low-level radioactive waste
LOS	level-of-service
lpm	liter(s) per minute
LOCA	loss-of-coolant accident
LR GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG-1437)
LR	license renewal
LRA	license renewal application
LRS	Liquid Radwaste System
LTSP	Long Term Seismic Program
m	meter(s)
m/s	meter(s)/second
m^2	square meter(s)
m^3	cubic meter(s)
Ma	million year(s) ago
MBTA	Migratory Bird Treaty Act
MBtu	million British thermal unit(s)
MG	million gallon(s)
MGD	million gallon(s) per day
MGM	million gallon(s) per month
MGY	million gallons per year
MHHW	mean higher high water
mi	mile(s)
MLLW	mean lower low water
MMBtu	metric million British thermal unit(s)
mph	mile(s) per hour
mrem	millirem(s)
MSA	Magnuson–Stevens Fisheries Conservation and Management Act or Mitigating Strategies Assessment
MSL	mean sea level
mSv	millisievert(s)

MT	metric ton(s)
MWe	megawatt(s) electric
mrad	millirad(s)
N_2O	nitrous oxide
NBHS	nearshore benthic hard substrate
NBSS	nearshore benthic soft substrate
NE	no effect
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NIEHS	National Institute of Environmental Health Sciences
NLAA	may affect but is not likely to adversely affect
NMFS	National Marine Fisheries Service
nmi^2	square nautical mile(s)
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPWC	nearshore pelagic/water column.
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
ODCM	Offsite Dose Calculation Manual
OECR	offsite economic cost risk
OHP	Office of Historic Preservation
ONMS	Office of National Marine Sanctuaries
OSHA	Occupational Safety and Health Administration
OTC Policy	Once-Through Cooling Policy
PBF	physical or biological features
PCE	primary constituent elements
PDR	population dose risk
PDS	plant damage state
PFMC	Pacific Fishery Management Council
PG&E	Pacific Gas and Electric Company
pH	potential of hydrogen

PM	particulate matter
PORV	Power Operated Relief Valve
ppb	parts per billion
ppm	parts per million
PRA	probabilistic risk assessment
PTO	Permit to Operate
PV	photovoltaic
PWR	pressurized water reactor
RAI	request for additional information
RCI	request for confirmation of information
RCP	representative concentration pathway
RCS	reactor coolant system
rem	roentgen equivalent man
REMP	Radiological Environmental Monitoring Program
ROI	region of influence
ROW	right-of-way
RPC	replacement power cost
RRW	risk reduction worth
RWMP	Receiving Water Monitoring Program
s	second(s)
SAMA	severe accident mitigation alternatives
SBO	station blackout
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SFP	spent fuel pool
SG	Steam Generator
SHPO	State Historic Preservation Officer
SIP	state implementation plan
SLOCAPCD	San Luis Obispo County Air Pollution Control District
SNM	special nuclear material
SPCC	spill prevention, control, and countermeasures plan
SPEI	standardized precipitation evapotranspiration index
SPUT	Special Purpose Utility
SRP	standard review plan
SSC	structures, systems, and components

STC	Source Term Category
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
SWRO	seawater reverse osmosis
TCP	Traditional Cultural Properties
Tenera	Tenera Environmental Services
TMDL	total maximum daily load
U.S.C.	*United States Code*
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USGCRP	United States Global Change Research Program
USGS	U.S. Geological Survey
yr	year(s)
ytt	*yak tit^{y}u tit^{y}u yak tiłhini*

1 INTRODUCTION AND GENERAL DISCUSSION

The U.S. Nuclear Regulatory Commission (NRC, the Commission) environmental protection regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51 (TN10253), “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” implement the National Environmental Policy Act of 1969 (NEPA), as amended (42 *United States Code* [U.S.C.] 4321 et seq.-TN661). The regulations in 10 CFR Part 51 (TN10253) require, in part, that the NRC staff prepare an environmental impact statement (EIS), which is a supplement to the Commission’s NUREG-1437, Revision 2, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Final Report*, dated August 2024 (LR GEIS) (TN10161), for the renewal of a nuclear power plant operating license.

The Atomic Energy Act of 1954 (AEA), as amended (42 U.S.C. 2011 et seq.-TN663), specifies that licenses for commercial nuclear power reactors can be granted for up to 40 years. The NRC regulations in 10 CFR Part 54 (TN4878), “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” allow for an option to renew such licenses for terms of up to an additional 20 years. The initial 40-year licensing period was based on economic and antitrust considerations rather than on technical limitations of the nuclear facility.

The decision to seek a license renewal (LR) rests entirely with nuclear power facility owners and, typically, is based on the facility’s economic viability and the investment necessary to continue to meet NRC safety and environmental requirements. The NRC makes the decision to grant or deny an LR application (LRA) based on whether the applicant has demonstrated that the safety and environmental requirements in the agency’s regulations can be met during the period of extended operation.

1.1 Proposed Federal Action

Pacific Gas and Electric Company (PG&E) initiated the proposed Federal action by submitting an LRA dated November 7, 2023, for the Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon), for which the existing licenses (DPR-80 and DPR-82) include the expiration dates of November 2, 2024, and August 26, 2025, respectively (PG&E 2023-TN9822). The NRC’s Federal action is to decide whether to renew the licenses for an additional 20 years. The regulation in 10 CFR 2.109 (TN6204), “Effect of Timely Renewal Application,” provides that if a licensee of a nuclear power plant files an application to renew an operating license at least 5 years before the expiration date of that license, the existing license will not be deemed to have expired until the NRC completes its safety and environmental reviews, and makes a final decision about whether to issue a renewed license. On March 2, 2023, the NRC issued to PG&E an exemption from this rule stating that if PG&E submits an LRA less than 5 years prior to expiration of the existing licenses but no later than December 31, 2023, and if the NRC staff finds it acceptable for docketing, the existing licenses will be in timely renewal under NRC regulations until the NRC has made a final determination on whether to approve the LRA (88 FR 14395-TN9998). As noted above, PG&E submitted the LRA for Diablo Canyon by letter dated November 7, 2023, and the NRC found that application acceptable for docketing on December 19, 2023 (88 FR 87817); therefore, the Diablo Canyon licenses are in timely renewal under NRC regulations until the NRC has made a final determination on whether to approve the LRA.

1.2 Purpose and Need for the Proposed Action

The purpose and need for the proposed action (renewal of operating licenses) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating licenses to meet future system generating needs, as such needs may be determined by State, utility, system, and, where authorized, Federal (other than NRC) decision-makers. This definition of purpose and need reflects the Commission's recognition that, absent findings in the safety review required by the AEA or in the environmental review required by NEPA that would lead the NRC to reject an LRA, the NRC has no role in the energy-planning decisions of power plant owners, State regulators, system operators, and, in some cases, other Federal agencies as to whether a particular nuclear power plant should continue to operate (61 FR 28467-TN4491; NRC 2024-TN10161).

If renewed licenses are issued, power plant owners, State regulators, system operators, and, in some cases, other Federal agencies will ultimately decide whether the nuclear power plant will continue to operate based on economics, energy reliability goals, and other factors within their jurisdiction or the owners' purview. If the operating licenses are not renewed, the nuclear power plant must shut down on or before the expiration dates of the current operating licenses or once the NRC has made the final determination to not approve the LRA if the plant is in timely renewal.

1.3 Major Environmental Review Milestones

The NRC has established an LR process that can be completed in a reasonable period of time with clear requirements to ensure safe plant operation for up to an additional 20 years of the nuclear power plant's life. The NRC staff conducts a safety review simultaneously with an environmental review and documents the findings of the safety review in a safety evaluation report and the findings of the environmental review in a supplemental environmental impact statement (SEIS). The safety evaluation report and the SEIS are both factors in the NRC's decision to either grant or deny the issuance of renewed licenses. The safety evaluation report and the SEIS schedules for the Diablo Canyon LRA are provided in the project website (NRC 2024-TN10003): https://www.nrc.gov/reactors/operating/licensing/renewal/applications/diablo-canyon.html.

By letter dated November 7, 2023, PG&E submitted an LRA to the NRC for Diablo Canyon, which included an environmental report (ER) (PG&E 2023-TN9822). On December 19, 2023, after reviewing the LRA and ER for sufficiency, the NRC staff published a notice of acceptance for docketing and opportunity to request a hearing in Volume 88 of the *Federal Register*, page 87817 (88 FR 87817-TN9999). On January 24, 2024, the NRC staff published a notice in the FR (89 FR 4631-TN10001) informing the public of the staff's intent to conduct an environmental scoping process, which began a 30-day scoping comment period, and to prepare a SEIS.

The NRC staff held a virtual public scoping meeting on February 1, 2024, followed by an in-person public scoping meeting on February 8, 2024, in San Luis Obispo, California. On September 20, 2024, the NRC staff issued a scoping summary report for the Diablo Canyon LRA environmental review (NRC 2024-TN10608), which included the comments received during the scoping process (Appendix A of this SEIS).

To independently verify information provided in the ER, the NRC staff conducted a hybrid environmental site audit and a virtual severe accident mitigation alternatives (SAMA) audit related to the Diablo Canyon LRA in March 2024 and June 2024, respectively. During the audits, the NRC staff held meetings with nuclear power plant personnel and reviewed site-specific documentation and photos. The NRC staff summarized the audits in letters dated April 18, 2024 (NRC 2024-TN10002), and July 16, 2024 (NRC 2024-TN10308).

Upon the completion of the scoping period and site audits, the NRC staff compiled its assessments and initial findings in the draft SEIS. This document was made available for public comment for 45 days. During that time, the NRC staff hosted public meetings and collected public comments. Based on the information gathered, the NRC staff amended the draft SEIS findings, as necessary, and published this final SEIS. Changes made to the draft SEIS are marked with change bars (i.e., vertical lines) in the side margin of the page. Figure 1-1 shows the major milestones of the NRC's LRA environmental review process.

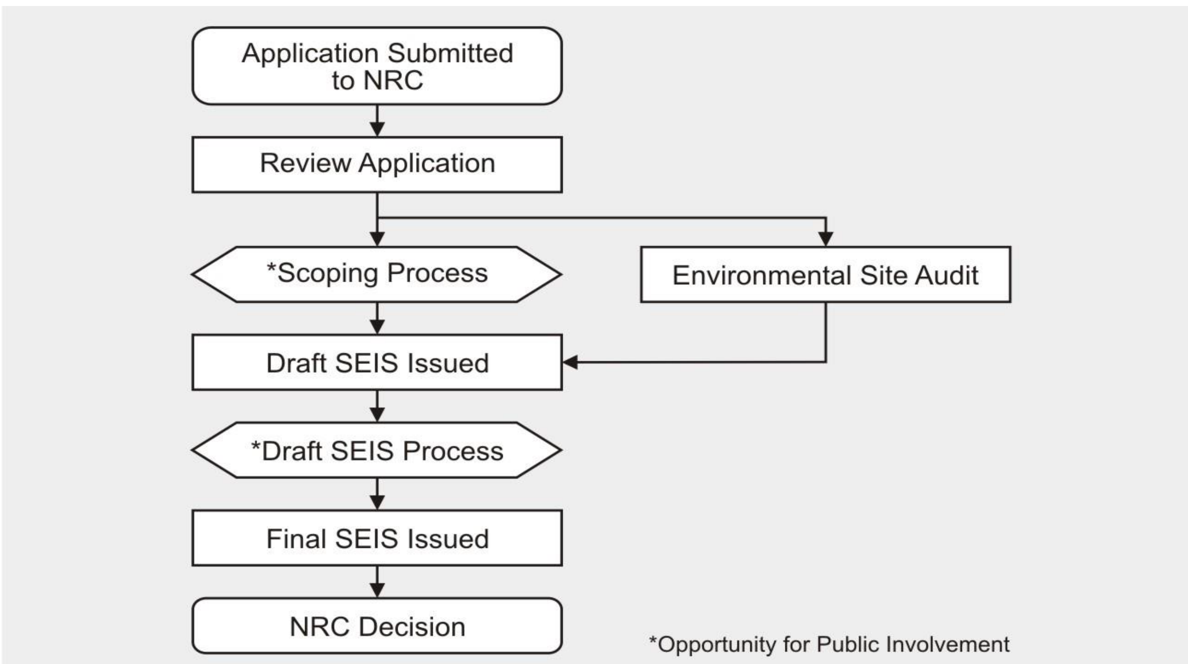


Figure 1-1 Environmental Review Process for Nuclear Power Plants

1.4 Generic Environmental Impact Statement

To improve the efficiency of its LR review process, the NRC staff performed a generic assessment of the environmental impacts associated with an LR. The 2024 LR GEIS (NRC 2024-TN10161) documents the results of the NRC's systematic approach to evaluating the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. In the LR GEIS, the NRC staff analyzed in detail and determined the impact of those environmental issues that could be resolved generically.

The LR GEIS establishes separate environmental issues for the NRC staff to independently evaluate in LR environmental reviews. Of these issues, the NRC staff determined that some issues are generic to all plants or a specific subset of plants (Category 1). Other issues do not lend themselves to generic consideration and are nuclear plant site-specific (Category 2 or uncategorized). For each LRA, the NRC staff evaluates these issues in a SEIS to the LR GEIS. Table B-1 in Appendix B to Subpart A of 10 CFR Part 51 (TN10253) provides a summary of the NRC staff's findings for environmental issues for an LR of nuclear power plants that were evaluated in the LR GEIS.

On August 6, 2024, the NRC published a final rule (89 FR 64166-TN10321) revising its environmental protection regulations in 10 CFR Part 51. Specifically, the final rule updated the potential environmental impacts associated with the renewal of an operating license for a nuclear power plant for up to an additional 20 years, which could either be an initial LR or a subsequent license renewal. The LR GEIS was also revised (NRC 2024-TN10161), as an update to the 2013 LR GEIS (NRC 2013-TN2654), and provided the technical basis for the final rule. The LR GEIS specifically supported the revised list of environmental issues and associated environmental impact findings for LR contained in Table B-1 in Appendix B to Subpart A of the revised 10 CFR Part 51. The LR GEIS and final rule reflect lessons learned, knowledge gained, and experience from LR environmental reviews performed since the development of the 2013 LR GEIS; consider changes to applicable laws and regulations; and factor in new scientific data and methodology with respect to the assessment of potential environmental impacts of a nuclear power plant LR. The LR GEIS and final rule identify 80 environmental issues (i.e., 59 Category 1, 20 Category 2, and 1 issue that remains uncategorized) that may be associated with nuclear power plant operation and refurbishment during the renewal term.

For the NRC staff, the final rule became effective 30 days after its publication in the FR and thereafter the staff considers the new and modified issues, as applicable, in its LR SEISs. Compliance with the final rule by LR applicants is not required until 1 year following publication in the FR (i.e., LR ERs submitted later than 1 year after publication must be compliant with the new rule).

For each potential environmental issue addressed in the LR GEIS, the NRC staff:

- describes the activity that affects the environment
- identifies the population or resource that is affected
- assesses the nature and magnitude of the impact on the affected population or resource
- characterizes the significance of the effect for both beneficial and adverse effects
- determines whether the results of the analysis apply to all plants
- considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants

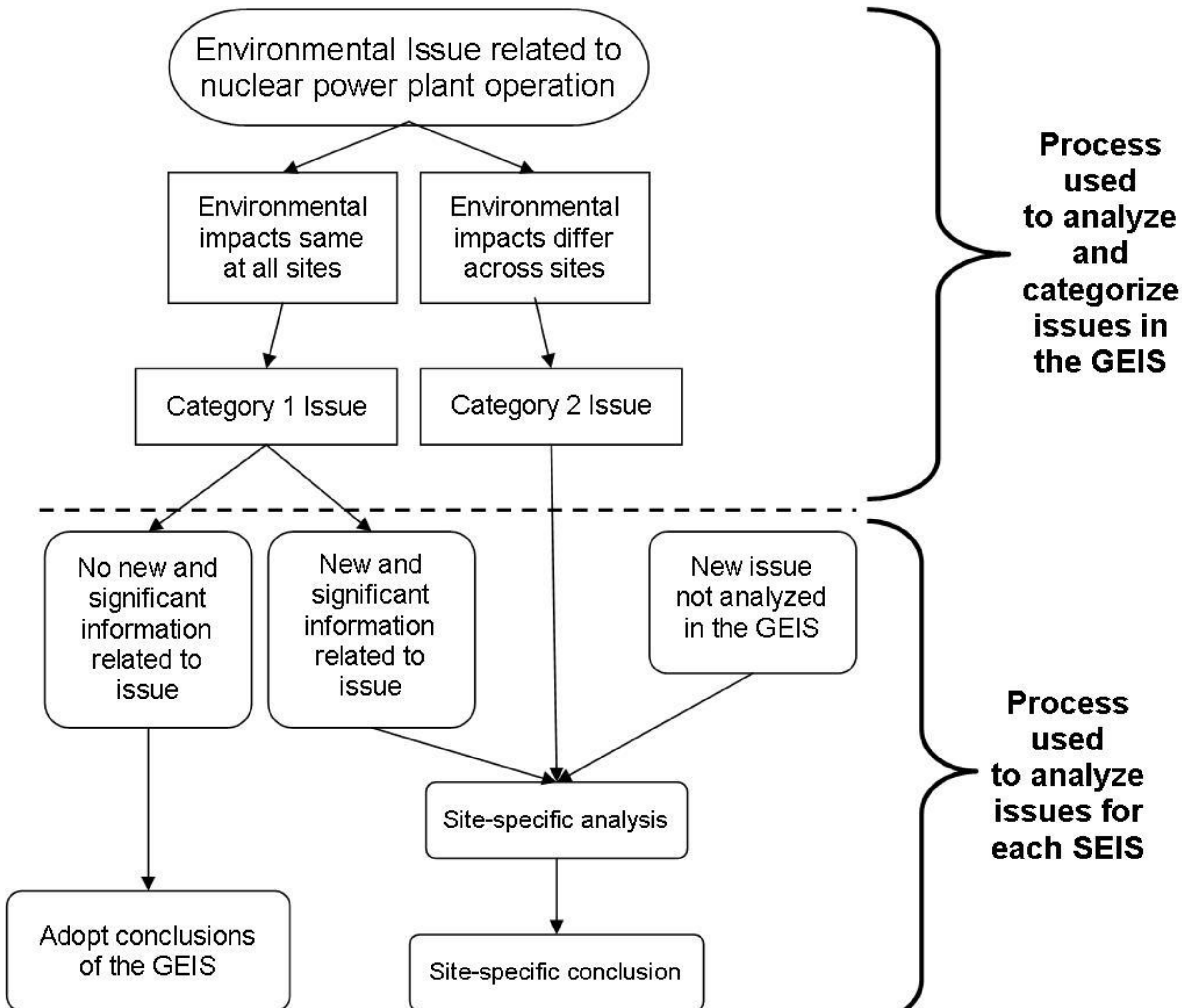
The NRC staff established three levels of significance for potential impacts—SMALL, MODERATE, and LARGE. The definitions of these terms are listed below.

- **SMALL:** Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered SMALL.
- **MODERATE:** Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- **LARGE:** Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

These levels are used for describing the environmental impacts of the proposed action as well as for the impacts of a range of reasonable alternatives to the proposed action. Resource-specific effects or impact definitions from applicable environmental laws and executive orders, other than SMALL, MODERATE, and LARGE, are used where appropriate.

The LR GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted (Figure 1-2). Issues are assigned a Category 1 or a Category 2 designation. As set forth in the LR GEIS, Category 1 issues are those that meet the following criteria:

- The environmental impacts associated with the issue have been determined to apply either to all nuclear power plants or, for some issues, to nuclear power plants having a specific type of cooling system or other specified plant or site characteristics.



The LR GEIS evaluated 80 issues. Site-specific analysis is required for 20 of those 80 issues.

Figure 1-2 Environmental Issues Evaluated for License Renewal of Nuclear Power Plants

- A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for offsite radiological impacts of spent nuclear fuel and high-level waste disposal and offsite radiological impacts – collective impacts from other than the disposal of spent fuel and high-level waste).
- Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

For generic issues (Category 1), no additional site-specific analysis is required in the SEIS unless new and significant information is identified. The process for identifying new and significant information is presented in Chapter 3 of this SEIS. Site-specific issues (Category 2) are those that do not meet one or more of the criteria of Category 1 issues; therefore, additional site-specific review for these issues is required. The results of that site-specific review are documented in the SEIS.

> **New information** can be identified from many sources, including the applicant, the NRC, other agencies, or public comments. If a new issue is revealed, it is first analyzed to determine whether it is within the scope of the LR environmental evaluation. If the new issue is not addressed in the LR GEIS, the NRC staff would determine the significance of the issue and document the analysis in the SEIS.
>
> **New and significant information** either identifies a significant environmental issue that was not covered in the LR GEIS or was not considered in the analysis in the LR GEIS and leads to an impact finding that is different from the finding presented in the LR GEIS.

1.5 Supplemental Environmental Impact Statement

This SEIS presents an analysis that considers the environmental effects of the continued operation of Diablo Canyon during the LR term, alternatives to LR, and mitigation measures for minimizing adverse environmental impacts. Chapter 2 of this SEIS describes the proposed action and alternatives to the proposed action. Chapter 3 of this SEIS contains analysis and comparison of the potential environmental impacts from the proposed action and alternatives to the proposed action. Chapter 4 of this SEIS presents the recommendation of the NRC staff on whether the adverse environmental impacts of LR for Diablo Canyon are so great that preserving the option of LR for energy-planning decision-makers would be unreasonable. The NRC staff's recommendation was made after consideration of comments received on the draft SEIS during the public comment period. The NRC staff based its recommendation on:

- the analysis and findings in the LR GEIS
- the applicant's ER
- the NRC staff's consultation with Federal, State, Tribal, and local agencies
- the NRC staff's independent environmental review
- the NRC staff's consideration of public comments received during the scoping process and on the draft SEIS

1.6 Decision to Be Supported by the EIS

The decision to be supported by this SEIS is whether to renew the Diablo Canyon operating licenses for an additional 20 years. The regulation in 10 CFR 51.103(a)(5) (TN10253) that specifies the NRC's decision standard with respect to its environmental review states:

In making a final decision on a license renewal action pursuant to Part 54 of this chapter, the Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision-makers would be unreasonable (10 CFR 51.103(a)(5)-TN10253).

There are many factors that the NRC takes into consideration when deciding whether to renew the operating licenses of a nuclear power plant. The analyses of environmental impacts evaluated in the LR GEIS, as supplemented by this SEIS, will provide the NRC's decision-maker (the Commission) with important environmental information for consideration in deciding whether to renew the Diablo Canyon operating licenses.

1.7 Cooperating Agencies

During the scoping process, the NRC staff did not identify any Federal, State, Tribal, or local agencies as cooperating agencies for this SEIS.

1.8 Consultations

Certain Federal environmental statutes require Federal agencies to consult with other agencies, Tribes, and organizations before taking an action that may affect protected environmental resources, such as endangered species, habitat of managed fisheries, and historical and cultural resources. The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.-TN1010); the Magnuson–Stevens Fishery Conservation and Management Act of 1976, as amended (MSA) (16 U.S.C. 1801 et seq.-TN9966); and the National Historic Preservation Act of 1966, as amended (NHPA) (54 U.S.C. 300101 et seq.-TN4157), require Federal agencies to consult with applicable State and Federal agencies, Tribes, and organizations before taking action that may affect endangered species, fisheries, or historic and archaeological resources, respectively. Appendix C to this SEIS contains a list of the agencies and groups with which the NRC staff consulted and describes that consultation and related correspondence.

1.9 Correspondence

During the course of the environmental review, the NRC staff corresponded with the applicant, as listed in Appendix D to this SEIS.

1.10 Status of Compliance

PG&E is responsible for complying with all NRC regulations and other applicable Federal, State, and local requirements. Appendix F to the 2024 LR GEIS describes some of the major applicable Federal statutes (NRC 2024-TN10161). Numerous permits and licenses are issued by Federal, State, and local authorities for activities at Diablo Canyon. Appendix B to this SEIS contains further information about PG&E's status of compliance.

1.11 Related Federal and State Activities

The NRC staff reviewed the possibility that activities (projects) of other Federal agencies might impact the renewal of the operating licenses for Diablo Canyon. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for preparing this SEIS. The NRC staff has determined that there are no Federal projects that would make it necessary for another Federal agency to be a cooperating agency in the preparation of this SEIS (10 CFR 51.10(b)(2)-TN10253). Projects and actions considered in the cumulative impacts analysis are provided in Appendix E to this SEIS.

The NRC is required under Section 102(2)(C) of NEPA (TN661) to consult with and obtain comments from any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the NRC's EISs. For example, during the preparation this SEIS, the NRC consulted with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Appendix C to this SEIS contains a list of key consultation correspondence.

2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

Although the NRC's decision-making authority in LR is limited to deciding whether to renew a nuclear power plant's operating license, the agency's implementation of NEPA (42 U.S.C. 4321 et seq.-TN661) requires consideration of the environmental impacts of that action as well as the environmental impacts of reasonable alternatives to that action. Although the ultimate decision about which alternative (or the proposed action) to implement falls to the power plant owners and State, utility, system, and, where authorized, Federal (other than NRC) energy-planning decision-makers, comparing the environmental impacts of renewing the operating license to the environmental impacts of alternatives allows the NRC to determine whether the environmental impacts of LR are so great that preserving the option of LR for energy-planning decision-makers would be unreasonable (10 CFR 51.95(c)(4)) (TN10253).

Energy-planning decision-makers and power plant owners ultimately decide whether the nuclear power plant will continue to operate, and economic and environmental considerations play important roles in this decision. In general, the NRC's responsibility is to ensure the safe operation of nuclear power plants, not to formulate energy policy, promote nuclear power, or encourage or discourage the development of alternative power generation. The NRC does not engage in energy-planning decisions and makes no judgment as to which sources of replacement power would be selected in any given case.

This chapter of the SEIS describes (1) the Diablo Canyon site and its operation, (2) the proposed action (renewal of the Diablo Canyon operating licenses), (3) reasonable alternatives to the proposed action (including the no-action alternative), and (4) alternatives eliminated from detailed study.

2.1 Description of Nuclear Power Plant Facility and Operation

Diablo Canyon is a dual-unit nuclear power plant located in San Luis Obispo County, California. It began commercial operation in May 1985 (Unit 1) and March 1986 (Unit 2). Generally, the NRC staff drew information about Diablo Canyon's facilities and operation from PG&E's ER (PG&E 2023-TN9822).

2.1.1 External Appearance and Setting

The Diablo Canyon site is located adjacent to the Pacific Ocean in San Luis Obispo County, California, approximately 7 miles (mi) (11 kilometers [km]) northwest of Avila Beach, 8 mi (13 km) south of Los Osos, and 12 mi (19 km) west-southwest of San Luis Obispo (PG&E 2023-TN9822).

Diablo Canyon is located on approximately 750 acres (ac) (304 hectares [ha]) of land controlled by PG&E. The main site structures at Diablo Canyon include two reactor buildings, a turbine building, an auxiliary building, a training building, a main warehouse, storage tanks, a cooling water intake structure, the Raw Water Storage Reservoir, 230 kilovolt (kV) and 500 kV switchyards, the Old Steam Generator Storage Facility, and an independent spent fuel storage installation (ISFSI). The Diablo Canyon ISFSI is licensed under a 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste" (TN4884), site-specific license. The arrangement of these structures on the plant site is depicted in Figure 2-1 below (PG&E 2023-TN9822).

Legend

- Protected Area Fence
- Approximate Exclusion Area Boundary (EAB)
- Building/Structure
- Diablo Canyon Power Plant Site Boundary

Feet
0 800 1,600

Figure 2-1 Diablo Canyon Nuclear Power Plant Layout. Adapted From: PG&E 2023-TN9822.

Figure 2-2 Diablo Canyon Nuclear Power Plant Site and 6 mi (10 km) Radius. Adapted From: PG&E 2023-TN9822.

Figure 2-3 Diablo Canyon Nuclear Power Plant Site and 50 mi (80 km) Radius. Adapted From: PG&E 2023-TN9822.

2.1.2 Nuclear Reactor Systems

The Diablo Canyon Unit 1 operating license was issued on November 2, 1984, and the Diablo Canyon Unit 2 operating license was issued on August 26, 1985. Both reactors at Diablo Canyon are four-loop Westinghouse pressurized water reactors. Diablo Canyon Units 1 and 2 were each licensed with reactor core thermal powers rated at 3,411 megawatts thermal, with corresponding gross electrical outputs of 1,190 megawatts electric (MWe). The design net electrical capacities are 1,138 MWe and 1,147 MWe for Units 1 and 2, respectively (PG&E 2023-TN9822).

2.1.3 Cooling and Auxiliary Water Systems

Diablo Canyon uses a once-through (open-cycle) cooling water intake system that withdraws water from and discharges recirculating water, along with other effluents, back to the Pacific Ocean (Figure 2-4). The Pacific Ocean is the primary water source for all onsite uses, including for condenser cooling, and it also serves as the ultimate heat sink for Diablo Canyon.

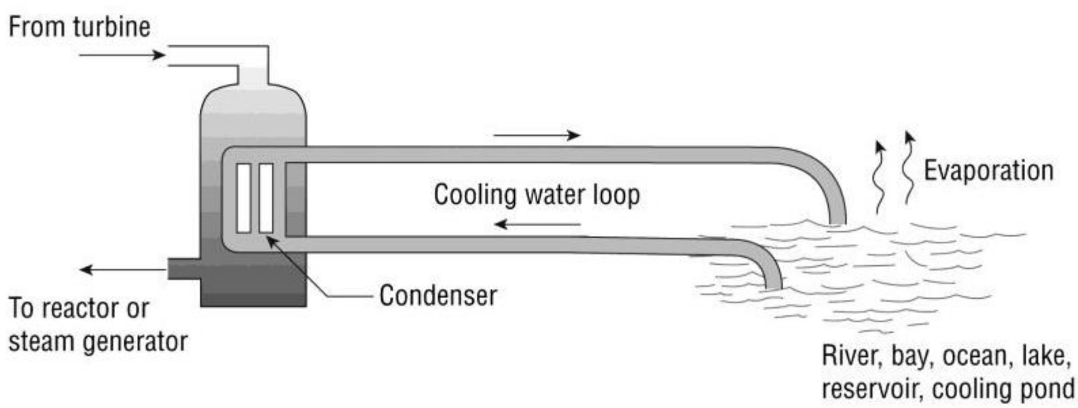


Figure 2-4 Once-Through Cooling Water System with Open Water Source. Adapted From: NRC 2024-TN10161.

In pressured water reactors, like those used at Diablo Canyon, water is heated to a high temperature under pressure inside the reactors. Such systems use three heat transfer (exchange) loops. The water heated in the reactor is first pumped in the primary loop to the steam generators serving each nuclear unit. Within the steam generator, water in the secondary loop is converted to steam. After steam drying, the steam is discharged to drive the turbines. The turbines turn the generator to produce electricity. The steam leaving the turbines is condensed by water in the tertiary condenser cooling water loop and returned to the steam generator. Heated water in the condenser cooling water loop can either flow to cooling towers where it is cooled by evaporation in order to dissipate waste heat or be discharged directly to a body of water. At Diablo Canyon, this water is returned directly to the Pacific Ocean.

A seawater reverse osmosis (SWRO) desalinization treatment system provides the majority of freshwater for plant primary and secondary systems' makeup, fire protection system source water, and plant domestic water system supply. The unit is supplied with raw seawater drawn from the power plant once-through cooling system intake and groundwater (PG&E 2023-TN9822). Groundwater supplied from an onsite deep well is also used as a supplemental freshwater supply.

2.1.3.1 Once-Through Cooling Water Intake System

Diablo Canyon uses a once-through cooling water system for condenser cooling whereby seawater is drawn from the Pacific Ocean through a shoreline intake structure and discharged back to the Pacific Ocean at a second, separate, shoreline location. Ambient temperature seawater is pumped through the heat exchanging steam condensers located in the turbine building. Each unit utilizes an independent cooling system; however, the systems share common intake and discharge structures.

The shoreline intake structure for Diablo Canyon Units 1 and 2 houses the circulating water pumps (CWPs), vertical debris bar racks, vertical traveling water screen mechanisms, and associated screen rotation and washing equipment. Each CWP draws from an isolated pump bay. Each pump bay is open to the ocean through three individually gated 11-foot (ft) (3.4-meter [m]) wide rectangular passages leading through 10 ft (3 m) wide (nominal) perpendicular vertical traveling screens. The isolation gates for an individual pump bay can be closed and sealed, and the bay dewatered for maintenance or inspection activities independent of the other bays (PG&E 2023-TN9822).

Diablo Canyon Unit 1 and Unit 2 intake configuration is mirrored, with the auxiliary pumps and associated bays located near the center of the intake structure. The structure is flat faced, with all bar racks, dewatering gates, and traveling screen systems installed parallel to the shoreline, and perpendicular to the inlet flow. Total equipment inventory includes four CWPs and associated inlet bays, four auxiliary service water pumps and two associated partitioned inlet bays, 14 individual vertical traveling screen wash systems, and 14 bar rack units installed in front of each traveling screen inlet passage. An additional 9 ft (2.7 m) wide bar rack bay serving as a fish escape route is provided at each end of the intake structure, bringing the total number of bar rack units to 16. A central concrete partition supporting a screen wash debris collection sump splits the submerged face of the intake into distinct Unit 1 and Unit 2 openings to the ocean environment. The partition is open between the units behind the bar racks. The opening provides for free flow of seawater and a migration route for fish from one end of the structure to the other (PG&E 2023-TN9822).

2.1.3.2 Condenser Circulating Water System

For each unit, two main seawater CWPs provide cooling flow to the main condenser inlets. Each CWP discharges into a concrete conduit approximately 1,800 ft (550 m) in length that rises from the shoreline intake structure to the turbine building. The conduits measure 11.75 feet square (ft^2) (1.10 meters square [m^2]) with the exception of the initial tapered section leading directly from the pump discharge, and a circular section used for flow monitoring. The CWPs produce a combined rated flow for Unit 1 between 778,000 gallons per minute (gpm) (2,945,050 liters per minute [lpm]) and 854,000 gpm (3,232,742 lpm), and for Unit 2 between 811,000 gpm (3,069,969 lpm) and 895,000 gpm (3,387,945 lpm). Two-unit combined flow is between 1,589,000 gpm (6,015,019 lpm) minimum and 1,749,000 gpm (6,620,685 lpm) maximum during normal plant operations (PG&E 2023-TN9822).

Seawater transit time through the power plant is approximately 5 minutes. At full power, cooling flow temperatures are elevated approximately 20°F (11°C) during condenser pass-through. Average aggregate power plant discharge temperature is 19.6°F (10.9°C) above ambient intake seawater temperatures. Temperature elevation can vary in response to ocean ambient temperatures, unit power levels, plant transients, and planned unit curtailments which may be accompanied by seawater circulator clearance (PG&E 2023-TN9822).

2.1.3.3 Auxiliary Saltwater System and Ultimate Heat Sink

While the circulating water system (CWS) provides condenser cooling water for Diablo Canyon, the safety-related auxiliary saltwater system provides the cooling and heat absorption capability required during normal operations and emergency conditions, with the Pacific Ocean serving as the ultimate heat sink. The two auxiliary service water pumps for each unit are serviced by a single 6 ft (1.8 m) wide rectangular concrete passage leading through 5 ft (1.5 m) wide (nominal) perpendicular vertical traveling screens. The screening mechanism for the auxiliary pump bays provides approximately 150 ft^2 (14 m^2) of filtration surface at mean sea level (MSL). Leading from the common debris screened inlet passage, the bay then widens and is partitioned into two sides, one for each auxiliary service water pump suction inlet (PG&E 2023-TN9822).

Each auxiliary saltwater pump is rated at 11,500 gpm (43,532 lpm). During routine plant operations, only one auxiliary saltwater train is in use for each unit, with the second pump in standby mode. Two operating pumps contribute an additional once-through cooling flow of 23,000 gpm (87,064 lpm). Using maximum pump ratings, total once-through cooling flow during routine full power operations is 1,772,000 gpm (6,707,750 lpm), equivalent to approximately 2.5 billion gallons (9.5 billion liters) of seawater circulated per day (PG&E 2023-TN9822).

2.1.3.4 Chemical Treatment System

The chlorination system provides chemical treatment of the circulating water to control the macro and micro fouling in the intake tunnels, piping, and the condenser tubes. The system is used as needed. Liquid sodium hypochlorite and a supplemental chemical, sodium bromide, are stored in tanks at the intake structure (common to both units). Sodium bisulfite may be injected into the CWS at the seawater main condensers to neutralize residual chlorine prior to discharge to maintain residual chlorine below the National Pollutant Discharge Elimination System (NPDES) discharge limits. Adequate valving is provided for isolating any of the tanks from the system. Each tank is within a secondary containment tank sized to contain the entire contents of the storage tank. When chlorination is required (based on a time schedule), the chemicals are injected via metering pumps and injected into the intake structure (PG&E 2023-TN9822).

2.1.3.5 Once-Through Cooling Discharge System

Heated discharge from the main condensers of each Diablo Canyon unit combines and flows to a common structure terminating in a shoreline outfall. The discharge for Unit 1 and Unit 2 is parallel within the structure separated by a central concrete partition. Cutouts exist in the dividing wall to promote mixing of thermal effluent between the operating units. The mixing also provides dilution and reduction of residual oxidants from seawater inlet systems chemical treatments (PG&E 2023-TN9822).

Discharge flows by gravity from the elevated turbine building into the outfall structure. Within the structure, flow passes over three weirs and across horizontal platforms fitted with vertical impact blocks. The cascading effect of the design creates mixing of the thermal effluent as well as dissipation of hydraulic energy. The width of the discharge flow out of the mouth of the structure is 27.5 ft (8.4 m) per unit. Once discharged, the thermal effluent mixes with the receiving water and dissipates across the ocean surface. (PG&E 2023-TN9822). Diablo Canyon’s current NPDES permit establishes a maximum temperature rise (Delta T) of 22°F (12.2°C) above the average daily natural temperature of the ocean intake water. The NPDES permit establishes a number of other effluent limitations for the once-through cooling water and comingled effluent streams, as further described in Section 3.5.1.3 of this SEIS.

2.1.3.6 Power Plant Makeup Water System Components

The intake structure supplies feedwater for Diablo Canyon's SWRO system, which provides the majority of freshwater for fire protection system source water. Seawater is filtered, sterilized, and desalinated by the SWRO system. The unit has the capacity to produce 450 gpm (1,703 lpm) of freshwater. The desalinated water is pumped to the open reservoir system. The two raw water reservoirs each have a capacity of 2.5 million gallons (MG) (9.5 million liters). The raw water storage reservoirs have plastic lined concrete walls. The reservoirs may also receive pretreated water from water supply well WW2. The reservoirs serve as freshwater storage for fire protection and as a source to the makeup water system and the auxiliary feedwater system pumps, providing a large water storage reservoir when the raw water supply is lower than the makeup water system demand (PG&E 2023-TN9822).

Diablo Canyon has no hydraulic connection with groundwater resources on properties outside of plant-controlled lands. There are three water supply wells at Diablo Canyon; however, one permitted well (WW2) supplies water to the makeup water system, which includes supplying the raw water storage reservoirs used for fire protection water and domestic water (PG&E 2023-TN9822: Section 2.2.3.7). The Diablo Canyon domestic water system receives its water from the domestic water treatment system. The domestic water treatment system takes water from the raw water storage reservoirs and processes it through a multi-media filter, a reverse osmosis module, a neutralizing-media filter, an activated carbon filter, and finally through a 10-micron cartridge filter. Prior to transferring the water to the domestic water storage and distribution piping system, it is disinfected using chlorine. The water is then supplied to the plant for drinking (PG&E 2023-TN9822).

Utilities that receive domestic water include lavatories, water heaters, showers, maintenance connections, emergency eye wash, hose bibs, kitchen sinks, chemical laboratory sink in the chlorination building, drinking fountains, chemical laboratory sinks in maintenance shop buildings, and landscape irrigation. After use, the domestic water passes into the plant sewage system where it is treated in a sewage treatment plant before being discharged to the ocean. The potentially radioactively contaminated utilities that use domestic water are the hot showers, laundry facilities, laboratory sinks, washdown area in hot machine shop, and utility water connections in the radiologically controlled area. This water, after being used, drains to the Liquid Radwaste System (LRS) for treatment (PG&E 2023-TN9822).

2.1.4 Radioactive Waste Management Systems

The NRC licenses nuclear power plants with the expectation that they will release a limited amount of radioactive material to both the air and water during normal operations. Diablo Canyon uses liquid, gaseous, and solid waste processing systems to collect and treat, as needed, radioactive materials produced as a byproduct of nuclear power plant operations. Section 2.2.6 of the PG&E ER, submitted as part of its LRA, provides an expanded description of Diablo Canyon's radioactive waste management systems (PG&E 2023-TN9822). The NRC staff discusses the radioactive waste management systems in Section 3.13.1, "Radioactive Waste," of this SEIS.

2.1.5 Nonradioactive Waste Management Systems

Diablo Canyon generates nonradioactive waste as a result of nuclear power plant maintenance, cleaning, and operational processes. Diablo Canyon manages nonradioactive wastes in accordance with applicable Federal and State regulations, as implemented through its corporate procedures. Section 2.2.7 of the PG&E ER, submitted as part of its LRA, provides an expanded description of Diablo Canyon's nonradioactive waste management systems (PG&E 2023-TN9822). The NRC staff discusses the nonradioactive waste management systems in Section 3.13.2, "Nonradioactive Waste," of this SEIS.

2.1.6 Utility and Transportation Infrastructure

The utility and transportation infrastructure at nuclear power plants typically interfaces with public infrastructure systems available in the region. Such infrastructure includes utilities, such as suppliers of electricity, fuel, and water, as well as roads and railroads that provide access to the site. The following sections briefly describe the existing utility and transportation infrastructure at Diablo Canyon.

2.1.6.1 Electricity

Nuclear power plants generate electricity for other users, but they also use electricity to operate. Off-site power sources provide power to engineered safety features and emergency equipment in the event of a malfunction or interruption of power generation at the plant. If power is interrupted, planned independent backup power sources provide power from both the plant itself and offsite power sources. At Diablo Canyon, three single-circuit 500 kV and one double-circuit 230 kV transmission lines connect Diablo Canyon to the regional electric grid at the onsite switchyard (PG&E 2023-TN9822). These lines transmit electricity to the grid and supply offsite power to Diablo Canyon.

2.1.6.2 Fuel

The Diablo Canyon nuclear units are operated using low-enriched uranium dioxide fuel with enrichment not exceeding 5 percent by weight of uranium-235. The fuel burnup at Diablo Canyon is less than 62,000 megawatt-days per metric ton of uranium (MWd/MTU), with a batch average of approximately 49,000 MWd/MTU and refueling occurs on an 18- to 21-month cycle (PG&E 2023-TN9822). Fresh (i.e., unirradiated) fuel is brought to the site and stored onsite in racks in vaults in the fuel-handling area of the auxiliary building before installation in the reactor cores. PG&E stores spent fuel in a spent fuel pool and an ISFSI, both of which are discussed in Section 3.13.1.4 of this SEIS.

2.1.6.3 Water

In addition to cooling and auxiliary water (described in Section 2.1.3 of this SEIS), nuclear power plants require potable water for sanitary and everyday uses by personnel (e.g., drinking, showering, cleaning, laundry, toilets, and eye washes). At Diablo Canyon, an onsite seawater reverse osmosis desalinization facility provides the majority of freshwater for plant primary and secondary systems makeup, fire protection system source water, and plant domestic water (including potable water) supply. An onsite deep well supplements freshwater supplied by the desalinization facility, as necessary, during equipment maintenance periods and during plant startup following refueling outages (PG&E 2023-TN9822: Section 2.2.3.8).

2.1.6.4 Transportation Systems

Nuclear power plants are served by controlled access roads that are connected to U.S. highways and inter-State highways. In addition to roads, many plants also have railroad connections for moving heavy equipment and other materials. Some plants that are located on navigable waters have facilities to receive and ship loads on barges. Section 3.10.6, “Local Transportation,” of this SEIS describes the Diablo Canyon transportation systems.

2.1.6.5 Power Transmission Systems

For LR, the NRC staff evaluates, as part of the proposed action, the continued operation of the Diablo Canyon power transmission lines that connect to the substation where it feeds electricity into the regional power distribution system (NRC 2024-TN10161). The transmission lines that are in scope for the Diablo Canyon LR environmental review are onsite and are not accessible to the general public (PG&E 2023-TN9822, 2024-TN10032). The NRC staff also considers the continued operation of the transmission lines that supply outside power to the nuclear plant from the grid. Section 3.11.4 of this SEIS describes these transmission lines.

2.1.7 Nuclear Power Plant Operations and Maintenance

Maintenance activities conducted at Diablo Canyon include inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental and safety requirements. These activities include in-service inspections of safety related structures, systems, and components; quality assurance and fire protection programs; and radioactive and nonradioactive water chemistry monitoring.

Additional programs include those implemented to meet technical specification surveillance requirements and those implemented in response to NRC generic communications. Such additional programs include various periodic maintenance, testing, and inspection procedures necessary to manage the effects of aging on structures and components. Certain program activities are performed during the operation of the units, whereas others are performed during planned refueling outages, which occur on a staggered 18 to 21-month schedule for each unit (PG&E 2023-TN9822: Section 2.2.2).

2.2 Proposed Action

As stated in Section 1.1 of this SEIS, the NRC’s Federal action is to decide whether to renew the Diablo Canyon operating licenses for an additional 20 years. Section 2.2.1 of this SEIS provides a description of normal nuclear power plant operations during the LR term.

2.2.1 Nuclear Power Plant Operations during the License Renewal Term

Nuclear power plant operation activities during the LR term would be the same as, or similar to, those occurring during the current license term. Section 2.1, “Description of Nuclear Power Plant Facility and Operation,” of this SEIS describes the general types of activities carried out during nuclear power plant operations. As part of its LRA, PG&E submitted an ER stating that Diablo Canyon will continue to operate during the LR term in the same manner as during the current license term except for additional aging management programs, as necessary (PG&E 2023-TN9822). Such programs would address structure and component aging in accordance with 10 CFR Part 54 (TN4878), “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.”

2.2.2 Refurbishment and Other Activities Associated with License Renewal

Refurbishment activities include replacement and repair of major structures, systems, and components (SSCs). The major refurbishment class of activities characterized in the LR GEIS is intended to encompass actions that typically take place only once in the life of a nuclear plant, if at all (NRC 2024-TN10161). These actions may have an impact on the environment beyond those that occur during normal operations and may require evaluation, depending on the type of action and the plant-specific design. In preparation for its LRA, PG&E performed an evaluation of the SSCs, in accordance with 10 CFR 54.21 (TN4878), to identify the need to undertake any major refurbishment activities that would be necessary to support the continued operation of Diablo Canyon during the proposed 20-year period of extended operation.

As a result of its evaluation of SSCs, PG&E did not identify the need to undertake any major refurbishment or replacement activities associated with LR to support the continued operation of Diablo Canyon beyond the end of the existing operating licenses. Therefore, refurbishment activities are not discussed under the proposed action in Chapter 3 of this SEIS.

2.2.3 Termination of Nuclear Power Plant Operations and Decommissioning after the License Renewal Term

NUREG-0586, Supplement 1, Volumes 1 and 2, Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Regarding the Decommissioning of Nuclear Power Reactors (the decommissioning GEIS) (NRC 2002-TN665), describes the environmental impacts of decommissioning. Most plant operational activities would cease with reactor shutdown. However, some activities (e.g., security and oversight of spent nuclear fuel) would remain unchanged, whereas others (e.g., waste management, administrative work, laboratory analysis, surveillance, monitoring, and maintenance) would continue at reduced or altered levels. Systems dedicated to reactor operations would cease operations. However, if these systems are not removed from the site after reactor shutdown, their physical presence may continue to affect the environment. Impacts associated with dedicated systems that remain in place, or with shared systems that continue to operate at normal capacities, could remain unchanged.

Decommissioning will occur whether Diablo Canyon is shut down at the end of its current operating licenses or at the end of the period of extended operation 20 years later. The 2024 LR GEIS identifies decommissioning as a Category 1 issue and concludes that LR would have a negligible (SMALL) effect on the impacts of terminating operations and decommissioning on all resources (NRC 2024-TN10161).

2.3 Alternatives

As stated above, NEPA requires the NRC to consider reasonable alternatives to the proposed action of renewing the Diablo Canyon operating licenses. For a replacement energy alternative to be considered reasonable, it must be either (1) commercially viable on a utility scale and operational before the reactor's operating licenses expire or (2) expected to become commercially viable on a utility scale and operational before the reactor's operating licenses expire.

In this SEIS, the NRC staff relies on the description of alternative sources of replacement energy in Appendix D of the LR GEIS. The alternatives analysis in this SEIS is consistent with NEPA Section 102(2)(C)(iii), which requires a detailed statement on "a reasonable range of alternatives to the proposed agency action, including an analysis of any negative environmental impacts of not implementing the proposed agency action in the case of a no action alternative, that are technically and economically feasible, and meet the purpose and need of the proposal."

The alternative to the proposed agency action of renewing the Diablo Canyon operating licenses is for the NRC to not renew the operating licenses. This is called the no-action alternative and is described in Section 2.3.1 of this SEIS. In addition, as a consequence of not implementing the proposed agency action in the case of the no-action alternative, two replacement energy alternatives were identified for detailed study, a purchased power alternative and a renewables combination alternative. As explained in Section 2.3.2 of this SEIS, these replacement energy alternatives would seek to meet the region's energy needs through other means or sources.

2.3.1 No-Action Alternative

Under the no-action alternative, the NRC would not renew the Diablo Canyon operating licenses, and Units 1 and 2 would shut down on or before their licenses' expiration dates.

After the permanent termination of reactor operations, nuclear power plant operators would initiate decommissioning in accordance with NRC regulations in 10 CFR 50.82, "Termination of License" (TN249). The NRC's decommissioning GEIS (NRC 2002-TN665) describes the environmental impacts of decommissioning activities at a nuclear power plant. The analyses and impact findings in the decommissioning GEIS would bound the environmental impacts of most of the site-specific decommissioning activities after PG&E terminates reactor operations at Diablo Canyon. A licensee must also assess in its post-shutdown decommissioning activities report whether the environmental impacts of planned site-specific decommissioning activities would be bounded by the impacts described in previously issued EISs. In addition, Section 2.2.3, "Termination of Nuclear Power Plant Operations and Decommissioning," of this SEIS describes the incremental environmental impacts of LR on decommissioning activities.

Termination of reactor operations would result in the total cessation of electrical power production at Diablo Canyon. Unlike the replacement power alternatives described in Section 2.3.2 of this SEIS, the no-action alternative does not meet the purpose and need of the proposed action, as described in Section 1.2, because the no-action alternative does not provide a means of delivering baseload power to meet future electric system needs. Assuming that a need currently exists for the electrical power generated by Diablo Canyon, the no-action alternative would likely create a need for replacement power.

2.3.2 Replacement Power Alternatives

The following sections describe replacement power alternatives that could be implemented as a consequence of not renewing the Diablo Canyon operating licenses in the case of the no-action alternative. The potential environmental impacts of these alternatives are described in Chapter 3 of this SEIS. Although the NRC's authority only extends to deciding whether to renew the operating licenses for Diablo Canyon Units 1 and 2, replacement power alternatives represent possible options that energy-planning decision-makers may need to consider if the Diablo Canyon operating licenses are not renewed. In evaluating replacement power alternatives, the NRC considered energy-generating technologies currently in commercial operation, as well as technologies likely to be commercially available by the time the Diablo Canyon operating licenses expire. Because energy-generating technologies continually evolve in capability and cost, and regulatory structures change to either promote or impede the development of certain technologies, this evaluation considered which replacement power alternatives would be available and commercially viable when the Diablo Canyon operating licenses expire.

The PG&E ER describes possible replacement power alternatives. In addition, information from the following sources was considered in the replacement power analysis:

- U.S. Department of Energy (DOE) offices, including the Energy Information Administration
- the U.S. Environmental Protection Agency (EPA)
- industry sources and publications

In total, the NRC staff considered 14 replacement power alternatives to the proposed action and eliminated 12 of these from detailed study because of existing technical, resource availability, or commercial limitations. These limitations are likely to continue when the current Diablo Canyon licenses expire, rendering these alternatives not feasible or commercially viable. The alternatives considered, but eliminated from detailed study were as follows:

- new nuclear power
- solar power
- wind power
- biomass power
- hydroelectric power
- geothermal power
- wave and ocean energy
- municipal solid waste-fired power
- natural gas-fired, petroleum-fired, and coal-fired power
- fuel cells
- delayed retirement of other power-producing facilities
- demand-side management/energy conservation/energy efficiency

The two replacement power alternatives remaining for detailed study were:

- purchased power
- renewables combination

The two replacement power alternatives of purchased power and renewables combination are described in Sections 2.3.2.1 and 2.3.2.2 of this SEIS. Alternatives that could not provide the equivalent of Diablo Canyon's current generating capacity were eliminated from detailed study, as were alternatives whose costs or benefits could not justify inclusion in the range of reasonable alternatives. Alternatives not likely to be constructed and operational by the time the Diablo Canyon operating licenses expire were also eliminated from detailed study. To ensure that alternatives are consistent with State or regional energy policies, the NRC staff reviewed energy-related statutes, regulations, and policies within the region of influence. Alternatives that would conflict with these requirements were eliminated from further consideration. Although analyses conducted by the California Energy Commission (CEC) concluded that adequate renewable energy resources could not be brought online before the operating licenses for Diablo Canyon Units 1 and 2 expire (CEC 2023-TN10081), the renewables combination alternative is included to provide a comprehensive comparison of the impacts of LR versus renewable replacement energy alternatives.

Section 2.4 of this SEIS briefly describes the 12 alternatives eliminated from detailed study and provides the basis for each elimination. Section 2.5 summarizes key characteristics of the two replacement power alternatives. The NRC assigns a significance level of SMALL, MODERATE, or LARGE for most site-specific issues. For ecological resources subject to the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.-TN1010) and the MSA (16 U.S.C. 1801 et seq.-TN9966), and for historic and cultural resources subject to the NHPA (54 U.S.C. 306108 et seq.-TN4839), the impact significance determination language is specific to the relevant law. The order in which this SEIS presents the different alternatives does not imply increasing or decreasing level of impact; nor does the order imply that an energy-planning decision-maker would be more (or less) likely to select any given alternative.

2.3.2.1 Purchased Power Alternative

Purchased power involves the importation of electric power into PG&E's service area under long-term contract to replace Diablo Canyon's net generation. While new replacement power alternatives have been considered in other LR reviews, there is not enough time to bring new power plant(s) online before the operating licenses for Diablo Canyon Units 1 and 2 expire, and the LR review is completed. As stated previously, for a replacement energy alternative to be reasonable, it must be either (1) commercially viable on a utility scale and operational, or (2) expected to become commercially viable on a utility scale and operational before the reactor's operating licenses expire. The environmental impacts from purchased power would depend on the generation technologies used to supply the purchased power including the source, type, and location of energy generated.

California's 100 Percent Clean Energy Act of 2018 requires all energy generation to be renewable and zero-carbon after 2045 (State of California 2018-TN9855). Natural gas-fired power plants can be a source of purchased power until 2045. Afterwards, all future sources of purchased power must be from renewable energy sources.

Until 2045, purchased power would likely come from the most common types of existing electric power generating technologies including nuclear power, natural gas-fired, coal, solar, and wind energy, some of which could be located outside of California. Purchased power may also rely on older and less-efficient power plants operating at higher levels of power generation than current operations. During power plant operations, impacts from nuclear, natural gas, and coal-fired power plants and from solar and wind energy facilities would be similar to those described under the common impacts sections in Chapter 3 of this SEIS for all resource areas.

2.3.2.2 Renewables Combination Alternative

PG&E did not consider any renewable energy generation source or combination of energy sources reasonable alternatives for replacing Diablo Canyon Units 1 and 2 based on the criteria that the replacement energy alternatives must be viable prior to the expiration of the current operating licenses. Analyses conducted by the CEC also concluded that adequate renewable energy resources could not be brought online before the operating licenses for Diablo Canyon Units 1 and 2 expire (CEC 2023-TN10081). Nevertheless, a renewables combination alternative is included to provide a comprehensive comparison of the impacts of LR versus renewable replacement energy alternatives. This alternative only considers renewables due to California's 100 Percent Clean Energy Act of 2018 as codified in the California Public Utilities Code Section 454.53 (TN9910), which requires all retail electricity sold in California to be powered by renewable and zero-carbon resources by December 31, 2045 (State of California 2018-TN9855). Renewable power generation as an alternative to LR could consist of:

- 8 wind turbine installations (1 sited at Diablo Canyon), 830 MW wind onsite and offsite with battery storage (2,005 MW of installed capacity, assuming a capacity factor of 41.4 percent for onshore wind facilities [DOE 2021-TN9562])

- 29 solar panel installations, 1,160 MW offsite with battery storage (3,540 MW of installed capacity, assuming a capacity factor of 32.8 percent [NREL 2022-TN9823])
- geothermal, 200 MW
- demand-side management, peak load reduction of 100 MWe annually through energy conservation and efficiency

2.4 Alternatives Considered but Eliminated from Detailed Review

2.4.1 New Nuclear Power

California Public Resources Code § 25524.1 (TN10004) prohibits new nuclear development until DOE determines that a viable path for spent nuclear fuel reprocessing is underway. The NRC does not have a regulatory framework for reprocessing. Therefore, a replacement nuclear power plant is not a reasonable alternative to Diablo Canyon LR.

2.4.2 Solar Power

Solar power, including photovoltaic and concentrating solar power technologies, generates power from sunlight. Solar photovoltaic components convert sunlight directly into electricity using solar cells made from silicon or cadmium telluride. Concentrating solar power uses heat from the sun to boil water and produce steam. Steam drives a turbine connected to a generator to produce electricity (NREL Undated-TN7710).

Solar generators are considered an intermittent electrical power resource because their availability depends on exposure to the sun, also known as solar insolation. To be viable, a utility-scale solar power alternative must replace the amount of electrical power that Diablo Canyon currently provides. Assuming a capacity factor of 32.8 percent, approximately 7,000 MW of additional solar energy capacity would need to be installed to replace the 2,285 MW of electricity generated by Diablo Canyon (NREL 2022-TN9823). Based on an estimate of 4 ac (2 ha) of land per MW, this would require approximately 28,000 ac (11,331 ha) of land.

It is unlikely that Diablo Canyon's generating capacity could be replaced by a single type of intermittent electricity generation, including utility-scale baseload solar. A combination of energy generating sources discussed in Section 2.3.2.2 such as wind, solar, and battery backup, along with purchased power and demand-side management, could complement each other and reduce intermittent electricity generation issues.

The resource requirements of a standalone baseload solar power alternative would be similar to those described in Section 2.3.2.2, although the magnitude would differ based on the amount of solar energy capacity to be constructed. As a result, a standalone baseload solar power alternative is not a reasonable alternative to Diablo Canyon LR.

2.4.3 Wind Power

As is the case with other renewable energy sources, the feasibility of wind energy providing baseload power depends on the location (relative to electricity users), value, accessibility, and constancy of the resource. To be considered a replacement for baseload power, wind energy would need to be supplemented with battery storage and there are limited energy storage opportunities available to overcome the intermittency and variability of wind resources. There is potential for both onshore and offshore wind generation, and impacts to sensitive environmental resources would have to be considered prior to siting any wind facility.

2.4.3.1 Onshore Wind

The American Clean Power Association reports a total of more than 122,000 MW of installed wind energy capacity nationwide as of December 31, 2020 (DOE Undated-TN8431). Based on 2022 EIA data, there is approximately 6,103 MW of installed wind capacity in California, with approximately 104 MW under construction (DOE 2022-TN9824).

To be considered a reasonable replacement power alternative to Diablo Canyon LR, a wind power alternative would have to replace the amount of electrical power that Diablo Canyon provides. Assuming a capacity factor of 41.4 percent for onshore wind facilities (DOE 2021-TN9562), land-based wind energy facilities would need to generate 5,500 MW of electricity to replace 2,285 MWe of Diablo Canyon's generating capacity. Based on the DOE estimates of 85 ac/MW (34 ha/MW) for wind farm boundaries, 2.47 ac/MW (1 ha/MW) for construction footprint, and 0.74 ac/MW (0.3 ha/MW) for permanent structures, approximately 500,000 total ac (202,343 ha) of land would be required (DOE 2015-TN8757). Additionally, because wind is an intermittent energy source, energy storage would be needed, increasing land requirements.

2.4.3.2 Offshore Wind

California has substantial offshore wind resources, and California's 100 Percent Clean Energy Act of 2018 established offshore wind goals of 2,000–5,000 MW of offshore wind by 2030 (CEC 2022-TN9825). Assuming a capacity factor of 43.3 percent for offshore wind facilities, greater than 5,000 MW of electricity would be needed to replace Diablo Canyon's generating capacity of 2,285 MWe. Assuming an average of 98.8 ac/MW, offshore generation could require approximately 500,000 total ac (202,343 ha) (DOE 2015-TN8757). Additionally, because wind is an intermittent energy source, energy storage would be needed.

2.4.3.3 Conclusion

It is unlikely that Diablo Canyon's generating capacity could be replaced by a single type of intermittent electric power generation, including a non-baseload resource such as utility-scale wind, either onshore or offshore. A combination of energy sources discussed in Section 2.3.2.2 such as wind, solar, and battery backup, along with purchased power and demand-side management, could complement each other and reduce intermittent electricity generation issues.

The resource requirements of a standalone baseload wind power alternative would be similar to those described in Section 2.3.2.2, although the magnitude would differ based on the amount of wind energy capacity to be constructed. As a result, a standalone baseload wind power alternative is not a reasonable alternative to Diablo Canyon LR.

2.4.4 Biomass Power

Biomass fuels used for power generation include agricultural residues, animal manure, wood wastes from forestry and industry, residues from food and paper industries, municipal green wastes, dedicated energy crops, and methane from landfills (IEA 2007-TN8436). Baseload biomass fuel-fired power generation depends on the geographic distribution, available quantities, constancy of supply, and energy content of biomass resources. As of 2022, biomass in California powered approximately 2 percent of total State electricity, most of that from wood fuel (DOE/EIA 2023-TN9828). For this analysis, biomass fuel would be combusted for power generation in the electricity sector.

For utility scale biomass fuel-fired electricity generation, technologies used for biomass energy conversion would be similar to the technology used in fossil fuel-fired power plants, including the direct combustion of biomass fuel in a boiler to produce steam (NRC 2024-TN10161). Accordingly, biomass electricity generation is considered a carbon-emitting technology.

Biomass energy generation is generally more cost-effective when co-located with coal-fired power plants (IEA 2007-TN8436). However, most biomass fuel-fired power plants only generate 50 MWe, which means that replacing Diablo Canyon's generating capacity, using only biomass fuel, would require the construction of 46 power plants. Increasing biomass fuel-fired generation capacity by expanding existing or constructing new units by the time the Diablo Canyon operating licenses expire is unlikely. For these reasons, biomass fuel-fired power generation is not a reasonable alternative to Diablo Canyon LR.

2.4.5 Hydroelectric Power

As of 2020, there were approximately 2,300 operating hydroelectric power facilities in the United States (DOE Undated-TN7701). Hydropower technologies capture the energy of flowing water and direct it to a turbine and generator to produce electricity (NRC 2024-TN10161). There are three variants of hydroelectric power generation: (1) run of the river (diversion) facilities that redirect the natural flow of a river, stream, or canal through a hydroelectric power facility; (2) store and release facilities that block the flow of the river by using dams that cause water to accumulate in an upstream reservoir; and (3) pumped storage facilities that use electricity from other power sources to pump water to higher elevations during off-peak hours to be released during peak load periods to generate electricity (EIA 2020-TN8352, EIA 2021-TN8353). The Helms Pumped Storage Project is a pumped storage project operated by PG&E in the Sierra Nevada mountains east of Fresno that was constructed to work in conjunction with Diablo Canyon. When demand for electricity is low, power from Diablo Canyon is used to pump water from the lower reservoir at Helms to the upper reservoir (Bender Undated-TN10082).

Although the EIA projects that hydropower will remain a leading source of renewable power generation in the United States through 2040, there is little expected new large-scale hydropower development (DOE/EIA 2013-TN2590). The potential for new large hydropower facilities has diminished out of public concern over flooding, habitat alteration and loss, and the impact on unaffected rivers (NRC 2024-TN10161).

Given the lack of growth in hydroelectric power, competing demands for water resources, and public opposition to the environmental impacts from the construction of large-scale hydroelectric power facilities, hydroelectric power is not a reasonable alternative to Diablo Canyon LR.

2.4.6 Geothermal Power

Geothermal energy generating technologies extract heat from geologic formations to produce steam to drive steam turbine generators. Electricity production from geothermal energy has demonstrated 95 percent or greater capacity factors, making geothermal energy a potential source of baseload electric power. As of 2021, California geothermal power plants had a combined capacity of 1,850 MW. Assuming a capacity factor of 71 percent, approximately 3,200 MW of additional geothermal energy capacity would need to be installed to replace the 2,285 MW of electricity generated by Diablo Canyon (DOE/EIA 2021-TN9847). As such, while geothermal power is considered as part of the renewables combination alternative, it is not reasonable as a standalone baseload power alternative to Diablo Canyon LR.

2.4.7 Wave and Ocean Energy

Ocean waves, currents, and tides are generally predictable and reliable, making them attractive candidates for potential renewable energy generation. Four major technologies can be used to harness wave energy: (1) terminator devices that range from 500 kilowatts (kW) to 2 MW, (2) attenuators, (3) point absorbers, and (4) overtopping devices (BOEM Undated-TN7696). Point absorbers and attenuators use floating buoys to convert wave motion into mechanical energy, driving turbine generators to produce electricity. Overtopping devices trap a portion of a wave at a higher elevation than the sea surface; waves enter a tube and compress air that is then used to drive a turbine generator producing electricity (NRC 2013-TN2654). Some of these technologies are undergoing demonstration testing at commercial scales, but none of the technologies are currently used to provide baseload power (BOEM Undated-TN7696). In the United States, there are currently several projects licensed or seeking permits, the largest of which is 20 MW (Duke Energy 2021-TN8897).

Large-scale application of wave energy technologies is unlikely to be viable, as wave and ocean energy-generation technologies are still in their infancy and currently lack commercial application (EPRI 2011-TN8442). Therefore, wave and ocean energy power generation is not a reasonable alternative to Diablo Canyon LR, either as a standalone alternative or as part of a combination alternative.

2.4.8 Municipal Solid Waste-Fired Power

Energy recovery from municipal solid waste converts nonrecyclable waste materials into usable heat, electricity, or fuel through combustion. The three types of municipal solid waste combustion technologies are mass burning, modular systems, and refuse derived fuel systems. Mass burning is the method used most frequently in the United States. The heat released from combustion is used to convert water to steam, which is then used to drive turbine generators to produce electricity. After combustion, ash is collected and taken to a landfill, and particulates are captured through a filtering system (EPA 2023-TN8443).

Currently, 75 waste-to-energy power plants are in operation in 21 States, processing approximately 29 million tons (MTs) (26,308 kilograms [kg]) of waste per year. These waste-to-energy power plants have an aggregate capacity of 2,725 MWe (Michaels and Krishnan 2019-TN7700). Although some power plants have expanded to handle additional waste and to produce more energy, only one new municipal solid waste combustion power plant has been built in the United States since 1995 (Maize 2019-TN7699). Because the average waste-to-energy power plant only produces about 50 MWe, each unit would provide a very small portion of the energy currently produced by Diablo Canyon.

The decision to burn municipal solid waste to generate electricity is usually driven by the need for a waste disposal alternative to landfills rather than a need to generate energy. Stable supplies of municipal solid waste would be needed to support a new waste-to-energy power plant. Based on this information, municipal solid waste-fired power is not a reasonable alternative to Diablo Canyon LR.

2.4.9 Natural Gas-Fired, Petroleum-Fired, and Coal-Fired Power

The 100 Percent Clean Energy Act of 2018 requires that all retail electricity sales in the State of California must come from renewable and zero-carbon-emitting resources by the end of 2045 (CA Utilities Code 454.53-TN9910). Additionally, in 2022, the California Air Resources Board committed to not build new fossil-fuel power plants (CARB 2022-TN9829). As such, new natural gas-fired, petroleum-fired, or coal-fired power plants are not reasonable alternatives to Diablo Canyon LR.

2.4.10 Fuel Cells

Fuel cells oxidize fuels without combustion and, therefore, without the environmental effects of combustion. Fuel cells use a fuel (e.g., hydrogen) and oxygen to create electricity through an electrochemical process. The only byproducts are heat, water, and carbon dioxide (depending on the hydrogen fuel type) (DOE Undated-TN7695). Hydrogen fuel can come from a variety of hydrocarbon resources, including natural gas. As of October 2020, the United States had only 250 MW of fuel cell power generation (EIA 2022-TN8955).

Currently, fuel cells are not economically or technologically competitive with other electricity generating alternatives. The EIA estimates that fuel cells may cost $6,639 per installed kilowatt (in 2021 dollars), which is high compared to other replacement energy alternatives (DOE/EIA 2022-TN7694). In June 2021, DOE launched an initiative to reduce the cost of hydrogen production to spur fuel cell and energy storage development over the next decade (DOE 2021-TN7693). It is unclear to what degree this initiative will lead to increased future development and deployment of fuel cell technologies.

More importantly, fuel cell units used for power production are likely to be small (approximately 10 MW). The world's largest industrial hydrogen fuel cell power plant is a 50 MWe plant in South Korea (Larson 2020-TN8401). Using fuel cells to replace the power that Diablo Canyon provides would require the construction of approximately 229 units. Given the limited deployment and high cost of fuel cell technology, fuel cells are not a reasonable alternative to Diablo Canyon LR.

2.4.11 Delayed Retirement of Other Generating Facilities

Delaying the retirement of a power generating facility provides for the continued supply of electricity from that facility. Due to new regulations requiring significant reductions in power plant emissions, some owners may opt to retire their older, less efficient units rather than incur the cost for compliance. Retirements may also be driven by low competing commodity prices (such as low natural gas prices), slow growth in electricity demand, and EPA's Mercury and Air Toxics Standards for fossil-fueled power plants (DOE/EIA 2015-TN4585; EPA 2020-TN8379).

Based on California's renewable energy mandates associated with the 100 Percent Clean Energy Act of 2018, delaying the retirement of power generating facilities could result in higher, less economical operating costs and, therefore, is not a reasonable alternative to Diablo Canyon LR.

2.4.12 Demand-Side Management

Demand-side management refers to energy conservation and efficiency programs that do not require the addition of new generating capacity. Demand-side management programs can include reducing energy demand through consumer behavioral changes or through altering the characteristics of the electrical load. These programs can be initiated by a utility, transmission operators, the State, or other load serving entities. In general, residential electricity consumers have been responsible for the majority of peak load reductions, and participation in most demand-side management programs is voluntary (NRC 2024-TN10161).

Therefore, the existence of a demand-side management program does not guarantee that reductions in electricity demand will occur. The LR GEIS concludes that, although the energy conservation or energy efficiency potential in the United States is substantial, there have been no cases in which an energy efficiency or conservation program alone has been implemented expressly to replace or offset large baseload power generation (NRC 2024-TN10161). Therefore, baseload demand-side management programs alone are not a reasonable alternative to Diablo Canyon LR. However, in combination with other power generating technologies (see the renewables combination alternative), demand-side management could be a reasonable alternative to Diablo Canyon LR.

2.5 Comparison of Alternatives

In this chapter, the NRC staff presents two replacement power alternatives to the proposed action of Diablo Canyon LR: (1) purchased power and (2) renewables combination (i.e., wind and solar energy with battery storage, geothermal energy, and demand-side management). Chapter 3 describes the environmental impacts of the proposed action and alternatives to the proposed action. Table 2-1 summarizes these environmental impacts.

The environmental impacts of the proposed action would be SMALL for all resource areas. In comparison, both replacement power alternatives would have environmental impacts in at least two resource areas with the potential to be greater than the environmental impacts of the proposed action. If the NRC does not renew the Diablo Canyon operating licenses (i.e., the no-action alternative), energy-planning decision-makers would have to choose a replacement power alternative similar to the ones evaluated in this SEIS. Based on the review of the replacement power alternatives, the no-action alternative, and the proposed action, the environmentally preferred alternative is the proposed action. Therefore, the NRC staff's recommendation is to renew the Diablo Canyon operating licenses.

Table 2-1 Summary of Environmental Impacts of the Proposed Action and Alternatives to the Proposed Action

Resource Area	Proposed Action – License Renewal	No Action	Purchased Power	Renewables Combination
Land Use	SMALL	SMALL	SMALL	MODERATE
Visual Resources	SMALL	SMALL	SMALL	MODERATE
Air Quality	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE
Noise	SMALL	SMALL	SMALL	SMALL to MODERATE
Geologic Environment	SMALL	SMALL	SMALL	SMALL to MODERATE
Groundwater and Surface Water	SMALL	SMALL	SMALL	SMALL
Terrestrial Resources	SMALL	SMALL	SMALL	MODERATE to LARGE
Aquatic Resources	SMALL	SMALL	SMALL	SMALL to MODERATE

Table 2-1 Summary of Environmental Impacts of the Proposed Action and Alternatives to the Proposed Action (Continued)

Resource Area	Proposed Action – License Renewal	No Action	Purchased Power	Renewables Combination
Special Status Species and Habitat	[a]	[b]	[c]	[c]
Historic and Cultural Resources	[d]	[e]	[f]	[f]
Socioeconomics	SMALL	SMALL to LARGE	SMALL	SMALL to LARGE
Transportation	SMALL	SMALL	SMALL	SMALL to LARGE
Human Health	SMALL[g]	SMALL[g]	SMALL[g]	SMALL[g]
Waste Management	SMALL	SMALL	SMALL	SMALL

(a) May affect and is likely to adversely affect green sea turtle, loggerhead sea turtle (North Pacific distinct population segment [DPS]), leatherback sea turtle, and Pacific olive ridley sea turtle (Mexico's Pacific Coast breeding population and all other populations). May affect but is not likely to adversely affect California red-legged frog, California condor, California least tern, Hawaiian petrel, marbled murrelet, short-tailed albatross, southern sea otter, black abalone, and humpback whale (Central American DPS and Mexico DPS). May affect but is not likely to destroy or adversely modify critical habitats of the black abalone and humpback whale. No effect on other federally listed species or critical habitats identified. See Section 3.8.4.1 and Section 3.8.4.2 of this SEIS. No more than minimal adverse effects on the designated essential fish habitat (EFH) of all life stages of coastal pelagic species complex, euphausiids (krill), groundfish, and highly migratory species. May affect but is not likely to destroy, cause the loss of, or injure sanctuary resources of the proposed Chumash Heritage National Marine Sanctuary.

(b) Overall, the effects on federally listed species, critical habitat, EFH, and sanctuary resources would likely be smaller under the no-action alternative than under continued operation but would depend on the specific shut down activities as well as the listed species, critical habitats, designated EFH, and sanctuary resources present when the no-action alternative is implemented.

(c) The types and magnitudes of adverse impacts to species listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.-TN1010), designated critical habitat, EFH, and sanctuary resources would depend on the proposed alternative site, facility design and operation, as well as listed species and habitats present when the alternative is implemented. Therefore, the NRC staff cannot forecast a level of impact for this alternative.

(d) Based on no new physical or visual modifications to the landscape, Tribal consultation, and the applicant's administrative procedures, the proposed action would have No Adverse Effect to historic properties under Section 106 of the NHPA or historic and cultural resources under NEPA.

(e) PG&E has concluded that two archaeological sites may be adversely affected from planned decommissioning activities (ML22293A419 [PG&E 2022-TN10296]). The extent of adverse impacts to the two archaeological sites would be unknown until PG&E submits a license amendment request for the NRC staff's review and approval. If the planned activities are determined to be adverse, consultation with the Advisory Council on Historic Preservation (ACHP), California Office of Historic Preservation, and Tribes would occur to mitigate and resolve the adverse effects.

(f) Potential impacts of this alternative would be dependent on the source, type, and location chosen. The NRC does not license natural gas or renewable energy facilities; therefore, the NRC would not be responsible for NHPA Section 106 consultations for this alternative. If there is a Federal nexus, the responsible Federal agency would determine the presence or absence of historic and cultural resources and apply the criteria of effect set forth in 36 CFR 800.4. If historic properties are determined to be present, impacts would be assessed and, if applicable, mitigated with the ACHP, California Office of Historic Preservation, and Tribes through the Section 106 process.

(g) The effects of electromagnetic fields on human health associated with operating nuclear power and other electricity generating plants are uncertain.

3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATING ACTIONS

3.1 Introduction

In conducting its review of the environmental effects of the proposed action of renewing the Diablo Canyon operating licenses for an additional 20 years, the NRC staff defines and describes the environment that could be affected by the proposed action. The NRC staff also evaluates the environmental consequences of the proposed action as well as alternatives to the proposed action.

In this chapter, the affected environment is the environment that currently exists at and around Diablo Canyon. Because existing conditions are at least partially the result of past construction and nuclear power plant operations, this chapter considers the nature and impacts of past and ongoing operations and evaluates how, together, these actions have shaped the current environment. This chapter also describes reasonably foreseeable environmental trends. The effects of ongoing reactor operations at Diablo Canyon have become well established as environmental conditions have adjusted to the presence of the facility.[1]

Sections 3.2 through 3.13 of this SEIS describe the affected environment for each resource area, followed by the NRC staff's evaluation of the environmental consequences of the proposed action and alternatives to the proposed action on the resource area. The NRC staff compares the environmental impacts of the proposed action with those of the no-action alternative and replacement power alternatives to determine whether the adverse environmental impacts of the proposed action are so great that preserving the option of license renewal for energy-planning decision-makers would be unreasonable.

The NRC staff's evaluation of environmental consequences includes the following:

- impacts associated with continued operations of Diablo Canyon during the period of extended operation
- impacts of the replacement power alternatives to the proposed action and the no-action alternative (not issuing renewed licenses)
- impacts common to all alternatives: (1) fuel cycle, including uranium fuel cycle, (2) terminating Diablo Canyon operations and decommissioning, and (3) greenhouse gas emissions and climate change
- impacts of postulated accidents (design-basis accidents and severe accidents)
- cumulative effects of the proposed action
- resource commitments associated with the proposed action, including unavoidable adverse impacts, the relationship between short-term use and long-term productivity, and irreversible and irretrievable commitment of resources
- new and potentially significant information about environmental issues related to the impacts of continued operations during the period of extended operation

[1] Where appropriate, the NRC staff has summarized referenced information (incorporated information by reference) in this SEIS. This allows the NRC staff to focus on new and potentially significant information identified since previous NEPA documentation became available for Diablo Canyon.

As stated in Sections 1.4 and 1.5, this SEIS documents the NRC staff’s environmental review of the Diablo Canyon LRA (PG&E 2023-TN9822) as a supplement to the information provided in the LR GEIS (NRC 2024-TN10161). The LR GEIS identifies 80 issues (divided into Category 1 [generic] and Category 2 [site-specific] issues) to be evaluated for the proposed action. Section 1.4 of this SEIS provides an explanation of the criteria for Category 1 issues and Category 2 issues, as well as the definitions of SMALL, MODERATE, and LARGE impact significance.

For the evaluation of Category 1 issues in this SEIS, the NRC staff relies on the analysis in the LR GEIS unless otherwise noted. Table 3-1 lists the applicable Category 1 issues for the Diablo Canyon LRA. For these issues, the NRC staff did not identify any new and significant information that would change the conclusions of the LR GEIS (see Section 3.14 of this SEIS). Therefore, as described in Sections 3.2 through 3.17 of this SEIS and as summarized in Table 3-1, there are no impacts related to these issues beyond those discussed in the LR GEIS. Section 3.14 of this SEIS describes the NRC staff’s process for evaluating new and significant information.

Table 3-1 Applicable Category 1 (Generic) Conclusions Regarding the Diablo Canyon Nuclear Power Plant License Renewal

Environmental Issue	LR GEIS Section	Impact
Land Use – Onsite land use	4.2.1.1	SMALL
Land Use – Offsite land use	4.2.1.1	SMALL
Land Use – Offsite land use in transmission line rights-of-way (ROWs)	4.2.1.1	SMALL
Visual Resources – Aesthetic Impacts	4.2.1.2	SMALL
Air Quality – Air quality impacts	4.3.1.1	SMALL
Air Quality – Air quality effects of transmission lines	4.3.1.1	SMALL
Noise – Noise impacts	4.3.1.2	SMALL
Geologic Environment – Geology and soils	4.4.1.1	SMALL
Surface Water Resources – Surface water use and quality (non-cooling system impacts)	4.5.1.1	SMALL
Surface Water Resources – Altered current patterns at intake and discharge structures	4.5.1.1	SMALL
Surface Water Resources – Scouring caused by discharged cooling water	4.5.1.1	SMALL
Surface Water Resources – Discharge of metals in cooling system effluent	4.5.1.1	SMALL
Surface Water Resources – Discharge of biocides, sanitary wastes, and minor chemical spills	4.5.1.1	SMALL
Surface Water Resources – Surface water use conflicts (plants with once-through cooling systems)	4.5.1.1	SMALL
Surface Water Resources – Effects of dredging on surface water quality	4.5.1.1	SMALL
Surface Water Resources – Temperature effects on sediment transport capacity	4.5.1.1	SMALL
Groundwater Resources – Groundwater contamination and use (non-cooling system impacts)	4.5.1.2	SMALL
Groundwater Resources – Groundwater use conflicts (plants that withdraw less than 100 gallons per minute [gpm])	4.5.1.2	SMALL
Groundwater Resources – Groundwater quality degradation resulting from water withdrawals	4.5.1.2	SMALL

Table 3-1 Applicable Category 1 (Generic) Conclusions Regarding the Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Environmental Issue	LR GEIS Section	Impact
Terrestrial Resources – Exposure of terrestrial organisms to radionuclides	4.6.1.1	SMALL
Terrestrial Resources – Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	4.6.1.1	SMALL
Terrestrial Resources – Bird collisions with plant structures and transmission lines	4.6.1.1	SMALL
Terrestrial Resources – Transmission line right-of-way (ROW) management impacts on terrestrial resources	4.6.1.1	SMALL
Terrestrial Resources – Electromagnetic field effects on terrestrial plants and animals	4.6.1.1	SMALL
Aquatic Resources – Entrainment of phytoplankton and zooplankton	4.6.1.2	SMALL
Aquatic Resources – Infrequently reported effects of thermal effluents	4.6.1.2	SMALL
Aquatic Resources – Effects of nonradiological contaminants on aquatic organisms	4.6.1.2	SMALL
Aquatic Resources – Exposure of aquatic organisms to radionuclides	4.6.1.2	SMALL
Aquatic Resources – Effects of dredging on aquatic organisms	4.6.1.2	SMALL
Aquatic Resources – Non-cooling system impacts on aquatic resources	4.6.1.2	SMALL
Aquatic Resources – Impacts of transmission line right-of-way (ROW) management on aquatic resources	4.6.1.2	SMALL
Socioeconomics – Employment and income, recreation and tourism	4.8.1.1	SMALL
Socioeconomics – Tax revenue	4.8.1.2	SMALL
Socioeconomics – Community services and education	4.8.1.3	SMALL
Socioeconomics – Population and housing	4.8.1.4	SMALL
Socioeconomics – Transportation	4.8.1.5	SMALL
Human Health – Radiation exposures to plant workers	4.9.1.1.1	SMALL
Human Health – Radiation exposures to the public	4.9.1.1.1	SMALL
Human Health – Chemical hazards	4.9.1.1.2	SMALL
Human Health – Microbiological hazards to plant workers	4.9.1.1.3	SMALL
Human Health – Physical occupational hazards	4.9.4.1.5	SMALL
Postulated Accidents – Design-basis accidents	4.9.1.2.1	SMALL
Postulated Accidents – Severe accidents	4.9.1.2.1	SMALL[a]
Waste Management – Low-level waste storage and disposal	4.11.1.1	SMALL
Waste Management – Onsite storage of spent nuclear fuel	4.11.1.2	SMALL
Waste Management – Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	4.11.1.3	[b]
Waste Management – Mixed-waste storage and disposal	4.11.1.4	SMALL
Waste Management – Nonradioactive waste storage and disposal	4.11.1.5	SMALL
Greenhouse Gas Emissions and Climate Change – Greenhouse gas impacts on climate change	4.12.1	SMALL
Uranium Fuel Cycle – Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste	4.14.1.5	SMALL
Uranium Fuel Cycle – Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste	4.14.1.5	[c]
Uranium Fuel Cycle – Nonradiological impacts of the uranium fuel cycle	4.14.1.5	SMALL
Uranium Fuel Cycle – Transportation	4.14.1.5	SMALL
Termination of plant operations and decommissioning	4.14.2.1	SMALL

Table 3-1 Applicable Category 1 (Generic) Conclusions Regarding the Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Environmental Issue	LR GEIS Section	Impact

gpm = gallon(s) per minute; ROW = right-of-way.

(a) While the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants, the topic of SAMA analysis is separately considered in this SEIS as if it were a Category 2 issue (see Appendix F) because the NRC staff has not previously considered a SAMA analysis for Diablo Canyon as part of an environmental review and because 10 CFR 51.53(c)(3)(ii)(L) states that, "[i]f the staff has not previously considered severe accident mitigation alternatives for the applicant's plant, in an EIS or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided.".

(b) The ultimate disposal of spent fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of this review. Per 10 CFR Part 51 (TN10253) Subpart A, the Commission concludes that the impacts presented in NUREG-2157 (NRC 2014-TN4117) would not be sufficiently large to require the NEPA conclusion, for any nuclear power plant, that the option of extended operation under 10 CFR Part 54 (TN4878) should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent nuclear fuel and high-level waste disposal, this issue is considered generic to all nuclear power plants.

(c) There are no regulatory limits applicable to collective doses to the general public from fuel cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel cycle facilities are designed and operated to meet the applicable regulatory limits and standards. As stated in the LR GEIS, "The Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated."

Sources: Table B-1 in Appendix B, Subpart A, to 10 CFR Part 51-TN10253; NRC 2024-TN10161.

The NRC staff analyzed the applicable Category 2 (site-specific) issues for Diablo Canyon and assigned a significance level for each issue as shown in Table 3-2.

Table 3-2 Applicable Category 2 (Site-Specific) Conclusions Regarding the Diablo Canyon Nuclear Power Plant License Renewal

Environmental Issue	LR GEIS Section	Impact[a]
Groundwater Resources – Radionuclides released to groundwater	4.5.1.2	SMALL
Terrestrial Resources – Non-cooling system impacts on terrestrial resources	4.6.1.1	SMALL
Aquatic Resources – Impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	4.6.1.2	SMALL
Aquatic Resources – Effects of thermal effluents on aquatic organisms (plants with once-through cooling systems or cooling ponds)	4.6.1.2	SMALL
Federally Protected Ecological Resources – Endangered Species Act: Federally listed species and critical habitats under U.S. Fish and Wildlife Service jurisdiction	4.6.1.3.1	May affect but is not likely to adversely affect California red-legged frog, California condor, California least tern, Hawaiian petrel, marbled murrelet, short-tailed albatross, and southern sea otter. No effect on other federally listed species or critical habitats identified. See Section 3.8.4.1 of this SEIS.

Table 3-2 Applicable Category 2 (Site-Specific) Conclusions Regarding the Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Environmental Issue	LR GEIS Section	Impact[(a)]
Federally Protected Ecological Resources – Endangered Species Act: federally listed species and critical habitats under National Marine Fisheries Service jurisdiction	4.6.1.3.2	May affect and is likely to adversely affect green sea turtle, loggerhead sea turtle (North Pacific distinct population segment [DPS]), leatherback sea turtle, and Pacific olive ridley sea turtle (Mexico's Pacific Coast breeding population and all other populations). May affect but is not likely to adversely affect black abalone, gray whale (Eastern North Pacific DPS), and humpback whale (Central American DPS and Mexico DPS). May affect but is not likely to destroy or adversely modify critical habitats of the black abalone and humpback whale. No effect on other federally listed species or critical habitats identified in Section 3.8.4.2 of this SEIS.
Federally Protected Ecological Resources – Magnuson-Stevens Act: essential fish habitat	4.6.1.3.3	No more than minimal adverse effects on the designated essential fish habitat of all life stages of coastal pelagic species complex, euphausiids (krill), groundfish, and highly migratory species.
Federally Protected Ecological Resources – National Marine Sanctuaries Act: sanctuary resources	4.6.1.3.4	May affect but is not likely to destroy, cause the loss of, or injure sanctuary resources of the proposed Chumash Heritage National Marine Sanctuary.
Historic and Cultural Resources – Historic and cultural resources	4.7.1	The proposed action would not adversely affect historic properties under the National Historic Preservation Act of 1966 or historic and cultural resources under NEPA.
Human Health – Microbiological hazards to the public	4.9.1.1.3	N/A[(c)]
Human Health – Electromagnetic fields (EMFs)[(b)]	4.9.1.1.4	Uncategorized (Uncertain Impact)
Human Health – Electric shock hazards	4.9.1.1.5	SMALL
Greenhouse Gas Emissions and Climate Change – Climate change impacts on environmental resources	4.12.2	See Section 3.15.3.2.3 of this SEIS.
Cumulative Effects – Cumulative effects	4.13	See Section 3.16 of this SEIS.

DPS = distinct population segments; SEIS = supplemental environmental impact statement.

(a) Impact determinations for Category 2 issues based on findings described in Sections 3.2 through 3.13 of this SEIS, as applicable, for the proposed action.

(b) This issue was not designated as Category 1 or Category 2 and is discussed in Section 3.11.6.1 of this SEIS.

(c) As discussed in Section 3.11.3 of this SEIS, Diablo Canyon utilizes a once-through cooling system that intakes and discharges to the Pacific Ocean. This area is not accessible to the public so further review is not warranted and continued operation is not expected to result in adverse effects to the health of the public.

Sources: Table B-1 in Appendix B, Subpart A, to 10 CFR Part 51-TN10253; NRC 2024-TN10161.

3.2 Land Use and Visual Resources

This section describes land use and visual resources in the vicinity of the Diablo Canyon site as well as the potential impacts from the proposed action of LR and alternatives to the proposed action. Section 3.2 of PG&E's ER (PG&E 2023-TN9822) describes current Diablo Canyon onsite and offsite land use conditions as well as visual resources.

3.2.1 Land Use

The Diablo Canyon site is located adjacent to the Pacific Ocean at the mouth of Diablo Creek in an unincorporated portion of San Luis Obispo County, California. The nearest communities to Diablo Canyon are Los Osos (2020 population: 16,174), located approximately 7 mi (11 km) to the north, and Avila Beach (2020 population: 1,455), located approximately 8 mi (13 km) to the southeast. All of San Luis Obispo County is within the San Luis Obispo–Paso Robles Metropolitan Statistical Area (2020 population: 282,424). The sections below describe onsite and offsite land use within a 6 mi (10 km) radius and also describe the California coastal zone and the regulations that govern its use.

3.2.1.1 Onsite Land Use

The Diablo Canyon property comprises approximately 750 ac (304 ha), within a larger surrounding area of approximately 12,000 ac (4,856 ha), that is owned and controlled by PG&E and referred to as the Diablo Canyon Lands. A portion of the Diablo Canyon upland property adjacent to the shoreline, as well as offshore lands underlying the intake and discharge coves, are owned by the State of California and are under the jurisdiction of the California State Lands Commission (PG&E 2023-TN9822). As shown in Table 3-3, the predominant land cover at Diablo Canyon is shrub or scrub (35.5 percent), developed lands (33.6 percent), and grassland or herbaceous (17.2 percent). Approximately 10 percent of the land use comprises high intensity development.

Table 3-3 Land Use or Land Cover, Diablo Canyon Nuclear Power Plant Site

Category	Acres	Percentage
Open Water	13.57	1.8
Developed, Open Space	49.15	6.5
Developed, Low Intensity	57.38	7.6
Developed, Medium Intensity	70.94	9.4
Developed, High Intensity	76.28	10.1
Barren Land (Rock/Sand/Clay)	0.22	0.0
Evergreen Forest	15.35	2.0
Mixed Forest	71.17	9.5
Shrub/Scrub	266.87	35.5
Grassland/Herbaceous	129.66	17.2
Pasture/Hay	0.44	0.1
Woody Wetlands	0.67	0.1
Emergent Herbaceous Wetlands	0.67	0.1
TOTAL	752.36	100.00

Source: PG&E 2023-TN9822.

San Luis Obispo County has zoned the Diablo Canyon site as “Public Facilities,” which designates areas with existing public or quasi-public facilities and uses, or publicly owned lands intended for the development of public facilities to meet public needs. Primary access to Diablo Canyon is from Diablo Canyon Road in Avila Beach. Major highways include California State Route 1 and U.S. Route 101. There is no rail access to Diablo Canyon, although the Union Pacific Transportation Company provides rail service paralleling U.S. Route 101, and Amtrak passenger rail passes through the county. The closest port to Diablo Canyon is Port San Luis

Harbor (approximately 6.5 mi [10.5 km] to the south-southeast), although no people or vessels are permitted to come within 2,000 yards (yd) (1,800 m) of the Diablo Canyon site. The closest commercial airport is the County of San Luis Obispo Regional Airport (approximately 12 mi [19 km] to the east).

3.2.1.2 Coastal Zone

Section 307(c)(3)(A) of the Coastal Zone Management Act of 1972 (CZMA), as amended (16 U.S.C. 1456(c)(3)(A)) (TN1243), requires that an applicant for a Federal license to conduct an activity affecting any land or water use or natural resource of the coastal zone provide in the application to the licensing agency (in this case, the NRC) a certification that the proposed activity complies with the enforceable policies of the State's coastal zone management program. The Federal regulations that implement the CZMA provide that this requirement is applicable to renewals of Federal license activities not previously reviewed by the State (15 CFR 930.51(b)(1)) (TN4475).

Diablo Canyon was constructed prior to the enactment of the CZMA and, therefore, its compliance with the enforceable policies of the California coastal management program was not previously reviewed by the State. In November 2023, PG&E submitted a Federal consistency certification to the NRC and to the California Coastal Commission (CCC) stating its position that continued operation of [Diablo Canyon] complies with California's coastal management program and will be conducted in a manner consistent with such program. In response, on December 7, 2023, the CCC informed PG&E that it needs more information before it can consider the Diablo Canyon license renewal consistency certification. Discussions between PG&E and the CCC are ongoing; to date, the CCC has not notified the NRC and PG&E whether it concurs with or objects to the consistency certification.

3.2.1.3 Offsite Land Use

The predominant land covers within the 6 mi (10 km) radius of the Diablo Canyon site include open water (56 percent), scrub or shrub (19 percent), and mixed forest (16 percent).

San Luis Obispo County occupies approximately 2,112,394 ac (854,856 ha), of which 931,291 ac (376,880 ha) are farmland, with a total of 2,349 farms. Primary farm crops include orchards, vegetables, forage, and corn. Other products include livestock commodities such as cattle and calves, sheep and lambs, and hogs and pigs. San Luis Obispo County has in place a comprehensive plan establishing standards, regulations, and goals for land development and appropriate uses for land, water, and resources. The land use planning portion of the county planning framework is divided into inland and coastal regions, incorporating principles such as preserving open space, limiting urban sprawl, and conserving resources.

3.2.2 Visual Resources

As noted in Section 3.2.1, the Diablo Canyon site is located on the Pacific Ocean in San Luis Obispo County, California. The tallest structures at Diablo Canyon include the Unit 1 and Unit 2 containment structures (243.5 ft [74.2 m]). Other structures include transmission switchyards, the ISFSI, raw water reservoirs, breakwater, intake structure, discharge structure, and simulator or training buildings, although the visibility of each structure depends on the vantage point. The site is generally not visible by the public on land due to coastal mountain ranges, although it can be seen at times from the Rancho Guadalupe Dunes Preserve to the south and from Windy Point on the Point Buchon Trail to the north, as well as offshore from the Pacific Ocean.

3.2.3 Proposed Action

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1, for generic issues related to land use and visual resources, the impacts of nuclear power plant LR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS with respect to Diablo Canyon LR, as further described below.

3.2.3.1 Onsite Land Use

Operational activities during the LR term would be similar to those already occurring at Diablo Canyon. Industrial land use conditions would continue unchanged. Based on this information, the NRC staff concludes that the impact of continued nuclear power plant operations on onsite land use during the Diablo Canyon LR term would be SMALL. In addition, the NRC staff did not identify any new onsite land use information that would alter this conclusion.

3.2.3.2 Offsite Land Use

LR activities have generally had little to no effect on population or tax revenue in communities near nuclear power plants. Operational activities during the LR term, including periodic nuclear refueling outages requiring temporary staff, would be similar to those already occurring at the nuclear power plant and would not affect offsite land use beyond what has already been affected. Based on this information, the NRC staff concludes that the impact of continued nuclear power plant operations on offsite land use during the Diablo Canyon LR term would be SMALL. In addition, the NRC staff did not identify any new offsite land use information that would alter this conclusion.

3.2.3.3 Offsite Land Use in Transmission Line Right-of-Ways

Maintenance activities in transmission line right-of-ways (ROWs) during the LR term would be the same as or similar to those already occurring and would not affect offsite land use beyond what has already been affected. Transmission line ROWs do not preclude the use of the land for other purposes, such as agriculture and recreation. However, land use is limited to activities that do not endanger power line operation. Based on this information, the NRC staff concludes that the impact of continued nuclear power plant operations during the Diablo Canyon LR term on offsite land use in transmission line ROWs would be SMALL. In addition, the NRC staff did not identify any new land use information that would alter this conclusion.

3.2.3.4 Visual Resources

The visual appearance of the Diablo Canyon structures and associated transmission lines has become well established over the nuclear power plant's operating history and is not likely to change during the LR term. The NRC staff concludes that the visual impact of continued nuclear power plant operations at Diablo Canyon during the LR term would be SMALL because the visual appearance of nuclear power plant structures, transmission lines, and plume will not change appreciably. In addition, the NRC staff did not identify any new information during the environmental review that would alter this conclusion.

3.2.4 No-Action Alternative

3.2.4.1 Land Use

Under the no-action alternative, the NRC would not issue renewed Diablo Canyon operating licenses, and reactor power generating operations would cease on or before the expiration of the current licenses. However, plant maintenance and decommissioning activities would continue. Under this alternative, onsite land use would remain similar to onsite land use under the proposed action until decommissioning. Shutdown of Diablo Canyon would not affect onsite land use. Plant structures and other facilities would remain in place until decommissioning. Most transmission lines and ROWs would remain in service after the cessation of reactor operations. Maintenance of most existing infrastructure would continue. Based on this information, the NRC staff concludes that land use impacts under the no-action alternative would be SMALL.

3.2.4.2 Visual Resources

Termination of reactor operations because of not renewing the operating licenses under the no-action alternative would not immediately change the visual appearance of the Diablo Canyon site. The most visible structures are the reactor containment and other buildings, and they would likely remain in place for some time during decommissioning until they are eventually dismantled. As a result, the NRC staff concludes that visual resources impacts from the no-action alternative would be SMALL.

3.2.5 Replacement Power Alternatives: Common Impacts

3.2.5.1 Land Use

The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a replacement power-generating facility or facilities.

Construction would require the permanent commitment of land chosen for industrial use at the site(s) and supporting infrastructure. Material laydown areas and onsite concrete batch plants could also result in temporary land use changes. Existing transmission lines and infrastructure would support each of the replacement power alternatives, thus reducing the need for additional land commitments.

Operation of new power-generating facilities would have impacts associated with the amount of land committed for the permanent use of the replacement power plant(s). Additional land may be required to support power plant operations, including land for mining, extraction, and waste disposal activities associated with each alternative.

3.2.5.2 Visual Resources

Installation of new power generating facilities and support structures at existing power plants sites would be consistent with the industrial character of the site. However, wind turbines, solar panels, geothermal facilities, and new transmission lines could be seen from a distance, depending on the landscape and screening vegetation.

3.2.6 Purchased Power Alternative

Land use and visual resources impacts would depend on the source, type, and location of existing energy generating facilities. Land use and visual effects are difficult to assess because this alternative would involve a combination of energy generating sources at multiple unknown sites. However, impacts would be similar to the operational effects described in the common impacts Section 3.2.5. This alternative is not expected to create any new land use and visual impacts but could intensify environmental effects at existing energy generating facilities. These facilities would likely have best management practices (BMPs) and other procedures in place to ensure that any changes in operational effects are minimized. Based on this information, land use and visual resources impacts from the purchased power alternative would be SMALL.

3.2.7 Renewables Combination Alternative

3.2.7.1 Land Use

- Wind turbines: Approximately 171,000 ac (69,200 ha) for wind farms, approximately 5,000 ac (2,023 ha) for construction, approximately 1,500 ac (607 ha) housing wind turbines with a small amount of additional land for battery storage. This acreage is based on the DOE estimates of land use for wind power projects (85 ac [34 ha] per MW for wind farms, 2.47 ac [1 ha] per MW for construction footprint, and 0.74 ac [0.3 ha] per MW for permanent structures [DOE 2015-TN8757])
- Solar panels: Approximately 14,500 ac (5,868 ha) plus a small amount of additional land for battery storage. This acreage is based on an estimated 4 ac/MW in California (PG&E 2014-TN9843)
- Geothermal: Approximately 250 ac (101 ha), using a land requirement of 404 m^2/GWh (DOE 2024-TN9856)

Overall land use impacts for the construction and operation of the renewables combination alternative at multiple locations would be MODERATE. This is primarily due to the large area of land required for the solar and wind components and the land uses that may be affected.

3.2.7.2 Visual Resources

Construction of new wind turbines, solar panels, geothermal facilities, and associated new transmission lines could be seen from a distance, depending on such factors as the location, topography, and screening vegetation. As determined by these factors, solar and wind farm installations could have a MODERATE visual impact. The visual impact of the geothermal facilities would likely be less than that of the solar and wind components of this alternative.

3.3 Meteorology, Air Quality, and Noise

3.3.1 Meteorology and Climatology

The State of California is characterized by a range of climates and extremes, with climatic changes occurring within short distances. The south-central coast region’s topography and proximity to the coast creates microclimates resulting in substantial temperature differences over short distances (Moser and Elkstrom 2012-TN10139). The Pacific Ocean dominates the climate in areas on the western side of California’s Coast Ranges resulting in warm winters, cool summers, and small daily and seasonal temperature ranges. Diablo Canyon is located in San Luis Obispo County along the south-central coast of California. San Luis Obispo County exhibits a Mediterranean climate with warm and dry summers and cooler and wetter winters. Most of the precipitation falls in the winter (Kauffman 2003-TN10139). The San Lucia Mountains, which run in a north-south direction through the County, prevent moist cool coastal air from reaching inland (Moser and Elkstrom 2012-TN10139). Annual mean temperature and total precipitation recorded at the San Luis Obispo Regional Airport weather station for the period from 1991 through 2020 is 59.7°F (15.4°C) and 17.94 in. (0.46 m), respectively (NCEI 2021-TN10298). For this 30-year period, the summer months (June, July, and August) have minimal precipitation (0.19 in. [0.48 centimeters (cm)]) and mean monthly temperature of 65.4°F (18.5°C), whereas the winter months received the greatest precipitation (10.67 in. [0.27 m]) and had the lowest mean monthly temperatures (53.1°F [11.7°C]).

PG&E maintains an onsite meteorological monitoring system at Diablo Canyon that consists of two meteorological towers (a primary and a backup meteorological tower). The primary meteorological tower measures ambient air temperature, wind speed and direction, precipitation, and dew point. In the ER, PG&E provided meteorological observations from the primary meteorological tower for the 1993–2022 period of record (PG&E 2023-TN9822).

The mean annual temperature from Diablo Canyon's onsite meteorological tower is 56.5°F (13.6°C), with a mean monthly temperature ranging from a low of 54.2°F (12.3°C) in April and a high of 60.1°F (15.6°C) in October (PG&E 2023-TN9822). The annual total precipitation from Diablo Canyon's onsite meteorological tower is 10.5 in. (0.27 m), with a mean monthly precipitation ranging from a low of 0.19 in. (0.48 cm) in July and a high of 1.92 in. (4.9 cm) in December (PG&E 2023-TN9822). The mean annual wind speed from Diablo Canyon's onsite meteorological tower is 10.2 miles per hour (mph) (6.3 kilometers per hour [km/h]), with a prevailing wind direction from the north-northwest (PG&E 2023-TN9822).

San Luis Obispo County experiences severe weather events, including tornadoes, hail, and floods. For the January 1950 through January 2024 period of record, the following events were recorded (NOAA 2024-TN10155):

- flood: 16 events
- hail: 6 events
- tornado: 2 events

3.3.2 Air Quality

Under the Clean Air Act of 1963, as amended (CAA) (42 U.S.C 7401, et seq. -TN1141), the EPA has set primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50, "National Primary and Secondary Ambient Air Quality Standards"-TN1089) for six common criteria pollutants to protect sensitive populations and the environment. These NAAQS criteria pollutants are carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and particulate matter (PM). Particulate matter is further categorized by size—PM_{10} (diameter of 10 microns or less) and $PM_{2.5}$ (diameter of 2.5 microns or less). The CAA allows States to adopt additional or more stringent air quality standards. California's State legislature has adopted the California Clean Air Act of 1988, which established a statewide air pollution control program by designating air districts as the local or regional lead air quality planning agencies. The California Air Resources Board (CARB) has set California Ambient Air Quality Standards (CAAQS). The CARB has also set standards for hydrogen sulfide and vinyl chloride. Table 3-4 presents the NAAQS and CAAQS.

Table 3-4 National and California Ambient Air Quality Standards

Pollutant	Averaging Time	National Standard Concentration	California Standard Concentration
Carbon monoxide	8 hr	9.0 ppm (primary)	9.0 ppm
Carbon monoxide	1 hr	35 ppm (primary)	20 ppm
Lead	Rolling 3-month average	0.15 μg/m^3 (primary and secondary)	-
Lead	30-day average	-	1.5 μg/m^3
Nitrogen oxide	1 hr	100 ppb (primary)	100 ppb
Nitrogen oxide	1 yr	53 ppb (primary and secondary)	0.030 ppm
Ozone	8 hr	0.070 ppm (primary and secondary)	0.070 ppm
Ozone	1 hr	-	0.09 ppm
Particulate matter less than or equal to 2.5 microns	1 yr	9.0 μg/m^3 (primary)	12 μg/m^3
Particulate matter less than or equal to 2.5 microns	1 yr	15.0 μg/m^3 (secondary)	-
Particulate matter less than or equal to 2.5 microns	24 hr	35 μg/m^3	-
Particulate matter less than or equal to 10 microns	24 hr	150 μg/m^3 (primary and secondary)	50 μg/m^3
Particulate matter less than or equal to 10 microns	1 yr	-	20 μg/m^3
Sulfur dioxide	1 hr	75 ppb (primary)	0.25 ppm
Sulfur dioxide	3 hr	0.5 ppm (secondary)	-
Sulfur dioxide	24 hr	-	0.04 ppm
Hydrogen sulfide	1 hr	-	0.03 ppm
Vinyl chloride	24 hr	-	0.01 ppm

hr = hour(s); m^3 = cubic meter(s); ppb = part(s) per billion; ppm = part(s) per million; yr = year(s); μg = microgram(s).Sources: EPA 2024-TN10322 and CARB 2024-TN10156.

The EPA designates areas of attainment and nonattainment with respect to NAAQS. Areas for which there is insufficient data to determine designation status are denoted as unclassifiable. Areas that were once in nonattainment, but are now in attainment, are called maintenance areas; these areas are under a 10-year monitoring plan to maintain the attainment designation status. States have primary responsibility for ensuring attainment and maintenance of the NAAQS. Under CAA Section 110 (42 U.S.C. 7410) (Clean Air Act-TN1141) and related provisions, States are to submit, for EPA approval, State implementation plans (SIPs) that provide for the timely attainment and maintenance of the NAAQSs. Furthermore, the CARB designates areas as attainment, nonattainment, or unclassified for each CAAQS. The CARB and air districts are responsible for achieving and maintaining CAAQS (CA Health and Safety Code § 40919-TN10194) and for developing district level air quality management plans, which are incorporated into the SIP (CA Health and Safety Code § 40920.5-TN10195 and § 41650-TN10299). The CARB has primary responsibility for the control of emissions from motor vehicles and air districts have responsibility for the control of emissions from all other sources (CA Health and Safety Code § 40000-TN10300). The California Clean Air Act of 1988 requires air districts to meet CAAQS by the earliest practical date.

Air quality designations are generally made at the county level. For the purpose of planning and maintaining ambient air quality with respect to the NAAQS, the EPA has developed Air Quality Control Regions. Air Quality Control Regions are intra-State or inter-State areas that share a common airshed (40 CFR 81.305 [TN7226]). Diablo Canyon is located in San Luis Obispo County; this county, along with Santa Barbara County, in California comprise the South Central Coast Air Quality Control Region (40 CFR 81.166 [TN7226]). With respect to NAAQS criteria pollutants, San Luis Obispo County is designated as a nonattainment area for ozone (8-hour ozone 2008 and 2015 standard) (EPA 2024-TN10157). With respect to CAAQS, San Luis Obispo County is designated as nonattainment for ozone and PM_{10} and unclassified for visibility reducing particles (CARB 2024-TN10173).

Air emission sources at Diablo Canyon are regulated under 12 Permits to Operate (PTOs) issued by the San Luis Obispo County Air Pollution Control District (SLOCAPCD). PTOs stipulate conditions including fuel requirements and operation limits. PTOs are renewed on an annual basis. Permitted emissions sources and associated PTOs are presented in Table 3-5. Table 3-5 also presents the operational limits and restrictions that govern the operation of equipment, and as can been seen from this table, equipment is operated intermittently, and the diesel engines are intended to supply backup emergency power. In addition to the sources listed in Table 3-5, on January 4, 2025, PG&E was issued a Conditional Permit Exemption (Number 2365-1) for 12 diesel engines (with a capacity rating less than 50 horsepower) at Diablo Canyon (PG&E 2024-TN10032). Non-emergency operation for these 12 diesel engines is limited to 100 hours per engine per calendar year. Issuance of a Conditional Permit Exemption is generally required for diesel engines greater than 25 horsepower but less than 50 horsepower (SLOCAPCD 2024-TN10174). PG&E reports that it has not received any notices of violation or non-compliance associated with Diablo Canyon's air permits between 2018–2023 (PG&E 2023-TN9822 and PG&E 2024-TN10032). Diablo Canyon estimated particulate matter and volatile organic compounds emissions are presented in Table 3-6. Table 3-6 also presents 2020 annual air emissions from San Luis Obispo County (EPA 2020-TN8975). The contributions of air emissions from Diablo Canyon represent a small fraction of the annual emissions from San Luis Obispo County.

Small amounts of ozone and substantially smaller amounts of nitrogen oxides are produced during corona, a phenomenon that occurs when air ionizes near isolated irregularities on the conductor surface of transmission lines. During corona, ozone is approximately 90 percent of the oxidants generated, and 10 percent is nitrogen oxides (BLM 2010-TN9626). PG&E has not conduced field tests of ozone or nitrogen oxide emissions generated by Diablo Canyon's 230 kV and 500 kV in-scope transmission lines (PG&E 2023-TN9822). However, field studies have shown that high-voltage lines up to 765 kV do not generate emissions above ambient measurements (Lee et al. 1989-TN7481; TVA 2013-TN7899; NRC 2015-TN5842).

Table 3-5 Permitted Equipment at Diablo Canyon Nuclear Power Plant

Permit to Emit	Equipment	Permit Conditions
PTO-49	One (1) Auxiliary Steam Boiler	Nitrogen oxide emissions should not exceed 0.15 lb/MMBtu Sulfur dioxide emissions should not exceed 0.501 lb/MMBtu Fuel oil sulfur content should not exceed 0.5% by weight and nitrogen content should not exceed 0.22% by weight
PTO-338-1	One (1) Paint Spray Booth	Total volatile organic compounds emissions should not exceed 28 lb/day

Table 3-5 Permitted Equipment at Diablo Canyon Nuclear Power Plant (Continued)

Permit to Emit	Equipment	Permit Conditions
PTO-415-4	Three (3) Stationary Abrasive Blasting Units	Must not cause a public nuisance
PTO-533-2	One (1) Stationary Abrasive Blasting Unit	Abrasive material transfer points must be fully enclosed System must shut down when the filters are clogged Dust and reclaimed abrasives must be discharged into closed containers
PTO-546-2	One (1) Gasoline Dispensing Facility	The maximum dispensing rate shall be 10 gpm Annual performance test shall be conducted. Emergency vents shall not leak Tank gauge components shall not leak
PTO-919-5	Eight (8) Emergency Diesel Generators	Main plant generators non-emergency operation is limited to 125 hr/yr for a single unit and the average run time for all six must not exceed 100 hr/yr Security generator non-emergency operation is limited to 100 hr/yr Fire station generator non-emergency operation is limited to 20 hr/yr May burn on road diesel only
PTO-1065-8	Five (5) Portable Diesel Combustion Units	May burn on road diesel only Visible emissions shall not exceed 5% opacity for periods of 3 minutes in any hour Shall be used for construction and maintenance activity Shall not be used for normal plant operations Shall be operated at the Diablo Canyon Power Plant location
PTO-1820-1	One (1) Emergency Diesel Generator	May burn on road diesel only Visible emissions shall not exceed 10% opacity for periods of 3 minutes in any hour Non-emergency operation limited to 30 hr/yr
PTO-1845-3	Nine (9) FLEX Portable Emergency Diesel Water Pumps	May burn on road diesel only Visible emissions shall not exceed 10% opacity for periods of 3 minutes in any hour Non-emergency operation limited to 30 hr/yr per engine
PTO-1944-1	Three (3) FLEX Portable Emergency Diesel Water Pumps	May burn on road diesel only Visible emissions shall not exceed 10% opacity for periods of 3 minutes in any hour Non-emergency operation limited to 15 hr/yr per engine
PTO-1946-1	One (1) Emergency Diesel Generator	May burn on road diesel only Visible emissions shall not exceed 10% opacity for periods of 3 minutes in any hour Non-emergency operation limited to 30 hr/yr
PTO-1980-2	Four (4) FLEX Portable Emergency Diesel Generators	May burn on road diesel only Visible emissions shall not exceed 10% opacity for periods of 3 minutes in any hour Non-emergency operation limited to 30 hr/yr per engine

gpm = gallon(s) per minute; hr/yr = hour(s) per year; lb = pound(s); MMBtu = metric million British thermal unit(s); PTO = Permit to Operate.
Source: PG&E 2023-TN9822

Table 3-6 Emissions from Diablo Canyon Nuclear Power Plant Site and San Luis Obispo County (in tons)

Year	Particulate Matter	Volatile Organic Compounds[c]
2018	0.11[a]	0.10
2019	0.22[a]	0.16
2020	0.13[a]	0.06
2021	0.17[a]	0.08
2022	0.15[a]	0.13
2023	0.20[b]	0.12
San Luis Obispo County	4,880[b]	52,966

(a) Emissions account for diesel engine listed in Table 3-5, a 162 horsepower emergency diesel generator removed from service in November 2022, and 10 permit exempt small diesel engines.
(b) Emissions account for diesel engines listed in Table 3-5, 12 diesel engines in Conditional Permit Exemption (Number 2365-1), and 8 permit exempt small diesel engines.
(c) Emissions from industrial paint and solvent use
(d) County emissions from EPA 2020-TN8975. Particulate matter is less than or equal to 10 microns.

The EPA promulgated the Regional Haze Rule to improve and protect visibility in national parks and wilderness areas from haze, which is caused by numerous, diverse air pollutant sources located across a broad region (40 CFR 51.308-309 [TN1090]). Specifically, Subpart D of 40 CFR Part 81, “Designation of Areas for Air Quality Planning Purposes” (TN7226), lists mandatory Class I Federal Areas where visibility is an important value. The Regional Haze Rule requires States to develop SIPs to reduce visibility impairment at Class I Federal Areas. There are several Class I Federal Areas around Diablo Canyon. The nearest Class I Federal Area is the San Rafael Wilderness Area administered by the U.S. Forest Service (40 CFR 81.405), which is about 46 mi (74 km) east of Diablo Canyon. The next nearest Class I Federal Areas are located beyond 62 mi (100 km) from Diablo Canyon and are the Ventana Wilderness Area administered by the U.S. Forest Service and Pinnacles National Park administered by the U.S. National Park Service, which are located about 64 mi (103 km) north-northwest and 84.5 mi (136 km) north of Diablo Canyon, respectively. Federal land management agencies that administer Class I Federal Areas consider an air pollutant source that is located greater than 50 km (31 mi) from an area to have negligible impacts with respect to the area if the total sulfur dioxide, nitrogen oxides, PM_{10}, and sulfuric acid annual emissions from the source are less than 500 tons per year (70 FR 39104-TN8374; NPS 2010-TN7925). Given the distance of Class I Federal Areas from Diablo Canyon and the air emissions of Diablo Canyon as presented in Table 3-6, there is little likelihood that ongoing activities at Diablo Canyon would adversely affect air quality and air quality-related values (e.g., visibility or acid deposition) in any of the Class I Federal Areas.

3.3.3 Noise

Noise is unwanted sound and can be generated by many sources. Sound intensity is measured in logarithmic units called decibels (dB). A dB is the ratio of the measured sound pressure level to a reference level equal to a normal person’s threshold of hearing. Most people barely notice a difference of 3 dB or less. Another characteristic of sound is frequency or pitch. Noise may be composed of many frequencies, but the human ear does not hear very low or very high frequencies. To represent noise as closely as possible to the noise levels people experience, sounds are measured using a frequency-weighting scheme known as the A-scale. Sound levels measured on this A-scale are given in units of A-weighted decibels (dBA). Levels can become annoying at 80 dBA and very annoying at 90 dBA. To the human ear, each increase of 10 dBA sounds twice as loud (EPA 1981-TN7412).

Several different terms are commonly used to describe sounds that vary in intensity over time. The equivalent sound intensity level (Leq) represents the average sound intensity level over a specified interval, often 1 hr. The day-night sound intensity level is a single value calculated from hourly Leq during a 24-hour period, with the addition of 10 dBA to sound levels from 10 p.m. to 7 a.m. This addition accounts for the greater sensitivity of most people to nighttime noise. Statistical sound level is the sound level that is exceeded n percent of the time during a given period. For example, L90, is the sound level exceeded 90 percent of the time and is considered the background level.

The California Noise Control Act states that excessive noise is a serious hazard to public health and welfare and that residents are entitled to a peaceful and quite environment (CA Health and Safety Code § 46000-TN10301). The San Luis Obispo County Land Use and Coastal Land Use ordinances specifies noise limits for daytime and nighttime hours (Chapter 22.10.120 [San Luis Obispo County Code § 22.10-TN10196] and Chapters 23.06.040 through 23.060.048 [San Luis Obispo County Code § 23.06-TN10197] of the San Luis Obispo County Code). During the day, hourly equivalent sound level should not exceed 50 dB and the maximum level should not exceed 70 dB; during the nighttime, the hourly equivalent sound level should not exceed 45 dB and the maximum level should not exceed 65 dB. However, noise sources associated with work performed by private and public utilities in the maintenance or modification of their facilities are exempted from the ordinances.

Primary offsite noise sources in the vicinity of Diablo Canyon include vehicle traffic, particularly along Avila Beach Drive, equipment use related to agricultural and ranching activity, ocean surf, wind, recreational activities, and marine animals (PG&E 2015-TN9836; PG&E 2023-TN9822). In 2020, an ambient sound measurement program was conducted to quantify the existing noise environment in the vicinity of Diablo Canyon. At the intersection of Diablo Canyon Road and Avila Beach Drive, the daytime equivalent sound intensity level was 61.8 dBA and the nighttime equivalent sound intensity level was 63.0 dBA (SLOC 2023-TN10105).

Primary noise sources at Diablo Canyon include pumps, transformers, turbines, generators, firing range, switchyard equipment, steam relief valves, loudspeakers, and sirens. The nearest noise sensitive receptor is a residence located approximately 1.5 mi (2.4 km) northwest from the Unit 1 containment building. In 2006, Diablo Canyon conducted a sound level survey during condensate booster pump work where employees wore personal noise dosimeters and the loudest sound level reached was 106 dB (PG&E 2023-TN9822). Within the turbine building, noise surveys conducted by Diablo Canyon have recorded levels as high as 115 dB and levels up to 140 dB can be emitted from diesel generators at start up (PG&E 2015-TN9836). However, these noise levels were measured in proximity to the noise source. In 2002, background noise levels were measured within the Diablo Canyon site. The daytime equivalent sound intensity levels within the site boundary ranged between 56 to 61 dBA (PG&E 2015-TN9836). PG&E has never received a noise complaint from the public because of operation of Diablo Canyon (PG&E 2023-TN9822; PG&E 2024-TN10032).

3.3.4 Proposed Action

3.3.4.1 Air Quality

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1, for generic issues related to air quality, the impacts of a nuclear power plant LR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. As discussed in Section 3.3, air emissions from sources at Diablo Canyon represent a small fraction of the annual emissions from San Luis Obispo County. PG&E does not anticipate future upgrades or replacement activities of air emission sources during the LR term to support plant operation. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation of Diablo Canyon on air quality would be SMALL. There are no site-specific (Category 2) air quality issues applicable to Diablo Canyon.

3.3.4.2 Noise

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1, for the generic issue related to noise, the impacts of a nuclear power plant LR and continued operations would be SMALL. The NRC staff's review did not identify any new and significant information that would change the conclusion in the LR GEIS. PG&E does not anticipate future upgrades or replacement activities during the LR term to support plant operation that could introduce new noise sources or increases in sound levels. Thus, as concluded in the LR GEIS, for this Category 1 (generic) issue, the impacts of continued operation of Diablo Canyon on noise would be SMALL. There are no site-specific (Category 2) noise issues applicable to Diablo Canyon.

3.3.5 No-Action Alternative

3.3.5.1 Air Quality

Under the no-action alternative, the permanent cessation of Diablo Canyon operations would reduce overall air emissions (e.g., from boiler, diesel generators, and vehicle traffic). Therefore, the NRC staff concludes that if emissions decrease, the impact on air quality from the shutdown of Diablo Canyon would be SMALL.

3.3.5.2 Noise

The permanent cessation of Diablo Canyon operations would result in a reduction in noise from the pumps, transformers, turbines, generators, firing range, switchyard equipment, steam relief valves, loudspeakers, sirens, and worker vehicles. As site activities are reduced, the NRC staff expects the impact on ambient noise levels to be less than current plant operations; therefore, the NRC staff concludes that impacts on noise levels from the no-action alternative would be SMALL.

3.3.6 Replacement Power Alternatives: Common Impacts

3.3.6.1 Air Quality

Construction of a replacement power alternative would result in temporary impacts on local air quality. Air emissions include criteria air pollutants (particulate matter, nitrogen oxide, carbon monoxide, and sulfur dioxide), volatile organic compounds, hazardous air pollutants, and greenhouse gases (GHGs). Air emissions would be intermittent and would vary based on the level and duration of specific activities throughout the construction phase. During the construction phase, the primary sources of air emissions would consist of engine exhaust and fugitive dust emissions. Engine exhaust emissions would be from heavy construction equipment and commuter, delivery, and support vehicular traffic traveling to and from the facility as well as within the site. Fugitive dust emissions would be from soil disturbances by heavy construction equipment (e.g., earthmoving, excavating, and bulldozing), vehicle traffic on unpaved surfaces, concrete batch plant operations, and, to a lesser extent, wind erosion. Various mitigation techniques and BMPs (e.g., watering disturbed areas, reducing equipment idle times, and using ultra-low sulfur diesel fuel) could be used to minimize air emissions and to reduce fugitive dust.

The impacts on air quality from operation of a facility for a replacement power alternative would depend on the energy technology (e.g., wind, solar, geothermal). Worker vehicles would result in additional emissions.

3.3.6.2 Noise

Construction of a replacement power facility would be similar to the construction of any industrial facility in that they all involve many noise-generating activities. In general, noise emissions would vary during each phase of construction, depending on the level of activity, types of equipment and machinery used, and site-specific conditions. Typical construction equipment, such as dump trucks, loaders, bulldozers, graders, scrapers, air compressors, generators, and mobile cranes, would be used, and pile-driving and blasting activities could take place. Other noise sources include construction worker vehicle and truck delivery traffic. However, noise from vehicular traffic would be intermittent.

Noise generated during operations could include noise from transformers, mechanical equipment, speakers, as well as offsite sources, such as employee and delivery vehicular traffic. Noise from vehicles would be intermittent.

3.3.7 Purchased Power Alternative

3.3.7.1 Air Quality

As discussed in Section 2.3.2.1, purchased power would come from existing operating energy generating sources using existing transmission lines. However, air emissions can result from existing facility modifications or upgrades to support power generation. Modifications would be short-term and, therefore, air quality impacts would be temporary and not significant.

California’s 100 Percent Clean Energy Act of 2018 requires that all energy generation be renewable and zero-carbon after 2045 (State of California 2018-TN9855). This Act also updates the state’s Renewable Portfolio Standard to ensure that by 2030, 60 percent of California’s electricity is renewable. Therefore, until 2045, purchased power would likely come from the most common types of electric power generating technologies in California, including natural gas, geothermal, hydroelectric, solar, and wind, with the share of renewable sources increasing over time. In 2022, approximately 47 percent of California’s in-State electricity generation was from natural gas and approximately 44 percent was from renewables (CEC 2024-TN10175). Assuming that purchased power would likely come from the common types of electricity generation within California (DOE/EIA 2023-TN10176), the NRC staff estimates the following annual air emissions:

- nitrogen oxides: 7,000 tons (6,350 MT)
- sulfur dioxide: 122 tons (111 MT)
- carbon dioxide: 4,813,992 tons (4,366,291 MT)

As discussed above, California’s 100 Percent Clean Energy Act updated the Renewable Portfolio Standard to ensure that by 2030, 60 percent of California’s electricity is renewable. Therefore, the annual emissions presented above are bounding since they are based on California’s 2022 in-State electricity generation and the electric power generating renewable technology mix should increase over time and, therefore, emissions should decrease. Until 2045, air emissions from purchased power can be significant and noticeable. Post 2045, all future sources of purchased power must be from zero-carbon renewable energy sources. Direct air emissions from renewable sources would be negligible because no fossil fuels would be burned to generate electricity. Given the potential for emissions from purchased power to be significant until 2045, the NRC staff concludes that air quality impacts from purchased power would be SMALL to MODERATE.

3.3.7.2 Noise

All the power would come from existing operating energy generating sources using existing transmission lines. However, noise can result from existing facility modifications to support power generation. This noise, however, would be limited to the site and be temporary. Operational changes would be minimal and should not result in additional noise sources or levels. Therefore, purchased power from existing energy generating facilities would not have noticeable noise impacts and would be SMALL.

3.3.8 Renewables Combination Alternative

3.3.8.1 Air Quality

The renewables combination alternative relies on onsite (at the Diablo Canyon site) wind turbines and offsite wind turbines with battery storage, solar panels with battery storage, geothermal, and demand side management. Demand side management initiatives would not require construction or operations of a facility and, therefore, there would be no associated air emissions and no impacts on air quality from this component of the renewables combination alternative. Air emissions and sources for construction of the renewable portions of this alternative would include those identified as common to all replacement power alternatives in Section 3.3.6.1. The solar with battery storage and wind (onsite and offsite with battery storage) portions of the renewables combination alternative would not have power block buildings. For most wind energy facilities, the site preparation phase would last for only a few months, followed by a year-long construction phase (depending on the size of the wind energy [Tegen 2006-TN10177]). Construction of a solar facility typically lasts for 1–2 years (DOE/EIA 2022-TN10178). Accordingly, the amount of heavy equipment and workforce, level of activities, and construction duration would be lower and consequently less air emissions would be generated. However, a significant amount of land would be required for the installation for the solar panels and wind turbines. Approximately 171,000 ac (69,200 ha) of land would be required for the wind component, of which up to 5,000 ac (2,023 ha) could be disturbed during construction. Approximately 14,500 ac (5,867 ha) of land would be required for solar panels. This can result in noticeable particulate air emissions during the construction phase.

Air emissions associated with construction of the geothermal power facility would be mainly from land disturbance and site clearing (excavation and grading), drilling associated with injection and production wells, construction equipment, and worker vehicles. Fugitive dust would result from land disturbance and site clearing activities, as well as vehicle traffic on unpaved roads. However, construction of the geothermal portion would not require a significant amount of land (approximately 250 ac [101 ha]) relative to the wind and solar components of the renewables combination alternative.

Direct air emissions associated with operation of the solar with battery storage and wind (onsite and offsite with battery storage) portions of this alternative would be negligible because no fossil fuels are burned to generate electricity. Emissions would include fugitive dust and engine exhaust from worker vehicles and heavy equipment associated with site inspections, maintenance activities, and wind erosion from cleared lands and access roads. Emissions would be localized and intermittent.

Operation of a geothermal power plant would result in air emissions from gases that occur naturally in geothermal fluids that are carried in the source stream. These emissions include carbon dioxide, hydrogen sulfide (which eventually becomes sulfur dioxide and sulfuric acid), and mercury, all of which can be emitted during well venting, maintenance activities, and normal operations (flash steam). Mercury abatement equipment can reduce mercury emissions from geothermal plant operations by 90 percent (Kagel et al. 2007-TN10179). Carbon dioxide and sulfur dioxide emissions from geothermal power plants can vary depending on the geothermal facility type (binary, dry steam, or flash steam). For instance, average sulfur dioxide emission factors can range from 0–0.35 lb/MWh and average carbon dioxide emission factors can range from 0–60 lb/MWh (Kagel et al. 2007-TN10179). As described in Section 2.3.2.1, California's 100 Percent Clean Energy Act of 2018 requires that all energy generation be renewable and zero-carbon after 2045. Therefore, post-2045, emissions from geothermal operation would have to result in zero carbon dioxide emissions. For this alternative, the NRC staff assumes that the emission factors from the geothermal power plant would be 0 lb/MWh for sulfur dioxide and carbon dioxide and that emissions would be zero. However, particulate matter would be emitted from the mechanical cooling towers associated with the geothermal power plant.

Given the potential for noticeable particulate matter emissions during construction from the solar and wind components, the NRC staff concludes that the air quality impacts associated with construction and operation of the renewables combination alternative would be SMALL to MODERATE.

3.3.8.2 Noise

Demand side management initiatives would not require construction or operations of a facility and, therefore, there would be no associated noise and no impacts on noise from this component of the renewables combination alternative. To the human ear, an increase of 3 dB or less is not noticeable, an increase of 5 dB is noticeable, and an increase of 10 dB sounds twice as loud (EPA 1981-TN7412 and CDOT 2024-TN10180). Noise levels generated by construction activities of a solar facility can range from 70 to 80 dBA at 50 ft (15 m) (BLM 2019-TN8386). For the wind portion of the renewables combination alternative, there would be no power block that would otherwise require intensive construction activities; however, blasting may be required during construction for turbine foundations (WAPA/FWS 2015-TN8725; BLM 2013-TN8882). Blasting operations can reach 94 dBA at 50 ft (15 m) (FHWA 2006-TN10181). Noise sources from construction of a geothermal facility would primarily be from construction equipment for well drilling, earthmoving, and hauling and worker vehicles. Noise levels for pile drivers can reach 95 dBA, but noise levels for a drill rig can reach 85 dBA (FHWA 2006-TN10181). The construction of a geothermal facility would also involve construction of new transmission lines. Therefore, noise would not be limited to the immediate vicinity of the geothermal facility site. Noise levels attenuate with distance from the source. For instance, noise emitted by construction equipment that ranges from 85 to 90 dBA can attenuate to levels from 51 to 61 dBA at a 0.5 mi (0.8 km) distance from construction equipment (NRC 2002-TN665).

The renewables combination alternative consists of wind turbine installation at the Diablo Canyon site. As discussed in Section 3.3.3, the nearest noise sensitive receptor is a residence located approximately 1.5 mi (2.4 km) from the Diablo Canyon site. The next nearest receptor is over 3 mi (4.8 km) away (PG&E 2023-TN9822). Given the distance to noise sensitive receptors to the Diablo Canyon site, the NRC staff does not anticipate that noise levels during the construction of wind turbines at the Diablo Canyon site would be noticeable. However, the solar, geothermal, and offsite wind with battery storage components can be located anywhere in the PG&E service area. Therefore, the noise source to receptor distance and site configuration and existing background levels are unknown for the solar, geothermal, and offsite wind with battery storage components. If there are changes in noise levels of 5 dB or more, noise may be noticeable.

The solar with battery storage portion of this alternative would have no power block or cooling towers. Therefore, a minimal number of noise sources, such as transformers and vehicular traffic, would be associated with maintenance and inspection activities. Noise generated by wind turbines would primarily include aerodynamic noise from the blades and mechanical noise from turbine drivetrain components (generator, gearbox). Wind turbine noise levels can reach 105 dBA; however, studies show that at approximately 1,000 ft (300 m) from a wind turbine, noise levels can fall to 43 dBA (GE 2014-TN10183; DOE Undated-TN10182). The renewables combination alternative consists of wind turbine installation at the Diablo Canyon site and wind turbine installation with battery storage located offsite anywhere else in the PG&E service area. As discussed in Section 3.3.3, the nearest noise sensitive receptor is a residence located approximately 1.5 mi (2.4 km) from the Diablo Canyon site. The next nearest receptor is over 3 mi (4.8 km) (PG&E 2023-TN9822). Given the distance of noise sensitive receptors to the Diablo Canyon site, the NRC staff anticipates that noise levels during operation of wind turbines at the Diablo Canyon site would not be noticeable. The location of the offsite wind with battery storage component of this alternative is unknown. Depending on the location, layout, existing background noise levels, and proximity of wind turbines to noise sensitive receptors, noise associated with operation of the offsite wind portion with battery storage of the renewables combination alternative could be noticeable.

Noise sources associated with the operation of a geothermal facility include transformers, cooling towers, pumping facilities associated with extraction and injection of geothermal fluids, and fluid movement through pipes. The facility arrangement and distance from noise sources to sensitive noise receptors is unknown, and the introduction of these new noise sources could be noticeable. For instance, operations of a geothermal power plant can generate noise levels in the 71 to 83 dBA range at a distance of 0.5 mi (0.8 km) (BLM/USFS 2008-TN7469), which can be noticeable depending on background noise levels.

Given that the distance from noise sources to sensitive noise receptors and background noise levels are unknown for the offsite wind with battery storage and geothermal components, new noise sources may be noticeable. Therefore, the NRC staff concludes that noise impacts from the renewables combination alternative would be SMALL to MODERATE.

3.4 Geologic Environment

This section of the SEIS summarizes the descriptive information related to the geologic environment of the Diablo Canyon site and site vicinity as provided in Section 3.5 of PG&E's ER (PG&E 2023-TN9822). The descriptive information addresses regional geology and physiography, site geology (stratigraphy and surficial deposits), geologic resources, soils (onsite soils, erosion potential, and prime farmland and soils), and seismic setting and history. The analysis by the NRC staff related to potential environmental impacts on geology and soils from the proposed action and alternatives to the proposed action follows the information summary.

3.4.1 Regional Geology and Physiography

The Diablo Canyon facility, located in the Southern Coast Range that is part of the California Coast Ranges section of the Pacific Border physiographic province, is situated at the coastline on the southwest flank of the San Luis Range. The dominant features in the region surrounding the Diablo Canyon site are the San Luis Range adjacent to the site on the northeast, including the Irish Hills that is the northwesternmost portion of that range; the Santa Lucia Range inland; the lowlands of the Los Osos and San Luis Obispo Valleys separating the San Luis and Santa Lucia Ranges; and the marine terrace along the coastal margin of the San Luis Range (PG&E 2023-TN9822).

Geomorphic landforms of the San Luis Range and the adjacent coastal marine terrace produce the topography at the site and in the surrounding site region. The San Luis Range is characterized by a west-northwest-trending ridge and canyon topography. Ridge crest altitudes range from about 800 to 1,800 ft (244 to 549 m). Most mountain slopes are relatively steep and have been modified by extensive landslides (PG&E 2023-TN9822).

The coastal marine terrace belt lies between the mountain front of the San Luis Range and a near vertical sea cliff with a height of 40 to 200 ft (12.2 to 61 m). The main terrace along the coastal margin of the San Luis Range is a gently to moderately sloping strip of land with a maximum width of 2,000 ft (610 m) that is covered by broad aprons of surficial alluvial deposits (i.e., alluvial fans and talus) on the landward portions of the terrace. The main terrace exhibits at least three wave-cut rock benches that have approximate elevations of 70, 100, and 120 ft (21, 30.5, and 36.6 m) (PG&E 2023-TN9822). The terraces reflect tectonic uplift in the region.

The Diablo Canyon site is located in an active tectonic region bordering the eastern margin of the Pacific Plate. The San Andreas fault zone, located about 50 mi (80 km) northeast of the Diablo Canyon site, accommodates most of the relative motion between the Pacific Plate and the Sierra Nevada-Great Valley microplate. West of the San Andreas, additional plate motion is accomodated by slip on Quaternary age faults that bound crustal blocks and deformation within the blocks (PG&E 2014-TN10188). Quaternary is defined as the geologic period between 2.58 million years ago (Ma) and the present.

Following the identification and investigation of the Shoreline fault zone located about 0.62 mi (1 km) offshore of the Diablo Canyon facility in 2008, PG&E interpreted the fault zone as a seismically active, reactivated, pre-existing geologic feature. The current deformation regime that began around middle Pliocene (about 3.6 Ma) reactivated several faults bounding the San Luis Range that includes the Irish Hills (PG&E 2011-TN10189).

The Geologic Mapping Project conducted as part of the Central California Coastal Seismic Imaging Project updated the geologic maps of the Diablo Canyon site area (PG&E 2014-TN10190). The geologic map of the site area is shown in a separate Central California Coastal Seismic Imaging Project reference (PG&E 2014-TN10191). This area is characterized by tectonic deformation between the San Andreas fault zone to the east and the San Gregorio-San Simeon-Hosgri system of near-coastal faults to the west. Those fault systems are described in ER Section 3.5.4 and briefly discussed herein in Section 3.4.4. Although no definitive evidence of late Quaternary displacement was noted along the Shoreline fault zone, PG&E concluded that the central and south segments of the fault zone are active and inferred that the northern seismicity sub-lineament is part of the active fault zone (PG&E 2011-TN10189). The Shoreline fault zone might contribute to the present day tectonic uplift of the Irish Hills that reflects Quaterary uplift driven by offshore and inland faults.

The ER describes regional stratigrahy and tectonic structures. Stratigraphy of the Irish Hills from oldest to youngest includes the Franciscan Complex; Cretaceous age (>66.0 Ma) sandstone; Oligocene (33.9 to 23.03 Ma) Morro Rock-Islay Hill Volcanic Intrusive Complex, Cambria Felsite, and Vaqueros Formation; Miocene 23.03 to 5.33 Ma) Rincon Formation, Obispo

Formation, and Monterey Formation; upper Miocene to Pliocene (about 11.62 to 3.6 Ma) Pismo Formation, and Quaternary surficial terrestrial deposits (PG&E 2014-TN10190). Tectonic deformation features in the Diablo Canyon site area include the Pismo syncline, a fold type in which the limbs close at the bottom of the fold, and the Los Osos, Edna, San Miguelito, San Luis Bay, and Shoreline fault zones. The Pismo syncline is a regional structure trending northwest-southeast across the crest of the Irish Hills. The syncline is a zone of folding with numerous northwest-southeast-trending synclines and anticlines. (An anticline is a fold type in which the limbs close at the top of the fold.) Deformation of the Pismo syncline likely continued into the Oligocene. The Los Osos fault zone and the section of the zone east of the Irish Hills contains fault scarps indictive of late Quaternary faulting. The Edna fault zone is a west-northwest-trending zone that offsets rock units along the northeast limb of the Pismo syncline. The San Miguelito fault zone is located along the southwest limb of the Pismo syncline and consists of numerous fault strands striking west-northwest. The San Luis Bay fault zone is a steeply north-dipping reverse fault, which is a type of fault in which rock units above the fault surface (i.e., the “hanging wall” of the fault) moves upward relative to the rock units below the fault surface (i.e.,the “footwall” of the fault). The Shoreline fault zone is inferred to be a strike-slip fault with some oblique displacement (i.e., a fault with a major component of displacement parallel to strike of the fault and a smaller component of movement down the dip of the fault surface).

3.4.2 Site Geology

The Diablo Canyon site area is characterized by wave-cut benches of Pleistocene age (2.58 to 0.01117 Ma) with irregular, but generally low, relief developed across bedrock by marine erosion (PG&E 2023-TN9822). The coastline at the Diablo Canyon facility is marked by a steep bedrock sea cliff inclined at more than 50° down to the ocean. The sea cliff transitions to areas of gentler topography where valleys and canyons have been incised by streams flowing westward to the Pacific Ocean. Diablo Creek and Diablo Canyon are prominent topographic features located immediately north of the Diablo Canyon facility power block.

The Diablo Canyon facility is located on a coastal marine terrace at approximately 85 ft (25.9 m) above mean sea level. The terrace is about 1,000 ft (30 m) in average width (PG&E 2023-TN9822). The bedrock beneath the main terrace area is covered by 3 to 35 ft (1 to 10.7 m) of surficial deposits, including marine sediments of Pleistocene age and nonmarine sediments of Pleistocene and Holocene (0.0117 Ma to present) age. The interface between the unconsolidated surficial deposits and underlying bedrock comprises flat to moderately irregular surfaces of Pleistocene marine planation and intervening steeper slopes that also represent Pleistocene erosion surfaces (PG&E 2023-TN9822).

Minor faults exhibiting irregular orientations and small displacements occur within the bedrock that underlies the power plant site. No faults offset the contact between bedrock and the cover deposits, and none extend into the surficial cover. Therefore, the latest movements along these small faults pre-dated erosion of the bedrock in Pleistocene time (PG&E 2023-TN9822). It is not currently known whether these minor faults were late-stage results of major folding in the region or products of independent tectonic activity. The ER notes that, in either case, the faults do not offset Quaternary terrace deposits exposed along the upper part of the sea cliff.

The wave-cut benches and the accumulation of marine deposits on these benches provide a reliable guide to the minimum age of the latest displacements along faults in the underlying bedrock. Detailed exploration of the interfaces between wave-cut benches and overlying marine deposits at the Diablo Canyon site has shown that no fault breaks extend across these interfaces, demonstrating that the youngest faulting in that area pre-dated the time of terrace cutting that is on the order of 80,000 to 120,000 years before the present (PG&E 2023-TN9822).

Regarding site stratigraphy, the ER states that the Obispo Tuff, which has been classified either as a separate formation or a member of the Miocene age Monterey Formation, is the oldest bedrock unit exposed in the site area. Obispo lithologies are the foundation unit for the Diablo Canyon facility. Stratified marine rocks variously correlated with the Monterey Formation, Point Sal Formation, and Obispo Tuff underlie most of the area, including the area where the power plant is located. They are almost continuously exposed along the sea cliff that borders Diablo Cove. These stratified marine rock units are assigned to the Monterey Formation in the ER to distinguish them from the tuffaceous rocks typical of the Obispo Tuff (PG&E 2023-TN9822). The observed rock types, listed in general order of decreasing abundance, are silty and tuffaceous sandstone, siliceous shale, shaly siltstone and mudstone, diatomaceous shale, sandy to highly tuffaceous shale, calcareous shale and impure limestone, bituminous shale, fine- to coarse-grained sandstone, impure vitric tuff, silicified limestone and shale, and tuff-pellet sandstone. The different rock types are interbedded, and intervals of uniform lithology are rarely thicker than 30 ft (9.1 m) as reported in the ER (PG&E 2023-TN9822).

The ER states that the sandstones are mainly fine- to medium-grained, and most are tuffaceous. Shards of volcanic glass are recognizable under the microscope. Some of the sandstone beds contain small, visible to the naked eye fragments of pumice, perlitic glass, and tuff. A few beds grade along strike into submarine tuff breccia. The sandstones are thinly to thickly bedded. Individual beds 6 in. to 4 ft (15.2 cm to 1.2 m) thick are relatively common, and a few are as thick as 15 ft (4.6 m). Some of the sandstones are resistant to erosion and form subdued but nearly continuous outcrops on hillslopes (PG&E 2023-TN9822).

The ER notes that the siliceous shales are moderately to extremely hard but break readily along bedding planes and fracture surfaces. The bituminous rocks and the siltstones and mudstones are softer and generally more compact, with some units very thinly bedded or laminated. The more tuffaceous rock units are softer (PG&E 2023-TN9822). Iron oxide stains are widespread on exposures of nearly all the Monterey rocks and are especially well developed on the finest-grained shales that contain disseminated pyrite. All but the hardest and most thickly bedded rocks are strongly fractured to depths of as much as 6 ft (1.8 m) in the zone of weathering on slopes other than the present sea cliff.

Some landslides occur along Diablo Canyon northeast of the power plant area as shown on the geologic map of the site area (PG&E 2014-TN10191). These landslides are confined to the steep walls of the canyon and need not be considered for the plant site. They have been considered related to grading design for the switchyard and other up-canyon installations (PG&E 2023-TN9822). Except for Patton Cove, no active landslide masses or other gross expressions of ground instability occur within the Diablo Canyon site boundaries. Patton Cove is located on the coast approximately 1,000 ft (304.8 m) southwest of Intake Cove. The landslide, a rotational slump that underlies Diablo Ocean Drive at the junction with Reservoir Road, is actively encroaching into Diablo Ocean Drive and has been monitored annually by PG&E since 2007. The landslide was reactivated by heavy winter rains during El Niño in 1968–1969 and 1969–1970. In the 1990s, slide movement broke a waterline under the roadway. This active landslide at the head of Patton Cove resulted from wave action breaching the resistant Obispo tuff when rising sea level reached the area about 5,000 years ago and eroded 200 ft (61 m) into the Obispo stratigraphy to create the cove. To stabilize the Patton Cove area, site drainage was modified in 2006 concurrent with the installation of a bypass road to redirect surface water discharge from most of the ridgeline watershed from Outfall 006 to Outfall 005. Figure 3-3 in the surface water resources section of this SEIS locates Patton Cove, Intake Cove, and Outfalls 005 and 006. PG&E geologists continue to monitor Diablo Ocean Drive annually. If an issue is observed, it is entered into the corrective action program (PG&E 2023-TN9822).

3.4.3 Geologic Resources

As discussed in ER Section 3.1.2, mineral rights for Diablo Canyon Lands that include the Diablo Canyon site are owned by PG&E and Eureka Energy Company. The greater portion of the approximately 12,000 ac (4,856 ha) Diablo Canyon Lands is classified as MRZ-1, a designation assigned when reasoning based on economic and geologic principles and adequate data have demonstrated that the likelihood for occurrence of significant mineral deposits is nil or slight. ER Section 3.5.2 specifically states that there are no mineral deposits of economic significance in the ground beneath the site. ER Section 3.5.2 also states that several exploratory wells were drilled for petroleum in the San Luis Range, but no production was achieved, and the wells were abandoned. The area is not active regarding oil production or exploration (PG&E 2023-TN9822).

3.4.4 Soils

Soils that occur within the Diablo Canyon site boundaries are described in detail in ER Table 3.5-1 and summarized below (USDA 2024-TN10187). ER Section 3.5.3.1 states that about 146 ac (59 ha) of the Diablo Canyon site (about 25 percent) consists of impervious surfaces (PG&E 2023-TN9822). Diablo Canyon soils are classified as follows:

- Nacimiento silty clay loam soils on 15 to 75 percent slopes of mountainous uplands formed in materials weathered from calcareous shale and sandstone
- Nacimiento-Calodo complex loamy soils on 50 to 75 percent slopes
- rock outcrop-Lithic Haploxerolls complex loamy soils on 30 to 75 percent slopes
- Santa Lucia channery clay loam on 30 to 50 percent slopes
- still gravelly sandy clay loam on 2 to 25 percent slopes
- Xererts-Xerolls-Urban land complex on 0 to 15 percent slopes

Regarding erosion potential, Diablo Canyon has been operational since the 1980s and stabilization measures have been in place since that time to prevent erosion and sedimentation impacts to the site and site vicinity. Approximately 62 percent of the site soils are rated as severe to very severe for erosion potential (USDA 2024-TN10187). BMPs commonly used at the facility to control erosion and sediment transport include, but are not limited to, check-dams and sandbag berms to reduce runoff velocity and promote sediment settling, installation of slope toe-boards and/or waddles to control erosion and capture sediments, deployment of filtration wadding within flow pathways to capture sediments, deployment of riprap in flow pathways to slow runoff velocity and trap sediments, protection of conveyance drop-in boxes within waddling and/or riprap fields, and installation of riprap slope armoring to reduce soil exposure and slope erosion. Approximately 25 percent of the 585 ac (237 ha) facility parcel is developed and/or impermeable. Within this developed area, approximately 65 percent of the acreage is covered with infrastructure, asphalt pavement, concrete, riprap, and compacted aggregate. Susceptibility to erosion is reduced or eliminated in these locations due to the ground coverings.

Regarding prime farmland and soils, the U.S. Department of Agriculture's Natural Resources Conservation Service maps show that approximately 2.1 percent of the site is considered prime farmland, if irrigated. As shown in ER Figure 3.5-2, the prime farmland is mapped near the Diablo Canyon site boundaries along the coastal bluff (USDA 2024-TN10187). These areas would most likely still be considered prime farmland even though they are part of the site. Even if areas of the property are designated prime farmland, the Diablo Canyon site would not be subject to the Farmland Protection Policy Act because the act does not include Federal permitting or licensing for activities on private or non-Federal lands. Soil units designated as prime farmland are identified in ER Table 3.5-1.

3.4.5 Seismic Setting and History

Present tectonic activity within the region is dominated by interaction between the Pacific and American crustal plates on opposite sides of the San Andreas fault and continuing vertical uplift of the Coast Ranges including the San Luis Range adjacent to the Diablo Canyon facility on the northeast. NRC staff independently reviewed the latest national seismic hazard map prepared by the U.S. Geological Survey (USGS) and noted that the Diablo Canyon site lies in a region (i.e., coastal California) having a 2 percent probability in 50 years (i.e., once in 2,500 years) of exceeding a ground acceleration of 1 g (Petersen et al. 2024-TN9940).

Epicenter locations of seismic events greater than magnitude 3.0 within a 200 mi (321.9 km) radius of the Diablo Canyon site from December 1971 through July 11, 2024, are shown in USGS 2024-TN10198. The closest recorded earthquake since 1971 of magnitude 3.0 or greater occurred 1.5 mi (2.4 km) from the site on September 24, 1974. The reported magnitude was 3.1 with an epicenter offshore of Avila Beach, California. The largest magnitude earthquake within 75 mi (120.7 km) of Diablo Canyon since 1971 was on December 22, 2003. The reported magnitude was 6.5 with an epicenter 36.5 mi (58.74 km) from the site near San Simeon, California. The maximum reported earthquake magnitude since 1971 within 200.0 mi (321.9 km) of the Diablo Canyon site was a magnitude 7.1 with an epicenter 187.2 mi (301.2 km) from the site (USGS 2024-TN10198).

California State Senate Bill 846 was passed in September 2022 to extend the operation of Diablo Canyon and included a covenant for PG&E to perform an updated seismic analysis. PG&E published the results of that analysis on March 6, 2024 (PG&E 2024-TN10192). The results were not discussed in the ER because they had not been publicly released when the ER was submitted to the NRC. The NRC staff independently reviewed pertinent portions of the updated analysis report, a peer review of the updated analysis conducted by the Diablo Canyon Independent Peer Review Panel (Seitz et al. 2024-TN11537), and PG&E's response to the peer review comments (PG&E 2025-TN11539) to determine whether new and significant information was provided therein that might change the ER's description of the affected geologic environment at and adjacent to the Diablo Canyon site. The reports provided new safety-significant information associated with seismic fault sources and seismicity (e.g., revised fault slip rates for two primary seismic sources—the Hosgri and Los Osos faults). At the primary level of interest (i.e., 10^{-4} to 10^{-6} annual hazard level), the Hosgri fault was determined to be the largest contributor to seismic hazard (PG&E 2024-TN10192). The NRC staff concludes that none of the new information indicates any impacts from continued plant operation on the geologic environment at or adjacent to the Diablo Canyon site that are different from impacts occurring during the current license term.

The impacts of natural phenomena associated with geologic and seismic hazards on nuclear power plant systems, structures, and components are outside the scope of the NRC staff's LR environmental review. Diablo Canyon was originally sited, designed, and licensed with due consideration for applicable geologic and seismic criteria. Seismic issues at operating nuclear power plants are assessed as part of the NRC's ongoing regulatory oversight of plant safety. The NRC requires all licensees to consider seismic activity to maintain safe operating conditions at nuclear power plants. When new geologic and seismic data bearing on potential earthquake hazard become available, the NRC staff evaluates those data to determine whether any changes are necessary at existing nuclear power plants to ensure safe plant operation. This ongoing oversight process, which considers seismic safety, is separate and distinct from the LR environmental review performed by the NRC staff.

3.4.6 Proposed Action

As documented in Table 3-1 for the geology and soils issue, the impact of LR and continued operations for Diablo Canyon on geology and soils would be SMALL. The finding in 10 CFR Part 51 (TN10253), Subpart A, Appendix B, Table B-1 related to geology and soils indicates that this generic Category 1 issue would result in a SMALL impact for all nuclear power plants.

The NRC staff independently reviewed applicable information for geology and soils in PG&E's ER and associated references therein, considered information discussed during site audits and the scoping process, and independently reviewed pertinent information about seismic setting in the updated seismic analysis report discussed above. The NRC staff did not identify any new and significant information related to geology and soils that would change the environmental impact determination stated in the LR GEIS (NRC 2024-TN10161) for this Category 1 generic issue. No significant impacts on geology and soils are anticipated during the LR term that would be different from those occurring during the current license term. Thus, the staff concludes that the impacts of LR related to the geology and soils issue would be SMALL for Diablo Canyon. There are no Category 2 issues related to the geologic environment that require consideration for the Diablo Canyon LR.

3.4.7 No-Action Alternative

The no-action alternative would involve not renewing the existing operating licenses. With the subsequent cessation of operations, there would be little or no additional impact on geology and soils. Any contamination of onsite geology or soils would be assessed during decommissioning, either at the end of the current licensing period or at the end of the LR period. A license termination plan would describe any necessary actions needed for site-specific clean up before release of the Diablo Canyon site. Consequently, NRC staff concludes that the impact of the no-action alternative on geology and soils would be SMALL.

3.4.8 Replacement Power Alternatives: Common Impacts

Construction

Construction activities associated with replacement power alternatives might result in temporary impacts on geology and soils if excavations for facility foundations or slope stabilization are necessary. Potential impacts would vary based on depth of excavations for impacts on geology and acreage of the area disturbed for impacts on soils. Development of a geothermal power generation facility would require drilling and could impact subsurface geology. However, siting and permitting of the facility would consider such impacts and implement the appropriate BMPs and the Federal, State, and local permitting requirements to avoid significant impacts on geology and soils. NRC staff expects that any impacts from construction of replacement power alternatives on geology and soils would be localized and of short duration. Potential impacts would be prevented or mitigated by the implementation of BMPs and Federal, State, and local permitting requirements. Therefore, NRC staff concludes that impacts to geology and soils from construction of replacement power alternatives would be SMALL.

Operation

The NRC staff expects that operation activities associated with replacement power alternatives would not result in any detrimental impacts on geology and soils because there would be no disruptions affecting geology and soils during normal operation of those alternatives. If additional production wells were drilled during operation of the geothermal power generation facility, BMPs and the necessary permitting requirements described in the construction discussion above would be implemented to avoid significant impacts to geology and soils. Therefore, NRC staff concludes that impacts to geology and soils from operation of replacement power alternatives would be SMALL.

3.4.9 Purchased Power Alternative

As discussed above in SEIS Section 2.3.2.1, purchased power would likely come from the most common types of existing electric power generating technologies including nuclear, natural gas-fired, coal, solar, and wind energy until 2045, with some sources possibly outside California. Afterwards, all future sources of purchased power must be from renewable energy sources. Purchased power may rely on older and less efficient power plants operating at higher levels of power generation than current operations.

ER Section 7.2.3.1.5 discusses the potential impact of purchased power derived from offsite generating sources on geology and soils. If additional power generation-related construction activities are required, the NRC staff expects impacts would be mainly on soils, temporary, and minimized by implementation of BMPs. Therefore, the NRC staff concludes that geology and soil impacts from the purchased power alternative would be SMALL.

3.4.10 Renewables Combination Alternative

Construction

ER Section 7.2.3.2.5 discusses the potential construction impacts on geology and soils for the renewables combination alternative, including components comprising wind turbines, solar panels, geothermal, and supporting transmission lines. Temporary soil impacts resulting from clearing and grubbing would be minimized by the implementation of BMPs. The development of a geothermal power generation facility would require drilling and could impact subsurface geology. However, siting and permitting of the facility would consider such impacts and impose the necessary permit conditions to avoid significant impacts on geology and soils. Geologic impacts from construction would be minor because any gravel or stone used would be sourced locally. The construction of solar and wind installations would require an NPDES construction stormwater permit and compliance with California regulations to control stormwater runoff. Consequently, the NRC staff concludes that impacts to geology and soils due to the construction related to the renewables combination alternative would range from SMALL to MODERATE.

Operation

The NRC staff expects that operation activities associated with the renewables combination alternative would not result in any detrimental impacts on geology and soils because there would be no disruptions affecting geology and soils during normal operation. If additional production wells were drilled during operation of the geothermal power generation facility, BMPs and the necessary permitting requirements stated in Section 3.4.8 above would be implemented to avoid significant impacts to geology and soils. Therefore, the NRC staff concludes that impacts to geology and soils from operation of the renewables combination alternative would range from SMALL to MODERATE.

3.5 Water Resources

This section of the SEIS describes surface water and groundwater resources at and around the Diablo Canyon site. The description of the resources is followed by the NRC staff's analysis of the potential impacts on surface water and groundwater resources of the proposed action and alternatives to the proposed action.

3.5.1 Surface Water Resources

Surface water encompasses all water bodies that occur above the ground surface, including rivers, streams, lakes, ponds, oceans, and human-made reservoirs or impoundments.

3.5.1.1 Surface Water Hydrology

3.5.1.1.1 Local and Regional Hydrology

Diablo Canyon is located along the central California Coast in San Luis Obispo County (Figure 3-1). Nearby coastal cities include Avila Beach 8 mi (13 km) to the southeast and the City of San Luis Obispo 12 mi (19 km) to the north. The coastline is characterized by steep and rocky shoreline often exposed to heavy wave action. Long-term sea-level data from 1946 are available from a National Oceanic and Atmospheric Administration (NOAA) station in Port San Luis (NOAA Center for Operational Oceanographic Products and Services Station 9412110), approximately 6 mi (10 km) east-southeast of Diablo Canyon. The NOAA station shows that ocean water levels range from -2.40 ft (-0.7 m) mean lower low water (MLLW) to 2.32 ft (0.71 m) mean higher high water (MHHW) (-5.20 to 4.85 ft MSL [-1.58 to 1.49 m MSL]) (NOAA 2024-TN10083). The power block area of Diablo Canyon is sited on a coastal terrace that is approximately 1,000 ft (305 m) wide and whose elevation ranges from 60 to 150 ft MSL (18 to 46 m MSL); the plant grade elevation is 85 ft MSL (26 m MSL) (PG&E 2023-TN9822).

The Diablo Canyon site is located at the coastal outlet of the Diablo Creek watershed, which is part of the larger regional Irish Hills Coastal Watershed. The main surface water features are the Pacific Ocean to the west and Diablo Creek to the east, which is the only major stream in the small, 5 mi^2 (13 km^2) Diablo Creek watershed. The Diablo Creek watershed, like many coastal watersheds in the area, has a gently sloping coastal terrace surrounded by steep uplands, with slopes commonly ranging from 35 to 70 percent. The Diablo Creek watershed is drained by a 5.1 mi (8.2 km) main channel that flows westwards to the Pacific Ocean with many ephemeral tributaries. The channel ranges in depth from 1 to 3 ft (0.3 to 0.9 m) and has steeply incised banks. Due to the steep and rocky terrain with shallow soils, precipitation generates rapid runoff. Diablo Creek flows into the northern boundary of the Diablo Canyon site. During construction of Diablo Canyon, 2,700 ft (823 m) of Diablo Creek was culverted (approximate historical channel location shown by dashed line in Figure 3-2). The original channel in this area was filled to construct the switchyard (PG&E 2023-TN9822). Diablo Creek is not a source of surface water for Diablo Canyon (PG&E 2023-TN9822). Diablo Creek discharges into Diablo Cove north of the Diablo Canyon discharge outlet and is a source of freshwater inflow to the cove.

Figure 3-1 Major Surface Water Features in the Vicinity of Diablo Canyon Nuclear Power Plant. Adapted From: PG&E 2023-TN9822.

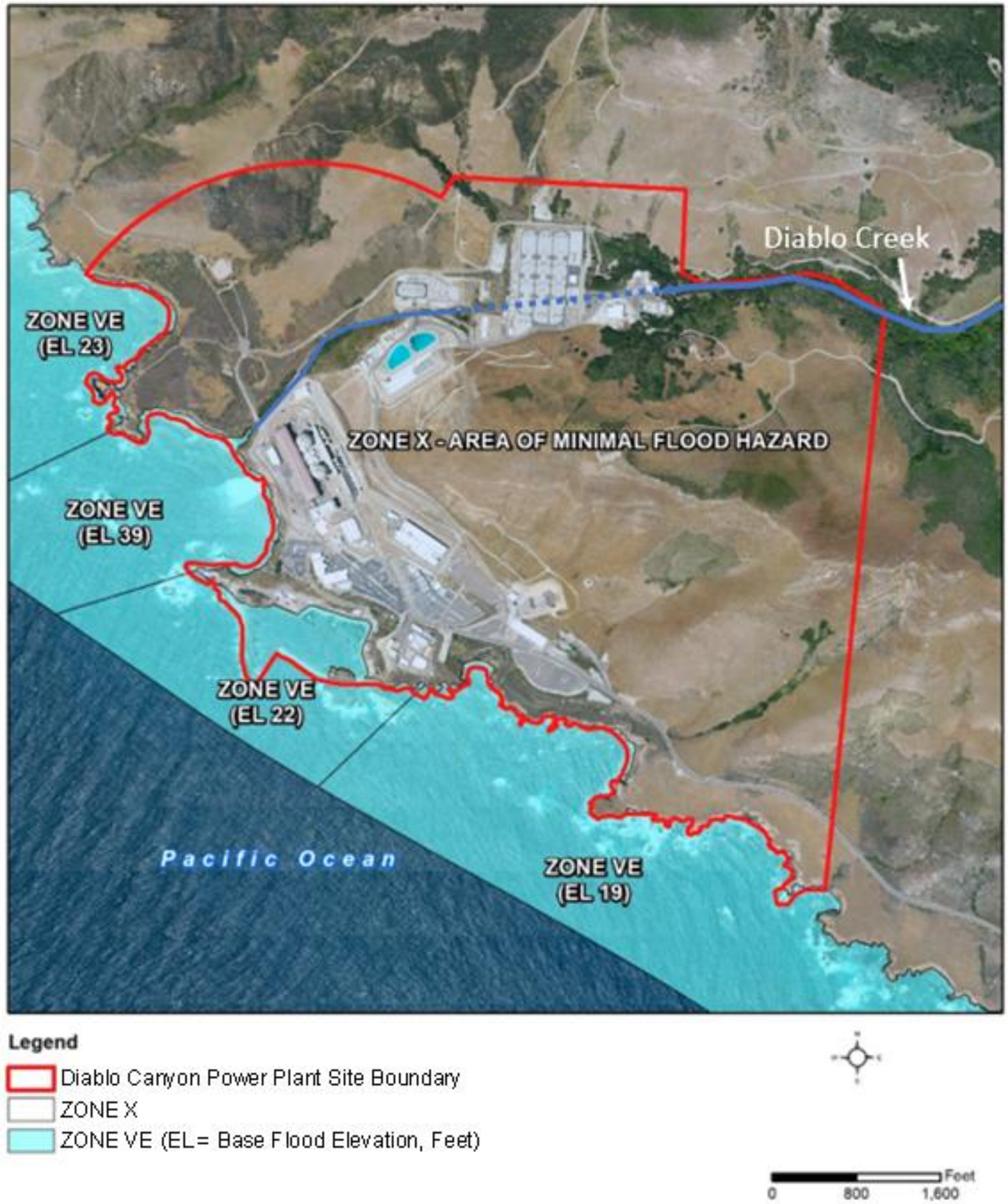


Figure 3-2 Federal Emergency Management Agency Flood Hazard Designation for the Diablo Canyon Nuclear Power Plant Site. Adapted From: PG&E 2023-TN9822.

The two units of Diablo Canyon have independent, once-through cooling systems but they share the same intake and discharge structures (PG&E 2023-TN9822). The intake structure for Diablo Canyon is located in a human-made cove created by breakwater structures designed to reduce the effects of wave action. The intake withdraws raw seawater that is routed to heat exchanging steam condensers in the turbine building. Seawater is also sent to a SWRO desalinization treatment system that provides the majority of freshwater for plant primary and secondary systems' makeup, fire protection system, and plant domestic water system. The Pacific Ocean is the heat sink for Diablo Canyon. On average, approximately 2.5 billion gallons per day of heated water consisting of circulating water and service water discharges, auxiliary water system discharge, and various plant freshwater waste streams, is discharged into the Diablo Cove (PG&E 2023-TN9822). The discharge structure is an energy dissipation design that limits discharge velocities and erosion.

Flooding

The two potential sources of flooding at Diablo Canyon are sea wave action from the Pacific Ocean and surface water flows in Diablo Creek. Sources of flooding from Diablo Creek include water flow in the upstream channel and water accumulation from channel blockage downstream of the plant. The Federal Emergency Management Agency flood hazard classification for the Diablo Canyon site designates the coastline below the sea cliff as a "Special Flood Hazard Zone" (Zone VE) and the area near Diablo Creek as an "Area of Minimal Flood Hazards" (Zone X) (Figure 3-2).

Flood hazard along the coastline comes from flood waves that include the combined effects of tsunami, wind generated storm waves, storm surge, and tides (PG&E 2023-TN10090). PG&E's 2016 analysis found that the cumulative effects of a probable maximum storm surge and seiche with wind-wave activity combined with an antecedent 10 percent exceedance high tide yielded wave heights of 41.7 and 9.9 ft MSL (12.7 and 3.0 m MSL) outside and inside the breakwaters, respectively (PG&E 2023-TN10136). The estimated wave heights along the coastline were 43 to 75 ft (13 to 23 m) below the power block elevation of 85 ft MSL (26 m MSL). There is no historical record of tsunamis at Diablo Canyon, but tsunamis recorded in the region result in water levels comparable to the normal tidal range. Tsunamis from distant sources generally result in moderate water levels along the California coast, except for certain areas that show higher water levels because of local coastal configurations and hydrodynamics (PG&E 2023-TN10090). According to the California Geological Survey Tsunami Hazard Map for San Luis Obispo County, the Diablo Canyon power block is outside the potential inundation zone. A site-specific tsunami evaluation conducted for Diablo Canyon estimated that the maximum tsunami runup elevations at the intake structure are 20 ft MSL (6 m MSL) for distantly generated tsunamis and 9.2 ft MSL (2.8 m MSL) for locally generated tsunamis (PG&E 2023-TN10136). The runup elevations for the combined effects of tsunami, wind-generated storm waves, storm surge, and tides are 30 and 34.6 ft MSL (9.1 and 10.5 m MSL) for distantly generated and local tsunamis, respectively (PG&E 2023-TN10136).

Historical flow data for Diablo Creek was collected between 1967 and 1983 at a V-weir located at an abandoned dam north of the East Canyon Area (PG&E 2023-TN9822). The weir was taken out of service in 1983, and a gauging station was installed downstream. Flow observations for Diablo Creek were terminated in 2008. Minimum flow in Diablo Creek is 0.44 cubic feet per second (cfs) (197.5 gpm), while maximum flows occur during short-term, high-flow conditions associated with storm events. Groundwater seepage sustains dry-season flow in Diablo Creek. Diablo Creek is the only stream on the Diablo Canyon site for which a probable maximum flood study was performed (PG&E 2023-TN10090). For the Diablo Creek drainage area of 5.19 square miles (mi^2) (13.44 square kilometers [km^2]), the probable maximum flood peak discharge was estimated to be 6,878 cfs for the 24-hour storm (PG&E

2023-TN10090). The 24-hour probable maximum precipitation is estimated to be 16.6 in. (42.1 cm) during the month of October (PG&E 2023-TN10090).

Additionally, the NRC evaluates nuclear power plant operating conditions and physical infrastructure to ensure ongoing safe operations through its Reactor Oversight Process. If new information about changing environmental conditions becomes available, the NRC will evaluate the new information to determine whether any safety-related changes are needed.

3.5.1.2 Surface Water Use

Cooling water for Diablo Canyon Units 1 and 2 is withdrawn from the Pacific Ocean using a shoreline intake structure, approximately 240 ft (43 m) long and 104 ft (32 m) wide (PG&E 2023-TN9822). The cooling water withdraw rate for Unit 1 is between 778,000 gpm (2,945,050 lpm) and 854,000 gpm (3,232,742 lpm), and for Unit 2 is between 811,000 gpm (3,069,969 lpm) and 895,000 gpm (3,387,945 lpm). The two-unit combined withdraw rate is between 1,589,000 gpm (6,015,019 lpm) minimum and 1,749,000 gpm (6,620,685 lpm) maximum during normal plant operations (PG&E 2023-TN9822, Section 2.2.3.3).

The average annual surface water use between 2018–2023 was 830,397 MGY (million gallons per year) or 2,275 million gallons per day (MGD). As summarized in Table 3-7, the minimum annual surface withdrawals were 755,762 MGY in 2019 and the maximum surface water withdrawals were 858,120 MGY in 2021. During the 2018–2023 period, the minimum monthly withdrawal was 34,365 million gallons per month (MGM) during 2020, and the maximum monthly withdrawal was 77,066 MGM, which was reported as the maximum for all 6 years.

Table 3-7 Surface Water Withdrawals for Diablo Canyon Nuclear Power Plant from the Pacific Ocean

Year	Monthly Average (MGM)	Monthly Minimum (MGM)	Monthly Maximum (MGM)	Yearly Total (MGY)
2018	71,232	47,713	77,066	854,778
2019	62,980	37,170	77,066	755,762
2020	69,545	34,365	77,066	834,539
2021	71,510	54,535	77,066	858,120
2022	69,599	48,276	77,066	835,186
2023	70,333	40,801	77,066	843,998

MGM = million gallon(s) per month; MGY = million gallon(s) per year.
All reported values are rounded.
Sources: PG&E 2023-TN9822, PG&E 2024-TN10032.

Diablo Canyon uses a SWRO water treatment system for its freshwater needs including primary and secondary systems make up, fire protection, and domestic water (PG&E 2023-TN9822). Raw seawater from the once-through cooling system intake is provided to the SWRO system and supplemented by a deep groundwater well during high water-demand plant maintenance, start-up, and forced outage periods. The SWRO system filters, sterilizes, and desalinates raw seawater to produce 450 gpm (1,793 lpm) of freshwater that is stored in two, 2.5 MG (9.5 million liters) open raw water reservoirs (PG&E 2023-TN9822). Diablo Canyon operates a domestic water supply system under the State of California domestic water supply permit for Public Water System No. 4000589. The domestic water supply system is a nontransient, noncommunity system serving 2,000–3,000 people. The domestic water supply system treats water from the raw water reservoirs using a multimedia filter, a reverse osmosis module, a neutralizing-media filter, and an activated carbon filter. The average annual Diablo Canyon water demand is reported to be approximately 101 MGY (382 million liters per year) (90 MGY [341 million liters per year] for power production purposes and 11 MGY [42 million liters per year] for domestic water supply) (PG&E 2023-TN9822).

In the vicinity of the Diablo Canyon site, surface water is captured on land owned by PG&E that is used by ranchers leasing land (PG&E 2023-TN9822). These capture locations are approximately 1 mi (1.6 km) to the north and 2 to 4 mi (3.2 to 6.4 km) to the south of the Diablo Canyon site. On these ranchlands, water is captured from streams and springs in Pecho and Rattlesnake Canyons to the south and from Crowbar Canyon to the north. Water for the nearby City of San Luis Obispo is primarily sourced from Salinas Reservoir, located 23 mi (37 km) east-northeast of the Diablo Canyon site. Whale Rock Reservoir (17 mi [27 km] north), Chorro Reservoir (13 mi [21 km] northeast), and multiple small reservoirs northeast of the site also provide water to the City of San Luis Obispo.

The total 2015 surface water withdrawals for the Counties of San Luis Obispo and Monterey were 2,024.73 and 211.33 MGD, respectively (PG&E 2023-TN9822). The two counties used 1,985.38 and 160.29 MGD, respectively, for power generation in 2015. In 2015, the County of Santa Barbara surface water withdrawal was 45.08 MGD with primary usage being public water supply (27.96 MGD) and irrigation (16.57 MGD).

3.5.1.3 Surface Water Quality and Effluents

3.5.1.3.1 Water Quality Assessment and Regulation

In accordance with Section 303(c) of the Federal Water Pollution Control Act (CWA) (33 U.S.C. 1251-1387-TN662), states have the primary responsibility for establishing, reviewing, and revising water quality standards for the Nation’s navigable waters. Such standards include the designated uses of a water body or water body segment, the water quality criteria necessary to protect those designated uses, and an anti-degradation policy with respect to ambient water quality. As established under Section 101(a) of the CWA, water quality standards are intended to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters and to attain a level of water quality that provides for designated uses. The EPA reviews each State’s water quality standards to ensure that they meet the goals of the CWA and Federal water quality standards regulations (40 CFR Part 131-TN4814, “Water Quality Standards”).

Section 303(d) of the CWA requires States to identify all “impaired” waters for which effluent limitations and pollution control activities are not sufficient to attain water quality standards in such waters. Similarly, CWA Section 305(b) requires States to assess and report on the overall quality of waters in their State. States prepare a CWA Section 303(d) list that identifies the water quality limited stream segments that require the development of total maximum daily loads (TMDLs) to assure future compliance with water quality standards. The list also identifies the pollutant or stressor causing the impairment and establishes a priority for developing a control plan to address the impairment. The TMDLs specify the maximum amount of a pollutant that a water body can receive and still meet water quality standards. Once established, TMDLs are often implemented through watershed-based programs administered by the State, primarily through permits issued under the NPDES permit program, pursuant to Section 402 of the CWA, and associated point and nonpoint source water quality improvement plans and associated BMPs. States are required to update and resubmit their impaired waters list every 2 years, which ensures that impaired waters continue to be monitored and assessed by the State until applicable water quality standards are met.

Under CWA Sections 305(b) and 303(d), California compiles an integrated report of surface water quality every 2 years in even-numbered years. The 2022 assessment of surface water quality was ratified on January 19, 2022, and the EPA approved the 2022 California 303(d) list on May 11, 2022 (SWRCB 2022-TN10084). The 2024 303(d) list was adopted by the State Water Board on February 6, 2024, was submitted to the EPA on March 26, 2024, and was partially approved and partially disapproved by the EPA on December 13, 2024. The EPA approved the majority of the 303(d) list but identified 53 waterbody-pollutant combinations it is considering for addition to the 303(d) list (CSWRCB 2025-TN11952). Near Diablo Canyon, the following impaired waters are listed in the California 2022–2024 Integrated Report (CSWRCB 2025-TN11952):

- Pacific Ocean between Point Buchon and Point San Luis for mercury
- Pacific Ocean at Estero Bay for dichlorodiphenyltrichloroethane (DDT) and mercury
- Warden Creek for toxicity, nitrate, and dissolved oxygen
- Los Osos Creek for dissolved oxygen, nitrate, and sedimentation
- Prefumo Creek for *E. coli*, nitrate, dissolved oxygen, toxicity, and selenium
- San Luis Obispo Creek for benthic macroinvertebrates bioassessments, chloride, sodium, nitrate, toxicity, and *E. coli*, and dissolved oxygen
- San Luis Obispo Creek Estuary for Enterococcus
- Port San Luis for polycyclic aromatic hydrocarbons, arsenic, dieldrin, and polychlorinated biphenyls

3.5.1.3.2 National Pollutant Discharge Elimination System Permitting Status and Plant Effluents

To operate a nuclear power plant, NRC licensees must comply with the CWA, including associated requirements imposed by the EPA or the State, as part of the NPDES permitting system under Section 402 of the CWA. The Federal NPDES permit program addresses water pollution by regulating point sources (i.e., pipes, ditches) that discharge pollutants to waters of the United States. NRC licensees must also meet State water quality certification requirements under Section 401 of the CWA. The EPA or the States, not the NRC, sets the limits for effluents and operational parameters in plant-specific NPDES permits. Nuclear power plants cannot operate without a valid NPDES permit and a current Section 401 Water Quality Certification. A water quality certification pursuant to Section 21(b) of the Federal Water Pollution Control Act and Title 23, Chapter 3, Subchapter 11 of the California Administrative Code was issued in October 1971 by the Central Coast Regional Water Quality Board (CCRWQCB) and the California State Water Resources Control Board (SWRCB) for Diablo Canyon (PG&E 2023-TN9822). PG&E is in active communication with the CCRWQCB regarding the CWA 401 certification (PG&E 2023-TN9822).

Since May 14, 1973, the State of California has the authority to administer the NPDES program (EPA 2024-TN10085). California's NPDES program is implemented through the SWRCB and nine Regional Water Quality Control Boards (SWRCB 2024-TN10086). Diablo Canyon Units 1 and 2 operate under NPDES Permit No. CA0003751 (PG&E 2023-TN9822). The current NPDES permit was issued on May 11, 1990, by the CCRWQCB, and had a listed expiration of July 1, 1995. However, the permit has been under administrative extension and is listed as currently active on the SWRCB database (SWRCB 2024-TN10087). According to PG&E, the NPDES permit is anticipated to be re-issued in late 2026 (PG&E 2023-TN9822). Specific requirements under a renewed NPDES permit may be refined from those in the current permit based on the California Ocean Plan and other information considered during the permitting process (CSWRCB 2019-TN11950).

The NPDES permit for Diablo Canyon Units 1 and 2 allows PG&E to discharge via external Outfalls 001 through 017 (Figure 3-3). Cooling water and industrial process wastewater from Diablo Canyon are discharged to the Pacific Ocean in accordance with Diablo Canyon NPDES Permit No. CA0003751, Order No. 90-09 (PG&E 2023-TN9822). The receiving water bodies are the Pacific Ocean and Diablo Creek. The NPDES permit also authorizes 13 additional outfalls that are internal. External Outfalls 004 through 015 are related to stormwater runoff. Outfall 001 discharges to Diablo Cove, Outfalls 002 and 004 discharge to Intake Cove, Outfall 003 discharges to the Pacific Ocean, Outfalls 005, 006, 016, and 017 discharge to the South Cove, Outfall 007 discharges to the Pacific Ocean, and Outfalls 008, 009, 010, 011, 012, 013, 014, and 015 discharge to Diablo Creek. There have not been any self-reported violations associated with Diablo Canyon wastewater discharges over the 5-year reporting period from 2018–2022 (PG&E 2023-TN9822). However, as stated in Section 3.7.5.2 of this SEIS, in 2021, there was a settlement between PG&E and the CCRWQCB associated with historical and ongoing thermal discharge impacts from Diablo Canyon cooling water discharge. The settlement, associated with Case No. 21CV-0111, was reached in May 2021 in the California Superior Court, County of San Luis Obispo. PG&E made a one-time payment to the Bay Foundation of Morro Bay to benefit water quality and the environment on California's Central Coast. The Consent Judgement did not specifically conclude if PG&E violated its NPDES permit.

Outfall 001: The NPDES permit specifies that the discharge rate at Outfall 001, which includes once-through cooling water discharge, must not exceed 2,760 MGD. The permit also lists instantaneous maximum, daily maximum, and 6-month median concentration limits for the following constituents: arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, silver, zinc, cyanide, total residual chlorine, ammonia, toxicity, non-chlorinated phenolic compounds, chlorinated phenolics, and radioactivity. Daily average discharge temperatures are limited to no more than 22°F (12.2°C) above the daily average intake water temperature, except during heat treatment for demusseling, when the daily average discharge temperature is limited to no more than 25°F (13.8°C) above the daily average intake water temperature. In addition to the once-through cooling water, service cooling water and in-plant waste streams are also discharged through Outfall 001 and are labeled Discharge 001A, 001B, 001D through 001N, and 001P. Discharges 001D, 001F through 001M, and 001P have specified concentration limits for suspended solids and oil and grease. When metal cleaning operations occur, discharges 001D, 001F, 00I, 001L, and 001M have specified concentration limits for total copper and total iron. Discharge 001N has specified concentration limits for suspended solids, settleable solids, and oil and grease.

Outfalls 002 through 005, 008, 009, and 013 through 017: The NPDES permit requires that the discharged effluent must not violate the water quality objectives in Chapter II, General Requirements in Chapter III, and Table B Toxic Materials Limitations in Chapter IV of the Water Quality Control Plan for Ocean Waters of California, California Ocean Plan.

Outfalls 003, 004, 005, 008, 009, 013, 015, 016, and 017: The NPDES permit specifies concentration limits on oil and grease.

Figure 3-3 National Pollutant Discharge Elimination System Permitted Outfalls at Diablo Canyon Nuclear Power Plant. Adapted From PG&E 2023-TN9822.

Additionally, the NPDES permit outlines receiving water limitations designed to minimize adverse effects of discharge on receiving water quality (PG&E 2023-TN9822). The conditions of the marine environment near Diablo Canyon are monitored under the Receiving Water Monitoring Program (RWMP) to satisfy the NPDES permit monitoring and reporting requirements. The RWMP consists of continuous intertidal and subtidal temperature monitoring at permanent stations along the Diablo Canyon coastline and intertidal and subtidal biological assessments at specified locations performed on a quarterly basis. Six areas are monitored:

South Diablo Cove, North Diablo Cove, South Diablo Point, Field's Cove, South Control at Patton Cove, and North Control (approximately 1 mi [1.7 km] north of Field's Cove). The north and south control points are located beyond the zone of influence of the plant thermal discharge. PG&E submits annual reports to the CCRWQCB summarizing the marine monitoring.

Chemical additives approved by the CCRWQCB are used to control potential of hydrogen (pH), scale, and corrosion in the CWS. The chlorination system provides chemical treatment of the circulating water to control the macro and micro fouling in the intake tunnels, piping, and condenser tubes. The system is used as needed. Liquid sodium hypochlorite and a supplemental chemical, sodium bromide, are stored in tanks at the intake structure. When chlorination is required (based on a time schedule), the chemicals are injected via metering pumps into the seawater CWP forebays within the intake structure. Chemical additives approved by the CCRWQCB are included in the 2011 NPDES permit renewal application (PG&E 2023-TN9822).

Other Surface Water Resources Permits and Approvals

Diablo Canyon operates under a General Industrial Storm Water Discharge Permit (WD ID No. 3401018248), issued by the SWRCB (PG&E 2023-TN9822). Stormwater runoff is permitted by the SWRCB Industrial Storm Water Permit for Discharges Associated with Industrial Activity (Order No. 2014-0057-DWQ), which is a statewide general permit for industrial stormwater discharges. Stormwater is associated with NPDES permitted Outfalls 004-015. Stormwater runoff from the Diablo Canyon site is routed using swales, culverts, and associated inlets, which is then discharged to the Pacific Ocean or Diablo Creek. Runoff from low to moderate storm events is collected in two large retention basins within the Diablo Canyon site that allow stormwater to settle and naturally infiltrate prior to potential discharge to receiving waters. If retention basins are full, excess stormwater runoff discharges to either Diablo Creek or the Pacific Ocean at outfalls located at Intake Cove. External Outfalls 010-015 drain stormwater runoff from the northern part of the Diablo Canyon site to Diablo Creek. Stormwater from the southern Diablo Canyon site is discharged through Outfalls 006 and 007 to the Pacific Ocean in Intake Cove.

As required by the general industrial stormwater permit, the Diablo Canyon site has implemented a Stormwater Pollution Prevention Plan (SWPPP) that uses BMPs to ensure that stormwater discharge complies with effluent and receiving water limits. The SWPPP includes sampling for constituents required under the general permit and additional sampling that complies with the California Ocean Plan. Constituents include, but are not limited to, total suspended solids, oil and grease, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature, turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity. The SWPPP outlines sampling locations, frequencies, and monitoring and reporting requirements (PG&E 2023-TN9822).

Under CWA Section 311(j)(1)(C), Diablo Canyon is required to develop a spill prevention, control, and countermeasures plan. The Diablo Canyon spill prevention, control, and countermeasures plan identifies and describes the procedures, materials, equipment, and facilities to minimize the frequency and severity of any oil spills. Discharge of oil in quantities exceeding those identified in CWA Section 311(b)(4) must be reported to the EPA's National Response Center. PG&E is required to review and evaluate the plan at least once every 5 years or immediately after a reportable quantity oil spill event (PG&E 2024-TN10032). If more effective prevention and control technology is identified during the review, the plan is required to be amended.

PG&E uses an integrated response to hazardous materials spills at Diablo Canyon. The integrated response includes written procedures, administrative controls, training of all site personnel, site-wide coordination, trained and dedicated hazardous materials response team, strategically placed and quarterly inventoried emergency spill kits, and emergency response agreements with outside hazardous materials response organizations (PG&E 2024-TN10032). During 2018–2022, there have been no releases at Diablo Canyon that have triggered a notification requirement. Following reporting, Diablo Canyon is required to clean up and remediate any spills.

A bathymetric survey conducted in 2020 revealed sand accumulation and extensive kelp growth in Intake Cove. PG&E decided to remove the accumulated sand and kelp by dredging Intake Cove, which had not been performed since the initial construction of the breakwater. The California Coastal Commission approved issuance of a Coastal Development Permit for the Diablo Canyon Intake Cove Dredging Project on March 14, 2024, which fulfills the CZMA certification requirement for the project. PG&E was authorized to dredge up to 70,000 cubic yards (53,519 cubic m [m^3]) of accumulated sand and sediment from within a 125,000 square foot (ft^2) (11,613 square meter [m^2]) dredge footprint at the north end of Intake Cove to a depth of -38 ft mean lower low water. Dredging of Intake Cove was conducted from June 25, 2024, through July 7, 2024, under Diablo Canyon Intake Cover Dredging Permit Number SPL-2023-00468 (PG&E 2024-TN10032) (PG&E 2024-TN10226). Approximately 26,000 cubic yards of material was removed from the cove and placed at the U.S. Army Corps of Engineers (USACE) Nearshore Placement Area located south of the entrance to Morro Bay and west of Morro Bay State Park (PG&E 2024-TN10226). Dredging activities were monitored by marine wildlife observers approved by the National Marine Fisheries Service, and PG&E will continue required post-dredging monitoring (e.g., annual eelgrass monitoring for 3 years) and reporting (PG&E 2024-TN10226).

Under the Diablo Canyon Radiological Environmental Monitoring Program (REMP), surface water samples include monthly sampling at three coastal Pacific Ocean locations—Diablo Cove, Rattlesnake Canyon, and the plant outfall)—and five freshwater surface water locations (Diablo Creek weir, Diablo Creek outlet, Blanchard Spring, the plant drinking water system, and the City of San Luis Obispo drinking water). The ocean and freshwater samples are analyzed for gamma emitters, gross beta, tritium, total strontium-89/90, iron-55, and nickel-63 (PG&E 2023-TN9822). Over the period from 2018 to 2021, no Diablo Canyon-related radionuclides were detected at any of the sample locations (PG&E 2023-TN9822).

3.5.2 Groundwater Resources

This section of the SEIS describes the groundwater flow systems (aquifers), groundwater use, and groundwater quality in and around the Diablo Canyon site. An aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to yield significant quantities of water to wells and/or springs.

3.5.2.1 Local and Regional Groundwater Resources

Sections 3.5 and 3.6.2 of the ER (PG&E 2023-TN9822) describe the geologic environment and groundwater resources, respectively, in the vicinity of the Diablo Canyon site. The NRC staff also evaluated information related to groundwater resources during the site audit, the scoping process, and review of other available information as cited in this SEIS.

The Diablo Canyon site, located in San Luis Obispo County, is in the California Coast Range section of the Pacific Border physiographic province. The province is characterized by coastal mountain ranges underlain by folded, faulted, and commonly metamorphosed marine and terrestrial sediments (Planert and Williams 1995-TN10088). Significant aquifers in the California coastal region occur in the terrestrial, marine, and volcanic rocks deposited in intermountain valleys (Planert and Williams 1995-TN10088). The central coast hydrologic region includes several significant groundwater basins, including the Los Osos and San Luis Obispo valleys in San Luis Obispo County, but no significant groundwater basins are located in the vicinity of Diablo Canyon (CNRA 2023-TN10089). No designated sole source aquifers are located in San Luis Obispo County; Fresno County aquifer, approximately 100 mi (160 km) from Diablo Canyon, is the nearest sole source aquifer (EPA 2025-TN11437).

Physiographic features at the Diablo Canyon site include the coastal cliff about 80 ft (24.4 m) high, the marine terrace on which the power block is situated, the steeply rising Overlook Ridge that forms the southern boundary of the Diablo Creek watershed, and Diablo Creek canyon. As described in Section 3.4.1 of this SEIS, Diablo Canyon site geology includes the Miocene-age Obispo Formation, which is subdivided into several members: resistant tuff; fine-grained claystone, shale, and siltstone; and dolomite, dolomitic sandstone, sandstone, and siliceous shale rocks, which forms the foundation of the power block buildings (PG&E 2023-TN10136). The different rock types are interbedded, with rare intervals of uniform lithology, and are folded and tilted. Individual sandstone beds 0.3 to 4 ft (0.09 to 1.2 m) thick are common (PG&E 2023-TN9822). Quaternary marine deposits of loosely to moderately consolidated silt, sand, and gravel are found on the wave-cut terraces with an average thickness of 2 ft (0.6 m) (PG&E 2023-TN9822). Thicker and more continuous alluvial fan deposits of silt, sand, and gravel overlie the marine deposits across much of the coastal terrace area (PG&E 2023-TN9822; PG&E 2014-TN10191). Substantial areas of landslide deposits occur within the Diablo Creek watershed. Fluvial terrace and alluvial deposits of silt, sand, and gravel occur along the lower elevations of Diablo Creek canyon (PG&E 2023-TN9822; PG&E 2014-TN10191).

The primary aquifer at the Diablo Canyon site occurs in the fractured rocks of the Obispo Formation, with accessible groundwater derived from the fractures and bedding planes and not from the intact rock (PG&E 2023-TN9822). Bedding planes and fractures control the direction of groundwater flow. Well screens at the Diablo Canyon site are long to intersect multiple fractured zones. Groundwater also occurs at the contact between the terrace rock and the overlying deposits and in the alluvium along Diablo Creek. Perched groundwater has been reported to occur at the site in the alluvial fan and marine terrace deposits, and in surficial soils (PG&E 2023-TN9822; ENTRIX 2008-TN10137). Because of the relatively low precipitation at the site, 16 in./yr (40 cm/yr), the perched groundwater is considered to be minor (PG&E 2023-TN9822). Recharge is conceptualized to occur from precipitation infiltrating in upland areas, with groundwater flow generally following the topography to discharge at lower elevations including Diablo Creek and the ocean. Groundwater discharge also occurs at a number of springs that have been identified on the Diablo Canyon site (Storrer 2022-TN10138). These springs may occur where groundwater perches above low permeability beds within a rock mass of generally greater permeability.

Because of the complex hydrogeologic features and the limited number of wells at the Diablo Canyon site, local groundwater flow paths and flow rates are uncertain. The most recent map of groundwater levels across the Diablo Canyon site was prepared from data collected in March 2012 (Figure 3-4). This map shows groundwater flow across the site toward the ocean. A localized groundwater basin may also be present within the Diablo Creek valley (PG&E 2023-TN9822), which includes the area where Diablo Canyon wells WW2 and WW5 are located. This basin could result in groundwater flow paths within the creek valley that are controlled by the local hydraulic gradients and fracture zones within the valley. Regardless of the specific groundwater flow paths at the site, the available hydrogeologic data indicate that groundwater use at well WW2 would not affect groundwater flow paths in the power block area and any release of contaminants to groundwater in the area of the power block buildings would not affect groundwater 3,500 ft (1,070 m) inland at the well WW2 location.

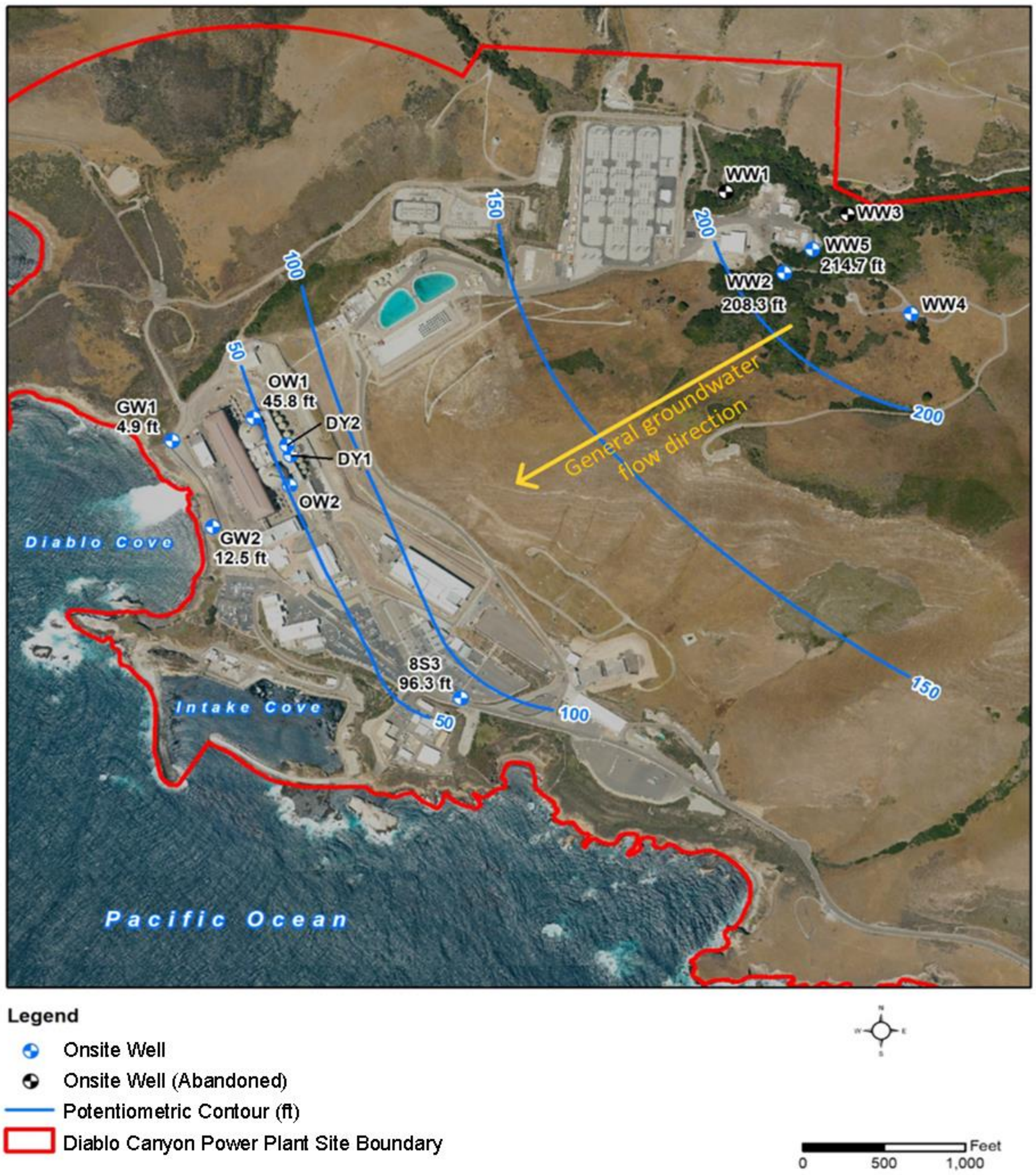


Figure 3-4 **Onsite Wells, Estimated Groundwater Levels Based on Data from March 2012, and General Path of Groundwater Flow at the Diablo Canyon Nuclear Power Plant Site. Adapted From ER Figures 3.6-6 and 3.6-7 From PG&E 2023-TN9822.**

Subsurface hydraulic properties described in the ER were obtained from pump tests using the wells installed in the Diablo Creek valley (ENTRIX 2008-TN10137). These tests indicated that well WW2 could reliably produce 150 gpm (9.5 liters per second) under normal conditions in which the well is pumped for several hours a day (ENTRIX 2008-TN10137). The testing also showed that pumping from well WW2 did not affect water levels in Diablo Creek, a result that was confirmed by pump testing conducted in 2021 (PG&E 2023-TN9822). Hydraulic conductivities estimated from the pump tests ranged from 0.4 to 2.4 ft/day (1.4×10^{-4} to 8.5×10^{-4} cm/s) (PG&E 2023-TN9822). Aquifer thickness at well WW5 was assumed to be 400 ft (122 m), but flow in well WW2 was determined to occur predominately from two fracture zones, 58 and 85 ft (18 and 26 m) thick, along the 250 ft (76 m) well screen length (ENTRIX 2008-TN10137). This information indicates that hydraulic conductivities of individual fracture zones are likely higher than the values estimated from pump tests (PG&E 2023-TN9822).

Information about groundwater conditions beneath the main Diablo Canyon buildings is limited. Bedrock beneath the power block consists of the interbedded dolomite, dolomitic sandstone, sandstone, and the siliceous shale member of the Obispo Formation. The individual sedimentary beds in the power block area are oriented west-northwest and dip to the north-northeast, steeply near the ocean cliff (dip angles from 55 to 85°) with the angle of dip decreasing to the east (12 to 50° around the power block) (PG&E 2024-TN10032). A review of historical photographs during plant construction showed no evidence of seepage into the excavations, suggesting that groundwater levels in the power block area are beneath the lowest portions of the structures, as depicted in Figure 3-5 (PG&E 2024-TN10032). Groundwater levels are measured in wells GW-1 and GW-2, located between the turbine building and the cliff edge, and in well 8S3, located in a parking lot about 1800 ft (550 m) southeast of the power block; water levels in 2012 are shown in Figure 3-4. GW-1 and GW-2 are 2 in. (5 cm) diameter monitoring wells, extending 85 ft (26 m) below ground surface to sea level, with the bottom 40 ft (12 m) screened. Groundwater levels measured hourly in wells GW-1 and GW-2 were about 12 ft (3.7 m) MSL from October 2020 through 2022, with daily fluctuations less than 1 in. (2.5 cm) and typical seasonal fluctuations of 1 to 2 in. (2.5 to 5 cm) (PG&E 2024-TN10032). A record rainfall in 2023 resulted in the water level rising at least 5 ft (1.5 m) in GW-1 and at least 8 ft (2.4 m) in GW-2 (PG&E 2024-TN10032). These measurements suggest that groundwater levels in the power block area are relatively insensitive to tidal variations in ocean levels and to normal precipitation events but can be impacted by extreme climatic events.

The groundwater contours shown in Figure 3-4 suggest a groundwater gradient of about 0.1 ft/ft (0.1 m/m) in the power block area. Assuming that the estimated hydraulic conductivity values from the pump tests in wells WW2 and WW5 apply to the Obispo Formation rocks in the power block area, the NRC staff calculated the groundwater velocity for this area. The NRC staff assumed a rock porosity of 0.2. With these assumptions, the average linear groundwater velocity would be about 0.2 to 1.2 ft/day (22 to 134 m/yr) in the power block area. With this groundwater velocity, any contaminants released to groundwater would transit the approximately 500 ft (150 m) between the reactor buildings and the GW-1 and GW-2 observation wells in about 1 to 7 years. Because of the uncertainties regarding rock properties and nature of flow along fractures and bedding planes, actual velocities could be outside this estimated range.

Enclosure 1
Attachment 14

PG&# Letter DCL-24-052
Page 42 of 44

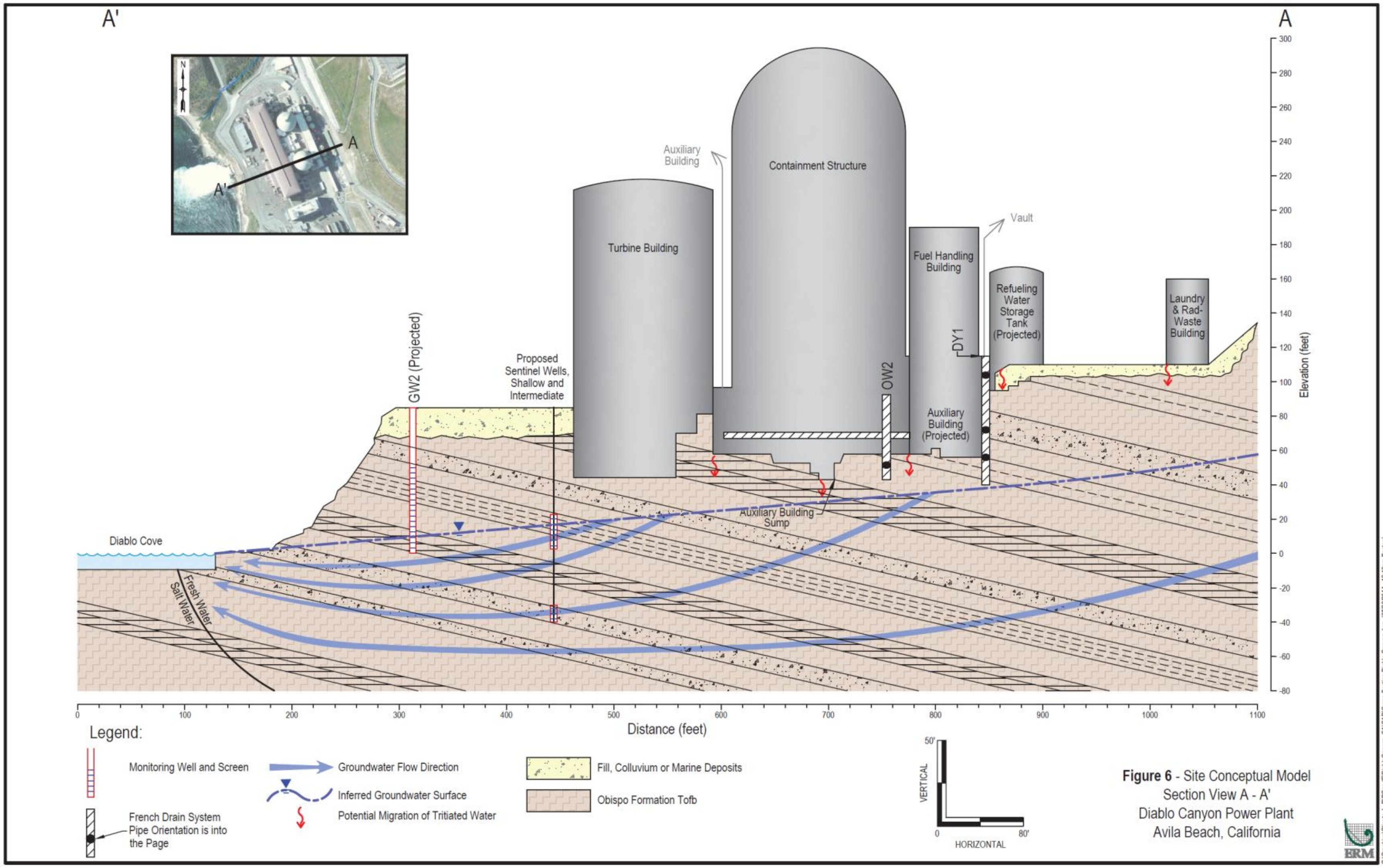


Figure 3-5 Cross-Section View Showing Potential Groundwater Flow Paths in the Diablo Canyon Nuclear Power Plant Power Block Area. Source: PG&E 2024-TN10032: Attachment 14.

3.5.2.2 *Local and Regional Water Consumption*

Diablo Canyon uses groundwater for plant operations to supplement the raw water supply from the SWRO desalination treatment system (PG&E 2023-TN9822). The monthly average plant groundwater use during 2018–2022 was about 22 gpm (83 lpm) with a maximum monthly use of 44 gpm (167 lpm) during that period. Groundwater for plant use is supplied by well WW2 located about 3,500 ft (1,070 m) from the power block (see Figure 3-5). As described above, this well derives most of its water from two fracture zones within the Obispo Formation. These fracture zones are found at elevations significantly below that of Diablo Creek (SLATE 2020-TN10303), a factor that limits the impacts of groundwater use on Diablo Creek flows.

Well WW2 was installed in 1985 and rehabilitated to improve production in 2007 or 2008 (ENTRIX 2008-TN10137). Its current estimated yield is sufficient to satisfy plant use requirements. Two other wells located in the Diablo Creek valley (WW1 and WW3) were installed in 1985 and subsequently abandoned without being used for production (PG&E 2023-TN9822). Wells WW4 and WW5, also located in the creek valley, were installed in 2007 to assess future production potential but are not currently used for production. Ranney wells, which were located near Diablo Creek and used to extract "excess" creek water prior to 2008, have been abandoned (PG&E 2023-TN9822).

Withdrawal of fresh groundwater in San Luis Obispo County totaled 77.32 MG (292.69 million liters) in 2015 (Dieter et al. 2018-TN9686). Of this total, the largest uses were for irrigation, 55.61 MG (210.51 million liters; 71.9 percent), and public water supply, 14 MG (53 million liters; 18.1 percent), with the remaining 7.71 MG (29.19 million liters; 10 percent) of groundwater withdrawals equally split between domestic and industrial uses. Irrigation and public supply uses would be concentrated in the agricultural and urban areas of the county lying within the major groundwater basins (i.e., the Los Osos and San Luis Obispo valleys and other basins identified in CNRA 2023-TN10089). The Diablo Canyon site is hydrologically isolated from these areas of major groundwater use. Two public water supplies using groundwater were identified within 10 mi (16 km) of the Diablo Canyon site—the Avila Beach Community Services District serving Avila Beach and the San Miguelito Mutual Water District serving most of the Avila Valley area (PG&E 2023-TN9822). Avila Beach is about 7 mi (11 km) from Diablo Canyon and outside the Diablo Canyon watershed. Twenty-eight water wells within 2 mi (3.2 km) of Diablo Canyon were identified using a State repository of well completion reports with many of them being utilized for domestic use (PG&E 2023-TN9822). Specific locations of these wells are unknown because the majority of the well completion reports are spatially registered to the center of the 1 × 1 mi Public Land Survey System section in which the well is located (CDWR 2024-TN10092). These wells are all outside the Diablo Canyon property boundary and some of them appear to be located within the Diablo Canyon watershed, upstream from the Diablo Canyon site.

3.5.2.3 *Groundwater Quality*

Groundwater quality in San Luis Obispo County is generally good as evidenced by its widespread use for irrigation, public supply, industrial, and domestic purposes. As stated above, Diablo Canyon site groundwater is hydrologically isolated from the principal groundwater basins in the county. Groundwater quality was reported in 2008 for samples obtained from Diablo Canyon wells WW2, WW4, and WW5 (ENTRIX 2008-TN10137). Water samples were of the bicarbonate type with no dominant cation. Sample pH was neutral (6.6–7.3). Specific conductance (1200–1610 μS/cm) was typical of a hard groundwater. Nitrate and inorganic chemical concentrations were low. Analysis of radiological constituents was not reported.

3.5.2.3.1 Nonradiological Spills

PG&E controls the use and storage of chemicals associated with Diablo Canyon maintenance and operations in accordance with the applicable Federal, State, and county authorizations (PG&E 2024-TN10032). In addition, the plant maintains a spill prevention control and countermeasure plan. Site-specific programs to minimize the potential for a chemical release to the environment are in place to ensure that best management practices and structural controls are used. Some liquid nonradioactive wastes are discharged along with Diablo Canyon cooling water in accordance with the NPDES permit (PG&E 2023-TN9822). No inadvertent releases or spills of nonradioactive contaminants that would trigger a notification requirement have occurred at the site between 2018 and May 2024 (PG&E 2023-TN9822, PG&E 2024-TN10032).

3.5.2.3.2 Historical Radiological Spills and Tritium in Groundwater

<u>Groundwater Protection Program</u>

Based on the Industry Groundwater Protection Initiative (NEI 2019-TN6775), a groundwater protection program (GPP) was implemented at Diablo Canyon in 2006 to ensure timely and effective management and reporting of inadvertent releases of licensed material to groundwater. Samples were initially collected in 2006 from wells OW1, OW2, DY1, and WW2 (PG&E 2023-TN9822). Based on the hydrogeology of the site, samples from WW2 are suitable for determining the quality of groundwater at the site that is unaffected by plant operations. OW1, OW2, and DY1 are part of the French drain system installed during plant construction to relieve potential groundwater hydrostatic pressure that might build up around the fuel handling building and reactor containment structures (PG&E 2024-TN10032). As illustrated in Figure 3-5, the juxtaposition of the deep foundation basements with the inferred groundwater elevation surface indicates that no areas of the power block currently extend below the water table into groundwater.

The French drain system wells were monitored as preferential migration pathways for spills or leaks to reach groundwater. Tritium subsequently detected in water from these wells was attributed to rain washout of gaseous tritium released from the permitted plant vent discharges (PG&E 2023-TN9822). DY1 was removed from the offsite-dose calculation manual in 2019 due to the tritium from rain washout, and this well is no longer monitored as part of the GPP (PG&E 2023-TN9822). As illustrated in Figure 3-5, vertical migration from inadvertent leaks and/or spills within the power block is possible through potential pathways at sumps, floor drains, underground pipes, or seismic gaps between buildings (PG&E 2024-TN10032). Wells GW1 and GW2, with screens extending into site groundwater, were added to the GPP monitoring program in 2011 to provide detection of potential releases at the perimeter of the site (PG&E 2023-TN9822). The current GPP monitoring program collects quarterly samples at wells WW2, OW1, OW2, GW1, GW2, and 8S3 and analyzes for tritium, gamma emitters, gross beta, strontium-89/90, iron-55, and nickel-63 (PG&E 2023-TN9822). In addition, samples are collected from two locations in Diablo Creek and from a spring at the nearest residence, about 1.5 mi (2.4 km) from the site (PG&E 2023-TN9822).

A review of the site conceptual model was completed in 2014 to satisfy requirements of the Industry Groundwater Protection Initiative (PG&E 2024-TN10032). Diablo Canyon SSCs with a credible mechanism for licensed material to reach groundwater were reviewed to evaluate early detection of releases. The SSCs of interest include power block structures, the auxiliary building sump, refueling water storage tanks, and underground piping (PG&E 2023-TN9822). The review concluded that monitoring for early detection of releases would be improved by installing additional multilevel monitoring wells along the western edge of the power block, with sampling intervals identified based on the locations of SSCs of interest and orientation of the Obispo Formation bedding and fractures along which transport of radionuclides would occur (PG&E 2024-TN10032). The review also concluded that any release from Diablo Canyon would travel in groundwater and discharge to Diablo Cove, where it would be diluted to background levels by mixing with seawater (PG&E 2024-TN10032).

Radiological Releases

No release of tritium to groundwater has been reported for Diablo Canyon (NRC 2023-TN9980). Annual Radiological Effluent Release Reports are submitted to the NRC (per 10 CFR 50.36a [TN249]) to report the quantities of radionuclides released from liquid and gaseous effluents. The NRC staff reviewed five years of effluent release reports (2019–2023) (PG&E 2020-TN10093, 2021-TN10094, 2022-TN10095, 2023-TN10096, and 2024-TN10097). These reports state that tritium in subsurface water samples is attributable to rain washout of tritium released in gaseous effluents and that no voluntary communications of spills, leaks, or groundwater sample results exceeding reporting thresholds were made. Groundwater sampling results under the GPP are provided in the Annual Radiological Environmental Operating Reports submitted to the NRC. The staff reviewed five years of the Diablo Canyon environmental operating reports (2019–2023), which confirmed that no radionuclides were measured above reporting thresholds (PG&E 2020-TN10065, PG&E 2021-TN10066, PG&E 2022-TN10067, PG&E 2023-TN10036, and PG&E 2024-TN10069). In addition, the only radionuclide above detection limits was tritium, measured at less 1000 pCi/L and attributed to the rain washout into the French drain system. Tritium was below detection limits in monitoring wells GW1 and GW2.

3.5.3 Proposed Action

3.5.3.1 Surface Water Resources

As documented in the LR GEIS (NRC 2024-TN10161) and cited in Table 3-1, for generic surface water resources issues, the impacts of nuclear power plant LR and continued operations would be SMALL for the Category 1 issues applicable to Diablo Canyon. This review, including the independent review of the ER, the scoping process, the audit, and evaluation of available information, did not identify any new and significant information related to the Category 1 issues for surface water resources that would change the conclusion reached in the LR GEIS.

The LR GEIS lists one Category 2 issue for surface water resources—surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) (NRC 2024-TN10161). Diablo Canyon has a once-through condenser cooling system and does not use cooling ponds or cooling towers. In addition, Diablo Canyon does not withdraw makeup water from a river (PG&E 2023-TN9822; NRC 2024-TN10161: Table 3.1-2). Therefore, the Category 2 issue related to surface water resources does not apply to Diablo Canyon.

3.5.3.2 Groundwater Resources

As documented in the LR GEIS (NRC 2024-TN10161) and cited in Table 3-1, for generic groundwater resources issues, the impacts of nuclear power plant LR and continued operations would be SMALL for the Category 1 issues applicable to Diablo Canyon. These issues are:

- groundwater contamination and use (non-cooling system impacts)
- groundwater use conflicts (plants that withdraw less than 100 gpm [379 lpm])
- groundwater quality degradation resulting from water withdrawals

These applicable Category 1 issues were determined to result in a SMALL impact in 10 CFR Part 51 (TN10253), Subpart A, Appendix B, Table B-1. No significant groundwater impacts with respect to Category 1 (generic) issues are anticipated during the LR term that would be different from those occurring during the current license term. As discussed in Section 3.5.2 of this SEIS, the NRC staff performed a review of groundwater use and quality. This review, including the independent review of the ER, the scoping process, the audit, and evaluation of available information, did not identify any new and significant information that would change the conclusion reached in the LR GEIS. Based on this review, the NRC staff concludes the following:

- No dewatering for groundwater control is expected during the renewal period. No discharges to groundwater requiring permits by regulatory agencies are expected during the renewal period. There are currently no regulated discharges to groundwater, and none were identified by the applicant to occur during the renewal period.
- There are no foreseeable conditions during the renewal period under which onsite groundwater withdrawals increase to near or above the 100 gpm (379 lpm) limit included in the LR GEIS conclusion.
- Groundwater pumping for plant use does not affect water levels in Diablo Creek and is not expected to result in the degradation of groundwater quality.

As a result, as concluded in the LR GEIS (NRC 2024-TN10161) for these Category 1 (generic) issues that are reported in Table 3-1, the impacts on groundwater resources of continued operation of Diablo Canyon would be SMALL.

As shown in Table 3-2, the NRC staff identified one site-specific Category 2 issue related to groundwater resources applicable to Diablo Canyon during the LR term. This Category 2 issue is radionuclides released to groundwater and it is analyzed below.

Radionuclides Released to Groundwater

The issue of radionuclides released to groundwater was added for consideration as part of the groundwater review for LR in the 2024 LR GEIS revision (NRC 2024-TN10161) because of the accidental releases of liquids containing radioactive material into the groundwater at power reactor sites (NRC 2023-TN9980). Most of the inadvertent releases that have occurred at operating plants involved leaks of water containing tritium or other radioactive isotopes from spent fuel pools, buried piping, or failed valves on effluent discharge lines. In 2006, the NRC released a report titled, "Liquid Radioactive Release Lessons Learned Task Force Report," documenting lessons learned from a review of these incidents that ultimately concluded that these instances had not adversely affected public health and safety (NRC 2006-TN1000). This report concluded, in general, that groundwater affected by radionuclide releases is expected to remain onsite, but that instances of offsite migration have occurred. Therefore, the 2024 LR GEIS (NRC 2024-TN10161) determined that impacts on groundwater quality from the release of radionuclides could be SMALL or MODERATE, depending on the magnitude of the leak, the radionuclides involved, hydrogeologic factors, distance to receptors, and the response time of plant personnel to identify and stop the leak. Consistent with the 2024 LR GEIS, this is a Category 2 issue requiring a site-specific evaluation and that evaluation with respect to Diablo Canyon LR is provided below.

The issue of radionuclides released to groundwater was discussed and evaluated in Sections 3.6.4.2 and 4.5.5 of the ER (PG&E 2023-TN9822). PG&E monitors groundwater at Diablo Canyon for inadvertent release as part of its groundwater protection program, which was implemented in 2006 to conform to Nuclear Energy Institute (NEI) 07-07 (NEI 2019-TN6775) and to satisfy the requirements of 10 CFR 20.1501 (TN283). Section 3.6.4.2 of the ER (PG&E 2023-TN9822) describes the detection of low levels of tritium in samples from the plant's French drain system. Based on its review of the available information, the NRC staff concludes that low levels of tritium present in samples from the French drain system are not indicative of inadvertent releases from the plant but likely result from rain washout of tritium deposited from regulated releases of gaseous effluents. Section 3.6.4.2 of the ER also describes the detection of low levels of tritium in water samples from the vault sumps of the Old Steam Generator Storage Facility. These releases are also attributed to rain washout. The NRC staff concludes that these sample results do not indicate an inadvertent release of radionuclides to groundwater.

Based on the information reviewed by the NRC staff, the French drain system wells are located above the power block groundwater level. As a result, these wells provide some monitoring of potential preferential migration pathways but do not provide consistent data on groundwater quality beneath the power block. The current site conceptual model, prepared for the GPP, describes the installation of additional groundwater monitoring wells to improve early detection of inadvertent releases (PG&E 2024-TN10032). However, these additional wells have not been installed. Monitoring wells GW1 and GW2 are the only wells screened within the saturated zone that provide detection of inadvertent releases from power block SSCs. These wells provide groundwater quality data near the Diablo Canyon facility perimeter where groundwater discharges to the ocean. There is no evidence of any release of radionuclides to groundwater based on GW1 and GW2 monitoring (PG&E 2023-TN9822). In addition, no significant historical release of radionuclides to groundwater at Diablo Canyon has been reported (NRC 2023-TN9980).

Based on the information reviewed, the NRC staff determined that the groundwater monitoring at Diablo Canyon could be improved to provide earlier detection of inadvertent releases of radionuclides to groundwater. However, there is no evidence that any significant releases have occurred during the operations history of the plant. Moreover, any inadvertent release to groundwater that reaches the site perimeter would be discharged to Diablo Cove, where it would be mixed and diluted by the plant discharge and the ocean water in the cove. Therefore, the NRC staff concludes that groundwater resources impacts due to the release of radionuclides to groundwater would be SMALL during the Diablo Canyon LR term.

3.5.4 No-Action Alternative

3.5.4.1 Surface Water Resources

Under the no-action alternative, the NRC would not issue renewed operating licenses for Diablo Canyon, and reactor power generating operations would cease at the end of the current license terms. With the cessation of operations, there would be a large reduction in the amount of water withdrawn from the Pacific Ocean. Wastewater discharges would also greatly decrease. Stormwater runoff would continue to be discharged from the site. As a result, Diablo Canyon shutdown would reduce the overall impacts on surface water use and quality. Therefore, the NRC staff concludes that the impact of the no-action alternative on surface water resources would be SMALL.

3.5.4.2 Groundwater Resources

Under the no-action alternative, the NRC would not issue renewed operating licenses for Diablo Canyon, and reactor power generating operations would cease at the end of the current license terms. With the cessation of operations, there would be little or no additional impact on groundwater quality. Any contamination of onsite soil and groundwater would be assessed during decommissioning, whether the plant is decommissioned at the end of the current licensing period or at the end of the LR period. A license termination plan would describe actions needed for site remediation to meet the NRC criteria for radiologic dose and site-specific clean up criteria to be met before release of the Diablo Canyon site. Groundwater use for site maintenance prior to decommissioning would be no greater than current use. Therefore, the NRC staff concludes that the impact of the no-action alternative on groundwater resources would be SMALL.

3.5.5 Replacement Power Alternatives: Common Impacts

3.5.5.1 Surface Water Resources

<u>Construction</u>

Construction activities associated with replacement power alternatives may cause temporary impacts on surface water quality by increasing sediment loading to water bodies and waterways. Construction of intake and discharge structures, if needed, could result in within-water activities including dredge-and-fill, underwater construction, and tunneling. Construction activities might also affect surface water quality through pollutants in stormwater runoff from disturbed areas and excavations, spills and leaks from construction equipment, and from sediment and other pollutants disturbed due to associated dredge-and-fill activities. These pollutants could be detrimental to downstream surface water quality, where applicable, and to ambient water quality in waterways near work sites.

Facility construction activities might alter surface water drainage features within the construction footprints of replacement power facilities, including any wetland areas. Impervious areas may increase, resulting in a potential for greater and quicker surface runoff. Potential hydrologic impacts would vary depending on the nature and acreage of the land area disturbed and the intensity of excavation work. Changes in stormwater runoff volume, timing, and quality are usually controlled and managed with applicable Federal, State, and local permits and the implementation of BMPs.

The NRC staff assumes that construction contractors would implement BMPs for soil erosion and sediment control to minimize water quality impacts in accordance with applicable Federal, State, and local permitting requirements. These measures would include spill prevention and response procedures, such as measures to avoid and respond to spills and leaks of fuels and other materials from construction equipment and activities. Surface water use during construction is generally related to concrete preparation, dust suppression, and potable and sanitary water for the workforce and is limited to the construction duration. These water needs are usually small compared to cooling water needs during thermoelectric plant operation.

<u>Operation</u>

Thermoelectric generation may require varying amounts of surface water for the cooling of plant components depending on the selected cooling technology and, therefore, may require new water use permits from and agreements with State and local agencies. Potable and sanitary water use for the plant would depend on the workforce size and, therefore, may also require new potable water use permits from and sanitary water disposal agreements with local agencies or municipalities.

Discharge of wastewater including cooling system discharges would require permits from Federal, State, and local agencies, including a certification that the discharges are consistent with State water quality standards. Wastewater discharges would be subject to treatment and monitoring and reporting requirements of relevant permitting agencies. The NRC staff assumes that plant operations would follow the requirements of any applicable Federal, State, and local permits.

3.5.5.2 Groundwater Resources

<u>Construction</u>

Excavation dewatering for foundations and substructures during construction of power generation facilities, as applicable, may be required to stabilize slopes and permit placement of foundations and substructures below the water table or in areas of perched groundwater. Groundwater levels in the immediate area surrounding an excavation may be temporarily affected, depending on the duration of dewatering and the methods (e.g., cofferdams, sheet piling, sumps, and dewatering wells) used for dewatering. The NRC staff expects that any impacts on groundwater flow and quality caused by dewatering would be highly localized, would be of short duration, and would not affect offsite groundwater users. Discharges resulting from dewatering operations would be released in accordance with applicable State and local permits, as described above.

Although foundations, substructures, and backfill may alter onsite groundwater flow patterns, local and regional trends would remain unaffected. Construction of power generating facilities may contribute to onsite changes in groundwater infiltration and quality due to the removal of vegetation and construction of buildings, parking lots, and other impervious surfaces. The potential impacts of increased runoff and subsurface pollutant infiltration or discharge to nearby water bodies would be prevented or mitigated through implementation of BMPs and an SWPPP.

In addition to construction dewatering, onsite groundwater could be used to support construction activities (e.g., dust abatement, soil compaction, and water for concrete batch plants). Groundwater withdrawal during construction could temporarily affect local water tables or groundwater flow, and these withdrawals and resulting discharges would be subject to applicable permitting requirements.

<u>Operation</u>

Dewatering for building foundations and substructures may be required during the operational life of the power facility. Operational dewatering rates, if required, would likely be lower than the rates required for construction and would be managed subject to applicable permitting requirements. Dewatering discharges and treatment would be properly managed in accordance with applicable NPDES permitting requirements. The NRC staff expects that any impacts on groundwater flow and quality affected by dewatering would be highly localized, and that there would be no effects on offsite groundwater users due to the site location.

Effluent discharges (e.g., cooling water, sanitary wastewater, and stormwater) from a facility are subject to applicable Federal, State, and other permits specifying discharge standards and monitoring requirements. Adherence to proper procedures by power facility operators during all material, chemical, and waste handling and conveyance activities would reduce the potential for any releases to the environment, including releases to the subsurface and groundwater.

Groundwater use during operation for the replacement power alternatives is assumed to be less than 100 gpm (380 lpm), which would likely have a minimal impact on surrounding offsite groundwater use or quality. Onsite groundwater withdrawals would be subject to applicable State water appropriation, permitting, and registration requirements.

3.5.6 Purchased Power Alternative

As discussed in Section 2.3.2.1 of this SEIS, until 2045, purchased power would likely come from the most common types of existing electric power generating technologies including nuclear power, natural gas-fired, coal, solar, and wind energy. Afterwards, all future sources of purchased power must be from renewable energy sources. Purchased power may also rely on older and less efficient power plants operating at higher levels of power generation than current operations.

3.5.6.1 Surface Water Resources

The impacts of purchased power on surface water resources are likely to be similar to the common impacts discussion in Section 3.5.5.1. Operation of nuclear, coal, and natural gas-fired power plants and renewable energy facilities would not be expected to result in incremental impacts on surface water use and quality as long as all energy-generating facilities operate within the bounds of applicable water use and NPDES permits. Therefore, based on this information, the NRC staff concludes that the impacts of this alternative on surface water resources would be SMALL.

3.5.6.2 Groundwater Resources

The impacts of purchased power on groundwater resources are likely to be similar to the common impacts discussion in Section 3.5.5.2 and bounded by the operational impact descriptions for the renewables combination alternative. Operation of energy generating facilities would not be expected to result in incremental impacts on groundwater use and quality. Therefore, based on this information, the NRC staff concludes that the impacts of this alternative on groundwater resources would be SMALL.

3.5.7 Renewables Combination Alternative

3.5.7.1 Surface Water Resources

Common impacts to surface water resources described in Section 3.5.1.1 of this SEIS also would apply to the renewables combination alternative. The three components of the renewables combination alternative (wind turbine, solar panel, and geothermal facilities) could be sited at different locations. Construction of new wind turbine, solar panel, and geothermal facilities would require approximately 400 workers over 4 years, 1,100 workers over 1–2 years, and 880 workers over 17–33 months, respectively. Based on the current workforce at Diablo Canyon (see Table 3-18), the potable and sanitary construction water needs for this alternative would be comparable to that currently needed to operate Diablo Canyon. The building-related water use would be limited to the duration of the building activities. Building-related impacts to surface water quality would also be limited to the building duration and would occur at multiple locations. These water quality impacts would be managed under applicable Federal, State, and local permits. Implementation of BMPs and adherence to Federal, State, and local permit requirements would minimize the impacts on surface water resources. Therefore, the NRC staff concludes that building-related impacts of the renewables combination alternative to surface water resources would be SMALL.

An operational work force of approximately 10, 16, and 148 persons would be needed for the wind turbine, solar panel, and geothermal facilities, respectively. The combined workforce for this alternative would be smaller than the current Diablo Canyon operational workforce. Therefore, the potable and sanitary water use for the renewables combination alternative would be smaller than the current Diablo Canyon potable and sanitary water use. During operations, the wind turbines and solar panels would not require a cooling system and, therefore, would not consume any cooling water.

The proposed installed capacity of the geothermal component of the renewables combination alternative is 200 MWe (see Section 2.3.2.2). While dry and wet cooling technologies can be employed for geothermal power plants, the consumptive water use of wet systems (e.g., mechanical draft cooling towers), on a per MWe basis, could be approximately 10 times that of a conventional nuclear power plant with once-through cooling (NRC 2024-TN10161). Therefore, water requirements for the geothermal power plant could be comparable or slightly greater than that of Diablo Canyon (approximately 2,285 MWe), which has a once-through cooling system that uses less water than a closed-cycle cooling system (e.g., mechanical draft cooling towers) on a per MWe basis (NRC 2024-TN10161).

Any surface water withdrawal needed to support the operation of the mechanical draft cooling towers (e.g., makeup, blowdown, and drift losses) would be small in comparison to the current Diablo Canyon surface water withdrawals. During operations, wastewater and cooling system discharges from the three components of the renewables combination alternative (i.e., wind, solar, and geothermal) would be controlled and managed under the CWA requirements (e.g., NPDES permits, State water quality certifications). Impacts to surface water quality from stormwater runoff from plant site areas would be permitted under a general industrial permit. The plant operators would be required to implement BMPs, monitor effluent quality, and report and remediate any inadvertent exceedances or violations. Therefore, the NRC staff concludes that operations-related impacts of the renewables combination alternative to surface water resources would be SMALL.

3.5.7.2 Groundwater Resources

The hydrologic and water quality assumptions and implications for construction and operations described in Section 3.5.5.2 as being common to all replacement power alternatives would apply to the renewables combination alternative. The NRC staff assumes that the cooling water for the geothermal power plant would not be derived from a groundwater source. In addition, the staff assumes that the geothermal resource extraction and underground injection required for operation of the geothermal power plant would be designed, constructed, operated, monitored, and decommissioned according to applicable Federal, State, and local permits to minimize and mitigate any impacts to groundwater quality or other groundwater uses and users. The NRC staff did not identify any other impacts on groundwater resources for this alternative beyond those discussed above as being common to all replacement power alternatives. Therefore, the staff concludes that the impacts on groundwater resources from construction and operations under the renewables combination alternative would be SMALL.

3.6 Terrestrial Resources

This section of the SEIS describes the terrestrial resources of the Diablo Canyon site and the surrounding landscape. Following this description, the NRC staff analyzes the potential impacts on terrestrial resources from the proposed action of LR and alternatives to the proposed action. Information here is based on PG&E's ER (PG&E 2023-TN9822), a terrestrial biological resources assessment (Terra Verde 2020-TN10098), and other publicly available information.

3.6.1 Ecoregion

The Diablo Canyon site lies within the Central California Foothills and Coastal Mountains Ecoregion (EPA Level III Ecoregion 6, EPA 2013-TN9981; Griffith et al. 2016-TN10099). The terrain consists of open, low mountains or foothills, with areas of irregular plains and narrow valleys. The primary distinguishing character of this ecoregion is its climate of hot, dry summers and cool, moist winters. Ranchland is the primary land use, but some valleys are cultivated for vineyards. Natural vegetation is mostly woodlands consisting of coast live oak (*Quercus agrifolia*), Coulter pine (*Pinus coulteri*), and unique native stands of Monterey pine (*Pinus radiata*) in the west, and blue oak (*Quercus douglasii*), black oak (*Quercus kelloggii*), and grey pine (*Pinus sabiniana*) in the east.

The USACE defines wetlands as areas either inundated or saturated by surface or groundwater at a frequency and duration sufficient to support (and that under normal circumstances do support) a prevalence of vegetation typically adapted for life in saturated soil conditions. In its ER (PG&E 2023-TN9822: Section 3.7.2.4), PG&E characterizes the National Wetlands Inventory features in the vicinity surrounding the Diablo Canyon site as follows:

- estuarine and marine deepwater—40,604 ac (16,432 ha)
- estuarine and marine wetlands—163 ac (66.0 ha)
- freshwater forested/shrub wetland—307 ac (124.2 ha)
- freshwater emergent wetlands—8.4 ac (3.4 ha)
- freshwater ponds—6.7 ac (2.7 ha)
- riverine waters—76.9 ac (31.1 ha)

3.6.2 Diablo Canyon Site

The Diablo Canyon site consists of approximately 750 ac (304 ha) along the western shore of the Pacific Ocean, along the mouth of Diablo Creek, in San Luis Obispo County, California (PG&E 2023-TN9822: Section 3.7.2.2). The Diablo Canyon site lies within the Southern Santa Lucia Range (Level IV Ecoregion 6aj; Griffith et al. 2016-TN10099), which includes northwest-trending mountains and hills with rounded ridges, steep sides, and narrow canyons. Coastal areas include narrow benches on marine terraces and small areas of sand dunes. Vegetation includes coast live oak woodlands, chaparral shrublands, and annual grasslands.

About 34 percent of the Diablo Canyon site consists of developed land cover types, 2 percent is open water, and the remaining 64 percent is vegetated (PG&E 2023-TN9822: Table 3.2-1). Shrub/scrub and grasslands/herbaceous are the dominant vegetation types, covering about 36 percent and 17 percent of the Diablo Canyon site, respectively. Mixed forest cover is about 10 percent, and evergreen forest is about 2 percent. All other vegetation types cover less than 1 percent of the site: pasture/hay, woody wetlands, emergent herbaceous wetlands, and barren land.

The descriptions in the ER (PG&E 2023-TN9822: Section 3.7.2.3) characterize the terrestrial habitats within the Diablo Canyon site boundary. Habitat descriptions of associated tree, shrub, and herbaceous strata are incorporated here by reference:

- wild oats and annual brome grassland
- needle grass – melic grass grassland
- hardstem and California bulrush marshes
- coyote brush scrub
- coastal bluff scrub
- California sagebrush scrub
- California coffee berry scrub
- bush monkeyflower scrub
- chamise-black sage chaparral
- buck brush chaparral
- toyon chaparral
- arroyo willow thickets
- coast live oak woodland and forest
- artesian springs/freshwater wetlands

The Diablo Canyon site boundaries contain a total of 27.32 ac (11.1 ha) of wetlands, lakes, ponds, and riverine waters (PG&E 2023-TN9822: Section 3.7.2.4). Table 3-8 summarizes the area and percentage of wetlands and surface water features on the Diablo Canyon site as documented in the National Wetlands Inventory. Figure 3-6 shows the location of National Wetlands Inventory wetlands on a map of the Diablo Canyon site.

Biologists conducted a terrestrial biological resources assessment on the Diablo Canyon site in 2020 (Terra Verde 2020-TN10098). They compiled a list of regionally occurring special status species, evaluated their potential for occurring onsite, conducted field surveys to evaluate terrestrial habitats on site, compiled plant and wildlife species lists for the site, and conducted jurisdictional analysis and mapping of wetlands and streams.

Table 3-8 Wetlands and Surface Water Features on the Diablo Canyon Nuclear Power Plant Site

Wetland or Water Feature	Area	Percent of Onsite Wetland Habitat
Estuarine and Marine Deepwater	12.82 ac	46.93
Estuarine and Marine Wetlands	7.21 ac	26.39
Freshwater Forested/Shrub Wetlands	2.96 ac	10.83
Freshwater Ponds	1.66 ac	6.08
Riverine Wetlands	2.67 ac	9.77
Total	**27.32 ac**	**100.00**

ac = acre(s); ha = hectare(s).

Figure 3-6 National Wetlands Inventory Map of the Diablo Canyon Nuclear Power Plant Site. Adapted From ER Figure 3.7-2, PG&E 2023-TN9822.

Wildlife species occurring on the Diablo Canyon site consist of those species typically found around the Pacific Coast scrub, chaparral, grasslands, forests, developed areas, wetland and riparian areas, and agricultural areas (PG&E 2023-TN9822: Section 3.7.2.5). Table 3.7-4 in the ER presents a list of species known to occur in San Luis Obispo County; this list includes 29 terrestrial mammals, 42 birds, 6 amphibians, and 11 reptiles. Table 3.7-5 in the ER presents a list of terrestrial species known to occur on the Diablo Canyon site. Mammals include mule deer (*Odomcoileus hemionus)*, coyote (*Canis latrans*), striped skunks (*Mephitis nephitis*), bobcat (*Lynx rufus*), woodrat (*Neotoma* sp.), brush rabbit (*Sylvilagus bachmani*), California ground squirrel (*Otospermophilus beecheyi*), and Botta's pocket gopher (*Thomomys bottae*).

3.6.3 Important Species and Habitats

3.6.3.1 Federally Listed Species

For a discussion of terrestrial species and habitats that are federally protected under the Endangered Species Act of 1973, as amended, see Section 3.8, "Federally Protected Ecological Resources," of this SEIS.

3.6.3.2 State-Listed Species

PG&E (PG&E 2023-TN9822: Table 3.7-7) provided a list of species known to occur within San Luis Obispo County that are designated as endangered or threatened by the U.S. Fish and Wildlife Service (FWS) or by the State of California. PG&E evaluated the 13 species that are State listed but not federally listed separately in its ER (PG&E 2023-TN9822: Section 3.7.8.2). Species rankings, life history, and habitat descriptions of these State-listed species (Table 3-9) are incorporated here by reference. Based on the results of the terrestrial biological resources assessment (Terra Verde 2020-TN10098), the NRC staff does not expect these species to occur onsite.

Table 3-9 State-Listed Species (That Are Not Also Federally Listed) for San Luis Obispo County, Potentially Occurring in the Vicinity of Diablo Canyon Nuclear Power Plant

Common Name	Scientific Name	Class	State Legal Status
Beach spectaclepod	*Dithyrea maritima*	Vascular Plant	Threatened
Hearst's manzanita	*Arctostaphylos hookeri* ssp. *Hearstiorum*	Vascular Plant	Endangered
Surf's thistle	*Cirsium rhothophilum*	Vascular Plant	Threatened
Crotch bumblebee	*Bombus crotchii*	Insect	Candidate
Western bumble	*Bombus occidentalis*	Insect	Candidate
Bald eagle	*Haliaeetus leucocephalus*	Bird	Endangered
Bank swallow	*Riparia riparia*	Bird	Threatened
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*	Bird	Endangered
California black rail	*Laterallus jamaicensis coturniculus*	Bird	Threatened
Swainson's hawk	*Buteo swainsoni*	Bird	Threatened
Tricolored blackbird	*Agelaius tricolor*	Bird	Threatened
Willow flycatcher	*Empidonax traillii*	Bird	Endangered
Nelson's (San Joaquin) antelope squirrel	*Ammospermophilus nelson*	Mammal	Threatened

In addition to listing species as threatened or endangered, California has additional rankings for plants and wildlife of concern. The terrestrial biological resource assessment found that the Diablo Canyon site has potential habitat for special status plants and wildlife (Terra Verde 2020-TN10098) that are not listed as endangered or threatened by the FWS or by the State of California. Species rankings, life history, and habitat descriptions of these State-listed species are incorporated here by reference.

In addition to listing plants as threatened or endangered, California uses rare plant rankings developed by the California Native Plant Society to define and categorize rarity in the California flora. The terrestrial biological resource assessment (Terra Verde 2020-TN10098: Appendix 1) found that the Diablo Canyon site has potential habitat for 41 special status plants that are not listed as endangered or threatened by the FWS or by the State of California. Species rankings, life history, and habitat descriptions of these special status plant species are incorporated here by reference. Biologists noted the presence or likely occurrence of four of these special status rare plant species on the Diablo Canyon site. Two of these are likely ornamental plantings based on location and so will not be discussed further (San Diego viguiera [*Bahiopsis laciniata*] and Monterey cypress [*Hesperocyparis macrocarpa*]). The other two rare plant species are Hoffman's sanicle and ocean bluff milkvetch (Terra Verde 2020-TN10098).

Hoffman's sanicle (*Sanicula hoffmanii*) has California Rare Plant Rank 4.3 (watch list: plants of limited distribution, not very threatened in California; CNPS Undated-TN10100). The habitat of this flowering, perennial herb is shrubby coastal hills and pine woodlands. Surveyors noted the species in scrub and woodland habitats in several locations on the Diablo Canyon site.

Ocean bluff milkvetch (*Astragalus nuttallii* var. *nutallii*) has California Rare Plant Rank 4.2 (watch list: plants of limited distribution, moderately threatened in California; CNPS Undated-TN10100). The habitat of this perennial herb is rocky, sandy areas and bluffs. A known population of ocean milkvetch occurs in coastal bluff scrub immediately north of the Diablo Canyon site. During field surveys, biologists found a population of the nonlisted variety of ocean bluff milkvetch (*Astragalus nuttallii* var. *virgatus*). Because much of this population was along an inaccessible bluff, biologists could not verify taxonomy to variety and, therefore, assumed that both varieties of ocean bluff milkvetch were present in a mixed population.

The State of California and San Luis Obispo County consider individual oak trees to be a sensitive resource (Terra Verde 2020-TN10098, p. 55). Biologists noted the presence of coastal oaks and coastal oak woodlands on the eastern portion of the site. In a 2021 survey focused on inventorying coast live oak on the Diablo Canyon site (Terra Verde 2021-TN10101), surveyors found a total of 245 coast live oak that were greater than 5 in. (12.7 cm) in diameter. Diablo Canyon developed an oak tree impact avoidance, minimization, and mitigation plan for decommissioning.

In addition to listing wildlife as threatened or endangered, California has additional listings for wildlife with conservation concerns. The terrestrial biological resource assessment (Terra Verde 2020-TN10098: Appendix 1) found that the Diablo Canyon site has potential habitat for 22 terrestrial wildlife species (7 mammals, 1 amphibian, 4 reptiles, 1 insect, and 9 birds) that are not listed as endangered or threatened by FWS or by the State of California but are animals with conservation concerns tracked by the State of California (CNDDB 2024-TN10102). Species rankings, life history, and habitat descriptions of these wildlife species are incorporated here by reference.

Mammals tracked by the State of California that may have habitat within the Diablo Canyon site are mountain lion (*Puma concolor*), American badger (*Taxidea taxus*), San Diego desert woodrat (*Neotoma lepida intermedia*), and four species of bats: pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Corynorhinus townsendii*), Western mastiff bat (*Eumops perotis*), and big free-tailed bat (*Nyctinomops macrotis*). Mountain lions use nearly all California habitats, from low to high elevations. American badgers are known to occur immediately north of the Diablo Canyon site and use open grasslands as habitat. Woodrats use woodland, mixed chaparral, and desert habitats. Biologists conducted daytime visual wildlife surveys of the Diablo Canyon site and evaluated onsite habitat conditions but did not conduct protocol or species-specific focused wildlife species surveys (Terra Verde 2020-TN10098). They found woodrat middens on the Diablo Canyon site but were not able to determine which species of woodrats created them. Suitable bat roosting habitats and structures may be present on the Diablo Canyon site (Terra Verde 2020-TN10098).

Southwestern pond turtles (*Actinemys pallida*), California newts (*Taricha torosa*), and two-striped garter snakes (*Thamnophis hammondii*) may use wetland and riparian habitats on the Diablo Canyon site. None were found during 2020 surveys (Terra Verde 2020-TN10098).

The Northern California legless lizard (*Anniella pulchra*), Blainville's horned lizard (*Phrynosoma blainvillii*), and obscure bumble bee (*Bombus caliginosus*) use scrub, chapparal, or woodland habitats. None were found during 2020 surveys (Terra Verde 2020-TN10098).

3.6.3.3 Species Protected under the Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (TN1447) extends regulatory protections to the bald eagle and golden eagle. The Act prohibits anyone without a permit from the Secretary of the Interior from taking bald eagles or golden eagles, including their parts, nests, or eggs.

Although bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are known to occur within San Luis Obsipo County (PG&E 2023-TN9822: Table 3.7-4), the FWS does not expect either species to nest within the Diablo Canyon site (FWS 2024-TN10254). PG&E reports no occurrences of bald eagles on the Diablo Canyon site (PG&E 2023-TN9822: 3.7.8.2) but notes that golden eagles have been observed near the Diablo Canyon site at North Ranch (PG&E 2023-TN9822: Section 3.7.8.4). The terrestrial biological resources assessment (Terra Verde 2020-TN10098) also states that golden eagles have been noted to nest north of the Diablo Canyon site. Golden eagles have a State status of Fully Protected and Watch List (CNDDB 2024-TN10102). Fully protected species may not be taken or possessed unless authorized by the California Department of Fish and Wildlife under specific circumstances. Watch list species are those species that were previously defined as Species of Special Concern but do not currently meet that criteria and for which there is a need for additional information to clarify status. No eagle mortalities have been reported on the Diablo Canyon site (PG&E 2024-TN10032: Attachment 18).

3.6.3.4 Species Protected under the Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale any migratory bird or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued under Federal regulations.

Of the 487 bird species known to occur in San Luis Obispo County (eBird 2024-TN10103), 463 are protected by the MBTA. The known range of several federally listed migratory birds overlaps the Diablo Canyon site (Section 3.8 of this SEIS). Of the species known from San Luis Obispo County, 52 warrant additional concern in the project vicinity (PG&E 2023-TN9822: Table 3.7-8): eagles, species that interact with eagles, species that are of special concern for certain offshore activities, or are listed as Birds of Conservation Concern (FWS 2021-TN8740). Of these species, 19 are identified as possibly occurring at the Diablo Canyon site by the FWS (FWS 2024-TN10254): black oystercatcher (*Haematopus bachmani*), black turnstone (*Arenaria melanocephala*), Brandt's cormorant (*Urile pencillatus*), brown pelican (*Pelecanus occidentalis*), California gull (*Larus californicus*), California thrasher (*Toxostoma redivivum*), common murre (*Uria aalge*), common yellowthroat (*Geothylpis trichas sinuosa*), double-crested cormorant (*Phalacrocorax auritus*), elegant tern (*Thalasseus elegans*), Heerman's gull (*Larus heermani*), marbled godwit (*Limosa fedoa*), Nutall's woodpecker (*Dryobates nutallii*), oak titmouse (*Baeolophus inornatus*), Santa Barbara song sparrow (*Melospiza melodia graminea*), surf scoter (*Melanitta perspicillata*), western gull (*Larus occidentalis*), willet (*Tringa semipalmata*), and wrentit (*Chamaea fasciata*).

The bluffs and offshore rocks at the Diablo Canyon site provide nesting and roosting habitats for a variety of migratory birds (PG&E 2023-TN9822: Section 3.7.2.5): brown pelican, pelagic cormorants (*Phalacrocorax pelagicus*), Brandt's cormorants, black oystercatchers, western gulls (*Larus occidentalis*), cliff swallows (*Petrochelidon pyrrhonota*), and peregrine falcons (*Falco peregrinus*). A large colony of Brandt's cormorants roost and nest on an offshore rock adjacent to the eastern breakwater.

The terrestrial biological resource assessment (Terra Verde 2020-TN10098: Appendix 1) noted that the following migratory birds tracked by the California Department of Fish and Wildlife (CDFW) (CNDDB 2024-TN10102) also have habitat within the Diablo Canyon site: Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), western burrowing owl (*Athene cunicularia*), white-tailed kite (*Elanus leucurus*), California horned lark (*Eremophila alpestris actia*), peregrine falcon, and loggerhead shrike (*Lanius ludovicianus)*.

Bird injuries and mortalities onsite (PG&E 2024-TN10032: Attachment 18) are at levels determined to be SMALL in the LR GEIS.

3.6.3.5 Invasive Species

Invasive species are identified as nonnative organisms whose introduction causes or is likely to cause economic or environmental harm or harm to human, animal, or plant health (Executive Order [EO] 13751, 81 FR 88609-TN8375). EO 13112 (64 FR 6183-TN4477) directs Federal agencies to not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species unless the Federal agency determines that the benefits of the action clearly outweigh the harm from invasive species and that all feasible and prudent measures to minimize risk of harm are taken (64 FR 6183-TN4477: Section 2).

In its ER (PG&E 2023-TN9822: Section 3.7.5), PG&E stated that the following terrestrial invasive species are known to occur within San Luis Obispo County but are not known to occur on the Diablo Canyon site:

- mammals: nutria (*Myocastor coypus*)
- birds: mute swan (*Cygnus olor*), brown-headed cowbird (*Molothrus ater*)
- reptiles: southern water snake (*Nerodia fasciata*), northern water snake (*Nerodia sipedon*), red-eared slider (*Trachemys scripta elegans*)
- amphibians: common coqui (*Eleutherodactylus coqui*), American bullfrog (*Lithobates catesbeianus*), and African clawed frog (*Xenopus laevis*)
- invertebrates: polyphagus and Kuroshio shot hole borers (*Euwallacea* spp.)

In 2016 and 2017, invasive plant surveys occurred on portions of PG&E-owned land in and around the Diablo Canyon site (PG&E 2023-TN9822: Section 3.7.5). Most of the invasive plant occurrences were in disturbed habitats. Table 3.7-6 of the ER (PG&E 2023-TN9822) lists the 34 invasive plants known to occur on the Diablo Canyon site. All but Eurasian milfoil (*Myriophyllum spicatum*) are terrestrial species.

The terrestrial biological resource assessment (Terra Verde 2020-TN10098) noted that most of the grasslands were dominated by nonnative grasses and forbs: thistles (*Carduus pycnocephalus*, *Silbum marianum*, and *Salsola tragus*), crown daisy (*Glebionis coronaria*), black mustard (*Brassica nigra*), and charlock (*Sinapsis arvensis*).

In its ER (PG&E 2023-TN9822: Section 3.7.5), PG&E stated that monitoring of invasive plants occurs during periodic site visits and that treatment of invasive plant species occurs on the Diablo Canyon site as needed, depending on field conditions, bloom status, and rate of spread. PG&E relies on administrative controls, including BMPs, to minimize impacts and has BMPs for herbicide-related activities at Diablo Canyon (PG&E 2023-TN9822: Section 4.6.5).

3.6.3.6 Important Habitats

Important habitats include any wildlife sanctuaries, refuges, preserves, or habitats identified by State or Federal agencies as unique, rare, or of priority for protection; wetlands and floodplains; and land areas identified as critical habitat for species listed by the FWS as threatened or endangered. No critical habitat for federally protected species occurs in and around the Diablo Canyon site. See Section 3.8 of this SEIS for further details.

Important habitats on and around the Diablo Canyon site include the Pacific Ocean, estuarine and freshwater wetlands (discussed above in Sections 3.6.1 and 3.6.2), Point Buchon State Marine Reserve/State Marine Conservation Area, Montaña de Oro State Park, and the proposed Chumash Heritage National Marine Sanctuary (PG&E 2023-TN9822: Section 3.7.4). The proposed national marine sanctuary is further discussed in Section 3.8.3 of this SEIS.

Because the Diablo Canyon site is within the coastal zone, all or parts of some terrestrial habitats (Section 3.6.2 of this SEIS) meet the definition of Environmentally Sensitive Habitat Areas or sensitive natural communities (Terra Verde 2020-TN10098, Table 4.3.1-1): needle grass—melic grass grassland, hardstem and California bulrush marshes, coastal bluff scrub, California sagebrush scrub, and artesian springs/freshwater wetlands.

3.6.4 Proposed Action

Table 3-1 and Table 3-2 in this SEIS list the generic (Category 1) and site-specific (Category 2) issues that apply to terrestrial resources at the Diablo Canyon site during the proposed LR period. The NRC staff did not identify any new and significant information associated with the Category 1 terrestrial resource issues listed in Table 3-1 during the review of the applicant's ER and available scientific literature, the site audit, and the Federal and State agency and public comments received during the scoping process. As a result, no information or impacts related to these issues were identified that would change the conclusions presented in the LR GEIS (NRC 2024-TN10161). For these generic (Category 1) issues, the LR GEIS concludes that the impacts are SMALL. The NRC staff analyzed the applicable Category 2 (site-specific) issues for Diablo Canyon LR and assigned a significance level for each issue as shown in Table 3-2. Table 3-2 identifies only one site-specific (Category 2) issue related to terrestrial resources during the Diablo Canyon LR term: effects on terrestrial resources from non-cooling system impacts. This issue is analyzed below. Diablo Canyon does not draw makeup water from a river; therefore, the site-specific (Category 2) issue related to water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river) does not apply.

3.6.4.1 Non-cooling System Impacts on Terrestrial Resources

According to the LR GEIS, non-cooling system impacts on terrestrial resources can include impacts that result from site and landscape maintenance activities, stormwater management, elevated noise levels, and other ongoing operations and maintenance activities that would occur during the LR period on and near a nuclear power plant site. The NRC staff based its analysis in this section on information derived from PG&E's ER (PG&E 2023-TN9822), unless otherwise cited. PG&E has not identified any refurbishment activities during the proposed LR term (PG&E 2023-TN9822). Therefore, no further analysis of potential impacts from refurbishment activities is necessary.

In its ER, PG&E (PG&E 2023-TN9822) states that it would conduct ongoing operational and maintenance activities at Diablo Canyon throughout the LR term, including landscape maintenance activities, stormwater management, piping installation, and fencing. The NRC staff expects that physical disturbance would be limited to paved or disturbed areas or to areas of mowed grass or early successional vegetation and would not encroach into wetlands or into the remaining areas of mixed forest. The NRC staff concurs with PG&E that the anticipated activities would have only minimal effects on terrestrial resources.

PG&E (PG&E 2023-TN9822) states that it has administrative controls in place at Diablo Canyon to ensure that it reviews operational changes or construction activities and minimizes environmental impacts through BMPs, permit modifications, or new permits, as needed. PG&E has BMPs for herbicide-related activities on the Diablo Canyon site, and PG&E (PG&E 2023-TN9822) further states that regulatory programs for issues like stormwater management, spill prevention, dredging, and herbicides further minimize impacts on terrestrial resources. The NRC staff concurs that continued adherence to environmental management practices and BMPs already established for Diablo Canyon would continue to protect terrestrial resources during the LR period.

The NRC staff presumes that PG&E would continue to comply with the applicable requirements of Federal and State regulatory programs. PG&E has procedures and policies relating to the handling and management of migratory birds (PG&E 2023-TN9822: Sections 3.7.8.5, 4.6.6.4.4). PG&E's nesting bird management plan has procedures to avoid and minimize disturbance with nesting birds. PG&E holds a company-wide Federal Migratory Bird Special Purpose Utility (SPUT) permit that authorizes the collection, transportation, and temporary possession of migratory birds found dead on utility property, structures, and ROWs. The SPUT also authorizes the relocation or destruction of active nests in emergency circumstance. Although PG&E's SPUT expired on March 31, 2021, the FWS has not yet processed a new permit. While it waits for the new SPUT, PG&E continues to operate under the terms of the previous SPUT and company procedures relating to migratory bird management (PG&E 2024-TN10032: p. 25).

Operational noise from Diablo Canyon facilities extends into the remaining natural areas on the site. However, Diablo Canyon has exposed these habitats to similar operational noise levels since its construction began approximately 55 years ago. Therefore, the NRC staff expects that wildlife in the affected habitats has long ago acclimated to the noise and human activity of Diablo Canyon operations and adjusted behavior patterns accordingly. Extending the same level of operational noise levels during the 20-year LR period is unlikely to noticeably change the patterns of wildlife movement and habitat use.

Based on its independent review, the NRC staff concludes that the landscape maintenance activities, stormwater management, elevated noise levels, and other ongoing operations and maintenance activities that PG&E might undertake during the LR term would primarily be confined to already disturbed areas of the Diablo Canyon site. These activities would neither have noticeable effects on terrestrial resources nor would they destabilize any important attribute of the terrestrial resources on or in the vicinity of the site. Accordingly, the NRC staff concludes that non-cooling system impacts on terrestrial resources during the proposed LR term would be SMALL.

3.6.5 No-Action Alternative

Under the no-action alternative, the NRC would not issue renewed licenses, and Diablo Canyon would shut down on or before the expiration of the current facility operating licenses. Much of the operational noise and human activity at Diablo Canyon would cease, thereby reducing disturbance to wildlife in forest cover, grasslands, wetlands, and other natural vegetation on and near the site. However, some continued maintenance of Diablo Canyon would still be necessary; thus, at least some human activity, noise, and herbicide application would continue at the site with possible impacts resembling, but perhaps of a lower magnitude than, those described for the proposed action. PG&E would conduct needed important species surveys and implement plans to identify sensitive locations, address habitat restoration, limit erosion, control contaminants, and minimize dust (SLOC 2023-TN10105; Section 4.3). Shutdown itself is unlikely to noticeably alter terrestrial resources. Reduced human activity and frequency of operational noise may constitute minor beneficial effects on wildlife inhabiting nearby natural habitats. Therefore, the NRC staff concludes that the impacts of the no-action alternative on terrestrial resources during the proposed LR term would be SMALL.

3.6.6 Replacement Power Alternatives: Common Impacts

The analysis of impacts on terrestrial resources focuses on the amount of land area that would be affected by the construction and operation of a power-generating facility or facilities, as well as the species that use terrestrial habitats. The NRC staff assumes that the power source originates within California. Because California’s 100 Percent Clean Energy Act of 2018 requires that all energy generation must be renewable and zero-carbon after 2045 (State of California 2018-TN9855), the NRC staff assumes that all power from these facilities would be renewable and zero-carbon after 2045.

Construction would require the permanent commitment of land chosen for industrial use at the site(s) and supporting infrastructure. Material laydown areas and onsite concrete batch plants could also result in temporary land use changes. Existing transmission lines and infrastructure would support each of the power-generating facilities, thus reducing the need for additional land commitments.

Operation of new power-generating facilities would have impacts associated with the amount of land committed for the permanent use of the facilities, as well as the effects on the terrestrial resources from emissions, wastes, and noise (NRC 2024-TN10161). Terrestrial biota can interact with plant buildings, structures, powerlines, and vehicles (NRC 2024-TN10161).

The NRC staff assumes that the applicant would conduct required ecological surveys and develop any needed mitigation plans for any protected terrestrial species. The applicant would also have to conduct wetland delineations of affected lands and apply for permits for any wetland fill from the USACE and the State of California. The NRC staff expects that any Federal or State permits authorizing wetland impacts would require mitigation. Wetland losses of this magnitude can typically be mitigated through various forms of compensatory wetland mitigation, such as mitigation banks. The MBTA makes it illegal to take any migratory bird (or parts, nests, or eggs), except under a valid permit issued under Federal regulations. The applicant may need to commission avian impact studies and obtain a permit for the take of MBTA-protected bird species.

3.6.7 Purchased Power Alternative

The purchased power alternative could have wide-ranging environmental effects that are difficult to assess because this alternative could include a mix of nuclear, coal, natural gas-fired (until 2045), solar, and wind energy generation across many different sites. The types of operational impacts would likely be similar to the environmental effects discussed as common impacts in Section 3.6.6 of this SEIS. This alternative could prolong or in some cases intensify environmental effects on terrestrial resources from continued operation of existing generating facilities, such as facilities remaining in operation longer than previously planned or if purchased power relies on older and less-efficient power plants, operating at higher levels of power generation than current operations. However, these facilities would likely have BMPs and other procedures in place to ensure that any operational effects to the environment are minimized. Based on this information, terrestrial resource impacts from the purchased power alternative would be SMALL.

3.6.8 Renewables Combination Alternative

The renewables combination alternative combines renewable energy sources (solar, wind, and geothermal) to replace the generating power of Diablo Canyon. This alternative would involve the construction and operation of a 200 MW geothermal plant, 29 solar panel installations (totaling 3,540 MW of installed capacity, with battery storage), and eight wind installations (totaling 2,005 MW of installed capacity, with battery storage). All facilities and transmission lines associated with this alternative would be in the State of California. The power generation facilities would require a total of about 192,250 ac (77,800 ha).

<u>Geothermal Component</u>

About 250 ac (100 ha) of land would be required to construct and operate a geothermal power plant. The impacts on terrestrial habitats and biota from the construction and operation of the geothermal power plant would depend largely on the amount of land required and its location. If the land chosen for the plant was previously cleared and used for industrial activity, the impacts on terrestrial resources would be less significant than if the land was forest, grasslands, wetlands, or desert containing important species and habitats. Vegetation clearing and tree removal would displace wildlife to nearby habitats, but some species would return at the end of construction when temporarily disturbed land is restored. Geothermal power plants would use mechanical draft cooling towers, and the NRC staff expects operational impacts from cooling towers on terrestrial resources for geothermal energy production to be similar to operational impacts from nuclear energy production. The 2024 LR GEIS (NRC 2024-TN10161: pg. 2-8) categorizes these operational impacts as SMALL for cooling system impacts on terrestrial resources, cooling tower impacts on terrestrial plants, and bird collisions with plant structures and SMALL to MODERATE for cooling towers using makeup water from a river. Based on this information, the NRC staff concludes that the impacts on terrestrial resources from the geothermal component of the renewables combination alternative would be SMALL to MODERATE.

Solar Component

Solar installations generating 3,540 MW of installed capacity would require an estimated 4 ac/MW in California (PG&E 2014-TN9843). As a result, the total area required for power generation would be approximately 14,500 ac (5,868 ha), which includes a small amount of additional land that would be needed to support the battery storage system at each installation.

The impacts on terrestrial habitats and biota from the construction and operation of solar photovoltaic (PV) plants would depend largely on the amount of land required and its location. The NRC staff assumes that one of the solar PV plants would be located on the Diablo Canyon site and that the others would be located offsite. If the lands chosen for the offsite plants were previously cleared and used for industrial activity, the impacts on terrestrial resources would be less significant than if the lands were forest, grasslands, wetlands, or desert containing important species and habitats. Vegetation clearing and tree removal would displace wildlife to nearby habitats, but some species would return at the end of construction when temporarily disturbed land is restored. Once in operation, solar PV plants pose special hazards to birds through collisions with PV equipment and transmission lines, electrocution by substation and distribution lines, and predation by other animals when birds are injured and stunned on the ground after collision (Hathcock 2019-TN8470). Another less understood cause of bird collisions is known as the lake effect theory. Birds, especially migrating waterfowl and shorebirds, perceive the horizontally polarized light of PV panels as bodies of water and are injured or killed when they attempt to land on the panels as if they were water (Horvath et al. 2009-TN897). Water-seeking insects can also collide with the panels for the same reasons. In large enough numbers, such insect deaths may affect food webs. The Multiagency Avian-Solar Collaborative Working Group is a collection of Federal and State agencies identifying information needs and best practices for reducing the avian impacts of solar energy. Collaboration with government agencies on best practices in the construction and siting of the solar facilities could mitigate their impacts on birds.

Based on this information, the NRC staff concludes that the impacts on terrestrial resources from the solar component of the renewables combination alternative would be MODERATE to LARGE because of the land requirement for solar PV plants and transmission corridors, resulting in significant losses of wildlife, habitats, and vegetation and because of the increased mortality risk to birds from collisions with solar panels and new transmission lines.

Wind Component

The wind component of the renewables combination alternative would require the following acreage: approximately 171,000 ac (69,200 ha) for wind farms, approximately 5,000 ac (2,023 ha) for construction, and approximately 1,500 ac (607 ha) for housing wind turbines with a small amount of additional land for battery storage. These areas are based on the DOE estimates of land use for wind power projects of 85 ac/MW for wind farms, 2.47 ac/MW for construction footprint, and 0.74 ac/MW for permanent structures (DOE 2015-TN8757).

The impacts on terrestrial habitats and biota from the construction and operation of wind farms as part of the renewables combination alternative would depend largely on the amount of land required, the location of the land, and whether the facility is onshore or offshore. If the lands chosen for the plants were previously cleared and used for industrial activity, the impacts on terrestrial resources would be less significant than if the lands were forest, grasslands, wetlands, or desert containing important species and habitats. Vegetation clearing and tree removal would displace wildlife to nearby habitats, though some species would return at the end of construction when temporarily disturbed land is restored.

The operation of wind farms would likely cause the injury and/or death of bats and birds that collide with wind turbines (Allison et al. 2019-TN8847). Species composition of deaths would vary regionally. Bat collision mortality appears to be largest for migratory tree-roosting species and lowest in areas with the greatest grassland cover around the wind farm (Thompson et al. 2017-TN8746). Most of the observed bird deaths at onshore wind farms are small songbirds (57 percent of deaths) or diurnal raptors (9 percent). Based on this information, the NRC staff concludes that the impacts on terrestrial resources from the wind component of the renewables combination alternative would be MODERATE to LARGE because construction would result in significant loss of vegetation and wildlife habitat and operation would negatively impact bird and bat populations.

Renewables Combination Alternative Conclusion

Based on the above analysis, the NRC staff concludes that the overall impacts on terrestrial resources from the renewables combination alternative would range from MODERATE to LARGE, mainly because of the large area of land and the types of land that could be used for the solar and wind components of the alternative and the operational impacts of these components on birds and bats.

3.7 Aquatic Resources

This section of the SEIS describes aquatic resources at and around the Diablo Canyon site. These include the marine environments of the Pacific Ocean, Diablo Cove, and Intake Cove and the inland freshwater aquatic features of four creeks (Coons Creek, Diablo Creek, Irish Canyon Creek, and Pecho Creek) and Tom’s Pond. Several intermittent and ephemeral channels and artesian springs also occur on the site. The NRC staff analysis related to potential environmental impacts on aquatic resources from the proposed action (i.e., LR) and alternatives to the proposed action follows this description.

3.7.1 Pacific Ocean

Diablo Canyon lies in central California in the eastern Pacific Ocean coastal region, an area influenced by the California Current, which is a cold-water Pacific Ocean current that moves southward along the western coast of North America, beginning off southern British Columbia and ending off southern Baja California. The cold ocean water is highly productive due to the upwelling caused by the prevailing northwesterly winds, which bring nutrient-rich waters to the surface. This pattern allows for high levels of phytoplankton production that support diverse marine life, including large population of whales, seabirds, and important fisheries.

The approximately 10 mi (16 km) stretch of shoreline between Point Buchon (north of Diablo Canyon) and Point San Luis (south of Diablo Canyon) consists of wave-exposed rocky headlands along with semi-protected coves. One of these coves is Diablo Cove, where the Diablo Canyon discharge structure is located, and immediately downcoast of Diablo Cove are breakwaters that form Intake Cove where the cooling water intake structure is located.

The nearshore marine environment is naturally divided into two broad marine benthic habitat areas or zones. The intertidal zone encompasses the area between highest and lowest tides and is subject to varying degrees of tidal submergence. It supports a wide variety of organisms that have adapted to surviving in this challenging, ever-changing environment. Maximum tidal range for the intertidal areas is approximately 9 ft (2.7 m) and extends from 7 ft (2.1 m) above MLLW to about 2 ft (0.6 m) below MLLW (PG&E 2023-TN9822). The subtidal zone is continually submerged and can encompass the area from the lowest tide zone all the way to the deepest depths of the ocean basins. According to a 2008 thermal study, the subtidal zone in this region reaches a maximum depth of approximately 60 ft (18 m) below MLLW (PG&E 2008-TN10104). Within each of these broad zones, more specific habitat types can be delineated based on elevation or water depth, substrate type, or dominant biological community. Table 3-10 summarizes the major habitats in each of these zones.

Table 3-10 Intertidal and Subtidal Habitats Near the Diablo Canyon Nuclear Power Plant Site

Zone	Habitat	Description
Intertidal	Rocky (semi-protected)	Bedrock and semi-stable boulder substrate; relatively protected from the direct force of ocean swells; and generally of low aspect. Organisms can occur both above and beneath moveable substrate.
Intertidal	Rocky (wave-exposed)	Stable, rocky headland with occasional very large boulders; exposed to the direct force of ocean swell; and generally of high aspect. Algae and invertebrates colonize higher elevations due to constant wave splash.
Intertidal	Tidepool	Entrapped pools of water that form in bedrock depressions during low tide. Tidepool species are typically those mainly found in upper subtidal zones.
Intertidal	Sand/cobble	Beach habitat formed by sand and shell debris or small cobble. Highly unstable during periods of high swell, often covering and uncovering bedrock substrate.
Subtidal	Bedrock/ boulder	Stable bedrock or boulder substrate ranging from shallow wave-exposed depths (0 to 20 ft) to deeper, less wave affected depths below 20 ft. Bathymetric relief ranges from low boulder/flat bedrock to high relief pinnacle.
Subtidal	Sand/shell debris	Sand and shell debris in small patches between rocks or forming extensive deposits. Can be highly unstable during periods of high swell, often covering and uncovering bedrock substrate.
Subtidal	Open water	Midwater zone from benthic substrate to sea surface.

ft = foot/feet; m= meter(s).
Source: PG&E 2023-TN9822.

3.7.1.1 Intake Cove and Diablo Cove

Intake Cove is an artificial embayment that consists of sand and soft sediments (8.1 ac [3.3 ha]) and boulder fields, low rock ridges, and emergent rocks (6.2 ac [2.5 ha]). Large areas of the seafloor in the eastern portion of the cove consist of soft, unconsolidated sediments, and the seabed between the Intake Cove entrance and the intake structure consists largely of sand. The shoreline within the cove consists of a granite boulder riprap-armored and graded road, a vertical concrete curtain wall forming the ocean-side of the intake structure, and sections of natural rock upcoast of the cooling water intake structure. The depth of Intake Cove ranges from 16 ft (4.9 m) below MLLW in the eastern portion of the cove to 33 ft (10 m) below MLLW adjacent to the intake structure (SLOC 2023-TN10105).

Diablo Cove consists of sandy subtidal habitat in the southern portion of the cove. Diablo Rock stands as a prominent feature in the cove, centered at the mouth of the cove, and other submerged and emergent offshore rocky pinnacles are scattered throughout the cove. Diablo Creek enters the cove just north of the discharge structure and provides the area with periodic and seasonal freshwater flow. Offshore of the cove, the seabed slopes across the continental shelf for approximately 50 mi (80 km) to a depth of over 3,000 ft (914 m). Diablo Cove has a surface area of approximately 42 ac (17 ha) and an average depth of approximately 26 ft (7.9 m) below MLLW with a maximum depth of approximately 60 ft (18 m) below MLLW. The intertidal and subtidal areas of the cove consist predominantly of bedrock, boulder, and cobble fields totaling approximately 41 ac (16.5 ha) representing 98.3 percent of the cove (SLOC 2023-TN10105).

Both Intake Cove and Diablo Cove include intertidal and subtidal zones, as summarized in Table 3-10.

3.7.1.2 Intertidal Algae and Aquatic Plants

PG&E (2023-TN9822) reports a total of 179 algal taxa from the intertidal zone in the vicinity of Diablo Canyon, 59 of which are unique to the intertidal zone. Most intertidal algal species are restricted to specific elevation ranges and occur in bands along the shoreline. The upper vertical distribution for most species is largely determined by their ability to withstand desiccation, but shading, competition for space, and grazing are important factors as well. The high intertidal zone is only occasionally wetted by wave splash and is sparsely covered by algae such as the red alga *Bangia* species, and the green alga *Enteromorpha* species. The barren appearance of the splash zone disappears lower in the intertidal zone (4 ft [1.2 m] above MLLW) as algal cover becomes more conspicuous with scattered clumps of rockweeds (*Fucus* and *Silvetia* species) and the turfy red alga *Endocladia muricata*. A dominant species in the mid to low intertidal zone is the iridescent red alga *Mazzaella flaccida*. Other algal taxa that are regularly observed include diatoms (class Chrysophyceae), filamentous red and brown algae, and various red algal taxa such as soft non-coralline crustose red algae, dead man's fingers (*Codium fragile*), graceful coral seaweed (*Corallina vancouveriensis*), juvenile articulated coralline algae, hollow branch seaweed (*Gastroclonium subarticulatum*), grapestone seaweed (*Mastocarpus papillatus*), and Christmas tree seaweed (*Chondracanthus canaliculatus*). The green algal taxa *Ulva* species is also common. Surfgrass (*Phyllospadix* species), a flowering plant, is the dominant plant in the transition zone between the low intertidal and the shallow subtidal zones (PG&E 2023-TN9822).

3.7.1.3 Subtidal Algae and Aquatic Plants

PG&E (2023-TN9822) reports a total of 169 algal taxa from the subtidal zone in the vicinity of Diablo Canyon, 49 of which are unique to the subtidal zone. The subtidal algal assemblage is spatially dominated by various species of kelp. Bull kelp (*Nereocystis luetkeana*) is a common surface canopy-forming kelp along the region's coast. Giant kelp (*Macrocystis pyrifera*) occurs with bull kelp in semi-exposed areas but tends to be more abundant in calmer water. A third surface canopy-forming kelp species, *Cystoseira osmundacea*, also occurs with these two kelps, generally in areas shallower than 30 ft (9.1 m). The canopies of all three species develop in the spring and become thickest during summer through fall. Smaller tree kelps (*Pterygophora californica* and *Laminaria setchellii*) do not reach the surface but are perennial species that provide subcanopy structure less than 3 ft (0.9 m) off the bottom (PG&E 2023-TN9822).

Below the kelp canopies are the lower-growing foliose, branched, filamentous, and crustose understory species, consisting mainly of red and brown algae. Among the red algae, the most abundant is the red algal coralline crust, followed by the articulated coralline red algae (*Cilliarthron* and *Bossiella* species). Other common understory algae include foliose and branching red algae (*Cryptopleura* species, *Pikea* species, *Farlowia* species, *Callophyllis* species, *Mastocarpus* species, and *Rhodymenia* species) as well as brown algae, including *Dictyoneurum californicum* and *Desmarestia* species. (PG&E 2023-TN9822).

3.7.1.4 Intertidal Invertebrates

Marine surveys have documented a total of 421 invertebrate taxa within the intertidal zone in the vicinity of Diablo Canyon. The diversity of invertebrate species increases with decreasing elevation. In the splash zone, periwinkle snails (*Littorina* species) are found in rock crevices, while the black turban snail (*Chlorostoma funebralis*) and lined shore crab (*Pachygrapsus crassipes*) occur in the shade of boulders. Occasionally, a high intertidal tidepool will contain species more commonly found in lower elevation habitats. The barren appearance of the splash zone disappears lower in the intertidal as algal cover becomes more conspicuous. This truly intertidal area (the highest regularly submerged area) is inhabited by numerous species of limpets (*Lottia* species), the acorn barnacle (*Chthamalus fissus*), patches of aggregating sea anemone *(Anthopleura elegantissima)*, and occasional patches of California mussels *(Mytilus californianus*). At lower intertidal levels, beneath the foliose blades of the algae, abundant organisms include hermit crabs (*Pagurus* species), turban snails (*Chlorostoma* species), tube-forming polychaete worms (*Phragmatopoma californica* and *Pista* species), and encrusting forms of various bryozoans, sponges, and tunicates. Common invertebrate predators in the intertidal zone include sea stars (*Pisaster ochraceus* and *Leptasterias* species), snails (*Acanthinucella* species, *Aptyxis luteopictus*, and *Ocenebrina* species), rock crabs (Family Cancridae), and octopus (*Octopus* species). Intertidal invertebrate herbivores include purple sea urchins (*Strongylocentrotus purpuratus*) and kelp crabs (*Pugettia* species) (PG&E 2023-TN9822).

3.7.1.5 Subtidal Invertebrates

During a 2008 thermal study (PG&E 2008-TN10104), researchers documented a total of 407 invertebrate taxa within the subtidal zone (shallower than 55 ft [16.7 m]) in the vicinity of Diablo Canyon. The distribution and abundance of these organisms are controlled by various biotic and abiotic factors, which cause their populations to fluctuate over time. Invertebrate herbivores include red urchins (*Strongylocentrotus franciscanus*), purple urchins (*S. purpuratus*), brown turban snails (*Chlorostoma brunnea*), Monterey turban snails (*C. montereyi*), top snails (*Pomaulax gibberosa* and *P. undosa*), red abalone (*Haliotis rufescens*), giant gumboot chitons (*Cryptochiton stelleri*), and many smaller species of invertebrates. Invertebrate predators include sunflower sea stars (*Pycnopodia helianthoides*), giant spined sea stars (*Pisaster giganteus*), short-spined sea stars (*Pisaster brevispinus*), rock crab (*Cancer antennarius*), Kellet's whelk (*Kelletia kelletii*), octopus, and a variety of smaller predatory sea stars, gastropods, and crustaceans. The common deposit feeders, scavengers, and filter feeders include bat stars (*Patiria miniata*), anemones (*Anthopleura xanthogrammica*, *A. sola*, and *Epiactis prolifera*), cup corals (*Balanophyllia elegans*), sponges (*Tethya californiana* and other encrusting forms), tunicates (*Styela montereyensis* and the encrusting colonial/social tunicates), tube snails (*Serpulorbis squamigerus*) and brittle stars (*Ophiothrix spiculata*). Invertebrate grazers include the nudibranchs *Phidiana hiltoni* and *Doriopsilla albopunctata* (PG&E 2023-TN9822).

Black abalone (*Haliotis cracherodii*), which are federally endangered, occur in Diablo Cove. Section 3.8 of this SEIS discusses this species and other federally protected ecological resources in the vicinity of Diablo Canyon in detail.

Notably, abalone of various species are culturally important to the *yak tit^yu tit^yu tiłhini* (*ytt*) people. Abalone is a traditional food source, and shells continue to be used by *ytt*'s members in many ways, including beads, pendants, buttons and ornaments for necklaces, earrings, hair pieces, bags, baskets, boats, tools, furniture, game pieces, and more. Abalone have also long been found and are still used in association with burials, prayer, and ceremony (SMWLLP 2024-TN11886). Section 3.9.1 of this SEIS provides more information about the cultural significance of the Diablo Canyon lands to the *ytt*.

3.7.1.6 Intertidal Fish Communities

Marine surveys have documented a total of 43 taxa of fish in the intertidal zone in the vicinity of Diablo Canyon, including 21 taxa that are only found in the intertidal zone and 22 that occur in both the intertidal and shallow subtidal zones. The assemblage is like that described from other central California rocky coast intertidal habitats. Several intertidal fishes are commonly associated with various algal species, which they either use directly as a food source or glean other foods from their surfaces (PG&E 2023-TN9822).

Common fishes found in the intertidal zone are black and rock pricklebacks (*Xiphister atropurpureus* and *X. mucosus*), high cockscomb (*Anoplarchus purpurescens*), sculpins (*Artedius* and *Oligocottus* species), clingfish (*Gobiesox maeandricus*), juvenile monkeyface eel (*Cebidichthys violaceus*), rockweed gunnel (*Apodichthys fucorum*), and penpoint gunnel (*Apodichthys flavidus*). Over 90 percent of the individual fish in the intertidal zone of the project area are small, eel-like fishes of the family Stichaeidae (pricklebacks) and Pholidae (gunnels) (PG&E 2023-TN9822).

3.7.1.7 Subtidal Fish Communities

Marine surveys have documented a total of 102 species of fish in nearshore areas (less than depths of 45 ft [14 m]) in the vicinity of Diablo Canyon. The most common adults and juveniles belong to the following families of fishes: rockfishes (Scorpaenidae), surfperches (Embiotocidae), sculpins (Cottidae), wrasses (Labridae), and greenlings (Hexagrammidae). Other schooling fish that can be very common at certain times of the year include northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), jack mackerel (*Trachurus symmetricus*), and tubesnout (*Aulorhynchus flavidus*) (PG&E 2023-TN9822).

Because of the proximity of Diablo Cove to Point Conception (the northern boundary of the southern California bight), fishes with more southern affinities are occasionally found in the area, especially during warm-water years. Sheephead (*Semicossyphus pulcher*), kelp bass (*Paralabrax clathratus*), white seabass (*Atractoscion nobilis*), giant kelpfish (*Heterostichus rostratus*), and garibaldi (*Hypsypops rubicundus*) are among the fishes that can either migrate as adults or be transported from south to north as larvae. Although migratory, these fishes can also establish small reproductive populations within vicinity of the site (PG&E 2023-TN9822).

3.7.1.8 Marine Mammals

At least 21 species of cetaceans (whales, dolphins, and porpoises) occur in central California, but few are common to waters near Diablo Canyon. PG&E (2023-TN9822) reports the species that have been observed in the vicinity of the site to be: gray whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), Pacific white-sided dolphin (*Lagenorhynchus obliquiden*s), Risso's dolphin (*Grampus griseus*), and common bottlenose dolphin (*Tursiops truncatus*).

California sea lion (*Zalophus californianus*), harbor seal (*Phoca vitulina*), northern elephant seal (*Mirounga angustirostris*) and southern sea otter (*Enhydra lutris*) are considered residential and common at and near the Diablo Canyon site. Seasonally, several hundred sea lions seek resting (haulout) habitat on dry land on Lion Rock, Pup Rock, and Pecho Rock. Diablo Rock and the Intake Cove breakwater are small in comparison to these rocks and typically provide marginal haulout habitat for sea lions. Local sea lion populations reach their peak in the fall as the breeding populations disperse from the Channel Islands in the Southern California Bight. Sea lions are wide ranging and may be found along the entire central California coastline. Northern (Steller) sea lions (*Eumetopias jubatus*) and northern elephant seals (*Mirounga angostrirostris*) also occur near the Diablo Canyon site but are rare (PG&E 2023-TN9822).

Section 3.8 of this SEIS discusses federally protected marine mammals in the vicinity of Diablo Canyon in more detail.

3.7.1.9 Sea Turtles

Four species of sea turtles, green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), and Pacific olive ridley (*Lepidochelys olivacea*), occur near Diablo Canyon. The National Marine Fisheries Service (NMFS) has issued a biological opinion that allows for the incidental entrainment of these species from cooling water withdrawals from the Pacific Ocean (NMFS 2006-TN7502). Section 3.8 of this SEIS discusses these species, as well as other federally protected ecological resources in the vicinity of Diablo Canyon, in detail.

3.7.2 Freshwater Ecology

Freshwater aquatic habitat is present within four primary drainages on the Diablo Canyon site, Coon Creek, Diablo Creek, Irish Canyon Creek, and Pecho Creek; and in one human-made pond, Tom's Pond.

Coon Creek and Diablo Creek lie to the north of the industrial portion of the site. These creeks flow in a westerly direction into the Pacific Ocean. Coon Creek has both perennial and intermittent segments of stream channel. It is located at the northern boundary of the Diablo Canyon site and drains a watershed of 5,500 ac (2,226 ha). Diablo Creek is the next largest primary drainage, with a watershed of 3,190 ac (1,291 ha). Surface flow in Diablo Creek is perennial in the lower reaches and intermittent in the upper reaches during the summer and fall. Diablo Creek passes beneath the 230 kV and 50 kV switchyards in a large culvert before returning to the natural creek approximately 0.3 mi (0.5 km) east of the Pacific Ocean (PG&E 2023-TN9822).

Irish Canyon Creek and Pecho Creek lie to the south of the industrial portion of the site. These creeks flow in a southerly direction into the Pacific Ocean and drain a combined watershed area of less than 4,000 ac (1,619 ha). Both creeks have intermittent surface water flow during the dry season. In the past, two small, human-made irrigation ponds were developed on each stream to support cattle grazing and small-scale agricultural operations. However, since 2005, all crops are dry-irrigated, and the creeks have been restored to their natural flows (PG&E 2023-TN9822).

Tom's Pond lies on the coastal terrace to the north of the industrial portion of the site. The pond was originally a spring-fed seep that was expanded into an approximately 0.25 ac (0.1 ha) pond in the late 1960s for ranching purposes (PG&E 2023-TN9822).

In addition to these features, one intermittent channel, six ephemeral channels, and nine artesian springs are located at the Diablo Canyon site.

3.7.3 Commercially and Recreationally Important Species

Commercial fishing activities near Diablo Canyon fall under California Marine District 118 and includes the Morro Bay statistical area. According to California commercial landings reports for this statistical area, the following species are typically harvested with at least 1,000 lbs (450 kg) in total landings annually: kelp greenling (*Hexagrammos decagrammus*), cabezon (*Scorpaenichthys marmoratus*), grenadier (family Macrourinae), Pacific hagfish (*Eptatretus stoutii*), California halibut (*Paralichthys californicus*), lingcod (*Ophiodon elongatus*), opah (*Lampis* species), rockfish (*Sebastes* species), sablefish (*Anoplopoma fimbria*), chinook salmon (*Oncorhynchus tshawytscha*), white seabass (*Atractoscion nobilis*), shortfin mako shark (*Isurus oxyrinchus*), thresher shark (*Alopias* species), barred surfperch (*Amphistichus argenteus*), swordfish (*Xiphias gladius*), longspine thornyhead (*Sebastolobus altivelis*), thornyhead shortspine (*Sebastolobus alascanus*), and albacore tuna (*Thunnus alalunga*). Crustacean species like Dungeness crab (*Metacarcinus magister*), brown rock crab (*Cancer pagurus*), red rock crab (*Cancer productus*), spider crab (superfamily Majoidea), yellow rock crab (*Metacarcinus anthonyi*), California spiny lobster (*Panulirus interruptus*), ridgeback prawn (*Sicyonia ingentis*), spot prawn (*Pandalus platyceros*), and ocean shrimp (*Pandalus* species) and the mollusk market squid (*Doryteuthis opalescens*) are all harvested at 1,000 lb (450 kg) or more in total annual landings. Of these species, chinook salmon, sable fish, and Dungeness crab have the highest economic value (CDFW 2024-TN10106).

The CDFW monitors recreational fishing through the California Recreational Fisheries Survey program. The primary target species or species groups near Diablo Canyon are chinook salmon, rockfishes, lingcod, cabezon, kelp greenling, California halibut, sanddabs (*Citharichthys sordidus*), and albacore tuna. Anglers from beaches and banks typically target surfperches (family Embiotocidae), jack silverside (*Atherinopsis californiensis*), and several nearshore rockfishes. Anglers from human-made structures target Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), jack silverside, surfperches, white croaker (*Genyonemus lineatus*), and several nearshore rockfishes (PG&E 2023-TN9822).

3.7.4 Aquatic Studies, Monitoring, and Assessments

PG&E or its contractors have conducted many ecological studies at the Diablo Canyon site. These include impingement studies (1985–1986), entrainment studies (1996–1999 and 2008–2009), an alternative cooling technologies assessment (2012 and 2014), Intake Cove bathymetry surveys (2019, 2021, and 2023), and a marine biological resources biological assessment (2020). Additionally, PG&E has several ongoing monitoring efforts, including a thermal effects monitoring program and an RWMP. Appendix G of this SEIS explains these study efforts in detail and summarizes relevant results.

In addition to these ecological studies, multiple technical and regulatory assessments have analyzed the results of PG&E's impingement and entrainment studies, including by the Central Coast Regional Water Quality Control Board, Tenera Environmental Services (Tenera), Aspen Environmental Group, Triangle Economic Research, and California Energy Commission;

independent scientists, including John Steinbeck and coauthors; and advocacy groups, including California Coastkeeper Alliance, San Luis Obispo Mothers for Peace, and Santa Lucia Chapter of the Sierra Club. Appendix G of this SEIS includes relevant references to these assessments.

3.7.5 Proposed Action

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1 of this SEIS, the impacts of all Category 1 (generic) aquatic resources issues would be SMALL. Table 3-2 of this SEIS identifies two Category 2 issues that are applicable to Diablo Canyon and that require site-specific analysis for each proposed LR to determine whether impacts would be SMALL, MODERATE, or LARGE. These issues are (1) impingement mortality and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) and (2) effects of thermal effluents on aquatic organisms (plants with once-through cooling systems or cooling ponds). The sections below analyze these issues in detail.

3.7.5.1 Impingement Mortality and Entrainment of Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

For plants with once-through cooling systems, such as Diablo Canyon, or cooling ponds, the NRC determined in the LR GEIS that the impingement and entrainment of aquatic organisms is a Category 2 issue that requires site-specific evaluation for each proposed LR (NRC 2024-TN10161).

Impingement occurs when organisms are trapped against the outer part of an intake structure's screening device (79 FR 48300-TN4488). The force of the intake water traps the organisms against the screen, and individuals are unable to escape. Impingement can kill organisms immediately or cause exhaustion, suffocation, injury, and other physical stresses that contribute to later mortality. The potential for injury or death is generally related to the amount of time an organism is impinged, its fragility (susceptibility to injury), and the physical characteristics of the screen wash and fish return systems of the intake structure. The EPA has found that impingement mortality is typically less than 100 percent if the cooling water intake system includes fish return or backwash systems (79 FR 48300-TN4488). Because impingeable organisms are typically fish with fully formed scales and skeletal structures and well-developed survival traits, such as behavioral responses to avoid danger, many impinged organisms can survive under proper conditions (79 FR 48300-TN4488).

Entrainment occurs when organisms pass through the screening device and travel through the entire cooling system, including the pumps, condenser or heat exchanger tubes, and discharge pipes (79 FR 48300-TN4488). Organisms susceptible to entrainment are of smaller size, such as ichthyoplankton, larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. During travel through the cooling system, entrained organisms experience physical trauma and stress, pressure changes, excess heat, and exposure to chemicals (Mayhew et al. 2000-TN8458). Because entrainable organisms generally consist of fragile life stages (e.g., eggs, which exhibit poor survival after interacting with a cooling water intake structure, and early larvae, which lack a skeletal structure and swimming ability), the EPA has concluded that, for purposes of assessing the impacts of a cooling water intake system on the aquatic environment, all entrained organisms die (79 FR 48300-TN4488).

Entrainment susceptibility is highly dependent upon life history characteristics. For example, broadcast spawners with non-adhesive, free-floating eggs that drift with water current may become entrained in a cooling water intake system. Nest-building species or species with adhesive, demersal eggs are less likely to be entrained in early life stages. The susceptibility of larval life stages to entrainment depends on body morphometrics and swimming ability.

If several life stages of a species occupy the source water, that species can be susceptible to both impingement and entrainment. For instance, adults and juveniles of a given species of fish may be impinged against the intake screens, while larvae and eggs may pass through the screening device and be entrained through the cooling system. The susceptibility to either impingement or entrainment is related to the size of the individual relative to the size of the mesh on the screening device. By definition, the EPA considers aquatic organisms that can be collected or retained on a sieve with 0.56 in. (1.4 cm) diagonal openings to be susceptible to impingement (79 FR 48300-TN4488). This equates to screen device mesh openings of 0.5 in. by 0.25 in. (1.3 cm by 0.635 cm), which is slightly larger than the openings on the typical ⅜ in. (1.4 cm) square mesh found at many nuclear power plants. Organisms smaller than the mesh openings are considered susceptible to entrainment.

The magnitude of impact that impingement and entrainment create on the aquatic environment depends on plant-specific characteristics of the cooling system as well as characteristics of the local aquatic community. Relevant plant characteristics include location of the cooling water intake structure, intake velocities, withdrawal volumes, screening device technologies, and the presence or absence of a fish return system. Relevant characteristics of the aquatic community include species present in the environment, life history characteristics, population abundances and distributions, special species statuses and designations, and regional management objectives.

Diablo Canyon Cooling Water Intake System

The Diablo Canyon cooling water intake system impinges and entrains aquatic organisms as it withdraws water from the Pacific Ocean. Section 2.1.3 of this SEIS describes the cooling and auxiliary water systems in detail. This section summarizes features of these systems relevant to the impingement and entrainment analysis.

Pacific Ocean water in Intake Cove first interacts with Diablo Canyon's cooling water intake structure at a curtain wall located at the front of the intake structure. As Diablo Canyon withdraws water, fish and other aquatic organisms that cannot swim fast enough to escape the flow of water may be swept into the intake. Approach velocity into the mouth of the structure (between the curtain wall and basement concrete floor) are relatively uniform at approximately 0.8 feet per second (fps) (0.2 m/s) (PG&E 2009-TN10113). Organisms within the source water that cannot resist or escape this flow are drawn into the cooling water intake structure along with the water.

Once drawn into the curtain wall, several barriers prevent large debris from entering the cooling water intake system. First, organisms encounter bar racks with ⅜ in. (1 cm) thick bars that intercept large, submerged debris. Intake velocity at this point is approximately 1.1 fps (0.3 m/s) (PG&E 2009-TN10113). Second, traveling screens intercept material that is larger than the 0.375 in. (0.95 cm) square mesh openings. Organisms that are too large to pass through the fixed screen mesh, such as juvenile and adult fish and shellfish, become impinged on the screens. Intake velocity at the traveling screens varies from 1.8 to 2.3 fps (0.5 to 0.7 m/s) (PG&E 2009-TN10113).

Diablo Canyon's cooling water intake structure does not contain a fish return system, so all impinged organisms are either collected at the trash racks or on the traveling screens and disposed of as solid waste along with other debris (PG&E 2009-TN10113). However, some fish should be able to swim away from the intake and escape impingement because of large cut-outs that PG&E installed between the closure gate forebays and the two bar rack bays at each end of the intake structure. These cut-outs provide a migration route for aquatic organisms and a relatively uniform moderate intake velocity throughout the space created within the interior of the structure (PG&E 2009-TN10113).

Organisms small enough to pass through the traveling screen mesh, such as fish eggs, larvae, and other zooplankton, are entrained into the cooling water system. Entrained organisms pass through the entire cooling system and re-enter the Pacific Ocean at Diablo Cove, along with heated effluent. During this process, entrained organisms are subject to mechanical, thermal, and toxic stresses.

Clean Water Act Section 316(b) Requirements for Existing Facilities

Section 316(b) of the CWA addresses the adverse environmental impacts caused by the intake of cooling water from waters of the United States. This section of the CWA grants the EPA the authority to regulate cooling water intake structures to minimize adverse impacts on the aquatic environment. Under CWA Section 316(b), the EPA has issued regulations for existing facilities, such as Diablo Canyon, at 40 CFR Part 122 (TN2769) and 40 CFR Part 125 (TN254), Subpart J. Existing facilities include power generation and manufacturing facilities that are not new facilities as defined in 40 CFR 125.83 and that withdraw more than 2 MGD (7.6 mLd) of water from waters of the United States and use at least 25 percent of the water they withdraw exclusively for cooling purposes.

Under the CWA Section 316(b) regulations, the location, design, construction, and capacity of cooling water intake structures of regulated facilities must reflect the best technology available (BTA) for minimizing impingement mortality and entrainment. The EPA, or authorized States and Tribes, impose BTA requirements through NPDES permitting programs. In California, the SWRCB administers the NPDES program and issues NPDES permits to regulated facilities.

With respect to impingement mortality (IM), the BTA standard requires that existing facilities comply with one of the following seven alternatives (40 CFR 125.94(c) [TN254]):

1. operate a closed-cycle recirculating system, as defined at 40 CFR 125.92(c)
2. operate a cooling water intake structure that has a maximum through-screen design intake velocity of 0.5 fps (0.15 m/s)
3. operate a cooling water intake structure that has a maximum actual through-screen intake velocity of 0.5 fps (0.15 m/s)
4. operate an offshore velocity cap, as defined at 40 CFR 125.92(v), that was installed on or before October 14, 2014
5. operate a modified traveling screen that the NPDES Permit Director determines meets the definition at 40 CFR 125.92(s) and that the NPDES Permit Director determines is the BTA for impingement reduction at the site
6. operate any other combination of technologies, management practices, and operational measures that the NPDES Permit Director determines is the BTA for impingement reduction

7. achieve a 12-month impingement mortality performance standard of all life stages of fish and shellfish of no more than 24 percent mortality, including latent mortality, for all non-fragile species

Options (1), (2), and (4) above are essentially preapproved technologies requiring either no demonstration or only a minimal demonstration that the flow reduction and control measures are functioning as the EPA envisioned. Options (3), (5), and (6) require more detailed information to be submitted to the permitting authority before the permitting authority may specify it as BTA for a given facility. Under Option (7), the permitting authority may also review site-specific data and conclude that a de minimis rate of impingement exists; and, therefore, no additional controls are warranted to meet the BTA IM standard.

With respect to entrainment, the CWA Section 316(b) regulations do not prescribe a single nationally applicable entrainment performance standard, because the EPA did not identify a technology for reducing entrainment that is effective, widely available, feasible, and does not lead to unacceptable non-water-quality impacts (79 FR 48300-TN4488). Instead, the permitting authority must establish the BTA entrainment requirement for each facility on a site-specific basis. In establishing site-specific requirements, the regulations direct the permitting authority to consider the following factors (40 CFR 125.98(f)(2) [TN254]):

1. numbers and types of organisms entrained, including, specifically, the numbers and species (or lowest taxonomic classification possible) of federally listed, threatened and endangered species, and designated critical habitat (e.g., prey base)
2. impact of changes in particulate emissions or other pollutants associated with entrainment technologies
3. land availability inasmuch as it relates to the feasibility of entrainment technology
4. remaining useful plant life
5. quantified and qualitative social benefits and costs of available entrainment technologies when such information on both benefits and costs is of sufficient rigor to make a decision

In support of entrainment BTA determinations, facilities must conduct site-specific studies and provide data to the permitting authority to aid in its determination of if site-specific controls would be required to reduce entrainment and which controls, if any, would be necessary.

California Once-Through Cooling Policy

In 2010, the SWRCB adopted the statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (referred to as the "Once-Through Cooling (OTC) Policy"). The OTC Policy establishes uniform, technology-based standards to implement CWA Section 316(b) and to reduce the harmful effects associated with cooling water intake structures on marine and estuarine life. The SWRCB created this policy because, at the time, there were no applicable nationwide standards to implement CWA Section 316(b) at existing power plants. This policy has been amended several times, including following the EPA's issuance of the final CWA Section 316(b) regulations for existing power plant facilities in 2014 described above.

The OTC Policy originally affected 19 once-through cooling power plants along the California coast. The policy now affects 9 plants, as 10 of those plants have ceased operations. The OTC Policy expresses a preference for closed-cycle wet cooling systems as the selected BTA, but it allows for the SWRCB to establish site-specific BTA requirements for power plants based on the results of special studies required under the Implementation Provisions (Section 3.D) of the policy. The special studies are required to investigate alternatives for power plants to meet the flow and impingement/entrainment reduction requirements of the OTC Policy, including the costs to implement such alternatives. Informed by the results of such studies, the OTC Policy establishes a schedule that provides a compliance date for the replacement, repowering, or retirement of each remaining power plant still using once-through cooling operations while accounting for potential impacts to California's electrical supply.

In 2012 and 2014, Bechtel Power Corporation assessed alternative cooling technologies or modifications to Diablo Canyon's existing once-through cooling system to support PG&E's compliance with California's OTC Policy (CSWRCB 2023-TN10114). In Phase 1 of this study, Bechtel (2012-TN10115) evaluated the feasibility of a wide variety of cooling technologies without regard for cost. In Phase 2 of the study, Bechtel (2014-TN10116) considered in depth three cooling technologies that it found to be feasible in Phase 1. These were closed-cycle cooling, onshore mechanical intake fine mesh screening systems, and offshore modular wedge wire screens. Multiple variants or configurations of each of these technologies were assessed with respect to their effectiveness in reducing impingement and entrainment, permitting requirements, seismic and tsunami issues, structure and construction, maintenance, and implementation timelines, among other factors. Phase 2 also evaluated nuclear-specific licensing considerations, such as safety concerns and permitting requirements. Ultimately, Bechtel found that none of the evaluated alternatives were feasible at Diablo Canyon.

PG&E intends to comply with the OTC Policy by ceasing the use of Diablo Canyon's once-through cooling water intake system by a specified compliance date. On September 2, 2022, California Governor Gavin Newsom signed California Senate Bill 846 (State of California 2022-TN10038) into law. Effective September 2, 2022, Senate Bill 846 established a new OTC Policy compliance date for Diablo Canyon. Senate Bill 846 added Section 13193.5 to the Water Code, which specifies, in part:

Notwithstanding any provision to the contrary in the State Water Resources Control Board's Water Quality Control Plan on the Use of Coastal and Estuarine Waters for Power Plant Cooling, as referenced in Section 2922 of Title 23 of the California Code of Regulations, the final compliance dates for Diablo Canyon Units 1 and 2 shall be October 31, 2030.

On August 15, 2023, the SWRCB (2023-TN10117) passed Resolution No. 2023-0025, which revised the compliance date in the OTC Policy for Diablo Canyon to conform with Senate Bill 846.

In the interim, Section 2.C(3)(b) of the OTC Policy allows for PG&E to pay an annual fee for continued surface water withdrawal through the compliance date in lieu of conversion to a closed-cycle (cooling tower) system. Under this option, PG&E demonstrates compliance with the interim mitigation requirement by providing funding to the Ocean Protection Council or State Coastal Conservancy to fund appropriate mitigation projects. The interim mitigation period commenced on October 1, 2015, and continues up to and until PG&E achieves final compliance with the OTC Policy (i.e., ceases the use of the once-through cooling water intake system). The annual interim mitigation payment is the sum of three components: an entrainment payment, an impingement payment using a facility-specific fee, and a management and monitoring payment (Raimondi 2023-TN11887). The structure of the fee, last revised in April 2024, is determined by adding the entrainment fee of $12.51 per million gallons of water withdrawn, plus the site-specific impingement fee of $33.46 per pound of fish impinged, plus the 20 percent management and monitoring fee (CSWRCB 2024-TN11888). This fee is subject to an annual increase, that the SWRCB deems appropriate in its discretion and that does not exceed all reasonable costs to, or incurred by, the State to address the entrainment impacts resulting from the continued withdrawal of Pacific Ocean water. The interim mitigation payment for Diablo Canyon for the operating period from October 1, 2021, through September 30, 2022, was $4,826,784.58 and from October 1, 2020, through September 30, 2021, was $4,356,867. With the passage of Senate Bill 846, PG&E would continue to pay the mitigation fee through October 31, 2030.

Analysis Approach

When available, the NRC staff relies on the expertise and authority of the NPDES permitting authority with respect to the impacts of impingement and entrainment. Therefore, if the NPDES permitting authority has made BTA determinations for a facility pursuant to CWA Section 316(b) in accordance with the current regulations specified in 40 CFR Part 122 (TN2769) and 40 CFR Part 125 (TN254), which were promulgated in 2014 (79 FR 48300-TN4488), and that facility has implemented any associated requirements or those requirements would be implemented before the proposed LR period, then the NRC staff assumes that adverse impacts on the aquatic environment will be minimized. In such cases, the NRC staff concludes that the impacts of either IM, entrainment, or both would be SMALL for the proposed LR term.

In cases in which the NPDES permitting authority has not made BTA determinations, the NRC staff analyzes the potential impacts of IM, entrainment, or both using a weight-of-evidence approach. In this approach, the NRC staff considers multiple lines of evidence to assess the presence or absence of ecological impairment (i.e., noticeable or detectable impact) on the aquatic environment. For instance, as its lines of evidence, the NRC staff might consider characteristics of the cooling water intake system design, the results of impingement and entrainment studies performed at the facility, and trends in fish and shellfish population abundance indices. The NRC staff then considers these lines of evidence together to predict the level of impact (SMALL, MODERATE, or LARGE) that the aquatic environment is likely to experience during the proposed LR term.

Baseline Condition of the Resource

For the purposes of this analysis, the NRC staff assumes that the baseline condition of the resource is the central California Pacific Ocean aquatic community as it occurs today, which is described in Section 3.7.1 of this SEIS. While species richness, evenness, and diversity within the community may change or shift between now and when the proposed LR period would begin, the NRC staff finds the present aquatic community to be a reasonable surrogate in the absence of fishery and species-specific projections.

Impingement Mortality and Entrainment Best Technology Available

As described in the previous sections, the SWRCB has determined that it is not practicable for Diablo Canyon to achieve final compliance under the OTC Policy by implementing an alternative to modify the current once-through cooling water intake system and that PG&E must cease the use of Diablo Canyon's cooling water intake system by October 31, 2030 (State of California 2022-TN10038). Until that time, the OTC Policy allows PG&E to pay an annual mitigation fee based on the volume of Pacific Ocean water that Diablo Canyon withdraws, among other factors. PG&E pays this fee to the Ocean Protection Council or State Coastal Conservancy to fund appropriate mitigation projects.

Because of the unique situation at Diablo Canyon, the NRC staff considers two additional lines of evidence below, engineered designs and operational controls and the results of impingement and entrainment studies, to determine the impacts of IM and entrainment of aquatic organisms during the proposed LR term.

Engineered Designs and Operational Controls

In the 2014 final CWA Section 316(b) rule, the EPA indicates that two basic approaches can reduce IM and entrainment: (1) flow reduction and (2) including technologies into the cooling water intake design that gently exclude organisms or collect and return organisms without harm to the water body. The EPA also notes that two additional approaches can reduce impingement and entrainment but that these technologies may not be available to all facilities. The two additional approaches are: relocating the facility's intake to a less biologically rich area in a water body and reducing the intake velocity. The Diablo Canyon cooling water intake structure incorporates several of these approaches.

Flow Reduction

Reducing the amount of water that is withdrawn for cooling purposes from a water body reduces the number of aquatic organisms that are drawn through the intake structure and subject to impingement or entrainment. Some nuclear power plants have conditions established in NPDES permits or other agreements that require the plant to reduce the volume of water withdrawn under certain conditions or at certain times of the year. For instance, reducing the volume of water withdrawn from a waterbody during peak spawning periods can significantly reduce entrainment. However, Diablo Canyon has no such requirements.

Technologies That Exclude or Collect and Return Organisms

Several of the Diablo Canyon cooling water intake system's technologies help exclude organisms from becoming impinged or entrained. As described at the beginning of Section 3.5.7.1, these include a curtain wall, bar racks, and traveling screens. The EPA indicates that, ideally, traveling screens would be used with a fish-handling and -return system (79 FR 48300-TN4488). While Diablo Canyon's intake does not contain a fish return system, some fish should be able to swim away from the intake and escape impingement because of the installation of cut-outs between the closure gate forebays and the two bar rack bays at each end of the intake structure. These cut-outs provide a migration route out of the intake structure. PG&E (PG&E 2009-TN10113: Section 3.2) describes the engineering of the intake structure and how it reduces potential impingement in more detail. This information is incorporated herein by reference.

Location of the Facility's Intake

Location of the intake system is another design factor that can affect impingement and entrainment because locating intake systems in areas with high biological productivity or sensitive biota can negatively affect aquatic life. Steinbeck (2008-TN10210) determined that despite Diablo Canyon's relatively high seawater intake design volume of 9.58 million cubic meters per day (2,530 MGD), the plant has the lowest impingement biomass per million gallons circulated of all the coastal plants in California using once-through cooling, in part, because of the reduced biological productivity immediately surrounding the intake structure. Steinbeck (2008-TN10210) found that impingement is relatively low because the intake structure lies in a relatively confined engineered cove and because the cove is along an exposed section of coastline, which is less biologically productive as compared to protected areas of the coastline that have not been significantly affected by anthropogenic activities. Conversely, high entrainment rates, however, suggest that the biological productivity of eggs and larvae are relatively high within Intake Cove (Steinbeck 2008-TN10210). Furthermore, the area surrounding Diablo Canyon provides habitat to diverse aquatic species and the CCRWQCB (CSWRCB 2011-TN10118) classified the coastal segment between Point Buchon to Point San Luis, encompassing the Diablo Canyon site, for the following existing beneficial uses: marine habitat; shellfish harvest; rare, threatened, or endangered species habitat; and commercial and sport fishing.

Intake Velocity

Water velocity associated with the intake structure greatly influences the rate of impingement and entrainment. The higher the approach velocity, through-screen velocity, or both, the greater the number of organisms that will be impinged or entrained. Most fish can escape impingement by swimming away from a cooling water intake structure if the approach velocity is 0.5 fps (0.15 m/s) or less (79 FR 48300 [TN4488]). The approach velocity at Diablo Canyon ranges from 0.8 fps (0.24 m/s) just in front of the intake structure to 1.1 fps (0.34 m/s) through the bar racks. As water travels through the traveling screens, its velocity increases to approximately 2 fps (0.61 m/s) due to the reduced cross-sectional area (AEC 1973-TN7277).

Steinbeck (2008-TN10210) determined that Diablo Canyon has the lowest impingement biomass per million gallons circulated of all the coastal plants in California using a once-through cooling system, in part, because the adult fish near Diablo Canyon can swim faster than the through-screen velocity and, therefore, avoid impingement. Nonetheless, the through screen velocity, which exceeds EPA recommendations, could adversely affect smaller, slower fish; early life stages; and less mobile organisms and life stages.

<u>Impingement Studies</u>

From April 1985 to March 1986, Tenera (PG&E 2010-TN10119) conducted an impingement study at Diablo Canyon in connection with CWA Section 316(b) requirements. Appendix G.1 of this SEIS describes the methodology, major findings, and conclusions of this study. In summary, the study found that the cooling water intake system rarely impinged adult fish. Most fish impinged at Diablo Canyon were small, young-of-the-year juveniles and most of these were yellow or olive rockfish (*Sebastes serranoides*, 20 percent of fish collected), thornback rays (*Raja clavata*, 14 percent of fish collected), and plainfin midshipmen (*Porichthys notatus*, 5 percent of fish collected). Researchers also collected a relatively small number of impinged shellfish, predominantly consisting of rock crabs (*Romaleon antennarius*) and sharpnose crabs (*Scyra acutifrons*).

PG&E (2009-TN10113) extrapolated the loss of impinged fish during full power to be approximately 2.5 lb (1.1 kg) of fish and shellfish per day, with a maximum of 900 to 1,200 lb (408 to 544 kg) of biomass per year. Steinbeck (2008-TN10210) used data from Tenera's (PG&E 2010-TN10119)[2] study to compare impingement rates at multiple California coastal power plants and determined that Diablo Canyon has the lowest impingement rate of any once-through cooling power plant in California that uses the Pacific Ocean as its source of cooling water. This impingement study, as well the related analyses, indicate that the impacts of

[2] Tenera Inc. 1998. Diablo Canyon Power Plant Cooling Water Intake Structure 316(b) Demonstration. Berkeley, California. Enclosure 2 in PG&E 2010-TN10119.

impingement have neither destabilized nor noticeably altered any important attribute of the aquatic environment during the Diablo Canyon current operating license term.

Entrainment Studies

Tenera has conducted two entrainment studies at Diablo Canyon. Tenera (2000-TN10211) conducted the first study from October 1996 through June 1999 and the second study (PG&E 2024-TN10032) from July 2008 through June 2009. Appendix G.1 of this SEIS describes the methodology, major findings, and conclusions of this study. In summary, Tenera found that the populations least affected by entrainment at Diablo Canyon were those taxa that had a wide range of depth and onshore-offshore distributions such as white croaker, rock crabs, and blue rockfish complex. The fish taxon with the highest estimated annual larval entrainment was the combined group Blennioidei/Zoarcoidei/Stichaeidae. Some commercially important fish with pelagic eggs and widespread populations that were not abundant in the entrainment samples in the 2008–2009 study (e.g., northern anchovy, Pacific sardine, sanddabs, and California halibut) were more abundant in the previous study. Tenera (PG&E 2024-TN10032: Enclosure 1, Attachment 3) concluded that these species had low estimated larval mortalities or small numbers of adult losses to their populations based on the results in the previous entrainment study. Tenera (PG&E 2024-TN10032: Enclosure 1, Attachment 3) also concluded that entrainment effects appear to be limited to localized effects on nearshore species and that the potential for damage due to entrainment on the biological value of the larger source water body is low. The entrainment studies indicate that the impacts of entrainment have neither destabilized nor noticeably altered any important attribute of the aquatic environment during the Diablo Canyon current operating license term.

Impingement Mortality and Entrainment Conclusion

The NRC staff reviewed CWA Section 316(b) BTA requirements, requirements under the State of California’s OTC Policy, engineered designs and operational controls, and the results of impingement and entrainment studies conducted at Diablo Canyon. Because no impingement studies have been conducted since 1986 and no entrainment studies since 2009, the NRC staff relies on the most recent available data unless future studies are required by the SWRCB under CWA or NPDES permitting. These sources of information indicate that impingement at Diablo Canyon is limited and that entrainment results in a small number of adult equivalent losses. Impingement primarily affects small juveniles of rockfish, thornback rays, and plainfin midshipmen, and entrainment primarily affects larvae of the combined group Blennioidei/Zoarcoidei/Stichaeidae. The available information indicates that impingement and entrainment is not destabilizing or noticeably altering any important attributes of the aquatic environment during the Diablo Canyon current operating license term.

The proposed LR would continue current operating conditions and environmental stressors rather than introduce entirely new impacts. Therefore, the impacts of current operations and LR on aquatic resources would be similar. For these reasons, the NRC staff expects that impingement during the Diablo Canyon LR term would not destabilize nor noticeably alter any important attribute of the aquatic environment. Further, the State of California’s OTC Policy requires Diablo Canyon to cease operation of its cooling water intake structure by October 31, 2030, which would limit the period over which impingement and entrainment could affect local aquatic populations. For the reasons described above, the NRC staff finds that the impacts of impingement mortality and entrainment of aquatic organisms resulting from the proposed LR of Diablo Canyon would be SMALL.

3.7.5.2 *Effects of Thermal Effluents on Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)*

For plants with once-through cooling systems, such as Diablo Canyon, or cooling ponds, the NRC determined in the 2024 LR GEIS that the effects of thermal effluents on aquatic organisms is a Category 2 issue that requires site-specific evaluation for each proposed LR (NRC 2024-TN10161).

The primary form of thermal impact of concern at Diablo Canyon is heat shock. Heat shock occurs when water temperature meets or exceeds the thermal tolerance of an aquatic species for some duration of the exposure (NRC 2024-TN10161). In most situations, fish can avoid areas that exceed their thermal tolerance limits, although some aquatic species or life stages lack such mobility. Heat shock is typically observable only for fish because they tend to float when dead. In addition to heat shock, thermal plumes resulting from thermal effluent can create barriers to fish passage, which is of particular concern for migratory species. Thermal plumes can also reduce the available aquatic habitat or alter habitat characteristics in a manner that results in cascading effects on the local aquatic community.

<u>Diablo Canyon Effluent Discharge</u>

Diablo Canyon discharges heated effluent to Diablo Cove, which flows into the Pacific Ocean. Heated effluent flows from the elevated turbine building into the outfall structure where water passes over three weirs and across horizontal platforms fitted with vertical impact blocks. This design causes water to cascade, dissipating heat and hydraulic energy. Once discharged, thermal effluent mixes with the receiving water in Diablo Cove. The immediate receiving water area is shallow with a typical water depth of less than 10 ft (3 m) MLLW. Topography directly in front of the discharge consists of shallow water rock ridges at oblique angles to the plume's trajectory. These bottom features modify the direction and momentum of the discharge plume, depending on tide. During low tides, the rock ridges act as guidance vanes that deflect the discharge plume northward toward Diablo Rock. The plume at high tide is oriented more in-line with the discharge structure and the south channel of the cove. During high tide, the plume passes over the ridges and mainly exits through the south channel. The deeper portions of Diablo Cove (below approximately 26 ft [8 m] MLLW) are typically below the main influence of the plume and show little or no increase in temperature (PG&E 2023-TN9822).

The thermal effluent plume consists of two general regions in which different physical processes occur. In the near-field region within Diablo Cove, the plume's inertia is the dominant force. In the far-field region beyond the cove, buoyancy force dominates. Environmental factors, such as winds, tides, waves, and ambient current, interact, resulting in various configurations for the Diablo Canyon thermal plume. The discharge has momentum from its 85 ft (26 m) drop in elevation and buoyancy from its increased temperature. The thermal discharge plume pushes aside ambient water at a constant velocity. Downstream, the plume expands both laterally and vertically. In this area, the mean velocities and temperature levels decrease with distance from the discharge point due to mixing with ambient water. The mixing rates of ambient waters are further compounded by the topography, which limits the lateral mixing due to the semi-enclosed bay at Diablo Cove and the bathymetry that inhibits the vertical mixing due to the shallowness at different tide stages. At some point along the plume's trajectory, the momentum is diluted to the extent that the force of buoyancy becomes dominant. The surface plume is subject to buoyant spreading that is an essential process in dissipating waste heat to the atmosphere (PG&E 2023-TN9822).

Clean Water Act Section 316(a) Requirements for Point Source Discharges

CWA Section 316(a) addresses the adverse environmental impacts associated with thermal discharges into waters of the United States. This section of the act grants the EPA the authority to impose alternative, less-stringent, facility-specific effluent limits (called "variances") on the thermal component of point source discharges. To be eligible, facilities must demonstrate, to the satisfaction of the NPDES permitting authority, that facility-specific effluent limitations will ensure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving body of water. CWA Section 316(a) variances are valid for the term of the NPDES permit (i.e., 5 years). Facilities must reapply for variances with each NPDES permit renewal application. The EPA issued regulations under CWA Section 316(a) at 40 CFR 125, Subpart H (TN254).

Analysis Approach

When available, the NRC staff relies on the expertise and authority of the NPDES permitting authority with respect to thermal impacts on aquatic organisms. Therefore, if the NPDES permitting authority has made a determination under CWA Section 316(a) that thermal effluent limits are sufficiently stringent to ensure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving body of water, and the facility has implemented any associated requirements, then the NRC staff assumes that adverse impacts on the aquatic environment will be minimized (see 10 CFR 51.10(c) [TN10253]; 10 CFR 51.53(c)(3)(ii)(B); and 10 CFR 51.71(d)). In such cases, the NRC staff concludes that thermal impacts on aquatic organisms would be SMALL.

In cases in which the NPDES permitting authority has not granted a CWA Section 316(a) variance, the NRC staff analyzes the potential impacts of thermal discharges on aquatic organisms using a weight-of-evidence approach. In this approach, the NRC staff considers multiple lines of evidence to assess the presence or absence of ecological impairment (i.e., noticeable or detectable impact) on the aquatic environment. For instance, as its lines of evidence, the NRC staff might consider characteristics of the cooling water discharge system design, the results of thermal studies performed at the facility, and trends in fish and shellfish population abundance indices. The NRC staff then considers these lines of evidence together to predict the level of impact (SMALL, MODERATE, or LARGE) that the aquatic environment is likely to experience during the proposed LR term.

Baseline Condition of the Resource

For the purposes of this analysis, the NRC staff assumes that the baseline condition of the resource is the nearshore Pacific Ocean aquatic community as it occurs today, which is described in Section 3.7 of this SEIS. While species richness, evenness, and diversity within the community may change or shift between now and when the proposed LR period would begin, the NRC staff finds the present aquatic community to be a reasonable surrogate in the absence of fishery and species-specific projections.

Clean Water Act Section 316(a) Thermal Variance

Because PG&E operates Diablo Canyon in compliance with the thermal discharge provisions in its NPDES permit (PG&E 2023-TN9822), a CWA Section 316(a) variance does not apply to Diablo Canyon operation. The following subsection describes these NPDES permit limits and PG&E's adherence to them.

NPDES Permit Provisions Pertaining to Thermal Effluent Discharges

The Diablo Canyon NPDES permit contains effluent limitation criteria and receiving water limitations. NPDES permit Effluent Limitation B.1(f) specifies that the daily average discharge temperature shall not exceed the daily average of the natural temperature of the intake water by more than 22°F (12.2°C) except during heat treatment for demusseling. During heat treatment, PG&E follows the NPDES permit Effluent Limitation B.1(g), which specifies that the daily average discharge temperature shall not exceed the daily average of the natural temperature of the intake water by more than 25°F (13.9°C), and the maximum temperature increase (delta T) measured at the point of discharge of the unit being treated shall be less than 50°F (27.8°C) over that of the intake. The duration of maximum temperature during heat treatment of any half-condenser shall not exceed 1 hour during any 24-hour period. Additionally, Receiving Water Limitation C of the NPDES permit establishes 16 receiving water limitations, including that wastewater discharges shall not individually or collectively cause the following:

- objectionable aquatic growth or degradation of indigenous biota (Receiving Water Limitation No. 9)
- degradation of marine communities, including vertebrate, invertebrate, and plant species (Receiving Water Limitation No. 11)
- temperature of the receiving water to adversely affect beneficial uses (Receiving Water Limitation No. 14)

Beneficial uses identified in the NPDES permit include water-contact recreation, non-contact water recreation, including aesthetic enjoyment, industrial water supply, navigation, marine habitat, shellfish harvesting, preservation of rare and endangered species, wildlife habitat, and ocean commercial and sport fishing.

PG&E monitors the marine environment near Diablo Canyon and submits annual RWMP reports to the CCRWQCB in accordance with other provisions of the NPDES permit. These reports document that PG&E is in continual compliance with the 22°F (12.2°C) delta T effluent limit. Appendix G.4 of this SEIS summarizes the results of this monitoring effort, as well as several other thermal effects studies dating back to 1976, prior to operation of the plant.

In 2021, the CCRWQCB filed a complaint with the San Luis Obispo Superior Court following the agency's investigations of alleged NPDES permit violations associated with Diablo Canyon's thermal effluent discharge. The CCRWQCB and PG&E negotiated a settlement concerning these allegations. In the associated Consent Judgement, the San Luis Obispo Superior Court (PG&E 2024-TN10032) documents PG&E's agreement to make a one-time payment to the Bay Foundation of Morro Bay to benefit water quality and the environment on California's Central Coast. Notably, the Consent Judgement does not make specific conclusions regarding whether PG&E violated its NPDES permit.

Thermal Studies

During early plant operations, thermal monitoring revealed changes in the marine environment in and near Diablo Cove. Monitoring data indicated that populations of marine algae, invertebrates, and fish underwent significant changes following plant startup when compared to local populations beyond Diablo Canyon's influence. Many intertidal invertebrate taxa abundances increased, while subtidal invertebrate taxa decreased. Many of these species either increased or decreased in both the intertidal and subtidal. Researchers determined that effects likely resulted from a combination of responses to increased temperatures and responses to changes in other components of the community, such as algal cover in the intertidal, and algal cover and fish abundance in the subtidal (PG&E 2008-TN10104: see citation for PG&E 1982b, 2023-TN9822). Notably, researchers observed mortality of black (*Haliotis cracherodii*) and red (*H. rufescens*) abalone due to withering syndrome. Although species recruitment contributed to increases in the Diablo Cove population in the early 1990s, abundances outside Diablo Cove also began decreasing during this same period. Researchers correlated increased black abalone mortality rates in Diablo Cove with the increased seawater temperatures from Diablo Canyon's thermal effluent discharge. Declines in red abalone populations were limited to areas within Diablo Cove contacted by the thermal effluent, and populations of this species in Diablo Cove below approximately 20 ft (6 m) depth and in control areas did not decline (PG&E 2023-TN9822).

Thermal monitoring also revealed a shift in the fish composition in and near Diablo Cove to more warm-tolerant species, including leopard shark (*Triakis semifasciata*), bat ray (*Myliobatis californica*), round ray (*Urobatis halleri*), white seabass (*Atractoscion nobilis*), opaleye (*Girella nigricans*), halfmoon (*Medialuna californiensis*), sheephead (*Semicossyphus* species), and señorita (*Oxyjulis californica*). Cool water species, such as greenlings (family Hexagrammidae) and some rockfishes (family Sebastidae), are now less prevalent in this area. At control sites outside of Diablo Cove, including Field's Cove and Lion Rock Cove (north of Diablo Cove), and the breakwater/seal haulout area (south of Diablo Cove), species composition of the fish community has been unaffected by Diablo Canyon's discharge (PG&E 2023-TN9822). Appendix G of this SEIS explains these study efforts in detail and summarizes relevant results.

In conjunction with CCRWQCB's 2021 complaint described previously in this section, the San Luis Obispo Superior Court discussed the results of thermal monitoring associated with Diablo Canyon's thermal effluent and found the following (PG&E 2024-TN10032):

- Changes within the discharge area are well-documented and well-understood.
- The geographical extent of the biological changes due to the thermal discharge has stabilized, with ecologically significant changes limited to Diablo Cove.
- The discharge temperature has remained steady during plant operations and will remain steady until Diablo Canyon ceases power-generating operations.

<u>Thermal Conditions During License Renewal</u>

PG&E proposes no operational changes during the LR term that would increase or otherwise alter thermal effluent discharged to the Pacific Ocean. During the proposed LR term, PG&E would continue to be subject to the limitations and requirements set forth in the Diablo Canyon NPDES permit, which the CCRWQCB has established pursuant to the provision of the CWA to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the Pacific Ocean.

<u>Thermal Impacts Conclusion</u>

Because PG&E operates Diablo Canyon in compliance with the thermal discharge provisions in its NPDES permit, a CWA Section 316(a) variance does not apply to Diablo Canyon operation, and the NRC staff finds that the adverse impacts on the aquatic environment associated thermal effluent are minimized. Further, thermal monitoring indicates that biological changes from Diablo Canyon's thermal effluent have stabilized and that ecologically significant changes are limited to Diablo Cove. Because the characteristics of the thermal effluent would remain the same under the proposed action, the NRC staff anticipates similar effects during the proposed LR period. Further, the CCRWQCB will continue to ensure PG&E's continued compliance with the NPDES permit. The CCRWQCB may require additional mitigation or monitoring in a future renewed NPDES permit if it deems such actions to be appropriate to assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the Pacific Ocean. The NRC staff assumes that any additional requirements that the CCRWQCB imposes would further reduce the impacts of Diablo Canyon's thermal effluent over the course of the proposed LR term. For these reasons, the NRC staff finds that thermal impacts during the proposed LR period would neither destabilize nor noticeably alter any important attribute of the aquatic environment and would, therefore, result in SMALL impacts on aquatic organisms.

3.7.6 No-Action Alternative

If Diablo Canyon were to permanently cease operating, impacts on the aquatic environment would decrease or stop following reactor shutdown. Some withdrawal of water from the Pacific Ocean would continue during the shutdown period to provide cooling to spent fuel in the spent fuel pool until that fuel could be transferred to dry storage. The amount of water withdrawn for this purpose would be a small fraction of water withdrawals during operations, would decrease over time, and would likely end within the first several years following shutdown. The reduced demand for cooling water would substantially decrease the effects of impingement, entrainment, and thermal effluent on aquatic organisms, and these effects would entirely cease following the transfer of spent fuel to dry storage. Effects from cold shock would be unlikely, given the small area of the ocean affected by thermal effluent under normal operating conditions, combined with the phased reductions in withdrawal and discharge of ocean water that would occur following shutdown.

Based on the above, the NRC staff concludes that the impacts of the no-action alternative on aquatic resources would be SMALL.

3.7.7 Replacement Power Alternatives: Common Impacts

Construction impacts for many components of the replacement power alternatives would be qualitatively and quantitatively similar. Construction of new power-generating facilities could result in aquatic habitat loss, alteration, or fragmentation; disturbance and displacement of aquatic organisms; mortality of aquatic organisms; and increase in human access. For instance, construction-related chemical spills, runoff, and soil erosion could degrade water quality in nearby aquatic habitats by introducing pollutants and increasing sedimentation and turbidity. Dredging and other in-water work could directly remove or alter the aquatic environment and disturb or kill aquatic organisms. Because construction effects would be short-term, associated habitat degradation would be relatively localized and temporary. Effects could be minimized by the use of existing infrastructure for those alternatives that would make use of the existing site, as well as the use of existing transmission lines, roads, parking areas, and certain existing buildings and structures. Aquatic habitat alteration and loss could be minimized by siting components of the alternatives farther from waterbodies and away from drainages and other aquatic features.

Water quality permits required through Federal and State regulations would control, reduce, or mitigate potential effects on the aquatic environment. Through such permits, the permitting agencies could include conditions requiring PG&E to follow BMPs or to take certain mitigation measures if adverse impacts are anticipated. For instance, the USACE oversees CWA Section 404 permitting for dredge and fill activities, and the SWRCB oversees NPDES permitting and general stormwater permitting. PG&E would likely be required to obtain each of these permits to construct a new replacement power alternative. Notably, the EPA final rule under Phase I of the CWA Section 316(b) regulations applies to new facilities and sets standards to limit intake capacity and velocity to minimize impacts on fish and other aquatic organisms in the source water (40 CFR Part 125-TN254). Any new replacement power alternative subject to this rule would be required to comply with the associated technology standards.

With respect to operation of replacement power alternatives, operational impacts would be qualitatively similar but would vary in intensity, based on each alternative's water use and consumption. Non-nuclear facilities generally consume significantly less water during operations.

3.7.8 Purchased Power Alternative

The purchased power alternative involves the establishment of a long-term contract to import replacement power into the Diablo Canyon service area to replace Diablo Canyon's net generation. Potential environmental impacts depend on the source, type, and location of the energy obtained under such a contract. This could include natural gas power plants until 2045 and must be renewal and zero-carbon after 2045 under California's 100 Percent Clean Energy Act of 2018.

The operation of solar facilities generally has no discernable effects on the aquatic environment. The operation of wind turbines could produce leaks of hydraulic fluid, antifreeze, and grease, but the impacts would be SMALL since these leaks occur in relatively small amounts and are managed by State permitting authorities (e.g., spill response and prevention plans). The impacts of additional power generation from existing natural gas plants would be SMALL since the water withdrawals and discharges would be managed by NPDES permits, and these impacts would be eliminated completely after 2045.

The NRC staff concludes that the impacts on aquatic resources for the purchased power alternative would be SMALL. Impacts from the alternative would be managed and regulated by Federal and State water quality permits.

3.7.9 Renewables Combination Alternative

The renewables combination alternative would involve the construction and installation of 2,005 MW (installed capacity) of wind turbines located both on and offsite of Diablo Canyon, 3,540 MW (installed capacity) of offsite solar panels located within the PG&E service area, 200 MW of geothermal power, and demand side management.

The impacts of the construction of the new wind, solar, and geothermal components of this alternative are discussed in the section that describes common impacts on all alternatives (see Section 3.7.7). These effects would be SMALL to MODERATE, depending on the site(s) selected, the aquatic habitats present, and the extent to which construction would degrade, modify, or permanently alter those habitats.

The operation of the solar photovoltaic component would have no discernable effects on the aquatic environment. The operation of the wind turbines could produce leaks of hydraulic fluid, antifreeze, and grease, but the impacts would be SMALL since these leaks occur in relatively small amounts and are managed by State permitting authorities (e.g., spill response and prevention plans). The operation of the geothermal and demand side management components of this alternative would have no discernable impact on the aquatic environment.

The NRC staff concludes that the impacts on aquatic resources for the renewables combination alternative would be SMALL to MODERATE during construction and SMALL during operation. Impacts from the alternative would be managed and regulated by Federal and State water quality permits.

3.8 Federally Protected Ecological Resources

The NRC must consider the effects of its actions on ecological resources protected under several Federal statutes and must consult with the FWS and NMFS or NOAA prior to taking action in cases where an agency action may affect those resources. These statutes include the following:

- ESA (16 U.S.C. § 1531 et seq.-TN1010)
- MSA (16 U.S.C. § 1801 et seq.-TN9966)
- National Marine Sanctuaries Act (NMSA) (16 U.S.C. § 1431 et seq.-TN4482)

This section describes the species and habitats that are federally protected under these statutes and analyzes how the proposed LR and alternatives may affect these resources.

3.8.1 Endangered Species Act

Congress enacted the ESA in 1973 to protect and recover imperiled species and the ecosystems upon which they depend. The ESA provides a program for the conservation of endangered and threatened plants and animals (collectively, listed species) and the habitats in which they are found. The FWS and the NMFS are the lead Federal agencies for implementing the ESA, and these agencies are charged with identifying species that warrant listing. The following sections describe the Diablo Canyon action area and the species and habitats that may occur in the action area under each of the Services' jurisdictions.

3.8.1.1 Endangered Species Act: Action Area

The implementing regulations for Section 7(a)(2) of the ESA define "action area" as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02-TN4312). The action area effectively bounds the analysis of federally listed species and critical habitats because only species and habitats that occur within the action area may be affected by the Federal action.

For the purposes of assessing the potential impacts of Diablo Canyon LR on federally listed species, the NRC staff considers the action area to consist of the following.

Diablo Canyon Site: The terrestrial region of the action area consists of approximately 750 ac (304 ha) of PG&E property associated with the Diablo Canyon site boundary. This area is contained within the larger Diablo Canyon Lands covering an area of approximately 12,000 ac (4,856 ha).

The Diablo Canyon owner-controlled area is defined as the land areas adjacent to the site boundary that are owned and controlled by the licensee, whereby access can be limited by the licensee for any reason. Generally described, the Diablo Canyon owner-controlled area is the area between the Port San Luis gate and security gate A, bounded by the eastern hills directly adjacent to the site access road and the northern evacuation route, and bounded to the west by the Pacific Ocean. Diablo Creek traverses the Diablo Canyon site and splits the 750 ac (304 ha) Diablo Canyon site boundary into two portions: a 165 ac (67 ha) portion north of Diablo Creek, owned by PG&E, and a 585 ac (237 ha) portion (Parcel P) south of Diablo Creek, owned by PG&E subsidiary Eureka Energy Company and leased to PG&E. The Diablo Canyon site boundary is bordered by the Pacific Ocean and rocky bluffs with gently to moderately sloping terraces ranging from 70 to 100 ft (20 to 30 m) above sea level to the west. Additionally, the Diablo Canyon Lands themselves are bordered by Montaña de Oro State Park directly to the north and northeast, by the Irish Hills to the east, and by the community of Avila Beach to the south. Section 3.6 of this SEIS describe the developed and natural features of the site and the characteristic vegetation and habitats.

<u>Intake Cove</u>: Diablo Canyon withdraws Pacific Ocean water from Intake Cove. Intake Cove is an artificial embayment that consists of sand and soft sediments, boulder fields, low rock ridges, and emergent rocks. The shoreline within the cove consists of a granite boulder riprap-armored and graded road, a vertical concrete curtain wall forming the ocean-side of the intake structure, and sections of natural rock upcoast of the cooling water intake structure. The depth of Intake Cove ranges from 16 ft (4.9 m) below MLLW in the eastern portion of the cove to 33 ft (10 m) below MLLW adjacent to the intake structure (SLOC 2023-TN10105). As explained in Section 3.7.5 of this SEIS, fish, shellfish, and other aquatic organisms within Intake Cove may be subject to impingement or entrainment.

<u>Diablo Cove</u>: Diablo Cove lies to the north of Intake Cove. This cove receives Diablo Canyon's thermal effluent discharge of Pacific Ocean water that the plant withdraws from Intake Cove for cooling purposes. Diablo Cove has a surface area of approximately 42 ac (17 ha) and an average depth of approximately 26 ft (7.9 m) below MLLW with a maximum depth of approximately 60 ft (18 m) below MLLW (SLOC 2023-TN10105). The intertidal and subtidal areas of the cove consist predominantly of bedrock, boulder, and cobble fields.

<u>Pacific Ocean</u>: Based on NPDES plume surveys from 1986 to 1990 (PG&E 2008-TN10104), Diablo Canyon's thermal plume is primarily detectable between 0.5 and 1 mi (0.8 and 1.6 km) offshore (41 to 60 percent of survey samples) with a maximum extent of 2 mi (3.2 km) either north or south of Diablo Cove during certain tidal conditions. The plume generally extends in two directions (northwest and west) from Diablo Cove with two relatively distinct arms. Figure G-2 in Appendix G of this SEIS shows a surface infrared aerial image of Diablo Canyon's thermal plume during low tide conditions, and Appendix G describes the results of thermal effluent monitoring in detail.

<u>Freshwater Environments</u>: Freshwater aquatic habitat is present within four primary drainages near the Diablo Canyon site: Coon Creek, Diablo Creek, Irish Canyon Creek, and Pecho Creek; and in one human-made pond, Tom's Pond. Coon Creek and Diablo Creek lie to the north of the industrial portion of the site. These creeks flow in a westerly direction into the Pacific Ocean. Irish Canyon Creek and Pecho Creek lie to the south of the industrial portion of the site. These creeks flow in a southerly direction into the Pacific Ocean. Only Diablo Creek lies within the Diablo Canyon site boundary. Therefore, this waterway is included in the action area. The other three waterways (Coon, Irish Canyon, and Pecho Creeks) do not traverse the Diablo Canyon site and would not be affected by any activities associated with the Diablo Canyon license renewal. Tom's Pond lies on the coastal terrace to the north of the industrial portion of the site. It was originally a spring-fed seep that was expanded into an approximately 0.25 ac (0.1 ha) pond in the late 1960s for ranching purposes. Section 3.7.2 of this SEIS describes these features in more detail.

The NRC staff recognizes that, although the described action area is stationary, federally listed species can move in and out of the action area. For instance, a migratory bird could occur in the action area seasonally as it forages or breeds within the action area. Thus, in its analysis, the NRC staff considers not only those species known to occur directly within the action area but those species that may passively or actively move into the action area. The NRC staff then considers if the life history and habitat requirements of each species make it likely to occur in the action area where it could be affected by the proposed LR. The following sections first discuss listed species and critical habitats under FWS jurisdiction, followed by those under NMFS jurisdiction.

3.8.1.2 Endangered Species Act: Federally Listed Species and Critical Habitats Under U.S. Fish and Wildlife Service Jurisdiction

The NRC staff identified 25 species under FWS jurisdiction that may occur in the action area. These species are federally listed as endangered or threatened under the ESA or are candidates for future listing. The NRC staff reviewed the ER, the FWS's Information for Planning and Conservation database, available ecological surveys, and other records to determine whether suitable habitat for each species occurs in the action area and whether the species itself may occur in the action area.

Two species have been documented in the action area in ecological surveys: the California red-legged frog (*Rana draytonii*) and southern sea otter (*Enhydra lutris nereis*). Five federally listed birds may occur in the action area as occasional migrants. These are the California condor (*Gymnogyps californianus*), California least tern (*Sterna antillarum browni*), Hawaiian petrel (*Pterodroma sandwichensis*), marbled murrelet (*Brachyramphus marmoratus*), and short-tailed albatross (*Phoebastria albatrus*). The Diablo Canyon action area only provides marginal habitat for each of these species. However, these species could occasionally transit the action area when moving between areas of more optimal habitat outside of the action area. The remaining species do not occur in the action area due to a lack of suitable habitat or lack of positive identification during appropriately timed ecological surveys.

The NRC staff identified that no designated or proposed critical habitat occurs in the action area. In January 2025, the FWS proposed to designate critical habitat for the foothill yellow-legged frog (*Rana boylii*) (90 FR 3412-TN11889). The proposed San Carpoforo Creek Unit (SC-1) is located in Monterey and San Luis Obispo Counties along San Carpoforo Creek within the Big Creek watershed. The NRC staff reviewed information on this proposed critical habitat and determined that it is not near the Diablo Canyon action area and does not need to be considered further in this SEIS.

Table 3-11 summarizes the results of the NRC staff's evaluation, including the habitat requirements and information on the occurrence of each species within the action area. The remainder of this section describes the California red-legged frog and southern sea otter in detail.

Table 3-11 Occurrences of Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
California red-legged frog (*Rana draytonii*)	FT	Lowlands and foothills in or near sources of water with shrubby or emergent riparian vegetation.	Resident. In a targeted survey for the species in March 2020, Terra Verde (Terra Verde 2020-TN10098) documented one individual in a pool formed by the outlet of the culvert that runs under the 500 kV and 230 kV switchyards. Pool located in an arroyo willow thicket and approximately 3 ft (0.9 m) deep. Additional areas of the site may provide suitable habitat, including Middle Diablo Creek (dispersal); Tom's Pond (reproduction); an ephemeral drainage and a retention basin (marginal seasonal use); and two small wetlands (temporary refuge and dispersal). Terra Verde's terrestrial biological resources assessment (Terra Verde 2020-TN10098: Appendix D) contains written habitat assessments and photographs of each of these locations.
California tiger salamander (*Ambystoma californiense*)	FT	Standing bodies of freshwater, including ponds, vernal pools, and other ephemeral or permanent water bodies that persist for at least 12 weeks to support the larvae development; adjacent upland habitat that contains small animal burrows or underground hideaways, including those constructed by California ground squirrel (*Spermophilus beecheyi*) and valley pocket gopher (*Thommomys bottae*).	Not present. No suitable habitat occurs in action area (PG&E 2023-TN9822).
foothill yellow-legged frog (*Rana boylii*)	FT	Streams and rivers with rocky substrate and open, sunny banks, in forest, chaparral, and woodlands. Sometimes found in isolated pools.	Not present. No suitable habitat occurs in action area (Terra Verde 2020-TN10098).

Table 3-11 Occurrences of Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
California clapper rail (*Rallus longirostris obsoletus*)	FE	Wetlands and coastal salt marshes.	Not present. No suitable habitat occurs in action area (Terra Verde 2020-TN10098).
California condor (*Gymnogyps californianus*)	FE	Foraging habitat includes open grasslands, oak savanna foothills, and beaches adjacent to coastal mountains. Condors roost on large trees or snags, or on rocky outcrops and cliffs. Nests are located in caves and ledges of steep rocky terrain or in cavities and broken tops of old growth conifers created by fire or wind.	Occasional migrant. Suitable habitat does not occur in the action area (PG&E 2023-TN9822). However, species may occasionally transit the site en route to more optimal habitats.
California least tern (*Sterna antillarum browni*)	FE	Seacoasts, beaches, bays, estuaries, lagoons, and lakes. Needs sandy or gravelly areas for nest construction.	Occasional migrant. Suitable habitat does not occur in action area (Terra Verde 2020-TN10098). However, species may occasionally transit the site en route to offshore foraging areas.
Hawaiian petrel (*Pterodroma sandwichensis*)	FE	Mostly found at sea. Nests in burrows, primarily in remote montane locations, along large rock outcrops, under cinder cones, under old lichen-covered lava, or in soil beneath dense vegetation. Can nest in a variety of environments from rainforest to subalpine rocky cliffs.	Occasional migrant. Suitable habitat does not occur in the action area (PG&E 2023-TN9822). However, species may occasionally transit the site en route to more optimal habitats.
least Bell's vireo (*Vireo bellii pusillus*)	FE	Mesquite scrub within arroyos, palm groves, and hedgerows bordering agricultural and residential areas.	Not present. No suitable habitat occurs in action area (Terra Verde 2020-TN10098).
marbled murrelet (*Brachyramphus marmoratus*)	FT	Mostly found at sea. Rests and feeds in nearshore marine waters usually within 1.2 to 3 mi (1.9 to 4.8 km) of shore, typically in waters less than 100 ft (30 m) deep.	Occasional migrant. Suitable habitat does not occur in the action area (PG&E 2023-TN9822). However, species may occasionally transit the site en route to more optimal habitats.
short-tailed albatross (*Phoebastria albatrus*)	FE	Mostly found at sea. Nests on isolated, windswept, offshore islands, with restricted human access. During breeding, individuals feed along areas of upwelling, such as continental	Occasional migrant. Suitable habitat does not occur in the action area (PG&E 2023-TN9822). However, species may occasionally transit the site en route to more optimal habitats.

Table 3-11 Occurrences of Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
		shelf-break areas that are 660 to 3,300 ft (200 to 1,000 m) deep.	
western snowy plover (*Charadrius nivosus nivosus*)	FT	Sandy beaches, salt pond levees, and shorelines of large alkali lakes. Needs friable soil for nesting.	Not present. No suitable habitat occurs in action area (Terra Verde 2020-TN10098).
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	FT	Dense woodlands and low foliage near slow moving water bodies. Forages in cottonwood trees and builds nests in trees and shrubs. Current California range limited to Sacramento and Kern Rivers.	Not present. Action area outside of species' current known range.
tidewater goby (*Eucyclogobius newberryi*)	FE	Shallow water lagoons and lower stream reaches with fairly still (but not stagnant) water and high oxygen levels. Can tolerate an array of different conditions depending on seasonal changes.	Not present. No suitable habitat occurs in action area (PG&E 2023-TN9822).
monarch butterfly (*Danaus plexippus*)	FPT	Relies on milkweed (*Asclepias* spp.) and protected stands of trees for roosting, usually blue gum (*Eucalyptus globulus*). Found in fields, meadows, weedy areas, marshes, and along roadsides.	Seasonal migrant. Suitable winter roosting habitat does not occur in action area (Terra Verde 2020-TN10098). However, the species is known to pass through or over Diablo Canyon lands; individuals may temporarily roost or forage within the action area in transit to Montana de Oro State Park or other overwintering roost sites (PG&E 2024-TN11890).
vernal pool fairy shrimp (*Branchinecta lynchi*)	FT	Vernal pools and depressions in grasslands.	Not present. No suitable habitat occurs in action area (Terra Verde 2020-TN10098).
giant kangaroo rat (*Dipodomys ingens*)	FE	Stabilized sand dune, coastal dune and coastal sage scrub; sandy soils essential for burrowing. Localized south of Morro Bay.	Not present. No suitable habitat occurs in action area, and action area outside of species' current known range (Terra Verde 2020-TN10098).
southern sea otter (*Enhydra lutris nereis*)	FT	Marine coastal areas along the central California coastline, including rocky and sandy areas along the exposed outer coast and	Resident. PG&E (2023-TN9822) reports regular sightings of this species at the site. Females and pups are known to frequent Intake Cove in groups of up to 30 individuals.

Table 3-11 Occurrences of Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[a]	Habitat	Type and Likelihood of Occurrence in Action Area
		protected areas, such as bays, coves, and estuaries.	
California jewelflower (*Caulanthus californicus*)	FE	Only known populations occur in three areas in hilly terrain west of the San Joaquin Valley: the Carrizo Plain, Santa Barbara Canyon (adjacent to the Cuyama Valley in Santa Barbara County), and the Kreyenhagen Hills (Fresno County).	Not present. No suitable habitat occurs in action area (PG&E 2023-TN9822).
Chorro Creek bog thistle (*Cirsium fontinales* var. *obispoense*)	FE	Serpentine seeps and streams at elevations <1150 ft (350 m).	Not present. No suitable habitat occurs in action area and species not observed during appropriately timed surveys (Terra Verde 2020-TN10098).
Indian knob mountainbalm (*Eriodictyon altissimum*)	FE	Sandstone ridges and chaparral at elevations <890 ft (270 m).	Not present. No suitable habitat occurs in action area and species not observed during appropriately timed surveys (Terra Verde 2020-TN10098).
marsh sandwort (*Arenaria paludicola*)	FE	Wet meadows and marshes at elevations <980 ft (300 m).	Not present. Low suitability habitat present within action area. However, species not observed during appropriately timed surveys (Terra Verde 2020-TN10098).
Morro manzanita (*Arctostaphylos morroensis*)	FT	Stabilized sand dunes, sandstones, and chaparral at elevations <660 ft (200 m).	Not present. No suitable habitat occurs in action area (Terra Verde 2020-TN10098).
Pismo clarkia (*Clarkia speciosa* ssp. *immaculata*)	FE	Sandy coastal hills at elevations <330 ft (100 m).	Not present. Low suitability habitat present within action area. However, species not observed during appropriately timed surveys, which included confirmation of a nearby reference population that was in peak bloom at the time of the site survey (Terra Verde 2020-TN10098).
salt marsh bird's-beak (*Cordylanthus maritimus* ssp. *maritimus*)	FE	Coastal salt marsh at elevations >33 ft (10 m).	Not present. No suitable habitat occurs in action area and species not observed during appropriately timed surveys (Terra Verde 2020-TN10098).

Table 3-11 Occurrences of Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
spreading navarretia (*Navarretia fossalis*)	FT	Vernal pools, alkali playas, and alkali sinks at elevations <4,250 ft (1,300 m).	Not present. No suitable habitat occurs in action area (PG&E 2023-TN9822).

(a) Indicates protection status under the Endangered Species Act. FE = federally endangered; FPT = federally proposed for listing as threatened; and FT = federally threatened.
Sources: FWS 2024-TN10254; PG&E 2023-TN9822; PG&E 2024-TN10032, Terra Verde 2020-TN10098.

California Red-Legged Frog

The FWS listed the California red-legged frog as threatened wherever found in 1996 (61 FR 25813-TN10107). In 2001, and as revised in 2010, the FWS designated critical habitat for the species in 27 California counties, including 536,165 ac (216,976 ha) in San Luis Obispo County (66 FR 14626-TN10108). No critical habitat occurs within the action area. The closest critical habitat unit, SLO-2, lies roughly 9 mi (14 km) north of the action area. SLO-2 is located along the coast from approximately Arroyo de Los Chinos southward to just before but not including Whale Rock Reservoir.

The California red-legged frog is the largest native frog in the western United States. Individuals have a red or salmon-colored abdomen and hind legs, which give the species its name. The information in this section is derived from the FWS's 5-year review (FWS 2022-TN10109) unless otherwise cited.

California red-legged frogs are endemic to California and Baja California, Mexico. They inhabit elevations from near sea level to 5,200 ft (1,500 m), although nearly all sightings have occurred below 3,500 ft (1,050 m). The species predominantly occupies permanent freshwater sources, including marshes, streams, and ponds, where dense scrubby vegetation such as willows, cattails, and bulrushes are dominant and water quality is suitable. Individuals also use uplands near aquatic habitat for foraging, shelter, and dispersal to neighboring aquatic habitat up to 1.7 mi (2.8 km) away. The species currently is widespread in the nine-county San Francisco Bay area and is abundant along the Pacific Coast north of Ventura County. Isolated populations exist in the Sierra Nevada range and in Los Angeles, Mariposa, Ventura, and San Diego Counties. The northernmost range of the species is in Mendocino County and the southernmost range of the species is Baja California, Mexico.

The California red-legged frog breeds along watercourses with pools that persist long enough for breeding and the development of larvae. Breeding time depends on winter rains and is usually between November and early April. Females deposit egg masses on emergent vegetation so that the masses will float on the surface of the water.

Population declines are primarily attributable to losses of habitat stemming from land conversion and a variety of land use practices, such as urbanization, agriculture, cultivated farming, and livestock grazing. Urbanization directly reduces available aquatic and terrestrial habitat through conversion of natural habitat areas to impermeable surfaces (i.e., asphalt and concrete) and impassible movement barriers (e.g., roads, fences, walls, and structures). Impassible barriers to movement tend to isolate breeding populations and alter historic migration patterns. Agricultural operations also present threats to the species through direct habitat loss and by decreasing watershed area. California red-legged frog populations have also declined due to the introduction of predators such as American bullfrog (*Lithobates catesbeianus*), centrarchid fish species (e.g., sunfish, blue gill, and largemouth bass), and crayfish (*Pacifastacus* species).

To date, no range-wide surveys of the species have been conducted because it is difficult to reliably census the California red-legged frog in the field. The most reliable census method is to perform repeated egg mass surveys during the breeding season. Because female ranid frogs deposit only one egg mass per year, total egg mass counts are close approximations to the number of breeding females in a survey area. The USGS surveys five breeding areas in Marin and San Mateo Counties. During the 2023 breeding season (December 2022 through March 2023), the USGS (TN10110) found 348 egg masses across 37 sites in the two counties. This is an overall decrease compared to previous years, with 491 total egg masses observed in 2022 and 496 in 2021. However, no such surveys are conducted in San Luis Obispo County.

In March 2020, Terra Verde Environmental Consulting, LLC (Terra Verde 2020-TN10098) performed a targeted California red-legged frog survey on the Diablo Canyon site in connection with PG&E's decommissioning planning efforts. Researchers documented one individual in a pool formed by the outlet of the culvert that runs under the 500 kV and 230 kV switchyards. The pool lies in an arroyo willow thicket and was approximately 3 ft (0.9 m) deep at the time of the survey. Researchers investigated additional aquatic habitats and features on the site to determine the presence of suitable habitat. Although no California red-legged frogs were observed elsewhere on the site, Terra Verde determined that frogs may inhabit or use Middle Diablo Creek (dispersal); Tom's Pond (reproduction); an ephemeral drainage and a retention basin (marginal seasonal use); and two small wetlands (temporary refuge and dispersal). Appendix D of Terra Verde's terrestrial biological resources assessment (Terra Verde 2020-TN10098: Appendix D) contains written habitat assessments and photographs of each of these locations. In 2022, Terra Verde prepared an addendum to its 2020 assessment to address comments received from the FWS requesting that PG&E assess the size of the California red-legged frog population present at Diablo Canyon and expand the survey to include potentially suitable habitat for California red-legged frog along the northern access road and main southern access road (PG&E 2023-TN9822). The 2022 addendum documented California red-legged frog within Diablo Creek in existing scour pools located immediately downstream of the culvert outlets from the 230-kV and 500-kV switchyards and the Diablo Canyon Road crossing. No suitable pool habitat was observed in the upper portion of Diablo Creek upstream of the 500-kV switchyard. The drainages along the southern access road were not observed to have suitable habitat for long-term use by California red-legged frog, though they may provide temporary dispersal habitat.

Southern Sea Otter

The FWS listed the southern sea otter as threatened wherever found in 1977 (42 FR 2965-TN10111). Since that time, the FWS has reviewed several petitions to delist the species. Most recently, in 2023, the FWS determined that delisting is not warranted (88 FR 64870-TN10112). The FWS has not designated critical habitat for the species.

The southern sea otter is a small marine-dwelling member of the weasel family (Mustelidae). Southern sea otters live along the Pacific Coast from San Mateo County to Santa Barbara County in California and are regularly observed in the marine environment of the Diablo Canyon site, including within Intake Cove. The information in this section is derived from the FWS's most recent species status assessment (FWS 2023-TN10255) unless otherwise cited.

Sea otter habitat is typically defined as occurring inshore of the 131 ft (40 m) depth contour. Southern sea otters forage in both rocky and soft-sediment communities in water depths generally 82 ft (25 m) or less, although some animals utilize deeper waters. Sea otters occasionally make dives of up to 328 ft (100 m), but most feeding dives (about 95 percent) occur in waters less than 131 ft (40 m) deep. Rocky habitats that are topographically heterogeneous and support kelp forests are likely to support the greatest diversity and abundance of sea otter food resources, which include abalone, rock crabs, sea urchins, kelp crabs, clams, turban snails, mussels, octopus, barnacles, scallops, sea stars, and chitons.

Southern sea otters are an important predator in the nearshore marine ecosystem because their predation on several invertebrates influences the health of habitat-forming species, such as kelp. For example, healthy populations of sea otters are believed to limit large outbreaks of urchins via predation. Uncontrolled urchin population outbreaks can result in over-grazing of kelp plants and a collapse in kelp habitat ecosystems.

Southern sea otters rely on thick fur to insulate against cold marine water, unlike most marine mammals that instead rely on subcutaneous fat reserves. They also rely on a high rate of food consumption to stay warm. Consequently, they are active, persistent foragers, spending 20 to 50 percent of their day actively foraging. The species exhibits limited migratory behavior compared with many other large marine organisms, such as sea turtles and other marine mammals, due to this physiological constraint.

Individuals raft in groups or may rest alone when not foraging. Resting is more typical among kelp canopies, although open water rafting does occur. Larger groups more typically contain males. Sea otters rarely haulout onto land. Males typically maintain one of two ranging behaviors: remaining within a limited territorial range or movement between multiple range centers over a larger total range. Females are usually more sedentary than males, typically ranging no more than 12 mi (19 km).

Mating and pupping occur throughout the year, although peak pupping occurs from October through January and a secondary peak occurs from March through April. Females typically birth a single pup and provide maternal care for up to 6 months after birth.

During the 18th and early 19th century, hunting of sea otters for their pelts led to near extirpation throughout their range. Since protections were implemented in 1911, southern sea otters have gradually expanded from a small number of surviving individuals near Bixby Creek in Monterey County. Large mortality events have also occurred from domoic acid poisoning in connection with red tide events (naturally occurring phytoplankton blooms). Great white shark (*Carcharodon carcharias*) attacks are currently the primary cause of mortality for southern sea otters; shark attacks account for more than 50 percent of recovered carcasses.

Southern sea otters in the Diablo Canyon action area belong to the Mendocinian Ecoregion, which includes the northernmost portions of the southern sea otters' historical range, from about Newport, Oregon, in the north to Cape Mendocino, California, in the south. This ecoregion is further divided into subpopulations. The Central Coast subpopulation is estimated at 694 sea otters (3-year average) as of 2019. The 5-year trend is negative at an average loss of 3.9 percent per year. Available habitat within the 131 ft (40 m) depth contour is 113 mi^2 (293 km^2), putting the estimated carrying capacity of this region at 1,064 individuals.

Since 1982, the CDFW has conducted surveys to monitor the southern sea otter population in California. Scientists of the USGS, CDFW, FWS, and Monterey Bay Aquarium and experienced volunteers cooperatively conduct these surveys. The spring surveys have traditionally been used to assess population status because they are both consistently higher than fall surveys and show less variability (CDFW 2024-TN10256). The fall survey data supplement the spring data to provide the necessary information to assess female reproductive rates and changes in reproductive success through time (CDFW 2024-TN10256). As of 2019, the most recent year a full census was completed, the range-wide population index for southern sea otters had increased to 2,962 individuals (88 FR 64870-TN10112). This number is far below the carrying capacity of California but well above the roughly 50 animals that remained in 1914 (88 FR 64870-TN10112).

In connection with these survey efforts, PG&E has permission from the CDFW to secure and collect sea otter carcasses found on the Diablo Canyon site or in surrounding marine waters. PG&E reports and turns over these carcasses to the CDFW to support the CDFW's sea otter monitoring program, in accordance with a CDFW letter dated September 15, 2021, that authorizes PG&E to conduct this activity (PG&E 2024-TN10032). PG&E has not collected any sea otter carcasses within the past 5 years, and PG&E has never identified either an injured otter or an otter carcass whose injury or death was attributable to Diablo Canyon operations (PG&E 2024-TN10032).

Within the action area, groups of up to approximately 30 southern sea otters regularly occur within Intake Cove. These animals typically stay overnight within the cove and disperse to offshore foraging areas during the day. Southern sea otters also raft in Diablo Cove and at Lion Rock. In connection with decommissioning planning, PG&E conducted visual surveys for sea otters from the site's coast from 2017 through 2020; observers recorded 279 otter sightings (PG&E 2023-TN9822).

3.8.1.3 Endangered Species Act: Federally Listed Species and Critical Habitats Under National Marine Fisheries Service Jurisdiction

The NRC staff identified 30 species, evolutionarily significant units (ESUs), or distinct population segment (DPSs) under NMFS jurisdiction that may occur in the action area. These species are federally listed as endangered or threatened under the ESA or are candidates for future listing. The NRC staff reviewed the ER, the NMFS's critical habitat mapper and available ecological surveys, and other records to determine whether suitable habitat for each species occurs in the action area and whether the species itself may occur in the action area.

Seven species have been documented in the action area in ecological surveys: black abalone (*Haliotus cracherodii*), sunflower sea star (*Pycnopodia helianthoides*), green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), gray whale (*Eschrichtius robustus*), humpback whale (*Megaptera novaeangliae*), and stellar sea lion (*Eumetopias jubatus*). Several additional species, including various whales and the Guadalupe fur seal (*Arctocephalus townsendi*), may occur offshore but are unlikely to occur within the action area itself. The remaining species do not occur in the action area due to a lack of suitable habitat or lack of positive identification during appropriately timed ecological surveys. Notably, although the NMFS's (2006-TN7502) biological opinion allows for the incidental take of leatherback sea turtles (*Dermochelys coriacea*) and Pacific olive ridley sea turtles (*Lepidochlys olivacea*), these species have never been collected at the site. Nonetheless, this section describes these species in more detail.

Designated critical habitat of the black abalone, humpback whale, and leatherback sea turtle also occurs in the action area.

Table 3-12 summarizes the results of the NRC staff's evaluation, including the habitat requirements and information on the occurrence of each species within the action area. The remainder of the section describes the black abalone, sunflower sea star, gray and humpback whales, and sea turtles, as well as the designated critical habitats of these species, in detail. Although stellar sea lions occur in the action area, individuals in this region are part of the Eastern DPS, which the NMFS delisted due to recovery in 2020 (78 FR 66140-TN10609). For this reason, this section does not address this species in detail beyond the information in Table 3-12.

Table 3-12 Occurrences of Federally Listed Species Under National Marine Fisheries Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
Chinook salmon (*Oncorhynchus tshawytscha*), California Coastal ESU	FT	Freshwater streams, estuaries, and associated wetlands (eggs, larvae, juveniles, and spawning) and ocean (adults). In North America, Chinook salmon range from the Monterey Bay area of California to the Chukchi Sea area of Alaska.	Not present. Species is unlikely to occur within the action area due to lack of known spawning sites in the area (Tenera 2021-TN10249).
Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley Spring-Run ESU	FT	Same as California Coastal ESU.	Not present. Same as California Coastal ESU.
Chinook salmon (*Oncorhynchus tshawytscha*), Sacramento River Winter-Run ESU	FE	Same as California Coastal ESU.	Not present. Same as California Coastal ESU.
Chinook salmon (*Oncorhynchus tshawytscha*), Upper Klamath and Trinity Rivers ESU	FC	Same as California Coastal ESU.	Not present. Same as California Coastal ESU.
green sturgeon (*Acipenser medirostris*)	FT	Freshwater streams (eggs, larvae, juveniles, and spawning) and ocean (adults). Range from Alaska to Mexico but are mostly encountered north of Point Conception, California.	Not present. Species is unlikely to occur within the action area (Tenera 2021-TN10249).
scalloped hammerhead shark (*Sphyrna lewini*)	FE	Temperate and tropical seas along coastal zones and in adjacent deep water of 72°F (22°C) or more.	Not present. Species is unlikely to occur within the action area (Tenera 2021-TN10249).

Table 3-12 Occurrences of Federally Listed Species Under National Marine Fisheries Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
steelhead (*Oncorhynchus mykiss irideus*), California Central Valley DPS	FT	Freshwater streams (eggs, larvae, juveniles, and spawning) and ocean (adults).	Not present. Steelhead salmon have been documented in Coon Creek, which enters the ocean approximately 4 mi (6 km) upcoast of the action area. The species includes a non-migratory form called rainbow trout that remains resident in rivers after spawning and does not migrate to the ocean. While *O. mykiss irideus* were documented in Diablo Creek in 2005, the mouth of Diablo Creek is assumed to be impassible to steelhead salmon in the creek and, therefore, researchers assumed that these fish did not migrate to the ocean and were not part of the listed steelhead population. (Tenera 2021-TN10249)
steelhead (*Oncorhynchus mykiss irideus*), Central California Coast DPS	FT	Same as California Central Valley DPS.	Not present. Same as California Central Valley DPS.
steelhead (*Oncorhynchus mykiss irideus*), Northern California DPS	FT	Same as California Central Valley DPS.	Not present. Same as California Central Valley DPS.
steelhead (*Oncorhynchus mykiss irideus*), South-Central DPS	FT	Same as California Central Valley DPS.	Not present. Same as California Central Valley DPS.
steelhead (*Oncorhynchus mykiss irideus*), Southern California DPS	FE	Same as California Central Valley DPS.	Not present. Same as California Central Valley DPS.
black abalone (*Haliotus cracherodii*)	FE	Rocky substrates in intertidal and shallow subtidal reefs (to about 18 ft [5 m] deep) along the coast in habitats with complex surfaces and deep crevices that provide shelter and in areas that experience extreme variations in temperature, salinity, moisture, and wave action. The species range is from about Point Arena,	Resident. Black abalone were first observed in Diablo Cove in 1988 and continue to exist in this cove (PG&E 2023-TN9822). Tenera (Tenera 2021-TN10249: Appendix 1, Tenera 2021-TN10249: Appendix 2) performed targeted surveys for the species in Intake Cove and Diablo Cove. Researchers identified one black abalone on the east breakwater and three on the west breakwater

Table 3-12 Occurrences of Federally Listed Species Under National Marine Fisheries Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
		California, to Bahia Tortugas and Isla Guadalupe, Mexico.	associated with Intake Cove (PG&E 2024-TN10611).
sunflower sea star (*Pycnopodia helianthoides*)	FPT	Considered a habitat generalist with no clear associations with specific habitat types or features. Can inhabit temperate waters of outer coasts, kelp forests, rocky intertidal shoals, and inside waters, which consist of glacial fjords, sounds, embayments, and tidewater glaciers.	Not present. Sunflower sea stars occurred in intertidal habitat within the action area in low numbers during ecological surveys associated with CWA Section 316(a) demonstrations in the 1980s. However, the species is now considered functionally extinct in California waters and has not been documented in California since sea star wasting disease caused a precipitous decline roughly a decade ago.
blue whale (*Balaenoptera musculus*)	FE	Along the West Coast of the United States, blue whales spend winters off of Mexico and Central America and feed during summer off the coast of the mainland and, to a lesser extent, in the Gulf of Alaska and central North Pacific waters.	Low likelihood of occurrence. Data from GPS satellite tagging between 1993 and 2009 indicate the persistent presence of blue whales within 40 mi (64 km) of the Diablo Canyon site for at least the period from August through September. However, species has not been observed within the action area to date. (PG&E 2023-TN9822)
fin whale (*Balaenoptera physalus*)	FE	Deep, offshore waters of all major oceans, primarily in temperate to polar latitudes. Occur less commonly in the tropics. Occur year-round in a wide range of locations, but the density of individuals in any one area changes seasonally. Most migrate from the Arctic and Antarctic feeding areas in the summer to tropical breeding and calving areas in the winter.	Low likelihood of occurrence. Species may occur offshore but is unlikely to occur within the action area (Tenera 2021-TN10249).
gray whale (*Eschrichtius robustus*), Eastern North Pacific DPS	DL	Found mainly in shallow coastal waters in the North Pacific Ocean, although during migration, they sometimes cross into deeper waters.	Seasonal. Occur in waters near Diablo Canyon during migration from February to May (northbound) and December to February (southbound). During protected species surveys conducted from 2017 to 2020, researchers observed 37

Table 3-12 Occurrences of Federally Listed Species Under National Marine Fisheries Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
			individual gray whales off the coast of Diablo Canyon (Tenera 2021-TN10249).
gray whale (*Eschrichtius robustus*), Western North Pacific DPS	FE	Same as Eastern North Pacific DPS.	Same as Eastern North Pacific DPS.
Guadalupe fur seal (*Arctocephalus townsendi*)	FT	Guadalupe fur seals from the Guadalupe Island rookery regularly forage in California waters between 46 and 310 mi (74 and 500 km) offshore.	Low likelihood of occurrence. Species may occur offshore but is unlikely to occur within the action area (Tenera 2021-TN10249).
humpback whale, Central American DPS (*Megaptera novaeangliae*)	FE	Breed in waters off Central America in the North Pacific Ocean and feed along the West Coast of the United States and southern British Columbia.	Seasonal. Have been regularly observed offshore of Diablo Canyon since 1987. Most common late summer to early winter. In one instance, a humpback whale was observed feeding as close to the Diablo Canyon action area as the seaward side of Diablo Rock (1,640 ft [500 m]) from the discharge) (PG&E 2023-TN9822).
humpback whale (*Megaptera novaeangliae*), Mexico DPS	FT	Breed or winter in the area of mainland Mexico and the Revillagigedo Islands, transit Baja California, and feed in the North Pacific Ocean, primarily off California-Oregon, northern Washington/southern British Columbia, northern and western Gulf of Alaska, and East Bering Sea.	Seasonal. Same as Central American DPS.
killer whale (*Orcinus orca*)	FE	Found in all oceans but are most abundant in colder waters like Antarctica, Norway, and Alaska. Species can also occupy tropical and subtropical waters. Typically found at least 9 mi (15 km) offshore but may also inhabit coastal waters.	Low likelihood of occurrence. Species may occur offshore but is unlikely to occur within the action area (Tenera 2021-TN10249).
North Pacific right whale (*Eubalaena japonica*)	FE	Occur primarily in the Central North Pacific and Bering Sea. Sightings have	Low likelihood of occurrence. Species may occur offshore but is unlikely to occur within the

Table 3-12 Occurrences of Federally Listed Species Under National Marine Fisheries Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
		been reported as far south as central Baja California in the eastern North Pacific, as far south as Hawaii in the central North Pacific, and as far north as the sub-Arctic waters of the Bering Sea and sea of Okhotsk in the summer. Migration patterns are unknown, although it is thought the whales spend the summer in far northern feeding grounds and migrate south to warmer waters, such as southern California, during the winter.	action area (Tenera 2021-TN10249).
sei whale (*Balaenoptera borealis*)	FE	Widely distributed and live in subtropical, temperate, and subpolar waters around the world. Species prefers temperate waters in the mid-latitudes, and can be found in the Atlantic, Indian, and Pacific Oceans.	Low likelihood of occurrence. Species may occur offshore but is unlikely to occur within the action area (Tenera 2021-TN10249).
sperm whale (*Physeter macrocephalus*)	FE	Found in all oceans, although distribution is highly dependent on food sources and suitable conditions for breeding and varies with the sex and age composition of the group. Migrations are not as predictable or well understood as migrations of baleen whales. Some populations appear to have different migration patterns by life history status, with adult males making long oceanographic migrations into temperate waters whereas females and young stay in tropical waters year-round.	Low likelihood of occurrence. Species may occur offshore but is unlikely to occur within the action area (Tenera 2021-TN10249).
Steller sea lion (*Eumetopias jubatus*), Eastern DPS	DL	Inhabit the colder temperate to subarctic waters of the North Pacific Ocean. Haulout and rookery sites	Rare. During protected species surveys conducted from 2017 to 2020, researchers observed a single individual at Lion Rock,

Table 3-12 Occurrences of Federally Listed Species Under National Marine Fisheries Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
		usually consist of beaches (gravel, rocky, or sand), ledges, and rocky reefs.	approximately 0.9 mi (1.4 km) upcoast of the action area (Tenera 2021-TN10249).
green sea turtle (*Chelonia mydas*), East Pacific DPS	FT	Occupy subtropical and temperate regions of the Atlantic, Pacific, and Indian Oceans, and the Mediterranean Sea. In the eastern North Pacific, green turtles have been sighted as far north as southern Alaska, but most commonly occur from southern California to northwestern Mexico.	Occasional occurrence. Since Diablo Canyon began operating, 16 green sea turtles have been collected at the Diablo Canyon cooling water intake structure. All individuals were alive, unharmed, and released back to the ocean. In 2006, NMFS (2006-TN7502) issued a biological opinion that allows for the incidental take of this species under the terms of the current facility operating licenses.
leatherback sea turtle (*Dermochelys coriacea*)	FE	Occur in the Atlantic, Pacific, and Indian Oceans. Nesting beaches are primarily located in tropical latitudes around the world. Western Pacific leatherbacks feed off the Pacific Coast of North America, and migrate across the Pacific to nest in Indonesia, Papua New Guinea, and the Solomon Islands. Eastern Pacific leatherbacks nest along the Pacific Coast of Mexico and Costa Rica, and forage in the south-central and eastern tropical Pacific Ocean.	Low likelihood of occurrence. Although the NMFS's 2006 biological opinion allows for the incidental take of this species at Diablo Canyon, it has never been collected at the site. However, telemetry studies indicate potential feeding areas several miles offshore of the action area, and individuals may migrate closer to adjacent waters to Intake Cove and Diablo Cove (Tenera 2021-TN10249).
loggerhead sea turtle (*Caretta caretta*), North Pacific DPS	FE	Inhabit subtropical and temperate regions of the Atlantic, Pacific, and Indian Oceans, and the Mediterranean Sea. In the eastern Pacific, loggerheads have been reported from Alaska to Chile.	Occasional occurrence. Since Diablo Canyon began operating, one loggerhead sea turtle has been collected at the Diablo Canyon cooling water intake structure. The individual was alive, unharmed, and released back to the ocean. In 2006, NMFS (2006-TN7502) issued a biological opinion that allows for the incidental take of this species under the terms of the

Table 3-12 Occurrences of Federally Listed Species Under National Marine Fisheries Service Jurisdiction in the Diablo Canyon Nuclear Power Plant License Renewal Action Area (Continued)

Species or Critical Habitat	Federal Status[(a)]	Habitat	Type and Likelihood of Occurrence in Action Area
			current facility operating licenses.
Pacific olive ridley sea turtle (*Lepidochlys olivacea*), Mexico's Pacific Coast breeding population	FE	Primarily inhabit the open ocean but also known to inhabit coastal areas. In the Eastern Pacific, they occur from Southern California to Northern Chile. This population breeds along Mexico's Pacific Coast.	Not present. Although the NMFS's 2006 biological opinion allows for the incidental take of this species at Diablo Canyon, it has never been collected at the site. Tenera (2021-TN10249) determined the species to be highly unlikely to occur in the action area.
Pacific olive ridley sea turtle (*Lepidochlys olivacea*), all other populations	FT	Same as above but includes all other breeding locations.	Not present. Same as above.
Critical habitat of the black abalone	FD	Specific Area 10, Montana de Oro State Park to Government Point.	Yes. Critical habitat occurs within the action area in the immediate offshore waters of the Diablo Canyon site.
Critical habitat of the humpback whale	FD	Unit 17, California Central Coast.	Yes. Critical habitat occurs within the action area in the immediate offshore waters of the Diablo Canyon site.
Critical habitat of the leatherback sea turtle	FD	California coastal marine waters.	Yes. Critical habitat occurs within the action area in the immediate offshore waters of the Diablo Canyon site.

DPS = distinct population segment; ESU = evolutionarily significant unit; km = kilometer(s); mi = mile(s); NMFS = National Marine Fisheries Service.

(a) Indicates protection status under the Endangered Species Act. DL = delisted; FC = candidate for Federal listing; FD = federally designated (critical habitat); FE = federally endangered; FPT = federally proposed for listing as threatened; and FT = federally threatened.

Sources: NOAA 2023-TN10258; PG&E 2023-TN9822; Tenera 2021-TN10249, Tenera 2021-TN10249: Appendix 1, Tenera 2021-TN10249: Appendix 2.

Black Abalone

The NMFS listed the black abalone as endangered throughout its range from Point Arena, California, to Bahia Tortugas, Mexico in 2009 (74 FR 1937-TN10259). In 2011, the NMFS designated critical habitat for the species, which is discussed separately below.

Black abalone are marine snails with a single shell, an anterior head, and a large muscular foot. The species is one of eight abalone species that occur within California's marine waters. The species occupies rocky intertidal and subtidal habitats from the upper intertidal to 20 ft (6 m) depth. Individuals most commonly occur in the middle and lower intertidal in habitats with complex surfaces and deep crevices that provide shelter for juvenile recruitment and adult survival. Crustose coralline algae are believed to be an important component of juvenile settlement habitat, whereas attached or drift macroalgae are important food resources for post-metamorphic juvenile and adult black abalone (NMFS 2020-TN10260).

Black abalone are broadcast spawners, and spawning is believed to occur from spring to early autumn. Larval black abalone rely entirely on the egg yolk sac for food (lecithrotrophic) and are understood to drift for 3 to 10 days in the plankton before settling to suitable intertidal habitat. Following settlement, larvae metamorphose into juveniles and occupy cracks and crevices in upper and middle intertidal zones. As they develop, juveniles progress to lower intertidal zones, occupying the undersides of large boulders. Juveniles are less than 1 in. (2.5 cm) in length after their first year and maintain a growth rate of 0.4 to 0.8 in. (1 to 2 cm) per year for the next several years. They attain sexual maturity at a shell length of approximately 2 in. (5 cm). Growth slows around 8 to 10 years of age at a length of about 4 in. (10 cm).

The black abalone population started declining in the late 1980s due to a disease called withering syndrome that is caused by a prokaryotic pathogen that is currently called *Candidatus Xenohaliotis californiensis*. Declines in the population continued through the 1990s with populations as far north as Cambria, north of Diablo Canyon at the northern border of San Luis Obispo County declining in abundance by more than 80 percent. Populations in southern California, south of Point Conception, declined over this period by more than 90 percent. Surveys near Diablo Canyon in the 1970s and early 1980s recorded concentrations of up to 6.9 black abalone per m^2 at sampling stations in Diablo Cove, with the highest densities in the northern part of the cove. By the late 1980s, abundances throughout the area had declined to less than one per m^2. Similar declines are well documented throughout California in scientific studies. For example, at Palos Verdes in southern California average densities were recorded as 1.0 to 6.8 per m^2 in 1975 and 1976. These averages declined to 0.3 per m^2 in 1987. On Santa Cruz Island average densities were recorded as 43–58 per m^2 in 1987 and these averages declined to less than 1 per m^2 in 1993 (Tenera 2021-TN10249).

Because black abalone rely on external fertilization, males and females must be relatively near to one another for successful fertilization. The combination of this reproductive strategy with the limited larval dispersal of black abalone and the low population density has led to breeding among closely related individuals in spatially constrained clusters and subpopulations throughout the species' range. Consequently, the current black abalone population has low levels of gene flow, which may make populations more vulnerable to extinction than a similar sized population with a higher level of gene flow because the reduced genetic variation may make the populations less able to adapt to changes in environmental conditions (Tenera 2021-TN10249).

Black abalone are residents within the action area. The species was first observed in Diablo Cove in 1988 and continues to occupy this cove (PG&E 2023-TN9822). As mentioned above, early surveys near the site recorded concentrations of up to 6.9 black abalone per m^2 in Diablo Cove, with the highest densities in the northern part of the cove. By the late 1980s, abundances throughout the area had declined to less than one per square meter. Most recently, Tenera (Tenera 2021-TN10249: Appendix 1, Tenera 2021-TN10249: Appendix 2) performed targeted surveys for the species in Intake Cove and Diablo Cove. Researchers identified one black abalone on the east breakwater and three on the west breakwater associated with Intake Cove (PG&E 2024-TN10611). All black abalone were found on the seaward sides of the breakwaters. While this study confirmed the continued presence of the species in the action area, researchers did not perform local density or population estimates. Black abalone have also been observed during routine intertidal monitoring surveys along the Diablo Canyon site coastline (PG&E 2024-TN10611).

Black Abalone Critical Habitat

In 2011, the NMFS designated 20 specific areas of black abalone critical habitat encompassing over 139 mi^2 (360 km^2) of intertidal and shallow subtidal rocky habitat in California from Del Mar Landing Ecological Reserve to the Palos Verdes Peninsula (76 FR 66806-TN10261). Within these geographical boundaries, the designation encompasses all rocky intertidal and subtidal habitats from the MHHW line to a depth of 20 ft (6 m) (relative to the MLLW line), as well as coastal marine waters overlying this zone.

In its final rule (76 FR 66806-TN10261), the NMFS identified the five primary constituent elements (PCEs) that are essential to conservation of the species. These PCEs are as follows.

1. **Rocky Substrate**: Suitable rocky substrate includes rocky benches formed from consolidated rock of various geological origins (e.g., igneous, metamorphic, and sedimentary) that contain channels with macro- and micro- crevices or large boulders (greater than or equal to 3.3 ft [1 m] in diameter) and occur from MHHW to a depth of -20 ft (-6 m) relative to MLLW.
2. **Food Resources**: Abundant food resources including bacterial and diatom films, crustose coralline algae, and a source of detrital macroalgae, are required for growth and survival of all stages of black abalone.
3. **Juvenile Settlement Habitat**: Rocky intertidal and subtidal habitat containing crustose coralline algae and crevices or cryptic biogenic structures (e.g., urchins, mussels, chiton holes, conspecifics, anemones) is important for successful larval recruitment and juvenile growth and survival.
4. **Suitable Water Quality**: Suitable water quality includes temperature, salinity, pH, and other chemical characteristics necessary for normal settlement, growth, behavior, and viability of black abalone. The biogeographical water temperature range of black abalone is from 54 to 77°F (12 to 25°C), but they are most abundant in areas where the water temperature ranges from 64.4 to 71.6°F (18 to 22°C).
5. **Suitable Nearshore Circulation Patterns**: Suitable circulation patterns are those that retain eggs, sperm, fertilized eggs, and ready-to-settle larvae enough so that successful fertilization and settlement to suitable habitat can take place. Nearshore circulation patterns are controlled by a variety of factors including wind speed and direction, current speed and direction, tidal fluctuation, geomorphology of the coastline, and bathymetry of subtidal habitats adjacent to the coastline.

The Diablo Canyon action area overlaps with Specific Area 10, which includes rocky intertidal and subtidal habitats from Montaña de Oro, San Luis Obispo County, to just south of Government Point, Santa Barbara County. Within the action area, all PCEs are present.

Sunflower Sea Star

The NMFS proposed the sunflower sea star for listing under the ESA as threatened in 2023 (88 FR 16212-TN10612). The proposed listing does not include critical habitat because the NMFS found such habitat to be currently undeterminable. The information in this section is derived from the NMFS's proposed rule to list the species (88 FR 16212-TN10612) unless otherwise cited.

The sunflower sea star is among the largest sea stars in the world, reaching over 3.3 ft (1 m) in total diameter from ray tip to ray tip across the central disk. Very young sunflower sea stars generally have fewer than a dozen arms, and additional arms are added by budding in symmetrical pairs as the individual grows. Other sea stars in the northern Pacific Ocean with many arms include several sun stars of the genera *Solaster, Crossaster,* and *Rathbunaster;* however, these species generally have 8 to 17 arms, as opposed to the 16 to 20 arms commonly found in sunflower sea stars, and all of these sea stars are considerably smaller and less massive.

The sunflower sea star is a habitat generalist with no clear associations with specific habitat types or features. It inhabits a large geographic and depth range, indicating that it is well-adapted for a wide variety of environmental conditions and habitat types. The species is found along both outer coasts and inside waters, which consist of glacial fjords, sounds, embayments, and tidewater glaciers. Preferring temperate waters, sea stars inhabit kelp forests and rocky intertidal shoals but are regularly found in eelgrass meadows, as well. Sunflower sea stars occupy a wide range of benthic substrates including mud, sand, shell, gravel, and rocky bottoms while roaming in search of prey. They occur in the low intertidal and subtidal zones to a depth of 1,430 ft (435 m) but are most common at depths less than 82 ft (25 m) and rare in waters deeper than 395 ft (120 m).

Most sea star species, including the sunflower sea star, have separate sexes that are externally indistinguishable from one another. Gametes are broadcast through gonopores on each ray into the surrounding seawater and fertilization occurs externally. Fertilized larvae develop through pelagic planktotrophic stages, capturing food with ciliary bands. The reproductive cycle of free-ranging sea stars has not been specifically studied, but one study estimates that the cycle may be from December through June in California.

Larval and pre-metamorphic sunflower sea stars are planktonic feeders and no data exist to suggest a prey preference at this stage. The diet of adult sunflower sea stars generally consists of benthic and mobile epibenthic invertebrates, including sea urchins, snails, crab, sea cucumbers, and other sea stars and appears to be driven largely by prey availability.

In the 1980s, researchers collected sunflower sea stars at multiple intertidal sampling stations within the action area during pre- and post-operational surveys associated with CWA Section 316(a) demonstrations. However, the species was not particularly abundant and averaged about one sea star per station (Tenera 1988-TN10247). The species is now considered functionally extinct in California waters since sea star wasting disease caused a precipitous population decline roughly a decade ago (UCSC 2024-TN10613; Humboldt 2024-TN10614).

In more recent ecological surveys conducted at the Diablo Canyon site in 2020, Tenera (Tenera 2021-TN10249) identified several sea stars along transects covering the intake cove, intake structure, and nearshore intertidal areas. These included bat (*Patiria miniata*), giant-spined (*Pisaster giganteus*), ochre (*P. ochraceus*), serpent (*Amphiodia occidentalis*), spiny brittle (*Ophiothrix spiculata*), and six-rayed (*Leptasterias hexactis*) sea stars. However, researchers did not collect any sunflower sea stars.

<u>Gray Whale, Western North Pacific DPS, and Humpback Whale, Central American DPS and Mexico DPS</u>

The gray whale was classified as endangered under the Endangered Species Conservation Act in 1970 and remained endangered when the ESA was passed in 1973. Since that time, the NMFS has classified and reclassified the species as DPSs. Mostly recently, the NMFS reclassified the Western North Pacific DPS as endangered throughout its range in 1993 (58 FR 3121-TN10615) and delisted the Eastern North Pacific DPS due to recovery in 1994 (59 FR 31094-TN10257).

Gray whales are a large whale species that have a mottled gray body, small eyes located just above the corners of the mouth, and no dorsal fin. Instead, individuals have a dorsal hump about two-thirds of the way back on the body, and a series of small bumps between the dorsal hump and the tail flukes.

Gray whales are found mainly in shallow coastal waters in the North Pacific Ocean, although during migration, they do sometimes cross deep waters far from shore. There are two geographic distributions of gray whales in the North Pacific: (1) the eastern North Pacific stock or DPS, found along the west coast of North America, and (2) the western North Pacific stock or DPS, primarily found along the coast of eastern Asia. Calves are born during migration or in the shallow lagoons and bays of Mexico from early January to mid-February. From mid-February to May, eastern North Pacific gray whales can be seen migrating northward along the U.S. West Coast. Although western and eastern stocks of gray whales were thought to be relatively isolated from each other, recent satellite tagging data and photo-identification and genetic matches have shown that at least some western North Pacific gray whales migrate across the northern Gulf of Alaska, and along the west coast of British Columbia, the United States, and Mexico. (NMFS 2024-TN10304)

Gray whales are frequently observed traveling alone or in small, mostly unstable groups, although large aggregations may be seen in feeding and breeding grounds. Like other baleen whales, long-term bonds between individuals are thought to be rare. Gray whales are primarily bottom feeders that consume a wide range of benthic and epibenthic invertebrates, such as amphipods. Gray whales suck sediment and food from the sea floor by rolling on their sides and swimming slowly along, filtering their food through coarse baleen plates on each side of their upper jaw. (NMFS 2024-TN10304)

Gray whales become sexually mature between 6 and 12 years, with an average of maturity age of 8 to 9 years old. After 12 to 13 months of gestation, females give birth to a single calf (NMFS 2024-TN10304).

Gray whales occur in the action area seasonally. Individuals have been observed near Diablo Canyon during migration from February to May (northbound) and from December to February (southbound). During protected species surveys conducted from 2017 to 2020, researchers observed 37 individual gray whales off the coast of Diablo Canyon (Tenera 2021-TN10249).

The humpback whale was classified as endangered under the Endangered Species Conservation Act in 1970 and remained endangered when the ESA was passed in 1973. In 2016, the NMFS revised the listing of humpback whales by listing 4 DPSs (including the Central American DPS) as endangered, 1 DPS (Mexico DPS) as threatened, and determining that 9 DPSs did not warrant listing (81 FR 62260-TN10263). Humpback whales in the action area belong to the Central American DPS or Mexico DPS. In 2021, the NMFS designated critical habitat for the species, which is discussed separately below.

The humpback whale is distinguished from other baleen whales by extraordinarily long flippers, a more robust body, fewer throat grooves, and complex, repetitive songs during courtship. The back is dark, and the ventral surface of the body and flukes have large areas of white pigmentation.

Humpback whales occur in all ocean basins, but they are less common in Arctic waters. In winter, the species tends to inhabit temperate and tropical waters in both hemispheres, and in summer, individuals move northward to waters of higher biological productivity. Humpback whales are generally considered to inhabit waters over continental shelves, along shelf edges, and around some oceanic islands. Individuals winter in warm waters at a small number of relatively specific locations. Along the northern and central California coastline, humpback whales are common during their feeding season (summer and fall). Whales from the Central American DPS tend to be more frequently observed in the southern parts of the feeding grounds than the Mexico DPS whales. It is expected that almost all the Central American DPS whales feed in California and Oregon. Whales from the Mexico DPS also feed in Washington and Alaskan waters. Whales from the Hawaii DPS, which is unlisted under the ESA, have also been observed feeding in California waters; however, these whales primarily feed in Southeast Alaska, Northern British Columbia, northern Gulf of Alaska, and the Bering Sea (86 FR 21082-TN10264).

Humpback whales consume a diverse diet of small schooling fish and krill. Known prey organisms include species representing *Clupea* (herring), *Scomber* (mackerel), *Ammodytes* (sand lance), *Sardinops* (sardine), *Engraulis* (anchovy), *Mallotus* (capelin), and krill such as *Euphausia, Thysanoessa,* and *Meganyctiphanes*. Humpback whales also exhibit flexible feeding strategies, sometimes foraging alone and sometimes cooperatively. During the winter, humpback whales subsist on stored fat and likely feed little or not at all (80 FR 22304-TN10265).

In the northern hemisphere, individuals become sexually mature at approximately 5 to 11 years of age. Females calf every 1 to 5 years, although every 2 to 3 years is most common, at a rate of 0.38 to 0.50 calves per mature female per year. Gestation lasts 11 to 12 months, and lactation lasts approximately 11 months, after which individuals exhibit maternally directed fidelity to specific feeding regions (80 FR 22304-TN10265).

Humpback whales occur in the action area seasonally. The species has been regularly observed offshore of Diablo Canyon since 1987, and sightings are most common in later summer to early winter. In one instance, a humpback whale was observed feeding as close to the Diablo Canyon action area as the seaward side of Diablo Rock (1,640 ft [500 m] from the discharge) (PG&E 2023-TN9822). From 2017 through 2020, Tenera conducted monthly to biweekly clifftop surveys of marine mammals at several locations within the action area. A total of seven humpback whales were observed over this time period (PG&E 2024-TN10611).

Humpback Whale Critical Habitat

In 2011, the NMFS designated approximately 59,411 square nautical miles (nmi^2) (203,774 km^2) of marine habitat in the North Pacific Ocean, including areas within the eastern Bering Sea and Gulf of Alaska, as critical habitat for the humpback whale (81 FR 62260-TN10263). California Central Coast Unit 17 begins approximately 0.6 mi (1 km) offshore from the Diablo Canyon site. This unit includes waters off southern Monterey County and San Luis Obispo and Santa Barbara counties. Unit 17 covers about 6,697 nmi^2 (22,970 km^2) of marine habitat.

In its final rule (81 FR 62260-TN10263), the NMFS identifies prey as the single physical and biological feature (PBF) essential to the conservation of the species. The final rule describes prey within critical habitat of each of the DPSs with critical habitat.

- **Central American DPS:** Prey species, primarily euphausiids (*Thysanoessa, Euphausia, Nyctiphanes,* and *Nematoscelis*) and small pelagic schooling fishes, such as Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), and Pacific herring (*Clupea pallasii*), of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.
- **Mexico DPS:** The above prey species, as well as capelin (*Mallotus villosus*), juvenile walleye pollock (*Gadus chalcogrammus*), and Pacific sand lance (*Ammodytes personatus*).

Within the action area, Pacific sardine and northern anchovy commonly occur in nearshore areas (see Section 3.7.1.7). The remaining species have not been specifically documented in aquatic surveys.

<u>Green, Leatherback, Loggerhead, and Pacific Olive Ridley Sea Turtles</u>

Sea turtles are marine reptiles with streamlined bodies and large flippers that are well-adapted to life in the ocean. Although sea turtles live most of their lives in the ocean, adult females lay their eggs on land. They migrate hundreds to thousands of miles every year between feeding grounds and nesting beaches. Most species have a worldwide distribution.

The NMFS and the FWS have shared jurisdiction for recovery and conservation of threatened and endangered sea turtles. The NMFS leads the conservation and recovery of sea turtles in the marine environment, while the FWS has the lead for the conservation and recovery of these animals on nesting beaches.

Six species are found in U.S. waters, all of which are listed under the ESA. Within the action area, two of the sea turtle species may occur based on ecological studies and past observations: the East Pacific DPS of the green sea turtle and the leatherback sea turtle.

The NMFS and the FWS jointly listed the green sea turtle as threatened or endangered in 1978. In 2016, the NMFS and the FWS revised this species' listing to divide it into 11 DPSs (81 FR 20058-TN10270). Green sea turtles in the action area belong to the East Pacific DPS, which is listed as threatened.

The green sea turtle has a circumglobal distribution, occurring throughout tropical, subtropical, and, to a lesser extent, temperate waters. Green turtles are generally found in shallow waters (except when migrating) inside reefs, bays, and inlets. The turtles are attracted to lagoons and shoals with an abundance of marine grass and algae. Open beaches with a sloping platform and minimal disturbance are required for nesting. Green turtles have a strong nesting site fidelity and often make long distance migrations between feeding grounds and nesting beaches. Hatchlings have been observed to seek refuge and food in Sargassum rafts. Hatchling green turtles eat a variety of plants and animals, but adults feed almost exclusively on seagrasses and marine algae (NOAA 2023-TN10271).

Since 1977, 16 green sea turtles have been collected at the Diablo Canyon cooling water intake structure. All individuals were alive, unharmed, and released back to the ocean. In 2006, the NMFS (2006-TN7502) issued a biological opinion that allows for the incidental take of this species under the terms of the current facility operating licenses. Incidental take may occur from entrainment into the cooling water intake system and may involve capture, injury, or mortality. Green turtles do not nest in or near the action area and are not expected to occupy terrestrial habitats within the action area.

The leatherback sea turtle was classified as endangered under the Endangered Species Conservation Act in 1970 and remained endangered when the ESA was passed in 1973. In 1979 and 2012, the NMFS and the FWS designated critical habitat for the species, which is discussed separately below.

The leatherback sea turtle is the largest turtle in the world. It is the only species of sea turtle that lacks scales and a hard shell. Leatherback turtles are named for their tough rubbery skin and have existed in their current form since the age of the dinosaurs. Leatherback turtles are highly migratory, some swimming over 10,000 mi (16,100 km) a year between nesting and foraging grounds. Western Pacific leatherbacks feed off the Pacific Coast of North America and migrate across the Pacific to nest in Indonesia, Papua New Guinea, and the Solomon Islands. Eastern Pacific leatherback turtles, on the other hand, nest along the Pacific Coast of Mexico and Costa Rica and forage in the south-central and eastern tropical Pacific Ocean. Generally, individuals remain offshore unless seeking nesting habitat (NOAA 2024-TN10272). Leatherback turtles primary consume jellyfish and other soft-bodied prey, but they also eat seaweed, fish, crustaceans, and other marine invertebrates.

Although the NMFS's 2006 biological opinion allows for the incidental take of this species at Diablo Canyon, it has never been collected at the site. However, telemetry studies indicate potential feeding areas several miles offshore of the action area, and individuals may migrate closer to adjacent waters to Intake Cove and Diablo Cove (Tenera 2021-TN10249). Leatherback turtles do not nest in or near the action area and are not expected to occupy terrestrial habitats within the action area.

The NMFS listed the loggerhead sea turtle as threatened in 1976 (41 FR 24378-TN10616). The NMFS revised this listing several times, and in 2011, the NMFS divided the species into nine DPSs, including the North Pacific DPS, listed as endangered, which is the DPS that may occur in the action area (76 FR 58868-TN10617).

Loggerhead turtles are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. The species nests in temperate and subtropical regions, with scattered nesting in the tropics. Juvenile loggerhead turtles originating from nesting beaches in the western Pacific Ocean appear to use oceanic developmental habitats and move with the predominant ocean gyres for many years before returning to their neritic foraging habitats. Recent resident times of juvenile North Pacific loggerhead turtles foraging at a known hotspot off Baja California were estimated at over 20 years, with turtles ranging in age from 3 to 24 years old. After spending years foraging in the central and eastern Pacific, loggerhead turtles return to their natal beaches for reproduction and remain in the western Pacific for the remainder of their life cycle. Loggerhead turtles feed on gastropods, heteropods, gooseneck barnacles, pelagic purple snails, medusae, pyrosomas, fish eggs, and amphipods.

Until 2024, it was unclear whether the loggerhead sea turtles used or inhabited the immediate action area of Diablo Canyon. However, in June 2024, PG&E collected a single loggerhead turtle that had been entrained at the Diablo Canyon cooling water intake structure (PG&E 2024-TN10618). The individual was alive, unharmed, and released back to the ocean. This is the only occurrence of a loggerhead turtle entrainment since Diablo Canyon began operating and there are no other specific records of this species occurring near the plant.

The NMFS listed the olive ridley sea turtle as threatened in 1978 (43 FR 32800-TN2753). The NMFS has revised the species' listing several times. Nesting populations of olive ridley sea turtles on the Pacific coast of Mexico are endangered while all other populations remain listed as threatened.

Olive ridley sea turtles occur throughout the world, primarily in tropical and sub-tropical waters. Nesting aggregations in the Pacific Ocean are found in the Marianas Islands, Australia, Indonesia, Malaysia, and Japan (western Pacific), and Mexico, Costa Rica, Guatemala, and South America (eastern Pacific). Like leatherback turtles, most olive ridley turtles lead a primarily pelagic existence, migrating throughout the Pacific, from their nesting grounds in Mexico and Central America to the deep waters of the Pacific that are used as foraging areas. While olive ridley turtles generally have a tropical to subtropical range, with a distribution from Baja California, Mexico to Chile, individuals do occasionally venture north, some as far as the Gulf of Alaska. Olive ridley turtles live within two distinct oceanic regions, including the subtropical gyre and oceanic currents in the Pacific. The gyre contains warm surface waters and a deep thermocline preferred by olive ridley turtles. The currents bordering the subtropical gyre, the Kuroshio Extension Current, North Equatorial Current, and the Equatorial Counter Current, all provide for advantages in movement with zonal currents and location of prey species. Olive ridley turtles feed on tunicates, salps, crustaceans, other invertebrates and small fish. Although the NMFS's 2006 biological opinion allows for the incidental take of this species at Diablo Canyon, it has never been collected at the site.

Leatherback Sea Turtle Critical Habitat

In 2012, the NMFS designated additional areas of critical habitat for the leatherback turtle within the Pacific Ocean, including approximately 16,910 mi^2 (43,798 km^2) stretching along the California coast from Point Arena to Point Arguello east of the 9,800 ft (3,000 m) depth contour (77 FR 4170). The action area lies at the southern end of this designation.

The NMFS identified one PCE essential for the conservation of leatherback sea turtles in marine waters off the U.S. west coast: the occurrence of prey species, primarily scyphomedusae (true jellyfish) of the order Semaeostomeae of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development of leatherback turtles.

Within the action area, Semaeostomeae jellyfish may be present, but none have been specifically identified in ecological studies of the area.

3.8.2 Magnuson–Stevens Act: Essential Fish Habitat

Congress enacted the MSA in 1976 to foster long-term biological and economic sustainability of the Nation's marine fisheries (TN9966). The MSA directs the Fishery Management Councils, in conjunction with the NMFS, to designate areas of essential fish habitat (EFH) and to manage marine resources within those areas. The EFH represents the coastal and marine waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity (50 CFR Part 600-TN1342). For each federally managed species, the Fishery Management Councils and the NMFS designate and describe the EFH by life stage (i.e., egg, larva, juvenile, and adult).

The Pacific Fishery Management Council (PFMC) maintains four fishery management plans (FMPs) for the Pacific Coast. These are the Coastal Pelagic Species FMP, the Pacific Coast Groundfish FMP, the Pacific Coast Salmon FMP, and the Highly Migratory Species FMP.

Species managed under three FMPs have EFH within the area that would be affected by the proposed Diablo Canyon LR. These include groundfish species, coastal pelagic species, and highly migratory species.

To determine the relevant EFH species for the NRC staff's LR review, the NRC staff queried the NMFS's EFH Mapper, an online mapping application. The EFH Mapper identified four taxa groups or units that may have EFH within the Pacific Ocean near the Diablo Canyon site: coastal pelagic species, euphausiid (krill), groundfish, and highly migratory species (NMFS 2024-TN10304). The NRC staff compared each species and life stage with habitat characteristics documented in scientific literature and the descriptions of EFH designated by the Fishery Management Councils and the NMFS in relevant fishery management plans and other regulatory documents. Table 3-13 summarizes the results of this review. Summaries of each of the taxa groups and EFH descriptions follow the table.

Table 3-13 Summary of Essential Fish Habitat Species and Life Stages Relevant to Diablo Canyon Nuclear Power Plant License Renewal

Species or Management Unit	Federal Management Plan[d]	EFH Mapper Results[e]	Relevant Species and Life Stages for EFH Analysis
coastal pelagic species complex[a]	CPS	E, L, J, A	All species and life stages
euphausiid (krill)	CPS	E, L, J, A	All species and life stages
groundfish unit[b]	PCG	E, L, J, A	Multiple species[f] and all life stages
highly migratory species unit[c]	HMS	E, L, J, A	Common thresher shark, all life stages

(a) The coastal pelagic species complex includes Pacific sardine (*Sardinops sagax*), Pacific (chub) mackerel (*Scomber japonicas*), northern anchovy (*Engraulis mordax*), Jack mackerel (*Trachurus symmetricus*), and market squid (*Doryteuthis opalescens*).
(b) The groundfish management unit includes over 90 groundfish species.
(c) The highly migratory species management unit includes tuna species, marlin (*Tetrapturus* spp. and *Makaira* spp.), oceanic sharks, sailfishes (*Istiophorus* spp.), and swordfish (*Xiphias gladius*).
(d) CPS = coastal pelagic species; HMS = highly migratory species; and PCG = Pacific Coast groundfish.
(e) E = eggs; L = larvae; J = juveniles; and A = adults.
(f) See Table 3-14 for groundfish species with a high likelihood of occurring in the affected area.

Coastal Pelagic Species Complex

For the purposes of EFH, the PFMC treats Pacific sardine (*Sardinops sagax*), Pacific (chub) mackerel (*Scomber japonicas*), northern anchovy (*Engraulis mordax*), Jack mackerel (*Trachurus symmetricus*), and market squid (*Doryteuthis opalescens*) as a single complex because of similarities in life history and habitat requirements. The four finfishes are schooling fish typically found near the surface. Market squid also form dense schools, especially near spawning grounds. Appendix A of the Coastal Pelagic Fishery Management Plan (PFMC 2024-TN10274) contains distribution, habitat, life history and population abundance information, and Section 2.3.1.2 of the plan contains more detailed information on EFH for these species. This section summarizes EFH and discusses whether this habitat occurs in the affected area.

In support of a future decommissioning permit application package to the USACE, Ramboll (PG&E 2024-TN10611: see enclosed Essential Fish Habitat Assessment prepared by Ramboll) developed a list of federally managed species that are likely to occur within the affected area for

Diablo Canyon decommissioning. Because the affected areas for LR and decommissioning are largely the same, the NRC staff relied upon this list in assessing EFH for the proposed Diablo Canyon LR. Ramboll (2024) determined that all species within the coastal pelagic complex have a high likelihood of occurring within the affected area based on data from past and ongoing aquatic studies.

EFH coastal pelagic species complex is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the Exclusive Economic Zone (EEZ) and above the thermocline where sea surface temperatures range between 50 to 78.8°F (10 to 26°C) (PFMC 2024-TN10274). The southern boundary is the United States-Mexico maritime boundary. The northern boundary is more dynamic and is defined as the position of the 5.6°F (10°C) isotherm, which varies seasonally and annually. This designation applies to all life stages of all species within the complex. Because this designation is broad, all marine waters within the affected area for Diablo Canyon LR are EFH for all life stages of coastal pelagic species.

Euphausiid (Krill)

Krill are also managed under the Coastal Pelagic Fishery Management Plan (PFMC 2024-TN10274). Krill include all species of euphausiids occurring in the West Coast EEZ, including the two most common species, *Euphausia pacifica* and *Thysanoessa spinifera*, as well as *Nyctiphanes simplex*, *Nematocelis difficilis*, *T. gregaria*, *E. recurve*, *E. gibboides*, and *E. eximia*. Within the West Coast EEZ, it is prohibited to fish for, harvest, or land krill in any fishery. Ramboll (PG&E 2024-TN10611: see enclosed Essential Fish Habitat Assessment prepared by Ramboll) determined that krill have a low likelihood of occurring within the affected area for Diablo Canyon LR based on data from past and ongoing aquatic studies.

The EFH designation for all species and life stages of krill extends the length of the West Coast from the shoreline to the 1,000 ft (300 m) isobath and to a depth of 1,300 ft (400 m) (PFMC 2024-TN10274). The designation is based on information about EFH for the two principal species, *Euphausia pacifica* and *Thysanoessa spinifera.* Because this designation is broad, all marine waters within the affected area for Diablo Canyon LR are EFH for all life stages of krill.

Groundfish Unit

The PFMC manages over 90 groundfish species as a unit due to the limited nature of available information on life history and habitat requirements for some groundfish species.

Table 3-14 lists groundfish taxa managed under the groundfish unit that are likely to occur in the Diablo Canyon LR affected area based on data from past and ongoing aquatic studies, grouped by habitat and likelihood of occurrence.

The PFMC defines groundfish EFH to be all waters and substrates in the following areas (PFMC 2023-TN10284):

- Depths less than or equal to 11,500 ft (3,500 m) to MHHW or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 parts per thousand during the period of average annual low flow.
- Seamounts in depths greater than 11,500 ft (3,500 m) as mapped in the EFH assessment geographic information system.
- Areas designated as habitat areas of particular concern not already identified by the above criteria.

Table 3-14 Federally Managed Groundfish Taxa Likely to Occur in the Diablo Canyon Nuclear Power Plant License Renewal Affected Area

Habitat[a]	Taxa	Scientific Name	Likelihood of Occurrence
NBHS	cabezon	*Scorpaenichthys marmoratus*	High
NBHS	rockfish species	*Sebastes* spp.	High
NBHS	lingcod	*Ophiodon elongates*	High
NBHS	kelp greenling	*Hexagrammos decagrammus*	High
NBSS	English sole	*Parophrys vetulus*	High
NBSS	starry flounder	*Platichthys stellatus*	High
NBSS	big skate	*Raja binoculata*	High
NBSS	California skate	*Raja inornata*	High
NBSS	curlfin sole	*Pleuronichthys decurrens*	Low
NBSS	Pacific sanddab	*Pleuronichthys decurrens*	Low
NBSS	sand sole	*Psettichthys melanostictus*	Low
NBSS	all other skates	endemic Arhynchobatidae	Low
NBSS	Dover sole	*Microstomus pacificus*	Low
NBSS	petrale sole	*Eopsetta jordani*	Low
NPWC	leopard shark	*Triakis semifasciata*	High
NPWC	silversides	*Atherinopsidae*	High
NPWC	Pacific whiting	*Merluccius productus*	Low
NPWC	sablefish	*Anoplopoma fimbria*	Low
NPWC	round herring	*Etrumeus teres*	Low
NPWC	Pacific saury	*Cololabis saira*	Low

(a) NBHS = nearshore benthic hard substrate; NBSS = nearshore benthic soft substrate; and NPWC = nearshore pelagic/water column.
Sources: PG&E 2024-TN10611: see enclosed Essential Fish Habitat Assessment prepared by Ramboll; NMFS 2024-TN10304.

Notably, this EFH identification is precautionary because uncertainty still exists about the relative value of different habitats to individual groundfish species and life stages, and thus the actual extent of groundfish EFH. Because this designation is broad, all marine waters within the affected area for Diablo Canyon LR are EFH for all life stages of groundfish.

Highly Migratory Species Unit

The highly migratory species unit includes North Pacific albacore (*Thunnus alalunga*), yellowfin tuna (*T. albacares*), bigeye tuna (*T. obesus*), skipjack tuna (*Katsuwonus pelamis*), and Pacific bluefin tuna (*T. orientalis*), common thresher shark (*Alopias vulpinus*), shortfin mako or bonito shark (*Isurus oxyrinchus*), blue shark (*Prionace glauca*), striped marlin (*Tetrapturus audax*), swordfish (*Xiphias gladius*), and dorado or dolphinfish (*Coryphaena hippurus*).

Because spatial data for highly migratory species EFH is not available on the NMFS's EFH Mapper and because the affected areas for LR and decommissioning are largely the same, the NRC staff relied upon Ramboll's (PG&E 2024-TN10611: see enclosed Essential Fish Habitat Assessment prepared by Ramboll) findings for highly migratory species. Ramboll (PG&E 2024-

TN10611) determined that only one highly migratory species, the common thresher shark, has the potential to occur in the affected area.

EFH for common thresher shark is defined as (PFMC 2024-TN11729):

- **Neonate/early juveniles:** Epipelagic, neritic, and oceanic waters off beaches, in shallow bays, in near surface waters from the U.S.-Mexico EEZ border north to off Santa Cruz (37°N. latitude) over bottom depths of 6 to 400 ft (2 to 120 m), particularly in water less than 100 ft (30 m) deep and to a lesser extent further offshore between 200 to 300 ft (60 to 90 m). Little known of the food of early juveniles; presumably feeds on small northern anchovy and other small, schooling fishes and invertebrates.
- **Late juveniles/subadults:** Epipelagic, neritic, and oceanic waters off beaches and open coast bays and offshore, in near-surface waters from the U.S.-Mexico EEZ border north to off Pigeon Point, California (37° 10' N. latitude) from the 6 ft to 1400 ft (2 m to 430 m) isobaths. Known to feed primarily on northern anchovy, Pacific hake, Pacific mackerel and sardine; secondarily on a variety of other fishes, squid, and pelagic red crab (warm water years). Northern anchovy especially important for juvenile fish less than 63 in. (160 cm) fork length.
- **Adults:** Epipelagic, neritic, and oceanic waters off beaches and open coast bays, in near surface waters from the U.S.-Mexico EEZ border north seasonally to Cape Flattery, Washington from the 40 ft (12 m) isobath westward to about 127° 30' W. longitude north of the Mendocino Escarpment and from the 40 to 1900 ft (12 to 580 m) isobath south of the Mendocino Escarpment. Known to feed primarily on northern anchovy, Pacific hake, Pacific mackerel and sardine; secondarily on a variety of other fishes, squid, and pelagic red crab (warm water years).

The affected area for Diablo Canyon LR contains habitat meeting the definition of EFH for all life stages of common thresher shark.

3.8.3 National Marine Sanctuaries Act: Sanctuary Resources

Congress enacted the NMSA in 1972 to protect areas of the marine environment that have special national significance. The NMSA authorizes the Secretary of Commerce to establish the National Marine Sanctuary System and designate sanctuaries within that system, which includes 16 sanctuaries and two marine national monuments, encompassing more than 600,000 mi^2 (1,554,000 km^2) of marine and Great Lakes waters from Washington State to the Florida Keys, and from Lake Huron to American Samoa. Within these areas, sanctuary resources include any living or nonliving resource of a national marine sanctuary that contributes to the conservation, recreational, ecological, historical, educational, cultural, archaeological, scientific, or aesthetic value of the sanctuary.

NOAA's Office of National Marine Sanctuaries (ONMS) designated a new sanctuary off the coast of central California, the Chumash Heritage National Marine Sanctuary, following review of a 2015 sanctuary nomination submitted by the Northern Chumash Tribal Council. This designation became effective on November 30, 2024 (89 FR 83554-TN11892; 89 FR 95101-TN11891). The purpose of the designation is to increase protection of the ecological, historical, and cultural qualities of the central California coastal marine environment. The designation provides conservation and comprehensive ecosystem-based management to address threats to the nationally significant biological, cultural, and historical resources of the sanctuary.

According to the ONMS, the area within this national marine sanctuary designation is an important and vibrant ecological transition zone with high biological productivity that supports dense aggregations of marine life, including a nationally significant biodiversity of seabirds, marine mammals, invertebrates, and fishes. It serves as headwaters for upwelling that nourishes important ecosystems down current of the proposed sanctuary; however, due to the myriad ongoing and emerging threats to the area from consumptive and non-consumptive human uses and climate change, additional protections are needed. Threats facing these increasingly vulnerable coastal and offshore ecosystems specifically include direct and indirect impacts from offshore energy development, pollution from offshore and onshore sources, increased vessel traffic and transportation, increased coastal development, and other stressors to the ecosystem that compromise its resilience—especially acute and cumulative impacts from climate change. Moreover, there is a need to recognize and promote indigenous cultural heritage of this area, including the bands of Salinan people and the Chumash people, one of the few ocean-going bands among the First Peoples of the Pacific Coast. The marine environments of California’s Central Coast provide a special sense of place to coastal communities and visitors (NOAA 2023-TN10277).

There are a variety of important marine habitats within this area, including sandy beaches, rocky shores, kelp forests and rocky reefs, estuaries and seagrass beds, shallow sandy seafloor areas, deep seafloor environments, and pelagic habitats. These habitats support diverse algae, plants, invertebrates, fish, marine mammals, and seabirds. Sections 3.7 and 3.8 of this SEIS discuss the terrestrial and aquatic ecological resources of the region. Figure 3-7 shows the sanctuary boundaries. Notably, while the proposed sanctuary boundaries extended to the coastline along the Diablo Canyon site, the final boundary encompasses 4,543 mi^2 (3,431 nmi^2) of submerged lands and marine waters from approximately 2 mi (3.2 km) southeast of Diablo Canyon Intake Cove to Naples along the Gaviota Coast in Santa Barbara County (89 FR 83554-TN11892).

3.8.4 Proposed Action

The following sections address the site-specific environmental impacts of Diablo Canyon LR on the environmental issues related to Federally protected ecological resources.

3.8.4.1 *Endangered Species Act: Federally Listed Species and Critical Habitats Under U.S. Fish and Wildlife* Service Jurisdiction

In Section 3.8.1.2 of this SEIS, the NRC staff determined that two federally listed species under FWS jurisdiction occur in the action area, the California red-legged frog and southern sea otter. Section 3.8.1.2 includes relevant information on habitat requirements, life history, and regional occurrence of these species. This section analyzes the potential impacts of the proposed Diablo Canyon LR on these species in detail.

An additional five bird species may occur in the action area as occasional migrants; these species are addressed in Table 3-15 below. In Section 3.8.1.2, the NRC staff also considered an additional 18 species and determined that these species do not occur or are unlikely to occur in the action area; therefore, the NRC staff does not address these species any further because the proposed action of Diablo Canyon LR would have no effect on them.

Table 3-15 identifies the NRC staff’s ESA effect determination for each species, provides a brief justification for the staff’s finding, and lists the date of the FWS’s concurrence, as applicable.

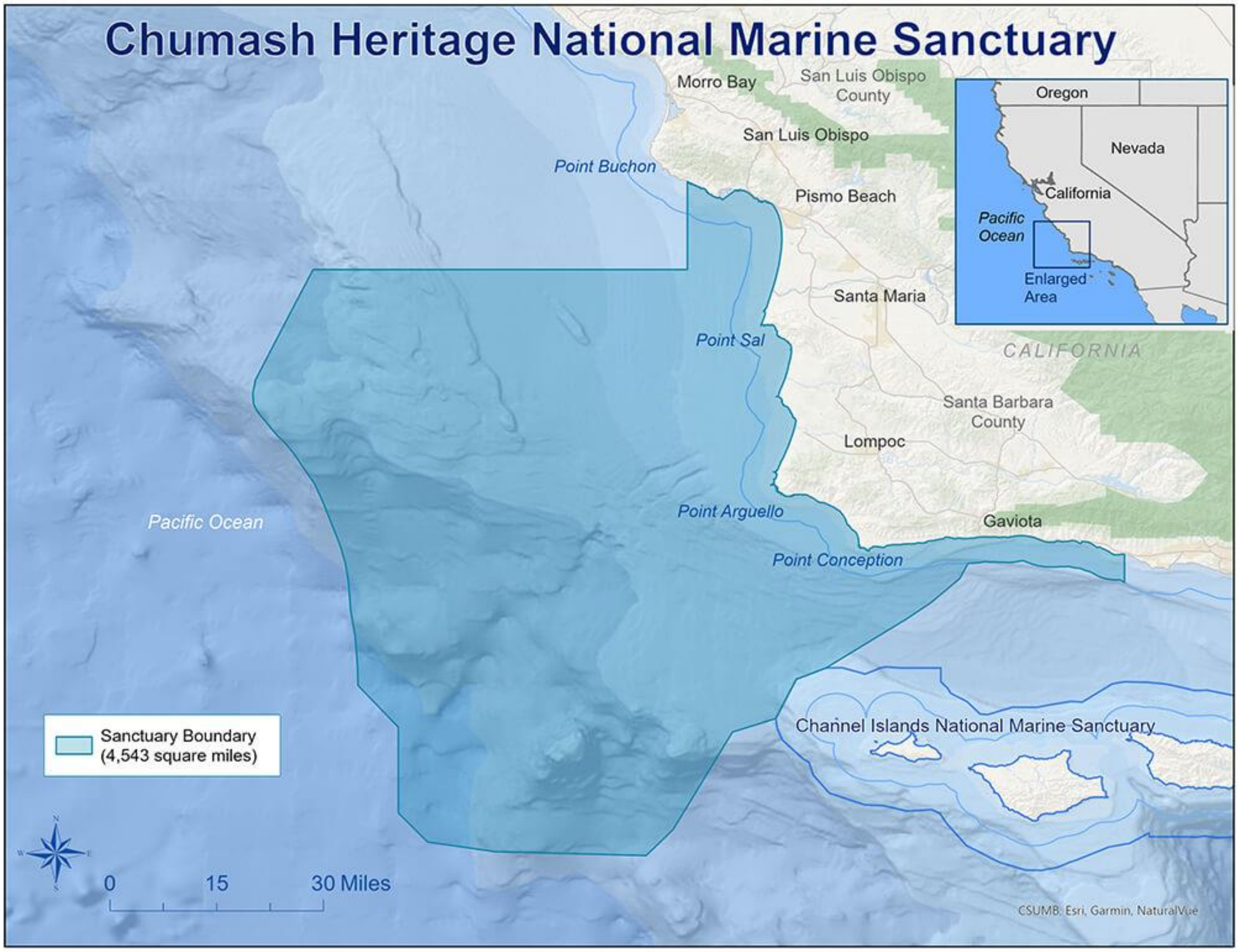


Figure 3-7 Boundaries of the Chumash Heritage National Marine Sanctuary. Source: NOAA 2025-TN11919.

Table 3-15 **Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal**

Species or Critical Habitat	Federal Status[(a)]	Summary of Effects	ESA Effect Determination [(b)]	FWS Concurrence Date[(c)]
California red-legged frog (*Rana draytonii*)	FT	PG&E has implemented protection measures to ensure that California red-legged frogs moving over roadways and paved areas within dispersal zones are unlikely to be injured or killed from vehicle traffic, machinery, and other human activities. Herbicides would only be applied according to labeled uses in developed and manicured areas of the site. Herbicides would not be applied in natural areas. Frogs would only have the potential to occur in treated areas during dispersal and when moving between areas of more suitable habitat, making the likelihood of herbicide exposure low. This represents an insignificant effect because it is unlikely to reach the scale where a take might occur. Continued preservation of the existing high-quality habitats in the action area would result in beneficial impacts on California red-legged frogs.	NLAA	12/20/25
California tiger salamander (*Ambystoma californiense*)	FT	Species does not occur in action area.	NE	n/a
foothill yellow-legged frog (*Rana boylii*)	FT	Species does not occur in action area.	NE	n/a
California clapper rail (*Rallus longirostris obsoletus*)	FE	Species does not occur in action area.	NE	n/a
California condor (*Gymnogyps californianus*)	FE	Mortality or injury of a federally protected bird resulting from collisions with nuclear power plant structures or vehicles has never been recorded at the site and is not expected to occur in the future because site conditions would remain the same during the proposed license renewal term. No behavioral changes are expected from continued noise, human activity, and other industrial site activities. License renewal would cause no habitat loss, degradation, disturbance, or fragmentation.	NLAA	12/20/25

Table 3-15 Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Species or Critical Habitat	Federal Status[(a)]	Summary of Effects	ESA Effect Determination[(b)]	FWS Concurrence Date[(c)]
California least tern (*Sterna antillarum browni*)	FE	See impacts described above for California condor.	NLAA	12/20/25
Hawaiian petrel (*Pterodroma sandwichensis*)	FE	See impacts described above for California condor.	NLAA	12/20/25
least Bell's vireo (*Vireo bellii pusillus*)	FE	Species does not occur in action area.	NE	n/a
marbled murrelet (*Brachyramphus marmoratus*)	FT	See impacts described above for California condor.	NLAA	12/20/25
short-tailed albatross (*Phoebastria albatrus*)	FE	See impacts described above for California condor.	NLAA	12/20/25
western snowy plover (*Charadrius nivosus nivosus*)	FT	Species does not occur in action area.	NE	n/a
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	FT	Action area is outside of species' current known range.	NE	n/a
tidewater goby (*Eucyclogobius newberryi*)	FE	Species does not occur in action area.	NE	n/a
monarch butterfly (*Danaus plexippus*)	FPT	PG&E would continue applying herbicides according to labeled uses but has no plans to apply herbicides in natural areas. The contribution of Diablo Canyon operations to climate change related effects on monarch butterflies would be too small to be meaningfully measured, detected, or evaluated. Continued preservation of the existing high-quality habitats in the action area would result in beneficial impacts on monarchs.	NLAA	n/a
vernal pool fairy shrimp (*Branchinecta lynchi*)	FT	Species does not occur in action area.	NE	n/a
giant kangaroo rat (*Dipodomys ingens*)	FE	Action area is outside of species' current known range.	NE	n/a
southern sea otter (*Enhydra lutris nereis*)	FT	Southern sea otters in the action area have become acclimated to the industrial nature of the site and do not appear to be affected by noise and other human activities. Southern sea otters are not subject to impingement or entrainment. Prey of otters are generally not impinged or entrained, and thermal	NLAA	12/20/25

Table 3-15 Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Species or Critical Habitat	Federal Status[(a)]	Summary of Effects	ESA Effect Determination[(b)]	FWS Concurrence Date[(c)]
		effects on prey have not been documented. Continued preservation of the existing high-quality habitats in the action area would result in beneficial impacts on southern sea otters.		
California jewelflower (*Caulanthus californicus*)	FE	Species does not occur in action area.	NE	n/a
Chorro Creek bog thistle (*Cirsium fontinales* var. *obispoense*)	FE	Species does not occur in action area.	NE	n/a
Indian knob mountainbalm (*Eriodictyon altissimum*)	FE	Species does not occur in action area.	NE	n/a
marsh sandwort (*Arenaria paludicola*)	FE	Species does not occur in action area.	NE	n/a
Morro manzanita (*Arctostaphylos morroensis*)	FT	Species does not occur in action area.	NE	n/a
Pismo clarkia (*Clarkia speciosa* ssp. *immaculata*)	FE	Species does not occur in action area.	NE	n/a
salt marsh bird's-beak (*Cordylanthus maritimus* ssp. *maritimus*)	FE	Species does not occur in action area.	NE	n/a
spreading navarretia (*Navarretia fossalis*)	FT	Species does not occur in action area.	NE	n/a

(a) Indicates protection status under the Endangered Species Act. FE = federally endangered; FPT = proposed for federal listing as threatened; and FT = federally threatened.
(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and NMFS Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). NE = no effect and NLAA = may affect but is not likely to adversely affect.
(c) Source: FWS 2025-TN11893. The ESA does not require Federal agencies to seek FWS concurrence for "not likely to adversely affect" determinations for proposed species or for "no effect" determinations. n/a = not applicable.

3.8.4.1.1 California Red-Legged Frog

In Section 3.8.1.2 of this SEIS, the NRC staff concludes that the California red-legged frog is a resident within the action area. In a targeted survey for the species in March 2020, Terra Verde (Terra Verde 2020-TN10098) documented one individual in a pool formed by the outlet of the culvert that runs under the 500 kV and 230 kV switchyards. Additional areas of the site may provide suitable habitat, including Middle Diablo Creek (dispersal); Tom's Pond (reproduction); an ephemeral drainage and a retention basin (marginal seasonal use); and two small wetlands (temporary refuge and dispersal).

Potential direct impacts to the California red-legged frog include injury or mortality associated with vehicle traffic, machinery, and other human activities on the Diablo Canyon site during routine maintenance and surveillance activities. The culvert where the California red-legged frog individual was observed in 2020 is part of Diablo Creek, and it lies adjacent to a private site access road. Uphill from the creek are two switchyards, the ISFSI, various equipment buildings and laydown areas, and raw water reservoirs. California red-legged frogs are known to disperse up to 1.7 mi (2.8 km) from breeding habitat (FWS 2005-TN10286). Therefore, frogs could move over these roadways and paved areas during dispersal.

To date, PG&E is not aware of any instances of California red-legged frog injuries or mortalities from vehicle traffic, machinery, and other human activities on the Diablo Canyon site. Following discovery of the California red-legged frog on the site in 2020, PG&E incorporated protection measures into its site procedures to ensure that frogs are not harmed during routine site activities. These protection measures are as follows:

- do not handle any frogs
- a biological monitor shall be present for any activities with potential to impact California red-legged frog in Diablo Creek, such as vegetation management, moving of heavy equipment or materials, or ground disturbance
- work within Diablo Creek should be limited to the dry season (May through October)
- look for frogs when lifting materials, such as plastic or plywood, moving equipment, or storage bins
- minimize standing water to the greatest extent possible
- collect and remove all trash daily
- keep all hazardous materials at least 100 ft (30.5 m) from Diablo Creek (e.g., fuel, oil, or other harmful chemicals)
- respond to spills, leaks, and drips immediately to protect adjacent water quality
- drive slowly (5 mph) on the north access road between Gate Charlie and Gate Alpha when it’s wet, foggy, or dark outside

If any frog is found, PG&E personnel and contractors must:

- stop work near the frog and carefully secure a buffer of at least 50 ft (15.2 m) around the frog
- call Environmental Operations
- monitor the frog to ensure it will not be harmed; expand the buffer if necessary
- continue monitoring until input is received, or the frog leaves the work site
- work may not resume until the frog has left on its own volition or the area can be entirely isolated and protected from operations

Additionally, as a result of ESA consultation with the FWS, PG&E agreed to implement an additional measure requiring onsite personnel and contractors to receive training on how to identify, avoid, and report California red-legged frogs (FWS 2024-TN11893). On-site personnel and contractors will receive a training on how to identify, avoid, and report California red-legged frogs.

Adherence to the above measures would reduce the likelihood of injury or mortality of California red-legged frogs during the proposed Diablo Canyon LR term such that, based on the NRC staff's best judgement, injury or mortality is extremely unlikely to occur. Accordingly, this represents an insignificant effect.

During the proposed Diablo Canyon LR period, PG&E would continue applying herbicides, as needed, according to labeled uses, but has no plans to apply herbicides in natural areas. Application would primarily be confined to industrial-use and other developed portions of the site, such as perimeters of parking lots, roads, and walkways. Continued herbicide application could directly affect frogs in the action area by injuring or killing individuals exposed to these chemicals. California red-legged frogs are only likely to occur in areas treated with herbicides when dispersing from breeding areas or otherwise moving between areas of more suitable habitat. Because of the low likelihood of frogs to be exposed to hazardous levels of chemicals, this potential impact is insignificant because it is unlikely to reach the scale where a take might occur.

In addition to direct impacts, the NRC staff considered indirect impacts. In the Information for Planning and Conservation database, the FWS identifies several generic indirect impacts that the California red-legged frog may experience from agency actions. These include any activities that would affect (1) the quality or quantity of algae, emergent aquatic vegetation, or freshwater resources (i.e., natural and human-made, permanent or semi-permanent pools, springs, and ponds that frogs may use as habitat); (2) upland areas within 1 to 2 mi (1.6 to 3.2 km) of breeding sites; (3) water quality (salinity, temperature, or other parameters); (4) the condition of habitat in general; or (5) California red-legged frog prey. None of the activities associated with Diablo Canyon LR alter, degrade, or disturb existing freshwater or riparian habitats in the action area. The LR would preserve existing high-quality habitats within the action area, which would result in beneficial impacts on the California red-legged frog.

Conclusion for the California Red-Legged Frog

All potential effects on the California red-legged frog resulting from the proposed action would be insignificant. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to adversely affect* the California red-legged frog.

On October 30, 2024, the NRC staff requested FWS concurrence with this determination (NRC 2024-TN11894). The FWS provided its concurrence by letter dated December 20, 2024 (FWS 2024-TN11893). The letter documents that the NRC has fulfilled its obligations under ESA Section 7(a)(2) with respect to this species.

3.8.4.1.2 Southern Sea Otter

In Section 3.8.1.2 of this SEIS, the NRC staff determined that the southern sea otter is a resident within the action area. PG&E (2023-TN9822) reports regular sightings of this species at the site, and females and pups are known to frequent Intake Cove in groups of up to 30 individuals.

The primary direct impacts that southern sea otters could experience from the proposed action of Diablo Canyon LR is altered behavior in the form of avoidance of the Intake Cove or Diablo Cove areas from noise and other human activities on the Diablo Canyon site. However, otters in the area have become acclimated to the industrial nature of the site and do not appear to avoid the area. On the contrary, otters regularly inhabit Intake Cove in large groups. Based on the

NRC staff's best judgement, the continued operation of Diablo Canyon during the proposed LR term is unlikely to result in behavioral changes that would be able to be meaningfully measured, detected, or evaluated. Accordingly, this represents an insignificant effect.

Otters are strong swimmers and are, therefore, not at risk of impingement or entrainment into the cooling water intake system. As explained in Section 3.7.5.1 of this SEIS, cut-outs between the closure gate forebays and the two bar rack bays at each end of the intake structure provide a migration route for aquatic organisms out of the intake structure. PG&E has reported no discoveries of sea otters trapped or otherwise entrained into Diablo Canyon's cooling water intake system, and the NRC staff identified no information indicating that this would be a risk during the proposed LR term.

In addition to direct impacts, the NRC staff considered indirect impacts. The primary indirect impact would be the potential reduction in available prey from impingement, entrainment, or thermal effects on these organisms. Although abalone and urchins were major food sources for sea otters when they first colonized the area surrounding Diablo Canyon, Benech (1996-TN10305) documents the decline of both abalone and urchins as part of the Diablo Canyon sea otter diet beginning in the late 1970s. For instance, between 1973 and 1978, abalone and urchins constituted an average of 73 percent of the sea otters' diet, but these food sources' prevalence decreased to an average of 41 percent between 1979 and 1981 and further decreased to an average of 20 percent between 1982 and 1995. Because this dietary composition shift appears to have been concurrent with the sea otters' colonization of the area, Benech (1996-TN10305) attributed the shift to constant sea otter predation, which reduced the availability of abalone and urchins as food sources and, in turn, reduced their desirability to sea otters as foods items. Beginning in the early 1980s, sea otters shifted their major food source to snails, mussels, clams, and octopus, which are more abundant in the area, without any measurable impact on the sea otter population size or health (Benech 1996-TN10305). These species are generally not impinged or entrained into Diablo Canyon's cooling water intake system, and thermal effects on these species have not been documented (see Sections 3.7.5.1 and 3.7.5.2). Therefore, the potential for Diablo Canyon operations during the proposed LR period to reduce the availability of sea otter prey represents an insignificant effect.

While Diablo Canyon continues to operate, public access to Intake Cove, Diablo Cove, and other nearshore marine areas will remain prohibited. Therefore, LR would preserve existing high-quality nearshore marine habitats within the action area, which would result in beneficial impacts on the southern sea otter.

Conclusion for the Southern Sea Otter

All potential effects on the southern sea otter resulting from the proposed action would be insignificant or discountable. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to adversely affect* the southern sea otter.

On October 30, 2024, the NRC staff requested FWS concurrence with this determination (NRC 2024-TN11894). The FWS provided its concurrence by letter dated December 20, 2024 (FWS 2024-TN11893). The letter documents that the NRC has fulfilled its obligations under ESA Section 7(a)(2) with respect to this species.

3.8.4.2 *Endangered Species Act: Federally Listed Species and Critical Habitats Under National Marine Fisheries Service Jurisdiction*

In Section 3.8.1.3 of this SEIS, the NRC staff determined that five federally listed species under NMFS jurisdiction occur in the action area: black abalone, green sea turtle, loggerhead sea turtle, gray whale, and humpback whale. Section 3.8.1.3 of this SEIS includes relevant information on habitat requirements, life history, and regional occurrence of these species. Additionally, critical habitats of three federally listed species occur in the action area: black abalone, humpback whale, and leatherback sea turtle. This section analyzes the potential impacts of the proposed Diablo Canyon LR on these species and habitats in detail. Additionally, this section considers the leatherback sea turtle and the Pacific olive ridley sea turtle because these species are included in the NMFS's 2006 biological opinion, although they have never been documented at the site. Although stellar sea lions occur in the action area, individuals in this region are part of the Eastern DPS, which the NMFS delisted due to recovery in 2020 (78 FR 66140-TN10609). Finally, while Section 3.8.1.3 of this SEIS evaluates the sunflower sea star in detail, as this species is considered to be functionally extinct in California. For these reasons, this section does not address the stellar sea lion or the sunflower sea star in detail beyond the information in Table 3-16.

In Section 3.8.1.3 of this SEIS, the NRC staff also considered additional taxa, including ESUs and DPSs of certain species, and determined that these taxa do not occur or are unlikely to occur in the action area; therefore, the staff does not address these taxa any further because LR would have no effect on them.

Table 3-16 identifies the NRC staff's ESA effect determination for each species, provides a brief justification for the staff's finding, and lists the date of NMFS concurrence (in the case of "not likely to adversely affect" findings) or the NMFS's "may affect" determination for species addressed in the NMFS's biological opinion, as applicable.

Table 3-16 Effect Determinations for Federally Listed Species Under National Marine Fisheries Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal

Species or Critical Habitat	Federal Status[a]	Summary of Effects	ESA Effect Determination[b]	NMFS Concurrence Date[c]
Chinook salmon (*Oncorhynchus tshawytscha*), California Coastal ESU	FT	Species does not occur in action area.	NE	n/a
Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley Spring-Run ESU	FT	Species does not occur in action area.	NE	n/a
Chinook salmon (*Oncorhynchus tshawytscha*), Sacramento River Winter-Run ESU	FE	Species does not occur in action area.	NE	n/a
Chinook salmon (*Oncorhynchus tshawytscha*), Upper Klamath and Trinity Rivers ESU	FC	Species does not occur in action area.	NE	n/a

Table 3-16 Effect Determinations for Federally Listed Species Under National Marine Fisheries Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Species or Critical Habitat	Federal Status[(a)]	Summary of Effects	ESA Effect Determination[(b)]	NMFS Concurrence Date[(c)]
green sturgeon (*Acipenser medirostris*)	FT	Species does not occur in action area.	NE	n/a
scalloped hammerhead shark (*Sphyrna lewini*)	FE	Species does not occur in action area.	NE	n/a
steelhead (*Oncorhynchus mykiss irideus*), California Central Valley DPS	FT	Species does not occur in action area.	NE	n/a
steelhead (*Oncorhynchus mykiss irideus*), Central California Coast DPS	FT	Species does not occur in action area.	NE	n/a
steelhead (*Oncorhynchus mykiss irideus*), Northern California DPS	FT	Species does not occur in action area.	NE	n/a
steelhead (*Oncorhynchus mykiss irideus*), South-Central DPS	FT	Species does not occur in action area.	NE	n/a
steelhead (*Oncorhynchus mykiss irideus*), Southern California DPS	FE	Species does not occur in action area.	NE	n/a
black abalone (*Haliotus cracherodii*)	FE	Continued thermal effluent discharges may cause black abalone to avoid the region of highest water temperatures immediately adjacent to the discharge structure. Because the plant has been operating for several decades, this would result in continued avoidance rather than displacement of individuals. PG&E would continue to monitor the black abalone population in accordance with the NPDES permit.	NLAA	4/22/2025
sunflower sea star (*Pycnopodia helianthoides*)	FPT	Species is functionally extinct in California.	NE	n/a
blue whale (*Balaenoptera musculus*)	FE	Species does not occur in action area.	NE	n/a
fin whale (*Balaenoptera physalus*)	FE	Species does not occur in action area.	NE	n/a
gray whale (*Eschrichtius robustus*), Eastern North Pacific DPS	DL	DPS is delisted.	n/a	n/a

Table 3-16 Effect Determinations for Federally Listed Species Under National Marine Fisheries Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Species or Critical Habitat	Federal Status[(a)]	Summary of Effects	ESA Effect Determination[(b)]	NMFS Concurrence Date[(c)]
gray whale (*Eschrichtius robustus*), Western North Pacific DPS	FE	Whales are not subject to impingement or entrainment and do not use areas affected by thermal effluent discharges. Impingement, entrainment, and thermal impacts on prey species would be minimal.	NLAA	4/22/2025
humpback whale, Central American DPS (*Megaptera novaeangliae*)	FE	Whales are not subject to impingement or entrainment and do not use areas affected by thermal effluent discharges. Impingement, entrainment, and thermal impacts on prey species would be minimal.	NLAA	4/22/2025
humpback whale (*Megaptera novaeangliae*), Mexico DPS	FT	See impacts described above for Central American DPS.	NLAA	4/22/2025
killer whale (*Orcinus orca*)	FE	Species does not occur in action area.	NE	n/a
North Pacific right whale (*Eubalaena japonica*)	FE	Species does not occur in action area.	NE	n/a
sei whale (*Balaenoptera borealis*)	FE	Species does not occur in action area.	NE	n/a
sperm whale (*Physeter macrocephalus*)	FE	Species does not occur in action area.	NE	n/a
Steller sea lion (*Eumetopias jubatus*), Eastern DPS	DL	DPS is delisted.	n/a	n/a
green sea turtle (*Chelonia mydas*), East Pacific DPS	FT	Occasional entrainment of individuals would constitute take under the ESA and could result in injury or mortality. All other impacts would be insignificant or discountable.	LAA	4/22/2025
leatherback sea turtle (*Dermochelys coriacea*)	FE	Rare entrainment of individuals would constitute take under the ESA and could result in injury or mortality. All other impacts would be insignificant or discountable.	LAA	4/22/2025
loggerhead sea turtle (*Caretta caretta*), North Pacific DPS	FE	Occasional entrainment of individuals would constitute take under the ESA and could result in injury or mortality. All other impacts would be insignificant or discountable.	LAA	4/22/2025

Table 3-16 Effect Determinations for Federally Listed Species Under National Marine Fisheries Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Species or Critical Habitat	Federal Status[a]	Summary of Effects	ESA Effect Determination[b]	NMFS Concurrence Date[c]
Pacific olive ridley sea turtle (*Lepidochlys olivacea*), Mexico's Pacific Coast breeding population	FE	Rare entrainment of individuals would constitute take under the ESA and could result in injury or mortality. All other impacts would be insignificant or discountable.	LAA	4/22/2025
Pacific olive ridley sea turtle (*Lepidochlys olivacea*), all other populations	FT	Rare entrainment of individuals would constitute take under the ESA and could result in injury or mortality. All other impacts would be insignificant or discountable.	LAA	4/22/2025
Critical habitat of the black abalone	FD	Diablo Canyon's thermal effluent would continue to affect water temperature (PCE 4), but black abalone survey results indicate that the population is not being measurably affected by plant operations. The NPDES permit limits thermal effluents, and PG&E would continue to monitor the black abalone population in accordance with the NPDES permit.	NLDAM	4/22/2025
Critical habitat of the humpback whale	FD	Two prey species (Pacific sardine and northern anchovy) identified in the PBF are present in the action area. Impingement, entrainment, and thermal impacts on these species would be minimal.	NLDAM	4/22/2025
Critical habitat of the leatherback sea turtle	FD	The PCE (Semaeostomeae jellyfish) is not present in the action area.	NE	4/22/2025

DPS = distinct population segment; ESA = Endangered Species Act; ESU = evolutionarily significant unit; n/a = not applicable; NMFS = National Marine Fisheries Service; NPDES = National Pollutant Discharge Elimination System; PBF = physical or biological feature; PCE = primary constituent element; PG&E = Pacific Gas and Electric Company.

(a) Indicates protection status under the Endangered Species Act. DL = delisted; FC = candidate for Federal listing; FD = federally designated (critical habitat); FE = federally endangered; FPT = federally proposed for listing as threatened; and FT = federally threatened.

(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and NMFS Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). LAA = may affect and is likely to adversely affect; NE = no effect; NLAA = may affect but is not likely to adversely affect; NLDAM = may affect but is not likely to destroy or adversely modify; and n/a = not applicable.

Source: NMFS 2025-TN11895. The ESA does not require Federal agencies to seek FWS concurrence for "not likely to adversely affect" determinations for proposed species or for "no effect" determinations. n/a = not applicable.

3.8.4.2.1 Black Abalone

In Section 3.8.1.3 of this SEIS, the NRC staff concludes that the black abalone is a resident within the action area. Black abalone have been present within Diablo Cove since at least the late 1980s and continue to reside there. Individuals have also been observed on the outside of the breakwaters of Intake Cove.

In 2021, Tenera (2021-TN10249) performed supplemental surveys on black abalone. Black abalone is a cryptic species typically found in deep cracks, and the shell is typically similar in shape and color to surrounding rock habitat and covered with encrusting invertebrates and algae that are also found on the adjacent rocky benthos. Therefore, there is potential that individual black abalone may be missed during a survey even when the survey methods specifically focus on black abalone. Therefore, even though the surveys included a focus on black abalone, there is still a potential that individual black abalone may not have been observed. The potential for missing black abalone was greatest in the surveys of the intertidal and shallow subtidal areas of the breakwaters where the shape of the interlocking concrete tribars creates deep cracks and small cave-like areas that field biologists could not access. However, the surveys did provide sufficient information to identify habitat for this species throughout the Diablo Canyon site, including along the breakwaters. Tenera (2021-TN10249) assumed the presence of black abalone in areas of suitable black abalone habitat based on the occurrence of suitable habitat for black abalone and the identification of black abalone in areas adjacent to suitable habitat where black abalone were not found.

As discussed in Section 3.7.5.2 of this SEIS, during early plant operations in the early 1980s, thermal monitoring revealed changes in the marine environment in and near Diablo Cove. During this time, PG&E consultants performed ecological monitoring related to the effects of Diablo Canyon’s thermal effluent discharge over a period of 9 pre-operational years and approximately 30 months of operation (18 months of 2-unit operation). Tenera (1988-TN10247) performed random intertidal black abalone surveys in 1981–82, 1983, and 1985–86. The population of black abalone in Diablo Cove was estimated at 11,240 in 1981–82 (a mean density of 0.72 abalone per m^2). By 1983, the population had declined by 50 percent to 6,000 (0.38 abalone per m^2). Diablo Canyon, Unit 1, began operating in November 1984, and Unit 2 began operating in August 1985. Following plant start-up, the black abalone population increased slightly to about 8,000 black abalone (0.55 abalone per m^2) in 1985–86 surveys. Researchers postulated that the large decline by over 50 percent between the 1981–82 and the 1985–86 surveys was due to the foraging activities of sea otters or other unknown causes. Tenera (1988-TN10247) concluded that the reductions were probably not related to power plant operation, since elevated temperatures would be expected to also affect the smaller (younger) abalone, which are generally more thermally sensitive than adults whereas sea otters and other predators generally select for larger individuals. Additionally, the timeline of the decline did not match the operational period.

In its report, Tenera (1988-TN10247) specifically considered whether black abalone may have been affected by elevated temperatures in areas adjacent to and within the discharge plume. One area that showed a large relative decline in black abalone abundance, from 80 total individuals in the 1981–1982 survey to 26 total in the 1985–1986 survey, was transect I-N, adjacent to the discharge structure. Since this area was not sampled in 1983, Tenera found it to be uncertain if the reduction in black abalone in this area was due to some aspect of power plant operation. However, transect I-S, immediately south of the discharge structure, also showed a decrease in black abalone between 1982 and 1983, which persisted through the 1985–1986 survey. These declines may have resulted from a reduction of preferred habitats for black abalone near the discharge structure or may have been just a natural decline. Researchers postulated that following Diablo Canyon start-up, recruitment of young animals or migration of older animals into these areas may have been inhibited because of elevated water temperatures and increased water velocity from the discharge. Black abalone in most other areas of Diablo Cove were not affected by thermal discharges, and total numbers of abalone within subareas either increased or remained the same after Diablo Canyon operations began.

However, during the 1985–1986 survey, the numbers of small (less than 2 in. [5 cm] shell length) black abalone nearly tripled over the previous survey in 1983. This was especially noticeable in areas near Diablo Point in south Diablo Cove (transect TV-S) and transects II-N and III-N in north Diablo Cove, areas of deep crevices and rocky overhangs. Abalone also showed slight increases in mean number per station per year from 1985 to 1988 at north and central Diablo Cove stations. These data suggest that a recruitment of black abalone occurred sometime after summer 1983. One station in south Diablo Cove exhibited a major decline in black abalone from 1980 to 1987. Tenera found that this decline may have been due to the burying of the intertidal zone with cobble and sand during the storms of 1982 and 1983.

In its thermal impact assessment, Tenera (1988-TN10247) found that, with the possible exception of the area adjacent to the discharge structure, the abundance of black abalone inside Diablo Cove does not appear to have been affected by power plant operation. The results paralleled experiments performed in laboratory thermal effects studies on black abalone indicating that no mortalities were expected at water temperatures below 78.8°F (26°C) and perhaps higher for intertidal black abalone and that black abalone can withstand temperatures of 86 to 89.6°F (30 to 32°C) for at least 1 hour. Although black abalone apparently do not have a clear temperature preference, some avoidance is observed at temperatures above 69.8 to 75.2°F (21 to 24°C). Because temperatures near the discharge structure may exceed this range, especially during heat treatments, Tenera found it possible that the reduction in black abalone from the areas adjacent to the discharge structure between 1983 and 1985–1886 was the result of migration out of an area where temperatures exceeded this range. Tenera (1988-TN10247) concluded that except near the discharge structure, elevated temperatures do not appear to have affected the survival of black abalone and that the recruitment observed at certain sampling stations following Diablo Canyon start-up indicated that black abalone had shifted their distribution to reside within areas of preferred temperatures and acclimated to the altered thermal conditions.

During subsequent thermal studies at Diablo Canyon, researchers observed mortality of black (*Haliotis cracherodii*) and red (*H. rufescens*) abalone due to withering syndrome. This condition was first observed in California in the southern California Channel Islands in 1986 and first observed in black abalone in Diablo Cove in spring 1988. Mortalities from the disease eventually resulted in an approximately 90 percent population decline in black abalone in Diablo Cove. Although recruitment contributed to increases in the Diablo Cove population in 1991 and 1992, abundances outside Diablo Cove also began decreasing during this same period. By 1994, black abalone populations along a shoreline distance of 7.9 mi (12.7 km) had significantly declined from withering syndrome (PG&E 2023-TN9822).

Diablo Canyon's thermal effluent is not expected to cause black abalone mortalities. During power plant operation, typical intertidal temperature regimes in north Diablo Cove expose black abalone to water temperatures in the range of 64.4 to 68°F (18 to 20°C) (PG&E 2023-TN9822), which is below the species' avoidance range of 69.8 to 75.2°F (21 to 24°C), as explained previously in this section. Black abalone in intertidal areas of north Diablo Cove can be exposed to seawater temperatures of up to 71.6°F (22°C) during high tides over several tidal cycles

(PG&E 2023-TN9822). While these temperatures are within the species' avoidance range, these periods of elevated temperatures are temporary and do not exceed the species' threshold of 78.8°F (26°C) known to cause mortality.

Based on the above, the NRC staff expects that the continued thermal effluent discharges during the proposed Diablo Canyon LR term may cause black abalone to avoid the region of highest water temperatures immediately adjacent to the discharge structure. However, because the plant has been operating for several decades, the staff expects that the proposed action would result in continued avoidance rather than displacement of individuals as may have occurred during initial power plant start-up when the distribution of the species shifted among the various sampling stations. Continued thermal effluent discharges are not expected to result in impacts that would rise to the level of take and would, therefore, be discountable. Additionally, the SWRCB requires PG&E to monitor the health and abundance of black abalone as a condition of the Diablo Canyon NPDES permit. Continued monitoring will ensure that any changes in the black abalone population are detected and addressed.

Conclusion for the Black Abalone

All potential effects on the black abalone resulting from the proposed action would be discountable. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to adversely affect* the black abalone.

On October 30, 2024, the NRC staff submitted a request to initiate formal consultation with the NMFS concerning the proposed Diablo Canyon LR (NRC 2024-TN11896). As part of that consultation, the NRC staff requested the NMFS's concurrence with its "not likely to adversely affect" finding for black abalone. The NMFS (2025-TN11895) issued a biological opinion on April 22, 2025, that determined the following with respect to black abalone:

> In summary, considering the status of the species, the environmental baseline, and cumulative effects, we do not expect the proposed action to reduce the likelihood of survival and recovery of black abalone. The proposed action would adversely affect black abalone by continuing to degrade habitat conditions within an approximately 80 meter length of shoreline immediately surrounding and including the Discharge Structure. This area is small compared to the total available habitat within the action area. We do not expect the continued degradation of this area of shoreline to affect habitat suitability in other areas of Diablo Cove and the rest of the action area, where black abalone remain present at low numbers, or to affect the ability of black abalone to recover within the action area. Continued monitoring of intake, discharge, and intertidal water temperatures as well as black abalone within the action area will be important to track trends in temperature and black abalone over time.

The biological opinion allows for the incidental take of black abalone in the form of avoidance of the approximately 260-ft (80-m) area of shoreline immediately surrounding and including the Discharge Structure in Diablo Cove, and the incidental take statement requires monitoring, documentation, and reporting of the extent of such take. "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). ESA Section 7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of the incidental take statement of the biological opinion.

3.8.4.2.2 Black Abalone Critical Habitat

The action area encompasses areas that are part of Specific Area 10 of designated black abalone critical habitat. In Section 3.8.1.3 of this SEIS, the NRC staff concludes that the action area contains all five PCEs essential to the conservation of the species. These PCEs are (1) rocky substrate, (2) food resources, (3) juvenile settlement habitats, (4) suitable water quality, and (5) suitable nearshore circulation patterns.

Continued operation of Diablo Canyon during the proposed LR term would have no effect on PCE 1, 2, 3, or 5. With respect to PCE 4, the proposed action would have no effect on salinity, pH, or other chemical characteristics necessary for normal settlement, growth, behavior, or viability of black abalone. The principal water quality parameter of concern is temperature. The biogeographical water temperature range of black abalone is from 54 to 77°F (12 to 25°C), but they are most abundant in areas where the water temperature ranges from 64.4 to 71.6°F (18 to 22°C) (76 FR 66806-TN10261). Section 3.7.5.2 of this SEIS, describes the characteristics of the thermal plume, which varies with tides. Regardless of tides, temperature disperses quickly upon discharge such that waters outside of Diablo Cove are generally not affected. Additionally, the deeper portions of Diablo Cove (below approximately 26 ft [8 m] MLLW) are typically below the main influence of the thermal plume and show little or no increase in temperature.

The Diablo Canyon NPDES permit contains conditions that limit the daily average discharge temperature at the discharge outfall to no more than 22°F (12.2°C) above ambient temperatures except during heat treatment for demusseling. PG&E’s RWMP reports document that PG&E is in continual compliance with this limit. Although discharge of thermal effluent during the proposed LR period would continue to affect the temperature of Diablo Cove water, results from black abalone surveys (described above) indicate that the population is not being measurably affected by plant operations. Additionally, the rapid dispersion and NPDES permit conditions would ensure that impacts of the thermal effluent remain minimal. Therefore, this impact would be insignificant.

Conclusion for the Black Abalone Critical Habitat

The proposed action would not affect PCE 1, 2, 3, or 5. All potential effects on PCE 4 of black abalone critical habitat resulting from the proposed action would be insignificant. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to destroy or adversely modify* Specific Area 10 of the black abalone critical habitat.

As indicated previously in this section, the NRC staff initiated formal consultation with the NMFS concerning the proposed Diablo Canyon license renewal in October 2024 (NRC 2024-TN11896). As part of that consultation, the NRC staff requested NMFS concurrence with its “not likely to destroy or adversely modify” finding for black abalone critical habitat. In its April 22, 2025, biological opinion, the NMFS (2025-TN11895) concurred with this determination.

3.8.4.2.3 Gray Whale, Western North Pacific DPS, and Humpback Whale, Central American DPS and Mexico DPS

In Section 3.8.1.3 of this SEIS, the NRC staff determined that gray and humpback whales seasonally inhabit the action area. These whales have been regularly observed offshore of Diablo Canyon since the 1980s and are most common from late summer to early winter.

Whales are not subject to impingement or entrainment into Diablo Canyon's cooling water intake system and do not use Diablo Cove, where elevated water temperatures from the thermal effluent are primarily present. Whales may pass through nearshore areas of the Pacific Ocean that are thermally influenced by Diablo Canyon's thermal plume. However, this is a relatively small area that is primarily detectable between 0.5 and 1 mi (0.8 and 1.6 km) offshore. Whales migrating through the area or using nearshore areas of the action area could experience elevated water temperatures. However, individuals could avoid these areas and would be unlikely to be measurably affected by the small increase in nearshore ocean temperatures. In 2006, the NMFS evaluated the impacts of Diablo Canyon operation in a biological opinion, including thermal impacts, and determined that whales are not likely to be adversely affected by Diablo Canyon operations (NMFS 2006-TN7502). The proposed action would not involve any in-water work that could directly harm individuals. Measurable effects to prey species are not anticipated, as discussed further below in Section 3.8.4.2.4.

Conclusion for the Gray Whale

All potential effects on the gray whale resulting from the proposed action would be insignificant. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to adversely affect* the Western North Pacific DPS of the gray whale.

As indicated previously in this section, the NRC staff initiated formal consultation with the NMFS concerning the proposed Diablo Canyon LR in October 2024 (NRC 2024-TN11896). As part of that consultation, the NRC staff requested NMFS concurrence with its "not likely to adversely affect" finding for the gray whale. In its April 22, 2025, biological opinion, the NMFS (2025-TN11895) concurred with this determination.

Conclusion for the Humpback Whale

All potential effects on the humpback whale resulting from the proposed action would be insignificant. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to adversely affect* the Central American DPS and Mexico DPS of the humpback whale.

As indicated previously in this section, the NRC staff initiated formal consultation with the NMFS concerning the proposed Diablo Canyon license renewal in October 2024 (NRC 2024-TN11896). As part of that consultation, the NRC staff requested NMFS concurrence with its "not likely to adversely affect" finding for the humpback whale. In its April 22, 2025, biological opinion, the NMFS (2025-TN11895) concurred with this determination.

3.8.4.2.4 Humpback Whale Critical Habitat

The action area encompasses areas that are part of California Central Coast critical habitat Unit 17. In Section 3.8.1.3 of this SEIS, the NRC staff concludes that two of the prey species (Pacific sardine and northern anchovy) identified as the single PBF essential to the conservation of the species are present in the action area. The proposed Diablo Canyon LR could affect the abundance or health of this PBF through impingement, entrainment, or thermal effects on these fish. However, neither Pacific sardine nor northern anchovy are susceptible to impingement because adults reside offshore. As explained in Section 3.7.5.1, both species were present in entrainment samples during studies conducted in 1996–1999 and 2008–2009. Annual proportional entrainment losses of these species constituted less than 1 percent of larvae entrained based on mean and maximum larval durations (see Figure G-3). Tenera (2000-TN10211) estimated low proportional entrainment losses of these and other offshore deeper-water species. With respect to thermal impacts, in Section 3.7.5.2, the NRC staff concludes that biological changes from Diablo Canyon's thermal effluent have stabilized and that ecologically significant changes are primarily limited to Diablo Cove. The NRC staff anticipates no additional observable impacts during the proposed LR. Further, the NRC staff identified no information indicating observable local population declines in Pacific sardine or northern anchovy. Therefore, effects of the proposed LR on the PBF of the humpback whale critical habitat are not expected to be able to be meaningfully measured, detected, or evaluated. Accordingly, impacts of the proposed LR would be insignificant.

Conclusion for the Humpback Whale Critical Habitat

All potential effects on the one PBF of humpback whale critical habitat resulting from the proposed action would be insignificant. Therefore, the NRC staff concludes that the proposed action *may affect but is not likely to destroy or adversely modify* California Central Coast critical habitat Unit 17 of the humpback whale.

As indicated previously in this section, the NRC staff initiated formal consultation with the NMFS concerning the proposed Diablo Canyon license renewal in October 2024 (NRC 2024-TN11896). As part of that consultation, the NRC staff requested NMFS concurrence with its "not likely to destroy or adversely modify" finding for humpback whale critical habitat. In its April 22, 2025, biological opinion, the NMFS (2025-TN11895) concurred with this determination.

3.8.4.2.5 Green, Leatherback, Loggerhead, and Pacific Olive Ridley Sea Turtles

In Section 3.8.1.3 of this SEIS, the NRC staff concludes that green sea turtles occasionally occur in the action area. Green sea turtles have been entrained into Diablo Canyon's cooling water intake structure on occasion. Leatherback sea turtles have never been documented within the action area, but telemetry studies indicate potential feeding areas several miles offshore of the action area. One loggerhead sea turtle was entrained into Diablo Canyon's cooling water intake structure in 2024. The Pacific olive ridley sea turtle has never been collected at the site, and Tenera (2021-TN10249) determined the species to be highly unlikely to occur in the action area. However, the NRC staff addresses this species in this section based on recommendations from the NMFS during preliminary discussions concerning Diablo Canyon ESA Section 7 consultation.

In 2006, the NMFS (2006-TN7502) issued a biological opinion for Diablo Canyon operations under the terms of the current facility operating licenses. That opinion contemplates the potential effect of entrainment of sea turtles into Diablo Canyon's cooling water intake system, which can cause injury or mortality to the turtles. When this occurs, sea turtles typically become caught between the bar racks and curtain wall of the intake structure. Entrainment can adversely affect a sea turtle through stress and forcible submergence. In natural situations, turtles may remain submerged for several hours; however, stress can decrease the amount of time a turtle can remain submerged and not drown. A turtle that is forcibly submerged may suffer from a "wet" or "dry" drowning. During a wet drowning, water enters the lungs, causing damage to the organs and asphyxiation. In a dry drowning, a reflex spasm seals lungs off from air and water. Typically, before drowning, a turtle becomes comatose or unconscious.

During a forcible submergence, a turtle rapidly depletes its oxygen store, resulting in potentially harmful conditions (NMFS 2006-TN7502). One such condition is metabolic acidosis, when blood lactate levels get too high from the submergence. Other conditions that may result from forced submergence include, an increase in carbon dioxide in the blood and increases in epinephrine and other hormones associated with stress. The effects of metabolic stress due to forced submergence are also related to other factors such as the size of the turtle, water temperature, and biological and behavioral differences among species. For example, larger sea turtles are capable of longer voluntary dives, thus they may be more able to survive a forced submergence for a longer period (Gregory et al. 1996-TN10306). Additionally, Gregory et al. (1996) notes that routine metabolic rates of turtles are higher during the warmer months, so the impacts of stress may be magnified. Sea turtles can also exhibit dynamic endocrine responses to stress. NMFS (2006-TN7502) summarizes studies on green and loggerhead sea turtles that illustrate the physiological effects of forced submergence. It is expected that other species of sea turtles would show similar effects.

Diablo Canyon began operations in 1985 (Unit 1) and 1986 (Unit 2). The first sea turtle reported as entrained in the cooling water intake structure was a green sea turtle in 1994. Since that time, 13 more green sea turtles and 1 loggerhead sea turtle have been collected at the Diablo Canyon cooling water intake structure (see Figure 3-8). All individuals were alive, unharmed, and released back to the ocean. At most, two sea turtles have been entrained in any given year, and the average number entrained over the 41-year period since 1984 (when Diablo Canyon first began withdrawing cooling water) through 2024 is 0.37 turtles per year. Based on this information, the NRC staff anticipates that Diablo Canyon may entrain an additional 8 sea turtles during the 20-year proposed LR period based on the frequency of past entrainments. Most of these individuals are expected to be green sea turtles based on the fact that only one of the entrainments to date has been of a loggerhead sea turtle. Additionally, most of these individuals are expected to be alive and unharmed based on past entrainment incidents. However, it is possible that turtles could become injured or die from forced submergence. In any scenario, whether unharmed, injured, or dead, such entrainment would constitute adverse impacts and would be considered a take under the ESA.

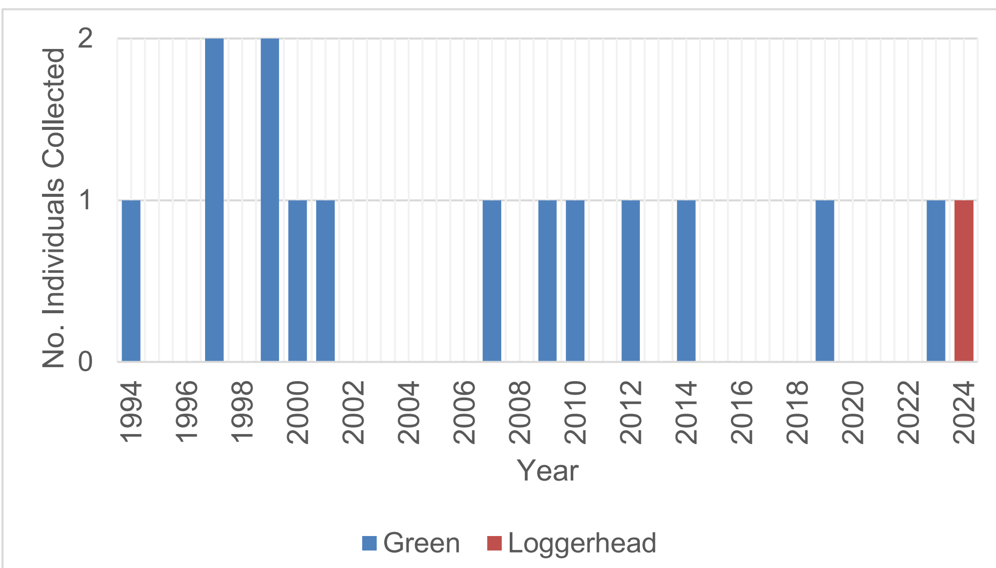


Figure 3-8 Sea Turtles Collected at the Cooling Water Intake Structure of Diablo Canyon Nuclear Power Plant, 1994–2024

In addition to the entrainment itself, sea turtles may experience stress associated with capture and release. PG&E personnel perform measurements and gather basic biological data on all captured sea turtles in accordance with Reasonable and Prudent Measure 2 of the 2006 NMFS biological opinion (NMFS 2006-TN7502). Personnel receive training on proper sea turtle handling techniques, and sea turtle handling time, including tagging and data collection, is limited to minimize stress in accordance with Term and Condition 3 of the biological opinion. The NRC staff finds that stress to sea turtles associated with capture and release activities during the proposed Diablo Canyon LR period would result in minimal impacts on these individuals because PG&E personnel are appropriately trained and follow safe handling protocols that have been developed in coordination with species experts to minimize stress to sea turtles.

Because no leatherback or Pacific olive ridley sea turtles have been entrained into Diablo Canyon's cooling water intake structure, which first began withdrawing cooling water in 1984, the NRC staff expects that future entrainment of these species is unlikely. Leatherback turtles do not forage as near to shore as green turtles, which may explain why the species has never been captured at the site. While olive ridley turtles are primarily considered open ocean dwellers, they can be found in nearshore areas. However, the NRC staff was unable to locate any records documenting the species within nearshore waters of San Luis Obispo County. Nevertheless, the NRC staff conservatively concludes that entrainment of either of these species is possible during the proposed LR term because the NMFS considered a take of both of these species to be possible in its 2006 biological opinion (NMFS 2006-TN7502).

The NMFS's (2006-TN7502) 2006 biological opinion also considers the impacts of thermal effluent discharges and chlorine use on sea turtles. These impacts would remain the same during the proposed Diablo Canyon LR term, and the NMFS's discussion of these impacts in the biological opinion is incorporated here by reference. These impacts would result in insignificant or discountable impacts on sea turtles in the action area.

Conclusion for the Green Sea Turtle, East Pacific DPS

The NRC staff concludes that the proposed action *may affect and is likely to adversely affect* the East Pacific DPS of the green sea turtle. The continued operation of Diablo Canyon would result in occasional entrainment of green sea turtles into the cooling water intake structure. While most individuals would likely survive entrainment and be released back to the ocean unharmed, some individuals could experience injury or mortality. All other effects to this species associated with the proposed action would be insignificant or discountable.

As indicated previously in this section, the NRC staff initiated formal consultation with the NMFS concerning the proposed Diablo Canyon LR in October 2024 (NRC 2024-TN11896), and the NMFS (2025-TN11895) issued a biological opinion on April 22, 2025, that concluded the consultation and replaced the previous biological opinion (NMFS 2006-TN7502). The new biological opinion determined the following with respect to sea turtles:

- Continued operation of Diablo Canyon is likely to result in low levels of entrainment of green, loggerhead, leatherback, and olive ridley sea turtles, and very low levels of lethal entrainment of green sea turtles.
- Thermal discharges from both facilities may also directly and indirectly impact sea turtles by attracting turtles to the heated discharge and modifying their normal foraging and migration behavior.

The NMFS (2025-TN11895) concluded that "[a]fter reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of East Pacific DPS green sea turtles, leatherback sea turtles, North Pacific Ocean DPS loggerhead sea turtles, [or] olive ridley sea turtles…."

The biological opinion allows for incidental take of sea turtles in the form of entrainment, and the incidental take statement requires monitoring, documentation, and reporting of the extent of such take. PG&E personnel must also be appropriately trained to identify and handle sea turtles. "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). ESA Section 7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of the incidental take statement of the biological opinion.

Conclusion for the Leatherback Sea Turtle

The NRC staff concludes that the proposed action *may affect and is likely to adversely affect* the leatherback sea turtle. The continued operation of Diablo Canyon could result in entrainment of this species into the cooling water intake structure. Based on the absence of such an event in the past, the NRC staff expects that future entrainment would be extremely rare. While most individuals would likely survive entrainment and be released back to the ocean unharmed, some individuals could experience injury or mortality. All other effects to this species associated with the proposed action would be insignificant or discountable.

As indicated previously in this section, the NRC staff initiated formal consultation with the NMFS concerning the proposed Diablo Canyon LR in October 2024 (NRC 2024-TN11896), and the NMFS issued a biological opinion on April 22, 2025, that concluded the proposed LR is not likely to jeopardize the continued existence of any sea turtle species. The opinion allows for incidental take of sea turtles in the form of entrainment subject to monitoring, documentation, and reporting requirements. See "Conclusion for the Green Sea Turtle, East Pacific DPS" above for more information.

Conclusion for the Loggerhead Sea Turtle, North Pacific DPS

The NRC staff concludes that the proposed action *may affect and is likely to adversely affect* the North Pacific DPS of the loggerhead sea turtle. The continued operation of Diablo Canyon would result in occasional entrainment of loggerhead sea turtles into the cooling water intake structure. While most individuals would likely survive entrainment and be released back to the ocean unharmed, some individuals could experience injury or mortality. All other effects to this species associated with the proposed action would be insignificant or discountable.

As indicated previously in this section, the NRC staff initiated formal consultation with the NMFS concerning the proposed Diablo Canyon LR in October 2024 (NRC 2024-TN11896), and the NMFS issued a biological opinion on April 22, 2025, that concluded that the proposed LR is not likely to jeopardize the continued existence of any sea turtle species. The opinion allows for incidental take of sea turtles in the form of entrainment subject to monitoring, documentation, and reporting requirements. See "Conclusion for the Green Sea Turtle, East Pacific DPS" above for more information.

Conclusion for the Pacific Olive Ridley Sea Turtle

The NRC staff concludes that the proposed action *may affect and is likely to adversely affect* the Pacific olive ridley sea turtle, including Mexico's Pacific Coast breeding population as well as all other populations. The continued operation of Diablo Canyon could result in entrainment of this species into the cooling water intake structure. Based on the absence of such an event in the past, the NRC staff expects that future entrainment would be extremely rare. While most individuals would likely survive entrainment and be released back to the ocean unharmed, some individuals could experience injury or mortality. All other effects to this species associated with the proposed action would be insignificant or discountable.

As indicated previously in this section, the NRC staff initiated formal consultation with the NMFS concerning the proposed Diablo Canyon LRin October 2024 (NRC 2024-TN11896), and the NMFS issued a new biological opinion on April 22, 2025, that concluded that the proposed LR is not likely to jeopardize the continued existence of any sea turtle species. The opinion allows for incidental take of sea turtles in the form of entrainment subject to monitoring, documentation, and reporting requirements. See "Conclusion for the Green Sea Turtle, East Pacific DPS" above for more information.

3.8.4.2.6 Leatherback Sea Turtle Critical Habitat

The action area lies at the southern end of the designation for leatherback sea turtle critical habitat within the Pacific Ocean. In Section 3.8.1.3 of this SEIS, the NRC staff concludes that the prey (Semaeostomeae jellyfish) identified as the single PCE essential to the conservation of the species is not present in the action area.

Conclusion for the Leatherback Sea Turtle Critical Habitat

Because the one PCE of this designated critical habitat is not present within the action area, the NRC staff concludes that the proposed action would have *no effect* on critical habitat of the leatherback sea turtle. The ESA does not require Federal agencies to seek NMFS concurrence for "no effect" determinations. Therefore, the NRC has fulfilled its obligations under ESA Section 7(a)(2) with respect to this critical habitat.

3.8.4.3 Magnuson–Stevens Act: Essential Fish Habitat

In Section 3.8.2 of this SEIS, the NRC staff determined that EFH for all life stages (i.e., eggs, larvae, juveniles, and adults) of four federally managed species groups occurs in the affected area. These are the coastal pelagic species complex, euphausiids (krill), groundfish, and highly migratory species. That section includes relevant information on the species and habitat requirements of each life stage. This section analyzes the potential impacts of the proposed Diablo Canyon LR on this EFH. Table 3-17 summarizes the NRC staff's EFH determinations.

The NMFS defines "adverse effect" under the MSA as (50 CFR 600.810 [TN1342]):

> any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Table 3-17 Effect Determinations for Essential Fish Habitat Species and Life Stages for Diablo Canyon Nuclear Power Plant License Renewal

Species or Management Unit	Federal Management Plan[(a)]	Relevant Species and Life Stages[(b)]	EFH Effect Determination[(c)]
coastal pelagic species complex	CPS	multiple species - E, L, J, A	MAE
euphausiid (krill)	CPS	E, L, J, A	MAE
groundfish unit	PCG	multiple species - E, L, J, A	MAE
highly migratory species unit	HMS	common thresher shark - E, L, J, A	MAE

(a) CPS = coastal pelagic species; HMS = highly migratory species; MAE = minimal adverse effects; PCG = Pacific Coast groundfish.
(b) E = eggs; L = larvae; J = juveniles; and A = adults.
(c) The NRC staff makes its effect determinations for EFH in accordance with the language and definitions specified in the EFH regulations at 50 CFR Part 600 (NMFS 2006-TN7502) and the NMFS's guidance for Federal action agencies (NOAA 2004-TN1344); MAE = minimal adverse effects.

Further, in 50 CFR 600.815(a)(7) (TN1342), adverse effects to EFH resulting from prey loss is discussed as follows:

> Loss of prey may be an adverse effect on EFH and managed species because the presence of prey makes waters and substrate function as feeding habitat, and the definition of EFH includes waters and substrate necessary to fish for feeding. Therefore, actions that reduce the availability of a major prey species, either through direct harm or capture, or through adverse impacts to the prey species' habitat that are known to cause a reduction in the population of the prey species, may be considered adverse effects on EFH if such actions reduce the quality of EFH.

The proposed Diablo Canyon LR has the potential to cause the following (generic) adverse effects on EFH in the area: (1) physical removal of habitat through cooling water withdrawals; (2) physical alteration of habitat through heated effluent discharges; (3) chemical alteration of habitat through radionuclides and other contaminants in heated effluent discharges; (4) physical removal of habitat through maintenance dredging; and (5) reduction in prey base of the habitat. In the sections below, the NRC staff evaluates each potential adverse effect as it relates to the proposed LR.

3.8.4.3.1 Physical Removal of Habitat Through Cooling Water Withdrawals

Diablo Canyon continuously withdraws Pacific Ocean water to cool the reactor cores and to serve other auxiliary functions. All water withdrawals represent a loss of fish habitat because withdrawal physically removes the water (habitat) from the ocean. However, most losses are temporary because Diablo Canyon's once-through cooling system returns most of the water it withdraws to Diablo Cove, north of Intake Cove. During normal plant operations, Diablo Canyon withdrawals between 1,589,000 gpm (6,015,019 lpm) and 1,749,000 gpm (6,620.685 lpm) of Pacific Ocean water via Intake Cove (PG&E 2023-TN9822). This volume represents a very small percentage of habitat within the nearshore marine water column in comparison to the source water (the Pacific Ocean). Because Diablo Canyon consumes a relatively small amount of the source water, the physical removal of habitat through cooling water withdrawals would have negligible impacts on the quality or quantity of fish habitat. Accordingly, the NRC staff concludes that this potential impact would result in no more than minimal adverse effects on EFH in the affected area.

3.8.4.3.2 Physical Alteration of Habitat Through Heated Effluent Discharges

Diablo Canyon continuously discharges heated effluent to the Pacific Ocean via Diablo Cove following its use for cooling and other auxiliary functions at the plant. Because discharges are of higher temperatures than the ambient ocean water, discharges represent a physical alteration to fish habitat. Section 3.7.5.2 of this SEIS describes the characteristics of the thermal plume, which varies with tides. Regardless of tides, temperature disperses quickly upon discharge such that waters outside of Diablo Cove are generally not affected. Additionally, the deeper portions of Diablo Cove (below approximately 26 ft [8 m] MLLW) are typically below the main influence of the thermal plume and show little or no increase in temperature.

Most of the relevant EFH species do not occupy the epipelagic region of the water column where effects of the thermal plume would be experienced. Thus, most EFH species would not encounter the thermal plume, and the continued discharge of heated effluent would not affect the quality or quantity of these species' habitats. Common thresher shark occupy the upper parts of the water column, but their depth range can extend to 2,460 ft (750 m) in depth (Carlson 2019-TN10275). Sharks are agile and can easily avoid areas of heated water. Additionally, the relatively small area affected by the thermal plume would not meaningfully affect the available habitat for this species. Accordingly, the NRC staff concludes that this potential impact would result in no more than minimal adverse effects on EFH in the affected area.

3.8.4.3.3 Chemical Alteration of Habitat Through Radionuclides and Other Contaminants in Heated Effluent Discharges

With heated effluent, Diablo Canyon discharges certain nonradiological chemical pollutants. The SWRCB limits the allowable concentrations of these pollutants through the site's NPDES permit. The NPDES permit establishes allowable pollutant discharge concentration limits for total residual chlorine, pH, total phosphorus, fecal coliform, total organic carbon, and total petroleum hydrocarbons at levels at or below the EPA (2024-TN10276) national recommended aquatic life criteria for acute (short-term) and chronic (long-term) exposure. Under these criteria, the EPA considers "unacceptable acute effects" to be those effects that are lethal or immobilize an organism during short-term exposure to a pollutant. "Unacceptable chronic effects" are those effects that will impair growth, survival, and reproduction of an organism following long-term exposure to a pollutant. Thus, the EPA aquatic life criteria are designed to ensure that aquatic species exposed to pollutants in compliance with these levels will not experience any impairment of growth, survival, or reproduction. The NRC staff assumes that because nonradiological pollutants that are discharged at levels at or below the EPA aquatic life criteria would not impair the ability of fish to carry out essential life functions, such discharges would also not impair the quality or quantity of the habitat itself. Accordingly, the NRC staff concludes that nonradiological pollutant discharges would result in no more than minimal adverse effects on EFH in the affected area.

With respect to the potential impacts of radiological contaminants on fish habitat, the primary radionuclide of concern is tritium. During operation, Diablo Canyon may discharge tritium through one of two pathways: (1) as liquid through effluent releases to the Pacific Ocean or (2) as gas through the air. PG&E has not detected tritium or any other radionuclides attributable to Diablo Canyon in aquatic exposure pathway samples based on the NRC staff's review of annual reports on PG&E's radiological environmental monitoring program from 2019–2023 (PG&E 2020-TN10093, PG&E 2021-TN10094, PG&E 2022-TN10095, PG&E 2023-TN10096, PG&E 2024-TN10097). These samples include offshore ocean sediment from Diablo Cove and Rattlesnake Canyon; marine flora, including kelp and intertidal algae; and fish and invertebrates, including rockfish, perch, and mussels. Thus, the quality of fish habitat in the area is extremely unlikely to be affected by radiological contamination. Accordingly, the NRC staff concludes that radionuclide discharges would result in no more than minimal adverse effects on EFH in the affected area.

3.8.4.3.4 Physical Removal of Habitat Through Maintenance Dredging

Dredging results in the direct removal of bottom habitats along with infaunal and epifaunal organisms of limited mobility inhabiting the affected substrates. Dredging also creates sediment plumes that increase water turbidity. Thus, dredging affects both the quantity and quality of fish habitat. The direct removal of substrates, sediments, and benthic organisms represent effects to habitat quantity. The resulting short-term reductions in biomass of benthic organisms and increased water turbidity represent effects on habitat quality. PG&E conducted dredging of the Intake Cove in summer 2024. In support of this effort, PG&E obtained a CWA Section 404 permit from the USACE prior to conducting dredging. Details on the dredging effort at the potential impacts to EFH can be found in PG&E's EFH assessment (Stantec 2023-TN10661).

PG&E has no plans to dredge during the proposed license renewal period. Therefore, there would be no impacts to EFH in the affected area associated with dredging.

3.8.4.3.5 Reduction in the Prey Base of the Habitat

Reduction in the prey base, or loss of prey, represents a potential impact to the quality of fish habitat. Sections 3.7.5.1 and 3.7.5.2 of this SEIS address the impacts of impingement, entrainment, and thermal discharges at the resource-wide level. In those sections, the NRC staff does not identify significant impacts to the prey of the relevant EFH species and, therefore, the NRC staff does not expect impingement, entrainment, or thermal effluent discharges to noticeably alter the availability of prey of EFH species.

All other potential impacts to the prey base of EFH species, such as physical and chemical alteration of the aquatic environment from effluent discharges, have already been addressed previously in this section. The NRC staff did not identify any unique impacts of these effects that would affect the prey of EFH species but not the EFH itself.

The NRC staff concludes that the reduction in the prey base of the habitat resulting from the proposed Diablo Canyon LR would result in no more than minimal adverse effects on EFH in the affected area.

Conclusion for Designated Essential Fish Habitat

Based on the above, the NRC staff concludes that the proposed action would result in *no more than minimal adverse effects* on the designated EFH of all life stages of coastal pelagic species complex, euphausiids (krill), groundfish, and highly migratory species.

In conjunction with its October 30, 2024, request for formal ESA consultation (NRC 2024-TN11896), the NRC staff requested to initiate abbreviated EFH consultation with the NMFS. The NMFS (2025-TN11895) responded to this request on April 22, 2025. The NMFS determined the following with respect to EFH:

> We also concluded that the proposed action would adversely affect EFH designated under the Pacific Coast Groundfish, Coastal Pelagic Species, and Highly Migratory

> Species Fishery Management Plans due to effects associated with the intake of ocean water and discharge of heated water for the [Diablo Canyon] once-through cooling water system. The proposed action includes measures to minimize many of these adverse effects. Therefore, as long as these measures are implemented, in addition to the measures identified in the [Reasonable and Prudent Measures] and [Terms and Conditions] of the opinion, we did not recommend any additional measures to avoid or minimize the adverse effects on EFH.

Because the NMFS did not provide any specific EFH conservation recommendations, NMFS's response documents the conclusion of EFH consultation for the proposed Diablo Canyon LR.

3.8.4.4 National Marine Sanctuaries Act: Sanctuary Resources

In Section 3.8.3 of this SEIS, the NRC staff describes the Chumash Heritage National Marine Sanctuary. In the draft SEIS (NRC 2024-TN11897), the NRC staff contemplated that once designated, the sanctuary might include nearshore waters affected by Diablo Canyon operations, including operations during the proposed LR period. However, in the final designation of this sanctuary, the northern boundary lies 2 mi (3.2 km) southeast of the Diablo Canyon Intake Cove (89 FR 83554-TN11892).

The ONMS considers impacts to sanctuary resources in terms of injury. "Injure" is defined in the ONMS regulations as meaning "to change adversely, either in the short or long term, a chemical, biological or physical attribute, or the viability, of a sanctuary resource. This includes, but is not limited to, to cause the loss of or destroy" (15 CFR 922.11). In previous sections of this SEIS, the NRC staff addressed the potential impacts of the proposed action on the chemical, biological, and physical attributes of the marine environment in detail. For instance, Sections 3.7.5.1 and 3.7.5.2 address the impacts of impingement, entrainment, and thermal discharges at the resource-wide level and conclude that these effects would have SMALL impacts on the marine environment. Section 3.8.4.2 considers impacts on federally listed marine species and critical habitats, and Section 3.8.4.3 considers whether the proposed action would noticeably affect the quality of habitat for federally managed species with EFH. Based on the information presented in this SEIS, the NRC staff did not identify any unique impacts that sanctuary resources could experience, and none of the described impacts would rise to the level of injury. Further, none of the potential impacts on aquatic resources assessed previously in this SEIS would be experienced within or near sanctuary boundaries.

Conclusion for Sanctuary Resources

The NRC staff concludes that the proposed action would have *no effect* on sanctuary resources of the Chumash Heritage National Marine Sanctuary. Thus, the NMSA does not require the NRC to consult with the NOAA for the proposed action.

3.8.5 No-Action Alternative

Under the no-action alternative, the NRC would not issue renewed licenses, and Diablo Canyon would shut down on or before the expiration of the current facility operating licenses. Sections 3.6 and 3.7 of this SEIS address impacts to terrestrial and aquatic resources. Impacts that federally protected ecological resources could experience from the no-action alternative would be qualitatively similar to the impacts described in those sections. The ESA action area, EFH and NMSA affected areas, and federally protected species and habitats for the no-action alternative would be similar to those described in Sections 3.8.1.1, 3.8.2, and 3.8.3. The NRC would consult with the FWS and the NMFS, as appropriate, to address potential impacts to federally listed species and critical habitats protected under the ESA. The NRC would consult with the NMFS, as appropriate, to address impacts to EFH protected under the MSA. The NRC would consult with the ONMS, as appropriate, to address impacts to sanctuary resources of the Chumash Heritage National Marine Sanctuary, the final designation for which would likely be finalized by the time a no-action alternative would be implemented. Actual impacts would depend on the specific shutdown activities and the federally protected resources identified to occur in the action area or affected areas when the no-action alternative is implemented.

3.8.6 Replacement Power Alternatives: Common Impacts

The ESA action area, EFH affected area, and NMSA affected area for the replacement power alternatives would depend on various factors including site selection, current land uses, planned construction activities, temporary and permanent structure locations and parameters, and the timeline of the alternative. The federally listed species, critical habitats, EFH, and national marine sanctuaries potentially affected by a replacement power alternative would depend on the boundaries of that alternative's effects and the species and habitats federally protected when the alternative is implemented. For instance, if Diablo Canyon continues to operate until the end of the current licenses' terms and a replacement power alternative is implemented at that time, the FWS and the NMFS may have listed new species, delisted currently listed species whose populations have recovered, or revised EFH designations. These listing and designation activities would change the potential for the various alternatives to impact federally protected ecological resources. Additionally, requirements for consultation under the ESA, MSA, and NMSA would depend on whether Federal permits or authorizations are required to implement each alternative.

Sections 3.6.6 and 3.7.7 of this SEIS describe the types of impacts that terrestrial and aquatic resources would experience under each alternative. Impacts on federally protected ecological resources would likely be similar in type. However, the magnitude and significance of such impacts could be greater for federally protected ecological resources because such species and habitats are rare and more sensitive to environmental stressors.

3.8.7 Purchased Power Alternative

The purchased power alternative involves the establishment of a long-term contract to import replacement power into the Diablo Canyon service area to replace Diablo Canyon's net generation. Potential environmental impacts depend on the source, type, and location of the energy obtained under such a contract. This could include natural gas power plants until 2045 and must be renewal and zero-carbon after 2045 under California's 100 Percent Clean Energy Act of 2018.

The NRC does not license natural gas or renewable energy facilities; therefore, the NRC would not be responsible for ESA, MSA, or NMSA consultations for this alternative. The Federal and private responsibilities for addressing impacts on federally protected ecological resources under this alternative would be like those described in Section 3.8.5 of this SEIS. Ultimately, the magnitude and significance of adverse impacts on federally protected ecological resources resulting from this alternative would depend on the site location and layout, plant design, plant operations, and the protected species and habitats present in the area when the alternative is implemented.

3.8.8 Renewables Combination Alternative

The renewables combination alternative would involve the construction and installation of 2,005 MW (installed capacity) of wind turbines located both on and offsite of Diablo Canyon, 3,540 MW (installed capacity) of offsite solar panels located within the PG&E service area, 200 MW of geothermal power, and demand side management.

The NRC does not license renewable energy facilities; therefore, the NRC would not be responsible for ESA, MSA, or NMSA consultations for this alternative. The Federal and private responsibilities for addressing impacts on federally protected ecological resources under this alternative would be like those described in Section 3.8.5 of this SEIS. Ultimately, the magnitude and significance of adverse impacts on federally protected ecological resources resulting from this alternative would depend on the site location and layout, plant design, plant operations, and the protected species and habitats present in the area when the alternative is implemented.

3.9 Historic and Cultural Resources

This section of the SEIS describes the cultural background and the historic and cultural resources found at Diablo Canyon and in the surrounding area. Section 106 of the NHPA (54 U.S.C. 306108; TN4839), requires Federal agencies to consider the effects of their undertakings on historic properties. Renewing the operating license of a nuclear power plant is an undertaking that could potentially affect historic properties. Historic properties are defined as resources eligible for listing in the National Register of Historic Places (NRHP). The criteria for eligibility are listed in 36 CFR 60.4 (TN1682) and include (A) association with significant events in history; (B) association with the lives of persons significant in the past; (C) embodiment of distinctive characteristics of a type, period, or method of construction; and (D) sites or places that have yielded, or may be likely to yield, important information in history or prehistory. In accordance with 36 CFR 800.8(c) (TN513), the NRC complies with its NHPA Section 106 obligations through its process under NEPA (TN661). Although NHPA Section 106 is focused on assessing effects to historic properties, the NRC staff also assesses impacts on historic and cultural resources that are not eligible for or listed in the NRHP in accordance with 10 CFR Part 51, as appropriate.

The proposed action is to renew the operating licenses for Diablo Canyon for an additional 20-year period. The LR area of potential effects (APE) includes lands within the nuclear power plant site boundary and the transmission lines up to the first substation that may be directly affected by land-disturbing or other operational activities associated with continued plant operations and maintenance and/or refurbishment activities. The APE may extend beyond the nuclear plant site when these activities may indirectly (e.g., visual and auditory) affect historic properties. This determination is made irrespective of land ownership or control. In the context of the NHPA, the APE for the proposed action is the 750 ac (304 ha) Diablo Canyon industrial site.

In accordance with the NHPA, the NRC is required to make a reasonable effort to identify historic properties within the APE. If the NRC finds that either there are no historic properties within the APE or the undertaking (i.e., Diablo Canyon LR) would have no effect on historic properties, the NRC provides documentation of this finding to the State Historic Preservation Officer (SHPO). In addition, the NRC notifies all consulting parties, including Indian Tribes, and makes this finding public through the NEPA process prior to issuing the renewed licenses. Similarly, if historic properties are present and could be affected by the undertaking, the NRC is required to assess and resolve any adverse effects in consultation with the SHPO and any Indian Tribe that attaches religious and cultural significance to identified historic properties.

In California, the Office of Historic Preservation (OHP) is responsible for administering Federal and State-mandated historic preservation programs to identify, evaluate, register, and protect California's archaeological and historic resources under the direction of the California SHPO, a gubernatorial appointee, and the State Historical Resources Commission. The California OHP maintains the California Historical Resources Information System, which inventories all the registered cultural resources in the State, including those within the Diablo Canyon site.

As part of its LR application, the applicant submitted an environmental report, which contains information and an analysis of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with LR and the impacts of operation during the LR term. In addition to its independent review, the NRC staff uses this information to support its NHPA Section 106 consultation obligations.

3.9.1 Cultural Background

This section of the SEIS documents the precontact, ethnographic, and historic chronology of California's Central Coast region. Archaeological records indicate continued human occupation in the Central Coast for over 10,300 years. Cultural sequences in this section are adapted from Jones and Klar 2007-TN9830, Price and Trumbly 2009-TN9832, Price and Clark 2019-TN10294, and Enright et al. 2021-TN10293. The chronology of the area is divided into the Paleoindian Period (pre-10,300 before present [BP]), the Millingstone/Lower Archaic Period (10,300 BP to 5700 BP), the Early Period (5700 BP to 2550 BP), the Middle Period (2550 BP to 950 BP), the Middle-Late Transition Period (950 BP to 700 BP [AD 950 to AD 1250]), the Late Period (AD 1250 to AD 1769), the Post-Contact/Ethnographic Period (AD 1769 to 1820s), and the Historic Period (1820s to present). General patterns summarizing each time period are briefly described below.

3.9.1.1 Paleoindian Period (Pre-8000 BC; Pre-10,300 BP)

The Paleoindian Period is considered to represent the earliest documented human occupation in the region, extending back more than 10,000 years ago to the terminal Pleistocene period. This period is typically characterized by small groups of highly mobile nomadic hunters who followed big game such as mammoths, mastodons, and bison across the landscape. In the Central Coast, this time period is known as the Paleo-Coastal Tradition, as sites along the California coast displayed a distinct maritime cultural adaptation. Early Paleoindian sites establish that shellfish, a limited array of vertebrate species, and plant foods were consumed during this time (Price and Clark 2019-TN10294).

At Diablo Canyon, Greenwood's 1968 excavations at SLO-2 produced two radiocarbon dates that fall during the terminal Pleistocene/early Holocene period (Greenwood 1972-TN10041, Enright et al. 2021-TN10293). Faunal analysis from early deposits at the site reveal that Pecho Paleo-Coastal populations consumed shellfish, marine birds, fish, and terrestrial fauna. Outside Diablo Canyon, the San Miguel and Santa Rosa Islands in the Santa Barbara Channel have registered numerous sites dating to the Paleoindian Period. Three fluted points have also been documented as isolated finds in Santa Barbara and San Luis Obispo counties (Enright et al. 2021-TN10293).

3.9.1.2 Millingstone/Lower Archaic Period (8000–3500 BC; 10,300–5700 BP)

The Millingstone/Lower Archaic Period represents a continuation of the hunter and gatherer subsistence economy practiced during the Paleoindian Period. Characterized by well-developed shell middens, large numbers of milling implements, and fishing tools, groups appear to have more intensively exploited their environment yet maintained their mobility (Jones and Klar 2007-TN9830; Price and Trumbly 2009-TN9832).

The archaeological record reveals a shift in settlement patterns during this period. Shoreline sites were most likely used as short-term camps, while inland sites were more specialized residential sites that were used for activities such as collecting plants or processing terrestrial and marine fauna. Toolkits from this period show the predominance of hand stones and milling slabs for the processing of hard seeds and other plant foods. Side-notched and contracting-stemmed dart sized points were used over projectile points, which reflect the change in processing of large and small game. Bifacial knives, coppers, and scrapers also were used during this time.

Both terrestrial fauna and coastal resources continued to be consumed. Various sites along Pecho Coast include faunal assemblages with an increased number of deer, marine birds, fish, and shellfish remains. Deposits dating to the Millingstone Period have been identified at both SLO-2 and SLO-585 (Price and Clark 2019-TN10294).

3.9.1.3 Early Period (3500–600 BC; 5700–2550 BP)

The Early Period marks an important adaptive transition along the Central Coast. Sites from this period show increased settlement patterns but are still seasonal in nature. Habitation sites reflect more short-term occupation of areas that were closer to more labor-intensive resources, suggesting an increase in logistical organization (Jones and Klar 2007-TN9830; Price and Trumbly 2009-TN9832). The Early Period also saw a slight change in subsistence patterns with the increased emphasis of marine and coastal resources over terrestrial mammals during this period (Enright et al. 2021-TN10293).

Technology such as mortars and pestles were introduced, replacing manos and milling stones as primary processing tools. Diagnostic artifacts from this period include contracting-stemmed projectile points, square stemmed, large side-notched, lanceolate points, mortars and pestles, pitted stones, net weights, and other bone and stone tools (Enright et al. 2021-TN10293, Price and Clark 2019-TN10294). The presence of exotic shell beads and obsidian in the archaeological record also mark an increase of trade and the exchange of goods.

It appears that SLO-2 and SLO-585 were briefly abandoned during the Early Period but smaller settlements, such as SLO-61, were occupied. SLO-61 is a residential camp occupied between 4600 and 3000 BP (Price and Clark 2019-TN10294). SLO-61's faunal remains are consistent with Early Period subsistence practices, including marine shellfish and fish, but supplemented with terrestrial animals when available. Instead of bifaces or the use of exotic materials as seen in other Early Period sites, simple core-and-flake lithics manufactured from available local stone were present (Price and Clark 2019-TN10294).

3.9.1.4 Middle Period (600 BC–AD 950; 2550–950 BP)

The Middle Period reflects increased technological and economical complexities. Similar to the Early Period, residential bases continued to be seasonally occupied while still continuing to use smaller resource procurement/processing sites for short-term occupation. Square stemmed and large side-notched variants disappear while contracting-stemmed projectile points continue to be used. In the latter end of this period, small leaf-shaped projectile points emerge, marking the arrival of the bow and arrow. During this period, marine bird consumption significantly declined, in part due to over-exploitation from earlier periods. The hunting of sea mammals, in particular sea otters, increased. The bigger use of mortars and pestles in comparison to earlier periods suggests the increased reliance of harder seeds such as acorns (Enright et al. 2021-TN10293).

Middle Period artifact assemblages typically include the presence of circular shellfish hooks, bone gorges, and grooved stones in addition to trade-obtained material such as Olivella shells/saucers and obsidian. The use of wooden plank canoes, also known as tomols, were introduced around 1500 BP, although its emergence appeared to be local to the Santa Barbara Channel region and not the entire Central Coast (Enright et al. 2021-TN10293). The Middle Period also demonstrates the emergence of bedrock mortars. This is evident at SLO-5, a shell midden site with associated bedrock mortars (Price and Clark 2019-TN10294). The site may have also been used as a short-term residential camp. Marine and terrestrial faunal remains including rabbit, deer, sea otters, rockfish, cabezon, and mussels were uncovered.

3.9.1.5 Middle-Late Transition Period (AD 950–1250; 950–700 BP)

The Central Coast during the Middle-Late Period reflects an increase in political complexity, social ranking, and craft specialization. This is especially evident in the south of Diablo Canyon in the Santa Barbara Channel. Settlement patterns suggest a deviation from coastal locales to inland locations, which may have been a result of warmer temperatures, decrease in precipitation, and overexploitation of available resources. Hopper mortars appear for the first time in the archaeological record alongside smaller projectile points for arrows, small bifacial bead drills, bedrock mortars, and shell beads. The absence of obsidian from the archaeological record in Santa Barbara area sites suggests the potential decline of trading during this period.

In the Pecho Coast, site SLO-9 is an example of a Middle-Late Transition Period site. SLO-9 is a coastal shell midden site on the northern mouth of Coon Creek in the southwest area of the Montaña de Oro State Park that was used between 1030 and 660 BP (Price and Clark 2019-TN10294). SLO-9 was the location of the California Polytechnic State University (Cal Poly) archaeological field schools in 2004 and 2005. Excavations revealed mussel and abalone, fire-altered rock, lithic and obsidian debitage, cores, bifacial and unifacial flake stone, shell beads, fishhooks, and faunal remains including bird, mammal, fish, and reptile remains (Price and Clark 2019-TN10294). Despite some evidence suggesting the decrease of trade during this period, SLO-9 has some Middle-Late Period deposits with larger densities of obsidian artifacts present. This indicates that trading continued in some shape or form with populations along the Pecho Coast.

3.9.1.6 Late Period (AD 1250–1769)

Populations along the Central Coast increased during the Late Period, resulting in more single-component sites during this period than before. The single-component sites appear more in the interior, suggesting the reduced occupation of coastal areas in favor of more inland ones (Price and Clark 2019-TN10294). Artifact assemblages from this period include small arrow points, small bead drills, and bedrock and hopper mortars. Shell and stone beads become more standardized during this period and became frequently exchanged items (Enright et al. 2021-TN10293). Mortars and pestles continued to be the main technology used, although the continuation of hand stones and milling slabs is still evident in some archaeological contexts.

Pecho Coast sites indicate that diets heavily consisted of terrestrial mammals, although this appears to contrast regional trends. Data from the Channel Islands suggest that marine resources, primarily fish, were consumed during the Late Period. Sites with Late Period components include SLO-2, SLO-51/H, SLO-1366/H, and SLO-1370/H. Excavations from SLO-1366/H, Tom's Pond, demonstrate an apparent response to climate shifts and associated impacts to terrestrial fauna by the increased use of marine resources for subsistence (Enright et al. 2021-TN10293).

3.9.1.7 Post-Contact/Ethnographic Period (AD 1769–1820s)

The region in and around Diablo Canyon is an area of interest to the Santa Ynez Band of Chumash Indians (Santa Ynez Band). In a letter dated February 15, 2024, the Santa Ynez Band stated that its original territory lies along the coast of California, between Malibu and Paso Robles, as well as on the Northern Channel Islands. The area was first settled about 13,000 years ago and at one time had a total population of about 18,000 people (Santa Ynez Band of Chumash Indians 2024-TN10281). Although outside the project area, the Santa Ynez Band have designated Morro Rock and sites surrounding Morro Rock as sacred sites and the location of the Santa Ynez's Solstice Ceremony (Santa Ynez Band of Chumash Indians 2024-TN10281).

The project area is within the traditional homelands of the Chumash, specifically the Northern Chumash. It is important to note that in some instances in the historical record, the Northern (*tiłhini)* Chumash are referred to as the *Obispeño,* which denotes the group's association with the San Luis Obispo de Tolosa mission. However, descendants consider the term derogatory, preferring to use *yak tit^{y}u tit^{y}u yak tiłhini* (*ytt*) instead. Therefore, the term *Obispeño* will only be used in this SEIS as referenced in cited archaeological or ethnographic studies.

At the time of contact, the Chumash were one of the most populous and socially complex Indigenous groups in California. Their traditional territory ranged from the Pacific Coast west to the Coast Range east and from the Santa Maria River south to Point Estero, north of Diablo Canyon (Price and Clark 2019-TN10294). The Northern Chumash appear to have had smaller population densities in comparison to other Chumash in the region. Leadership responsibilities were inherited, in some cases, chiefs ruled over several villages. Ethnographic work from the early 1900s recorded at least six Chumash languages (*Obispeño, Ineseño, Barbareño, Ventureño, Purisimeño, Ysleño*), each corresponding to a regionally based group (NARA 2019-TN10278, Mills and Brickfield 1986-TN10279). The *Obispeño* language was spoken in the Diablo Canyon region (NRC 2025-TN11981).

During the Post-Contact/Ethnographic Period, the Chumash were non-agrarian and relied on fishing, hunting, and gathering for their sustenance. As described in previous sections, much of their subsistence was based on marine resources but also included acorns and other nuts as staples. The Chumash participated in the regional trading network, supplying materials such as univalve *Columella* ornaments, steatite vessels, wooden dishes, shell beads, asphaltum, dried fish, and sea otter furs to indigenous groups north and inland. In return, they received goods such as obsidian and beads (Enright et al. 2021-TN10293).

Many of the villages dating to the Late Period are Chumash villages. Johnson (2020-TN10045) conducted an ethnographic and genealogical study of the Diablo Canyon area, aiming to identify descendants of Northern Chumash people who belonged to rancherías (native villages) that were in the Diablo Canyon Lands area. Records determined that at least five rancherías existed between Avila Beach and Montaña de Oro State Park, north of the Diablo Canyon site: *Tsquieu* (tsɨkyɨw), *Sepjato* (tsɨpxatu), *Chano* (čanu), *Petpatsu* (petpatsu), and *Guejetmimu* (wexetmimu'). *Tsɨkyɨw* (also known as *Tstyiwi* [SLO-51/H]) is the only village positively confirmed to be within the Diablo Canyon Lands (Johnson 2020-TN10045).

Tstyiwi (SLO-51/H) was a fully sedentary, year-round village occupied during the Post-Contact Period. *Tstyiwi* was also occupied during the Late Period, thought to represent the primary long-term residential site during that period. The site is unique for its evidence of terrestrial bird exploitation during the Post-Contact Period. Additionally, it is the only Pecho Coast site where macrobotanical remains were recovered from excavations.

The Post-Contact Period assemblages from the site result from two excavated units. The excavations yielded shell and glass trade beads (Olivella beads and abalone epidermis disk beads), high densities of projectile points, fishing equipment, pestles, unfinished fishhook blanks, and similar tools (Enright et al. 2021-TN10293). From the 1,373 macrobotanical specimens collected from a hearth-like feature, acorn nutshell and wild cherry were the most common species identified. Samples also included brome grass (*Bromus* sp.), fescue grass (*Vulipa* sp.), red maids, goosefoot (*Chenopodium* sp.), clover (*Trifolium* sp.), nightshade (*Solanum* sp.), and berries. Small quantities of Eurasian seeds were also observed (Enright et al. 2021-TN10293).

The faunal assemblage at *Tstyiwi* shows a significant decline in terrestrial mammal consumption. The presence of cottontail, mule deer, cattle, and similar fauna suggests that the village inhabitants were limited to foraging within their immediate area, perhaps to avoid the Spanish who were using Avila Beach at the time. The high density of fish remains encountered also indicate that fishing was extremely important during this period. Rockfish, pricklebacks, herrings, cabezon, shellfish, and sea mussels were noted in the archaeological record (Enright et al. 2021-TN10293). Terrestrial birds from the cultural deposits recovered included California quail (*Callipepla califorica*), thrush (*Catharus* sp.), and American robin (*Turdus migratorius*) (Enright et al. 2021-TN10293).

3.9.1.8 Historic Period (1820s to present)

Spanish explorers began to arrive in the now-Mexico area in the 1500s but did not attempt to occupy the area until the 1700s. To settle the "new" territory, the Spanish Crown established missions and presidios (fortified settlements) to control New Spain, today's Mexico and Baja California. Additional missions were ordered to be constructed in Alta California (now California) in 1768. Historic accounts from the Portolá and Anza expeditions in 1769 and 1775 record them passing along San Luis Obispo and stopping by Chumash settlements (Price and Clark 2019-TN10294). Spanish encroachment in native territories was detrimental. The Spanish restricted access to areas important for foraging and resource procurement. The introduction of European plants and animals impacted the local ecology. Further, Native Californians were exposed to diseases they had little resistance to, ultimately decimating their populations.

The establishment of San Antonio de Padua (1771), San Luis Obispo de Tolosa (1772), and San Miguel Arcángel (1797) in the San Luis Obispo area significantly disrupted the Chumash's social, economic, and political structure (Price and Clark 2019-TN10294). Most Chumash eventually succumbed to the Spanish mission system way, but others refused and escaped further inland, finding refuge with other Tribes.

In 1821, as a result of the Mexican Revolution, California became a part of the Republic of Mexico, and the new government began secularizing the Spanish missions by converting them into churches. In 1834, the Alta California government granted former mission properties to prominent Mexican citizens as ranchos. Referred to as the Rancho Period, this land-granting policy introduced wealthy landowners who controlled the development of the area.

A total of 35 land grants were awarded within San Luis Obispo County. In 1842, Governor Juan Bautista Alvarado granted Victor Linares, a retired soldier and *alcalde* in San Luis Obispo, the *Rancho Cañada de Los Osos* grant in the northern area of Pecho Coast (Greenwood 1972-TN10041, Enright et al. 2021-TN10293). A year later, Governor Manuel Micheltorena granted *Rancho Pecho y Islay* to Francisco Padillo. In 1845, Governor Micheltorena was ousted and replaced by Pio de Jesus Pico IV. Pico combined both ranchos and later granted the property to Diego Scott and Juan Wilson (Price and Trumbly 2009-TN9832, Enright et al. 2021-TN10293). By 1850, Wilson became the sole proprietor of the grant. Wilson and those who leased and bought portions of this land over the following 115 years used the Diablo Canyon area for pasture and other agricultural purposes. Crops were grown on the coastal terraces and livestock were grazed on the hills farther inland.

In 1892, Alden Spooner leased 6,500 ac (2,630 ha) of Pecho Coast land, which extended north of Islay Creek to Diablo Creek. In 1902, he purchased the ranch from Henry Cowell, who had purchased the property from Ramona Hillard, Juan Wilson's granddaughter. Spooner developed his ranch into an agricultural and dairy enterprise. Spooner's three sons inherited the farming business in 1920, after their father's death.

In the 1920s and 1930s, Japanese-American farmers leased much of the coastal terrace area, including the area around the Diablo Canyon site, for agricultural use. The Teraoka, Yoshida, Fujita, Kuranaga, Nakamura, and Honda families were a part of the Japanese community along the coast. These farmers made a significant impact on the agricultural economy and historic landscape until they were relocated to internment camps during World War II. The Teraoka family farm is now archaeological site SLO-1197/H. The Yoshida family farm is registered as SLO-1196H.

Eventually, the northern half of the Spooner Ranch became part of the Montaña de Oro State Park in 1965, and the southern half was bought by PG&E (Price and Trumbly 2009-TN9832). In 1985, commercial operation of Diablo Canyon began servicing customers in central and northern California.

3.9.2 Historic and Cultural Resources at Diablo Canyon

Historic and cultural resources refer to archaeological sites, historic buildings, Traditional Cultural Properties (TCPs) important to a living community, shipwrecks, and other resources considered through Section 106 of the NHPA (54 U.S.C. § 306108-TN4839). Historic and cultural resources that have been determined to be significant include those that have been determined eligible for inclusion on or formally listed in the NRHP. Section 106 of the NHPA requires Federal agencies to consider the effects of their undertakings on historic properties that are listed or eligible for listing on the NRHP. If historic and cultural resources are present, the eligibility of any historic properties for listing on the NRHP is determined through the application of the NRHP criteria in 36 CFR 60.4 (36 CFR Part 60-TN1682) in consultation with the SHPO, American Indian Tribes (Tribes) that attach cultural and religious significance to historic properties, and other interested parties.

The Diablo Canyon area is considered sacred to the Northern (*tiłhini*) Chumash (SMWLLP 2024-TN11886). The marine and terrestrial cultural resources within and beyond the Diablo

Canyon area are direct evidence of Chumash lifeways and are considered TCPs to the Tribes. For the *ytt*, Pecho Coast is the home of their ancestors' villages, and the lands are still used today as prayer sites and as a gathering location for resource procurement for making basketry and regalia. Additionally, as stated by the ytt:

> The Northern (*tiłhini)* Chumash people have a profound cultural relationship with tspeteʔ, known in English as abalone. *ytt*'s members hold memories of our relatives gathering and diving for abalone, pounding the meat to eat, and leaving a tall mound of abalone shells in the backyard. *ytt*'s foodways are medicine for our bodies; they give us health, strength, and life. After thousands of years, our bodies and DNA are adapted to this local diet, evolving to require it for optimal physical and spiritual health. Not only does abalone provide a traditional food source, but it also represents a richness and presence of certain life—a specific terrain and habitat that goes hand-in-hand with abalone. Where there is abalone, *ytt*'s people have found kelp for tools; eelgrass for clothing; seaweed and sea vegetables for food; muscles, sea urchins, and crabs for food; fish, sharks, otters and sea lions for food, oil, clothing, furniture, tools; Olivella snails to manufacture shell money beads for trade; birds for food, musical instruments, and ceremony; and stone for tools and places for prayer (SMWLLP 2024-TN11886).

To identify additional cultural resources and historic properties within the project area, a literature search incorporating a one-mile buffer was reviewed through the California Historical Resources Information System Central Coast Information Center (CCIC) database to gain a better understanding of the archaeological resources that could potentially be affected by the proposed action. A total of 27 archaeological sites and one archaeological historic district are within one mile of the APE.

Applied EarthWorks, Inc. (Æ) and ERM (Enright et al. 2021-TN10293) had performed a cultural resources review for the Diablo Canyon decommissioning prior to California Senate Bill 846 (State of California 2022-TN10038), which supported extending Diablo Canyon's operation for an additional five years. This review offers the most recent inventory of PG&E's archaeological record. The following sections provide more detail of the historic and cultural resources within the project area.

3.9.2.1 Rancho Cañada De Los Osos y Pecho y Islay Archaeological Historic District

Portions of the APE intersect the *Rancho* Archaeological Historic District (District). The District is located along the coastal terrace within the Diablo Canyon property and crosses into the Montaña de Oro State Park, north of the Diablo Canyon property. The District is 2,434 ac (985 ha) and comprises 106 sites, 84 are contributing to the district and 22 are noncontributing. The 22 noncontributing sites include seven that lack integrity or have been destroyed, 14 that date exclusively to the historic period, and one that is of undetermined age. The contributing sites range from the late Paleoindian Period (pre-10,300 BP) to the historic period (ca. 1820s). Several of the archaeological sites described in the following section are contributing properties to the District.

The District was first registered by Robert Hoover in 1973 as part of his survey for proposed development at Marre Ranch, south of the project area (Hoover 1973-TN10047). Of the 22 sites he identified or revisited (14 sites were recorded prior to his survey), he nominated 15 for the National Register as a district, naming it the *Rancho Cañada de Los Osos y Pecho y Islay*. The Keeper of the National Register accepted the nomination in 1975 (Enright et al. 2021-TN10293, Price and Clark 2019-TN10294).

The District is eligible for the National Register under criterion D of 36 CFR 60.4 for its potential to yield information important in prehistory under themes including chronology, subsistence, technology, settlement patterns, land use strategies, sociopolitical organization, and paleoenvironmental change. The District also retains all aspects of integrity: setting, location, design, materials, workmanship, feeling, and association (Price and Clark 2019-TN10294). The District has been expanded numerous times between 1974 and 2019. The latest revision was completed by Price and Clark (2019), in which they included 69 nominated contributing properties to the District (Price and Clark 2019-TN10294). The updated District nomination is currently undergoing revisions and PG&E expects to submit the documentation to the OHP's Registration Unit in 2025 (NRC 2025-TN11982).

3.9.2.2 Previously Recorded Sites

A total of 27 archaeological sites are within one mile of the APE, 10 within the 750 ac (304 ha) APE and 17 within the larger one-mile radius. The sites consist of former village sites, short term habitation sites, and lithic scatters all dating to the precontact era (Enright et al. 2021-TN10293). Eight of the 10 sites within the APE contribute to the *Rancho* Archaeological District. The two sites, SLO-584 and SLO-1163, do not contribute because they have been destroyed.

The largest archaeological site within the APE is SLO-2, a precontact village site sitting on 47 ac (19 ha) of coastal terrace within the Diablo Canyon property. The site was first recorded in 1947 by Arnold Pilling as a large burial locale. Two decades later, prior to the construction of Diablo Canyon, Roberta Greenwood excavated a portion of the site. Her excavations uncovered significant archaeological material including a 10 ft (3.5 m) deep midden, close to 3,000 artifacts, and over 35,000 faunal remains. Radiocarbon dating confirmed the site to be 10,250 years old with site occupation during the Paleoindian, Millingstone, Early, and Late Periods (Greenwood 1972-TN10041, Enright et al. 2021-TN10293). Today, the site is listed individually on the NRHP and is also a contributing element to the *Rancho* District.

Another site within the APE is SLO-61, a short term residential precontact site that overlooks the coast. Similar to SLO-2, the site was recorded by Pilling in 1948 and was one of the six sites in which Greenwood conducted excavations in the 1970s. Although the construction of Diablo Canyon impacted portions of the site, it was discovered in 2011 during the installation of a fiber optic cable that portions of the site were still intact. In 2016, Æ excavated three shovel tests and four test units. The excavations revealed over 300 pieces of lithic debitage, one stemmed projectile point, close to 40 fire-modified rocks, a handful of ground stone pieces, and two shell beads. The excavation also uncovered over 1,000 fish and nonfish bones, over 12,600 grams of marine shell, and 46 botanical specimens (Enright et al. 2021-TN10293, CCIC 2024-TN10282).

While most of the 17 sites within the one-mile radius of the APE are predominantly precontact, a few are historic. The Yoshida farmstead (SLO-1196H) is the former farm location of the Yoshida family, one of several Japanese families who resided and farmed along the Pecho Coast in the early 1900s. The site was originally recorded in 1987 and has been updated periodically. In 2013 and 2015, shovel testing conducted by Æ revealed artifacts representing residential and consumption activities. Japanese decorated ceramics, bottle glass, shell, bone, clothing, and other domestic artifacts were identified (CCIC 2024-TN10282). Several members of the Japanese families were also interviewed for Jennifer Whiteman's 2013 ethnography (see Ethnographic Studies section below). The Yoshida family farm site was the location of the 2024 Cal Poly field school. While the farmstead is eligible individually, it is one of the 22 noncontributing sites to the *Rancho* District.

The only multicomponent site within one mile of the APE is Lion Rock Gully. The site was recorded in 1990 as a historic trash dump and a small lithic scatter (CCIC 2024-TN10282). The site is contributing to the *Rancho* District.

3.9.2.3 Previous Archaeological Surveys

The entirety of the APE has been surveyed for historic and cultural resources (PG&E 2024-TN10032). Table 3.8-1 in PG&E's ER describes all the previous studies conducted on or near Diablo Canyon from the 1950s to present (PG&E 2023-TN9822).

Arnold Pilling is considered the first to complete a formal archaeological survey in the area, although it appears that earlier undocumented work occurred by the Los Angeles County Museum in the late 1920s (Enright et al. 2021-TN10293). Pilling surveyed the Pecho Coast in the 1950s, in which he recorded numerous sites along the coast from Morro Bay north to Avila Beach south of the project area. Work associated with the construction of the Diablo Canyon site began in the 1960s with Francis Riddell's investigations. Riddell recorded five archaeological sites within the Diablo Canyon boundary (labeled Riddell 1–5), including the now-site SLO-2 as Riddell 1 (Riddell 1966-TN10043). He recorded an additional six sites as part of his fieldwork for the access road from Avila Beach to the now-Diablo Canyon site during the same time (Riddell 1966-TN10043).

Additional investigations were conducted by Roberta Greenwood and Robert Hoover in the 1960s and 70s. Greenwood's excavations centered on six sites, including SLO-2. Throughout the following decade, Greenwood returned to Diablo Canyon to assist PG&E with the management of cultural resources and to conduct subsequent archaeological surveys. Her extensive work established the long-term use and human occupation of the area for over 9,000 years (Greenwood 1972-TN10041). Hoover (1973-TN10047) conducted a survey south of Diablo Canyon as part of an environmental study for the proposed development at Marre Ranch. As described above, Hoover's work registered 15 sites, which served as the basis for the *Rancho Cañada de Los Osos y Pecho y Islay* Archaeological District.

In 2009, Price and Trumbly prepared a study to determine if it was feasible to renew the Diablo Canyon operating licenses (Price and Trumbly 2009-TN9832). The report gave an overview of existing resources within 6 mi (10 km) of the plant area. As part of the review, they conducted a targeted survey of the PG&E property, visiting areas that had not been previously surveyed but appeared to be sensitive for cultural resources. Additionally, they visited previously recorded sites to assess the condition of the sites and the adequacy of the site records. No new archaeological or architectural resources were recorded in their survey (Price and Trumbly 2009-TN9832). Their findings determined that the continued operations of Diablo Canyon were not expected to adversely affect cultural resources in the study area.

The most recent survey of Diablo Canyon Lands was prepared by Enright et al. (2021-TN10293) in support of the decommissioning of the Diablo Canyon site. The report focused on the 750 ac (304 ha) site and the Pismo Yard project. The review documented the results of their pedestrian survey and site updates for eight resources on the Diablo Canyon property, including the *Rancho* District nomination. No new archaeological sites were recorded as part of their investigation (Enright et al. 2021-TN10293). Last, their review offered a preliminary assessment of proposed project effects/impacts on eligible cultural resources, offered recommendations for additional studies, and presented an outreach plan for public engagement.

3.9.2.4 Previous Architectural Surveys

One architectural survey has been conducted within Diablo Canyon Lands. Specifically, in 2022, Page & Turnbull evaluated all the Diablo Canyon facilities on behalf of the County of San Luis Obispo for the Diablo Canyon decommissioning. The architectural survey was conducted over the course of two days in September 2021, evaluating the buildings by zone. Page & Turnbull determined that none of the facilities were eligible for the NRHP or for the California Register (P&T 2022-TN10044).

3.9.2.5 Previous Ethnographic Surveys

Three ethnographic studies have been completed in the vicinity of Diablo Canyon. The earliest studies in the area were by John P. Harrington between 1913 and 1916. Harrington was a linguist and ethnologist associated with the Smithsonian's Bureau of American Ethnography who spent most of his 40-year career documenting California Tribes. His collection of work included recording over 130 languages, extensive information on Tribal boundaries, local geography, folklore, ceremonies, music, material culture, and other important information (NARA 2019-TN10278; Mills and Brickfield 1986-TN10279). Harrington studied the Chumash more thoroughly than any other Tribe in California. He worked with several Chumash members to document six distinct dialects (*Obispeño, Ineseño, Barbareño, Ventureño, Purisimeño, and Ysleño*) of the language. Harrington's work represents the fullest and most reliable documentation of the Chumash language today.

Harrington's documentation of the Chumash language is because of Rosario Cooper, the last known native speaker of the *Obispeño* language. They began working in 1913 and over the years, Harrington chronicled over 100 pages of notes from his work with Ms. Cooper, detailing sentences and vocabulary on various Chumash dialects. Cooper also shared *Obispeño, Purisimeño, Barbareño, Tulareño*, Yaqui, and Spanish songs with Harrington (Mills and Brickfield 1986-TN10279). Harrington's collection is publicly accessible at the Smithsonian Institution (Smithsonian 2024-TN10283).

Whiteman (2013-TN10295) led an ethnographic study of the Yoshida, Teraoka, and other Japanese-American families who resided in Pecho Coast in the 1920s-40s, prior to their forced removal to internment camps in 1942. These families leased land from the Spooner family to grow crops including artichokes, peas, brussels sprouts, lettuce, and other crops (Whiteman 2013-TN10295, Enright et al. 2021-TN10293). Whiteman's ethnography included interviews with family members and a visit to the Yoshida farm site, now a historic archaeological site.

Whiteman's ethnography provided an extensive overview of Japanese agriculture in California, farming on the Pecho Coast, daily living on the Pecho Coast, in particular for the Yoshida and Teraoka families, and their experiences during and after World War II and the internment camps. Members of the Japanese families who grew up along Pecho Coast have returned to visit the area several times. In April 2013, as part of the ethnographic study, PG&E invited the families to visit the Pecho Coast and the sites of their family farms. The public can read more about the Japanese farmers via an interpretive sign located along the Point Buchon Trail in the Montaña de Oro State Park. The sign has a brief history of the families, crops farmed, and historic photos of the farming era.

In 2020, the Santa Barbara Museum of Natural History performed the genealogical study on behalf of PG&E for the proposed Diablo Canyon North Ranch Road Improvement project. The purpose of the study was to identify descendants of Northern Chumash people who belonged to rancherías (native villages) that once existed in the Diablo Canyon Lands area. Based on archival sources, ethnographic records, and mission register data, the study identified five previous rancherías that existed between Avila Beach south of the project area and Montaña de Oro State Park, north of the Diablo Canyon Lands (Johnson 2020-TN10045).

The ethnographic study determined that the *ytt* had the strongest case for cultural affiliation with the Diablo Canyon Lands. It was concluded that the majority of *ytt* members descended from Rosario Cooper (the same individual that Harrington worked with) and Maria Agustina Olivera (Johnson 2020-TN10045). Members of the *ytt* could not only trace their ancestry back to one of the five rancherías but could also demonstrate continuity and identity as a Northern Chumash community that has been in the San Luis Obispo area from colonial times to the present day (Johnson 2020-TN10045).

3.9.3 Procedures and Integrated Cultural Resources Management Plan

PG&E has a well-established cultural resources program comprised of several full-time professional archaeologists who oversee the PG&E service area. PG&E has one professional archaeologist dedicated to Diablo Canyon that oversees ongoing maintenance and operations activities at Diablo Canyon. PG&E archaeologists have a strong relationship with local Tribes as well as the Cal Poly archaeology program, which PG&E allows to conduct surveys and field schools within its property. Additionally, PG&E's Land Stewardship Team considers the potential risks to historic and cultural resources from ground-disturbing activities at Diablo Canyon. The Land Stewardship Team, which includes PG&E archaeologists, provides recommendations for avoiding impacts to historic and cultural resources and oversees implementation of protection measures prior to the start of any ground-disturbing activities.

PG&E has extensive administrative controls and environmental procedures that aim to identify, protect, and minimize potential impacts to historic properties within Diablo Canyon Lands. All administrative procedures were requested and provided for the NRC staff's confirmatory review. Utility Procedure ENV-8005P-01, "Cultural Resource Constraints Report (CRCR) Procedure," directs PG&E staff on impact screening practices and how inadvertent discoveries are handled. This includes stopping all work in the vicinity of the discovery and immediately notifying a PG&E archaeologist (PG&E 2024-TN10032). PG&E's best management practices also include an internal Cultural Resources Guidance Wiki, available to all environmental staff and contractors fleetwide, and a Cultural Resources Awareness and Response brochure that is distributed throughout PG&E and its contractors to support appropriate measures taken during an inadvertent discovery.

PG&E has two fleetwide inadvertent discovery plans for the discovery of human remains. One addresses discoveries on State and private lands and a separate one handles discoveries on Federal lands where Native American Graves Protection and Repatriation Act (43 CFR Part 10-TN4845) compliance may apply. PG&E complies with State public resources codes that administer next steps, including the identification of the Most Likely Descendant. The Most Likely Descendant and landowner determine the desired disposition of any human remains.

As part of the initial licenses for operation, the NRC required PG&E to develop a management plan for the avoidance and protection of site SLO-2. The license condition also stipulated the continued access of Diablo Canyon Lands to the Northern Chumash for cultural and religious activities. In response, PG&E developed the 1980 Archaeological Resources Management Plan (ARMP). Interdepartmental Administrative Procedure EV1.ID2, "CA-SLO-2 Site Management," guides the implementation of the ARMP for continued compliance at Diablo Canyon. This includes ongoing monitoring to document any natural or physical changes to SLO-2. If projects are to impact the site, the Land Stewardship Committee coordinates completion and submittal of regulatory agency notifications, responses to requests, and other project related reports.

3.9.4 Proposed Action

Section 106 of the NHPA requires Federal agencies to consider the effects of their undertakings on historic properties; renewing the operating license of a nuclear power plant is an undertaking that could potentially affect historic properties. The criteria for eligibility in the NRHP are discussed in Section 3.9 of this SEIS.

3.9.4.1 Consultation

In October 2023, PG&E sent letters to the Tribes and the California OHP seeking comments on the proposed action of Diablo Canyon LR. PG&E sent a letter to California SHPO Julianne Polanco on October 12, 2023, and letters were sent to the *ytt*, Barbareño Band of Mission Indians, Chumash Council of Bakersfield, Coastal Band of the Chumash Nation, Northern Chumash Tribal Council, Salinan Tribe of Monterey and San Luis Obispo counties, Santa Ynez Band of Chumash Indians, Tule River Indian Tribe, and the Xolon-Salinan Tribe on October 17, 2023 (PG&E 2023-TN9822; Appendix D). A response from the *ytt* was received on October 18, 2023. PG&E followed up with the same Tribes on November 7, 2023, informing them of the submittal of the Diablo Canyon LR application to the NRC. No responses were received (PG&E 2024-TN10032). PG&E met with Senior State Archaeologist Brendon Greenaway on November 8, 2023, to share information on the proposed LR and clarification of next steps with the NRC, including the NRC's separate consultation with the California OHP.

On January 24, 2024, the NRC initiated NHPA Section 106 consultation with the ACHP, the California OHP, and seven Tribes: the Santa Ynez Band of Chumash, the Tule River Tribe, the *ytt*, the Coastal Band of the Chumash Nation, the Salinan Tribe of Monterey and San Luis Obispo counties, the Northern Chumash Tribal Council, and the San Luis Obispo County Chumash Indians (NRC 2024-TN10005, NRC 2024-TN10006, NRC 2024-TN10007, and NRC 2024-TN10008). In its letters, the NRC provided information about the proposed action of Diablo Canyon LR, defined the APE, and indicated that the NHPA review would be integrated with the NEPA process, in accordance with 36 CFR 800.8(c). The NRC extended an invitation to participate in the scoping process and in the identification of cultural resources. The *ytt* responded on February 6, 2024, accepting the invitation to consult and requesting a meeting in person during the NRC staff's visit to San Luis Obispo (*ytt* Northern Chumash Tribe 2024-TN10309). The Santa Ynez Band of Chumash Indians responded on February 22, 2024, requesting formal consultation (Santa Ynez Band of Chumash Indians 2024-TN10310). Responses were not received from the other five Tribes.

On March 20, 2024, the NRC staff met in person with California OHP SHPO Julianne Polanco and Brendon Greenaway to discuss the proposed action, the NRC's consultation efforts thus far, and the anticipated next steps with respect to the LR application (NRC 2024-TN10311). OHP questioned if decommissioning was going to be addressed in the current proposed action and if so, they suggested a programmatic agreement to address potential impacts to historic properties since effects were not yet known. OHP offered suggestions on consultation and identifying unknown historic properties. The NRC staff had a follow-up meeting with Brendon Greenaway on April 4, 2024 (NRC 2024-TN10312). The NRC staff summarized updates from the NRC's meetings with the Santa Ynez Band and the *ytt* and the results of the site visit to Diablo Canyon. The NRC staff also presented on the previously registered sites and the various cultural resources surveys that have occurred at Diablo Canyon. The NRC staff discussed future decommissioning actions and the potential impacts to sites SLO-2 and SLO-61. The NRC staff specified that PG&E could not perform decommissioning activities that may adversely impact the two sites without prior NRC approval. Brendon Greenaway recommended a programmatic agreement to address future decommissioning activities and potential adverse effects to the two sites. Brendon Greenaway also recommended that the APE be extended from the 750 ac (304 ha) Diablo Canyon site to encompass the entirety of the *Rancho* District. On January 14, 2025, NRC staff met with Brendon Greenaway to discuss the status of NHPA Section 106 consultation, preliminary findings, and comments received on the draft SEIS.

The NRC staff met with the *ytt* on six occasions: February 8, March 21, April 5, September 30, and November 20, 2024, and April 24, 2025 (NRC 2024-TN10313, NRC 2024-TN10314, NRC 2024-TN10315, NRC 2024-TN11951, NRC 2025-TN11981). On February 8, 2024, the NRC staff discussed with the *ytt* the proposed action of Diablo Canyon LR, the NRC's environmental and cultural resources review processes, and the NRC's regulatory authority. Additionally, the NRC staff learned about the *ytt*'s history of interactions with PG&E and various State agencies. In the meeting, the *ytt* provided two reports to include in the NRC's environmental review. The *ytt* also requested that PG&E conduct a cultural resources study in coordination with the *ytt*. On March 21, 2024, the NRC staff continued its discussion with the *ytt* on the proposed action and shared key dates and methods available for engagement. The *ytt* discussed their sovereignty and their demonstrated ancestral ties to the Diablo Canyon Lands and shared their concerns about consultation. Additionally, the *ytt* reiterated their desire for an agreement and additional archaeological survey of the Diablo Canyon Lands. On April 5, 2024, the NRC staff again discussed, this time virtually, with the *ytt* the proposed action, as well as the separate action of the ISFSI license renewal. The *ytt* inquired about the previous archaeological surveys conducted on the Diablo Canyon Lands and what areas within the APE were still intact. The *ytt* requested copies of all archaeological surveys available, preconstruction photos of the area, and maps of recorded sites within the Diablo Canyon Lands. PG&E notified the NRC on May 15, 2024, that the requested files were provided to the *ytt*. At the September 30, 2024, meeting, the *ytt* discussed recommendations related to their review of PG&E's ER, which was submitted to the NRC on November 7, 2023 (NRC 2024-TN11951). The *ytt* offered several recommendations related to wording in the ER, provided clarifications on historical discussions, and identified areas where they believe information should be reviewed for accuracy or updated to reflect recent documentation related to the *ytt* and Diablo Canyon Lands (i.e., the 2018 Governor's State Historic Preservation Award and the 2020 Johnson ethnographic study). The *ytt* also shared their desire for an update to the 1982 access agreement to reflect the current practice for notifications. Finally, the *ytt* provided comments related to the consideration of the *ytt* with respect to the issues of environmental justice and socioeconomics (NRC 2024-TN11951). The NRC met with the *ytt* on November 20, 2024, to discuss the *ytt's* preliminary comments on the draft SEIS, and again on April 24, 2025, to discuss the NRC staff's resolution of the *ytt's* comments (NRC 2025-TN11981).

The NRC staff met with Sam Cohen, representing the Santa Ynez Band, on March 23, 2024 (NRC 2024-TN10316), and with their archaeologist Wendy Teeter on May 10, 2024 (NRC 2024-TN10317). The NRC staff discussed with Mr. Cohen the proposed LR. Mr. Cohen shared two copies of the book *Chumash Renaissance* by Paul H. Gelles and a list of Tribal representatives who may be helpful during the review of the LR application. Mr. Cohen requested hard copies of the draft and final SEIS when they are published. The NRC staff discussed with Santa Ynez Band archaeologist Wendy Teeter the Diablo Canyon Lands cultural resources, previous archaeological surveys completed in the area, and any potential concerns with the proposed LR. Ms. Teeter shared the Santa Ynez Band's work on proposing Morro Rock (Lisamu') as a

TCP and potentially having the entirety of Diablo Canyon's coastline as a Traditional Cultural Landscape. Ms. Teeter requested copies of the Enright et al. 2021 report and the Johnson 2020 ethnographic survey for her records (NRC 2024-TN10317).

On April 22, 2025, the NRC staff held a virtual meeting with representatives of PG&E and provided an update on the status of NHPA Section 106 consultations and discussed revisions made to the historic and cultural resources section of the draft SEIS as a result of comments received during the public comment period (NRC 2025-TN11982). The NRC staff met with PG&E and the *ytt* on May 15, 2025, to facilitate a discussion related to a site access request received as part of the *ytt's* comments on the draft SEIS (NRC 2025-TN11983).

Appendix C of this SEIS discusses the NRC's consultation documents.

3.9.4.2 Findings

The undertaking of Diablo Canyon LR has the potential to affect the *Rancho* Archaeological District and its contributing properties. Overall, the District has remained relatively intact except for disturbances associated with historic-era farming and the construction of Diablo Canyon. Because the majority of the area has retained its integrity, the District continues to contribute information about long term human occupation, settlement patterns, site use, resource procurement, processing activities, and other important themes in archaeology. Despite previous impacts, ground disturbing activities have continued to encounter intact deposits that still have enough integrity to contribute to the understanding of past culture.

No new construction or modifications are anticipated for the proposed action. Plant operations and maintenance activities necessary to support the continued operation would be limited to previously disturbed areas and would be expected to be similar to current operations. If unplanned digging activities were to occur, PG&E has procedures and mechanisms in place to minimize and protect any potential impacts to archaeological sites. As such, the proposed action will result in no adverse effect to historic properties, as defined in 36 CFR 800.5(b) (TN513). The undertaking would also not adversely impact the *Rancho* Archaeological District or historic and cultural resources.

3.9.5 No-Action Alternative

Under the no-action alternative, the NRC would not renew the operating licenses, and the power plant would begin decommissioning at or before the expiration of the current licenses. PG&E submitted a post-shutdown decommissioning activities report to the NRC in 2019 (PG&E 2019-TN10318) and a revised post-shutdown decommissioning activities report with updated conclusions on October 12, 2022 (PG&E 2022-TN10296). PG&E determined that archaeological sites SLO-2 and SLO-61 were likely to experience adverse effects from planned decommissioning activities.

The NRC's response letter dated June 20, 2023 (NRC 2023-TN10319), provided that per requirements in 10 CFR 50.82(a)(6), PG&E cannot perform planned decommissioning activities that will have significant environmental impacts to cultural resources without prior approval from the NRC. To this end, PG&E would have to submit a license amendment request and ER describing and evaluating any environmental impacts of the planned decommissioning activities that result in environmental impacts not previously reviewed. The NRC staff would review the license amendment request and ER and would ensure that all relevant legal requirements are met, including the NHPA and consultations thereunder. Based on the above, while adverse impacts have been preliminarily identified for decommissioning, it is unknown how detrimental those impacts would be until PG&E submits the required license amendment request and ER and until the NRC completes its review and any required consultations. Moreover, consistent with the NHPA, adverse effects would be assessed, determined, and mitigated with the SHPO and any Indian Tribe that attaches religious and cultural significance to identified historic properties.

3.9.6 Replacement Power Alternatives: Common Impacts

Impacts to cultural resources from construction and operation of replacement power alternatives would be dependent on the site at which these efforts are localized. For construction, impacts to historic properties would vary depending on the degree of ground disturbance (i.e., land clearing, excavations). If the project has a Federal nexus (i.e., license, permit), the Federal agency would need to make a reasonable effort to identify historic properties within the area of potential effects and consider the effects of their undertaking on historic properties, in accordance with Section 106 of the NHPA. Identified historic and cultural resources would need to be recorded and evaluated for eligibility for listing in the NRHP. If historic properties are present and could be affected by the undertaking, adverse effects would be assessed, determined, and mitigated with the SHPO and any American Indian Tribe that attaches religious and cultural significance to identified historic properties through the Section 106 consultation process.

Similar to construction, the potential for impacts from the operation of replacement power alternatives would be dependent on ground disturbing activities associated with plant operations, ongoing maintenance, modifications to the facility, and/or transmission lines. Areas subject to ground disturbance would need to be surveyed to identify and record any historic and cultural material encountered, if applicable. The appearance of the alternative power-generating facility and transmission lines could also result in alterations to the visual setting which, whether temporary or permanent, could affect other types of historic and cultural resources such as cultural landscapes, architectural resources, or TCPs. Impacts would vary depending on plant heights, associated exhaust stacks, or cooling towers.

3.9.7 Purchased Power Alternative

The purchased power alternative involves the establishment of a long-term contract to import replacement power into the Diablo Canyon service area to replace Diablo Canyon's net generation. Purchased power may come from natural gas power plants until 2045; then, any purchased power must come from renewable and zero-carbon sources as required by the State's 100 Percent Clean Energy Act of 2018 (State of California 2018-TN9855). Renewable sources may be wind, solar, or geothermal based. The NRC does not license natural gas or renewable energy facilities; therefore, the NRC would not be responsible for NHPA Section 106 consultations for this alternative. Ultimately, the magnitude and significance of adverse impacts on historic properties and historic and cultural resources resulting from this alternative would depend on the site location and layout, plant design and operations, and the resources present.

3.9.8 Renewables Combination Alternative

The renewables combination alternative would involve the construction and installation of 830 MW of wind turbines located both on and offsite of Diablo Canyon, 2,005 MW of offsite solar panels located within the PG&E service area, 200 MW of geothermal power, and demand side management. Impacts would be dependent on construction and operation and the physical and visual impacts associated with the construction and operation. To truly understand the impacts from this alternative, consultation with Tribes is crucial. In many cases, larger landscapes are considered TCPs and sacred areas to Tribes. Historic viewsheds would also need to be taken into consideration, as any potential modification to the landscape may have adverse impacts. For construction outside the APE, natural and cultural resources surveys should occur prior to beginning any ground disturbing activity to confirm the presence or absence of cultural resources in an effort to avoid impacts as much as reasonably possible.

Solar and wind installations would require significant acreage for siting and construction. For wind, siting in remote/rural areas increases the chance of encountering cultural resources, especially precontact ones. Further impacts may occur to natural and cultural resources with clearing land, vegetation, leveling, and other mechanical means if the selected location for construction/installation has not been previously disturbed. The physical footprint of a turbine may be limited to the foundation pad that it is installed on; however, ground clearing, laydown yards, and service roads are indirect impacts that would need to be taken into consideration. The visual impact may be more substantial for wind in comparison to other renewable energies. Wind turbines are large and are easily seen from miles away. The installation of any turbine would be an obstruction to the landscape; therefore, visual impacts may be greater, if not adverse, to any potential TCPs and/or historic properties within the area.

While solar would also require a significant amount of acreage, there is more flexibility in siting compared to wind. Using previously disturbed industrial sites for solar installations could minimize impacts to historic properties, or they could be sited in areas away from historic properties and/or TCPs. If solar and wind installation is to take place near or within the Diablo Canyon area, project activities would need to consider the *Rancho* Archaeological District and avoid physical and visual impacts to the District as much as possible.

Impacts to historic and cultural resources as a result of geothermal would vary depending on the location of the geothermal power-generating facility. Any ground disturbance associated with the construction of the power blocks, well pads, pipelines, access roads, and new transmission lines could impact historic and cultural resources. If sited near Diablo Canyon, impacts to the *Rancho* Archaeological District may be adverse if the District could not be avoided.

3.10 Socioeconomics

This section of the SEIS describes current socioeconomic factors that have the potential to be affected by changes in power plant operations at Diablo Canyon. Diablo Canyon and the communities that support it can be described as a dynamic socioeconomic system. The communities supply the people, goods, and services required to operate the nuclear power plant. Nuclear power plant operations, in turn, supply wages and benefits for people and dollar expenditures for goods and services. The measure of a community's ability to support Diablo Canyon continued reactor operations depends on its ability to respond to changing environmental, social, economic, and demographic conditions.

3.10.1 Nuclear Power Plant Employment

The socioeconomic region of influence (ROI) is defined by the areas where Diablo Canyon workers and their families reside, spend their income, and use their benefits, thus affecting the economic conditions of the region. PG&E employs a permanent full-time workforce of 1,222 workers (PG&E 2023-TN9822). Eighty-four percent of Diablo Canyon permanent workers reside in San Luis Obispo County, California (PG&E 2023-TN9822). The remaining workers are spread among other counties in California and other States (PG&E 2023-TN9822) (Table 3-18). Because most Diablo Canyon workers are based in San Luis Obispo County, the greatest socioeconomic effects are likely to be experienced there. The focus of the impact analysis, therefore, is on the socioeconomic impacts of continued Diablo Canyon operations in San Luis Obispo County.

Table 3-18 Residence of Permanent Full-Time Employees of Diablo Canyon Nuclear Power Plant

State or County	Number of Employees	Percentage of Total
San Luis Obispo County	1,023	84
Other California counties	186	15
Other states	13	1
Total	**1,222**	**100**

Refueling outages occur annually and last 35 days per unit. During a typical outage, an average of about 500 to 600 additional workers are onsite; however, there can be as many as 1,000 additional workers onsite during an outage (PG&E 2023-TN9822).

3.10.2 Regional Economic Characteristics

Goods and services are needed to operate Diablo Canyon. Although procured from a wider region, some portion of these goods and services are purchased directly from within the socioeconomic ROI. These transactions sustain existing jobs and maintain income levels in the local economy. This section presents information about employment and income in the Diablo Canyon socioeconomic ROI.

3.10.2.1 Regional Employment and Income

According to the U.S. Census Bureau's (USCB's) 2018–2022 American Community Survey 5-Year Estimates, educational services and the healthcare and social assistance industry represented the largest employment sector in the socioeconomic ROI, followed by professional, scientific, management, and administrative services (USCB 2023-TN10186). The San Luis Obispo County civilian labor force consisted of 138,411 individuals, and the number of employed individuals was 131,506 (USCB 2023-TN10186). Estimated income information for the socioeconomic ROI is presented in Table 3-19.

Table 3-19 Estimated Income Information for the Diablo Canyon Nuclear Power Plant Socioeconomic Region of Influence, 2018–2022, 5-Year Estimates

Metric	San Luis Obispo County	California
Median household income (dollars)	90,158	91,905
Per capita income (dollars)	47,390	45,591
Families living below the poverty level (percent)	6.1	8.5
People living below the poverty level (percent)	12.6	12.1
Unemployment rate	5.0	6.4

Source: USCB 2023-TN10186.

As shown in Table 3-19, people living in San Luis Obispo County had a median household income slightly lower than the State average. Additionally, the percentage of individuals living below the poverty level in San Luis Obispo County was slightly higher than the percentage of individuals living below the poverty level in the State of California.

According to the USCB 2018–2022 American Community Survey 5-Year Estimates, the unemployment rate in San Luis Obispo County was 5 percent. Comparatively, the unemployment rate in California during this same time period was 6.4 percent (USCB 2023-TN10186).

3.10.3 Demographic Characteristics

According to the 2020 Census, an estimated 155,845 people live within 20 mi (32 km) of Diablo Canyon, which equates to a population density of 124 persons per square mile (PG&E 2023-TN9822). This amount translates to a Category 4 population density using the LR GEIS (NRC 2024-TN10161: See page 3-86, adapted from original source, NUREG/CR-2239) measure of sparseness, which is defined as “greater than or equal to 120 persons per square mile within 20 mi (32 km).” An estimated 499,581 people live within a 50 mi (80 km) radius of the Diablo Canyon site, which equates to a population density of 64 persons per square mile (PG&E 2023-TN9822). This translates to a Category 3 proximity index. Therefore, Diablo Canyon is a combination of “sparseness” Category 4 and “proximity” Category 3 translating to a “high” population area based on the LR GEIS sparseness and proximity matrix (NRC 2024-TN10161).

Table 3-20 shows population projections and percent growth from 2000 to 2045 for San Luis Obispo County. During the last several decades, San Luis Obispo County has experienced a stable population. Based on population projections, the population is generally expected to increase through 2045, but at a slow rate.

The 2020 Census demographic profile of the Diablo Canyon ROI population is presented in Table 3-21. According to the 2020 Census, minorities (race and ethnicity combined) comprise 35 percent of the total population in the ROI. The largest minority population of any race in the ROI were Hispanic of any race (24 percent of the total population; 69 percent of the total minority population) and two or more races (4.8 percent of the total population; 14 percent of the total minority population) (USCB 2020-TN10033).

According to the USCB’s 2018–2022 5-year estimates, minority populations in the ROI were relatively stable at 35 percent (see Table 3-22).

Table 3-20 Population and Percent Growth in the Diablo Canyon Nuclear Power Plant Socioeconomic Region of Influence, San Luis Obispo County, California

Metric	Year	San Luis Obispo County Population	San Luis Obispo County Population Percentage Change
Recorded	2000	-	-
Recorded	2010	269,637	-
Recorded	2020	282,424	+0.46%
Projected	2030	284,729	+0.08%
Projected	2040	285,918	+0.04%
Projected	2045	286,006	+0.01%

Sources: USCB 2000-TN9672; PG&E 2023-TN9822.

Table 3-21 Demographic Profile of the Population in the Diablo Canyon Nuclear Power Plant Socioeconomic Region of Influence, 2020

Demographic	San Luis Obispo County
Total population	**282,424**
Percent White race	65.0%
Percent Black or African American race	1.5%
Percent American Indian and Alaska Native race	0.4%
Percent Asian race	3.5%
Percent Native Hawaiian and Other Pacific Islander race	0.1%
Percent some other race	0.6%
Percent two or more races	4.8%
Hispanic, Latino, or Spanish Ethnicity of Any Race (Total Population)	67,921
Percent Hispanic, Latino, or Spanish Ethnicity of Any Race of total population	24.0%

Source: USCB 2020-TN10033.

Table 3-22 Demographic Profile of the Population in the Diablo Canyon Nuclear Power Plant Socioeconomic Region of Influence, 2018–2022, 5-Year Estimates

Demographic	San Luis Obispo County
Total population	**281,712**
Percent White race	46.7%
Percent Black or African American race	1.2%
Percent American Indian and Alaska Native race	0.9%
Percent Asian race	3.8%
Percent Native Hawaiian and other Pacific Islander race	0.2%
Percent some other race	5.3%
Percent two or more races	11.9%
Hispanic, Latino, or Spanish Ethnicity of Any Race (Total Population)	65,946
Percent Hispanic, Latino, or Spanish Ethnicity of Any Race of total population	23.4%

Source: USCB 2023-TN10186.

3.10.3.1 Transient Population

San Luis Obispo County can experience seasonal transient population growth as a result of local tourism and recreational activities associated with multiple Federal, State, and local parks as well as camping areas in the county. There are three public use lands within 6 mi (10 km) of Diablo Canyon. The closest public use lands include a portion of Montaña de Oro State Park, Point Buchon Trail, and Pecho Coast Trail. A transient population creates a demand for temporary housing and services in the area.

Based on the USCB 2018–2022 American Community Survey 5-year estimates (USCB 2023-TN10186), 9,689 seasonal housing units are located in the socioeconomic ROI.

3.10.3.2 *Migrant Farm Workers*

Migrant farm workers are individuals whose employment requires travel to harvest agricultural crops. These workers may or may not have a permanent residence. Some migrant workers follow the harvesting of crops, particularly fruit, throughout rural areas of the United States. Migrant workers may be members of minority or low-income populations. Because they travel and can spend a significant amount of time in an area without being actual residents, migrant workers may be unavailable for counting to census data collectors. If uncounted, these minority and low-income workers are underrepresented in the decennial Census population counts.

Since 2002, the Census of Agriculture has reported the numbers of farms hiring migrant workers defined as a farm worker whose employment required travel that prevented the worker from returning to his or her permanent place of residence the same day (USDA 2017-TN9674). The Census of Agriculture is conducted every 5 years and results in a comprehensive compilation of agricultural production data for every county in the Nation.

Information about both migrant and temporary farm labor (i.e., working fewer than 150 days) can be found in the 2017 Census of Agriculture. Table 3-23 presents information about migrant and temporary farm labor in San Luis Obispo County. According to the 2017 Census of Agriculture, 6,681 farm workers were hired to work for fewer than 150 days and were employed on 879 farms in the socioeconomic ROI. A total of 132 farms in San Luis Obispo reported hiring migrant workers.

Table 3-23 Migrant Farm Workers and Temporary Farm Labor in Counties Located in the Socioeconomic Region of Influence (50 mi [80 km]) of Diablo Canyon Nuclear Power Plant

County	Number of Farms with Hired Farm Labor	Number of Farms Hiring Workers for Fewer Than 150 Days	Number of Farm Workers Working for Fewer Than 150 Days	Number of Farms Reporting Migrant Farm Labor
San Luis Obispo	879	588	6,681	132

Source: Table 7. Hired farm Labor—Workers and Payroll: 2017 (USDA 2017-TN10185).

3.10.4 Housing and Community Services

3.10.4.1 *Housing*

Table 3-24 lists the total number of occupied and vacant housing units, vacancy rates, and median values in the ROI. Based on USCB's 2018–2022 American Community Survey 5-year estimates, there are 123,968 housing units in the ROI, of which 108,099 are occupied. The median value of owner-occupied housing units in the ROI is $726,700. The homeowner vacancy rate is approximately 2.2 percent (USCB 2023-TN10186).

3.10.4.2 *Education*

San Luis Obispo County has 13 public school districts comprising 83 schools with a total of 32,598 students in the 2022–2023 school year. These 83 public schools include 1 preschool, 43 elementary schools, 4 elementary-middle schools, 10 middle schools, 2 middle-high schools, 20 high schools, and 3 K-12 schools (IES/NCES 2023-TN10030).

Table 3-24 Housing in the Diablo Canyon Nuclear Power Plant Socioeconomic Region of Influence, 2018–2022, 5-Year Estimate

San Luis Obispo County	Housing Data
Total housing units	**123,968**
Occupied housing units	108,099
Total vacant housing units	15,869
Percent total vacant	13%
Owner occupied units	67,031
Median value (dollars)	$726,700
Owner vacancy rate (percent)	2.2%
Renter occupied units	41,068
Median rent (dollars/month)	$1,800
Rental vacancy rate (percent)	4.7%

Source: USCB 2023-TN10186.

3.10.4.3 Public Water Supply

The primary source of water for San Luis Obispo County is groundwater. The County also gets 20 percent of its water supply from surface water and imported water. The largest water provider in the county is San Luis Obispo Water Department (PG&E 2023-TN9822). Water service is supplied to residents of San Luis Obispo County by 73 public and private water systems (SWRCB-DDW 2024-TN10031). Areas not serviced by these public and private water providers would likely use a private groundwater well. San Luis Obispo County has sufficient capacity for water supply and is projected to continue to have sufficient capacity into the future (PG&E 2023-TN9822).

The City of San Luis Obispo Water Resource Recovery Facility treats wastewater within the city. San Luis Obispo County Los Osos Wastewater System treats wastewater for the Golden State Water Company and the Los Osos Community Services District. Diablo Canyon is not serviced by these public water systems and has a private water supply and sanitary waste treatment system (PG&E 2023-TN9822).

3.10.5 Tax Revenues

Diablo Canyon has historically paid property taxes directly to San Luis Obispo County. The Board of Equalization is responsible for establishing property taxes for utility companies based on the value of all utility-operated property and assets throughout the State. This single unitary value is used instead of separately assigning a value to each component part. The Board of Equalization allocates the unitary value of public utility assets among taxing jurisdictions in proportion to the replacement cost new, less depreciation, value of each item of unitary property within a specific county. PG&E also pays environmental mitigation annual payments to the State Water Resources Control Board (SWRCB) in accordance with the OTC Policy (PG&E 2023-TN9822).

In 2016, PG&E announced the closure of Diablo Canyon with Unit 1 to permanently cease operations in 2024 and Unit 2 to permanently cease operations in 2025. PG&E participated in the Joint Proposal Agreement in coordination with the County of San Luis Obispo, San Luis Coastal Unified School District, and a local Coalition of Cities. As part of this agreement, PG&E agreed to a Community Impact Mitigation Plan with local jurisdictions to ease the impacts of the impending closure of Diablo Canyon (PG&E 2023-TN9822). The Community Impact Mitigation Plan included an Essential Services Mitigation Fund totaling $75 million paid to the county in annual installments through 2025 in the amount of $9,375,000 (PG&E 2024-TN10032). The second part is an Economic Development Fund one-time payment of $10 million paid to the county intended to fund regional economic development and job creation (PG&E 2023-TN9822). Due to the Joint Proposal Agreement and legislation in California Senate Bill 1090, the unitary tax paid by PG&E for Diablo Canyon was set on a linear path to zero by August 2025 (the planned permanent cessation of Unit 2). As of the publication of this draft SEIS, legislation regarding a new tax structure for Diablo Canyon has not been introduced.

Total San Luis Obispo County revenues, along with PG&E property tax payments for Diablo Canyon and OTC Policy environmental mitigation payments, are listed in Table 3-25.

Table 3-25 Total San Luis Obispo County Revenues and Tax Payments by Pacific Gas and Electric Company

Year	County of San Luis Obispo Total General Revenue (USD)	County of San Luis Obispo Total Property Tax Paid by PG&E (USD)	% of County Total Property Tax Paid by PG&E	Amount Paid to State Water Resources Control Board by PG&E (USD)
2018	$216,802,000	$29,585,881	13.65%	$9,017,476.58
2019	$273,501,000	$23,416,404	8.56%	$3,869,311.82
2020	$253,744,000	$20,784,902	8.19%	$4,402,397.82
2021	$294,345,000	$17,291,160	5.87%	$4,649,397.94
2022	$256,219,000	$15,054,757	5.88%	$5,517,119.02
2023	$303,556,000	$13,943,808	4.59%	NA

PG&E = Pacific Gas and Electric Company; NA = not available; USD = U.S. dollar.
Source: PG&E 2023-TN9822, 2024-TN10032 and SLOC 2023-TN10288.

3.10.6 Local Transportation

The transportation network surrounding Diablo Canyon comprises local roads, highways, rail, and air. U.S. Route 101 is a major highway east of Diablo Canyon running north–south through California. U.S. Route 101 provides commuter access to Diablo Canyon via Avila Beach Drive and San Luis Bay Drive. These roads merge to become Avila Beach Drive, which terminates at Avila Beach. Diablo Canyon Road is the primary access road leading from Avila Beach to the main facilities at the Diablo Canyon site, serving the employee population. Diablo Canyon Road is a paved, private, two-lane road with a secured access gate at Avila Beach Drive. Slip lanes on the north side of Avila Beach Drive and on Diablo Canyon Road speed the flow of traffic. Smaller unpaved roads provide access for grazing licensees and are not heavily used by employees (PG&E 2023-TN9822). Average annual daily traffic volumes and commuting routes to Diablo Canyon are listed in Table 3-26. Based on these volumes, the level-of-service (LOS) rating for existing roadway segments is LOS “S,” while freeway segments on U.S. 101 range between LOS “B” to LOS “D.”

Table 3-26 Average Annual Daily Traffic on Commuting Routes to Diablo Canyon Nuclear Power Plant

Roadway	Location	Average Annual Daily Traffic Volume
Avila Beach Drive/Diablo Canyon Road	Northwest of Avila Beach Drive	3,837
Avila Beach Drive	East of Diablo Canyon Road	4,203
Avila Beach Drive	East of San Juan Street	8,346
Avila Beach Drive	West of Cave Landing Road	10,258
Avila Beach Drive	West of San Luis Bay Drive	10,591
Avila Beach Drive	West of U.S. 101 Southbound Ramps	9,657
Avila Beach Drive	Between U.S. 101 Ramps	5,877
Avila Beach Drive	North of Avila Beach Drive	6,421
San Luis Bay Drive	West of Ontario Road	6,393

Source: PG&E 2023-TN9822.

Amtrak rail provides passenger service to the region via a route through the County of San Luis Obispo. The Union Pacific Transportation Company provides shipment service to the county. Other rail services exist in the City of San Luis Obispo. The County of San Luis Obispo Regional Airport is located approximately 12 mi (19 km) east of Diablo Canyon and is the nearest airport offering commercial air travel. There are no airports within 10 mi (16 km) of Diablo Canyon (PG&E 2023-TN9822).

3.10.7 Proposed Action

Socioeconomic effects of ongoing reactor operations at Diablo Canyon have become well established as regional socioeconomic conditions have adjusted to the presence of the nuclear power plant. Changes in employment and tax revenue could impact the availability of community services and housing, as well as traffic on roads near Diablo Canyon. These conditions are described in the preceding section. Any changes in employment and tax payments caused by LR and any associated refurbishment activities could have direct and indirect impacts on community services and housing demand, as well as traffic volumes in the communities near the nuclear power plant.

Socioeconomic NEPA issues from Table B-1 in Appendix B to Subpart A of 10 CFR Part 51, applicable to the LR of Diablo Canyon, are listed in Table 3-1. The review conducted for the LR GEIS did not identify any Category 2 socioeconomic NEPA issues (NRC 2024-TN10161).

The socioeconomic impact analysis for the LR of Diablo Canyon included a review of the PG&E ER (PG&E Applicant ER), scoping comments, and other information records. The NRC staff did not identify any new and significant information during the review that would result in impacts that would exceed the predicted socioeconomic impacts evaluated in the LR GEIS, nor any additional socioeconomic NEPA issues beyond those listed in Table B-1.

PG&E indicated in its ER that it has no plans to add non-outage workers during the LR term and that increased maintenance and inspection activities could be managed using the current workforce. Consequently, people living near Diablo Canyon would not experience any changes in socioeconomic conditions during the LR term beyond what is currently being experienced. Therefore, the impact of continued reactor operations during the renewal term would not exceed the socioeconomic impacts predicted in the LR GEIS. For these issues, the LR GEIS predicted that socioeconomic impacts, including transportation, would be SMALL for all nuclear power plants.

3.10.8 No-Action Alternative

3.10.8.1 Socioeconomics

Under the no-action alternative, the NRC would not renew the operating licenses and Diablo Canyon would shut down on or before the expiration of the current operating licenses. This would have a noticeable impact on socioeconomic conditions in the counties and communities near Diablo Canyon. The loss of jobs, income, and tax revenue would have an immediate socioeconomic impact. As jobs are eliminated, some, but not all, of the more than 1,200 workers could leave the region. Income from the buying and selling of goods and services needed to maintain the nuclear power plant would also be reduced. In addition, loss of tax revenue could affect the availability of public services.

If Diablo Canyon workers and their families move out of the region, increased vacancies and reduced demand for housing would likely cause property values to fall. The greatest socioeconomic impact would be experienced in the communities located nearest to Diablo Canyon in San Luis Obispo County. However, the loss of jobs, income, and tax revenue may not be as noticeable in larger communities due to the time and steps required to prepare the nuclear power plant for decommissioning. Therefore, depending on the jurisdiction, socioeconomic impacts from not renewing the operating licenses and terminating reactor operations at Diablo Canyon (no-action alternative) could range from SMALL to LARGE.

3.10.8.2 Transportation

Traffic volume on roads near Diablo Canyon may be noticeably reduced after the termination of reactor operations. Any reduction in traffic volume would coincide with workforce reductions at Diablo Canyon. Similarly, truck deliveries and shipments would also be reduced until active decommissioning. Therefore, due to the time and steps required to prepare the nuclear power plant for decommissioning, traffic-related transportation impacts would be SMALL.

3.10.9 Replacement Power Alternatives: Common Impacts

Workforce requirements for replacement power alternatives were evaluated to measure their possible effects on current socioeconomic and transportation conditions. The following sections provide a discussion of the common socioeconomic and transportation impacts during construction and operations of replacement power alternatives facilities. These common impacts encompass the specific impacts of the purchased power and the renewables combination replacement power alternatives. Potential differences in socioeconomic and transportation impacts between specific replacement power alternatives are differentiated in Table 3-27.

Table 3-27 Socioeconomic and Transportation Impacts of Replacement Power Alternatives to the Diablo Canyon Nuclear Power Plant

Alternative	Resource Requirements	Impacts	Discussion
Purchased Power	No new resource or worker requirements at existing, operating energy generating facilities	SMALL	Long-term agreement would not affect existing energy generating facility operations and workforce.
Combination, wind, PV, geothermal, DSM	Construction Workers (per installation): 1,100 over 1–2 years (29 solar PV installations), 400 over 4 years (8 wind installations), and 880 over 17–33 months (1 geothermal installation)	SMALL to LARGE	Workers would be scattered throughout the region and would have a significant noticeable effect on the local economy.
Combination, wind, PV, geothermal, DSM	Operation Workers (per installation): 16 (29 solar PV installations), 10 (8 wind installations), and 148 (1 geothermal installation)	SMALL to MODERATE	Workers would be scattered throughout the region and would not have a noticeable effect on local economy.

DSM = demand side management; PV = photovoltaic.
Sources: BLM 2019-TN8386; DOE 2011-TN8387; NRC 2011-TN6437; Luminant 2013-TN8669; NRC 2019-TN6136; Tegen 2016-TN8826.

3.10.9.1 Socioeconomics

Socioeconomic impacts are defined in terms of changes in the social and economic conditions of a region. For example, the creation of jobs and the purchase of goods and services during the construction and operation of a replacement power plant could affect regional employment, income, and tax revenue. For each alternative, two types of jobs would be created: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact, and (2) operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts.

While the selection of a replacement power alternative could create opportunities for employment and income and generate tax revenue in the local economy, employment, income, and tax revenue would be greatly reduced or eliminated in communities near Diablo Canyon. These impacts are described in the no-action alternative (Section 3.10.8). The following provides a discussion of the common socioeconomic and transportation impacts on the communities near replacement power alternatives facilities during the construction and operations of these facilities.

Construction

During construction of a replacement power alternatives facility, the relative economic effect of an influx of workers on the local economy and tax revenue would vary and depend on the size of the workforce and construction completion time. The greatest impact would occur in the communities where the majority of construction workers would reside and spend their income. As a result, some communities could experience a short-term economic boom during construction from increased tax revenue and income generated by expenditures for goods and services and increased demand for temporary (rental) housing. After construction, local communities would likely experience a return to preconstruction economic conditions.

Operation

Before the commencement of startup and operations at a replacement power alternatives facility, local communities would see an influx of operations workers and their families and increased demand for permanent housing and public services. These communities would also experience the economic benefits from increased income and tax revenue generated by the purchase of goods and services needed to operate a new power plant. Consequently, when compared to construction, power plant operations would have a greater potential for effecting permanent, long term socioeconomic impacts on the region.

3.10.9.2 Transportation

Transportation impacts are defined in terms of changes in level of service conditions on local roads near the replacement power alternatives facility. Additional vehicles during construction and operations could lead to traffic congestion, level of service impacts, and delays at intersections.

Construction

Transportation impacts would consist of commuting workers and truck deliveries of equipment and material to the construction site. Traffic volumes would increase during shift changes. In addition, trucks would deliver equipment and material to the construction site and remove waste material, thus increasing the amount of traffic on local roads. The increase in traffic volumes could result in levels of service impacts and delays at intersections during certain hours of the day. In some instances, construction material could also be delivered and removed by rail or barge.

Operation

Traffic-related transportation impacts on local roads would be greatly reduced after construction has been completed. Transportation impacts would include daily commuting by the operations workforce and deliveries of material, and the removal of commercial waste material.

3.11 Human Health

Diablo Canyon is both an industrial facility and a nuclear power plant. Similar to any industrial facility or nuclear power plant, the operation of Diablo Canyon during the LR period would produce various human health risks for workers and members of the public. This section describes the human health risks resulting from the operation of Diablo Canyon, which are those related to radiological exposure, chemical hazards, microbiological hazards, electromagnetic fields, physical occupational hazards, and electric shock hazards. The description of these risks is followed by the NRC staff's analysis of the potential impacts on human health of the proposed action of Diablo Canyon LR and the alternatives to the proposed action.

3.11.1 Radiological Exposures and Risk

- Operation of a nuclear power plant involves the use of nuclear fuel to generate electricity. Through the fission process, the nuclear reactor splits uranium atoms, resulting very generally in (1) the production of heat, which is then used to produce steam to drive the nuclear power plant's turbines and generate electricity, and (2) the creation of radioactive byproducts. As required by NRC regulations at 10 CFR 20.1101 (TN283), "Radiation protection programs," PG&E designed a radiation protection program to protect onsite personnel (including employees and contractor employees), visitors, and offsite members of the public from radiation and radioactive material at Diablo Canyon. The Diablo Canyon radiation protection program is extensive and includes, but is not limited to, the following:

- organization and administration (e.g., a radiation protection manager who is responsible for the program and ensures trained and qualified workers for the program)
- implementing procedures
- an as low as is reasonably achievable (ALARA) program to minimize radiation dose to workers and members of the public
- dosimetry program (i.e., measure radiation dose to nuclear power plant workers)
- radiological controls (e.g., protective clothing, shielding, filters, respiratory equipment, and individual work permits with specific radiological requirements)
- radiation area entry and exit controls (e.g., locked or barricaded doors, interlocks, local and remote alarms, personnel contamination monitoring stations)
- posting of radiation hazards (i.e., signs and notices alerting nuclear power plant personnel of potential hazards)
- recordkeeping and reporting (e.g., documentation of worker dose and radiation survey data)
- radiation safety training (e.g., classroom training and use of mockups to simulate complex work assignments)
- radioactive effluent monitoring management (i.e., controlling and monitoring radioactive liquid and gaseous effluents released into the environment)
- radioactive environmental monitoring (e.g., sampling and analysis of environmental media, such as air, water, groundwater, milk, food products, and sediment to measure the levels of radiation emitted into the environment that may impact human health)
- radiological waste management (i.e., controlling, monitoring, processing, and disposing of radioactive solid waste)

With respect to radiation exposure to Diablo Canyon personnel, the NRC staff reviewed the data contained in NUREG-0713, Volume 43, *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and other Facilities 2021: Fifty-Fourth Annual Report* (NRC 2024-TN9915). The fifty-fourth annual report was the most recent annual report available at the time of this environmental review. It summarizes the occupational exposure data in the NRC's Radiation Exposure Information and Reporting System database through 2021. Nuclear power plants are required by 10 CFR 20.2206 (TN283), "Reports of individual monitoring," to report their occupational exposure data to the NRC annually.

NUREG-0713 contains a calculation of a 3-year average collective dose per reactor for workers at all nuclear power reactors licensed by the NRC. The 3-year average collective dose is one of the metrics that the NRC uses in the Reactor Oversight Process to evaluate the applicant's ALARA program. Collective dose is the sum of the individual doses received by workers at a facility licensed to use radioactive material during a 1-year time period. There are no NRC or EPA standards for collective dose. Based on the data for operating pressurized-water reactors like the units at Diablo Canyon, the average annual collective dose per reactor year was 30 person-roentgen equivalent man (rem) (NRC 2024-TN9915). In comparison, Diablo Canyon had a reported annual collective dose per reactor year of 15.8 person-rem. PG&E continues to maintain a focus on exposure and source term reduction at Diablo Canyon. There are no plans to change the ALARA program during the LR term, but PG&E plans to continue to implement strategies for dose reduction along with ALARA program reviews and periodic assessments for good radiation worker practices.

Section 3.13.1 of this SEIS discusses offsite dose to members of the public.

3.11.2 Chemical Hazards

State and Federal environmental agencies regulate the use, storage, and discharge of chemicals, biocides, and sanitary wastes. Such environmental agencies also regulate how facilities like Diablo Canyon manage minor chemical spills. Chemical and hazardous wastes can potentially affect workers, members of the public, and the environment.

PG&E currently controls the use, storage, and discharge of chemicals and sanitary wastes at Diablo Canyon in accordance with its associated procedures and site-specific plans. PG&E monitors and controls discharges of chemical and sanitary wastes through Diablo Canyon's NPDES permit process, discussed in Section 3.5.1.3 of this SEIS. These plant procedures, plans, and processes are designed to prevent and minimize the potential for a chemical or hazardous waste release and, in the event of such a release, minimize the impact on workers, members of the public, and the environment (PG&E 2023-TN9822).

3.11.3 Microbiological Hazards

Microbiological hazards occur when workers or members of the public come in contact with disease-causing microorganisms, also known as etiological agents. Thermal effluents associated with nuclear power plants that discharge to water accessible to the public have the potential to promote the growth of certain thermophilic microorganisms linked to adverse human health effects. Microorganisms of particular concern include several types of bacteria and the free-living amoeba *Naegleria fowleri* (*N. fowleri*). There are optimum growth temperatures for the microorganisms of concern as further discussed in the LR GEIS (NRC 2024-TN10161).

As discussed in Section 2.1.3, Diablo Canyon utilizes a once-through cooling water system to remove thermal energy. Water is withdrawn from the Pacific Ocean and returned to the ocean after completing the cooling cycle. The Diablo Canyon intake and discharge coves, which connect directly to the Pacific Ocean, are protected by a 2,000 yd (1,800 m) marine exclusionary area. This barrier restricts public access to the intake and discharge coves (PG&E 2023-TN9822). These access restrictions limit public exposure to thermophilic microorganisms in the receiving waters of the plant. Therefore, continued operation is not expected to result in adverse effects to the health of the public from microbiological hazards. Public exposure to Legionella from nuclear power plant operation is generally not a concern because exposure risk is confined to components and equipment, which are typically within the protected area of the site and, therefore, not accessible to the public.

Plant workers are most likely to be exposed to pathogenic microorganisms from power plant operations when cleaning or providing other maintenance services that involve the cooling water system, including cooling towers and condensers. Diablo Canyon does not have cooling towers, although workers could be exposed while cleaning or maintaining other portions of the cooling water system, such as condensers. Diseases (e.g., legionellosis and primary amoebic meningoencephalitis) that involve respiratory or nasal infectivity routes are of primary concern, and workers should wear appropriate respiratory protection. Workers performing underwater activities should wear protective gear to prevent oral or nasal exposure to amoebae or other pathogenic bacteria. Diablo Canyon has a health and safety program that includes procedures for entry to cooling water systems where occurrence of Legionella is possible. Additional monitoring and precautions, including sampling for Legionella and respiratory protection, as appropriate, for work in these areas is part of the health and safety program (PG&E 2023-TN9822).

3.11.4 Electromagnetic Fields

Electromagnetic fields (EMFs) are generated by any electrical equipment. All nuclear power plants have electrical equipment and power transmission systems associated with them. Power transmission systems consist of switching stations (or substations) located on the nuclear power plant site and the transmission lines needed to connect the plant to the regional electrical distribution grid. Transmission lines operate at a frequency of 60 hertz (Hz) (60 cycles per second), which is low compared to the frequencies of 55 to 890 megahertz for television transmitters and 1,000 megahertz and greater for microwaves.

The scope of the evaluation of transmission lines includes only those transmission lines that connect the plant to the switchyard where electricity is fed into the regional power distribution system (encompassing those lines that connect the plant to the first substation of the regional electrical power grid), and power lines that feed the plant from the grid are considered within the regulatory scope of the LR environmental review. Transmission lines in scope are confined to the Diablo Canyon site, spanning the short distance between the generating units and the switchyards, as depicted in Figure 2.2-2 of PG&E's ER (PG&E 2023-TN9822).

Occupational workers or members of the public near transmission lines may be exposed to the EMFs produced by the transmission lines. The EMF varies in time as the current and voltage change, so that the frequency of the EMF is the same (e.g., 60 Hz for standard alternating current, or AC). Electrical fields can be shielded by objects such as trees, buildings, and vehicles. Magnetic fields, however, penetrate most materials, but their strength decreases with increasing distance from the source. The EMFs resulting from 60 Hz power transmission lines fall under the category of non-ionizing radiation. The LR GEIS (NRC 2024-TN10161) summarizes NRC-accepted studies on the health effects of EMFs. There are no U.S. Federal standards limiting residential or occupational exposure to EMFs from transmission power lines, but some States have set electric field and magnetic field standards for transmission lines (NIEHS 2002-TN6560). A voluntary occupational standard has been set for EMFs by the International Commission on Non-Ionizing Radiation Protection (ICNIRP 1998-TN6591). The National Institute for Occupational Safety and Health does not consider EMFs to be a proven health hazard (NIOSH 1996-TN6766).

3.11.5 Other Hazards

This section addresses two additional human health hazards: (1) physical occupational hazards and (2) electric shock hazards.

Nuclear power plants are industrial facilities that have many of the typical occupational hazards found at any other electric power-generation utility. Nuclear power plant workers may perform electrical work, electric powerline maintenance, repair work, and maintenance activities and may be exposed to potentially hazardous physical conditions. A physical hazard is an action, agent, or condition that can cause harm upon contact. Physical actions could include slips, trips, and falls from height. Physical agents could include noise, vibration, and ionizing radiation. Physical conditions could include high heat, cold, pressure, confined space, or psychosocial issues, such as work-related stress.

The Occupational Safety and Health Administration (OSHA) is responsible for developing and enforcing workplace safety regulations. Congress created OSHA by enacting the Occupational Safety and Health Act of 1970, as amended (TN4453), to safeguard the health of workers. With specific regard to nuclear power plants, plant conditions that result in an occupational risk, but do not affect the safety of licensed radioactive materials, are under the statutory authority of OSHA rather than the NRC, as set forth in a memorandum of understanding (NRC 2013-TN10165) between the NRC and OSHA. Occupational hazards are reduced when workers adhere to safety standards and use appropriate protective equipment; however, fatalities and injuries from accidents may still occur. Diablo Canyon maintains an occupational safety program for its workers in accordance with OSHA regulations (PG&E 2023-TN9822).

Based on its evaluation in the LR GEIS (NRC 2024-TN10161), the NRC has not found electric shock resulting from direct access to energized conductors or from induced charges in metallic structures to be a problem at most operating plants. Generally, the NRC also does not expect electric shock from such sources to be a human health hazard during the LR period. However, a site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of this SEIS. Transmission lines that are within the scope of the NRC's LR environmental review are limited to (1) those transmission lines that connect the nuclear plant to the substation where electricity is fed into the regional electrical power grid and (2) those transmission lines that supply power to the nuclear plant from the grid (NRC 2024-TN10161).

As discussed in Section 2.1.6.5 of this SEIS, all in-scope transmission lines are located within the Diablo Canyon site boundary. Specifically, there are two transmission corridors that encompass the in-scope transmission lines. In California, the National Electrical Safety Code criteria are not the governing standard for the construction of overhead transmission lines. The governing standard is the State of California Public Utilities Commission's General Order 95, "Rules for Overhead Electric Line Construction" (PG&E 2023-TN9822). The three 500 kV lines and the double-circuit 230 kV line associated with Diablo Canyon were designed and constructed to comply with the applicable State of California standards. PG&E inspects the Diablo Canyon in-scope transmission lines in accordance with California Public Utilities Commission governing standards and utility procedures. LiDAR surveys are used periodically at Diablo Canyon to support the visual transmission line inspections (PG&E 2024-TN10032). Diablo Canyon maintains an occupational safety program and electrical safety program, which includes protection from acute electrical shock and is conducted in accordance with OSHA regulations.

3.11.6 Proposed Action

According to the LR GEIS (NRC 2024-TN10161), the generic issues related to human health as identified in Table 3-1 would have SMALL impacts resulting from LR. The NRC staff identified no new and significant information about these issues. Thus, as concluded in the LR GEIS, the impacts of the generic issues related to human health would be SMALL.

Table 3-2 identifies one uncategorized issue (EMFs) and one site-specific (Category 2) issue (electric shock hazards) related to human health applicable to Diablo Canyon LR. These issues are analyzed below. As discussed in Section 3.11.3 of this SEIS, Diablo Canyon utilizes a once-through cooling system that intakes and discharges to the Pacific Ocean. This area is not accessible to the public. Therefore, the NRC staff concludes that the Category 2 issue of microbiological hazards to the public is not applicable to Diablo Canyon LR, that further review of the issue is not warranted, and that continued operation is not expected to result in adverse effects with respect to the issue.

3.11.6.1 Electromagnetic Fields (EMFs)

The LR GEIS (NRC 2024-TN10161) does not designate the chronic effects of 60 Hz EMFs from powerlines as either a Category 1 or 2 issue. Until a scientific consensus is reached about the health implications of EMFs, the NRC will not include them as Category 1 or 2 issues.

The potential for chronic effects from these EMFs continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the DOE. The NIEHS report (NIEHS 1999-TN78) contains the following conclusion:

The NIEHS concludes that ELF-EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement was not sufficient to cause the NRC to change its position with respect to the chronic effects of EMFs. The NRC staff considers the LR GEIS finding of “Uncategorized (Uncertain impact)” still appropriate and will continue to follow developments on this issue.

3.11.6.2 Electric Shock Hazards

Based on the LR GEIS (NRC 2024-TN10161), the NRC found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been identified as a problem at most operating plants and generally is not expected to be a problem during the LR term. However, a site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of the Diablo Canyon LR review.

As discussed in Section 3.11.5 of this SEIS, there are no offsite transmission lines that are in scope for this LR. Therefore, there are no potential impacts on members of the public. The onsite overhead transmission lines with the potential for electric shock to workers through induced currents are depicted in Figure 2.2-2 of the ER. To address this occupational hazard, PG&E adheres to the California Public Utilities Commission General Orders and OSHA compliance requirements for shock hazard avoidance (PG&E 2023-TN9822 and PG&E 2024-TN10032). As discussed in Section 3.11.5, Diablo Canyon maintains an occupational safety program and an electrical safety program in accordance with OSHA regulations for its workers, which includes protection from acute electric shock. Therefore, the NRC staff concludes that the potential impacts from electric shock hazards during the LR term would be SMALL.

3.11.6.3 Environmental Consequences of Postulated Accidents

In addition to the human health impacts discussed above, the issues of design-basis accidents and severe accidents at nuclear power plants are applicable to the proposed action. These issues are not applicable to the replacement power alternatives and, therefore, are not discussed further with respect to those alternatives.

3.11.6.3.1 Design-Basis and Severe Accidents

The LR GEIS (NRC 2024-TN10161) evaluates the following two classes of postulated accidents as they relate to LR:

- design-basis accidents: postulated accidents that a nuclear facility must be designed and built to withstand without loss to the systems, structures, and components necessary to ensure public health and safety
- severe accidents: postulated accidents that are more severe than design-basis accidents because they could result in substantial damage to the reactor core

As shown in Table 3-1, the LR GEIS (NRC 2024-TN10161) addresses design-basis accidents as a Category 1 issue and concludes that the environmental impacts of design-basis accidents are of SMALL significance for all nuclear power plants. No new and significant information related to design-basis accidents was identified during the review of the applicant’s ER (PG&E 2023-TN9822), the site audit, the scoping process, or evaluation of other available information. Therefore, there are no impacts related to this issue beyond those discussed in the LR GEIS.

Additionally, as shown in Table 3-1, the LR GEIS (NRC 2024-TN10161) also addresses severe accidents as a Category 1 issue and concludes that the environmental impacts from severe accidents are SMALL for all nuclear power plants. No new and significant information related to severe accidents was identified during the review of the applicant’s ER (PG&E 2023-TN9822), the site audit, the scoping process, or evaluation of other available information. Therefore, there are no impacts related to this issue beyond those discussed in the LR GEIS.

The LR GEIS also specifies that with respect to severe accidents, although the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are SMALL for all plants, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives and would be the functional equivalent of a Category 2 issue requiring plant-specific analysis (NRC 2024-TN10161). Furthermore, 10 CFR 51.53(c)(3)(ii)(L) requires that license renewal applicants consider alternatives to mitigate severe accidents if the NRC staff has not previously evaluated severe accident mitigation alternatives (SAMAs) for the applicant’s plant in an EIS or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving the environmental impact of severe accidents are identified and evaluated. SAMAs have not been previously considered for Diablo Canyon; therefore, the remainder of this section addresses SAMAs.

<u>Overview of the SAMA Process</u>

This section presents a summary of the SAMA evaluation for Diablo Canyon conducted by PG&E and the NRC staff’s review of that evaluation. The NRC staff performed its review with contract assistance from Pacific Northwest National Laboratory. The NRC staff’s review is available in full in Appendix F to this SEIS; the SAMA evaluation is available in full in PG&E's ER (PG&E 2023-TN9822).

The SAMA evaluation for Diablo Canyon was conducted with a four-step approach. In the first step, PG&E quantified the level of risk associated with potential reactor accidents using the plant-specific probabilistic risk assessment (PRA) and other risk models. In the second step, PG&E examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and training. PG&E initially identified a list of 21 potential SAMA candidates after eliminating those candidates that (1) were not applicable to Diablo Canyon, (2) had already been implemented at Diablo Canyon, (3) were combined with another SAMA candidate, or (4) were expected to have a very low benefit. This list was further reduced to 13 unique SAMA candidates by eliminating SAMAs that had an excessive implementation cost but with an additional 5 SAMA candidates being retained after considering the impact of uncertainty. In the third step, PG&E estimated the benefits and the costs associated with each of the 18 SAMAs. Estimates were made of how much each SAMA could reduce risk. Those estimates were developed in terms of dollars in accordance with NRC guidance for performing regulatory analyses (NRC 1997-TN676). The cost of implementing the proposed SAMAs was also estimated. Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether the SAMA was cost beneficial, meaning that the benefits of the SAMA were greater than the costs (a positive cost-benefit). PG&E concluded in its ER that two of the SAMAs evaluated are potentially cost beneficial (PG&E 2023-TN9822, PG&E 2024-TN10619).

The potentially cost-beneficial SAMAs identified through PG&E's evaluation do not relate to adequately managing the effects of aging during the period of extended operation; therefore, they do not need to be implemented as part of license renewal pursuant to 10 CFR Part 54. PG&E's SAMA evaluation and the NRC staff's review are discussed in more detail below.

Estimate of Risk

PG&E submitted an assessment of SAMAs for Diablo Canyon as part of the ER (PG&E 2023-TN9822). This assessment was based on the most recent revision of the Diablo Canyon PRA, which includes models for internal events, internal flooding, fire, and seismic, and a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System (WinMACCS) computer program, as well as insights from the Diablo Canyon Individual Plant Examination (IPE) (PG&E 1992-TN10662) and Individual Plant Examination of External Events (IPEEE) (PG&E 1994-TN10620).

PG&E combined two distinct analyses to form the basis for the risk estimates used in the SAMA analysis: (1) the Diablo Canyon Level 1 and 2 PRA model, which is an updated version of the IPE (PG&E 1992), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PRA model) developed specifically for the SAMA analysis. Other than fire and seismic events, the scope of the models does not include external events.

The Diablo Canyon total core damage frequency (CDF) is approximately 8.80×10^{-5} per year. The Diablo Canyon internal events CDF, excluding internal flooding events, is approximately 4.76×10^{-6} per year as determined from quantification of the Level 1 PRA model for Unit 1. The Diablo Canyon CDF estimates for internal flooding events, fire events, and seismic events are 7.61×10^{-6} per year, 4.60×10^{-5} per year, and 2.96×10^{-5} per year, respectively, as determined from quantification of the Level 1 PRA model for Unit 1. The Unit 1 risk estimates bound those of Unit 2, and owing to similarities between the units, the Unit 1 risk models provide a reasonable basis for the SAMA analysis for both units.

The breakdown of CDF by initiating event for Diablo Canyon is provided in Table 3-28, Table 3-29, Table 3-30, and Table 3-31 for internal events (excluding internal floods), internal flooding events, fire events, and seismic events, respectively. PG&E used the PRA model for Diablo Canyon in determining the potential risk reduction benefits of each SAMA. PG&E accounted for the potential risk reduction benefits associated with external events beyond fire and seismic events by multiplying the estimated benefits obtained from the Diablo Canyon PRA by a factor of 1.018.

Table 3-28 Core Damage Frequency for Internal Events (Excluding Internal Flooding) at Diablo Canyon Nuclear Power Plant

Initiating Event	CDF (per year)	% CDF Contribution
Small Break LOCA (Non-Isolable)	1.12×10^{-6}	24
Non-Isolated Steam Generator Tube Rupture for Level 2	8.44×10^{-7}	18
Loss of Offsite Power (Severe Weather)	3.39×10^{-7}	7
Loss of Auxiliary Saltwater Initiator	2.90×10^{-7}	6
Loss of Offsite Power (Grid Related)	2.79×10^{-7}	6
RCP Seal Catastrophic Seal Failure	2.29×10^{-7}	5
Reactor Trip	2.23×10^{-7}	5
Medium LOCA	2.00×10^{-7}	4
Loss of Offsite Power (Switchyard Related)	1.93×10^{-7}	4
Loss of Condenser Vacuum	1.35×10^{-7}	3
Loss of Switchgear Ventilation	1.14×10^{-7}	2
Excessive LOCA	1.07×10^{-7}	2
Loss of Offsite Power (Plant Centered)	1.05×10^{-7}	2
Other Initiating Events(a)	5.82×10^{-7}	12
Total CDF (Internal Events)	4.76×10^{-6}	**100(b)**

CDF = core damage frequency; LOCA = loss-of-coolant accident; RCP = reactor coolant pump.
(a) Multiple initiating events with each contributing less than 3 percent.
(b) Sum of contributors does not add up to 100 percent due to round off error.

Table 3-29 Core Damage Frequency for Internal Flooding Events at Diablo Canyon Nuclear Power Plant

Flood Area	CDF (per year)	% CDF Contribution
Fuel Handling Building	3.16×10^{-6}	42
Battery, Inverter, and DC Switchgear, F Bus	1.10×10^{-6}	14
Hallway Outside Diesel Generator Rooms	8.43×10^{-7}	11
Containment Penetration Area, 100’	8.07×10^{-7}	11
Unit 1 Main Turbine Building, 85’, 104’, and 119’	3.32×10^{-7}	4
Motor-Driven Auxiliary Feedwater Pump Room	2.38×10^{-7}	3
Other Flood Areas(a)	1.13×10^{-6}	15
Total CDF (Internal Flooding Events)	7.61×10^{-6}	**100(b)**

CDF = core damage frequency; DC = direct current.
(a) Multiple flood areas with each contributing less than 3 percent.
(b) Sum of contributors does not add up to 100 percent due to round off error.

Table 3-30 Core Damage Frequency for Fire Events at Diablo Canyon Nuclear Power Plant

Fire Area	CDF (per year)	% CDF Contribution
7A (Cable Spreading Room)	1.25×10^{-5}	27
5A4 (480V Non-Vital Switchgear and Hot Shutdown Panel Area 100')	4.92×10^{-6}	11
6A3 (Battery, Inverter and DC Switchgear, H Bus)	3.10×10^{-6}	7
14A (Unit 1 Main Turbine Building 85', 104', and 119')	2.82×10^{-6}	6
Other Fire Areas[(a)]	2.27×10^{-5}	49
Total CDF (Fire Events)	4.60×10^{-5}	**100[(b)]**

CDF = core damage frequency; DC = direct current.
(a) Multiple fire areas with each contributing less than 5 percent.
(b) Sum of contributors does not add up to 100 percent due to round off error.

Table 3-31 Core Damage Frequency for Seismic Events at Diablo Canyon Nuclear Power Plant

Initiating Event	CDF (per year)	% CDF Contribution
Seismic Level 13 (3.0 - 3.5g)	6.60×10^{-6}	22
Seismic Level 15 (4.0 - 6.0g)	4.26×10^{-6}	14
Seismic Level 14 (3.5 - 4.0g)	3.90×10^{-6}	13
Seismic Level 11 (2.5 - 2.75g)	3.90×10^{-6}	13
Seismic Level 12 (2.75 - 3.0g)	2.70×10^{-6}	9
Seismic Level 10 (2.25 - 2.5g)	2.26×10^{-6}	8
Seismic Level 9 (2.0 - 2.25g)	2.21×10^{-6}	7
Seismic Level 1 (0.2 - 0.35g)	1.12×10^{-6}	4
Other Initiating Events[(a)]	2.65×10^{-6}	9
Total CDF (Seismic Events)	2.96×10^{-5}	**100[(b)]**

CDF = core damage frequency.
(a) Multiple initiating events with each contributing less than 5 percent.
(b) Sum of contributors does not add up to 100 percent due to round off error.

PG&E estimated the dose to the population within 50 mi (80 km) of the Diablo Canyon site to be approximately 0.369 person Sieverts (Sv) per year (36.9 person-rem per year) for internal events, internal flooding events, fire events, and seismic events combined (PG&E 2023-TN9822). The breakdown of the total population dose and offsite economic cost risk by containment release mode is summarized in Table 3-32. Small and large early releases are the dominant contributors to population dose risk.

The NRC staff reviewed PG&E's data and evaluation methods and concludes that the quality of the risk analyses is adequate to support an assessment of the risk reduction potential for candidate SAMAs. Accordingly, the NRC staff bases its assessment of offsite risk on the CDFs, offsite doses, and offsite economic costs reported by PG&E.

Table 3-32 Base Case Mean Population Dose Risk and Offsite Economic Cost Risk at Diablo Canyon Nuclear Power Plant

Release Category: ID[a]	Release Category: Frequency (per year)	Population Dose Risk: person-rem/yr[b]	Population Dose Risk: % Contribution	Offsite Economic Cost Risk: $/yr	Offsite Economic Cost Risk: % Contribution
ST1 (Large Early)	4.63×10^{-6}	4.12	11.17	7.23×10^{4}	14.6
ST2 (Small Early)	3.79×10^{-5}	28.7	77.89	4.10×10^{5}	82.6
ST3 (Late)	4.01×10^{-5}	3.12	8.46	6.17×10^{3}	1.24
ST4 (Bypass w/AFW)	1.88×10^{-6}	0.585	1.59	4.21×10^{3}	0.85
ST5 (Interfacing System LOCA)	4.74×10^{-8}	0.329	0.89	3.35×10^{3}	0
ST6 (Intact)	3.61×10^{-8}	negligible	negligible	negligible	negligible
Total	**8.45×10^{-5} [c]**	**36.9[c]**	**100[d]**	**4.96×10^{5}[c]**	**100[d]**

AFW = Auxiliary Feedwater; ID = identification; LOCA = loss-of-coolant accident.
(a) Release Category descriptions provided in response to an NRC staff request for additional information (PG&E 2024-TN10032).
(b) Unit Conversion Factor: 1 Sv = 100 rem.
(c) Sum of contributors may not add up to Total due to round off error.
(d) Sum of contributors may not add up to 100 percent due to round off error.

Potential Plant Improvements

Once the dominant contributors to plant risk were identified, PG&E searched for ways to reduce that risk. In identifying potential SAMAs, PG&E considered SAMAs identified in industry documents including the SAMA analyses performed for other nuclear power plants, insights from the plant-specific PRA models, and plant improvements identified in the Diablo Canyon IPE and IPEEE. PG&E initially identified a list of 21 potential SAMA candidates after eliminating those candidates that (1) were not applicable to Diablo Canyon, (2) had already been implemented at Diablo Canyon, (3) were combined with another SAMA candidate, or (4) were expected to have a very low benefit. This list was further reduced to 13 unique SAMA candidates by eliminating SAMAs that had an excessive implementation cost but with an additional 5 SAMA candidates being retained after considering the impact of uncertainty. A detailed cost-benefit analysis was performed for each of the 18 remaining SAMAs.

The NRC staff concludes that PG&E used a systematic and comprehensive process for identifying potential plant improvements for Diablo Canyon, and that the set of SAMAs evaluated in the ER is reasonably comprehensive and, therefore, acceptable.

Evaluation of Risk Reduction and Costs of Improvements

PG&E evaluated the risk reduction potential of the 18 candidate SAMAs. The SAMA evaluations were performed using generally conservative assumptions. PG&E used PRA model re-quantification to determine the potential benefits for each SAMA. The CDF, population dose, and offsite economic cost reductions for internal events, including internal flooding, as well as fire and seismic events were estimated using the Diablo Canyon PRA model (PG&E 2023-TN9822). PG&E accounted for the potential risk reduction benefits associated with external events beyond fire and seismic events by multiplying the estimated benefits obtained from the Diablo Canyon PRA by a factor of 1.018.

The NRC staff reviewed PG&E assumptions used to evaluate the benefit or risk reduction estimate for each of the plant improvements and concludes that the rationale and assumptions for estimating risk reduction are sufficient and appropriate for use in the SAMA evaluation because it is technically sufficient and meets the guidance provided in NEI 05-01A, *Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document*, which was endorsed by the NRC in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013-TN4791).

PG&E estimated the costs of implementing each of the candidate SAMAs through the development of Diablo Canyon-specific cost estimates. The cost estimates conservatively did not account for the cost of replacement power during extended outages, if required to implement the modifications, nor did the cost estimates include contingency costs associated with unforeseen implementation obstacles.

The NRC staff reviewed the bases for the applicant’s cost estimates. For certain improvements, the NRC staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for nuclear power plants. The NRC staff also reviewed the basis for the cost estimates during the NRC audit of the SAMA analysis (NRC 2024-TN10308). The NRC staff concludes that the cost estimates provided by PG&E are sufficient and appropriate for use in the SAMA evaluation.

<u>Cost-Benefit Comparison</u>

The cost-benefit analysis performed by PG&E was based primarily on NUREG/BR-0184, “Regulatory Analysis Technical Evaluation Handbook” (NRC 1997), and was executed consistent with this guidance. NEI 05-01A states that two sets of estimates should be developed—one at 3 percent and one at 7 percent (NEI 2005-TN1978). PG&E provided a base set of results using a discount rate of 3 percent and a 20-year license renewal period and based its decisions on potentially cost-beneficial SAMAs on these values.

In PG&E’s analysis, if the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA was determined to be not cost beneficial. If the SAMA benefit exceeded the estimated cost, the SAMA candidate was considered to be potentially cost beneficial. Considering the results from the baseline and sensitivity analyses, the full set of potentially cost-beneficial SAMAs identified in the ER and in response to NRC staff inquiries are:

- SAMA 8—Protect cables and components required for operation of auxiliary feedwater motor driven pump 1-2 in Fire Area 14A
- SAMA 11—Change procedures to explicitly address vulnerability of automatic safety injection

PG&E indicated that the two potentially cost-beneficial SAMAs will be formally evaluated for potential implementation at the plant (PG&E 2023-TN9822, PG&E 2024-TN10619). The NRC staff reviewed PG&E’s cost-benefit evaluations of each SAMA and concludes that, with the exception of the potentially cost-beneficial SAMAs discussed above, the costs of the SAMAs evaluated would be higher than the associated benefits.

Conclusions

The NRC staff reviewed PG&E's evaluation and concluded that the methods used and the implementation of those methods were reasonable. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by PG&E are reasonable and sufficient for the license renewal submittal.

The NRC staff agrees with PG&E's conclusion that the two candidate SAMAs discussed in this section are potentially cost beneficial, which was based on a generally conservative treatment of costs, benefits, and uncertainties. This conclusion of a small number of potentially cost-beneficial SAMAs is consistent with the low residual level of risk indicated in the Diablo Canyon PRA and the fact that PG&E has already implemented the plant improvements identified from the IPE and IPEEE. Because the potentially cost-beneficial SAMAs do not relate to aging management during the period of extended operation, they do not need to be implemented as part of license renewal in accordance with 10 CFR Part 54. Nevertheless, PG&E stated that each of these potentially cost-beneficial SAMAs will be formally evaluated for potential implementation at the plant.

3.11.6.3.2 Severe Accidents Initiated by Terrorist Events

The potential for a severe accident initiated by terrorist events is usually analyzed generically for LR; however, the NRC has stated that licensing actions for facilities subject to the jurisdiction of the U.S. Court of Appeals for the Ninth Circuit will include an analysis of the environmental impacts of a terrorist attack (San Luis Obispo Peace v. Nuclear Regulatory 2006-TN6959: 449 F.3d 1016 [9th Cir. 2006]; NRC 2007-TN6957). Consistent with this requirement, the NRC staff considered site-specific information for Diablo Canyon. The analysis concludes that there is no new and significant information specific to Diablo Canyon that would change the generic determination.

Background

The NRC staff evaluates the environmental consequences of a severe accident in terms of risk, which takes into consideration both the probability of an accident occurring and the consequences should one occur. Therefore, a high-consequence, low-probability event could result in a small impact determination if the risk is sufficiently low. The 1996 LR GEIS (NRC 1996-TN288) included the following discretionary analysis of terrorist acts in connection with LR:

> Although the threat of sabotage events cannot be accurately quantified, the Commission believes that acts of sabotage are not reasonably expected. Nonetheless, if such events were to occur, the Commission would expect that resultant core damage and radiological releases would be no worse than those expected from internally initiated events.

The LR GEIS continues to take this position and generically concludes that the risk from sabotage at existing nuclear power plants is small (NRC 2024-TN10161). In other words, even though the environmental effects of a successful terrorist attack could potentially be significant and on par with a reactor accident as documented in the LR GEIS, the probability that one or more malevolent actors would be able to successfully stage an attack on a nuclear facility resulting in a radiological release is sufficiently low enough that the risk of a terrorist-initiated severe accident is small.

The Commission has held that the generic determination that the environmental impacts of a terrorist attack are bounded by those resulting from internally initiated events is sufficient to address the environmental impacts of terrorism (NRC 2007-TN6957, NRC 2011-TN7868). The LR GEIS explains that no additional plant-specific analysis is required in a SEIS unless new and significant information is identified with respect to a generic (i.e., Category 1) issue. Specifically, the applicant's ER must contain any new and significant information regarding the environmental impacts of LR of which the applicant is aware, even if it concerns a Category 1 issue (see 10 CFR 51.53(c)(3)(iv)-TN10253). The NRC staff must consider whether there is new and significant information that would change the conclusions in the LR GEIS. If no new and significant information is identified that would change the conclusions in the LR GEIS, then no plant-specific assessment on the issue is required.

The NRC staff reviewed PG&E's ER and comments received during the scoping process and conducted an independent review for any new and significant information regarding severe accident initiated by terrorist events. The NRC staff considered whether this information would change the generic conclusions noted in the LR GEIS with respect to this issue. In doing so, the staff conducted a site-specific analysis of the matter.

As discussed below, consistent with NRC requirements, Diablo Canyon has a number of security measures in place that make the probability of a successful terrorist attack very low. In addition, the NRC has required PG&E to implement a number of additional safety features that are intended to maintain coolability, further reducing the probability that a successful terrorist attack would lead to a release of radionuclides. As a result, the environmental consequences of a terrorist attack at Diablo Canyon are bounded by those previously considered for internally initiated events. The NRC staff did not identify any new and significant information that changes the LR GEIS's generic conclusions on this issue. Therefore, no additional consideration is necessary under the Commission's regulations and case law.

General Security Considerations

Nuclear power plant safety is achieved in layers, with multiple approaches concurrently at work. Nuclear power plants are inherently secure, robust structures and, coupled with the deployment of effective and visible physical security measures, act as deterrents to terrorist attacks. In addition, the NRC works closely with the U.S. Department of Homeland Security, the Federal Bureau of Investigation, intelligence agencies, the U.S. Department of Defense, DOE, States, and local law enforcement to ensure that the NRC can act quickly on any threats to its licensed facilities. Thus, it is unlikely that an adversary force could successfully overcome these security measures and access the sensitive facilities, and it is even less likely that they could do this quickly enough to prevent operators from placing the plant's reactor into a safe shutdown mode. Although the security of nuclear power plants has always been a concern, the NRC has taken substantial actions since 2001 to further enhance security at all nuclear power plants. As a result, Diablo Canyon, like all nuclear power plants, is among the most secure commercial facilities in the United States.

Security Enhancements Since 2001

As a result of the terrorist attacks of September 11, 2001, the NRC carried out a comprehensive review of the agency's security program and required significant enhancements to nuclear power plant security. These enhancements included significant reinforcement of the security response capabilities for nuclear facilities, better control of sensitive information, and implementation of mitigating strategies to deal with postulated events potentially causing loss of large areas of the plant due to explosions or fires, including those that an aircraft impact might create. These measures are outlined in greater detail in NUREG/BR-0314, Revision 4, *Protecting Our Nation: A Report of the U.S. Nuclear Regulatory Commission*, dated August 2015 (NRC 2015-TN10621), and in Sandia National Laboratories Letter Report, Revision 2, *Mitigation of Spent Fuel Pool Loss-of-Coolant Inventory Accidents and Extension of Reference Plant Analyses to Other Spent Fuel Pools* (SNL 2006-TN7830), dated November 2006. That information is incorporated herein by reference.

The NRC continues to routinely assess threats and other information from a variety of Federal agencies and sources. The NRC also ensures that licensees meet appropriate security-level requirements. The NRC will continue to focus on the prevention of terrorist acts for all nuclear facilities and will not focus on site-specific evaluations of speculative environmental impacts resulting from terrorist acts. While these are legitimate matters of concern, the NRC will continue to address them through the ongoing regulatory process as a current and generic regulatory issue that affects all nuclear facilities and many of the activities carried out at nuclear facilities. The issue of security and risk from terrorist acts at nuclear power facilities is not unique to facilities that have requested a renewal of their licenses.

<u>Mitigation Strategies for Reactor, Containment, and Spent Fuel Pools</u>

In the aftermath of the terrorist attacks of September 11, 2001, the NRC issued a series of Security Orders to require PG&E to implement additional interim security measures (NRC 2002-TN10622, NRC 2003-TN10623). Through these Security Orders, the NRC supplemented the Design Basis Threat rule for radiological sabotage and mandated specific licensee enhancement of security force training, access authorization, and defensive strategies plus additional mitigative measures. In response to the Security Orders, PG&E (2004-TN10624) revised its physical security plans, access authorization programs, training and qualification plans, and safeguard contingency plans. These revisions enhanced physical security with increased patrols, augmented security forces and capabilities, added additional security posts, added additional physical barriers, and required vehicle checks at greater standoff distances. In modifying the Diablo Canyon licenses to incorporate the revised Design Basis Threat requirements, the NRC (NRC 2004-TN10625) found that PG&E's revised security plans provided the required high assurance that Diablo Canyon will be protected against the revised Design Basis Threat.

<u>Strengthened Security Requirements</u>

In 2009, the NRC issued a new Power Reactor Security Requirements rule to establish and update generically applicable security requirements for power reactors—similar to those previously imposed by several of the NRC Security Orders—including security and mitigative requirements for ground-based, water-based, cyber-based, and air-based attacks (74 FR 13926-TN6300). The cybersecurity requirements, codified at 10 CFR 73.54-TN423, "Protection of Digital Computer and Communication Systems and Networks," require PG&E to provide high assurance that Diablo Canyon's digital computer and communication systems and networks are adequately protected against cyberattacks, up to and including the Design Basis Threat. The NRC staff reviewed PG&E's cybersecurity plan for Diablo Canyon and determined that it satisfied the requirements of 10 CFR 73.54 (NRC 2011-TN10626).

The NRC staff ensures PG&E's compliance with its security regulations through its operating reactor security baseline inspection program. Force-on-force security inspections are part of this program. In addition, the NRC continues to reevaluate the threat environment, as necessary, to consider whether changes to the Design Basis Threat are appropriate.

Environmental Consequences of a Terrorist-Initiated Event

The potential consequences of sabotage or terrorist acts are dependent on the effectiveness of the licensee to detect, assess, interdict, and neutralize the threat as mandated by NRC requirements. The NRC expects the consequences of a successful terrorist attack on a nuclear power plant to be no worse than those of a reactor accident, the effects of which are generically documented in the LR GEIS (NRC 2024-TN10161). Although the 1996 LR GEIS did not include an explicit assessment of the environmental impacts of accidents at the spent fuel pools (SFPs) located at each reactor site, the NRC determined in the 2024 LR GEIS that the environmental impacts from SFP accidents can be comparable to those from full-power reactor accidents (NRC 2024-TN10161). Similarly, when reevaluating the issue in NUREG-2157, the NRC determined that the probability-weighted population doses and economic consequences of an SFP accident are comparable to the values calculated for a severe reactor accident (NRC 2014-TN4117). The NRC further determined in NUREG-2157 that the environmental risk of a successful sabotage attack on an SFP is SMALL. The NRC staff identified no information during the site audit or the scoping process or as part of its evaluation of PG&E's site-specific PRA for Diablo Canyon that would change the LR GEIS's generic conclusions as they relate to reactor accidents.

Although the consequences of a terrorist attack against one of the Diablo Canyon reactors or SFP could be similar to those of a reactor accident (NRC 2024-TN10161), the actual consequences would likely be much less due to the need for the adversaries to rapidly defeat physical protection and access controls and the redundant safety system functions required by the NRC's regulations and orders. Additionally, mitigation measures implemented by PG&E as a result of NRC regulations and orders adopted since 2001 (discussed below) have lowered the probability and risk of severe accidents at Diablo Canyon. Even if the physical protection and accident mitigation measures were only partially effective, these features and measures should delay the time to core damage and radionuclide release and reduce the consequences of any such release.

Accident Mitigation

Mitigating strategies generally consist of specific guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities using existing or readily available resources (equipment and personnel). These strategies can be effectively carried out under the circumstances associated with loss of large areas of the plant due to explosions or fire, including those that a large aircraft impact might create. An Interim Compensatory Measures (ICM) Order was issued on February 25, 2002, as part of a comprehensive effort by the NRC, in coordination with other government agencies, to improve the capabilities of commercial nuclear reactor facilities to respond to terrorist threats. Section B.5.b of the ICM Order requires licensees to develop specific guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities—using existing or readily available resources (equipment and personnel)—that could be effectively carried out under the circumstances associated with loss of large areas of the plant due to explosions or fire, including those that a large aircraft impact might create. Although it was recognized before September 11, 2001, that nuclear power plants already had significant capabilities to withstand a broad range of attacks, carrying out these mitigation strategies significantly enhances Diablo Canyon's capabilities to withstand a broad range of threats (NRC 2007-TN10627).

The NRC staff carried out inspections of the implementation of the ICM Order Section B.5.b requirements in 2002 and 2003. In 2005, additional guidance was issued by the NRC establishing a phased approach for responding to Section B.5.b. Determination of the specific strategies required to satisfy the ICM Order was termed Phase 1. Site-specific assessments of SFPs were deemed Phase 2, and site-specific assessments of reactor core and containment were deemed Phase 3. During 2005 and 2006, the NRC staff performed Phase 1 inspections and Phases 2 and 3 assessments (NRC 2007-TN10627).

The NRC staff's technical evaluation for Diablo Canyon is described in a publicly available safety evaluation report (NRC 2007-TN10627). The NRC staff concluded that PG&E's responses to the February 25, 2005, Phase 1 guidance document, and the Phases 2 and 3 SFP and reactor core and containment mitigating strategy assessments meet the requirements of ICM Order Section B.5.b, which are now generically captured in 10 CFR 50.54(hh). Additionally, the NRC staff concluded that full implementation of PG&E's enhancements constitutes satisfactory compliance with NRC requirements and that they represent reasonable measures to enhance PG&E's effectiveness in maintaining reactor core and SFP cooling and containment integrity under circumstances involving the loss of large areas of the plant due to fires or explosions. The requirements for mitigating strategies were incorporated into the facility operating licenses for Diablo Canyon.

The NRC conducted additional evaluations to assess its regulatory framework in response to the March 2011 Fukushima Dai-ichi accident and determined that some additional improvements would be beneficial. On March 12, 2012, the NRC (NRC 2012-TN3237) issued a Mitigation Strategies Order requiring all nuclear power plants in the United States to implement strategies that will allow them to cope without their permanent electrical power sources for an indefinite amount of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the thick concrete containment buildings that surround each reactor. The Mitigation Strategies Order requires a three-phase approach to mitigating beyond-design-basis events, with an initial response phase using installed equipment, a transition phase using portable equipment and consumables to provide core and SFP cooling and to maintain the containment functions, and a third phase of indefinite sustainment of these functions using offsite resources (NRC 2012-TN3237). PG&E (PG&E 2013-TN10628) submitted its Integrated Plan to the NRC on February 27, 2013. In addition to its Mitigation Strategies Order, the NRC issued an Order on March 12, 2012, requiring all nuclear power plants in the United States to install reliable SFP instrumentation to support effective prioritization of event mitigation and recovery actions in the event of a beyond-design-basis external event (NRC 2012-TN7764). The instrumentation must remotely report at least three distinct water levels: (1) normal level, (2) low level but still enough to shield workers above the pools from radiation, and (3) a level near the top of the spent fuel rods where more water should be added without delay. PG&E submitted its Integrated Plan to the NRC on February 27, 2013 (PG&E 2013-TN10629). On May 8, 2020, the NRC acknowledged and documented that the actions required by the orders issued following the Fukushima Dai-ichi accident had been completed for Diablo Canyon (NRC 2020-TN7284).

Conclusion

The NRC staff's efforts to protect against terrorism, including efforts to evaluate potential options or alternatives to reduce the likelihood or severity of a terrorist attack, will continue during the current licensing period and any potential license renewal periods. The NRC staff's consideration of terrorism is a matter of ongoing regulatory oversight and one that will continue to be dealt with on a daily basis. Based on this and the many other actions that have been taken by both the NRC and industry since the terrorist attacks of September 11, 2001, and the March 2011 accident at the Fukushima Dai-ichi plant, the NRC staff maintains that although terrorist or sabotage events are considered credible by the NRC, they are not considered likely to occur because of the deterrent effects of the required Physical Protection Program. Security measures in place at Diablo Canyon make it unlikely that an adversary force could successfully gain entry into the sensitive areas, and it is even less likely that it could do this quickly enough to prevent operators from placing the plant's reactors into a safe shutdown mode. These factors, in conjunction with robust plant design and national anti-terrorist measures to prevent, for example, aircraft hijackings, make the probability of a successful terrorist attack, though numerically indeterminable, very low (73 FR 46204-TN10289). Further, although the consequences of a terrorist attack against one of the Diablo Canyon reactors or SFPs could be similar to those of a reactor accident (NRC 2024-TN10161), they would likely be much less due to the need for the adversaries to rapidly defeat physical protection and access controls and the redundant safety system functions. Even if the physical protection and accident mitigation measures were only partially effective, these features and measures should delay the time to core damage and radionuclide release and reduce the consequences of any such release. The NRC staff has also not identified any new and significant information concerning this issue specific to Diablo Canyon. Therefore, the NRC staff concludes that the environmental consequences of a terrorist attack at Diablo Canyon are bounded by those generically considered in the 2024 LR GEIS.

3.11.7 No-Action Alternative

Under the no-action alternative, the NRC would not issue renewed licenses, and Diablo Canyon would shut down on or before the expiration of the current licenses. Human health risks would be smaller after plant shutdown. The reactor units, which currently operate within regulatory limits, would emit less radioactive gaseous, liquid, and solid material to the environment. In addition, after shutdown, the variety of potential accidents at the plant (radiological or industrial) would be reduced to a limited set associated with shutdown events and fuel handling and storage. In Section 3.11.6 of this SEIS, the NRC staff concludes that the impacts of continued plant operation on human health would be SMALL, except for EMFs for which the impacts are uncertain. In Section 3.11.6.3, the NRC staff concludes that the impacts of postulated accidents during operation are SMALL. Therefore, as both radioactive emissions to the environment and the likelihood and types of accidents decrease after shutdown, the NRC staff concludes that the risk to human health under the no-action alternative would be SMALL.

3.11.8 Replacement Power Alternatives: Common Impacts

The impacts on human health from the construction of a replacement power alternative would be similar to the impacts associated with the construction of any major industrial facility. Compliance with worker protection rules, the use of personal protective equipment, training, and placement of engineered barriers would limit the impacts on workers to acceptable levels.

The impacts on human health from the operation of a facility for a replacement power alternative would depend on the energy technology (e.g., wind, solar, geothermal). Regulatory agencies, including the EPA and State of California agencies, base applicable standards and requirements on human health impacts.

3.11.9 Purchased Power Alternative

Purchased power would come from existing energy generating facilities. These facilities would likely have BMPs and other procedures in place to ensure that any human health effects from operational changes are minimized. Therefore, based on this information, the impact of this alternative on human health would be SMALL.

3.11.10 Renewables Combination Alternative

The impacts of the renewables combination alternative on human health are similar to the impacts related to the construction and operation of industrial facilities as discussed in Section 3.11.8 of this SEIS. Operational hazards for the workforce include potential exposure to toxic gas or chemicals, working in extreme weather, and physical hazards that include working at heights, near energized or rotating systems, high-pressure water, exposure to low-frequency sound, EMF exposure, and potential for electric shock. These operational hazards are reduced by compliance with worker protection rules, the use of personal protective equipment, and training, which would limit the impacts on workers to acceptable levels. Therefore, given the expected compliance with worker and environmental protection rules and the use of personal protective equipment, training, and engineered barriers, the NRC staff concludes that the potential human health impacts of the renewables combination alternative would be SMALL.

3.12 Reserved

10 CFR Part 51 (TN10253), Subpart A, Appendix B, Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants," requires an environmental impact statement for license renewal to include an analysis for the Category 2 issue of "Environmental Justice—Impacts on minority populations, low-income populations, and Indian Tribes." Executive Order 14173 (90 FR 8633-TN11607), "Ending Illegal Discrimination and Restoring Merit-Based Opportunity," issued January 21, 2025, revoked Executive Order 12898 (59 FR 7629-TN1450), "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," issued February 11, 1994, among other things. Staff Requirements Memorandum (SRM)-COMSECY-25-0007, "Withdrawing the Environmental Justice Policy Statement and Environmental Justice Strategy," issued April 10, 2025 (NRC 2025-TN11710), approved publication of a notice in the *Federal Register* (90 FR 17887-TN11684), which explained that, in response to the policies in Executive Order 12898, the NRC had made voluntary commitments on environmental justice in its Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (Environmental Justice Policy Statement) and its Environmental Justice Strategy (69 FR 52040-TN1009). Accordingly, with the revocation of Executive Order 12898, the NRC also withdrew its Environmental Justice Policy Statement and its Environmental Justice Strategy. Based on Executive Order 14173 and SRM-COMSECY-25-0007, and pursuant to 10 CFR 51.6 (TN10253), "Specific exemptions," the NRC staff has, upon its own initiative, determined that an exemption from the requirement to address environmental justice in this SEIS is authorized by law and otherwise in the public interest. Accordingly, this SEIS does not address that issue.

3.13 Waste Management

Like any operating nuclear power plant, Diablo Canyon would produce both radioactive and nonradioactive waste during the proposed LR period. This section of the SEIS describes waste management and pollution prevention at Diablo Canyon. The description of these waste management activities is followed by the NRC staff's analysis of the potential impacts of waste management from the proposed action of Diablo Canyon LR and alternatives to the proposed action.

3.13.1 Radioactive Waste

The NRC licenses nuclear power plants with the expectation that they will release a limited amount of radioactive material to both the air and water during normal operations. However, NRC regulations require that gaseous and liquid radioactive releases from nuclear power plants meet radiation dose based limits specified in 10 CFR Part 20 (TN283), "Standards for Protection Against Radiation," and the ALARA criteria in 10 CFR Part 50 (TN249), Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents." In other words, the NRC places regulatory limits on the radiation dose that members of the public can receive from radioactive effluents of a nuclear power plant. For this reason, all nuclear power plants use radioactive waste management systems to control and monitor radioactive wastes.

Diablo Canyon uses liquid, gaseous, and solid waste processing systems to collect and treat, as needed, radioactive materials produced as a byproduct of nuclear power plant operations. Radioactive materials in liquid, gaseous, and solid effluents are reduced before being released into the environment so that the resultant dose to members of the public from these effluents is well within the NRC and EPA dose standards. Radionuclides that can be efficiently removed from the liquid and gaseous effluents before release are converted to a solid waste form for disposal in a licensed disposal facility.

PG&E maintains a REMP to assess the radiological impact, if any, to the public and the environment from radioactive effluents released during operations at Diablo Canyon (PG&E 2023-TN9822).

PG&E has an Offsite Dose Calculation Manual (ODCM) that contains the methods and parameters for calculating offsite doses resulting from liquid and gaseous radioactive effluents. These methods ensure that radioactive material discharges from Diablo Canyon meet NRC and EPA dose standards. The ODCM also contains the requirements for the REMP (PG&E 2024-TN10097). As discussed during the audit, there are no proposed changes or upgrades to the effluent control program planned for the LR term (PG&E 2024-TN10032).

3.13.1.1 Radioactive Liquid Waste Management

Radioactive liquids are processed as necessary by the liquid radwaste system (LRS) before being discharged to the environment into the Pacific Ocean through either unit's circulating water system (CWS). The LRS is designed so that liquid radwaste discharged from the site will have radioactive nuclide concentrations well within the limits specified in 10 CFR Part 20 and Appendix I to 10 CFR Part 50 (PG&E 2023-TN9822).

Section 2.2.6.2 of the ER describes the radioactive liquid waste management systems at Diablo Canyon. Diablo Canyon Units 1 and 2 share a common LRS, except for equipment located inside containment. Following treatment to reduce radioactivity levels, effluents from the LRS are released to the environment at either of the unit's CWS discharge structures via the auxiliary saltwater system. The radioactive liquid effluents are diluted in the auxiliary saltwater system and CWS flows. Radioactive liquid effluent discharges into the environment require operator action, are continuously monitored, and can be automatically terminated in the event of a high radiation alarm or a power failure.

Most radioactive waste liquids originate from the reactor coolant system, and most of these wastes are processed and retained, with only a fraction being discharged to the LRS. A minor source of radioactive liquid waste is from the turbine building drains, which are monitored and can be routed to the LRS if needed. The use of these radioactive waste systems and the procedural requirements in the ODCM ensure that the dose from radioactive liquid effluents complies with NRC and EPA dose standards.

Dose estimates for members of the public are calculated based on radioactive liquid effluent release data and aquatic transport models. PG&E's annual radiological effluent release report contains a detailed presentation of the radioactive liquid effluents released from Diablo Canyon and the resultant calculated doses. These reports are publicly available on the NRC's website (https://www.nrc.gov/). The NRC staff reviewed 5 years of radioactive effluent release data: 2019 through 2023 (PG&E 2020-TN10093, 2021-TN10094, 2022-TN10095, 2023-TN10096, and 2024-TN10097). A 5-year period provides a dataset that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and maintenance activities that can affect the generation of radioactive effluents. The NRC staff compared the data against NRC dose limits and looked for indications of adverse trends (i.e., increasing dose levels or increasing radioactivity levels) over the period of 2019 through 2023.

The doses calculated for radioactive liquid effluents released from Diablo Canyon during 2023 are summarized below (PG&E 2024-TN10097).

Diablo Canyon (Combined Units 1 and 2) Liquid Effluents in 2023

- The total-body dose to an offsite member of the public from liquid radioactive effluents was 2.85×10^{-4} millirem (mrem) (2.85×10^{-6} millisievert [mSv]), which is well below the 3 mrem (0.03 mSv) dose criterion in Appendix I of 10 CFR Part 50-TN249.
- The maximum organ dose (gastrointestinal lining) to an offsite member of the public from liquid radioactive effluents was 4.76×10^{-4} mrem (4.76×10^{-6} mSv), which is well below the 10 mrem (0.1 mSv) dose criterion in Appendix I of 10 CFR Part 50-TN249.

The NRC staff's review of PG&E's radioactive liquid effluent control program shows that the applicant maintained radiation doses to members of the public well within NRC and EPA radiation protection standards, as contained in Appendix I to 10 CFR Part 50-TN249, 10 CFR Part 20-TN283, and 40 CFR Part 190 (TN739), "Protection of Environment, Environmental Radiation Protection Standards for Nuclear Power Operations." The NRC staff observed no adverse trends in the dose levels.

As documented in the effluent reports, there were no abnormal releases in the period from 2019 through 2023 (PG&E 2020-TN10093, 2021-TN10094, 2022-TN10095, 2023-TN10096, and 2024-TN10097). As confirmed during the audit, there have been no reportable unplanned releases of radioactive materials since the ER was written PG&E 2024-TN10032).

During the LR term, PG&E would continue to perform routine plant refueling and maintenance activities. Based on PG&E's past performance in operating a radioactive waste system at Diablo Canyon that maintains ALARA doses from radioactive liquid effluents, the NRC staff expects that Diablo Canyon would maintain similar performance during the LR term.

3.13.1.2 Radioactive Gaseous Waste Management

Section 2.2.6.1 of the ER discusses radioactive gaseous waste management. The NRC staff summarizes that information below and incorporates the information in the PG&E ER, Section 2.2.6.1 (PG&E 2023-TN9822: 2-12), herein by reference. The Gaseous Radwaste System used at Diablo Canyon is designed to remove fission product gases from the reactor coolant and minimize the amount of radioactive material released into the environment. The gases are stored for an appropriate time to allow for radioactive decay of the material to levels that comply with plant procedures to ensure that the radiation doses to members of the public are within regulatory limits (PG&E 2023-TN9822). The radioactive gaseous waste sampling and analysis program specifications provided in the ODCM address the gaseous release type, sampling frequency, minimum analysis frequency, type of activity analysis, and lower limit of detection (i.e., sensitivity) for the radiation monitor (PG&E 2023-TN9822).

Each gas decay tank is equipped with a flow control valve connected to the plant vent that will close if the radioactivity in the waste gas exceeds a pre-set limit. The final processing of waste gas before release to the atmosphere is by a high-efficiency particulate filter located downstream of the radiation control valve and upstream of the plant vent. The sampling system associated with the Gaseous Radwaste System is used to monitor the hydrogen and oxygen content of the gases in the system.

PG&E calculates dose estimates for members of the public based on radioactive gaseous effluent release data and atmospheric transport models. PG&E's annual radioactive effluent release reports present in detail the radiological gaseous effluents released from Diablo Canyon and the resultant calculated doses. As described in Section 3.13.1.1 of this SEIS, the NRC staff reviewed 5 years of radioactive effluent release data from the 2019 through 2023 reports (PG&E 2020-TN10093, 2021-TN10094, 2022-TN10095, 2023-TN10096, and 2024-TN10097). The NRC staff compared the data against NRC dose limits and looked for indications of adverse trends (i.e., increasing dose levels or increasing radioactivity levels) over the period of 2019 through 2023.

The calculated doses from radioactive gaseous effluents released from Diablo Canyon during 2023 (PG&E 2024-TN10097) are summarized below. The values below are the sum of doses from Unit 1 and Unit 2 as reported in the 2023 Effluent Report.

Diablo Canyon (Combined Units 1 and 2) Gaseous Effluent in 2023

- The air dose due to noble gases with resulting gamma radiation in gaseous effluents was 1.03×10^{-3} millirad (mrad) (1.03×10^{-5} milligray), which is well below the 10 mrad (0.1 milligray) dose criterion in Appendix I of 10 CFR Part 50-TN249.
- The air dose from beta radiation in gaseous effluents was 4.25×10^{-4} mrad (4.25×10^{-6} milligray), which is well below the 20 mrad (0.2 milligray) dose criterion in Appendix I of 10 CFR Part 50-TN249.
- The critical organ dose (lung) to an offsite member of the public from radiation in gaseous effluents as a result of iodine-131, iodine-133, hydrogen-3, and particulates with greater than 8-day half-lives was 2.20×10^{-4} mrem (2.2×10^{-6} mSv), which is below the 15 mrem (0.15 mSv) dose criterion in Appendix I of 10 CFR Part 50-TN249.

The NRC staff's review of Diablo Canyon's radioactive gaseous effluent control program showed radiation doses to members of the public that were well below NRC and EPA radiation protection standards contained in Appendix I of 10 CFR Part 50-TN249, 10 CFR Part 20-TN283, and 40 CFR Part 190-TN739. The NRC staff observed no adverse trends in the dose levels over the 5 years reviewed.

During the LR term, PG&E would continue to perform routine plant refueling and maintenance activities. Based on the past performance of PG&E in operating a radioactive waste system at

Diablo Canyon that maintains ALARA doses from radioactive gaseous effluents, the NRC staff expects that Diablo Canyon would maintain similar performance during the LR term.

3.13.1.3 Radioactive Solid Waste Management

Diablo Canyon's radioactive solid waste management system provides for packaging and/or solidification of radioactive waste that will subsequently be shipped offsite to an approved burial facility, in accordance with NRC regulations in 10 CFR Parts 61 and 71. Transportation of the radioactive solid waste is governed by the U.S. Department of Transportation regulations in 49 CFR Part 171 to 49 CFR Part 178 (49 CFR Parts 171-178-TN10307).

Section 2.2.6.3 of the ER discusses radioactive solid waste management. The NRC staff summarizes that information below and incorporates the information in the PG&E ER, Section 2.2.6.3 (PG&E 2023-TN9822: pp. 2-14 to 2-15), herein by reference. Solid radioactive wastes are logged, processed, packaged, and stored for subsequent shipment and offsite burial. Solid radioactive wastes and potentially radioactive wastes include reactor components, equipment, and tools removed from service; chemical laboratory samples; spent resins; used filter cartridges; and radioactively contaminated hardware, as well as compacted wastes such as contaminated protective clothing, paper, rags, and other trash generated from plant design modifications and operations and routine maintenance activities. In addition, nonfuel radioactive solid wastes result from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. The waste is divided into two categories: (1) dry active waste and (2) wet active waste. Low-level radioactive waste (LLRW) is classified as Class A, Class B, Class C, or greater than Class C. Class A includes both dry active waste and processed waste (e.g., dewatered resins). Classes B and C normally include processed waste and irradiated hardware. The majority of LLRW generated at Diablo Canyon is Class A waste. Classes B and C wastes constitute a low percentage by volume of the total LLRW generated. Radioactive waste that is greater than Class C waste is the responsibility of the Federal government. Low-level mixed waste is managed and transported to the facility with which PG&E has contracts.

Diablo Canyon sends its Class A LLRW to either Energy*Solutions* in Utah or Waste Control Specialists in Texas. Classes B and C waste is disposed of at Waste Control Specialists in Utah (PG&E 2023-TN9822). Routine plant operation, refueling outages, and maintenance activities that generate radioactive solid waste would continue during the LR term. Radioactive solid waste is expected to be generated and shipped off site for disposal during the LR term. As discussed during the audit, there are no plans to change the radioactive solid waste disposal program during the LR period (PG&E 2024-TN10032).

3.13.1.4 Radioactive Waste Storage

As indicated in PG&E's ER and discussed with the NRC staff at the virtual audit, Diablo Canyon has sufficient existing capability to store all generated LLRW onsite (PG&E 2023-TN9822, PG&E 2024-TN10032). Also, in the event that mixed waste is generated, it would be stored in a designated area of the Solid Radwaste Storage Facility, and no other waste types would be stored with it. PG&E has no plans to store mixed waste long-term at Diablo Canyon. In addition, Diablo Canyon staff would consult with a mixed waste treatment/disposal vendor regarding potential disposal paths for the waste. No additional construction of onsite storage facilities would be necessary for LLRW or mixed waste storage during the proposed LR period. As PG&E confirmed during the audit, there are no other types of waste stored in the area designated for mixed waste storage, and there are no proposed changes to the mixed waste storage program during the LR term (PG&E 2024-TN10032).

PG&E stores spent fuel in the Diablo Canyon Unit 1 and Unit 2 spent fuel pools and in an onsite ISFSI. The ISFSI safely stores spent fuel onsite in licensed and approved dry cask storage containers. Spent fuel is stored in the ISFSI under a separate license. By letter dated March 9, 2022, PG&E requested renewal of special nuclear materials (SNM) License No. SNM-2511 for the Diablo Canyon ISFSI for an additional 40 years (PG&E 2022-TN10200). In accordance with 10 CFR Part 51, the NRC staff's environmental review of the proposed renewal for the Diablo Canyon ISFSI will be documented in a separate environmental assessment.

Section 3.11.6.3 of this SEIS discusses environmental impacts of postulated accidents, including a hypothetical terrorist attack at Diablo Canyon. As stated in Section 3.11.6.3, the NRC staff concludes that the environmental consequences of a terrorist attack at Diablo Canyon are bounded by those generically considered in the LR GEIS.

The ISFSI and the spent fuel pools are sized to accommodate all spent nuclear fuel generated through the LR period. During the audit discussion, PG&E personnel clarified that there are currently no plans for construction around the existing developed ISFSI site or outside the ISFSI pad for spent fuel. If the dry storage capacity needs to be increased, previously disturbed land on the site is likely to be sufficient for the expansion (PG&E 2024-TN10032). The NRC staff understands that PG&E is allowed under a 10 CFR Part 72 (TN4884) general license as part of its 10 CFR Part 50 (TN249) licenses to build ISFSI capacity as necessary (see 10 CFR 72.210-TN4884).

PG&E confirms that it will ensure that there will be adequate spent fuel storage to safely accommodate spent fuel onsite for the current license term and during the proposed LR term. The impacts of onsite storage of spent nuclear fuel during the LR period is a Category 1 issue and has been determined to be SMALL at all plants, as stated in 10 CFR Part 51 (TN10253), Appendix B, Table B-1. For the period after the licensed life for reactor operations, the impacts of onsite storage of spent nuclear fuel during the continued storage period are discussed in NUREG-2157 and as stated in 10 CFR 51.23(b), shall be deemed incorporated into this issue (TN4117).

As confirmed during the audit, there are no proposed changes or upgrades to the solid waste processing system program being considered for the LR term. Also as confirmed during the audit, there is adequate storage between the ISFSI, low-level waste storage capacity, and spent fuel pools to safely store the greater-than-Class C waste likely to be generated during the LR term, accounting for the needed capacity for the spent nuclear fuel generated through the LR period (PG&E 2024-TN10032).

3.13.1.5 Radiological Environmental Monitoring Program

PG&E maintains a REMP to assess the radiological impact, if any, to the public and the environment from Diablo Canyon operations. The REMP measures the aquatic, terrestrial, and atmospheric environment for ambient radiation and radioactivity. Monitoring is conducted for the following: direct radiation, air, precipitation, well water, river water, surface water, milk, food products and vegetation (such as edible broad leaf vegetation), fish, silt, and shoreline sediment. The REMP also measures background radiation (i.e., cosmic sources, global fallout, and naturally occurring radioactive material, including radon). As part of the REMP, PG&E

conducts analyses of selected wells for the presence of gamma emitters and tritium in groundwater on a quarterly basis (PG&E 2023-TN9822).

The NRC staff reviewed 5 years of annual radiological environmental monitoring data from 2019 through 2023 (PG&E 2020-TN10065, 2021-TN10066, 2022-TN10067, 2023-TN10036, and 2024-TN10069). A 5-year period provides a dataset that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and maintenance that can affect the generation and release of radioactive effluents into the environment. The NRC staff reviewed the data for indications of adverse trends (i.e., increasing dose levels or increasing radioactivity levels) over the period of 2019 through 2023.

In addition to the REMP, PG&E established an onsite groundwater protection initiative program in accordance with NEI 07-07, “Industry Groundwater Protection Initiative” (NEI 2007-TN1913). This program monitors the onsite nuclear power plant environment to detect leaks from nuclear power plant systems and pipes containing radioactive liquid. Section 3.5.2.3 of this SEIS contains information on Diablo Canyon’s onsite groundwater protection initiative program. PG&E performs groundwater monitoring from a network of groundwater monitoring wells, indoor and outdoor piezometers, and manholes to monitor for potential radioactive releases to groundwater, environmental conditions, and groundwater elevation in accordance with site procedures as described in Section 3.6.2.4 of the ER (PG&E 2023-TN9822).

Based on its review of the REMP and inadvertent release data, the NRC staff finds no apparent increasing trend in concentration or pattern indicating persistently high tritium or other radionuclide concentrations that might indicate an ongoing inadvertent release from Diablo Canyon. The groundwater monitoring program data at Diablo Canyon show that PG&E monitors, characterizes, and actively remediates spills, and that there were no significant radiological impacts to the environment from operations at Diablo Canyon.

3.13.2 Nonradioactive Waste

Diablo Canyon generates nonradioactive waste from nuclear power plant maintenance, cleaning, and operational processes. Diablo Canyon manages nonradioactive wastes in accordance with applicable Federal and State regulations, as implemented through its corporate procedures. Diablo Canyon generates and manages hazardous wastes, nonhazardous wastes, and universal wastes. PG&E maintains a list of waste vendors that it has approved for use across the entire company to remove and dispose of the nonradioactive wastes offsite (PG&E 2023-TN9822). As confirmed during the audit, PG&E currently uses Clean Harbors, Pacific Petroleum, and Safety Kleen for shipping its hazardous and nonhazardous wastes, and the following is a list of the facilities utilized for treatment, storage, and/or disposal of these wastes: Chemical Waste Management Kettleman Hills Facility, Clean Harbors Aragonite, Clean Harbors San Jose, Clean Harbors Grassy Mountain, Clean Harbors Buttonwillow, Safety Kleen Newark, Emerald Services, and Thermo Fluids (PG&E 2024-TN10032).

Waste minimization and pollution prevention are important elements of operations at all nuclear power plants. Licensees are required to consider pollution prevention measures as dictated by the Pollution Prevention Act (Public Law 101 5084-TN6607) and the Resource Conservation and Recovery Act of 1976, as amended (Public Law 94 580-TN1281).

The Resource Conservation and Recovery Act governs the disposal of solid waste. The California Environmental Protection Agency is authorized by the EPA to implement the Resource Conservation and Recovery Act and regulate solid and hazardous waste in California

(PG&E 2023-TN9822). Diablo Canyon has a nonradioactive waste management program to handle nonradioactive waste in accordance with Federal, State, and corporate regulations and procedures. Diablo Canyon maintains a waste minimization program that uses material control, process control, waste management, recycling, and feedback to reduce waste.

Diablo Canyon's SWPPP identifies potential sources of pollution that may affect the quality of stormwater discharges from permitted outfalls. The SWPPP also describes best management practices for reducing pollutants in stormwater discharges and assuring compliance with the site's NPDES permit (PG&E 2023-TN9822).

Diablo Canyon also has an environmental management system (PG&E 2023-TN9822). Procedures are in place to monitor areas within the site that have the potential to discharge oil into or on navigable waters, in accordance with the regulations in 40 CFR Part 112, "Oil Pollution Prevention" (TN1041). The Pollution Incident/Hazardous Substance Spill Procedure identifies and describes the procedures, materials, equipment, and facilities that PG&E uses to minimize the frequency and severity of oil spills at Diablo Canyon.

Diablo Canyon is subject to the EPA reporting requirements in 40 CFR Part 110, "Discharge of Oil," under CWA Section 311(b)(4) (TN8485). Under these regulations, Diablo Canyon must report to the EPA's National Response Center any discharges of oil if the quantity may be harmful to the public health or welfare or to the environment. Based on the NRC staff's review of Section 9.5.3.6 of the PG&E's ER (PG&E 2023-TN9822) and a review of records from 2018 to 2022, there have been no releases at Diablo Canyon that have triggered this notification requirement (PG&E 2023-TN9822) during that time period. In addition, PG&E confirmed that there have been no reportable spills under the provisions of 40 CFR Part 110 in 2022, 2023, or 2024 through when the NRC staff's audit took place in March 2024 (PG&E 2024-TN10032).

Diablo Canyon is also subject to the reporting provisions of Health and Safety Code Section 25510 as it relates to significant spills or threatened releases of hazardous materials including oil and radioactive materials. Any discharges must be reported to the California Governor's Office of Emergency Services, California State Warning Center, as well as to the local emergency response agency (CAL OES 2014-TN10201). Based on the NRC staff's review of Section 9.5.3.7 of PG&E's ER and of records from 2018–2022, there have been no releases at Diablo Canyon that have triggered the notification requirement (PG&E 2023-TN9822). In addition, the applicant confirmed that there have been no inadvertent releases or spills of nonradioactive contaminants at Diablo Canyon that would trigger the notification requirement since the ER was developed through the NRC staff audit in March 2024 (PG&E 2024-TN10032).

Diablo Canyon is subject to the reporting provisions of 40 CFR 262.34(d)(5)(iv)(C) as it relates to a fire, explosion, or other release of hazardous waste that could threaten human health outside the facility boundary or when the facility has knowledge that a spill has reached a surface water. Any such event must be reported to the EPA's National Response Center. Based on the NRC staff's review of Section 9.5.14.2 of PG&E's ER and of records from 2018–2022, there have been no releases at Diablo Canyon during that time period that triggered this notification requirement (PG&E 2023-TN9822). In addition, the applicant confirmed that there have been no inadvertent releases or spills at Diablo Canyon that would trigger the notification requirement from when the ER was developed through the NRC staff audit in March 2024 (PG&E 2024-TN10032).

3.13.3 Proposed Action

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1 for generic issues related to waste management, the impacts of nuclear power plant LR and continued operations would be SMALL during the LR term for the issues of low-level waste storage and disposal, onsite storage of spent nuclear fuel, mixed waste storage and disposal, and nonradioactive waste storage and disposal. For the period after the licensed life for reactor operations, the impacts of onsite storage of spent nuclear fuel during the continued storage period are discussed in NUREG-2157 and as stated in 10 CFR 51.23(b), shall be deemed incorporated into this SEIS (NRC 2014-TN4117). The NRC staff's review did not identify any new and significant information that would change the conclusions in the LR GEIS. Thus, as concluded in the LR GEIS, for these Category 1 (generic) issues, the impacts of continued operation on waste management during the LR term would be SMALL. The ultimate disposal of spent fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of this review. Per 10 CFR Part 51 (TN10253) Subpart A, Appendix B, the Commission concludes that the impacts presented in NUREG-2157 (NRC 2014-TN4117) would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 (TN4878) should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent nuclear fuel and high-level waste disposal, this issue is considered generic to all nuclear power plants. There are no site-specific (Category 2) waste management issues applicable to Diablo Canyon (Table 3-2).

3.13.4 No-Action Alternative

Under the no-action alternative, Diablo Canyon would cease operation at the end of the term of the current licenses or sooner and enter decommissioning. After entering decommissioning, the plant would generate less spent nuclear fuel, emit fewer gaseous and liquid radioactive effluents into the environment, and generate less low-level radioactive and nonradioactive waste. In addition, after shutdown, the variety of potential accidents at the plant (radiological and industrial) would be reduced to a limited set associated with shutdown events and fuel handling and storage. Therefore, as radioactive emissions to the environment decrease, and the likelihood and variety of accidents decrease after shutdown and decommissioning, the NRC staff concludes that impacts resulting from waste management for the no-action alternative would be SMALL.

3.13.5 Replacement Power Alternatives: Common Impacts

The LR GEIS in Appendix D, Section D.4.10 provides types of wastes routinely associated with the construction and operation of replacement power alternatives (NRC 2024-TN10161). The NRC staff summarizes that information below and incorporates the information in NUREG-1437, Revision 2, Appendix D, Section D.4.10 (2024 LR GEIS: D-38, D-40), herein by reference.

Construction – Impacts would be from construction-related nonradiological debris. Materials and wastes would be accumulated onsite and disposed of or recycled through licensed offsite disposal and treatment facilities. As discussed in Section 3.13.6 of this SEIS, construction under the purchased power alternative could occur if available excess capacity is not sufficient to offset losses (NRC 2024-TN10161).

Operations – Solid wastes would be generated throughout the period of plant operations. Most facilities produce small amounts of industrial solid wastes associated with onsite maintenance of equipment and infrastructure. Such wastes could include used oils, used glycol-based antifreeze, waste lead-acid storage batteries, spent cleaning solvents, and excess corrosion control coatings, requiring proper characterization and disposal. The LR GEIS in Appendix D, Section D.4.10 provides types of wastes routinely associated with the maintenance of mechanical and electrical equipment (NRC 2024-TN10161).

3.13.6 Purchased Power Alternative

Purchased power would come from existing energy generating facilities. Waste material generated at these facilities would be managed in accordance with existing contracts, permits, approvals, and/or disposal agreements. Therefore, based on this information and depending on the types of energy sources used to provide the purchased electricity, waste management impacts would likely be SMALL.

3.13.7 Renewables Combination Alternative

As discussed in Section 2.3.2.2 of this SEIS, the renewables combination alternative would consist of wind turbine installations, solar panel installations, geothermal energy, and demand side management.

Impacts from the waste generated during the construction and operation of the renewables combination alternative would include those identified in Section 3.13.5 of this SEIS as being common to all replacement power alternatives.

The construction and operation of the solar PV facilities would create sanitary and industrial waste. This waste could be recycled or shipped to an offsite waste disposal facility. All the waste would be handled in accordance with appropriate California regulations. Therefore, the NRC staff concludes that the waste management impacts resulting from the construction and operation of the PV facilities would be SMALL.

During construction and operation of onshore wind facilities as part of the renewables combination alternative, waste materials or the accidental release of fuels are expected to be negligible because of the limited amount of traffic and construction activity that might occur with construction, installation, operation, and decommissioning of onshore turbine generators. Therefore, the NRC staff concludes that the waste management impacts resulting from the construction and operation of the onshore wind facilities would be SMALL.

Operational solid wastes from a geothermal plant could include precipitates (scale) resulting from cooling and depressurized hydrothermal fluids that must be periodically removed from equipment; some precipitates may include naturally occurring radioactive material. All the waste would be handled in accordance with appropriate California regulations. Therefore, the NRC staff concludes that the waste management impacts resulting from the construction and operation of a geothermal facility would be SMALL.

Based on the above determinations, the NRC staff concludes that the waste management impacts of the renewables combination alternative would be SMALL.

3.14 Evaluation of New and Significant Information

As stated in Section 1.4 of this SEIS, for Category 1 (generic) issues, the NRC staff can rely on the analysis in the LR GEIS (NRC 2024-TN10161) unless otherwise noted. Table 3-1 lists the

Category 1 issues that apply to Diablo Canyon during the proposed LR period. For these issues, the NRC staff did not identify any new and significant information based on its review of the PG&E ER (PG&E 2023-TN9822), the environmental site audits, and review of available information as cited in this SEIS or arising from the environmental scoping process that would change the conclusions presented in the LR GEIS.

New and significant information must be new based on a review of the LR GEIS (NRC 2024-TN10161) as codified in Table B-1 of Appendix B to Subpart A of 10 CFR Part 51 (TN10253). Such information must also bear on the proposed action or its impacts, presenting a picture of the impacts that are seriously different from those envisioned in the LR GEIS (i.e., impacts of greater severity than impacts considered in the LR GEIS, considering their intensity and context).

The NRC defines new and significant information in Regulatory Guide 4.2, Supplement 1, "Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications" (NRC 2024-TN10280), as (1) information that identifies a significant environmental impact issue that was not considered or addressed in the LR GEIS and, consequently, not codified in Table B-1, in Appendix B to Subpart A of 10 CFR Part 51 (TN10253) or (2) information not considered in the assessment of impacts evaluated in the LR GEIS leading to a picture of the environmental consequences of the action that is significantly different than previously considered, such as an environmental impact finding different from that codified in Table B-1. Further, a significant environmental issue includes, but is not limited to, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or with an intensity and/or scope (context) not previously recognized.

In accordance with 10 CFR 51.53(c) (TN10253), "Operating License Renewal Stage," the applicant's ER must analyze the Category 2 (site-specific) issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. Additionally, the applicant's ER must discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action. In accordance with 10 CFR 51.53(c)(3), the applicant's ER does not need to analyze any Category 1 issue unless there is new and significant information about a specific issue.

NUREG-1555, Supplement 1, Revision 2, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants for Operating License Renewal," describes the NRC process for identifying new and significant information (NRC 2024-TN10251). The search for new information includes:

- review of the applicant's ER (PG&E 2023-TN9822) and process for discovering and evaluating the significance of new information
- review of public comments
- review of environmental quality standards and regulations
- coordination with Federal, State, and local environmental protection and resource agencies
- review of technical literature as documented through this SEIS

New information that the NRC staff discovers is evaluated for significance using the criteria set forth in the LR GEIS. For Category 1 issues in which new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to assessment of the relevant new and significant information; the scope of the assessment does not include other facets of an issue that the new information does not affect.

The NRC staff reviewed the discussion of environmental impacts associated with operation during the LR term in the LR GEIS and has conducted its own independent review, including a public involvement process (e.g., public meetings and comments) to identify new and significant issues for the Diablo Canyon LR application environmental review. The assessment of new and significant information for each resource is addressed in each resource area discussion.

3.15 Impacts Common to All Alternatives

This section describes the impacts that the NRC staff considers common to all alternatives discussed in this SEIS, including the proposed action and replacement power alternatives. In addition, the following sections discuss the termination of nuclear power plant operations, the decommissioning of a nuclear power plant and potential replacement power facilities, and GHG emissions and climate change.

3.15.1 Fuel Cycle

This section of the SEIS describes the environmental impacts associated with the fuel cycles of both the proposed action (uranium fuel cycle) and all replacement power alternatives that are analyzed in detail in this SEIS.

3.15.1.1 Uranium Fuel Cycle

The uranium fuel cycle consists of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level wastes and high-level wastes related to uranium fuel cycle activities. Section 4.14.1 of the 2024 LR GEIS describes in detail the generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes (NRC 2024-TN10161). The NRC staff incorporates the information in the LR GEIS, Section 4.14.1 (NRC 2024-TN10161: 4-150—4-164), herein by reference. The LR GEIS does not identify any site-specific (Category 2) uranium fuel cycle issues.

As stated in the LR GEIS (NRC 2024-TN10161), the generic issues related to the uranium fuel cycle as identified in Table 3-1 would not be affected by continued operations associated with LR. The NRC staff identified no new and significant information for these issues. Thus, as concluded in the LR GEIS, the impacts of generic issues related to the uranium fuel cycle would be SMALL.

3.15.1.2 Replacement Power Alternatives Fuel Cycles

3.15.1.2.1 Purchased Power Alternative

The environmental impacts from fuel cycles for the purchased power alternative are dependent on the type of power purchased. The following discusses the environmental impacts from fuel cycles for nuclear and fossil fuel power.

Uranium fuel cycle impacts for a nuclear plant result from the initial extraction of fuel, transport of fuel to the facility, and management and ultimate disposal of spent fuel. The environmental impacts of the uranium fuel cycle are referenced above in Section 3.15.1.1 of this SEIS and discussed in more detail in Section 4.14.1 and Appendix D, Section D.4.12.2 of the 2024 LR GEIS (NRC 2024-TN10161).

Fuel cycle impacts for a fossil fuel fired power plant result from the initial extraction of fuel, cleaning and processing of fuel, transport of fuel to the facility, and management and ultimate disposal of any solid wastes from fuel combustion. These impacts are discussed in more detail in Appendix D, Section D.4.12.1 of the 2024 LR GEIS (NRC 2024-TN10161) and can generally include the following: significant changes to land use and visual resources; impacts on air quality, including release of criteria pollutants, fugitive dust, volatile organic compounds, and methane into the atmosphere; noise impacts; geology and soil impacts caused by land disturbances and mining; water resource impacts, including degradation of surface water and groundwater quality; ecological impacts, including loss of habitat and wildlife disturbances; historic and cultural resource impacts within the mine or pipeline footprint associated with the extraction of the fuel; socioeconomic impacts from employment of both the mining workforce and service and support industries; health impacts on workers from exposure to airborne dust and methane gases; and generation of industrial wastes.

3.15.1.2.2 Renewables Combination Alternative

As stated in Appendix D, Section D.4.12.3 of the 2024 LR GEIS (NRC 2024-TN10161) (under "Renewable Alternatives"), the fuel cycles for renewable technologies such as wind, solar, and geothermal are difficult to define. This is because the associated natural resources exist regardless of any effort to harvest them for electricity production. Impacts from the presence or absence of these renewable energy technologies are often difficult to determine (NRC 2024-TN10161).

3.15.2 Termination of Nuclear Power Plant Operations and Decommissioning

This section of the SEIS describes the environmental impacts associated with the termination of operations and the decommissioning of a nuclear power plant and replacement power alternatives. All operating power plants will terminate operations and be decommissioned at some point after the end of their operating life or after a decision is made to cease operations. The proposed action would only delay this eventuality for Diablo Canyon.

3.15.2.1 Existing Nuclear Power Plant

Decommissioning would occur whether Diablo Canyon is shut down at the end of the term of its current licenses or at the end of the LR term. NUREG-0586 evaluates the environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license (NRC 2002-TN7254). Additionally, Section 4.14.2.1 of the LR GEIS (NRC 2024-TN10161) summarizes the incremental environmental impacts associated with nuclear power plant decommissioning activities as a result of LR. As noted in Table 3-1, there is one Category 1 issue, "Termination of plant operations and decommissioning," applicable to Diablo Canyon LR. The LR GEIS did not identify any site-specific (Category 2) decommissioning issues. The NRC staff did not identify any new and significant information that would change the conclusion in the 2024 LR GEIS and, therefore, the NRC staff concludes that the impacts of the proposed action from termination of plant operations and decommissioning would be SMALL.

3.15.2.2 Replacement Power Alternatives

3.15.2.2.1 Purchased Power Alternative

The environmental impacts from the termination of power plant operations and decommissioning of a power-generating facility are dependent on the type of facility and the facility's decommissioning plan. The decommissioning plan outlines the actions necessary to restore the site to a condition equivalent in character and value to the site on which the facility was first constructed (NRC 2024-TN10161). General elements and requirements for a fossil fuel energy facility decommissioning plan are discussed in Appendix D, Section D.4.13.1 of the LR GEIS (NRC 2024-TN10161). The NRC staff considers the impacts of decommissioning to be representative of those associated with decommissioning any thermoelectric power-generating facility. The staff incorporates the information in the LR GEIS, Appendix D, Section D.4.13.1 (NRC 2024-TN10161: pp. D-44 and D-45), herein by reference.

Activities that are unique to the termination of operations and decommissioning of a nuclear power-generating facility include the safe removal of the facility from service and the reduction of residual radioactivity to a level that permits release of the property under restricted conditions or unrestricted use and termination of the license as further discussed in Section 4.14.2.1 and Appendix D, Section D.4.13.2 in the LR GEIS (NRC 2024-TN10161).

3.15.2.2.2 Renewables Combination Alternative

Termination of power plant operation and decommissioning for renewable energy facilities would generally be similar to the activities and impacts discussed for nuclear and fossil fuel facilities above. Decommissioning would involve the removal of facility components and any operational wastes and residues to restore sites to a condition equivalent in character and value to the site on which the facility was first constructed. In other circumstances, supporting infrastructure (e.g., buried utilities and pipelines) could be abandoned in place (NRC 2024-TN10161). The range of possible decommissioning considerations and impacts, depending on the renewable energy technology considered, are discussed in Appendix D, Section D.4.13.3 of the LR GEIS (NRC 2024-TN10161). The staff incorporates the information in the LR GEIS, Section D.4.13.3 (NRC 2024-TN10161: pp. D-45 and D-46), herein by reference.

3.15.3 Greenhouse Gas Emissions and Climate Change

3.15.3.1 Greenhouse Gas Impacts on Climate Change

Gases found in the Earth's atmosphere that trap heat and play a role in the Earth's climate are collectively termed greenhouse gases, or GHGs. These GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), water vapor, and fluorinated gases, such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The Earth's climate responds to changes in concentrations of GHGs in the atmosphere because these gases affect the amount of energy absorbed and heat trapped by the atmosphere. Increasing concentrations of GHGs in the atmosphere generally increase the Earth's surface temperature. Atmospheric concentrations of CO_2, CH_4, and N_2O have significantly increased since 1850 (IPCC 2013-TN7434, 2021-TN7435). For instance, since 1850, CO_2 concentrations have increased by almost 50 percent (USGCRP 2023-TN9762). In 2019, atmospheric concentrations of CO_2 (measured at 410 ppm) were higher than any time in at least 2 million years (IPCC 2023-TN8557). The annual rate of increase in atmospheric CO_2 over the last 60 years is 100 times faster than previous natural increases (USGCRP 2023-TN9762).

Long-lived GHGs—CO_2, CH_4, N_2O, and fluorinated gases—are well mixed throughout the Earth's atmosphere, and their impact on climate is long-lasting and cumulative in nature as a result of their long atmospheric lifetimes (EPA 2016-TN7561). Therefore, the extent and nature of climate change is not specific to where GHGs are emitted. CO_2 is of primary concern for global climate change because it is the primary gas emitted as a result of human activities. In 2019, global net GHG emissions were estimated to be 59 ± 6.6 gigatons of CO_2 equivalents (CO_2eq), with the largest share in gross GHG emissions being CO_2 from fossil fuel combustion and industrial processes (IPCC 2023-TN8557).

The 2013 LR GEIS (NRC 2013-TN2654) presents life-cycle GHG emissions associated with nuclear power generation. GHG emissions over the nuclear life-cycle consist of contributions from the uranium fuel cycle phases and nuclear power plant construction, operation, and decommissioning. As presented in Table 4.12-4 through Table 4.12-6 of the 2013 LR GEIS, life-cycle GHG emissions from nuclear power can range from 1 to 228 grams carbon equivalent per kilowatt-hour. GHG emissions from operation of nuclear power plants are typically minor. Operation of Diablo Canyon results in direct and indirect GHG emissions. PG&E calculated GHG emissions from stationary and portable combustion sources (shown in Table 3-5), refrigerant used at the facility, and indirect emission sources (workforce commuting for plant activities where information was readily available). GHG emissions generated from operation at Diablo Canyon are presented in Table 3-33. Fluorinated gas emissions from refrigerant sources and from electrical transmission and distribution systems can result from leakage, servicing, repair, or disposal of sources. In addition to being GHGs, chlorofluorocarbons and hydrochlorofluorocarbons are ozone-depleting substances that are regulated by the CAA under Title VI, "Stratospheric Ozone Protection." As presented in Section 9.5.2.3 of the ER (PG&E 2023-TN9822), Diablo Canyon maintains a program to manage stationary refrigeration appliances at the plant to recycle, recapture, and reduce emissions of ozone-depleting substances, including perfluorocarbons, and follows Section 608 of the CAA. PG&E uses sulfur hexafluoride in small hermetically sealed breakers at Diablo Canyon; as the breakers are sealed, there were no GHG emissions associated with sulfur hexafluoride between 2018 and 2023 (PG&E 2024-TN10032). PG&E does not maintain an inventory on mobile emissions sources such as visitor and delivery vehicles and therefore they are not accounted for in Table 3-33 (PG&E 2023-TN9822).

Table 3-33 Annual Greenhouse Gas Emissions from Operations at Diablo Canyon Nuclear Power Plant, Units 1 and 2, tons of carbon dioxide equivalents[(a)]

Emission Source	2018	2019	2020	2021	2022	2023
Combustion Sources[(b)]	790	1,120	815	1,040	1,150	1,270
Workforce Commuting[(c)]	7,720	7,720	7,720	7,720	7,720	7,720
Total	**8,510**	**8,840**	**8,535**	**8,760**	**8,870**	**8,990**

(a) Greenhouse gas (GHG) emissions are reported in metric tons and converted to short tons. All reported Values are rounded. To convert to metric tons per year, multiply by 0.90718. Expressed in carbon dioxide equivalents (CO_2eq), a metric used to compare the emissions of GHGs based on their global warming potential (GWP). The GWP is a measure used to compare how much heat a GHG traps in the atmosphere. The GWP is the total energy that a gas absorbs over a period of time compared to carbon dioxide. CO_2eq is obtained by multiplying the amount of the GHG by the associated GWP.

(b) Emissions for years 2018 through 2022 are based on fuel usage for combustion sources from permitted air emission sources (Table 3-5 of this SEIS), a 162 horsepower emergency diesel generator removed from service in November 2022, 10 permit exempt small diesel engines, and recorded refrigerant used at the Diablo Canyon facility (EPA 2024-TN10060). Emissions for year 2023 are based on fuel usage for combustion sources from permitted air emission sources (Table 3-5 of this SEIS), 12 diesel engines in Conditional Permit Exemption (Number 2365-1), 8 permit exempt small diesel engines, and recorded refrigerant used at the Diablo Canyon facility. Source: PG&E 2024-TN10032 and NRC 2024-TN10202.

(c) Workforce commuting calculations are based on the total number of Diablo Canyon employees as of March 2023 (1,633 employees) and EPA's Greenhouse Gas Equivalencies Calculator (EPA 2024-TN10062).

3.15.3.1.1 Proposed Action

As described in the LR GEIS (NRC 2024-TN10161) and as cited in Table 3-1 of this SEIS, the GHG impacts on climate change from continued operations would be SMALL. The NRC staff did not identify any new and significant information that would change the conclusion in the LR GEIS. GHG emissions from routine operations at Diablo Canyon include diesel engines, refrigeration systems, boiler, as well as mobile sources and are minor. PG&E does not anticipate future upgrades or replacement activities of emission sources during the LR term to support plant operation that could result in a significant increase in GHG emissions. Thus, as concluded in the LR GEIS, for the “Greenhouse gas impacts on climate change” generic issue, the impacts of continued operation of Diablo Canyon on climate change would be SMALL.

3.15.3.1.2 No-Action Alternative

Under the no-action alternative, the NRC would not issue renewed licenses, and Diablo Canyon would permanently shut down on or before the expiration of the current licenses. At some point, all nuclear power plants will terminate operations and undergo decommissioning. The decommissioning GEIS (NRC 2002-TN7254) considers the environmental impacts of decommissioning. Therefore, the scope of impacts considered under the no-action alternative includes the immediate impacts resulting from activities at Diablo Canyon that would occur between plant shutdown and the beginning of decommissioning (i.e., activities and actions necessary to cease operation of Diablo Canyon). When the facility stops operating, a reduction in GHG emissions from activities related to plant operation, such as the use of generators and employee vehicles would occur. The NRC staff anticipates that GHG emissions for the no-action alternative would be less than those presented in Table 3-33, which shows the estimated direct GHG emissions from operation of Diablo Canyon and associated mobile emissions. Therefore, the NRC concludes that the impacts of the no-action alternative on climate change would be SMALL.

3.15.3.1.3 Purchased Power Alternative

As described in Section 2.3.2.1 of this SEIS, until 2045, purchased power would likely come from the most common types of existing electric power technologies including natural gas, geothermal, hydroelectric, solar, and wind. California’s 100 Percent Clean Energy Act of 2018 requires all energy generation be renewable and zero-carbon after 2045 (State of California 2018-TN9855). Therefore, post-2045 all sources of purchased power must be renewable energy sources. Furthermore, California’s 100 Percent Clean Energy Act updated the Renewable Portfolio Standard to ensure that by 2030, 60 percent of California’s electricity is renewable (CEC 2021-TN10203). Therefore, until 2045, purchased power would likely come from the most common types of electric power generating technologies in California including natural gas, geothermal, hydroelectric, solar, and wind with the share of renewable sources increasing and carbon dioxide emissions decreasing over time. Using California’s 2022 in-State electricity generating technology mix as a bounding case (DOE/EIA 2023-TN10176), approximately 4.8 million tons (4.4 million MT) of carbon dioxide equivalents a year can be emitted up until 2045. After 2045, all sources of purchased power must be from zero-carbon renewable energy sources and therefore direct CO_2eq should be negligible and insignificant. As can be seen from Table 3-34, if Diablo Canyon’s generating capacity were to be replaced by purchased power, initially there would be a significant increase (orders of magnitude) in GHG emissions. GHG emissions from purchased power, however, would decrease given the 2030 goal that 60 percent of electricity must come from renewable sources and eventually emissions would be negligible by 2045. Therefore, given the potential for a significant increase in GHG emissions followed by a decrease in emissions and eventually negligible emissions, the NRC staff concludes that the impacts of the purchased power alternative on climate change would be SMALL to MODERATE.

Table 3-34 Direct Greenhouse Gas Emissions from Operations of Diablo Canyon Nuclear Power Plant Under the Proposed Action and Alternatives

Technology/Alternative	Carbon Dioxide Equivalent (tons/yr)[(a)]
Proposed Action[(b)]	1,270
No-Action Alternative[(c)]	<1,270
Purchased Power Alternative[(d)]	<4.8 million up to year 2045; post-2045 emissions are negligible
Renewables Combination Alternative[(e)]	negligible

(a) Carbon dioxide equivalent (CO_2eq) is a metric used to compare the emissions of greenhouse gases (GHGs) based on their global warming potential (GWP). The GWP is a measure used to compare how much heat a GHG traps in the atmosphere. The GWP is the total energy that a gas absorbs over a period of time compared to carbon dioxide. CO_2eq is obtained by multiplying the amount of the GHG by the associated GWP.
(b) GHG emissions include direct emissions from onsite combustion sources.
(c) Emissions resulting from activities at Diablo Canyon that would occur between plant shutdown and the beginning of decommissioning and assumed not to be greater than GHG emissions from operation at Diablo Canyon.
(d) Until 2045, purchased power would likely come from the most common types of electric power generating technologies in California including natural gas, geothermal, hydroelectric, solar, and wind with the share of renewable sources increasing and CO_2 emissions decreasing over time. Using California’s 2022 in-State electricity generating technology mix as a bounding case (DOE/EIA 2023-TN10176), approximately 4.8 million tons (4.4 million MT) of CO_2eq a year can be emitted up until 2045 but would likely be less than this since California’s 100 Percent Clean Energy Act updated the Renewable Portfolio Standard to ensure that by 2030, 60 percent of California’s electricity is renewable. After 2045, all sources of purchased power must be from zero-carbon renewable energy sources and therefore direct CO_2 emission equivalents should be negligible.
(e) Direct air emissions associated with operation of the solar with battery storage and wind (onsite and offsite with battery storage) portions of this alternative are negligible because no fossil fuels are burned to generate electricity. Similarly, since California’s 100 Percent Clean Energy Act of 2018 requires all energy generation be renewable and zero-carbon after 2045, the NRC staff assumes that the CO_2 emission factor from the geothermal power plant would be 0 lbs/MWh.

3.15.3.1.4 Renewables Combination Alternative

The renewables combination alternative presented in Section 2.3.2.2 of this SEIS consists of the following: 830 MW (2,005 MW installed capacity) wind onsite and offsite with battery storage, 1,160 MW (3,540 MW installed capacity) solar PV with battery storage, 200 MW of geothermal, and demand side management. The 2013 LR GEIS (NRC 2013-TN2654) presents life-cycle emissions (e.g., material production, system and plant component manufacturing, installation and plant construction, operation, decommissioning). Life-cycle emissions from wind, solar, and geothermal power generation can range from 2 to 81, 5 to 217, and 6 to 79 grams CO_2eq per kilowatt hour, respectively. GHG emission sources during construction of the renewables combination alternative would be similar to the construction of an industrial facility and include construction equipment, engine exhaust, and workforce commuting. GHG emissions from construction of the renewables combination alternative would depend on the construction duration and equipment usage of each component (i.e., wind, solar, geothermal). Facility construction is responsible for 24 percent of wind life-cycle emissions and 19 percent of solar PV lifecycle emissions (Nugent and Sovacool 2014-TN10630). With respect to geothermal power plants, life-cycle assessments vary with some studies indicating that facility construction is responsible for 24 percent of life cycle emissions (Karlsdottir et al. 2010-TN10631) and other assessments indicating that construction is responsible for a considerable portion of life cycle emissions (Zhao et al. 2024-TN10632). There would be no construction GHG related emissions associated with demand side management.

Direct GHG emissions associated with operation of the solar with battery storage and wind (onsite and offsite with battery storage) portions of this alternative are negligible because no fossil fuels are burned to generate electricity. While operation of geothermal power plants can result in the emission of CO_2 from the gases that occur naturally in geothermal fluids (see Section 3.3.8 for discussion on emissions factors), because California's 100 Percent Clean Energy Act of 2018 (State of California 2018-TN9855) requires all energy generation to be renewable and zero-carbon after 2045 (State of California 2018-TN9855), the geothermal component of this alternative would not emit CO_2. Therefore, GHG emissions associated with operation of the geothermal component would be negligible. Therefore, the NRC staff concludes that the impacts of the renewables combination alternative on climate change would be SMALL.

3.15.3.2 Climate Change

Climate change is the decades or longer change in climate measurements (e.g., temperature and precipitation) that has been observed on a global, national, and regional level (IPCC 2007-TN7421; EPA 2016-TN7561; USGCRP 2014-TN3472). Worldwide, 2023 was the warmest year on record and 2014–2023 was the warmest decade on record since thermometer-based observation began (EPA 2024-TN10205). Climate change research indicates that the cause of the Earth's warming over the last 50 to 100 years is due to the buildup of GHGs in the atmosphere resulting from human activities (IPCC 2013-TN7434; IPCC 2021-TN7435; IPCC 2023-TN8557; USGCRP 2014-TN3472; USGCRP 2017-TN5848; USGCRP 2018-TN5847). Climate change can vary regionally, spatially, and seasonally, depending on local, regional, and global factors. Just as regional climate differs throughout the world, the impacts of climate change can vary among locations.

3.15.3.2.1 Observed Trends in Climate Change Indicators

Global surface temperature has increased faster since 1970 than in any other 50-year period over at least the last 2,000 years (IPCC 2023-TN8557). From 2011 through 2020, the global surface temperature was 2°F (1.1°C) warmer than that in the preindustrial period (1850–1900) (IPCC 2023-TN8557). From 1901 to 2023, global precipitation has increased at an average rate of 0.03 in. (0.08 cm) per decade (EPA 2024-TN10205). From 1901 to 2023, average surface temperature across the contiguous United States has increased by 0.17°F (0.09°C) per decade (EPA 2024-TN10205). From 1901 to 2023, total annual precipitation in the contiguous United States has increased at a rate of 0.18 in. (0.4 cm) per decade (EPA 2024-TN10205).

The United States Global Change Research Program (USGCRP) reports that since 1970, the contiguous United States is warming faster than the global average. Since 1970, global temperature has increased by 1.7°F (0.9°C), while average surface temperature in the contiguous United States has increased by 2.5°F (1.4°C) (USGCRP 2023-TN9762). Observed climate change indicators across the United States include increases in the frequency and intensity of heavy precipitation, earlier onset of spring snowmelt and runoff, rise of sea level and increased tidal flooding in coastal areas, an increased occurrence of heat waves, and a decrease in the occurrence of cold waves. Average sea level along the continental U.S. coastline has risen by about 11 in. (27 cm) over the last century, and between 1993 and 2020 average sea level rose 1.8 in. (4.6 cm) per decade (USGCRP 2023-TN9762).

Climate change and its impacts can vary regionally, spatially, and seasonally, depending on local, regional, and global factors. Observed climate changes and impacts have not been uniform across the United States. Annual average temperature data for a greater part of the Southwest (where Diablo Canyon is located) between 2002 and 2021 (relative to 1901–1960) exhibit an increase of more than 2.0°F (1.1°C) (USGCRP 2023-TN9762: Figure 2.4). The number of hot days (days at or above 95°F [35°C]) has increased by 5.5 days, the number of cold days (days at or below 32°F [0°C]) has decreased by 10.2 days, and the number of warm nights (nights at or above 70°F [21°C]) has increased by 4.2 days in the Southwest from 2002 to 2021 relative to 1901–1960 (USGCRP 2023-TN9762: Figure 2.7). Average annual precipitation from 2002 to 2021 (relative to the 1901–1960 average) for a greater part of the Southwest has decreased by 0–15 percent (USGCRP 2023-TN9762: Figure 2.4). The Southwest has experienced a 17-percent increase in the number of extreme precipitation days (defined as the top 1 percent of heaviest precipitation events) from 1958 to 2021 (USGCRP 2023-TN9762: Figure 2.8). Between 1993 and 2020, sea level along the California coast rose between 0 and 2 in. (0 and 5.0 cm) per decade (USGCRP 2023-TN9762: Figure 2.5). In the last century, California's coastal ocean warmed by 1.26°F (0.7°C) (Phillips et al. 2018-TN10290). The California coast has experienced several record-breaking floods and wildfires (USGCRP 2018-TN5847). Long term data (from 1900 to 2022) exhibits both wetter and drier conditions for California, with northern and southern coastal areas having a standardized precipitation evapotranspiration index (SPEI) ranging between 0 and −0.5, and central coastal and inland areas having an SPEI ranging between 0 and 1.0 (USGCRP 2023-TN9762: Figure A4.9). SPEI measures the combination of precipitation and evapotranspiration to determine if an area is experiencing extreme drought (negative SPEI) or extreme moisture (positive SPEI). In the Southwest, wildfires have become larger, more frequent, and more severe. Of the 50 largest U.S. wildfires in 2020, 22 occurred in California (USGCRP 2023-TN9762). USGCRP reports that warming temperatures trends, changes in precipitation patterns, and increases in vapor pressure deficit have influenced the wildfire patterns across the Southwest.

The NRC staff used the NOAA "Climate at a Glance" tool to analyze temperature and precipitation trends for the 1895–2024 period in the Central Coast Drainage climate division within California. A trend analysis shows that the average annual temperature has increased at a rate of 0.2°F (0.1°C) per decade, and average precipitation has decreased at a rate of 0.04 in. (1.01 mm) per decade (NOAA 2023-TN8560).

3.15.3.2.2 Climate Change Projections

Future global GHG emission concentrations (emission scenarios) and climate models are commonly used to project possible climate change. Climate model simulations often use GHG emission scenarios to represent possible future social, economic, technological, and demographic development that, in turn, drives future emissions. Climate models indicate that over the next decade, warming is very similar across all emission scenarios (USGCRP 2023-TN9762). However, by mid-century (2040–2070), differences between projected temperatures under higher and lower emission scenarios become observable. The impacts of climate change increase with warming, and warming is certain to continue if emissions of CO_2 do not reach net zero (USGCRP 2023-TN9762).

The Intergovernmental Panel on Climate Change (IPCC) has generated various representative concentration pathway (RCP) scenarios commonly used by climate modeling groups to project future climate conditions (IPCC 2000-TN7652; 2013-TN7434; USGCRP 2017-TN5848; 2018-TN5847). In the IPCC Fifth Assessment Report, four RCPs were developed and are based on the predicted changes in radiative forcing (a measure of the influence that a factor, such as GHG emissions, has in changing the global balance of incoming and outgoing energy) in the year 2100, relative to preindustrial conditions. The four RCP scenarios are numbered in accordance with the change in radiative forcing measured in watts per square meter (i.e., +2.6 [very low], +4.5 [lower], +6.0 [mid-high], and +8.5 [higher]) (USGCRP 2018-TN5847). For example, RCP 2.6 is representative of a mitigation scenario aimed at limiting the increase of global mean temperature to 1.1°F (0.7°C) (IPCC 2014-TN7651). RCP 8.5 reflects a continued increase in global emissions resulting in increased warming by 2100. In the IPCC Working Group contribution to the Sixth Assessment Report, five shared socioeconomic pathways were used along with associated modeling results as the basis for the climate change assessments (IPCC 2021-TN7435). These five socioeconomic pathway scenarios cover a range of GHG pathways and climate change mitigation.

The NRC staff considered the best available climate change studies performed by USGCRP and California's Climate Change Assessment as part of the staff's assessment of potential climate change projections during the Diablo Canyon LR term (2024–2044 for Unit 1 and 2025–2045 for Unit 2). The Fourth National Climate Assessment relies on the four RCPs in the IPCC Fifth Assessment Report and presents projected climate change categorized by U.S. geographic region (USGCRP 2018-TN5847: Figure 3-12). The Fifth National Climate Assessment (USGCRP 2023-TN9762) uses shared socioeconomic pathways, RCPs, and global warming levels when presenting projected climate change. Global warming levels are used to describe the level of global temperature increase (e.g., 2.7°F or 1.5°C) relative to preindustrial temperature conditions (USGCRP 2023-TN9762). California's Fourth Climate Change Assessment relies on two RCPs. Climate model projections indicate that changes in climate will not be uniform across the United States. The results of these reports are summarized as follows. At the time of the publication of this draft SEIS, the development of California's Fifth Climate Change Assessment was underway but not published.

Regional projections for annual mean temperature are available from the Fourth National Climate Assessment based on the RCP 4.5 and RCP 8.5 scenarios for the midcentury (2036–2065) as compared to the annual mean temperature for 1976–2005. The modeling predicts increases of 3.72–4.8°F (2.1–2.7°C) across the Southwest region by midcentury, with higher GHG emission scenarios leading to greater and faster temperature increases (USGCRP 2017-TN5848: Table 6.4). Specific to the portion encompassing California, predicted annual temperature increases range from 2–6°F (1.1–3.4°C) under the RCP 4.5 and RCP 8.5 scenarios (USGCRP 2017-TN5848: Figure 6.7). Under the RCP 8.5 scenario, the coldest and warmest daily temperatures of the year are expected to increase by 0.5 and 3.99°F (0.2 and 2.3°C), respectively, in the Southwest by midcentury (USGCRP 2017-TN5848). Projections for annual average maximum and minimum temperatures for San Luis Obispo County are available from California's Fourth Climate Assessment for 2040–2069 relative to 1961–1990. Modeling predicts that annual average maximum temperature increases by 3.8°F (2.1°C) and 5°F (2.8°C) and that annual average minimum temperature increases by 3.7°F (2.0°C) and 4.8°F (2.7°C) under the RCP 4.5 and RCP 8.5 emission scenarios, respectively (Langridge 2018-TN9854).

As for precipitation, the climate model simulations suggest small changes in average annual precipitation, with overall decreases in average rainfall during winter, spring, and summer (USGCRP 2017-TN5848; EPA 2023-TN8803). Under an intermediate scenario (RCP 4.5), projected changes in annual precipitation by midcentury (2036–2065, relative to 1991–2020) for California indicate increases and decreases in precipitation; the southern and central regions of California primarily indicate a decrease ranging from 0–1 in. (0–2.5 cm), while the northern and central coastal regions indicate an increase ranging from 0–2 in. (0–5.0 cm) (USGCRP 2023-TN9762: Figure 4.3). The USGCRP, however, predicts continued increases in the frequency and intensity of heavy precipitation events across the United States, including across the Southwest. Generally, extreme precipitation events are observed to increase by 6–7 percent for each degree Celsius of temperature increase (USGCRP 2017-TN5848). California's Fourth Climate Assessment projects annual average precipitation increases for San Luis Obispo

County of 1.5 in. (3.8 cm) and 1.4 in. (3.6 cm) under the RCP 4.5 and RCP 8.5 emission scenarios, respectively, by midcentury (2040–2069 relative to 1961–1990) (Langridge 2018-TN9854).

Decreases in average precipitation coupled with increases in extreme precipitation, temperatures, and evapotranspiration can result in increased aridity, more frequent droughts, and reduction in the average flow of rivers and streams (USGCRP 2018-TN5847; EPA 2023-TN8803). USGCRP reports that higher temperatures can cause a drought to develop or become more intense than would be expected from precipitation deficits alone (USGCRP 2023-TN9762). USGCRP defines drought as a mismatch between moisture supply and demand and driven by many climatic factors including temperature, potential evapotranspiration, soil moisture, or precipitation. Under an intermediate scenario (RCP 4.5), projected changes for California's Central Coast by midcentury (2036–2065, relative to 1991–2020) indicate an annual actual evapotranspiration decrease of 0–0.5 in. (0–1.2 cm), average summer soil moisture decrease of 0–0.05 in. (0–0.12 cm), and annual climatic water deficit (defined as the shortfall of water necessary to fully supply vegetation requirements) increase of 0.5–1 in. (1.27–2.5 cm) (USGCRP 2023-TN9762: Figures 4.4, 4.6, 4.9). USGCRP reports that there is a high confidence that fires in the Southwest have become larger and more severe and that increases in temperatures and changes in precipitation, combined with droughts and heatwaves, will very likely result in continued larger and severe wildfires (USGCRP 2023-TN9762). California's Fourth Climate Change Assessment reports that there is uncertainty in wildfire projections due to various interacting factors (wind, vegetation type), but projections of wildfires in future decades in California range from modest to large increases from historical conditions (Bedsworth et al. 2018-TN10206).

A broad range of sea level rise projections and differences along the California coast exist due to the use of different models, emission scenarios, and assumptions of ice sheet loss (e.g., Bedsworth et al. 2018-TN10206; Griggs et al. 2017-TN10291). The NRC considered NOAA's sea level rise technical report as it provides the most up to date sea level rise projections for U.S. States and territories (Sweet et al. 2022-TN10207). The California Sea Level Rise Task Force adopted the sea level scenarios for California from Sweet et al. (2022-TN10207) in its 2024 State of California Sea Level Rise Guidance (California Sea Level Rise Guidance 2024-TN10292). Sweet et al. (2022-TN10207) developed observation-based extrapolations for U.S. coastal regions based on five global mean sea level rise scenarios for 2100 (Low 1 ft [0.3 m]), Intermediate-Low (1.5 ft [0.5 m]), Intermediate (3 ft [1 m]), Intermediate-High (5 ft [1.5 m]), and High (6.5 ft [2 m]), and downscaled to local and regional levels. The observation-based extrapolations estimate a median sea level rise in 2050 (relative to 2000) along the California coast ranging from 0.5 to 1.2 ft (0.15 to 0.38 m) (Sweet et al. 2022-TN10207). The Interagency Sea Level Rise Scenario Tool developed sea level rise estimates at individual tide gauge locations. These estimates are observation-based extrapolations based on the five global mean sea level rise scenarios for 2100 and the rate and acceleration of sea level rise from 1970 to 2020 calculated from sea level rise observations from regional tide gauges. The Interagency Sea Level Rise Scenario Tool, which originated from NOAA's 2022 sea level rise technical report, includes scenarios for the Port of San Luis. The median range of sea level rise in the Port of San Luis is projected to be 0.32 to 1.09 ft (0.09–0.33 m) by 2050 (relative to 2000) (NASA 2024-TN10208).

The Fifth National Climate Assessment reports that sea level rise will continue to cause permanent inundation and an increase in the severity of coastal flooding (USGCRP 2023-TN9762). By 2050, under an Intermediate sea level scenario, minor (disruptive, 1–2 ft [0.3–0.6 m] of flooding in shoreline and vulnerable areas), moderate (damaging, 2–3 ft [0.6–0.9 m] of flooding in shoreline and vulnerable areas), and major (destructive, 3–5 ft [0.9–1.5 m] of flooding in shoreline and vulnerable areas) coastal annual average event flood frequencies will increase by a factor of 10 to 17, relative to 2020, along the California coast (Sweet et al. 2022-TN10207).

3.15.3.2.3 Climate Change Impacts on Environmental Resources

As described in the 2024 LR GEIS (NRC 2024-TN10161) and as cited in Table 3-2 of this SEIS, there is a Category 2 issue “Climate Change Impacts on Environmental Resources” applicable to Diablo Canyon. According to the 2024 LR GEIS, the impacts of climate change on environmental resources during the LR term are location-specific and cannot be evaluated generically. Changes in climate can have broad implications for certain resource areas. Climate change may impact the affected environment in a way that alters the environmental resources that are impacted by the proposed action (Diablo Canyon LR). In order for there to be a climate change impact on an environmental resource, the proposed action must have an incremental new, additive, or increased physical effect or impact on the resource or environmental condition beyond what is already occurring. Below, the NRC staff considers the effects of climate change on environmental resource areas that may also be directly affected by Diablo Canyon continued operations during the LR term.

The effects of climate change on Diablo Canyon’s SSCs are outside the scope of this Category 2 issue. Site-specific environmental conditions are considered when siting nuclear power plants. This includes the consideration of meteorological and hydrologic siting criteria as set forth in 10 CFR Part 100-TN282, “Reactor Site Criteria.” NRC regulations require that plant SSCs important to safety be designed to withstand the effects of natural phenomena, such as flooding, without loss of capability to perform their safety functions. Further, nuclear power plants are required to operate within technical specifications in accordance with their NRC operating licenses, including coping with natural phenomena hazards. The NRC conducts safety reviews prior to allowing licensees to make operational changes due to changing environmental conditions. Additionally, the NRC evaluates nuclear power plant operating conditions and physical infrastructure to ensure ongoing safe operations under the plant’s operating licenses through the NRC’s Reactor Oversight Program. If new information about changing environmental conditions (such as rising sea levels that threaten safe operating conditions or challenge compliance with the plant’s technical specifications) becomes available, the NRC will evaluate the new information to determine whether any safety-related changes are needed at licensed nuclear power plants. This is a separate and distinct process from the NRC staff’s LR environmental review that it conducts in accordance with NEPA.

Air Quality: Climate change can impact air quality as a result of changes in meteorological conditions. Air pollutant concentrations are sensitive to winds, temperature, humidity, and precipitation. Ozone levels and PM have been found to be particularly sensitive to climate change influences. Ozone is formed by the chemical reaction of nitrogen oxide and volatile organic compounds in the presence of heat and sunlight. The emission of ozone precursors also depends on the temperature, wind, and solar radiation (IPCC 2007-TN7421). Warmer temperatures, air stagnation, droughts, and wildfires are favorable conditions for higher levels of ozone and $PM_{2.5}$ (USGCRP 2023-TN9762). As discussed in Section 3.3.2 of this SEIS, San Luis Obispo County is designated as a nonattainment area for ozone with respect to NAAQS, and as nonattainment for ozone and PM_{10} under CAAQS. The USGCRP expects that increases in wildfires will increase $PM_{2.5}$ concentrations. The USGCRP reports that there is medium confidence that climate change is projected to worsen air quality in many U.S. regions (USGCRP 2023-TN9762). This is due to the uncertainty in how meteorology will respond to climate change and how these meteorological conditions will in turn change air pollutant concentrations. For instance, while warmer average temperatures are projected to increase seasonal mean daily maximum 8 hour average ozone and $PM_{2.5}$ concentrations, increases in annual average precipitation will decrease $PM_{2.5}$ concentrations (USGCRP 2023-TN9762).

Surface Water Resources: Climatic changes, such as changes in air temperature and precipitation patterns, can affect the availability of water resources (NRC 2024-TN10161).

Climate change projections suggest that a variety of impacts to water resources in the region where Diablo Canyon is located may occur over the LR period. These impacts may include more extreme precipitation events, more frequent droughts, and a reduced average flow for rivers and streams (Langridge 2018-TN9854; USGCRP 2023-TN9762). Diablo Canyon surface water withdrawals are exclusively from the Pacific Ocean. Therefore, climate change impacts to the Pacific Ocean are the primary concern for this analysis. Sea level along the California coast has risen and is projected to continue to rise. The magnitude of the projected rise varies depending on the model and assumptions used. Using observation-based extrapolations, Sweet et al. 2022 (TN10207) estimate a median sea level rise along the California coast in 2050 (relative to 2000) ranging from 0.49 to 1.25 ft (0.15 to 0.38 m). Given this projected rise, there are no anticipated or reasonably foreseeable conflicts in surface water supplies and allocations over the LR period.

The sea surface temperature on California's coast has increased by 1.0°F (0.7°C) between 1900 and 2016 (Langridge 2018-TN9854). Continued effects of climate change include increases in ocean surface temperature (USGCRP 2024-TN10064). Under the RCP 8.5 scenario, the California coastal ocean temperature is projected to increase by an additional 0.9–2.7°F (0.5–1.5°C) by 2040 (Langridge 2018-TN9854). Warmer water and higher air temperatures can reduce the efficiency of thermal power plant cooling technologies. Increased seawater temperatures could lead to an increase in annual average seawater withdrawal and other operational changes and/or an increase in the volume and temperature of the circulating cooling water discharged back to the Pacific Ocean. As discussed in Section 3.5.1.3 of this SEIS, Diablo Canyon operates under an NPDES permit that limits the thermal discharges to 22°F (12.2°C) above the intake temperature during normal operation. Currently, Diablo Canyon discharges average 19.6°F (10.9°C) above the intake temperature (PG&E 2023-TN9822). It is likely that the projected increases in air and sea temperatures could be accommodated by operational changes without substantial adverse impact. Regardless, thermal and chemical discharges would still need to meet applicable NPDES permit requirements.

Aquatic Resources: Changes in sea level rise and sea surface temperature can alter the balance of marine ecosystems. Increases in sea surface temperature reduces vertical mixing of ocean water that brings nutrients up from deeper waters (USGCRP 2014-TN3472). In turn, warming and altered ocean circulation can reduce the supply of oxygen to deeper waters, which can impact biodiversity and change biological productivity. Warming sea temperatures may influence the abundance and distribution of species, as well as result in earlier spawning times. Species may migrate or shift their ranges northward to cooler waters in response to habitat loss from warming waters (Phillips et al. 2018-TN10290). Asch (2015-TN10633) determined that the spawning period for some species of coastal California fish has occurred earlier in the season, likely due to warmer surface water temperatures in early spring. A marine heatwave occurred along the U.S. west coast from 2014 to 2016, resulting in the region's highest 3-year average ocean temperature and the northward shift of crabs and subtropical fish into the coastal waters, resulting in cool-water habitats compressed along the coastal waters of California (Phillips et al. 2018-TN10290 and USGCRP 2023-TN9762). Rising water temperatures have also been linked to the transport of disease outbreaks affecting corals, algae, black abalone, and eelgrass

(USGCRP 2014-TN3472). Under the RCP 8.5 scenario, the California coastal ocean temperature is projected to increase by an additional 0.9–2.7°F (0.5–1.5°C) by 2040 (Langridge 2018-TN9854). PG&E's adherence to permit requirements, such as temperature-related criteria established in the NPDES permit, and applicable regulations would minimize the impacts of the continued operation of Diablo Canyon such that continued operations during the LR period would not further exacerbate climate change-related impacts on the aquatic environment.

3.16 Cumulative Effects of the Proposed Agency Action

Actions considered in the cumulative effects analysis include the incremental effects of the proposed action (Diablo Canyon LR) when added to the environmental effects of other past, present, and reasonably foreseeable future actions. The analysis considers all actions including minor ones, because the effects of individually minor actions may be significant when considered collectively over a period of time. The goal of the cumulative effects analysis is to identify potentially significant environmental impacts. The environmental effects of the proposed LR action when combined with the effects of other actions could result in a cumulative effect.

The cumulative effects analysis only considers resources and environmental conditions that could be affected by the proposed LR action, including the effects of continued reactor operations during the LR term and any refurbishment activities at a nuclear power plant. For there to be a cumulative effect, the proposed action (i.e., Diablo Canyon LR) must have an incremental new, additive, or increased physical effect on the resource or environmental condition beyond what is already occurring.

For the purposes of analysis, past and present actions include all actions that have occurred since the commencement of reactor operations up to the submittal of the LR application. Older actions are accounted for in baseline assessments presented in the affected environment discussions in Sections 3.2 through 3.13. The time frame for the consideration of reasonably foreseeable future actions is the LR term. Reasonably foreseeable future actions include current and ongoing planned activities at Diablo Canyon through the end of the LR period.

The incremental effects of the proposed action (Diablo Canyon LR) when added to the effects from past, present, and reasonably foreseeable future actions and other actions result in the overall cumulative effect. A qualitative cumulative effects analysis is conducted in instances where the incremental effects of the proposed action and past, present, and reasonably foreseeable future actions are uncertain or not well known.

Information from PG&E's ER; responses to requests for additional information; information from other Federal, State, and local agencies; scoping comments; and information gathered during the environmental site audit at Diablo Canyon were used to identify past, present, and reasonably foreseeable future actions in the cumulative effects analysis.

Potential projects at Diablo Canyon include ISFSI modifications to accommodate a new spent fuel storage system, although there remains enough storage in the existing ISFSI and spent fuel pools to accommodate spent fuel generated during the LR period.

Potential projects near Diablo Canyon include:

- roadway safety and enhancement projects
- water and wastewater management projects in San Luis Obispo County

- offshore wind development projects off of the California coast, 41 mi (66 km) northwest of Diablo Canyon

The following sections discuss the cumulative effects on the environment near Diablo Canyon when the incremental effects of the proposed action of Diablo Canyon LR are compounded by the environmental effects from past, present, and reasonably foreseeable future actions. For the most part, environmental conditions near Diablo Canyon are not expected to change appreciably during the LR term beyond what is already being experienced. Consequently, no cumulative impacts analysis was performed for the following resource areas: land use, visual resources, noise, geologic environment, terrestrial resources, aquatic resources, federally protected ecological resources, and historic and cultural resources.

3.16.1 Air Quality

The region of influence that the NRC staff considered in the cumulative air quality analysis consists of San Luis Obispo County because air quality designations in California are made at the county level. PG&E has not proposed any refurbishment activities during the LR term. As a result, the NRC staff expects that air emissions and sources from the nuclear power plant during the LR term would be similar to those presented in Section 3.3 of this SEIS. Consequently, cumulative impacts to air quality in San Luis Obispo County would be the result of future projects and actions that change present-day emissions within the county. Roadway safety and enhancement projects could increase emissions during their respective construction periods, but those air emissions would be temporary and localized. Similarly, construction of offshore wind development projects would result in air emissions, but they would be temporary and localized. Air emission associated with the operation of wind development projects would be negligible because no fossil fuels would be directly burned to generate electricity. However, there would be emissions associated with the use of diesel generators supporting meteorological data collection facilities and engine exhaust of vessel traffic traveling to and from offshore sites for operation and maintenance activities.

3.16.2 Water Resources

3.16.2.1 Surface Water Resources

The description of the affected environment in Section 3.5.1 of this SEIS serves as the baseline for the cumulative impacts assessment for surface water resources. As described in Section 3.5.3.1, the incremental impacts on surface water resources from the continued operation of Diablo Canyon during the LR term would be SMALL.

Diablo Canyon operates from a relatively remote coastline location. There are no municipalities within the 6 mi (10 km) vicinity of the plant. The nearest community is Los Osos, located approximately 7 mi (11 km) north, which had a population of 16,174 in 2020. The community of Avila Beach is located approximately 8 mi (13 km) southeast of Diablo Canyon and in 2020 reported a population of 1,455 persons (USCB 2024-TN10250). Diablo Canyon withdraws saltwater exclusively from the Pacific Ocean for operational purposes. Once-through cooling water and other permitted effluent streams are discharged back to the Pacific via a shoreline discharge structure located on Diablo Cove. As such, this cumulative impact review focuses on those nearby projects and activities that would withdraw water from, or discharge effluents to the Pacific Ocean. Although power plants using once-through cooling have a large water withdrawal rate, almost all the water they withdraw is returned to the water source. Consequently, as stated in the LR GEIS (NRC 2024-TN10161), surface water use conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems. The nearest facility with a seawater intake is the Moss Landing natural gas power plant, which is located approximately 150 mi (241 km) north of Diablo Canyon (PG&E 2024-TN10032).

A substantial regulatory framework exists to address current and potential future sources of Pacific Ocean water quality degradation in the vicinity of Diablo Canyon. Ongoing cooling water, process effluents, and stormwater discharges from Diablo Canyon are subject to a CCRWQCB-issued NPDES permit (see Section 3.5.1.3 of this SEIS). Diablo Canyon discharges would continue to be subject to NPDES permit requirements during the LR term. These would be modified by the CCRWQCB, as necessary, with water quality-based effluent limits in accordance with the Federal CWA. Stormwater discharges from the Diablo Canyon site are also regulated in accordance with the State NPDES General Industrial Permit (i.e., General Permit to Discharge Storm Water Associated with Industrial Activity).

In addition to the NPDES permit discharge volume limits, PG&E complies with the interim mitigation requirements in Section 2.C(3)(b) of California's OTC Policy. PG&E demonstrates compliance with the interim mitigation requirement by providing funding to the Ocean Protection Council or State Coastal Conservancy to fund appropriate mitigation projects. Annual interim mitigation fee payment amounts are calculated in part based on Diablo Canyon monthly once-through cooling water intake volume data (PG&E 2024-TN10032). As discussed in Section 3.5.1.3 of this SEIS, the water quality of several water bodies near Diablo Canyon are impaired; however, Diablo Canyon operations do not contribute to these impairments. Moreover, PG&E has no planned refurbishment activities for the period of extended operation.

Therefore, based on an assessment of the hydrologic setting, compliance with applicable water use and water quality permitting and associated permit conditions, and adherence to BMPs, the proposed action would have no cumulative effect on the quality and use of surface water resources beyond what is already being experienced.

3.16.2.2 Groundwater Resources

The description of the affected environment in Section 3.5.2 is used as the basis for the cumulative impacts assessment for groundwater resources. Current groundwater use at Diablo Canyon does not affect groundwater flow paths in the power block area, which are generally toward the coast with groundwater discharge occurring into Diablo Cove. Groundwater withdrawals for operations during the proposed LR term are not anticipated to increase from the current low rates. In addition, Diablo Canyon groundwater use is isolated from the areas of major groundwater use in San Luis Obispo County, and the proposed and projected future projects listed above would not have significant effects on groundwater in the Diablo Canyon vicinity. Diablo Canyon will continue to implement its groundwater protection program and spill prevention control plans to reduce groundwater quality impacts. Based on this information, the proposed action would have no cumulative impacts beyond those identified in Section 3.5.3.2.

3.16.3 Socioeconomics

As discussed in Section 3.10.7, the continued operation of Diablo Canyon during the LR term would have no impact on socioeconomic conditions in the region beyond what is already being experienced. PG&E has no planned activities at Diablo Canyon beyond continued reactor operations and maintenance. Because PG&E has no plans to hire additional workers during the LR term, overall expenditures and employment levels at Diablo Canyon would remain unchanged and there would be no new or increased demand for housing and public services.

Therefore, the only contributory effects would come from reasonably foreseeable future planned operational activities at Diablo Canyon and other planned offsite activities, unrelated to the proposed action. When combined with past, present, and reasonably foreseeable future activities, the proposed action would have no new or increased effect beyond what is currently being experienced.

3.16.4 Human Health

The NRC and the EPA have established radiological dose limits to protect the public and workers from both acute and long-term exposure to radiation and radioactive materials. These dose limits are specified in 10 CFR Part 20 (TN283) and 40 CFR Part 190 (TN739), "Environmental Radiation Protection Standards for Nuclear Power Operations." As discussed in Section 3.11.6 of this SEIS, the impacts on human health from continued plant operations during the LR term would be SMALL.

For the purposes of this cumulative impacts analysis, the geographical area considered is the area within a 50 mi (80 km) radius of Diablo Canyon. There are no other operational nuclear power plants within this 50 mi (80 km) radius. As discussed in Section 3.13.1 of this SEIS, PG&E stores spent nuclear fuel from Diablo Canyon in a storage pool and in an onsite ISFSI.

The EPA regulations at 40 CFR Part 190 (TN739) limit the dose to members of the public from all sources in the nuclear fuel cycle, including nuclear power plants, fuel fabrication facilities, waste disposal facilities, and transportation of fuel and waste. As discussed in Section 3.13.1, Diablo Canyon has a REMP that measures radiation and radioactive materials in the environment from Diablo Canyon operations, its ISFSI, and all other sources. The NRC staff reviewed the radiological environmental monitoring results for the 5-year period from 2019 through 2023 as part of this cumulative impacts assessment (PG&E 2020-TN10065, 2021-TN10066, 2022-TN10067, 2023-TN10068, and 2024-TN10069). The review of Diablo Canyon's data showed no indication of an adverse trend in radioactivity levels in the environment from either Diablo Canyon or the ISFSI. The data showed that there was no measurable impact on the environment from operations at Diablo Canyon.

In summary, the NRC staff concludes that there would be no cumulative effect on human health resulting from the proposed action of Diablo Canyon LR beyond what is already being experienced, in combination with the cumulative effects from other sources. The NRC staff bases this conclusion on its review of REMP data, radioactive effluent release data, and worker dose data; the expectation that Diablo Canyon would continue to comply with Federal radiation protection standards during the LR period; and the continued regulation of any future development or actions in the vicinity of the Diablo Canyon site by the NRC and the State of California, as appropriate.

3.16.5 Reserved

This SEIS does not address this issue. See Section 3.12 of this SEIS for more information.

3.16.6 Waste Management and Pollution Prevention

This section of the SEIS considers the incremental waste management impacts of the proposed Diablo Canyon LR term when added to the contributory effects of other past, present, and reasonably foreseeable future actions. In Section 3.13.3, the potential waste management impacts from continued operations at Diablo Canyon during the LR term was determined to be SMALL.

As discussed in Sections 3.13.1 and 3.13.2 of this SEIS, PG&E maintains waste management programs for radioactive and nonradioactive waste generated at Diablo Canyon and is required to comply with Federal and State permits and other regulatory waste management requirements. All industrial facilities, including nuclear power plants and other facilities within a 50 mi (80 km) radius of Diablo Canyon, are also required to comply with appropriate NRC, EPA, and State requirements for the management of radioactive and nonradioactive waste. Current waste management activities at Diablo Canyon would likely remain unchanged during the LR term. Furthermore, the NRC staff expects that Diablo Canyon would continue to comply with Federal and State requirements for radioactive and nonradioactive waste.

Therefore, the proposed action, including continued radioactive and nonradioactive waste generation during the LR term, would have no cumulative effect beyond what is already being experienced. This is based on Diablo Canyon's expected continued compliance with Federal and State of California requirements for radioactive and nonradioactive waste management, as applicable, and the expected regulatory compliance of other waste producers in the area.

3.17 Resource Commitments Associated with the Proposed Action

This section of the SEIS describes the NRC's consideration of potentially unavoidable adverse environmental impacts that could result from implementation of the proposed action and alternatives, the relationship between short-term use of the environment and the maintenance and enhancement of long-term productivity, and the irreversible and irretrievable commitment of resources.

3.17.1 Unavoidable Adverse Environmental Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all workable mitigation measures. Carrying out any of the replacement power alternatives considered in this SEIS, including the proposed action, would result in some unavoidable adverse environmental impacts.

Minor unavoidable adverse impacts on air quality would occur due to emission and release of various chemical and radiological constituents from power plant operations. Nonradiological emissions resulting from power plant operations are expected to comply with Federal EPA and State emissions standards. Chemical and radiological emissions would not exceed the national emission standards for hazardous air pollutants.

During nuclear power plant operations, workers and members of the public would face unavoidable exposure to low levels of radiation as well as hazardous and toxic chemicals. Workers would be exposed to radiation and chemicals associated with routine plant operations and the handling of nuclear fuel and waste material. Workers would have higher levels of exposure than members of the public, but doses would be administratively controlled and would not exceed regulatory standards or administrative control limits. In comparison, the alternatives involving the construction and operation of a nonnuclear power-generating facility would also result in unavoidable exposure to hazardous and toxic chemicals, for workers and the public.

The generation of spent nuclear fuel and waste material, including low-level radioactive waste, hazardous waste, and nonhazardous waste, would be unavoidable. Hazardous and nonhazardous wastes would be generated at some nonnuclear power-generating facilities. Wastes generated during plant operations would be collected, stored, and shipped for suitable treatment, recycling, or disposal in accordance with applicable Federal and State regulations.

Due to the costs of handling these materials, the NRC staff expects that power plant operators would optimize all waste management activities and operations in a way that generates the smallest possible amount of waste.

3.17.2 Relationship between Short-Term Use of the Environment and Long-Term Productivity

The operation of power-generating facilities would result in short-term uses of the environment, as described in Sections 3.2 through 3.13 of this SEIS (see sections titled, "Proposed Action," "No Action," and "Replacement Power Alternatives: Common Impacts"). Short term is the period of time that continued power-generating activities take place.

Power plant operations require short-term use of the environment and commitment of resources (e.g., land and energy) indefinitely or permanently. Certain short-term resource commitments are substantially greater under most energy alternatives, including LR, than under the no-action alternative because of the continued generation of electrical power and the continued use of generating sites and associated infrastructure. During operations, all energy alternatives entail similar relationships between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

Air emissions from nuclear power plant operations introduce small amounts of radiological and nonradiological emissions to the region around the plant site. Over time, these emissions would result in increased concentrations and exposure, but the NRC staff does not expect that these emissions would affect air quality or radiation exposure to the extent that they would impair public health and long-term productivity of the environment.

Continued employment, expenditures, and tax revenues generated during power plant operations directly benefit local, regional, and State economies over the short term. Local governments investing project-generated tax revenues into infrastructure and other required services could enhance economic productivity over the long term.

The management and disposal of spent nuclear fuel, low-level radioactive waste, hazardous waste, and nonhazardous waste require an increase in energy and consume space at treatment, storage, or disposal facilities. Regardless of the location, the use of land to meet waste disposal needs would reduce the long-term productivity of the land.

Power plant facilities are committed to electricity production over the short term. After decommissioning these facilities and restoring the area, the land could be available for other future productive uses.

3.17.3 Irreversible and Irretrievable Commitment of Resources

Resource commitments are irreversible when primary or secondary impacts limit the future options for use of a resource. For example, the consumption or loss of nonrenewable resources is irreversible. An irretrievable commitment refers to the use or consumption of resources for a period of time (e.g., for the duration of the action under consideration) that are neither renewable nor recoverable for future use. Irreversible and irretrievable commitments of resources for electrical power generation include the commitment of land, water, energy, raw materials, and other natural and human-made resources required for power plant operations. In general, the commitments of capital, energy, labor, and material resources are also irreversible.

The implementation of any of the replacement power alternatives considered in this SEIS would entail the irreversible and irretrievable commitments of energy, water, chemicals, and—in some cases—fossil fuels. These resources would be committed during the LR term and over the entire life cycle of the power plant, and they would be unrecoverable.

Energy expended would be in the form of fuel for equipment, vehicles, and power plant operations and electricity for equipment and facility operations. Electricity and fuel would be purchased from offsite commercial sources. Water would be obtained from existing water supply systems or withdrawn from surface water or groundwater. These resources are readily available, and the NRC staff does not expect that the amounts required would deplete available supplies or exceed available system capacities.

4 CONCLUSION

4.1 Environmental Impacts of License Renewal

This SEIS contains the environmental review of the application for renewed operating licenses for Diablo Canyon. After reviewing the site-specific (Category 2) environmental issues in this SEIS, the NRC staff concluded that issuing renewed licenses for Diablo Canyon would have SMALL impacts for the Category 2 issues applicable to the LR at Diablo Canyon. The NRC staff considered mitigation measures for each Category 2 issue, as applicable. The NRC staff concluded that no additional mitigation measure is warranted.

4.2 Comparison of Alternatives

In Chapter 3 of this SEIS, the NRC staff considered the following alternatives to issuing renewed operating licenses for Diablo Canyon:

- no-action alternative
- purchased power alternative
- renewables combination alternative

Based on the review presented in this SEIS, the NRC staff concludes that the environmentally preferred alternative is the proposed action. The NRC staff recommends that renewed Diablo Canyon operating licenses be issued. As shown in Table 2-1, all replacement power alternatives have impacts in more than one resource area that are greater than LR, in addition to the environmental impacts inherent to new construction projects. To make up the lost power generation if the NRC does not issue renewed licenses for Diablo Canyon (i.e., the no-action alternative), energy decision-makers may implement one of the replacement power alternatives discussed in Chapter 3, or a comparable alternative capable of replacing the power generated by Diablo Canyon.

4.3 Recommendation

The NRC staff's recommendation is that the adverse environmental impacts of LR for Diablo Canyon are not so great that preserving the option of LR for energy-planning decision-makers would be unreasonable. This recommendation is based on:

- the analysis and findings in the LR GEIS
- the applicant's ER
- the NRC staff's consultation with Federal, State, Tribal, and local agencies
- the NRC staff's independent environmental review
- the NRC staff's consideration of public comments received during the scoping process and on the draft SEIS

5 REFERENCES

10 CFR Part 2. *Code of Federal Regulations*, Title 10, *Energy*, Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders." TN6204.

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." TN283.

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities." TN249.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." TN10253.

10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." TN4878.

10 CFR Part 72. *Code of Federal Regulations*, Title 10, *Energy*, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste." TN4884.

10 CFR Part 73. *Code of Federal Regulations*, Title 10, *Energy*, Part 73, "Physical Protection of Plants and Materials." TN423.

10 CFR Part 100. *Code of Federal Regulations*, Title 10, *Energy*, Part 100, "Reactor Site Criteria." TN282.

15 CFR Part 930. *Code of Federal Regulations*, Title 15, *Commerce and Foreign Trade*, Part 930, "Federal Consistency with Approved Coastal Management Programs." TN4475.

36 CFR Part 60. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 60, "National Register of Historic Places." TN1682.

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties." TN513.

40 CFR Part 50. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards." TN1089.

40 CFR Part 51. Code of Federal Regulations, Title 40, Protection of Environment, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans." TN1090.

40 CFR Part 81. *Code of Federal Regulations*, Title 40, *Air Programs*, Subchapter C, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes." TN7226.

40 CFR Part 110. *Code of Federal Regulations*, Title 40, Protection of Environment, Part 110, "Discharge of Oil." TN8485.

40 CFR Part 112. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 112, "Oil Pollution Prevention." TN1041.

40 CFR Part 122. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 122, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System." TN2769.

40 CFR Part 125. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 125, "Criteria and Standards for the National Pollutant Discharge Elimination System." TN254.

40 CFR Part 131. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 131, "Water Quality Standards." TN4814.

40 CFR Part 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations." TN739.

43 CFR Part 10. *Code of Federal Regulation*s, Title 43, *Public Lands: Interior*, Part 10, "Native American Graves Protection and Repatriation Regulations." TN4845.

49 CFR Parts 171-178. *Code of Federal Regulations*, Title 49, *Transportation*, Subchapter C, "Hazardous Materials Regulations (49 CFR Parts 171-178)." TN10307.

50 CFR Part 402. *Code of Federal Regulations,* Title 50, *Wildlife and Fisheries*, Part 402, "Interagency Cooperation—Endangered Species Act of 1973, as amended." TN4312.

50 CFR Part 600. *Code of Federal Regulations*. Title 50, *Wildlife and Fisheries*, Part 600, "Magnuson-Stevens Act Provisions." TN1342.

41 FR 24378. June 16, 1976. "Sea Turtles, Proposed Regulations Treating 3 Species as Threatened Under the "Similarity of Appearance" Clause." *Federal Register*, U.S. Fish and Wildlife Service, National Marine Fisheries Service. TN10616.

42 FR 2965. January 14, 1977. "Endangered and Threatened Wildlife and Plants; Determination that the Southern Sea Otter is a Threatened Species." *Federal Register,* U.S. Fish and Wildlife Service, Department of the Interior. Washington, D.C. TN10111.

43 FR 32800. July 28, 1978. "Listing and Protecting Loggerhead Sea Turtles as 'Threatened Species' and Populations of Green and Olive Ridley Sea Turtles as Threatened Species or 'Endangered Species.'" *Federal Register,* U.S. Fish and Wildlife Service. TN2753.

58 FR 3121. January 7, 1993. "Endangered Fish and Wildlife; Gray Whale." Notice of determination; *Federal Register*, National Marine Fisheries Service (NMFS), NOAA, Commerce. TN10615.

59 FR 7629. February 16, 1994. "Executive Order 12898 of February 11, 1994: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations." *Federal Register*, Office of the President. TN1450.

59 FR 31094. June 16, 1994. "Endangered and Threatened Wildlife and Plants; Final Rule to Remove the Eastern North Pacific Population of the Gray Whale From the List of Endangered Wildlife." Final Rule, *Federal Register*, Fish and Wildlife Service, Interior, and National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10257.

61 FR 25813. May 23, 1996. "Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the California Red-Legged Frog." *Federal Register*, Fish and Wildlife Service, Interior. TN10107.

61 FR 28467. June 5, 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register*, Nuclear Regulatory Commission. TN4491.

64 FR 6183. February 8, 1999. "Executive Order 13112 of February 3, 1999: Invasive Species." *Federal Register*, Office of the President. TN4477.

66 FR 14626. March 13, 2001. "Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the California Redlegged Frog." *Federal Register*, Fish and Wildlife Service, Interior. TN10108.

69 FR 52040. August 24, 2004. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register*, Nuclear Regulatory Commission. TN1009.

70 FR 39104. July 6, 2005. "Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations." *Federal Register*, Environmental Protection Agency. TN8374.

73 FR 46204. August 8, 2008. "The Attorney General of Commonwealth of Massachusetts, The Attorney General of California; Denial of Petitions for Rulemaking." Petition for Rulemaking; denial, *Federal Register*, Nuclear Regulatory Agency (NRC). TN10289.

74 FR 1937. January 14, 2009. "Endangered and Threatened Wildlife and Plants; Endangered Status for Black Abalone." Final Rule, *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10259.

74 FR 13926. March 27, 2009. "Power Reactor Security Requirements." Final Rule, *Federal Register*, Nuclear Regulatory Commission. TN6300.

76 FR 58868. September 22, 2011. "Endangered and Threatened Species; Determination of Nine Distinct Population Segments of Loggerhead Sea Turtles as Endangered or Threatened." Final Rule; *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce; United States Fish and Wildlife Service (USFWS), Interior. TN10617.

76 FR 66806. October 27, 2011. "Endangered and Threated Wildlife and Plants: Final Rulemaking to Designate Critical Habitat for Black Abalone." Final Rule, *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10261.

78 FR 66140. November 4, 2013. "Endangered and Threatened Species; Delisting of the Eastern Distinct Population Segment of Steller Sea Lion Under the Endangered Species Act; Amendment to Special Protection Measures for Endangered Marine Mammals." Final rule; *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10609.

79 FR 48300. August 15, 2014. "National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities." *Federal Register*, Environmental Protection Agency. TN4488.

80 FR 22304. April 21, 2015. "Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*) and Proposed Revision of Species-Wide Listing." Proposed Rule; 12-month findings, *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10265.

81 FR 20058. 2016. "Endangered and Threatened Wildlife and Plants; Final Rule to List Eleven Distinct Population Segments of the Green Sea Turtle (Chelonia mydas) as Endangered or Threatened and Revision of Current Listings Under the Endangered Species Act." Final Rule, *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce; United States Fish and Wildlife Service (USFWS), Interior. TN10270.

81 FR 62260. September 8, 2016. "Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (Megaptera novaeangliae) and Revision of Species-Wide Listing." Final Rule, *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10263.

81 FR 88609. December 8, 2016. "Safeguarding the Nation from the Impacts of Invasive Species." Executive Order 13751. *Federal Register*, Office of the President. TN8375.

86 FR 21082. April 21, 2021. "Endangered and Threatened Wildlife and Plants: Designating Critical Habitat for the Central America, Mexico, and Western North Pacific Distinct Population Segments of Humpback Whales." Final Rule, *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10264.

88 FR 14395. Wednesday, March 8, 2023. "Pacific Gas and Electric Company; Diablo Canyon Power Plant, Units 1 and 2." *Federal Register*, U.S. Nuclear Regulatory Commission. TN9998.

88 FR 16212. March 16, 2023. "Proposed Rule to List the Sunflower Sea Star as Threatened Under the Endangered Species Act." Proposed rule; request for comments; *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10612.

88 FR 64870. September 20, 2023. "Endangered and Threatened Wildlife and Plants; One Species Not Warranted for Delisting and Six Species Not Warranted for Listing as Endangered or Threatened Species." *Federal Register,* Fish and Wildlife Service, Interior. TN10112.

88 FR 87817. Tuesday, December 10, 2023. "License Renewal Application; Pacific Gas and Electric Company; Diablo Canyon Nuclear Power Plant, Units 1 and 2." *Federal Register*, U.S. Nuclear Regulatory Commission. TN9999.

89 FR 4631. Wednesday, January 24, 2024. “Notice of Intent to Conduct Scoping Process and Prepare Environmental Impact Statement; Pacific Gas and Electric Company; Diablo Canyon Nuclear Power Plant, Units 1 and 2.” *Federal Register*, U.S. Nuclear Regulatory Commission. TN10001.

89 FR 64166. August 6, 2024. “Renewing Nuclear Power Plant Operating Licenses - Environmental Review.” Final rule and guidance; issuance, *Federal Register*, Nuclear Regulatory Commission. TN10321.

89 FR 83554. October 16, 2024. “15 CFR Part 922, Chumash Heritage National Marine Sanctuary.” Final Rule Federal Register, National Oceanic and Atmospheric Administration, Commerce. TN11892.

89 FR 95101. December 2, 2024. “15 CFR Part 922, Chumash Heritage National Marine Sanctuary.” Notification of effective date of final rule. Federal Register, National Oceanic and Atmospheric Administration, Commerce. TN11891.

90 FR 17887. April 30, 2025. “Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions; Environmental Justice Strategy.” *Federal Register*, Nuclear Regulatory Commission. TN11684.

90 FR 3412. January 14, 2025. “Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Four Distinct Population Segments of the Foothill Yellow-Legged Frog.” *Federal Register*, Fish and Wildlife Service, Interior. TN11889.

90 FR 8633. January 31, 2025. “Executive Order 14173 of January 21, 2025, Ending Illegal Discrimination and Restoring Merit-Based Opportunity.” Federal Register, Presidential Documents. TN11607.

16 U.S.C. § 1801 et seq. Conservation, Chapter 38, “Fishery Conservation and Management.” TN9966.

54 U.S.C. § 306108. National Historic Preservation Act Section 106, “Effect of Undertaking on Historic Property.” TN4839.

AEC (U.S. Atomic Energy Commission). 1973. *Final Environmental Statement Related to the Nuclear Generating Station Diablo Canyon Units 1 & 2*. May. Washington, D.C. ADAMS Accession No. ML15043A481. TN7277.

Allison, T.D., J.E. Diffendorfer, E.F. Baerwald, J.A. Beston, D. Drake, A.M. Hale, C.D. Hein, M.M. Huso, S.R. Loss, J.E. Lovich, M.D. Strickland, K.A. Williams, and V.L. Winder. 2019. “Impacts to Wildlife of Wind Energy Siting and Operation in the United States.” Ecological Society of America, *Issues in Ecology*, Report No. 21, Washington, D.C. TN8847.

Asch, R.G. 2015. “Climate change and decadal shifts in the phenology of larval fishes in the California Current ecosystem.” *Proceedings of the National Academy of Sciences of the United States of America*, NAS E4065-E4074, Washington, D.C. TN10633.

Atomic Energy Act of 1954. 42 U.S.C. § 2011 et seq. Public Law 112-239, as amended. TN663.

Bald and Golden Eagle Protection Act. 16 U.S.C. § 668-668d et seq. TN1447.

Bechtel (Bechtel Power Corporation). 2012. *Independent Third-Party Interim Technical Assessment for the Alternative Cooling Technologies or Modifications to the Existing Once-Through Cooling System for Diablo Canyon Power Plant*. Report No. 25762-000-30R-G01G-00009, Revision 2, Reston, Virginia. TN10115.

Bechtel (Bechtel Power Corporation). 2014. *Independent Third-Party Final Technologies Assessment for the Alternative Cooling Technologies or Modifications to the Existing Once-Through Cooling System for Diablo Canyon Power Plant*. Report No. 25762-000-30H-G01G-00001, Reston, Virginia. TN10116.

Bedsworth, L., D. Cayan, G. Franco, L. Fisher, and S. Ziaja. 2018. *California's Fourth Climate Change Assessment, Statewide Summary Report*. SUM-CCCA4-2018-013, Sacramento, California. TN10206.

Bender, W. Undated. *The Helms Pumped Storage Project*. Golden West Chapter of the International Society of Explosives Engineers, Sacramento, California. TN10082.

Benech, S.V. 1996. *Observations of the Sea Otter, Enhydra lutris, Population, Between Point Buchon and Rattlesnake Creek, San Luis Obispo, California, January through December 1995*. Ventura, California. ADAMS Accession No. ML11166A128. TN10305.

BLM (Bureau of Land Management). 2010. *North Steens 230-kV Transmission Line Project Draft Environmental Impact Statement*. DOI-BLM-OR-B060-2010-0035-EIS, Bureau of Land Management, Hines, Oregon. TN9626.

BLM (Bureau of Land Management). 2013. *Final Environmental Impact Statement for the Mohave County Wind Farm Project (Volume 1)*. BLM/AZ/PL-13/003, Washington, D.C. TN8882.

BLM (Bureau of Land Management). 2019. *Gemini Solar Project, Final Resource Management Plan Amendment and Environmental Impact Statement, Volume 1: Chapters 1 – 4.* DOI-BLM-NV-S010-2018-0051-EIS, Washington D.C. TN8386.

BLM/USFS (Bureau of Land Management and U.S. Forest Service). 2008. *Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States*. FES 08-44, Washington, D.C. Accessed May 31, 2022, at https://www.blm.gov/sites/blm.gov/files/Geothermal_PEIS_final.pdf. TN7469.

BOEM (Bureau of Ocean Energy Management). Undated. "Renewable Energy on the Outer Continental Shelf: Ocean Wave Energy." Washington, D.C. Accessed June 12, 2022, at https://www.boem.gov/Renewable-Energy-Program/Renewable-Energy-Guide/Ocean-Wave-Energy.aspx. TN7696.

CA Health and Safety Code § 40000. Division 26, *Air Resources*, Part 3, *Air Pollution Control Districts*, Chapter 1, *General Provisions*, Section 40000. *California Code of Regulations*, Sacramento, California. TN10300.

CA Health and Safety Code § 40919. Division 26, *Air Resources*, Part 3, *Air Pollution Control Districts*, Chapter 10, *District Plans to Attain State Ambient Air Quality Standards*, Section 40919. *California Code of Regulations*, Sacramento, California. TN10194.

CA Health and Safety Code § 41650. Division 26, *Air Resources*, Part 4, *Nonvehicular Air Pollution Control*, Chapter 2.5, *Nonattainment Area Plans*, Section 41650. *California Code of Regulations*, Sacramento, California. TN10299.

CA Health and Safety Code § 46000. Division 28, *Noise Control Act*, Chapter 1, *Findings, Declarations, and Intent*, Section 46000. *California Code of Regulations*, Sacramento, California. TN10301.

CA Health and Safety Code § 40920.5. Division 26, *Air Resources*, Part 3, *Air Pollution Control Districts*, Chapter 10, *District Plans to Attain State Ambient Air Quality Standards*, Section 40920.5. *California Code of Regulations*, Sacramento, California. TN10195.

CA Public Resources Code § 25524.1. Division 15, *Energy Conservation and Development*, Chapter 6, *Power Facility and Site Certification*, Section 25524.1. *California Code of Regulations*, Sacramento, California. TN10004.

CA Utilities Code 454.53. Division 1, *Regulation of Public Utilities*, Part 1, *Public Utilities Act*, Chapter 3, *Rights and Obligations of Public Utilities*, Article 1, *Rates*, Section 454.53. *California Code of Regulations*, Sacramento, California. TN9910.

CAL OES (California Governor's Office of Emergency Services). 2014. *California Hazardous Materials Spill / Release Notification Guidance*. Sacramento, California. TN10201.

California Sea Level Rise Guidance. 2024. Draft: State of California Sea Level Rise Guidance: 2024 Science and Policy Update. California Sea Level Rise Science Task Force, California Ocean Protection Council, and California Ocean Science Trust, Sacramento, California. TN10292.

CARB (California Air Resources Board). 2022. "CARB Approves Unprecedented Climate Action Plan to Shift World's 4th Largest Economy from Fossil Fuels to Clean and Renewable Energy." Sacramento, California. Accessed March 25, 2024, at https://ww2.arb.ca.gov/news/carb-approves-unprecedented-climate-action-plan-shift-worlds-4th-largest-economy-fossil-fuels. TN9829.

CARB (California Air Resources Board). 2024. "California Ambient Air Quality Standards." Sacramento, California. Accessed July 2, 2024, at https://ww2.arb.ca.gov/resources/california-ambient-air-quality-standards. TN10156.

CARB (California Air Resources Board). 2024. "Maps of State and Federal Area Designations." Sacramento, California. Accessed July 8, 2024, at https://ww2.arb.ca.gov/resources/documents/maps-state-and-federal-area-designations. TN10173.

Carlson, J. 2019. *Memorandum of Understanding on the Conservation of Migratory Sharks, Fact Sheet, Thresher Shark*. Shark MOU Advisory Committee, NOAA Fisheries Service-Southeast Fisheries Science Center Panama City, Florida. TN10275.

California Historical Resources Information System (CHRIS), Central Coast Information Center (CCIC). 2024. Records search request for the Diablo Canyon License Renewal. San Luis Obispo, California. Records results restricted to professional archaeologists. TN10282.

CDFW (California Department of Fish and Wildlife). 2024. "MFDE: California Commercial Landings." Marine Region (Region 7), Monterey, California. Accessed June 25, 2024, at https://wildlife.ca.gov/Conservation/Marine/Data-Management-Research/MFDE/Commercial-Landings. TN10106.

CDFW (California Department of Fish and Wildlife). 2024. "MWVCRC - Sea Otter Surveys." Sacramento, California. Accessed July 23, 2024, at https://wildlife.ca.gov/OSPR/Science/MWVCRC/Sea-Otter-Surveys. TN10256.

CDOT (Colorado Department of Transportation). 2024. "Noise FAQs." Denver, Colorado. Accessed July 8, 2024, at https://www.codot.gov/programs/environmental/noise/noise-faqs. TN10180.

CDWR (California Department of Water Resources). 2024. "Sustainable Groundwater Management Act (SGMA) Data Viewer." Sacramento, California. Accessed on June 24, 2024, at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#currentconditions. TN10092.

CEC (California Energy Commission). 2022. "CEC Adopts Historic California Offshore Wind Goals, Enough to Power Upwards of 25 Million Homes." Sacramento, California. Accessed March 23, 2024, at https://www.energy.ca.gov/news/2022-08/cec-adopts-historic-california-offshore-wind-goals-enough-power-upwards-25. TN9825.

CEC (California Energy Commission). 2023. *Draft Senate Bill 846 Diablo Canyon Power Plant Extension Cost Comparison*. CEC-200-2023-013-SD, Sacramento, California. TN10081.

CEC (California Energy Commission). 2024. "2022 Total System Electric Generation." Sacramento, California. Accessed July 8, 2024, at https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2022-total-system-electric-generation. TN10175.

CEC (California Energy Commission). 2021. *2021 SB 100 Joint Agency Report, Achieving 100 Percent Clean Electricity in California: An Initial Assessment*. CEC-200-2021-001, Sacramento, California. TN10203.

Clean Air Act. 42 U.S.C. § 7401 et seq. TN1141.

CNDDB (California Natural Diversity Database). 2024. *Special Animals List*. California Department of Fish and Wildlife, Sacramento, California. TN10102.

CNPS (California Native Plant Society). Undated. "California Rare Plant Ranks." Sacramento, California. Accessed on June 25, 2024, at https://www.cnps.org/rare-plants/california-rare-plant-ranks. TN10100.

CNRA (California Natural Resources Agency). 2023. "California's Groundwater Update 2020 (Bulletin 118)." Sacramento, California. Accessed July 1, 2024, at https://data.cnra.ca.gov/dataset/calgw_update2020. TN10089.

Coastal Zone Management Act of 1972. 16 U.S.C. § 1451 *et seq*. TN1243.

CSWRCB (California State Water Resources Control Board). 2011. *Water Quality Control Plan for the Central Coastal Basin*. Sacramento, California. TN10118.

CSWRCB (California State Water Resources Control Board). 2019. *Water Quality Control Plan Ocean Waters of California*. Sacramento, California. TN11950.

CSWRCB (California State Water Resources Control Board). 2023. *Resolution No. 2023-0025, Amendment to the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling to Revise Compliance Schedules for Alamitos, Huntington Beach, Ormond Beach, and Scattergood Generating Stations, and Diablo Canyon Nuclear Power Plant*. Sacramento, California. TN10117.

CSWRCB (California State Water Resources Control Board). 2023. *Once-Through Cooling Policy, Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling*. Sacramento, California. TN10114.

CSWRCB (California State Water Resources Control Board). 2024. State Water Resources Control Board Resolution No. 2024-0014, Revisions to the Interim Mitigation Calculation for the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling. University of California- Santa Cruz, California. TN11888.

CSWRCB (California State Water Resources Control Board). 2025. "2024 California Integrated Report." Sacramento, California. Accessed March 17, 2025, at https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/2024-integrated-report.html. TN11952.

Dieter, C.A., K.S Linsey, R.R. Caldwell, M.A. Harris, T.I. Ivahnenko, J.K. Lovelace, M.A. Maupin, and N.L. Barber. 2018. "Estimated Use of Water in the United States County-Level Data for 2015 (Ver. 2.0; June 2018)." Washington, D.C. Accessed January 16, 2024, at https://www.sciencebase.gov/catalog/item/get/5af3311be4b0da30c1b245d8. TN9686.

DOE (U.S. Department of Energy). 2011. *Final Environmental Impact Statement: Volume 1 Department of Energy Loan Guarantee to Royal Bank of Scotland for Construction and Startup of the Topaz Solar Farm, San Luis Obispo County, California.* DOE/EIS-0458, Washington, D.C. TN8387.

DOE (U.S. Department of Energy). 2015. *Wind Vision: A New Era for Wind Power in the United States*. Washington, D.C. TN8757.

DOE (U.S. Department of Energy). 2021. *Hydrogen Shot: An Introduction.* Office of Energy Efficiency and Renewable Energy, Hydrogen and Fuel Cells Technology Office. Washington, D.C. Accessed June 12, 2022, at https://www.energy.gov/eere/fuelcells/articles/hydrogen-shot-introduction. TN7693.

DOE (U.S. Department of Energy). 2021. *Land-Based Wind Market Report: 2021 Edition*. Washington, D.C. Accessed December 12, 2023, at https://www.energy.gov/sites/default/files/2021-08/Land-Based%20Wind%20Market%20Report%202021%20Edition_Full%20Report_FINAL.pdf. TN9562.

DOE (U.S. Department of Energy). 2022. "WINDExchange, Wind Energy in California." Washington, D.C. Accessed March 23, 2024, at https://windexchange.energy.gov/states/ca. TN9824.

DOE (U.S. Department of Energy). 2024. “Geothermal Basics.” Washington, D.C. Accessed April 1, 2024, at https://www.energy.gov/eere/geothermal/geothermal-basics. TN9856.

DOE (U.S. Department of Energy). Undated. “Fuel Cell Basics: Hydrogen and Fuel Cell Technologies Office.” Washington, D.C. Accessed June 12, 2022, at https://www.energy.gov/eere/fuelcells/fuel-cell-basics.TN7695.

DOE (U.S. Department of Energy). Undated. “Types of Hydropower Plants.” Washington, D.C. Accessed June 12, 2022, at https://www.energy.gov/eere/water/types-hydropower-plants. TN7701.

DOE (U.S. Department of Energy). Undated. “Wind Energy State Information.” Washington, D.C. Available at https://windexchange.energy.gov/states. TN8431.

DOE (U.S. Department of Energy). Undated. “WINDExchange, Wind Turbine Sound.” Washington, D.C. Accessed July 8, 2024, at https://windexchange.energy.gov/projects/sound#:~:text=On%20average%2C%20land%2Dbased%2C,to%20a%20home%20or%20building). TN10182.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2013. *Annual Energy Outlook 2013 with Projections to 2040.* DOE/EIA-0383(2013), Washington, D.C. ADAMS Accession No. ML13253A313. TN2590.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2015. *Annual Energy Outlook 2015 with Projections to 2040*. DOE/EIA-0383(2015), Washington, D.C. ADAMS Accession No. ML16172A121. TN4585.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2021. “Table 4.08.B. Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels.” Washington, D.C. Accessed March 27, 2024, at https://www.eia.gov/electricity/annual/html/epa_04_08_b.html. TN9847.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2022. *Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2021*. Washington, D.C. Accessed June 12, 2022, at https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf. TN7694.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2022. “North Carolina State Energy Profile*.”* Washington, D.C. Available at https://www.eia.gov/state/analysis.php?sid=VA. TN8955.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2022. “Utility-scale solar projects report delays, Planned utility-scale solar photovoltaic generating capacity reporting a delay (Jan 2018-Jun 2022).” Washington, D.C. Accessed July 8, 2024, at https://www.eia.gov/todayinenergy/detail.php?id=53400. TN10178.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2023. “California State Energy Profile.” Washington, D.C. Accessed March 25, 2024, at https://www.eia.gov/state/print.php?sid=ca. TN9828.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2023. "State Electricity Profiles, Table 1, 2022 Summary Statistics (California)." Washington, D.C. Accessed on July 8, 2024, at https://www.eia.gov/electricity/state/california/. TN10176.

Duke Energy. 2021. Letter from S.M. Snider, Vice President, Oconee Nuclear Station, to NRC Document Control Desk, dated June 7, 2021, regarding "Duke Energy Carolinas, LLC (Duke Energy) Oconee Nuclear Station (ONS), Units 1, 2, and 3 Docket Numbers 50-269, 50-270, 50-287 Renewed License Numbers DPR-38, DPR-47, DPR-55 Application for Subsequent Renewed Operating Licenses." Seneca, South Carolina. ADAMS Accession No. ML21158A193. TN8897.

eBird. 2024. "Bird List, San Luis Obispo, California." Cornell Lab or Ornithology, Cornell University, Ithaca, New York. Accessed on June 9, 2024, at https://ebird.org/region/US-CA-079/bird-list. TN10103.

EIA (U.S. Energy Information Administration). 2021. "State Electricity Profiles. Table 5. Electric Power Industry Generation by Primary Energy Source, 1990 through 2019." Washington, D.C. Available at https://www.eia.gov/electricity/state. TN8353.

EIA (U.S. Energy Information Administration). 2022. "Virginia State Profile and Energy Estimates -Analysis*."* Washington, D.C. Available at https://www.eia.gov/state/analysis.php?sid=VA. TN8352.

Endangered Species Act of 1973. 16 U.S.C. § 1531 et seq. TN1010.

Enright, E., J. Kidwell, R. Hanes, D. Douglas, and D. McDougal. 2021. *Diablo Canyon Decommissioning Cultural Resource Inventory and Study Plan.* Applied EarthWorks, Inc. and ERM, San Luis Obispo, California. TN10293.

ENTRIX (ENTRIX Environmental and Natural Resources Management Consultants). 2008. Letter from T. Thompson, Vice President - Water Resource Sciences, to D. Squyres, Senior Project Manager, dated August 22, 2008, regarding "Pacific Gas & Electric (PG&E) Company, Diablo Canyon Power Plant (DCPP) Water Resources Evaluation: Well Installation and Aquifer Testing." Ventura, California. TN10137.

EPA (U.S. Environmental Protection Agency). 1981. *Noise Effects Handbook: A Desk Reference to Health and Welfare, Effects of Noise*. EPA 350/9-82-106. Washington, D.C. TN7412.

EPA (U.S. Environmental Protection Agency). 2013. *Level III Ecoregions of the Continental United States*. National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. TN9981.

EPA (U.S. Environmental Protection Agency). 2016. *Climate Change Indicators in the United States 2016*. Fourth Edition, EPA 430-R-16-004, Washington D.C. Accessed June 7, 2022, at https://www.epa.gov/sites/default/files/2016-08/documents/climate_indicators_2016.pdf. TN7561.

EPA (U.S. Environmental Protection Agency). 2020. “2020 National Emissions Inventory Data.” Washington, D.C. Accessed September 20, 2023, at https://awsedap.epa.gov/public/single/?appid=20230c40-026d-494e-903f-3f112761a208&sheet=5d3fdda7-14bc-4284-a9bb-cfd856b9348d&opt=ctxmenu,currsel. TN8975.

EPA (U.S. Environmental Protection Agency). 2020. “Map of Sole Source Aquifer Locations.” Washington, D.C. Accessed November 3, 2020, at https://www.epa.gov/dwssa/map-sole-source-aquifer-locations. TN6709.

EPA (U.S. Environmental Protection Agency). 2020. “Mercury and Air Toxics Standards (MATS).” Washington D.C. Available at https://www.epa.gov/mats. TN8379.

EPA (U.S. Environmental Protection Agency). 2023. “ECHO (Enforcement and Compliance History Online) Detailed Facility Report, Facility Summary, Comanche Peak Nuclear Power Plant.” Washington, D.C. Available at https://echo.epa.gov/detailed-facility-report?fid=110001143227&ej_type=sup&ej_compare=US. TN8803.

EPA (U.S. Environmental Protection Agency). 2023. “Energy Recovery from the Combustion of Municipal Solid Waste (MSW).” Washington, D.C. Available at https://www.epa.gov/smm/energy-recovery-combustion-municipal-solid-waste-msw#EnergyRecovery. TN8443.

EPA (U.S. Environmental Protection Agency). 2024. “California Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants.” Washington, D.C. Accessed July 2, 2024, at https://www3.epa.gov/airquality/greenbook/anayo_ca.html. TN10157.

EPA (U.S. Environmental Protection Agency). 2024. *Climate Change Indicators in the United States*, *Fifth Edition*. EPA 430-R-24-003, Washington, D.C. TN10205.

EPA (U.S. Environmental Protection Agency). 2024. “Criteria Air Pollutants, NAAQS Table.” Washington, D.C. Accessed August 7, 2024, at https://www.epa.gov/criteria-air-pollutants/naaqs-table. TN10322.

EPA (U.S. Environmental Protection Agency). 2024. “GHG Emission Factors Hub.” Washington, D.C. Accessed June 11, 2024, at https://www.epa.gov/climateleadership/ghg-emission-factors-hub. TN10060.

EPA (U.S. Environmental Protection Agency). 2024. “Greenhouse Gas Equivalencies Calculator.” Washington, D.C. Accessed June 11, 2024 at https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator. TN10062.

EPA (U.S. Environmental Protection Agency). 2024. “NPDES State Program Authority.” Washington, D.C. Accessed June 11, 2024, at https://www.epa.gov/npdes/npdes-state-program-authority. TN10085.

EPA (U.S. Environmental Protection Agency). 2024. “Water Quality Criteria, Aquatic Life Criteria and Methods for Toxics.” Washington, D.C. Accessed July 24, 2024, at https://www.epa.gov/wqc/aquatic-life-criteria-and-methods-toxics. TN10276.

EPA (U.S. Environmental Protection Agency). 2025. *Sole Source Aquifers near San Lous Obispo Co., CA.* Washington, D.C. TN11437.

EPRI (Electric Power Research Institute). 2011. *Mapping and Assessment of the United States Ocean Wave Energy Resource*. 1024637, EPRI, Palto Alto, California. TN8442.

Federal Water Pollution Control Act of 1972 (commonly referred to as the Clean Water Act). 33 U.S.C. § 1251 *et seq.* TN662.

FHWA (Federal Highway Administration). 2006. "Construction Noise Handbook." DOT-VNTSC-FHWA-06-02, U.S. Department of Transportation, Washington, D.C. Accessed July 8, 2024, at https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/. ADAMS Accession No. ML083260828. TN10181.

FWS (U.S. Fish and Wildlife Service). 2005. *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog*. Washington, D.C. Accessed June 7, 2024, at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83914&inline. TN10286.

FWS (U.S. Fish and Wildlife Service). 2021. *Birds of Conservation Concern 2021, Migratory Bird Program*. Washington, D.C. TN8740.

FWS (U.S. Fish and Wildlife Service). 2022. *California Red-Legged Frog* (Rana draytonii), *5-Year Review: Summary and Evaluation*. Sacramento, California. TN10109.

FWS (U.S. Fish and Wildlife Service). 2023. *Species Status Assessment Report for the Southern Sea Otter* (Enhydra lutris nereis). Fish and Wildlife Service, Region 8, Sacramento, California. TN10255.

FWS (U.S. Fish and Wildlife Service). 2024. Letter from J. Brandt, Asst. Field Supervisor, U.S. Fish and Wildlife Service, to B. Arlene, Conservation Biologist & ESA Consultation Coordinator, Nuclear Regulatory Commission, dated December 20, 2024, regarding "Informal Consultation for the Diablo Canyon Units 1 and 2 Proposed License Renewal, San Luis Obispo County, California." Ventura, California. ADAMS Accession No. ML25006A097. TN11893.

FWS (U.S. Fish and Wildlife Service). 2024. Letter from Ventura Fish and Wildlife Office, to NRC, dated June 7, 2024, regarding "List of threated and endangered species that may occur in your proposed project location or may be affected by your proposed project." Ventura Fish and Wildlife Office, Ventura, California. ADAMS Accession No. ML24200A205. TN10254.

FWS and NMFS (U.S. Fish and Wildlife Service and National Marine Fisheries Service). 1998. *Endangered Species Act Consultation Handbook, Procedures for Conducting Section 7 Consultation and Conference*. Washington, D.C. ADAMS Accession No. ML14171A801. TN1031.

GE (General Electric). 2014. "How Loud is a Wind Turbine?" Boston, Massachusetts. Accessed July 8, 2024, at https://www.ge.com/news/reports/how-loud-is-a-wind-turbine#:~:text=The%20closest%20that%20a%20wind,run%20at%20around%2040%20decibels. TN10183.

Greenwood, R.S. 1972. *9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California*. TN10041.

Gregory, L.F., T.S. Gross, A.B. Bolten, K.A. Bjorndal, and L.J. Guillette, Jr. 1996. “Plasma Corticosterone Concentrations Associated with Acute Captivity Stress in Wild Loggerhead Sea Turtles *(Caretta caretta)*.” *General and Comparative Endocronology*104:312-320, Academic Press, Cambridge, Massachusetts. TN10306.

Griffith, G.E., J.M. Omernik, D.W. Smith, T.D. Cook, E. Tallyn, K. Moseley, and C.B. Johnson. 2016. *Ecoregions of California, U.S. Geological Survey Open-File Report 2016–1021, with map, scale 1:1,100,000*. Western Geographic Science Center, U.S. Geological Survey, Menlo Park, California. TN10099.

Griggs, G., D. Cayan, C. Tebaldi, H.A. Fricker, J. Arvai, R. DeConto, and R.E. Kopp. 2017. *Rising Seas in California, an Update on Sea-Level Rise Science*. California Ocean Science Trust, Sacramento, California. TN10291.

Hathcock, C. 2019. *Literature review on impacts to avian species from solar energy collection and suggested mitigations*. Department of Energy. TN8470.

Hoover, R. 1973. *Preliminary Field Reconnaissance, Marre Ranch, Avila Beach, San Luis Obispo County, Archaeological Element for Environmental Impact Report*. Avila Beach, California. TN10047.

Horvath, G., G. Kriska, and B. Robertson. 2009. “Polarized Light Pollution: A New Kind of Ecological Photopollution.” *Frontiers in Ecology and the Environment* 7(6):317–325, Washington, D.C. TN897.

Humboldt (California State Polytechnic University, Humboldt). 2024. “Saving Sunflower Sea Stars.” Arcata, California. Accessed October 7, 2024, at https://now.humboldt.edu/news/saving-sunflower-sea-stars#:~:text=Once%20common%20in%20the%20Pacific,Coast%20were%20devastated%20by%20disease. TN10614.

ICNIRP (International Commission on Non-Ionizing Radiation Protection). 1998. “Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz).” *Health Physics* 74 (4): 494-522, Philadelphia, Pennsylvania. Accessed October 7, 2020, at https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf. TN6591.

IEA (International Energy Agency). 2007. *Biomass for Power Generation and CHP*. ETE03, IEA Energy Technology Essentials, License CC BY 4.0. Paris, France. TN8436.

IES/NCES (Institute of Education Sciences/National Center for Education Statistics). 2023. “Search for Public Schools.” Washington, D.C. Accessed on June 3, 2024, at https://nces.ed.gov/ccd/schoolsearch/school_list.asp?Search=1&State=06&County=san+luis+obispo. TN10030.

IPCC (Intergovernmental Panel on Climate Change). 2000. *Summary for Policymakers, Emissions Scenarios, A Special Report of IPCC Working Group III*. Intergovernmental Panel on Climate Change, Geneva, Switzerland. Accessed June 11, 2022, at https://www.ipcc.ch/site/assets/uploads/2018/03/sres-en.pdf. TN7652.

IPCC (Intergovernmental Panel on Climate Change). 2007. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. ADAMS No. ML112710385. Accessed May 23, 2022, at https://www.ipcc.ch/site/assets/uploads/2018/05/ar4_wg1_full_report-1.pdf. TN7421.

IPCC (Intergovernmental Panel on Climate Change). 2013. *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midgley, eds. Cambridge University Press, Cambridge, United Kingdom. Accessed May 25, 2022, at https://www.ipcc.ch/report/ar5/wg1/. TN7434.

IPCC (Intergovernmental Panel on Climate Change). 2014. *Climate Change 2014, Synthesis Report*. Geneva, Switzerland. Accessed June 11, 2022, at https://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf. TN7651.

IPCC (Intergovernmental Panel on Climate Change). 2021. "Climate Change 2021: The Physical Science Basis." Accessed May 24, 2022, at https://www.ipcc.ch/report/ar6/wg1/. TN7435.

IPCC (Intergovernmental Panel on Climate Change). 2023. *AR6 Synthesis Report: Climate Change 2023.* Intergovernmental Panel on Climate Change, Geneva, Switzerland. TN8557.

Johnson, J.R. 2020. *Descendants of Native Rancherias in the Diablo Lands Vicinity, A Northern Chumash Ethnohistorical Study*. Santa Barbara Museum of Natural History, Santa Barbara, California. TN10045.

Jones, T.L. and K.A. Klar. California Prehistory, Colonization, Culture, and Complexity. AltaMira Press, Lanham, Maryland. TN9830.

Kagel, A., D. Bates, and K. Galwell. 2007. *A Guide to Geothermal Energy and the Environment, Updated April 2007*. Geothermal Energy Association, Washington, D.C. TN10179.

Karlsdottir, M.R., O.P. Palsson, and H. Palsson. 2010. *Factors for Primary Energy Efficiency and CO2 Emission of Geothermal Power Production*. University of Iceland, Reykjavik, Iceland. TN10631.

Kauffman, E. 2003. *Atlas of the Biodiversity of California*. Department of Fish and Game, State of California, Sacramento, California. TN10139.

Langridge, R. 2018. *California's Fourth Climate Change Assessment*, *Central Coast Region Report*. SUM-CCCA4-2018-006, University of California, Santa Cruz, California. TN9854.

Larson, A. 2020. "Innovative Byproduct-Hydrogen Fuel Cell Power Plant Completed." *POWER.* Rockville, Maryland. Available at https://www.powermag.com/innovative-byproduct-hydrogen-fuel-cell-power-plant-completed/. TN8401.

Lee, J.M., V.L. Chartier, D.P. Hartmann, G.E. Lee, K.S. Pierce, F.L. Shon, R.D. Stearns, and M.T. Zeckmeister. 1989. *Electrical and Biological Effects of Transmission Lines: A Review*. DOE/BP-945. U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon. June. Accessed June 1, 2022, at https://doi.org/10.2172/5712107. TN7481

Luminant. 2013. *Comanche Peak Nuclear Power Plant Units 3 and 4, COL Application, Part 3, Environmental Report, Revision 4 (Non-Proprietary Version)*. Glen Rose, Texas. ADAMS Accession No. ML13345A730. TN8669.

Maize, K. 2019. "Waste-to-Energy: A Niche Market in Decline?" *POWER*, Rockville, Maryland. Accessed June 12, 2022, at https://www.powermag.com/waste-to-energy-a-niche-market-in-decline. TN7699.

Mayhew, D.A., L.D. Jensen, D.F. Hanson, and P.H. Muessig. 2000. "A comparative review of entrainment survival studies at power plants in estuarine environments." *Environmental Science & Policy* (3) Supplement 1: 295-301, Hunt Valley, Maryland. TN8458.

Michaels T., and K. Krishnan. 2019. *Energy Recovery Council, 2018 Directory of Waste-to-Energy Facilities*. Washington, D.C. Accessed June 12, 2022, at https://wtert.org/wp-content/uploads/2023/02/WtE-facilities-2018-directory.pdf. TN7700.

Mills, E.L. and A.J. Brickfield. 1986. *The Papers of John Peabody Harrington in the Smithsonian Institution 1907-1957, Volume Three, A Guide to the Field Notes: Native American History, Language and Culture of Southern California/Basin*. Kraus International Publications, White Plains, New York. TN10279.

NARA (National Archives and Records Administration). 2019. "Papers of John Peabody Harrington, 1907-1957." Washington, D.C. Accessed July 24, 2024, at https://www.archives.gov/nhprc/projects/catalog/john-peabody-harrington. TN10278.

NASA (National Aeronautics and Space Administration). 2024. "Sea Level Change, Interagency Sea Level Rise Scenario Tool, Port San Luis." Washington, D.C. Accessed July 17, 2024, at https://sealevel.nasa.gov/task-force-scenario-tool?psmsl_id=508. TN10208.

National Environmental Policy Act of 1969 (NEPA), as amended. 42 U.S.C. § 4321 et seq. TN661.

National Historic Preservation Act. 54 U.S.C. § 300101 et seq. TN4157.

National Marine Sanctuaries Act, as amended. 16 U.S.C. § 1431 et seq. TN4482.

NCEI (National Centers for Environmental Information). 2021. "U.S. Climate Normals Quick Access, Annual/Seasonal, 1991-2020, San Luis Obispo AP, California." Asheville, North Carolina. Accessed July 30, 2024, at https://www.ncei.noaa.gov/access/us-climate-normals/#dataset=normals-annualseasonal&timeframe=30&location=CA&station=USW00093206. TN10298.

NEI (Nuclear Energy Institute). 2005. *Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document*. NEI-05-01, Revision A, Washington, D.C. ADAMS Accession No. ML060530203. TN1978.

NEI (Nuclear Energy Institute). 2007. *Industry Ground Water Protection Initiative—Final Guidance Document.* NEI 07–07, Washington, D.C. ADAMS Accession No. ML091170588. TN1913.

NEI (Nuclear Energy Institute). 2019. *Industry Groundwater Protection Initiative – Final Guidance Document, Rev. 1.* NEI-07-07, Revision 1, Washington, D.C. ADAMS Accession No. ML19142A071. TN6775.

NIEHS (National Institute of Environmental Health Sciences). 1999. *NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields*. NIH Publication No 99–4493, National Institutes of Health, Research Triangle Park, North Carolina. ADAMS Accession No. ML093240277. TN78.

NIEHS (National Institute of Environmental Health Sciences). 2002. *Electric and Magnetic Fields Associated with the Use of Electric Power: Questions and Answers*. National Institutes of Health, Research Triangle Park, North Carolina. ADAMS Accession No. ML112660024. TN6560.

NIOSH (National Institute for Occupational Safety and Health). 1996. *EMFs In The Workplace*. Washington, D.C. ADAMS Accession No. ML21145A339. TN6766.

NMFS (National Marine Fisheries Service). 2006. Letter from R.R. McInnis to P.T. Kuo, dated September 18, 2006, regarding "Nuclear Regulatory Commission's (NRC) continued operation of the Diablo Canyon Power Plant (DCPP) and the San Onofre Nuclear Generating Station (SONGS) on threatened and endangered species in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended." Long Beach, California. ADAMS Accession No. ML063000348. TN7502.

NMFS (National Marine Fisheries Service). 2020. *Final Endangered Species Act (ESA) Recovery Plan for Black Abalone* (Haliotis cracherodii). West Coast Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration. TN10260.

NMFS (National Marine Fisheries Service). 2024. "Essential Fish Habitat Mapper." Silver Spring, Maryland. Accessed July 30, 2024, at https://www.habitat.noaa.gov/apps/efhmapper/?page=page_4&views=view_16. TN10304.

NMFS (National Marine Fisheries Service). 2025. Letter from C. Yates, Assistant Regional Administrator for Protected Resources, National Marine Fisheries Service, to B. Arlene, Conservation Biologist & ESA Consultation Coordinator, Nuclear Regulatory Commission, dated April 22, 2025, regarding "Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Diablo Canyon Power Plant, Units 1 and 2, Proposed License Renewal in San Luis Obispo County, California (Docket Numbers: 50-275 and 50-323)." Long Beach, California. ADAMS Accession No. ML25111A195. TN11895.

NOAA (National Oceanic and Atmospheric Administration). 2004. *Preparing Essential Fish Habitat Assessments: A Guide for Federal Action Agencies*. Version 1, Washington, D.C. ADAMS Accession No. ML14309A276. TN1344.

NOAA (National Oceanic and Atmospheric Administration). 2023. "Divisional Time Series." Washington, D.C. Available at https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/divisional/time-series. TN8560.

NOAA (National Oceanic and Atmospheric Administration). 2023. “Green Turtle.” Silver Spring, Maryland. Accessed on June 4, 2024, at https://www.fisheries.noaa.gov/species/green-turtle. TN10271.

NOAA (National Oceanic and Atmospheric Administration). 2023. “National ESA Critical Habitat Mapper.” Silver Spring, Maryland. Accessed July 23, 2024, at https://www.fisheries.noaa.gov/resource/map/national-esa-critical-habitat-mapper. TN10258.

NOAA (National Oceanic and Atmospheric Administration). 2023. *Proposed Chumash Heritage National Marine Sanctuary, Draft Environmental Impact Statement*. Office of National Marine Sanctuaries, National Oceanic and Atmospheric Administration, Silver Spring, Maryland. TN10277.

NOAA (National Oceanic and Atmospheric Administration). 2024. “Leatherback Turtle.” Silver Spring, Maryland. Accessed on June 4, 2024, at https://www.fisheries.noaa.gov/species/leatherback-turtle. TN10272.

NOAA (National Oceanic and Atmospheric Administration). 2024. “Proposed Chumash Heritage National Marine Sanctuary.” Silver Spring, Maryland. Accessed on June 4, 2024, at https://sanctuaries.noaa.gov/chumash-heritage/. TN10297.

NOAA (National Oceanic and Atmospheric Administration). 2024. “Storm Events Database Search Results for San Luis Obispo County, California.” National Centers for Environmental Protection Information, Silver Spring, Maryland. Accessed July 2, 2024, at https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=ALL&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=01&endDate_dd=31&endDate_yyyy=2024&county=SAN%2BLUIS%2BOBISPO%3A79&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=6%2CCALIFORNIA. TN10155.

NOAA (National Oceanic and Atmospheric Administration). 2024. “Tides & Currents, Port San Luis, CA - Station ID: 9412110.” Washington, D.C. Accessed April 10, 2024, at https://tidesandcurrents.noaa.gov/ofs/ofs_station.html?stname=Port%20San%20Luis&ofs=wc&stnid=9412110&subdomain=sca. TN10083.

NOAA (National Oceanic and Atmospheric Administration). 2025. “Final Chumash Heritage National Marine Sanctuary.” Silver Spring, Maryland. Accessed on February 4, 2025, at https://sanctuaries.noaa.gov/chumash-heritage/. TN11919.

NPS (National Park Service). 2010. *Federal Land Managers’ Air Quality Related Values Work Group (FLAG). Phase I Report-Revised (2010), Natural Resource Report NPS/NRPC/NRR-2010/232*. Hopkins, South Carolina. ADAMS Accession No. ML22118A305. TN7925.

NPS (National Park Service). 2023. “2023 California Red-legged Frog Breeding Surveys Yield Mixed Results, Golden Gate National Recreation Area.” Washington, D.C. Accessed June 25, 2024, at https://www.nps.gov/articles/000/sfanblog_2023-california-red-legged-frog-breeding-surveys-yield-mixed-results.htm. TN10110.

NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Volumes 1 and 2, NUREG-1437, Washington, D.C. ADAMS Accession Nos. ML040690705, ML040690738. TN288.

NRC (U.S. Nuclear Regulatory Commission). 1997. *Regulatory Analysis Technical Evaluation Handbook.* NUREG/BR–0184, Washington, D.C. ADAMS Accession No. ML050190193. TN676.

NRC (U.S. Nuclear Regulatory Commission). 2002. "Final Generic Environmental Impact Statement of Decommissioning of Nuclear Facilities (NUREG-0586)." NUREG–0586, Supplement 1, Volumes 1 and 2, Washington, D.C. ADAMS Accession Nos. ML023470327, ML023500228. TN665.

NRC (U.S. Nuclear Regulatory Commission). 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1: Regarding the Decommissioning of Nuclear Power Reactors, Main Report - Final Report*. NUREG-0586, Supplement 1, Volume 1 and 2, Washington, D.C. ADAMS Accession Nos. ML023470304, ML023470323, ML023500187, ML023500211, ML023500223. TN7254.

NRC (U.S. Nuclear Regulatory Commission). 2002. Letter from S.J. Collins, Director, Office of Nuclear Reactor Regulation, to G.M. Rueger, Senior Vice President Generation and Chief Nuclear Officer, Diablo Canyon Nuclear Power Plant Units 1 & 2, Pacific Gas and Electric Company, dated February 25, 2002, regarding "Issuance of Order for Interim Safeguards and Security Compensatory Measures for - Diablo Canyon Nuclear Power Plant Units 1 & 2." Washington, D.C. ADAMS Accession Package No. ML020490014. TN10622.

NRC (U.S. Nuclear Regulatory Commission). 2003. Letter from S.J. Collins, Director, Office of Nuclear Reactor Regulation, to Holders of Licenses for Operating Power Reactors as listed in Enclosure 2, dated January 7, 2003, regarding "Issuance of Order for Compensatory Measures Related to Access Authorization." EA-02-261, Washington, D.C. ADAMS Accession No. ML030060360. TN10623.

NRC (U.S. Nuclear Regulatory Commission). 2004. Letter from J.A. Nakoski, Chief, Security Plan Review Team, Project Directorate II, Division of Licensing Project Management, Office of Nuclear Reactor Regulation, to G.M. Rueger, Senior Vice President, Generation and Chief Nuclear Officer, Pacific Gas and Electric Company, dated October 28, 2004, regarding "Diablo Canyon Nuclear Power Plant, Units 1 and 2 - Administrative Change to Facility Operating Licenses in Conjunction with the Commission Order EA-03-086 Regarding Revised Design Basis Threat (DBT); and Revisions to Physical Security Plan, Training and Qualification Plan, and Safeguards Contingency Plan (TAC NOS. MC2913 AND MC2914)." Washington, D.C. ADAMS Accession No. ML043180005. TN10625.

NRC (U.S. Nuclear Regulatory Commission). 2006. *Liquid Radioactive Release Lessons Learned Task Force Final Report*. Washington, D.C. ADAMS Accession No. ML083220312. TN1000.

NRC (U.S. Nuclear Regulatory Commission). 2007. Letter from A.B. Wang, Project Manager, Plant Licensing Branch IV, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, to J.S. Keenan, Senior Vice President and Chief Nuclear Officer, Pacific Gas and Electric Company, dated July 11, 2007, regarding "Diablo Canyon Power Plant, Unit Nos. 1 and 2 - Conforming License Amendments to Incorporate the Mitigation Strategies Required by Section B.5.b. of Commission Order EA-02-026 (TAC NOS. MD4527 and MD4528)." Washington, D.C. ADAMS Accession Package No. ML071910029. TN10627.

NRC (U.S. Nuclear Regulatory Commission). 2007. Memorandum and Order in the Matter of Amergen Energy Company, LLC (License Renewal for Oyster Creek Nuclear Generating Station). CLI-07-08, Washington, D.C. ADAMS Accession No. ML21145A372. TN6957.

NRC (U.S. Nuclear Regulatory Commission). 2011. Letter from A.B. Wang, Project Manager, Plant Licensing Branch IV, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, to J.T. Conway, Senior Vice President - Energy Supply and Chief Nuclear Officer, Pacific Gas and Electric Company, dated July 15, 2011, regarding "Diablo Canyon Power Plant, Unit Nos. 1 and 2 - Issuance of Amendments Re: Approval of Cyber Security Plan (TAC NOS. ME4290 and ME4291)." Washington, D.C. ADAMS Accession No. ML111640274. TN10626.

NRC (U.S. Nuclear Regulatory Commission). 2011. *Diablo Canyon Power Plant Independent Spent Fuel Storage Installation*. CLI-11-11, 74 NRC 427. NUREG-0750. Volume 74, Book II of II. ADAMS Accession No. ML14028A565. TN7868

NRC (U.S. Nuclear Regulatory Commission). 2011. *Final Environmental Impact Statement for Combined Licenses (COLs) for Comanche Peak Nuclear Power Plant Units 3 and 4*. NUREG-1943, Volume 1, Washington, D.C. ADAMS Accession No. ML11131A001. TN6437.

NRC (U.S. Nuclear Regulatory Commission). 2012. "In the Matter of All Power Reactor Licensees and Holders of Construction Permits in the Active or Deferred Status. Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Effective Immediately)." 7590-01-P, EA-12.051, NRC-2012-0067, Washington, D.C. ADAMS Accession No. ML12056A044. TN7764.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from E. Leeds and M. Johnson to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, dated March 12, 2012, regarding "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events." Washington, D.C. ADAMS Accession No. ML12054A735. TN3237.

NRC (U.S. Nuclear Regulatory Commission). 2013. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Revision 1, Washington, D.C. ADAMS Package Accession No. ML13107A023. TN2654.

NRC (U.S. Nuclear Regulatory Commission). 2013. Letter from R.K. Johnson, Chief Fuel Manufacturing Branch Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Materials Safety and Safeguards, to D.W. Johnson, Director, Office of Technical Programs and Coordination Activities, Department of Labor Occupational Safety and Health Administration, dated July 29, 2013, regarding "Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the Occupational Safety and Health Administration." Washington, D.C. ADAMS Accession No. ML11354A411. TN10165.

NRC (U.S. Nuclear Regulatory Commission). 2013. *Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications*. Regulatory Guide 4.2, Supplement 1, Revision 1, Washington, D.C. ADAMS Accession No. ML13067A354. TN4791.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel.* Final Report, NUREG–2157, Washington, D.C. ADAMS Package Accession No. ML14198A440. TN4117.

NRC (U.S. Nuclear Regulatory Commission). 2015. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants; Supplement 53 Regarding Sequoyah Nuclear Plant, Units 1 and 2, Final Report.* NUREG-1437, Supplement 53, Washington, D.C. ADAMS Accession No. ML15075A438. TN5842.

NRC (U.S. Nuclear Regulatory Commission). 2015. *Protecting Our Nation, A Report of the U.S. Nuclear Regulatory Commission*. NUREG/BR-0314, Revision 4, Washington, D.C. ADAMS Accession No. ML15232A263. TN10621.

NRC (U.S. Nuclear Regulatory Commission). 2019. *Environmental Impact Statement for an Early Site Permit (ESP) at the Clinch River Nuclear Site*. NUREG-2226, Washington, D.C. ADAMS Package Accession No. ML19087A266. TN6136.

NRC (U.S. Nuclear Regulatory Commission). 2020. Letter from NRC to J.M. Welsch at Pacific Gas and Electric Company, dated May 8, 2020, regarding "Diablo Canyon Power Plant, Unit Nos. 1 and 2 – Documentation of the Completion of Required Actions Taken in Response to the Lessons Learned from the Fukushima Dai-Ichi Accident." Washington, D.C. ADAMS Accession No. ML20093B934. TN7284.

NRC (U.S. Nuclear Regulatory Commission). 2023. Letter from S.S. Lee, Project Manager, to P. Gerfen, Senior Vice President, PG&E, dated June 20, 2023, regarding "Diablo Canyon Nuclear Power Plant, Units 1 and 2 - Review of Post-Shutdown Decommissioning Activities Report (EPID L-2019-LRL-0004, EPID L-2019-LRL-0005, and EPID L-2019-LRL-0006)." Washington, D.C. ADAMS Accession No. ML23122A236. TN10319.

NRC (U.S. Nuclear Regulatory Commission). 2023. *List of Leaks and Spills at Operating U.S. Commercial Nuclear Power Plants October 11, 2023*. Washington, D.C. ADAMS Accession No. ML23284A164. TN9980.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from J. Davis, Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated October 25, 2024, regarding "September 30, 2024, Summary of Meeting Between the U.S. Nuclear Regulatory Commission Staff and the YTT Northern Chumash Tribe." Washington, D.C. ADAMS Accession No. ML24275A216. TN11951.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from J. Trefethen, Environmental Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated July 1, 2024, regarding "April 4, 2024; Summary of Meeting Between the U.S. Nuclear Regulatory Commission Staff and the California State Historic Preservation Office (Docket Numbers: 50-275 and 50-323)." Washington, D.C. ADAMS Accession No. ML24157A025. TN10312.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from J. Trefethen, Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated June 3, 2024, regarding "April 5, 2024, Summary of Meeting Between the U.S. Nuclear Regulatory Commission Staff and the YTT Northern Chumash Tribe." Washington, D.C. ADAMS Accession No. ML24143A120. TN10315.

NRC (U.S. Nuclear Regulatory Commission). 2024. "Diablo Canyon - License Renewal Application, Information and Review Schedule." Washington, D.C. Accessed May 28, 2024, at https://www.nrc.gov/reactors/operating/licensing/renewal/applications/diablo-canyon.html. TN10003.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from K. Conway, Environmental Project Manager, to P. Gerfen, PG&E Senior Vice President, dated July 16, 2024, regarding "Diablo Canyon Nuclear Power Plant, Units 1 and 2 - Summary of the June 2024 Audit Related to the License Renewal Application Severe Accident Mitigation Alternatives Review (EPID Number: L-2023-LNE-0004)." Washington, D.C. ADAMS Accession Package No. ML24187A131. TN10308.

NRC (U.S. Nuclear Regulatory Commission). 2024. Email from K. Conway, NRC, to T. Rebel, PG&E, dated July 2, 2024, regarding "Diablo Canyon LR Environmental Review: Summary of June 27 Clarification Call Regarding PG&E"s Response to RCI AQN-3." Washington, D.C. ADAMS Accession No. ML24187A138. TN10202.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from B. Goldstein, Environmental Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated June 4, 2024, regarding "February 8, 2024; Summary of meeting between the U.S. Nuclear Regulatory Commission staff and the YTT Northern Chumash Tribe." Washington, D.C. ADAMS Accession No. ML24127A133. TN10313.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from S.S. Koenick, Chief, Environmental Project Manager Branch 1, Division of Rulemaking, Environment, and Financial Support, Office of Nuclear Material Safety and Safeguards, to A. Peck, Acting Senior Vice President, Generation and Chief Nuclear Officer, Pacific Gas and Electric Company, Diablo Canyon Nuclear Power Plant, dated September 20, 2024, regarding "Issuance of Supplemental Environmental Impact Statement Scoping Process Summary Report Related to the Diablo Canyon Nuclear Power Plant, Units 1 and 2 License Renewal Application (EPID Number: L-2023-LNE-0004)." Washington, D.C. ADAMS Accession Package No. ML24240A017. TN10608.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from J.M. Moses, Deputy Director, to Honorable K. Kahn, Chairman, Santa Ynez Band of Chumash Indians, dated January 24, 2024, regarding "Request to Initiate Section 106 Consultation and Scoping Process for the Environmental Review of Diablo Canyon Nuclear Power Plant, Units 1 and 2 License Renewal Application (Docket Numbers: 50-275 and 50-323)." Washington, D.C. ADAMS Accession Package No. ML24012A037. TN10005.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from J.M. Moses, Deputy Director, to Honorable V.S. Walker, Chairwoman, Northern Chumash Tribal Council, dated January 24, 2024, regarding "Section 106 Consultation and Scoping Process for the Environmental Review of Diablo Canyon Nuclear Power Plant, Units 1 and 2 License Renewal Application (Docket Numbers: 50-275 and 50-323)." Washington, D.C. ADAMS Accession Package No. ML24012A157. TN10006.

NRC (U.S. Nuclear Regulatory Commission). Letter from K. Conway, Environmental Project Manager, to P. Gerfen, Senior Vice President, Pacific Gas and Electric Company, dated April 18, 2024, regarding “Diablo Canyon Nuclear Power Plant, Units 1 and 2 - Summary of the March 2024 Environmental Audit Related to the Review of the License Renewal Application Environmental Report (EPID NUMBER: L-2023-LNE-0004).” Washington, D.C. ADAMS Accession Package No. ML24106A290. TN10002.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from S.S. Koenick, Chief, Environmental Project Management Branch 1, to J. Polanco, State Historic Preservation Officer, California Office of Historic Preservation, dated January 24, 2024, regarding “Request to Initiate Section 106 Consultation and Scoping Process for the Environmental Review of Diablo Canyon Nuclear Power Plant, Units 1 and 2 License Renewal Application (Docket Numbers: 50-275 and 50-323).” Washington, D.C. ADAMS Accession Package No. ML24012A039. TN10008.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from S.S. Koenick, Chief, Environmental Project Management Branch 1, to R. Nelson, Executive Director, Advisory Council on Historic Preservation, dated January 24, 2024, regarding “Request to Initiate Section 106 Consultation and Scoping Process for the Environmental Review of Diablo Canyon Nuclear Power Plant, Units 1 and 2 License Renewal Application (Docket Numbers: 50-275 and 50-323).” Washington, D.C. ADAMS Accession Package No. ML24012A007. TN10007.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from J. Trefethen, Environmental Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated May 28, 2024, regarding “March 20, 2024; Summary of Meeting Between the U.S. Nuclear Regulatory Commission Staff and the California State Historic Preservation Office.” Washington, D.C. ADAMS Accession No. ML24109A191. TN10311.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from J. Trefethen, Environmental Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated June 4, 2024, regarding “March 21, 2024, Summary of Meeting Between the U.S. Nuclear Regulatory Commission Staff and the YTT Northern Chumash Tribe.” Washington, D.C. ADAMS Accession No. ML24155A205. TN10314.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from J. Trefethen, Environmental Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated May 28, 2024, regarding “March 23, 2024; Summary of Meeting Between the U.S. Nuclear Regulatory Commission Staff and the Santa Ynez Band of Chumash Indians.” Washington, D.C. ADAMS Accession No. ML24109A188. TN10316.

NRC (U.S. Nuclear Regulatory Commission). 2024. Memorandum from J. Trefethen, Environmental Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated June 21, 2024, regarding “May 10, 2024; Summary of Meeting Between the U.S. Nuclear Regulatory Commission Staff and the Santa Ynez Band of Chumash Indians.” Washington, D.C. ADAMS Accession No. ML24143A134. TN10317.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volume 1-3, Revision 2, Washington, D.C. ADAMS Accession No. ML24087A133. TN10161.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from B. Arlene, Conservation Biologist & ESA Consultation Coordinator, Nuclear Regulatory Commission, to J. Quan, Regional Administrator, West Coast Regional Office, National Marine Fisheries Service, dated October 30, 2024, regarding "Request to Initiate Formal Endangered Species Act Consultation and Abbreviated Essential Fish Habitat Consultation for Diablo Canyon Power Plant, Units 1 and 2, Proposed License Renewal in San Luis Obispo County, California (Docket Numbers: 50-275 And 50-323)." Washington, D.C. ADAMS Accession No. ML24275A062. TN11896.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from B. Arlene, Conservation Biologist & ESA Consultation Coordinator, Nuclear Regulatory Commission, to Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service, dated October 30, 2024, regarding "Request for Concurrence with Endangered Species Act Determinations for Diablo Canyon Power Plant, Units 1 and 2, and Independent Spent Fuel Storage Installation Proposed License Renewals in San Luis Obispo County, California (Ipac Project Codes 2024-0020172 And 2024-0103109) (Docket Numbers: 50-275, 50-323, and 72-026)." Washington, D.C. ADAMS Accession No. ML24276A148. TN11894.

NRC (U.S. Nuclear Regulatory Commission). 2024. *NUREG-1437 DFC, Supplement 62, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 62, Regarding License Renewal of Diablo Canyon Nuclear Power Plant, Units 1 and 2."* Washington, D.C. ADAMS Accession No. ML24299A167. TN11897.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2021, Fifty-Fourth Annual Report*. NUREG-0713, Volume 43, Washington, D.C. ADAMS Accession No. ML24060A017. TN9915.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Regulatory Guide 4.2 – Supplement 1, Revision 2, Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications*. Washington, D.C. ADAMS Accession No. ML23201A144. TN10280.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal, Final Report*. NUREG-1555, Revision 2, Washington, D.C. ADAMS Accession No. ML23201A227. TN10251.

NRC (U.S. Nuclear Regulatory Commission). 2025. Email from K. Conway, NRC, to T. Rebel, PG&E, dated May 28, 2025, regarding "Diablo Canyon LR Environmental Review: summary of April 22 call between NRC and PG&E." Washington, D.C. ADAMS Accession No. ML25148A294. TN11982.

NRC (U.S. Nuclear Regulatory Commission). 2025. Memorandum from C.M. Safford, Secretary, to B.P. Clark, General Counsel, dated April 10, 2025, regarding "Staff Requirements - COMSECY-25-2007 - Withdrawing the Environmental Justice Policy Statement and Environmental Justice Strategy." Washington, D.C. ADAMS Access No. ML25100A106. TN11710.

NRC (U.S. Nuclear Regulatory Commission). 2025. Memorandum from J. Davis, Environmental Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated June 2, 2025, regarding "summary of May 15, 2025 meeting between the U.S. Nuclear Regulatory Commission Staff, Pacific Gas and Electric Company, and the yak titʸu titʸu yak tiłhini Northern Chumash Tribe." Washington, D.C. ADAMS Accession No. ML25150A040. TN11983.

NRC (U.S. Nuclear Regulatory Commission). 2025. Memorandum from J. Davis, Environmental Project Manager, Environmental Technical Review Branch 1, to M.R. Rome, Chief, Environmental Technical Review Branch 1, dated June 5, 2025, regarding "Summary of November 20, 2024, and April 24, 2025, meetings between the U.S. Nuclear Regulatory Commission Staff and the yak titʸu titʸu yak tiłhini Northern Chumash Tribe." Washington, D.C. ADAMS Accession No. ML25150A349. TN11981.

NREL (National Renewable Energy Laboratory). 2022. “Annual Technology Baseline, Utility-Scale PV.” Golden, Colorado. Accessed March 23, 2024, at https://atb.nrel.gov/electricity/2022/utility-scale_pv. TN9823.

NREL (National Renewable Energy Laboratory). Undated. “Concentrating Solar Power.” Golden, Colorado. Accessed June 12, 2022, at https://www.nrel.gov/csp/index.html. TN7710.

Nugent, D. and B.K. Sovacool. 2014. “Assessing the lifecycle greenhouse gas emissions from solar PV and wind energy: A critical meta-survey.” *Energy Policy* 65: 229-244, *Elsevier*, Amsterdam, Netherlands. TN10630.

Occupational Safety and Health Act of 1970, as amended. 29 U.S.C. § 651 *et seq*. TN4453.

P&T (Page & Turnbull). 2022. Diablo Canyon Power Plant Decommissioning Project, Historic Built Environment Evaluation Report. San Luis Obispo County, California. TN10044.

Petersen, M.D., A.M. Shumway, P.M. Powers, E.H. Field, M.P. Moschetti, K.S. Jaiswal, K.R. Milner, S. Rezaeian, A.D. Frankel, A.L. Llenos, A.J. Michael, J.M. Altekruse, S.K. Ahdi, K.B. Withers, C.S. Mueller, Y. Zeng, R.E. Chase, L.M. Salditch, N. Luco, K.S. Rukstales, J.A. Herrick, D.L. Girot, B.T. Aagaard, A.M. Bender, M.L. Blanpied, R.W. Briggs, O.S. Boyd, B.S. Clayton, C.B. DuRoss, E.L. Evans, P.J. Haeussler, A.E. Hatem, K.L. Haynie, E.H. Hearn, K.M. Johnson, Z.A. Kortum, N.S. Kwong, A.J. Makdisi, H.B. Mason, D.E. McNamara, D.F. McPhillips, P.G. Okubo, M.T. Page, F.F. Pollitz, J.L. Rubinstein, B.E. Shaw, Z.-K. Shen, B.R. Shiro, J.A. Smith, W.J. Stephenson, E.M. Thompson, J.A.T. Jobe, E.A. Wirth, and R.C. Witter. 2024. “The 2023 US 50-State National Seismic Hazard Model: Overview and Implications.” *Earthquake Spectra* 40(1):5-88, Thousand Oaks, California. http://dx.doi.org/10.1177/87552930231215428. TN9940.

PFMC (Pacific Fishery Management Council). 2023. *Pacific Coast Ground Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery*. Portland, Oregon. Accessed on June 6, 2024, at https://www.pcouncil.org/documents/2022/08/pacific-coast-groundfish-fishery-management-plan.pdf/. TN10284.

PFMC (Pacific Fishery Management Council). 2024. *Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species, Amended Through Amendment 8*. Portland, Oregon. Accessed April 30, 2025, at https://www.pcouncil.org/documents/2023/04/fishery-management-plan-for-west-coast-fisheries-for-highly-migratory-species-through-amendment-8.pdf/. TN11729.

PFMC (Pacific Fishery Management Council). 2024. *Coastal Pelagic Species Fishery Management Plan as Amended Through Amendment 21*. Portland, Oregon. Accessed on June 6, 2024, at https://www.pcouncil.org/documents/2023/06/coastal-pelagic-species-fishery-management-plan.pdf/. TN10274.

PG&E (Pacific Gas and Electric Company). 1992. *Diablo Canyon Power Plant Units 1 and 2 Individual Plant Examination*. Avila Beach, California. ADAMS Accession No. ML073600368. TN10662. Nonpublic.

PG&E (Pacific Gas & Electric Company). 1994. Letter from G.M. Rueger, Senior Vice President and General Manager, Nuclear Power Generation, to NRC Document Control Desk, dated June 27, 1994, regarding "Diablo Canyon Units 1 and 2, Response to Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities." PG&E Letter DCL-94-133, San Francisco, California. ADAMS Accession No. ML073600371. TN10620.

PG&E (Pacific Gas & Electric Company). 2004. Letter from D.H. Oatley, Vice President and General Manager, to NRC Document Control Desk, dated November 12, 2004, regarding "Full Compliance with the Order for Compensatory Measures Related to Fitness-For-Duty Enhancements Applicable to Nuclear Facility Security Force Personnel (EA-03-038); Order for Compensatory Measures Related to Training Enhancements on Tactical and Firearms Proficiency and Physical Fitness Applicable to Armed Nuclear Power Plant Security Force Personnel (EA-03-039); and Order Requiring Compliance with Revised Design Basis Threat (EA-03-086), dated April 29, 2003." PG&E Letter DCL-04-154, Avila Beach, California. ADAMS Accession No. ML043240097. TN10624.

PG&E (Pacific Gas & Electric Company). 2008. *Diablo Canyon License Renewal Feasibility Study Environmental Report, Technical Data Report, Heat Shock*. Revision 0, Avila Beach, California. ADAMS Accession No. ML11166A151. TN10104.

PG&E (Pacific Gas & Electric Company). 2009. *Diablo Canyon License Renewal Feasibility Study Environmental Report, Technical Data Report, Impingement of Fish and Shellfish*. Revision 0, Avila Beach, California. ADAMS Accession No. ML11166A153. TN10113.

PG&E (Pacific Gas & Electric Company). 2010. Letter from J.R. Becker, Site Vice President, to NRC Document Control Desk, dated October 27, 2010, regarding "Diablo Canyon Units 1 and 2, Information to Support NRC Review of DCPP License Renewal Application (LRA) Environmental Report - Operating License Renewal Stage." PG&E Letter DCL-10-124, Avila Beach, California. ADAMS Accession No. ML103070305. TN10119.

PG&E (Pacific Gas & Electric Company). 2011. *Report on the Analysis of the Shoreline Fault Zone, Central Coastal California*. Avila Beach, California. ADAMS Accession No. ML110140425. TN10189.

PG&E (Pacific Gas & Electric Company). 2013. Letter from B.S. Allen, Site Vice President, to NRC Document Control Desk, dated February 27, 2013, regarding "Diablo Canyon Units 1 and 2, Pacific Gas and Electric Company's Overall Integrated Plan in Response to March 12, 2012, Commission Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051)." PG&E Letter DCL-13-011, Avila Beach, California. ADAMS Accession No. ML13059A500. TN10629.

PG&E (Pacific Gas & Electric Company). 2013. Letter from B.S. Allen, Site Vice President, to NRC Document Control Desk, dated February 27, 2013, regarding "Pacific Gas and Electric Company's Overall Integrated Plan in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)." PG&E Letter DCL-13-007, Avila Beach, California. ADAMS Accession No. ML13059A501. TN10628.

PG&E (Pacific Gas & Electric Company). 2014. *DCPP 3D/2D Seismic-Reflection Investigation of Structures Associated with the Northern Shoreline Seismicity Sublineament of the Point Buchon Region*. GEO.DCPP.TR.12.01, Revision 1, Avila Beach, California. ADAMS Accession No. ML14260A035. TN10188.

PG&E (Pacific Gas & Electric Company). 2014. *DCPP Geologic Mapping Project, Plate 1: Geologic Map of the Irish Hills and Adjacent Area*. Ch9.GEO.DCPP.TR.14.01, Revision 0, Avila Beach, California. ADAMS Accession No. ML14260A068. TN10191.

PG&E (Pacific Gas & Electric Company). 2014. *Geologic Mapping and Data Compilation for the Interpretation of Onshore Seismic-Reflection Data*. GEO.DCPP.TR.14.01, Revision 0, Avila Beach, California. ADAMS Accession No. ML14260A069. TN10190.

PG&E (Pacific Gas & Electric Company). 2014. Letter from E.D. Halpin, Senior Vice President, to NRC Document Control Desk, dated December 22, 2014, regarding "Diablo Canyon Units 1 and 2, 10 CFR 54.21(b) Annual Update to the Diablo Canyon Power Plant License Renewal Application (LRA), Amendment 48 and LRA Appendix E, Applicant's Environmental Report - Operating License Renewal Stage, Amendment 1." PG&E Letter DCL-14-103, Diablo Canyon Power Plant, Avila Beach, California. ADAMS Accession Package No. ML14364A259. TN9843.

PG&E (Pacific Gas and Electric Company). 2015. Letter from E.D. Halpin, Senior Vice President, to NRC Document Control Desk, dated December 4, 2015, regarding "Response to NRC Letter dated November 5, 2015, "Request for Additional Information Related to the Environmental Review of the Diablo Canyon Power Plant, Units 1 and 2, License Renewal Application (CAC Nos. MF4019 and MF40200." PG&E Letter DCL-15-142, Diablo Canyon Power Plant, Avila Beach, California. ADAMS Accession Package No. ML16048A230. TN9836.

PG&E (Pacific Gas & Electric Company). 2019. Letter from J.M. Welsch, Senior Vice President and Chief Nuclear Officer, Diablo Canyon Power Plant, to NRC Document Control Desk, dated December 4, 2019, regarding "Diablo Canyon Power Plant, Units 1 and 2 - Post-Shutdown Decommissioning Activities Report." PG&E Letter DCL-19-077, Avila Beach, California. ADAMS Accession No. ML19338F173. TN10318.

PG&E (Pacific Gas & Electric). 2020. Letter from P. Gerfen, Site Vice President, to NRC Document Control Desk, dated April 16, 2020, regarding "Diablo Canyon Power Plant, Units 1 and 2, 2019 Annual Radiological Environmental Operating Report." ADAMS Accession No. ML20107F734. TN10065.

PG&E (Pacific Gas & Electric Company). 2020. Letter from P. Gerfen, Site Vice President, to NRC Document Control Desk, dated April 30, 2020, regarding “Diablo Canyon Units 1 and 2, 2019 Annual Radioactive Effluent Release Report.” PG&E Letter DCL-20-019, Avila Beach, California. ADAMS Accession No. ML20133J965. TN10093.

PG&E (Pacific Gas & Electric). 2021. Letter from P. Gerfen, Site Vice President, to NRC Document Control Desk, dated April 1, 2021, regarding “Diablo Canyon Power Plant, Units 1 and 2, 2020 Annual Radiological Environmental Operating Report.” ADAMS Accession No. ML21091A033. TN10066.

PG&E (Pacific Gas & Electric Company). 2021. Letter from P. Gerfen, Site Vice President, to NRC Document Control Desk, dated April 20, 2021, regarding “Diablo Canyon Units 1 and 2, 2020 Annual Radioactive Effluent Release Report.” PG&E Letter DCL-21-023, Avila Beach, California. ADAMS Accession No. ML21154A100. TN10094.

PG&E (Pacific Gas & Electric Company). 2022. Letter from M.R. Zawalick, Vice President, Decommissioning and Technical Services, to NRC Document Control Desk, dated October 12, 2022, regarding “Diablo Canyon Power Plant, Units 1 and 2 - Post-Shutdown Decommissioning Activities Report, Revision 1.” PG&E Letter DCL-22-042, Avila Beach, California. ADAMS Accession No. ML22293A419. TN10296.

PG&E (Pacific Gas & Electric Company). 2022. Letter from D. Petersen, Station Director, to NRC Document Control Desk, dated April 21, 2022, regarding “Diablo Canyon Units 1 and 2, 2021 Annual Radioactive Effluent Release Report.” PG&E Letter DCL-22-017, Avila Beach, California. ADAMS Accession No. ML22124A030. TN10095.

PG&E (Pacific Gas & Electric). 2022. Letter from D.B. Petersen, Station Director, to NRC Document Control Desk, dated April 21, 2022, regarding “Diablo Canyon Power Plant, Units 1 and 2, 2021 Annual Radiological Environmental Operating Report.” ADAMS Accession No. ML22111A327. TN10067.

PG&E (Pacific Gas & Electric Company). 2022. Letter from M.R. Zawalick, Vice President, to NRC Document Control Desk, dated March 9, 2022, regarding “License Renewal Application for the Diablo Canyon Independent Spent Fuel Storage Installation.” PG&E Letter DIL-22-003, Avila Beach, California. ADAMS Accession No. ML22068A189. TN10200.

PG&E (Pacific Gas & Electric). 2023. Letter from P. Gerfen, Senior Vice President and Chief Nuclear Officer, to NRC Document Control Desk, dated November 7, 2023, regarding “Diablo Canyon Units 1 and 2, Docket No. 50-275, OL-DPR-80, Docket No. 50-323, OL-DPR-82, License Renewal Application.” Avila Beach, California. ADAMS Accession No. ML23311A154. TN9822.

PG&E (Pacific Gas and Electric Company). 2023. Letter from C. Sutton, Manager, Radiation Protection, to NRC Document Control Desk, dated May 1, 2023, regarding “Diablo Canyon Power Plant, Units 1 and 2, 2022 Annual Radiological Environmental Operating Report.” PG&E Letter DCL-23-036, Avila Beach, California. ADAMS Accession No. ML23121A304. TN10036.

PG&E (Pacific Gas & Electric). 2023. Letter from C. Sutton, Manager, Radiation Protection, to NRC Document Control Desk, dated May 1, 2023, regarding “Diablo Canyon Power Plant, Units 1 and 2, 2022 Annual Radiological Environmental Operating Report.” ADAMS Accession No. ML23121A034. TN10068.

PG&E (Pacific Gas & Electric Company). 2023. Letter from D. Cortina, Manager, Chemistry and Environmental Services, to NRC Document Control Desk, dated May 1, 2023, regarding “Diablo Canyon Units 1 and 2, 2022 Annual Radioactive Effluent Release Report.” PG&E Letter DCL-23-025, Avila Beach, California. ADAMS Accession No. ML23121A323. TN10096.

PG&E (Pacific Gas & Electric). 2023. Letter from J.R. Morris, Manager, Regulatory Services, to NRC Document Control Desk, dated May 25, 2023, regarding “Diablo Canyon Power Plant Units 1 and 2, Submittal of Updated Final Safety Analysis Report, Revision 27.” PG&E Letter DCL-23-044, Avila Beach, California. ADAMS Accession Package No. ML23241A052. TN10090.

PG&E (Pacific Gas & Electric Company). 2023. *Preliminary Engineering Geology Report for the Decommissioning of the Diablo Canyon Power Plant, Response to County of San Luis Obispo Request April 5, 2022*. Report No. GEO.22.95, Revision 0, Avila Beach, California. TN10136.

PG&E (Pacific Gas & Electric Company). 2024. Letter from T.P. Jones, Senior Director, Regulatory, Environmental, & Repurposing, to NRC Document Control Desk, dated August 28, 2024, regarding “Diablo Canyon Power Plant Decommissioning Draft Biological Assessment and Draft Essential Fish Habitat Assessment.” PG&E Letter DCL-24-082, Avila Beach, California. ADAMS Accession No. ML24241A271. TN10611.

PG&E (Pacific Gas & Electric Company). 2024. *Diablo Canyon Updated Seismic Assessment, Response to Senate Bill 846*. Avila Beach, California. TN10192.

PG&E (Pacific Gas and Electric Company). 2024. Email from T. Rebel, PG&E, to K. Conway, NRC, dated July 10, 2024, regarding “Dredge Data and File Location on Certrec.” Avila Beach, California. ADAMS Accession No. ML24199A063. TN10226.

PG&E (Pacific Gas & Electric). 2024. Letter from C.D. Sutton, Manager, Radiation Protection, to NRC Document Control Desk, dated May 1, 2024, regarding “Diablo Canyon Power Plant, Units 1 and 2, 2023 Annual Radiological Environmental Operating Report.” ADAMS Accession No. ML24122C609. TN10069.

PG&E (Pacific Gas & Electric Company). 2024. Letter from D. Cortina, Manager, Chemistry and Environmental Services, to NRC Document Control Desk, dated April 28, 2024, regarding “Diablo Canyon Units 1 and 2, 2023 Annual Radioactive Effluent Release Report.” PG&E Letter DCL-24-027, Avila Beach, California. ADAMS Accession No. ML24120A379. TN10097.

PG&E (Pacific Gas and Electric Company). 2024. Letter from M.R. Zawalick, Vice President, Business and Technical Services, to NRC Document Control Desk, dated May 16, 2024, regarding “Responses to NRC Requests for Additional Information on the Diablo Canyon Power Plant License Renewal Application Environmental Report.” PG&E Letter DCL-24-052, Avila Beach, California. ADAMS Accession No. ML24137A314. TN10032.

PG&E (Pacific Gas & Electric Company). 2024. Letter from M.R. Zawalick, Vice President, Business and Technical Services, to NRC Document Control Desk, dated August 15, 2024, regarding “Responses to NRC Requests for Additional Information on the Diablo Canyon Power Plant License Renewal Application Severe Accident Mitigation Alternatives Analysis.” PG&E Letter DCL-24-077, Avila Beach, California. ADAMS Accession No. ML24229A120. TN10619.

PG&E (Pacific Gas & Electric Company). 2024. Letter from T. Jones, Senior Director, Regulatory, Environmental & Repurposing, Pacific Gas & Electric Company, to NRC Document Control Desk, dated December 13, 2024, regarding "Diablo Canyon Units 1 and 2 Docket No. 50-275, OL-DPR-80 Docket No. 50-323, OL-DPR-82 Diablo Canyon Power Plant Draft Supplemental Environmental Impact Statement Comment Letter." Avila Beach, California. ADAMS Accession No. ML24348A232. TN11890.

PG&E (Pacific Gas & Electric Company). 2024. Letter from T. Rebel, Manager, Environmental Protection - Diablo Canyon Power Plant, to J. Viezbicke, California Stranding Network Coordinator, NOAA Fisheries, dated July 2, 2024, regarding "Sea Turtle Stranding Report (Loggerhead Sea Turtle) Diablo Canyon Power Plant." PG&E Letter DCL-2024-527, Avila Beach, California. ADAMS Accession No. ML24212A209. TN10618.

PG&E (Pacific Gas & Electric Company). 2025. Letter from M.R. Zawalick, Vice President Business and Technical Services, to D. Zizmor, Esq., dated January 14, 2025, regarding "Re: Pacific Gas and Electric Company's Response to California Public Utility Commission Independent Peer Review Panel Report No. 16." Avila Beach, California. TN11539.

Phillips, J., L. Sievanen, G. Griggs, C. Colgan, J. Finzi Hart, E. Hartge, T. Hill, R. Kudela, N. Mantua, K. Nielsen, and L. Whiteman. 2018. *California's Coast and Ocean Summary Report*. California's Fourth Climate Change Assessment, SUMCCC4A-2018-011, Sacramento, California. TN10290.

Planert, M. and J.S. Williams. 1995. *Ground Water Atlas of the United States, Segment 1, California, Nevada*. Hydrologic Investigations Atlas 730-B, Reston, Virginia. TN10088.

Pollution Prevention Act of 1990. 42 U.S.C. § 13101 *et seq*. TN6607.

Price, B. A. and T. Clark. 2019. *National Register of Historic Places Registration form: Rancho Cañada de los Osos y Pecho y Islay Archaeological District (Boundary Increase.* Applied EarthWorks Inc., San Luis Obispo, California. TN10294.

Price, B.A. and M. Trumbly. 2009. *Cultural Resources Overview for the Diablo Relicensing Feasibility Study, San Luis Obispo, Monterey, Fresno, Kings and Kern Counties, California*. Applied EarthWorks, Inc., Fresno, California and Pacific Gas and Electric Company, Sacramento, California. ADAMS Accession No. ML11166A177. TN9832.

Raimondi, P. 2023. Recommendations to Update the Interim Mitigation Cost Calculation for Once-Through Cooling Intake Use Leading to Marine Life Entrainment and Impingement. University of California- Santa Cruz, California. TN11887.

Resource Conservation and Recovery Act of 1976. 42 U.S.C § 6901 *et seq*. Public Law 94-580, 90 Stat. 2795. TN1281.

Riddell, F.A. 1966. *An Archaeological Reconnaissance of the Diablo Creek Vicinity*, *San Luis Obispo County, California*. Sacramento, California. TN10043.

San Luis Obispo County Code § 22.10. Title 22, *Land Use Ordinance*, Article 3, *Site Planning and Project Design Standards*, Chapter 22.10, *General Property Development and Operating Standards*. San Luis Obispo, California. TN10196.

San Luis Obispo County Code § 23.06. Title 23, *Coastal Zone Land Use,* Chapter 23.06, *Operational Standards.* San Luis Obispo, California. TN10197.

San Luis Obispo Peace v. Nuclear Regulatory Commission (San Luis Obispo Mothers for Peace v. NRC*).* 2006*.* 449 F.3d 1016 (9th Cir. 2006). U.S. Court of Appeals Ninth Circuit Decision, June 2, 2006. TN6959.

Santa Ynez Band of Chumash Indians. 2024. Email from A. McAdams, Executive Assistance, Legal Department, Santa Ynez Band of Chumash Indians, to NRC, dated February 15, 2024, regarding "SYBCI Comments - Diablo Canyon NOI." Santa Ynez, California. ADAMS Accession No. ML24108A054. TN10281.

Santa Ynez Band of Chumash Indians. 2024. Letter from Crystal Mendoza, Cultural Resources Administrative Assistant, Santa Ynez Band of Chumash Indians, to J. Trefethen, Environmental Project Manager, NRC, dated February 22, 2024, regarding "Re: Diablo Canyon Nuclear Power Plant, Units 1 and 2." Santa Ynez, California. ADAMS Accession No. ML24058A256. TN10310.

Seitz G., P.L. Johnson, R. Chen, and T. Dawson. 2024. *Initial Review of the PG&E "Updated Seismic Assessment, February 2024" by the Independent Peer Review Panel for Seismic Hazard Studies of the Diablo Canyon Nuclear Power Plant*. IPRP Report No. 16, County of San Luis Obispo, California. TN11537.

SLATE (SLATE Geotechnical Consultants). 2020. Letter from C.J., Associate Principal Geologist, and S.C., Consultant, to W. Page, PG&E Principal Geologist, and J. Bachhuber, PG&E Director of Geosciences, dated December 9, 2020, regarding "Diablo Canyon Power Plant Groundwater Study Phase 1 - Findings and Recommendations, Final Memorandum." TN10303.

SLOC (San Luis Obispo County). 2023. *Annual Comprehensive Financial Report, County of San Luis Obispo, California, Fiscal Year Ended June 30, 2023*. San Luis Obispo, California. TN10288.

SLOC (San Luis Obispo County). 2023. "Diablo Canyon Power Plant Decommissioning Project, Draft Environmental Impact Report." San Luis Obispo, California. Accessed June 25, 2024, at https://www.slocounty.ca.gov/departments/planning-building/grid-items/community-engagement/active-planning-projects/diablo-canyon-power-plant-decommissioning-(1)/draft-environmental-impact-report. TN10105.

SLOCAPCD (San Luis Obispo County Air Pollution Control District). 2024. "Public Safety Power Shutoff, Information on the Use of Backup Generators." San Luis Obispo, California. Accessed July 8, 2024, at https://www.slocleanair.org/rules-regulations/psps.php. TN10174.

Smithsonian (Smithsonian Institution). 2024. "National Anthropological Archives, Guide to the John Peabody Harrington papers, 1907-1959 (some earlier)." Washington, D.C. Accessed July 24, 2024, at https://sova.si.edu/record/naa.1976-95/contents. TN10283.

SMWLLP (Shute, Mihaly, and Weinberger, LLP). 2024. Letter from T. Gibbons, Attorney, Shute, Mihaly, and Weinberger, LLP, to K. Conway, Project Manager, Nuclear Regulatory Commission, dated December 13, 2024, regarding “Comments of the yak tityu tityu yak tiłhini Northern Chumash Tribe re the Nuclear Regulatory Commission’s Draft Supplemental Environmental Impact Statement for Pacific Gas and Electric Company’s Diablo Canyon Nuclear Power Plant, Units 1 and 2 [Docket No. NRC-2023-0192; NUREG-1437, Supplemental 62, draft].” San Francisco, California. ADAMS Accession No. ML25008A048. TN11886.

SNL (Sandia National Laboratories). 2006. *Mitigation of Spent Fuel Pool Loss-of Coolant Inventory Accidents and Extension of Reference Plant Analyses to Other Spent Fuel Pools*. Sandia Letter Report, Revision 2, Albuquerque, New Mexico. November. ADAMS Accession No. ML120970086. TN7830.

Stantec (Stantec Consulting Services Inc.). 2023. *Diablo Canyon Power Plant Intake Cove Dredging Project, Administrative Draft Environmental Assessment*. San Francisco, California. TN10661.

State of California. 2018. *Senate Bill No. 100, California Renewables Portfolio Standard Program: emissions of greenhouse gases*. Sacramento, California. TN9855.

State of California. 2022. *Senate Bill No. 846, Diablo Canyon powerplant: extension of operations*. Sacramento, California. TN10038.

Steinbeck, J. 2008. *Compilation of California Coastal Power Plant Entrainment and Impingement Estimates for California State Water Resources Control Board Staff Draft Issue Paper on Once-through Cooling*. Pismo Beach, California. TN10210.

Storrer (Storrer Environmental Services). 2022. *Site Assessment for California Tiger Salamander* (Ambystoma californiense)*, Diablo Canyon Power Plant, San Luis Obispo County, California*. Santa Barbara, California. TN10138.

Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White and C. Zuzak. 2022. *Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines*. National Oceanic and Atmospheric Administration, Silver Spring, Maryland. TN10207.

SWRCB (State Water Resources Control Board). 2022. “2020-2022 California Integrated Report.” Sacramento, California. Accessed June 6, 2024, at https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/2020_2022_integrated_report.html. TN10084.

SWRCB (State Water Resources Control Board). 2024. “California Integrated Water Quality System Project (CIWQS), Facility At-A-Glance Report.” Washington, D.C. Accessed June 17, 2024, at https://ciwqs.waterboards.ca.gov/ciwqs/. TN10087.

SWRCB (State Water Resources Control Board). 2024. “National Pollutant Discharge Elimination System (NPDES) - Wastewater.” Washington, D.C. Accessed June 11, 2024, at https://www.waterboards.ca.gov/water_issues/programs/npdes/. TN10086.

SWRCB-DDW (State Water Resources Control Board-Division of Drinking Water). 2024. "California Drinking Water System Area Boundaries." Sacramento, California. Accessed on June 3, 2024, at https://gispublic.waterboards.ca.gov/portal/home/webmap/viewer.html?useExisting=1&layers=fbba842bf134497c9d611ad506ec48cc. TN10031.

Tegen, S. 2006. *Comparing Statewide Economic Impacts of New Generation from Wind, Coal, and Natural Gas in Arizona, Colorado, and Michigan*. NREL/TP-500-37720, National Renewable Energy Laboratory, Golden, Colorado. TN10177.

Tegen, S. 2016. "Wind Energy Workforce Development & Jobs." *Nebraska Wind and Solar Conference*, Lincoln, Nebraska. TN8826.

Tenera (Tenera Environmental Services). 1988. *Pacific Gas and Electric Company*, *Diablo Canyon Power Plant, Final Report, Thermal Effects Monitoring Program, Volume 1*. Berkely, California. ADAMS Accession No. ML1166A219. TN10247.

Tenera (Tenera Environmental Services). 2000. *Diablo Canyon Power Plant 316(b) Demonstration Report*. San Francisco, California. ADAMS Accession No. ML003689887. TN10211.

Tenera (Tenera Environmental Services). 2021. *Diablo Canyon Decommissioning, Marine Biological Resources Assessment, Revision 1*. San Luis Obispo, California. TN10249.

Terra Verde (Terra Verde Environmental Consulting, LLC and ERM). 2020. *Diablo Canyon Decommissioning, Terrestrial Biological Resources Assessment*. San Luis Obispo, California. TN10098.

Terra Verde (Terra Verde Environmental Consulting, LLC). 2021. *Preliminary Oak Tree Inventory and Mitigation Plan for Pacific Gas & Electric, Diablo Canyon Power Plant Decommissioning Project*. San Luis Obispo, California. TN10101.

Thompson, M., J.A. Beston, M. Etterson, J.E. Diffendorfer, and S.R. Loss. 2017. "Factors Associated with Bat Mortality at Wind Energy Facilities in the United States." *Biological Conservation*, 215:241-254, *Elsevier*, Amsterdam, Netherlands. TN8746.

TVA (Tennessee Valley Authority)*. 2013. Sequoyah Nuclear Plant, Units 1 and 2, License Renewal Application, Appendix E, Applicant's Environmental Report, Operating License Renewal Stage*. Chattanooga, Tennessee: TVA. January 7, 2013. ADAMS Nos. ML13024A012, ML13024A013, ML13024A006, ML13024A007, ML13024A008, ML13024A009, and ML13024A010. TN7899.

UCSC (University of California Santa Cruz). 2024. "Multi-Agency Rocky Intertidal Network (MARINe), SSWS Updates." Santa Cruz, California. Accessed October 7, 2024, at https://marine.ucsc.edu/data-products/sea-star-wasting/updates.html#:~:text=Sea%20star%20observations%20submitted%20over,us%20in%20CA%20since%202018. TN10613.

USCB (United States Census Bureau). 2000. “Profile of General Demographic Characteristics: 2000, Hood County, Texas; Somervell County, Texas; Tarrant County, Texas.” Washington, D.C. Available at https://data.census.gov/table?q=2000+population&t=Population+Total&g=050XX00US48221,48425,48439&tid=DECENNIALDPSF42000.DP1. TN9672.

USCB (U.S. Census Bureau). 2020. Decennial Census, DEC Demographic and Housing Characteristics, Table P5, “Hispanic or Latino Origin by Race,” All Block Groups within California. Washington, D.C. Accessed on June 4, 2024, at https://data.census.gov/table/DECENNIALDHC2020.P5?q=P5:%20HISPANIC%20OR%20LATINO%20ORIGIN%20BY%20RACE&g=040XX00US06$1500000&y=2020&d=DEC%20Demographic%20and%20Housing%20Characteristics. TN10033.

USCB (U.S. Census Bureau). 2021. American Community Survey, 5-Year Estimates Subject Tables, Table S0802, “Means of Transportation to Work by Selected Characteristics,” California. Washington, D.C. Accessed October 24, 2024, at https://data.census.gov/table/ACSST1Y2021.S0802?text=S0802&g=040XX00US06&moe=false. TN10784.

USCB (U.S. Census Bureau). 2023. “Press Kit: 2018-2022 American Community Survey 5-Year Estimates.” Washington, D.C. Accessed July 9, 2024, at https://www.census.gov/newsroom/press-kits/2023/acs-5-year.html. TN10186.

USCB (U.S. Census Bureau). 2024. “TIGER/Line Shapefiles, 2022.” Washington, D.C. Accessed July 22, 2024, at https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.2022.html#list-tab-790442341. TN10250.

USDA (U.S. Department of Agriculture). 2017. *2017 Census of Agriculture - County Data, California, Table 7. Hired Farm Labor - Workers and Payroll: 2017*. Washington, D.C. TN10185.

USDA (United States Department of Agriculture). 2017. “2017 Census Volume 1, Chapter 2: County Level Data, Texas.” Washington, D.C. Available at https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Texas/. TN9674.

USDA (U.S. Department of Agriculture). 2024. *Custom Soil Resource Report for San Luis Obispo County, California, Coastal Part*. Washington, D.C. TN10187.

USGCRP (U.S. Global Change Research Program). 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment*. J.M. Melillo, T.C. Richmond, and G.W. Yohe (eds.). U.S. Government Printing Office, Washington, D.C. ADAMS Accession No. ML14129A233. TN3472.

USGCRP (U.S. Global Change Research Program). 2017. *Climate Science Special Report: Fourth National Climate Assessment*. Volume I. Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.). Washington, D.C. ADAMS Accession No. ML19008A410. doi: 10.7930/J0J964J6. TN5848.

USGCRP (U.S. Global Change Research Program). 2018. *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*. Volume II. D.R. Reidmiller, C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.). Washington, D.C. ADAMS Accession No. ML19008A414. doi: 10.7930/NCA4.2018. TN5847.

USGCRP (U.S. Global Change Research Program). 2023. *The Fifth National Climate Assessment*. A.R. Crimmins, C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. Washington, D.C. Available at https://doi.org/10.7930/NCA5.2023. TN9762.

USGCRP (U.S. Global Change Research Program). 2024. "U.S. Climate Resilience Toolkit, Southwest." Washington, D.C. Accessed June 12, 2024 at https://toolkit.climate.gov/regions/southwest. TN10064.

USGS (U.S. Geological Survey). 2024. "Search Earthquake Catalog, Earthquake Hazards Program." Latitude 35.2119, Longitude -120.85507, Reston, Virginia. Accessed July 11, 2024 at https://earthquake.usgs.gov/earthquakes/search/. TN10198.

WAPA/FWS (Western Area Power Administration, U.S. Fish and Wildlife Service). 2015. *Upper Great Plains Wind Energy Programmatic Environmental Impact Statement, Final*. DOE/EIS-0408, Billings, Montana and Lakewood, Colorado. TN8725.

Whiteman, J. 2013. *Reflections of Japanese Farming Along the Pecho Coast of California.* Northwest Cultural Resource Consultants, Pioneer, California. TN10295.

YTT Northern Chumash Tribe. 2024. Email from S. Lathrop, YTT Northern Chumash Tribe, to M. Rome, Branch Chief, NRC, dated February 7, 2024, regarding "Re: Tribal Consultation Request." San Luis Obispo, California. ADAMS Accession No. ML24045A197. TN10309.

Zhao, Y., L. Shi, X. Zhang, J. Gao, G. Luo, C. Ye, and Y. Tang. 2024. "Life cycle CO2 emission assessment of an organic Rankine cycle based geothermal power plant." *International Journal of Low-Carbon Technologies* 19: 149-156, *Oxford University Press*, Oxford, England. TN10632.

6 LIST OF PREPARERS

Members of the U.S. Nuclear Regulatory Commission (NRC) Office of Nuclear Material Safety and Safeguards prepared this supplemental environmental impact statement (SEIS) with assistance from other NRC organizations and Pacific Northwest National Laboratory (PNNL). Table 6-1 identifies each preparer's name, education and experience, and function or expertise.

Table 6-1 List of Preparers

Name	Education and Experience
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Lloyd Desotell, NRC	MS Civil Engineering MS Water Resources Management BA Environmental Studies Over 20 years of experience conducting surface and subsurface hydrologic analyses
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Stephen Koenick, NRC	MS Environmental Engineering BS Mechanical Engineering Over 30 years of government experience
Nancy Martinez, NRC	BS Earth and Environmental Science AM Earth and Planetary Science 13 years of experience in environmental impact analysis
John Parillo, NRC	MS Environmental Engineering BS Mechanical Engineering 50 years of experience in nuclear power, primarily in design basis and severe accident dose consequence analysis

Table 6-1 List of Preparers (Continued)

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Jeffrey Rikhoff, NRC	MRP Regional Environmental Planning MS Development Economics BA English 44 years of combined industry and government experience in NEPA compliance for DOE Defense Programs/NNSA and Nuclear Energy, DoD, and DOI; project management; land use and socioeconomics impact analysis, historic and cultural resource impact assessments, consultation with American Indian Tribes, and comprehensive industrial land use and development planning studies
Ted Smith, NRC	MS Environmental Engineering BS Electrical Engineering 38 years of experience, including DOE Power Administration support of site environmental management programs and spent fuel management; oversight of U.S. Navy nuclear ships design, construction, and operation; and NRC project management
Gerry Stirewalt, NRC	PhD Structural Geology with 2 Post-Doctoral Appointments BA Geology/Mathematics Registered PG and CEG 50+ years relevant experience in Environmental and Engineering Geology, including 3-D geospatial modeling of subsurface stratigraphy, tectonic faults, and groundwater contaminant plumes
Jean Trefethen, NRC	BA Biology and Chemistry Duke NEPA Certificate 15 years of professional experience
Teresa Carlon, PNNL	BS Information Technology 30 years of experience as SharePoint administrator, project coordinator, and databases
Kirsten Chojnicki, PNNL	PhD Geological Sciences MS Geological Sciences BS Earth and Space Science 7 years management experience 12 years of experience in geology, 3 years of experience in environmental impact analysis
Caitlin Condon, PNNL	PhD Radiation Health Physics BS Environmental Health 6 years of experience in health physics, NEPA environmental impact assessments, waste management, radionuclide dispersion and dosimetry modeling
Julia Flaherty, PNNL	MS Environmental Engineering BS Civil Engineering 20 years of experience in boundary layer meteorology and dispersion modeling

Table 6-1 List of Preparers (Continued)

Name	Education and Experience
	15 years of experience in NEPA environmental impact assessments
Tracy Fuentes, PNNL	PhD Urban Design and Planning MS Plant Biology BS Botany Over 15 years of experience, including NEPA planning; environmental impact analysis, environmental resource monitoring, data analysis, and research
Dave Goodman, PNNL	JD Law BS Economics 12 years of experience including NEPA environmental impact assessments, ecological restoration, Endangered Species Act, land use and visual resources, and environmental law and policy
Lexie Goldberger, PNNL	MS Atmospheric Sciences BS Geophysical Sciences 10 years of experience including NEPA environmental impact assessments, field deployments, data analysis, and research
William Ivans, PNNL	PhD Fire Protection Engineering MS Fire Protection Engineering MS Nuclear Engineering BS Nuclear Engineering 18 years of experience in probabilistic risk assessment, nuclear safety analysis, and technical reviews of risk-informed license amendment requests and severe accident mitigation alternatives
Rebecka Iveson, PNNL	MS Hydrogeology and Water Resource Management BS Earth and Environmental Science 5+ years in groundwater resource assessment and environmental impact evaluation, contaminated land risk assessment and remediation, and natural resource management and monitoring
Hayley McClendon, PNNL	BS Environmental Science 8 years of experience in environmental compliance and technical document preparation and review.
Philip Meyer, PNNL	PhD Civil Engineering MS Civil Engineering BA Physics 30 years relevant experience in subsurface hydrology and contaminant transport, including 15 years of experience in groundwater resource assessment and environmental impacts analysis
Dan Nally, PNNL	MA Urban and Environmental Policy and Planning BS Biology 11 years of experience in preparation and review of NEPA documents, related regulatory compliance, and conducting public outreach and engagement
Tara O'Neil, PNNL	MBA Business Administration BA Anthropology 32 years of relevant experience in NEPA environmental impact assessments, program/project management, cultural resource management, Section 106 compliance, stakeholder engagement and management, and Tribal consultation and Engagement
Mike Parker, PNNL	BA English Literature

Table 6-1 List of Preparers (Continued)

Name	Education and Experience
	25 years of experience copyediting, document design, and formatting and 20 years of experience in technical editing
Rajiv Prasad, PNNL	PhD Civil and Environmental Engineering MTech Civil Engineering BE Civil Engineering 25 years of experience in applying hydrologic principles to water resources engineering, hydrologic design, flooding assessments, environmental engineering, and impacts assessment including 15 years of experience in NEPA environmental assessments of surface water resources
Lindsey Renaud, PNNL	MA Anthropology BA Anthropology 12 years in cultural resource management, Section 106 and 110 compliance, and NEPA environmental impact assessments. Secretary of the Interior-qualified Registered Professional Archaeologist. Experience in Tribal engagement and Native American Graves Protection and Repatriation Act compliance
Kacoli Sen, PNNL	PhD Cancer Biology MS Zoology (Specialization Ecology) BS Zoology Diploma in Environmental Law Over 6 years of document editing and production experience
Steven Short, PNNL	MS Nuclear Engineering MBA Business Administration BS Nuclear Engineering 40 years of experience including nuclear safety analysis, probabilistic risk assessment, technical reviews of risk-informed license amendment requests and severe accident mitigation alternatives
Kazi Tamaddun, PNNL	PhD Civil and Environmental Engineering MS Civil Engineering 8 years of experience in hydrologic, hydraulic, ecosystem, and water systems modeling; hydro-climatology; climate change modeling and analysis

AM or MA = Master of Arts; BA = Bachelor of Arts; BE = Civil Engineering; BS = Bachelor of Science; CEG = Certified Engineering Geologist; DoD = U.S. Department of Defense; DOE = U.S. Department of Energy; DOI = U.S. Department of the Interior; JD Law = Juris Doctor Program; MBA = Master of Business Administration; MRP = Master of Regional Planning; MS = Master of Science; NEPA = National Environmental Policy Act of 1969; NNSA = National Nuclear Security Administration; NRC = U.S. Nuclear Regulatory Commission; PG = Professional Geologist; PhD = Doctor of Philosophy; PNNL = Pacific Northwest National Laboratory.

7 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT ARE SENT

Table 7-1 List of Agencies, Organizations, and Persons to Whom Copies of this Supplemental Environmental Impact Statement Are Sent

Name	Affiliation
Anthony Chu	California Department of Public Health
Hon. Charmaine McDarment	Tule River Tribe
Chloe Nelson	U.S. Environmental Protection Agency
David Hochschild	California Energy Commission
Delphine Hou	California Department of Water Resources
Hon. Gabe Frausto	Coastal Band of Chumash Indians
Hon. Gary Pierce	Salian Tribe of Monterey and San Luis Obispo Counties
Jennifer Quan	National Marine Fisheries Service
Julianne Polanco	California Office of Historic Preservation
Justin Cochran, Sr.	California Energy Commission
Hon. Kenneth Kahn	Santa Ynez Band of Chumash Indians
Hon. Mona Olivas Tucker	yak titʸu titʸu yak tiłhini Northern Chumash
Po-Chieh Ting	U.S. Environmental Protection Agency
Reid Nelson	Advisory Council on Historic Preservation
Tom Luster	California Coastal Commission
Trevor Keith	San Luis Obispo County Department of Planning and Building
Tribal Council	San Luis Obispo County Chumash Indians
Susan Strachan	San Luis Obispo County Department of Planning and Building
Hon. Violet Sage Walker	Northern Chumash Tribal Council
Ventura Field Office	U.S. Fish and Wildlife Service

This supplemental environmental impact statement will also be provided to commenters who provided their contact information during the scoping period. The NRC staff has listed the names of all commenters in the scoping summary report (Agencywide Documents Access and Management System (ADAMS) Accession No. ML24240A023).

APPENDIX A

COMMENTS RECEIVED ON THE DIABLO CANYON NUCLEAR POWER PLANT, UNITS 1 AND 2 ENVIRONMENTAL REVIEW

A.1 Comments Received During the Scoping Period

The scoping process began on January 24, 2024, with the publication by the U.S. Nuclear Regulatory Commission (NRC, Commission) of a notice of intent to conduct scoping in the Federal Register (89 FR 4631-TN10001). The scoping process included two public meetings: a virtual meeting held on February 1, 2024, and an in-person meeting held in San Luis Obispo, California, on February 8, 2024. The meetings consisted of prepared statements by NRC staff and a public comment session. Attendees provided oral statements that were recorded and transcribed by a certified court reporter. Written statements submitted at the public meetings are captured in the NRC's Agencywide Documents Access and Management System (ADAMS). The transcripts of the meetings are included as an attachment to the scoping meetings summary, dated May 7, 2024 (ML24108A144; NRC 2024-TN10209). In addition to the comments received during the public meetings, comments were also received electronically via submissions through Regulations.gov and emails sent to the NRC. At the conclusion of the scoping process, the NRC staff issued a scoping summary report (NRC 2024-TN10608). The report contains comments received during the public meetings and electronically during the scoping period as well as the NRC staff's consideration of these comments.

A.2 Comments Received on the Draft Supplemental Environmental Impact Statement

In October and November 2024, the NRC staff published NUREG-1437, Supplement 62, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding License Renewal of Diablo Canyon Nuclear Power Plant, Units 1 and 2, Draft Report for Comment" (draft SEIS), provided the draft SEIS to Federal, State, Tribal, and local government agencies as well as to interested members of the public, and issued a Notice of Availability of the draft SEIS in the *Federal Register* (89 FR 87433-TN11730). The U.S. Environmental Protection Agency (EPA) issued its Notice of Availability of the draft SEIS in the *Federal Register* on November 1, 2024 (89 FR 87366-TN11731). The public comment period was 45 days and ended on December 16, 2024. As part of the process to solicit public comments on the draft SEIS, the NRC staff did the following:

- placed copies of the draft SEIS at the San Luis Obispo Library in San Luis Obispo, California
- made a copy of the draft SEIS available in the NRC's Public Document Room in Rockville, Maryland
- provided access to the draft SEIS at several locations on the NRC website
- provided a copy of the draft SEIS to any member of the public at the in-person public meeting held on November 20, 2024
- sent letters to certain Federal, State, Tribal, and local government agencies informing them how they could access the draft SEIS electronically

- published a Notice of Availability of the draft SEIS in the Federal Register as described above
- filed the draft SEIS with the EPA
- announced and held two public meetings to describe the preliminary results of the environmental review in the draft SEIS and to receive public comments

Approximately 140 people attended the virtual public meeting held on November 14, 2024. A majority of those attendees providing comments were supportive of the proposed license renewal (LR) of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon) and provided favorable comments on the draft SEIS. The NRC staff received comments on a range of topics including, but not limited to: the effects of continued operations on climate change; grid reliability concerns; the economic impacts of both continued operations and shutdown; the consideration of decarbonization goals and grid reliability issues in the no-action alternative; emissions estimates and assumptions associated with new energy sources; land stewardship and protection of resources; impacts to aquatic resources from once-through cooling systems; impacts on raptors from wind component of the renewables combination alternative; future demand based on the State of California's electrification goals; seismic hazards and concerns related to seismic characterization; assumptions related to transportation infrastructure in the Avila Beach area; impacts of uranium mining to support operations; and concerns related to reactor pressure vessel embrittlement.

Approximately 150 people attended the in-person public meeting held on November 20, 2024. A majority of those attendees providing comments were supportive of the proposed LR of Diablo Canyon and provided favorable comments on the draft SEIS. The NRC staff received comments on a range of topics including, but not limited to: the effects of continued operations on climate change; grid reliability concerns; the reasonableness of the alternatives to the proposed action; the need for realistic assumptions related to emissions for new energy sources; the economic impacts of both continued operations and shutdown; greenhouse gas emissions; land stewardship and protection of resources; future demand based on the State of California's electrification goals; seismic hazards and concerns related to seismic characterization; consideration of potential earthquake-generated tsunamis; impacts of uranium mining to support operations; long-term management of spent fuel and shipment of radioactive waste; and concerns related to reactor pressure vessel embrittlement.

A court reporter recorded the oral comments and prepared written transcripts of both public meetings (NRC 2024-TN11732, NRC 2024-TN11733).

In addition to the comments received at the public meetings, the NRC staff received additional comments from letters, emails, and submittals through Regulations.gov. To identify each individual comment, the NRC staff reviewed the transcripts of the public meetings and each letter, email, and Regulations.gov submittal related to the draft SEIS, all of which are accessible in ADAMS. The NRC staff identified statements related to the proposed action of Diablo Canyon LR and recorded the statements as comments.

Comments submitted during the comment period and the associated correspondence were given a specific comment identification number consisting of the correspondence identification number and a number associated with the sequential order of the comment within the specific document. Table A-1 lists individuals that provided comments during the comment period, including their affiliation (if stated), the correspondence identification number, the comment source, and the ADAMS Accession Number for the comment. Table A- lists the individuals submitting all or part of the form content from Correspondence ID 67 and ADAMS Accession No. ML24352A102. The comments and the NRC staff's responses thereto are provided in Sections A.2.1 through A.2.32 below. The comments are recited verbatim from the comment source.

Table A-1 Individuals Providing Comments on the Draft SEIS

Commenter	Affiliation (if stated)	Comment Source	ADAMS Accession Number	Correspondence ID
Alvarellos Jr., Jose L.		Regulations.gov	ML24324A216	37
Anonymous		Meeting Transcript	ML24346A026	50-56
Anonymous		Regulations.gov	ML24345A215	72
Anonymous	Californians for Green Nuclear Power, Inc.	Regulations.gov	ML24326A033	43
Anonymous	Mothers for Peace	Email	ML24324A050	21
Anonymous, Marvin		Meeting Transcript	ML24346A026	50-33
Arnold, Debbie	San Luis Obispo County Board of Supervisors	Meeting Transcript	ML24346A026	50-1
Asad, Khaled		Regulations.gov	ML24313A045	20
Ault, Gary		Regulations.gov	ML24324A222	35
Babiarz, Nina	Public Watchdogs	Meeting Transcript	ML24346A024	49-21
Bailey, John		Regulations.gov	ML24334A019	44
Baldwin, David	Local 403 Union	Meeting Transcript	ML24346A026	50-51
Beymer, John		Meeting Transcript	ML24346A026	50-16
Boyd, Daniel		Meeting Transcript	ML24346A026	50-40
Boyer, Michael	Santa Maria Valley Chamber of Commerce	Email	ML24326A039	28
Brown, Marilyn E.		Email	ML24351A038	61
Brown, Mike	Coalition of Labor, Business and Agriculture of Santa Barbara County	Meeting Transcript	ML24346A026	50-38
Brown, Susannah		Meeting Transcript	ML24346A026	50-17
Budy, David		Email	ML24317A023	8
Bunk, Fereshteh		Meeting Transcript	ML24346A026	50-18
Burnham, Christopher		Meeting Transcript	ML24346A026	50-24
Burnham, Christopher		Meeting Transcript	ML24346A024	49-17
Calvo, Lucinda	California State Lands Commission	Regulations.gov	ML25008A036	73
Cannon, Michael	Cannon	Email	ML24324A051	22
Cannon, Mike		Meeting Transcript	ML24346A024	49-8

Table A-1 Individuals Providing Comments on the Draft SEIS (Continued)

Commenter	Affiliation (if stated)	Comment Source	ADAMS Accession Number	Correspondence ID
Carey, Michael		Email	ML24317A026	12
Chambers, Jeff	South County Chambers of Commerce	Email	ML24317A024	10
Chambers, Jeff	South County Chambers of Commerce	Meeting Transcript	ML24346A026	50-22
Christensen, Nicholas		Regulations.gov	ML24324A217	41
Clay, Jennifer	Mothers for Peace	Meeting Transcript	ML24346A026	50-45
Cochran, June		Email	ML24326A038	32
Cohen, Melanie	Mothers for Peace	Email	ML24319A245	18
Conner, Vicki	Econ Alliance	Meeting Transcript	ML24346A026	50-19
Cordero, Lisa		Meeting Transcript	ML24346A026	50-5
Cordero, Mike		Meeting Transcript	ML24346A026	50-4
Cunningham, Jordan		Email	ML24326A041	30
Curran, Diane	San Luis Obispo Mothers for Peace	Email	ML24351A252	63
Dionne, Rachel		Meeting Transcript	ML24346A026	50-34
Donez, Francisco	U.S. Environmental Protection Agency	Regulations.gov	ML25058A185	83
Eggers, Frank		Regulations.gov	ML24324A223	40
Fitzer, Joe		Meeting Transcript	ML24346A026	50-29
Fledderman, Jude		Meeting Transcript	ML24346A026	50-47
Foote, Michael	Regional Economic Action Coalition (REACH)	Meeting Transcript	ML24346A026	50-50
French, Walter		Meeting Transcript	ML24346A024	49-10
Fuss, Marilyn		Email	ML24310A130	2
Gale, Daryl		Meeting Transcript	ML24346A024	49-7
Gale, Daryl		Meeting Transcript	ML24346A026	50-30
Gibbons, Tori	On behalf of the yak tit^{y}u tit^{y}u yak tiłhini Northern Chumash Tribe	Regulations.gov	ML25008A048	82
Gorania, Anil		Regulations.gov	ML24313A047	23
Greening, Eric		Email	ML24348A243	54
Greening, Eric		Meeting Transcript	ML24346A024	49-1
Greening, Eric		Meeting Transcript	ML24346A024	49-23
Grijalva, Ally		Meeting Transcript	ML24346A026	50-42
Gutierrez, Thomas		Meeting Transcript	ML24346A026	50-37

Table A-1 Individuals Providing Comments on the Draft SEIS (Continued)

Commenter	Affiliation (if stated)	Comment Source	ADAMS Accession Number	Correspondence ID
Hamilton, Shelley	Mothers for Peace	Email	ML24326A036	27
Hamon Jr., John R.	City of Paso Robles	Email	ML24313A224	3
Hanke, Aaron	Santa Barbara County	Meeting Transcript	ML24346A026	50-3
Harvey, Susan	Sierra Club, Santa Lucia Chapter	Email	ML24350A001	55
Hisasue, Carole		Email	ML24348A244	59
Hisasue, Carole		Regulations.gov	ML25008A052	59
Hoff, Heather	Mothers for Nuclear	Email	ML24351A204	56
Holland, Carl E.		Email	ML24350A002	62
Hopf, James		Email	ML24351A253	52
Hopf, James		Meeting Transcript	ML24346A024	49-3
Hotchkiss, Frank		Email	ML24313A229	7
Huang, Julia		Meeting Transcript	ML24346A026	50-48
Hucik, Steven		Email	ML24346A008	47
Inman, Stacy		Meeting Transcript	ML24346A026	50-8
Jiang, "Joy" Yue	The Breakthrough Institute	Regulations.gov	ML25008A056	80
Johnson, Jack	International Brotherhood of Electrical Workers (IBEW) Local 639	Meeting Transcript	ML24346A026	50-27
Jones, Thomas P.	Pacific Gas and Electric Company	Email	ML24348A232	65
Kirkland, Gary		Meeting Transcript	ML24346A024	49-24
Kirkland, Gary		Meeting Transcript	ML24346A024	49-4
Kohlen, Patricia		Email	ML24326A035	31
Lathrop, Scott	yak titʸu titʸu yak tiłhini Northern Chumash Tribe	Meeting Transcript	ML24346A026	50-41
Lavagnino, Steve	Santa Barbara County Board of Supervisors	Meeting Transcript	ML24346A026	50-2
Lewis, Sherry	San Luis Obispo Mothers for Peace	Meeting Transcript	ML24346A026	50-21
Lindsey, John		Meeting Transcript	ML24346A026	50-35
Lodge, Ryan E.	California Coast Regional Water Quality Control Board	Email	ML24351A243	71
Louis, Daniel		Regulations.gov	ML24324A226	39
Lovering, Jessica	Good Energy Collective	Meeting Transcript	ML24346A024	49-5
Lovering, Jessica	Good Energy Collective	Meeting Transcript	ML24346A026	50-13

Table A-1 Individuals Providing Comments on the Draft SEIS (Continued)

Commenter	Affiliation (if stated)	Comment Source	ADAMS Accession Number	Correspondence ID
Lucas, Fernanda		Meeting Transcript	ML24346A026	50-44
Lundquist, Dina		Meeting Transcript	ML24346A026	50-6
Luster, Tom	California Coastal Commission	Email	ML24351A190	51
Malone, Don		Meeting Transcript	ML24346A026	50-36
Mansfield-Wells, Julie		Email	ML24351A251	68
Mansfield-Wells, Julie		Regulations.gov	ML25008A061	68
Martin, Ph.D., Ronald J.		Email	ML24351A235	60
McClintock, Francene		Regulations.gov	ML25008A049	81
Medrano, Joshua	Tri-Counties Building and Construction Trades Council	Meeting Transcript	ML24346A026	50-46
Meyer, Eric		Regulations.gov	ML24334A020	45
Meyers, Gwen		Email	ML24346A007	46
Miller, Ted		Regulations.gov	ML24345A207	69
Mousharrafie, Zachary		Meeting Transcript	ML24346A026	50-39
Nelson, Bob	Santa Barbara County	Email	ML24319A246	16
Nelson, Chloe	Environmental Protection Agency	Meeting Transcript	ML24346A024	49-6
Nelson, Gene	Californians for Green Nuclear Power	Meeting Transcript	ML24346A026	50-49
Nordby, Ingrid	Deep Fission	Meeting Transcript	ML24346A024	49-20
Olsen, Steve		Email	ML24313A226	5
O'Mahoney, Kevin		Meeting Transcript	ML24346A026	50-52
Ortiz-Legg, Dawn	San Luis Obispo County	Meeting Transcript	ML24346A024	49-22
Ortiz-Legg, Dwan	San Luis Obispo County	Email	ML24318C466	13
Ortiz-Wines, Paris		Email	ML24352A102	67
Osborne, Jenelle	City of Lompoc	Meeting Transcript	ML24346A026	50-7
Parks, Linda	Mothers for Peace	Meeting Transcript	ML24346A026	50-43
Pelizzari, Michael		Email	ML24318C542	14
Perry, David		Email	ML24317A023	9
Pfremmer, Dale		Email	ML24346A009	48
Pickering, Ryan	University of California-Berkeley	Meeting Transcript	ML24346A024	49-19

Table A-1 Individuals Providing Comments on the Draft SEIS (Continued)

Commenter	Affiliation (if stated)	Comment Source	ADAMS Accession Number	Correspondence ID
Pickering, Ryan	University of California-Berkeley	Email	ML25108A127	84
Pittman, Brendan		Meeting Transcript	ML24346A024	49-9
Pivovaroff, Joe		Meeting Transcript	ML24346A026	50-55
Poggemann, Connor		Regulations.gov	ML25008A058	74
Popovich, Belinda		Meeting Transcript	ML24346A026	50-32
Preciado, Alvaro		Meeting Transcript	ML24346A026	50-9
Rameson, Colleen		Email	ML24313A228	6
Raven, Robert		Email	ML24319A140	15
Redmond, Mark		Regulations.gov	ML24324A225	36
Reneau, Mary		Meeting Transcript	ML24346A026	50-14
Ripley, Ellie		Email	ML24329A002	33
Rochte, Tim		Email	ML24310A103	1
Roddy, Maureen		Email	ML24324A049	25
Romans, Kenneth		Regulations.gov	ML24324A220	34
Rosenberger-Haider, Laura		Email	ML24351A236	57
Rosenberger-Haider, Laura		Email	ML24351A237	70
Rosenberger-Haider, Laura		Email	ML24351A238	66
Salazar, Rudy		Meeting Transcript	ML24346A026	50-26
Sanders, Sara	San Luis Obispo Council of Governments	Email	ML24347A245	64
Sarvey, Robert		Regulations.gov	ML25008A053	79
Schalk, Vidya		Meeting Transcript	ML24346A026	50-23
Schroder, Madison	Generation Atomic	Meeting Transcript	ML24346A024	49-14
Scott, Jonathan		Regulations.gov	ML25008A057	75
Scott, Jonathan		Regulations.gov	ML25008A062	77
Scott, Jonathon		Meeting Transcript	ML24346A024	49-12
Seastrand, Andrea		Meeting Transcript	ML24346A026	50-10
Simonin, Mark		Meeting Transcript	ML24346A026	50-12
Smet, Evie		Meeting Transcript	ML24346A024	49-18
Smid, Stephen		Meeting Transcript	ML24346A026	50-53
Snyder, Van		Email	ML24322A001	17
Snyder, Van		Meeting Transcript	ML24346A024	49-13
Sommer, Henry		Regulations.gov	ML25008A054	78

Table A-1 Individuals Providing Comments on the Draft SEIS (Continued)

Commenter	Affiliation (if stated)	Comment Source	ADAMS Accession Number	Correspondence ID
Stefenel, Rudy		Regulations.gov	ML24324A224	42
Stein, Adam	The Breakthrough Institute	Meeting Transcript	ML24346A024	49-15
Stein, Adam	The Breakthrough Institute	Regulations.gov	ML25008A056	80
Stewart, Jim		Email	ML24351A233	58
Stoker, Mike	Santa Barbara County Taxpayer Advocacy Center	Email	ML24313A225	4
Summer, Liz		Meeting Transcript	ML24346A026	50-15
Swanson, Jane	San Luis Obispo Mothers for Peace	Meeting Transcript	ML24346A026	50-31
Swanson, Lucy Jane	San Luis Obispo Mothers for Peace	Regulations.gov	ML25008A050	76
Taliaferro, Stefani		Email	ML24317A025	11
Tanner, Jennifer	Indivisible California Green Team	Meeting Transcript	ML24346A024	49-16
Thompson, T.L.		Email	ML24347A246	53
Tillman, Karen		Meeting Transcript	ML24346A026	50-11
Tyler, Robert		Meeting Transcript	ML24346A026	50-20
Verdin, Adam		Meeting Transcript	ML24346A026	50-28
Weiss, Nancy G.	Mothers for Peace	Email	ML24326A037	26
Whalen, Rachel	San Luis Obispo Chamber of Commerce	Meeting Transcript	ML24346A024	49-2
White, James		Meeting Transcript	ML24346A026	50-54
White, Keith		Regulations.gov	ML24324A219	38
Woodcock, Charlene M.		Email	ML24324A052	24
Wurtz, Carl	Fission Transition	Meeting Transcript	ML24346A024	49-11
Yarbrough, Jim	Mothers for Peace	Email	ML24319A141	19
ZamEk, Jill		Email	ML24326A043	29
ZamEk, Jill		Meeting Transcript	ML24346A026	50-25

Table A-2 Individuals Submitting All or Part of the Form Content from Correspondence ID 67 and ADAMS Accession Number ML24352A102

Commenter	Affiliation (if stated)	Comment Source	ADAMS Accession Number
Bunk, Fereshteh		Regulations.gov	ML25008A059
Poggemann, Kathy		Email	ML24351A249

A.2.1 Accidents - Design Basis

Comment: 3.11.6.3.2 Severe Accidents Initiated by Terrorist Events According to the SEIS, "The potential for a severe accident initiated by terrorist events is usually analyzed generically for LR; however, the NRC has stated that licensing actions for facilities subject to the jurisdiction of the U.S. Court of Appeals for the Ninth Circuit will include an analysis of the environmental impacts of a terrorist attack (San Luis Obispo Peace v. Nuclear Regulatory 2006-TN6959: 17 449 F.3d 1016 [9th Cir. 2006]; NRC 2007-TN6957). Consistent with this requirement, the NRC staff considered site-specific information for Diablo Canyon. **The analysis concludes that there is no new and significant information specific to Diablo Canyon that would change the generic determination**." [56]

The SEIS ignores the new and significant advance of drone warfare and the ease at which a drone operator could explode ordinance that damages the spent fuel storage facility leading to a catastrophic zirconium fire. The Ukrainians have demonstrated that even simple over the counter drones can be used to drop ordinance with extreme precision and significant damage.

[56] SEIS Page 3-177 (**79-2-1** [Sarvey, Robert])

Response: *The comment expressed concerns related to potential terrorist events involving drones. Security-related issues are addressed as a current operating issue, rather than an LR issue. As a result of the September 11, 2001, terrorist attacks, the NRC conducted a comprehensive review of the agency's security program and made further enhancements to security at a wide range of NRC-regulated facilities. These enhancements included significant reinforcement of the defense capabilities for nuclear facilities, better control of sensitive information, enhancements in emergency preparedness to further strengthen the agency's nuclear facility security program, and implementation of mitigating strategies to deal with postulated events.*

The NRC updated its regulations in 2024 to require nuclear power plant licensees to report sightings of drones over their facilities. These reports are sent to the NRC, the Federal Aviation Administration, the Federal Bureau of Investigation, and local law enforcement. Additionally, in late 2019, the nuclear industry began coordinating with the U.S. Department of Energy and the Federal Aviation Administration to restrict drone overflights over certain nuclear power plants.

Nuclear power plants maintain high levels of security measures, which ensure that they can defend against threats up to and including the applicable design basis threats. These licensees are required to maintain well-trained and armed security forces, physical barriers, and intrusion detection and surveillance systems to defend against these threats.

The NRC staff continuously monitors and analyzes terrorist and criminal tactics, techniques, and procedures that occur domestically and worldwide to assess and ensure the continued adequacy of the NRC's design basis threats. The staff also conducts liaison activities with the Intelligence Community, law enforcement, and other Federal agencies in support of its intelligence and security mission. The staff further monitors and inspects nuclear power plants to ensure NRC regulated facilities provide reasonable assurance of public health and safety as well as the common defense and security.

With respect to malevolent acts or sabotage, the NRC position is that the environmental impacts of events initiated by malevolent acts or sabotage would be bounded by the environmental impacts of the severe accidents considered in NUREG-1437, "Generic Environmental Impact

Statement for License Renewal of Nuclear Plants" (LR GEIS) (NRC 2024-TN10161). This comment does not provide any new and significant information that the environmental impacts of events initiated by malevolent acts or sabotage would not be bounded by the LR GEIS. Therefore, no changes were made to the SEIS as a result of this comment.

Comment: Why 50 miles? This is not explained. A nuclear accident would affect a much greater area than 50 miles. Chernobyl (and Fukushima) plumes went world-wide. Ernest J. Sternglass, Ph.D. wrote a paper on how there were no chicks born in the spring after the Chernobyl cloud had passed at Point Reyes Bird Observatory in California. Chernobyl exploded April 26, 1986. I believe it was the spring of 1987 that no chicks hatched.
(**81-12-9** [McClintock, Francene])

Response: *One commenter asked for an explanation of the 50 mile (mi) (80 kilometer [km]) emergency planning zone. Title 10 of the Code of Federal Regulations (10 CFR) 50.47(c)(2) states that the ingestion pathway emergency planning zone of a nuclear power plant shall consist of an area approximately 50 mi (80 km) in radius. Protective action plans for this area are designed to avoid or reduce exposure from eating or drinking radioactive materials. Information about the NRC's emergency planning zones can be found on the NRC's website (https://www.nrc.gov/about-nrc/emerg-preparedness/about-emerg-preparedness/planning-zones.html).*

This comment does not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of this comment.

A.2.2 Accidents – Severe Accident Mitigation Alternatives

Comment: A nuclear accident could pollute the crops that are essential to feed the entire U.S. and increase the cancer rate to 1 in 2 people in the US getting cancer in their lifetime.
(**66-1** [Rosenberger-Haider, Laura])

Response: *The comment expressed concerns related to potential cancer risk as a result of a nuclear accident. Severe accident risk, which is the estimated probability-weighted consequences (or the likelihood of the severe accident times its estimated consequences) considers, in the consequence assessment portion, the consequences to the public from postulated releases due to postulated severe accidents. In addition, the severe accident mitigation alternatives (SAMA) analysis uses the estimate of severe accident risk to determine if there are any potentially cost-beneficial plant improvements to further reduce severe accident risk.*

The 1996 LR GEIS (NRC 1996-TN288) supported rulemaking regarding the generic determination that the probability-weighted consequences to the public and environment, which accounts for both the likelihood and consequences of postulated severe accidents, are SMALL. This assessment included pathways such as the exposure of individuals directly from the passage of the cloud of radioactive material released from an accident, material deposited on the ground, and the longer-term effects from other terrestrial pathways, such as the ingestion of crops.

Diablo Canyon completed a plant-specific SAMA analysis and assessed plant-specific probability-weighted consequences using Level 3 probabilistic risk assessment (PRA). In Section 3.11.6.3 and Appendix F of this SEIS, the NRC staff concluded that the Diablo Canyon *plant-specific probability-weighted consequences are bounded by the LR GEIS and are therefore, SMALL. The staff also concluded that two SAMA candidates to reduce severe accident risk were determined to be potentially cost-beneficial.*

This comment does not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of this comment.

A.2.3 Alternatives – No-Action

Comment: Section 2.4.3.3 discusses a no-action alternative. Its conclusion states: "A combination of energy sources discussed in Section 2.3.2.2 such as wind, solar, and battery backup, along with purchased power and demand-side management, could complement each other and reduce intermittent electricity generation issues." I support the no-action alternative. I suggest that our ratepayer and taxpayer money be invested in renewable energy with battery backup. (**29-2** [ZamEk, Jill])

Comment: Section 2.4.3 discusses a no-action alternative. Its conclusion states, quote, "A combination of energy sources discussed in Section 2.3.2.2 such as wind, solar and battery backup along with purchase power and demand-side management could complement each other and reduce intermittent electricity generation issues," end quote.

I support the no-action alternative. suggest that our rate payer and taxpayer money be invested in renewable energy with battery backup. (**50-25-2** [ZamEk, Jill])

Response: *These comments expressed support for the no-action alternative and a preference for replacing the generating capacity of Diablo Canyon with renewable energy sources.*

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

Comment: That said, I do have some recommendations to improve the EIS.
First of all, presenting the no-action case as defined in the EIS, as an alternative is confusing and misleading. It's not an actual alternative because it does not evaluate the impacts of the power generation that would replace Diablo Canyon's power.

NRC acknowledges that Diablo's power would have to be replaced with something in Sections 2.3.1 and 4.2. Thus, I recommend redefining the no-action case, perhaps the purchased power alternative could be used. (**49-3-2** [Hopf, James])

Comment: Finally, there is one area that I would like to provide feedback and improvement for the final SEIS. For the no-action alternative, the SEIS does attempt to detail the negative impacts of not issuing the permit, but does not address them in regards to decarbonization efforts and mostly about grid reliability. Near-term reliability is ignored.

The State's electricity demand continues to increase and replacing 2.2 gigawatts of reliable power is not possible in the near-term to long term, based on current California Energy Commission staff findings.

In 2023, the CEC issued a statement and staff analysis titled "CEC Determines Diablo Canyon Power Plant Needed to Support Grid Reliability" which recommended the State pursue extending operation of Diablo Canyon based on data showing California risks energy shortfalls and that Diablo Canyon stay online until at least 2030.

I recommend staff review this report and include any relevant information about grid reliability risks that would occur under a no action, not issuing permit scenario. (**49-9-6** [Pittman, Brendan])

Comment: Regarding the no-action alternative, I would like to underscore the significant challenges to achieving California's SB 100 goals without Diablo Canyon.

This nuclear facility's planned retirement pre-dated SB 100, leading to an increased reliance on natural gas, which obstructs the State's clean energy objectives.

Based on my research, I have found that SB 100 cannot realistically reach 100 percent clean energy due to an inherent dependency on natural gas to balance renewable variability, further emphasizing the need for reliable, clean, power from nuclear. (**49-19-3** [Pickering, Ryan])

Comment: I think it's an oversight in the report to assume that PG&E can purchase power from existing in-state generators and that the electricity will match the average emissions of the grid today because Diablo Canyon is 9 percent of the grid today, so emissions will definitely go up if Diablo Canyon goes offline.

We've seen this in the past happen with San Onofre in Southern California, plants in the Northeast closing. So living in California, we already have experience with power capacity shortfalls. A lot of people have already mentioned Flex Alerts. And what that means is that the state does not have enough capacity on the grid now to meet peak demand, and taking Diablo Canyon offline will only exacerbate that, because it's 9 percent of the electricity.

We'll need to import more. We'll need to burn more natural gas, is the most likely. Even though we can't build new natural gas plants in the state, we can run them at higher loads than they are today from excess capacity.

So I think to replace Diablo Canyon ignores the reality of our already constrained grid. So my suggestion for improving this EIS would be to include some modeling of California's grid under scenarios with and without nuclear, going out through 2045 to meet California's 100 percent carbon-free mandate.

For example, one study I recommend, in 2020, the Clean Air Task Force and Environmental Defense Fund both have good records on environmental policy. They commissioned three teams of modelers from Princeton, E3, and Stanford to explore how California can meet this mandate. They did a lot of different technology scenarios. It's a really detailed study. (**50-13-1** [Lovering, Jessica])

Comment: There are only a few more sections I'd like to comment on, mostly due to an incompleteness in the analysis of the negative impacts of alternatives to relicensing Diablo.

The no-action alternative analysis assumes that California has an excess energy capacity to fall back on after losing the nearly 9 percent or 15 percent of clean energy Diablo provides. This is incorrect, as evidenced by the rolling blackouts in 2020 and Senate Bill 846's decision to extend Diablo's operation, partially due to energy shortfalls.

There also wasn't adequate reporting on the rise of greenhouse gas emissions in the no-action alternative. As natural gas is California's marginal utility, any increase in unmet energy demand will be supplemented with more natural gas. A similar emission increase is well documented after the closure of San Onofre. (**50-18-2** [Bunk, Fereshteh])

Comment: And I think on the no-action alternative, a couple of the things where we would like to see some improvement. Although it attempts to detail the negative impacts of not issuing the permit, we don't feel that it adequately addresses those impacts in regards to decarbonization efforts and grid reliability, in particular near-term reliability needs to be a bigger focus. (**50-45-4** [Clay, Jennifer])

Comment: First of all, presenting the "no action" case currently defined in the EIS as an alternative is confusing to the reader. It is not an actual alternative, because it does not evaluate the impacts of the power generation that would replace Diablo Canyon's power. I understand that NRC is trying to stay within a generic EIS format, which requires presentation of a "no action" case. I also appreciate that NRC clari.es things in Sections 2.3.1 and 4.2, which acknowledge that Diablo's power would have to be replaced with something. But given the confusion caused, I would recommend removing the currently defined "no action case" as an evaluated alternative. Instead, NRC should classify the "Purchased Power Alternative" currently defined in Section 2.3.2.1 as the "no action" alternative, as it is the most likely result of closing Diablo Canyon. (**52-2** [Hopf, James])

Comment: Specifically, the No-Action Alternative analysis attempts to detail the negative impacts of not issuing the license to DCPP, but doesn't adequately address implications for decarbonization efforts. If DCPP is shut, dependence on natural gas and emissions will increase, as seen after the closure of similar plants like San Onofre and Indian Point. (**56-2** [Hoff, Heather])

Comment: 1. No-Action Alternative: ***The analysis attempts to detail the negative impacts of not issuing the permit to DCNPP, but fails to address their implications for decarbonization efforts and grid reliability***

Since 2020, California has struggled with reliability, when the state had its first rolling blackouts since 2001, leaving nearly 2 million citizens without power for up to 24 hours. It is assumed that California can replace DCNPP, a plant that provides 10% of our state's electricity and ignores state policies passed to prevent the closure. In 2022, the state legislator passed SB846, the bill that reversed and requested the continuation of the plant because of grid reliability concerns and insufficient capacity. And in 2023 the California Energy Commission report confirmed concerns and warned of energy shortfalls, recommending Diablo stay online until 2030. If the plant is shut, dependence on natural gas and emissions would increase, as seen after San Onofre's closure. (**67-2** [Ortiz-Wines, Paris])

Comment: 1. No-Action Alternative: The analysis attempts to detail the negative impacts of not issuing the permit to DCNPP, but fails to address their implications for decarbonization efforts and grid reliability

California has struggled with reliability since 2020, when the state had its first rolling blackouts since 2001, leaving nearly 2 million citizens without power for up to 24 hours. It is assumed that California can replace DCNPP, a plant that provides 10 per cent of our state's electricity and ignores state policies passed to prevent the closure. In 2022, the state legislator passed SB846, the bill that reversed and requested the continuation of the plant due to grid reliability concerns and insufficient capacity. Furthermore, in 2023 the California Energy Commission report confirmed concerns and warned of energy shortfalls, recommending Diablo stay online until 2030. If the plant is decommissioned, because natural gas is our marginal utility, our dependence on natural gas and emissions would increase as seen after San Onofre's closure. (**74-2** [Poggemann, Connor])

Comment: However, we hold concerns about some components of this SEIS. We believe that adjustments are necessary to more accurately address the negative impacts of the no-action alternative and consider the replacement alternatives. It is imperative for the NRC to include those adjustments in the final EIS, not only because it is required by the National Environmental Policy Act (NEPA), but also to improve how the NRC considers the negative impacts of the no-action alternative in an EIS for future cases. Improving the process for evaluating these impacts also aligns implementation of the ADVANCE Act directives to streamline a number of its licensing processes, including environmental reviews.[2]

[2] U.S. Public Law No. 118-67 § 501 (2024) (hereinafter ADVANCE Act)
(**80-2** [Jiang, "Joy" Yue] [Stein, Adam])

Comment: As you are well aware, the Fiscal Responsibility Act of 2023 (FRA) included amendments to NEPA. NEPA, as amended, now mandates consideration of the negative impacts of “not implementing the proposed agency action”, including the “no-action” alternative:[7]

...a reasonable range of alternatives to the proposed agency action, including an analysis of ***any negative environmental impacts of not implementing the proposed agency action*** *in the case of a no action alternative, that are technically and economically feasible, and* ***meet the purpose and need of the proposal.*** *[emphasis added]*

[7] National Environmental Policy Act of 1969 § 102(2)(C)(iii), 42 U.S.C. § 4332.

The purpose and need of this proposal, as stated in SEIS Section 1.2, is “to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating licenses to meet future system generating needs, as such needs may be determined by State, utility, system, and, where authorized, Federal(other than NRC) decision-makers”.[8]

[8] SEIS, page 38.

A reasonable range of alternatives and analysis of the negative environmental impacts of the alternatives, including the no-action alternative. In this case, it requires the NRC to consider the broader impacts of not renewing DCPP’s operating license. Such implications could include prolonging fossil fuel use and the serious public health, environmental impacts, and climate consequences involved.

We acknowledge that the staff is integrating new requirements in NEPA from the 2023 amendments. The way these requirements are implemented could improve the Final EIS and future EISs. (**80-5** [Jiang, "Joy" Yue] [Stein, Adam])

Comment: 2. No-action Alternative

Since the alternatives do not meet their purposes as stated above, the no-action alternative becomes the focus of the SEIS. **The proposed no-action alternative is not being addressed**

appropriately. In SEIS Section 2.3.1, the NRC acknowledged that "the no-action alternative does not meet the purpose and need of the proposed action."[17] The NRC states the result of the no-action alternative as "the total cessation of electrical power production at Diablo Canyon….because the no-action alternative does not provide a means of delivering baseload power to meet future electric system needs. "[18] In SEIS Section 3.15.3.1.2, The NRC staff anticipates that GHG emissions for the no-action alternative would be less than the DCPP's operation and the environmental impact will be SMALL.[19] The unmentioned negative environmental impacts include, but are not limited to:

[17] SEIS, page 56.
[18] SEIS, page 56.
[19] SEIS, page 272.

1) More GHG emissions which deviates from the US and California's clean energy future. If DCPP is not renewed, California may keep more gas-fired facilities or even build more, to fulfill the energy demand as the first priority before the carbon neutrality goal comes in 20 years. The state's commitment to carbon neutrality by 2045 will be undermined if DCPP is not renewed. The Final EIS must acknowledge that closing DCPP risks perpetuating fossil fuel use, potentially delaying the state's transition to a carbon-free grid.

2) The closure of DCPP will increase the demand for minerals and mining required for other energy sources, which has a significantly higher environmental and economic cost compared to nuclear[20]. Nuclear power has the lowest (0.6-1.4) tons of infrastructure raw materials per gigawatt-hour (GWh) of electricity produced. Whether it is solar (1.8 tons/GWh), wind (onshore: 7.1 tons/GWh; offshore: 2.0 tons/GWh), or other energy being purchased, will directly or indirectly increase the mineral and mining costs.

[20] See Breakthrough Institute, "Updated Mining Footprints and Raw Material Needs for Clean Energy" (Apr. 25, 2024), https://thebreakthrough.org/issues/energy/updated-mining-footprints-and-raw-material-needs-for-clean-energy.

3) If DCPP is not renewed, California's electricity grid will face increased instability and price volatility. There could be a huge price spread of electricity among different areas of California and during different time periods. The continued operation of DCPP will provide sustainable energy to California statewide and locally without skyrocketing the customer's electricity bill. The Final EIS must clearly state that the continued operation of DCPP is critical to maintaining energy reliability and preventing significant cost increases for Californians

The impact of no-action alternatives will be at least as bad, if not worse, than the proposed replacement power alternatives. Potential new construction of alternative energy sources will have a negative environmental impact, and delays in construction will degrade energy reliability in California. California can potentially build a new natural gas facility to keep the grid reliable and retire it by 2045 due to SB 100, only with more GHG emissions, environmental impacts on local communities, extra capital and labor costs on transmission lines, etc. On the other hand, there is no additional environmental impact (based on the SEIS) from issuing this license renewal. Nonetheless, if the license renewal is approved, it will expire in 20 years when California can re-evaluate its energy mix according to SB 100. Whether DCPP is to be included or not in 20 years is irrelevant to this decision.

No action is inconsequential, but the no-action alternative does not result in a feasible future—California will not simply cease to use electricity. We urge the NRC to accurately consider the broader implications of the “no-action” alternative. The NRC has touched on this previously with Hermes 2 design EA.[21]

[21] Environmental Assessment and Finding of No Significant Impact for the Construction Permits for the Kairos Hermes 2 Test Reactors, Draft Report for Comment, April 2024, https://www.nrc.gov/docs/ML2410/ML24103A002.pdf. “The applicant could still build Hermes but would not have the ability to test elements of the Hermes 2 design absent from the Hermes design, such as the intermediate cooling loop. While forgoing the opportunities provided by Hermes 2 might not necessarily preclude future development of reactors using the KP-FHR technologies, it could slow or impede safe and efficient development of the technology.”
(**80-7** [Jiang, "Joy" Yue] [Stein, Adam])

Response: *The comments expressed concerns related to the NRC staff’s evaluation of the no-action alternative and its relation to replacement energy. As stated in the purpose and need statement of this SEIS, the purpose and need for the proposed agency action is to provide energy-planning decision-makers with the option to continue nuclear power plant operations beyond the current licensing term to meet future system generating needs. In addition, unless there are findings in the NRC's safety or environmental review that would lead the NRC to reject an LR application, the NRC does not have a role in making energy-planning decisions about whether a particular nuclear power plant should continue to operate. The regulatory authority over licensee economics (including need for power, grid reliability, and the ability to procure or develop new replacement energy) falls within the jurisdiction of the State and, to some extent, the Federal Energy Regulatory Commission (FERC).*

The NRC acknowledges in Section 2.3.1 of the SEIS that the no-action alternative (i.e., not renewing the Diablo Canyon operating licenses) would not provide a means of delivering power to meet future electric system needs. The NRC also assumes that there is a need for the electrical power generated by Diablo Canyon, and that the no-action alternative would likely create a need for replacement power. Consequently, two replacement power alternatives were identified for detailed study as a consequence of the no-action alternative—namely, a purchased power alternative and a renewables combination alternative. The environmental impacts of the no-action alternative and these replacement power alternatives are described in Chapter 3 for each resource area, and the comparative environmental impacts of the no-action alternative and these replacement power alternatives are summarized in Table 2-1 of the SEIS.

In response to these comments, Section 2.3, Alternatives, has been revised to clarify that the alternatives analysis in this SEIS is consistent with the National Environmental Policy Act of 1969 (NEPA), as amended (42 United States Code [U.S.C.] 4321 et seq.-TN661) Section 102(2)(C)(iii) and that as a consequence of the no-action alternative, in part, the analysis presents "a reasonable range of alternatives to the proposed agency action, including an analysis of any negative environmental impacts of not implementing the proposed agency action in the case of a no-action alternative, that are technically and economically feasible, and meet the purpose and need of the proposal.”

A.2.4 Alternatives-Replacement Energy Technologies

Comment: One caller remarked that an energy system supplied entirely by renewable generators is possible. Professor Simon Michaux has obtained the list of "technology units" that the IEA claims would be necessary to power the Earth using solar, wind, hydro, and minor contributors such as geothermal and biofuels, with battery storage. Constructing these would require more copper, nickel, cobalt, lithium, graphite, and vanadium than are known to be recoverable using existing technology. His report is available at https://tupa.gtk.fi/julkaisu/bulletin/bt_416.pdf . Professor Michaux's estimate of required storage capacity was very optimistic. (**17-5** [Snyder, Van])

Comment: Also, the analysis does not include the gas generation that will replace some of most of Diablo's power, while the replacement renewable generation is being built. Renewable generation that would be used to replace Diablo's power will not instantly appear after the plant closes. It will take a significant amount of time to build.

More generally, as long as there is gas generation on California's grid, the net effect of closing Diablo will be its replacement with gas because any new renewable generation could have been used to replace gas instead of Diablo.

The fact that gas generation will not be allowed after 2045 is not relevant to this license extension evaluation, which covers the 20-year period between 2025 and 2045.

Thus, the renewable combination alternative case should assume a mixture of gas and renewable generation over the course of the 20-year extended license period. (**49-3-4** [Hopf, James])

Comment: Also, the analysis does not include the gas generation that will replace some or most of Diablo's power while the replacement renewable generation is being built. Renewable generation that would be used to replace Diablo's power will not instantly appear after the plant closes. It will take a significant amount of time to build.

The fact that gas generation will not be allowed after 2045 is not relevant to this license extension evaluation, which covers the 20-year period between 2025 and 2045.

Thus, the Renewable Combination Alternative case should assume a mixture of gas and renewable generation, over the course of the 20-year extended operation period. If it did so, the emissions would be well over a million tons per year. The emissions associated with continued operation of Diablo Canyon would be orders of magnitude smaller. (**52-4** [Hopf, James])

Comment: In considering energy alternatives, the NRC Staff makes no effort to identify or analyze alternatives that are consistent with the State's goals and limitations. Instead, the Draft SEIS asserts that:

It is unlikely that Diablo Canyon's generating capacity could be replaced by a single type of wind, either onshore or offshore. A combination of energy sources . . . such as wind, solar, and battery backup, along with purchased power and demand-side management, could complement each other and reduce intermittent electricity generation issues.[23]

[23] Draft SEIS at 2-16. (**63-10** [Curran, Diane])

Comment: 3. Meeting the Purpose and Need of the Proposal

One key consideration has to be that the alternative proposed solutions, including purchasing alternative power or renewable energy generations are considered to be **viable** alternatives and meet the purpose and goal of this proposal.

The alternatives evaluated in the SEIS constitute a reasonable range only under the assumption that they are available. There is no substantial basis to assume availability, particularly in California, where current generating capacity is insufficient. California is the largest importer of electricity and the third largest electricity consumer among the states[22]; California has an emergent need for a sustainable, GHG emission-free clean energy supply. DCPP provides 9% of California's electricity generation and 17% of the current clean electricity generation.

[22] See, U.S. Energy Information Administration, "California State Energy Profile,"2023, https://www.eia.gov/state/?sid=CA

As of 2024, half of California's energy supply is from natural gas. Growth of renewable energy is expected but not sufficient to pick up the slack of this huge energy demand in California. The SEIS assumes that SB 100's goal of 100% renewable energy by 2045[23] is a foregone conclusion. This overlooks that the continued operation of DCPP is also highlighted in the law (SB 846) for grid reliability and the inability to replace the power with alternatives[24]. The CEC confirmed the importance of DCPP to California's grid reliability and agreed with SB 846.[25] [26]

[23] See California Legislature, "SB 100 - California Renewables Portfolio Standard Program: Emissions of Greenhouse Gases," 2017, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100.
[24] See California Energy Commission, "CEC Determines Diablo Canyon Power Plant Needed to Support Grid Reliability," February 2023, https://www.energy.ca.gov/news/2023-02/cec-determines-diablo-canyon-power-plant-needed-support-grid-reliability.
[25] See California Energy Commission, "CEC Determines Diablo Canyon Power Plant Needed to Support Grid Reliability," February 2023, https://www.energy.ca.gov/news/2023-02/cec-determines-diablo-canyon-power-plant-needed-support-grid-reliability.
[26] See Los Angeles Times, "Battery Storage Rapidly Increasing but Not Enough to End Blackouts, Governor Newsom Says," April 25, 2024, https://www.latimes.com/environment/story/2024-04-25/battery-storage-rapidly-increasing-but-not-enough-to-end-blackouts-governor-newsom-says.

California residents are facing the challenge of blackouts.[27] In recent years, the California government has been extending the closure date of some gas plants to avoid blackouts.[28] The California Public Utility Commission (CPUC) ordered utilities to procure an additional 4,000 MW of Net Qualifying Capacity in addition to the 11,500MW ordered in June 2021.[29] California has issued emergency orders to procure any available electrical capacity and emergency gas-operated generators for grid reliability.[30] The California grid operator CAISO has also been forced to request emergency orders under the Federal Power Act to operate power plants notwithstanding their emissions or permitlimits.[31] The existing and persistent challenge with deploying alternative resources to enable the retirement of DCPP, recurring electricity scarcity and emergency orders, and resulting CA statute and CEC analysis to retain the operation of DCPP supports the conclusion that **the alternatives as framed in the SEIS are not viable and do not meet the purpose of the proposal.**

[27] See The New York Times, "California's Power Grid Strains to Keep Up With Heat and Demand, "September 25, 2022, https://www.nytimes.com/2022/09/25/business/energy-environment/california-energy-grid-heat.html
[28] See Los Angeles Times, "Despite Climate Goals, California Will Let Three Gas Plants Keep

Running," August 15, 2023, https://www.latimes.com/environment/newsletter/2023-08-15/despite-climate-goals-california-will-let-thre e-gas-plants-keep-running-boiling-point.
[29] See California Public Utilities Commission, "CPUC Augments Historic Clean Energy Procurement Goals to Ensure Electric Reliability," 2023, https://www.cpuc.ca.gov/news-and-updates/all-news/cpuc-augments-historic-clean-energy-procurement-goals-to-ensure-electric-reliability-2023.
[30] For example, see https://www.gov.ca.gov/wp-content/uploads/2021/07/Energy-Emergency-Proc-7-30-21.pdf
[31] For example, see https://www.caiso.com/documents/sep7-2021-request-department-energy-emergencyorder-section202c-federalpoweract.pdf

Only firm capacity can meet the purpose and need for reliability. The SEIS seems to assume that California's renewable energy goals can be met without considering the substantial need for reliable, firm capacity, which DCPP provides. If a future goal in law (SB100) is substantial enough to guide conclusions in the SEIS, then a near-term need in law (SB 846) should be as well.

Renewable energy like solar and wind can provide capacity additions, but not necessarily a firm and consistent power supply. This is another reason that the purpose and need of this proposal cannot be met with the renewable energy alternative.

DCPP is the only remaining nuclear power plant in California, and it provides nearly 9% of the state's electricity and generates 17% of its zero-carbon energy. [32] With the California Energy Commission estimating that power demand across the state will rise roughly 43% in the next 15 years, DCPP will only become a more critical clean, reliable energy asset. [33]

[32] See Pacific Gas and Electric, "Nuclear Power," 2023, https://www.pge.com/en/about/pge-systems/nuclear-power.html#:~:text=Serving%20our%20planet,the%20state's%20total%20electricity%20supply.
[33] See PR Newswire, "PG&E Launches First Commercial Deployment of On-Site Generative AI Solution for the Nuclear Energy Sector at Diablo Canyon," 2023, https://www.prnewswire.com/news-releases/pge-launches-first-commercial-deployment-of-on-site-generative-ai-solution-for-the-nuclear-energy-sector-at-diablo-canyon-302304042.html.
(**80-8** [Jiang, "Joy" Yue] [Stein, Adam])

Comment: Natural gas produced from above-ground plants is CARBON NEGATIVE and would satisfy the 100 Percent Clean Energy Act of 2018. (**81-2-4** [McClintock, Francene])

Response: *The comments expressed concerns related to the viability or appropriateness of replacement power alternatives evaluated in the SEIS. As explained in Section 2.3.2 of the SEIS, as a consequence of not renewing the Diablo Canyon operating licenses in the case of a no-action alternative, two replacement power alternatives were identified for detailed study—a purchased power alternative and a renewables combination alternative. However, the NRC's decision-making authority only extends to deciding whether to renew the Diablo Canyon operating licenses. Therefore, replacement energy alternatives represent options that energy-planning decision-makers may consider if the Diablo Canyon operating licenses are not renewed.*

The purpose and need for the proposed agency action is to provide energy-planning decision-makers with the option to continue nuclear power plant operations beyond the current licensing term to meet future system generating needs. The NRC does not have a role in making energy-

planning decisions. The regulatory authority over licensee economics (including need for power, grid reliability, and the ability to procure or develop new replacement energy) falls within the jurisdiction of the State and, to some extent, FERC.

Non-renewable energy sources were eliminated from detailed study in part due to the California 100 Percent Clean Energy Act of 2018, which requires all energy generation to be renewable and zero-carbon after 2045. While certain comments stated that natural gas could be part of a combination alternative, the California Air Resources Board committed in 2022 to not build any new fossil-fuel power plants.

In addition, the renewables combination alternative considered which replacement energy sources would be available and commercially viable when the Diablo Canyon operating licenses expire. The renewables combination alternative compares the environmental impacts of LR with the impacts from various replacement energy sources, including onsite and offsite wind, solar, geothermal, and demand-side management.

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

Comment: However, we have some concerns about how the staff has implemented new requirements based off of recent amendments to NEPA in this Draft SEIS.

We'll provide detailed written comments on this for your ease of reference. However, one consideration has to be that the alternative proposed solutions, including purchasing alternative power or renewable energy generations are considered to be viable alternatives.

However, the recent amendments to NEPA require considerations of negative impacts to alternatives, not taking the proposed action, or the no-action alternative for, and alternatives that meet the stated purpose.

These alternatives proposed in the SEIS, do not necessarily meet stated purpose because the continued operation of Diablo Canyon as authorized by State law as referenced in the SEIS, is to reduce greenhouse gas emissions but also due to reliability for the grid.

Currently, California has been unable to meet its renewable deployment objective in greenhouse gas reductions, as stated by others, and has been required to meet grid reliability by employing additional natural gas generation.

Therefore, that indicates that the stated purpose of enhancing grid reliability would not be met by the alternatives presented here because renewables, so far, have not been able to replace the capacity at Diablo Canyon as intended all the way back from 2016.

And the State has not been able to deploy sufficient additional capacity of any kind to meet grid reliability. As I said, I will provide more detailed comments, and we appreciate the opportunity to comment in this meeting. (**49-15-2** [Stein, Adam])

Comment: Similarly, for the renewable combination alternative, I also think the environmental impacts are underestimated. So for lifecycle emissions, much of the impact for renewable energy and batteries occurs outside the U.S. So it is outside the scope of the NRC's evaluation. But if we're thinking a little more holistically, it's important for us to be conscious of those impacts either way, from manufacturing of solar panels or processing lithium for batteries in China, mining cobalt in the Congo, those sorts of things. I think we should keep them in mind even if they don't have a local impact. (**50-13-1** [Lovering, Jessica])

Comment: So a survey of wind and solar developers by Lawrence Berkeley National Lab found that 1/3 of renewables projects that applied for siting permits in the last five years were canceled, and public opposition was one of the top three reasons for cancellation. And beyond this grassroots opposition, 15 percent of counties across the U.S. have effectively prohibited new utility-scale solar or wind development. About half of these bans came in just in 2023.

So these are the sorts of real-world constraints on renewable energy that I think are going to affect the emissions of the alternative scenarios. And I think they should be included in some way, even if it's just a rough estimate, in the draft SEIS. (**50-13-4** [Lovering, Jessica])

Comment: The purchased power alternative fails to recognize that Californians already pay the most for electricity in the nation and how that would be impacted. It also assumes that there will be no more greenhouse gas emissions from fossil fuels after 2045 because of Senate Bill 100. Although I admit it would be hard to analyze, this is not an accurate assumption, proven by Senate Bill 846's license extension of Diablo in part because of how behind schedule we were in decarbonizing our electricity production.

Lastly, the renewables combination alternative incorrectly assumes both that renewables will instantaneously replace lost energy capacity from Diablo and is just as clean if not cleaner. Renewables are not being integrated into the grid at a rate fast enough to replace Diablo at this time, once again evidenced by Senate Bill 846.

And existing nuclear power plants have a significantly lower environmental footprint than new solar and wind when factoring in operating emissions, construction emissions and land use. You can also see this data at ourworldindata.com. And also when it comes to renewable replacement, California does not have any additional hydropower capacity. (**50-18-3** [Bunk, Fereshteh])

Comment: I thank you for your time, and I thank you for crafting this excellent report. That said, I do have some quibbles.

For example, in Section 3.7.9 in particular, the renewable combinations alternative section, I believe that it is incorrectly framed in my opinion. It appears to assume the State has available existing capacity and that renewables have a lower impact than existing nuclear plants.

In this context, it is important to note that solar and wind do have impacts and do take up more land resources than an existing nuclear plant. Nuclear has far fewer emissions than solar, wind, and hydro. It is the lowest emitter of all alternative energies. (**50-37-1** [Gutierrez, Thomas])

Comment: We also feel that in the purchase power alternative that was submitted, it understates the socioeconomic greenhouse gas emissions and environmental justice impacts of increasing energy output from existing generating facilities, while also overestimating the State's ability to procure additional capacity. So we'd like to see that addressed.

And in the renewables combination alternative, we agree that with another commenter that we think it's incorrectly framed, assuming that the capacity is available to the State already existing, and that they have a lower impact than an existing nuclear power plant. So we would just encourage you to address those areas in the revision to the report. (**50-45-5** [Clay, Jennifer])

Comment: The Purchased Power Alternative also understates the socioeconomic, GHG emissions, and environmental justice impacts of increasing energy output from existing generating facilities while also overestimating the state's ability to procure capacity.

California implemented the renewables portfolio standard (RPS) in the early 2000's yet has failed to make significant progress on clean energy since then, with nearly half of electricity still being generated from natural gas. There is no indication that current state energy policies will lead to a different outcome, and SB-100 is essentially locking in reliance on fossil fuels. Just because the state has mandates to stop burning fossil fuels after 2045 does not mean it will happen (Table 3-34). Failure to procure "replacement" clean energy for Diablo Canyon per the original "Joint Proposal", and the subsequent reversal of this decision through SB846 is more indication that the state's clean energy goals are not coming to fruition.

Finally, the framing of the Renewables Combination Alternative assumes sufficient capacity and underestimates the land and resource demands of renewable energy. Nuclear energy, especially existing sites like DCPP, has a significantly lower environmental footprint than solar, wind, or hydro when considering emissions and land use. The Department of Energy's Pathways to Commercial Liftoff report for advanced nuclear details that many metrics used to evaluate the cost of nuclear (like LCOE) don't adequately consider the lifespan of these facilities. The same is true of environmental impacts when considering raw materials needed to build replacement generation. This should all be considered in comparison when evaluating the environmental impacts of shutting existing facilities. (**56-3** [Hoff, Heather])

Comment: Again, this analysis is so broad as to be worthless for purposes of evaluating alternatives that would meet the State's goals and satisfy its limitations as set forth in S.B. 846. (**63-11** [Curran, Diane])

Comment: 2. Purchased Power Alternative: ***The EIS understates the <u>socio-economic, GHG emissions, and environmental justice</u> impacts of increasing energy output from existing generating facilities while also <u>overestimating the state's ability</u> to procure capacity.***

Because the state has struggled with reliability during times of high demand, expensive procurements and extensions of fossil fuels have burdened citizens. California's electricity prices, already among the nation's highest, continue to rise, with many residents struggling to pay their bills. Although the report correctly states that emissions from purchased power will initially increase GHG emissions it assumes that because the state has mandates to stop burning fossil fuels after 2045 this means it will happen. However, the state had originally planned to close Diablo in 2016 claiming that enough replacement power would be ready but in 2022 that wasn't the case and SB846 legislation was passed to extend Diablo.

The loss of DCNPP was calculated in the MIT-Stanford report which found that delaying DCNPP's retirement could reduce carbon emissions by over 10%, save billions in energy costs, and improve grid reliability.

"Delaying the retirement of Diablo Canyon to 2035 would reduce California power sector carbon emissions by more than 10% from 2017 levels and reduce reliance on gas, save $2.6 Billion in power system costs, and bolster system reliability to mitigate brownouts; if operated to 2045 and beyond, Diablo Canyon could save up to $21 Billion in power system costs and spare 90,000 acres of land from use for energy production, while meeting coastal protection requirements."

3. Renewables Combination Alternative: The framing of this alternative assumes sufficient capacity and underestimates the land and resource demands of renewable energy.

Nuclear energy, especially existing sites like DCNPP, has a significantly lower environmental footprint than solar, wind, or hydro when considering emissions and land use. (**67-3** [Ortiz-Wines, Paris])

Comment: I believe the report could benefit from a more detailed discussion of the potential negative outcomes of the alternatives to DCNPP's clean energy supply. (**67-6** [Ortiz-Wines, Paris])

Comment: 2. Purchased Power Alternative: The EIS understates the socio-economic, GHG emissions, and environmental justice impacts of increasing energy output from existing generating facilities while also overestimating the state's ability to procure capacity.

Because the state has struggled with reliability during times of high demand, expensive procurements and extensions of fossil fuels have burdened citizens. California's electricity prices, already among the nation's highest, continue to rise, with many residents struggling to pay their bills. Although the report correctly states that emissions from purchased power will initially increase GHG emissions it assumes that because the state has mandates to stop burning fossil fuels after 2045 this means it will happen. However, the state had originally planned to close Diablo in 2016 claiming that enough replacement power would be ready but in 2022 that wasn't the case and SB846 legislation was passed to extend Diablo.

The loss of DCNPP was calculated in the MIT-Stanford report which found that delaying DCNPP's retirement could reduce carbon emissions by over 10%, save billions in energy costs, and improve grid reliability.

Delaying the retirement of Diablo Canyon to 2035 would reduce California power sector carbon emissions by more than 10 per cent from 2017 levels and reduce reliance on gas, save $2.6 Billion in power system costs, and bolster system reliability to mitigate brownouts; if operated to 2045 and beyond, Diablo Canyon could save up to $21 Billion in power system costs and spare 90,000 acres of land from use for energy production, while meeting coastal protection requirements.

3. Renewables Combination Alternative: The framing of this alternative assumes sufficient capacity and underestimates the land and resource demands of renewable energy.

Nuclear energy, especially existing sites like DCNPP, has a significantly lower environmental footprint than solar, wind, or hydro when considering emissions and land use.

4. Table 3-34, the EIS incorrectly assumes that after 2045 the emissions are negligible. This fails to acknowledge the state's inability to procure energy capacity and assumes the lost power from nuclear and gas will be replaced with clean energy sources. (**74-3** [Poggemann, Connor])

Comment: However, I believe the report could benefit from a more detailed discussion of the potential negative outcomes of the alternatives to DCNPP's clean energy supply. I kindly ask that you consider this research when refining the final report. (**74-5** [Poggemann, Connor])

Comment: The SEIS fails to conduct a proper alternative analysis. A proper alternatives analysis would have identified that Load Serving Entities in California have already procured the zero carbon resources necessary to meet their procurement obligations required by the CPUC and enough to retire the DCPP. The mixed renewable projects alternative is the superior alternative and the projects have already been procured with a planned excess of 2,182 megawatts needed to retire Diablo Canyon. Unlike Diablo Canyon the renewable resources procured by load serving entities in California do not have the environmental impacts of the nuclear fuel cycle. (**79-1-4** [Sarvey, Robert])

Comment: **<u>2.3 Alternatives</u>**
<u>2.3.2 Replacement Power Alternatives</u>
The SEIS states, "To ensure that alternatives are consistent with State or regional energy policies, the NRC staff reviewed energy-related statutes, regulations, and policies within the region of influence. Alternatives that would conflict with these requirements were eliminated from further consideration.[16] California's 100 Percent Clean Energy Act of 2018 requires all energy generation to be renewable and zero-carbon after 2045.[17] According to the SEIS "PG&E did not consider any renewable energy generation source or combination of energy sources reasonable alternatives for replacing Diablo Canyon Units 1 and 2 based on the criteria that the replacement energy alternatives must be viable prior to the expiration of the current operating licenses."[18]

[16] Draft Report Page 2-13
[17] Draft Report Page 2-14
[18] SEIS Page 2-14

The CPUC ordered Load Serving Entities (LSEs) to procure 11,500 MW NQC of new resources between August 2023 and June 2026 via an order in the Integrated Resource Planning (IRP) proceeding, D.21-06-035.[19] All of those resources are to be renewable and zero carbon. Of the 11,500 MW, 2,500 MW NQC must be from zero-emitting generation, generation paired with storage, or demand response resources for Diablo Canyon Replacement (DCR).[20] The CPUC's latest report on progress with the CPUC's procurement authorizations is entitled, "*Summary of Compliance with Integrated Resource Planning (IRP) Order D.19-11-016 and Mid Term Reliability (MTR) D.21-06-035 Procurement.*"[21] That report analyzes data submitted by the load serving entities as of December 31, 2023 over a year ago. That report as illustrated below states that as of the December 1, 2023 the load serving entities will have procured all of the zero carbon resources needed to retire Diablo Canyon with a surplus of 2,182 MW.[22]

[19] For more details see **Summary of Compliance with Integrated Resource Planning (IRP) Order D.19-11-016 and Summary of Compliance with Integrated Resource Planning (IRP) Order D.19-11-016 and Mid Term Reliability (MTR) D.21-06-035 Procurement** https://www.cpuc.ca.gov/-/media/cpucwebsite/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irpltpp/irp12123compliancereport.pdf Page 5
[20] **Summary of Compliance with Integrated Resource Planning (IRP) Order D.19-11-016 and Mid Term Reliability (MTR) D.21-06-035 Procurement** Page 20 https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energydivision/documents/integrated-resource-plan-and-long-term-procurement-plan-irpltpp/irp12123compliancereport.pdf
[21] https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resourceplan-and-long-term-procurement-plan-irp-ltpp/irp12123compliancereport.pdf
[22]**Summary of Compliance with Integrated Resource Planning (IRP) Order D.19-11-016 and Mid Term Reliability (MTR) D.21-06-035 Procurement Page** 20

https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energydivision/documents/integrated-resource-plan-and-long-term-procurement-plan-irpltpp/irp12123compliancereport.pdf Page 44

2025 Forecasted Diablo Canyon Replacement Procurement Reported by LSE Type
LSE Type: IOU
Cumulative MTR Tranche 3 Obligation: 1,483
Collective Forecasted MTR 2025 Online by 6/1/2025: 3,351
Collective Forecasted MTR Tranche 3 Excess or Shortfall: 1,868

LSE Type: CCA
Cumulative MTR Tranche 3 Obligation: 773
Collective Forecasted MTR 2025 Online by 6/1/2025: 1,098
Collective Forecasted MTR Tranche 3 Excess or Shortfall: 325

LSE Type: ESP
Cumulative MTR Tranche 3 Obligation: 242
Collective Forecasted MTR 2025 Online by 6/1/2025: 233
Collective Forecasted MTR Tranche 3 Excess or Shortfall: -9

LSE Type: Total
Cumulative MTR Tranche 3 Obligation: 2,500
Collective Forecasted MTR 2025 Online by 6/1/2025: 4,682
Collective Forecasted MTR Tranche 3 Excess or Shortfall: 2,182

*As of the 12/1/2023 Compliance filings, collectively LSEs are forecast to exceed Diablo Canyon Replacement obligations by 2,182 MW NQC.
*LSEs' progress towards Diablo Canyon Replacement is pending the necessary compliance documentation verification to be filed by 6/1/2025.
*Note Column 3 and 4 figures include sum of excess and deficiencies. [Note: These are LSE reported MWs that have not yet been validated by staff and only track capacity not energy procurement, [23]

[23] **Summary of Compliance with Integrated Resource Planning (IRP) Order D.19-11-016 and Mid Term Reliability (MTR) D.21-06-035 Procurement** Page 20
https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energydivision/documents/integrated-resource-plan-and-long-term-procurement-plan-irpltpp/irp12123compliancereport.pdf Page 44 (**79-1-13** [Sarvey, Robert])

Comment: The SEIS states that solar technology was considered as an alternative but eliminated. The SEIS states, *"Solar generators are considered an intermittent electrical power resource because their availability depends on exposure to the sun, also known as solar insolation. To be viable, a utility-scale solar power alternative must replace the amount of electrical power that Diablo Canyon currently provides. Assuming a capacity factor of 32.8 percent,* ***approximately 7,000 MW of additional solar energy capacity would need to be installed to replace the 2,285 MW of electricity generated by Diablo Canyon (NREL 2022-TN9823)"***. [24]

[24] SEIS Page 2-15

Since the CPUC authorized 11,500 MW of zero carbon emitting resources load serving entities in California have procured over 7,333 MW of solar generation. [25] That amount of solar will eliminate any need for Diablo Canyon.

[25] Tracking Energy Development October 2024 tracking data https://www.cpuc.ca.gov/-/media/cpucwebsite/divisions/energy-division/documents/summer-2021-reliability/tracking-energy-development/resource -
tracking-data-october-2024-release.pdf Page 5

Diablo Canyon is not needed for reliability and its replacement projects are expected to be complete by June 1,2025

In enacting SB 846 the Legislature declared that "continued operations of Diablo Canyon" through 2030 "may be necessary to improve statewide energy system reliability" and continue reduction of greenhouse gases until "new renewable energy and zero-carbon resources" come online and can meet demand. (Pub. Res. Code, § 25548(b)). New reliability information provided by the Joint Agency Reliability Planning Assessment -SB 846 Combined Second and Third Quarterly Report 2024 issued on August 5, 2024 sheds new light on the reasonableness of continued operations at Diablo Canyon. As stated in the report,

"Throughout the state, over 20,000 MW of new nameplate capacity have come online from January 2020 to May 2024. *In this year alone, as shown by Table 1, California continues to experience rapid growth in renewable resources, particularly solar photovoltaics (PV) and energy storage. In 2023 alone, over 5,000 MW of solar PV and energy storage nameplate capacity were added to the electric grid.* ***The CPUC staff estimates that new generation and storage investments represent approximately $7 billion in new infrastructure investment in California in 2022 and 2023."*** [26]

[26] Joint Agency Reliability Planning Assessment - SB 846 Combined Second and Third Quarterly Report 2024 Page 9 of 28 https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/summer-2021-reliability/tracking-energy-development/joint-agency-reliability-planning-assessment--sb-846-combined-second-and-third-quarterly-report-2024.pdf CARE-02 Page 2

> "Under a 2020 equivalent event, the September surplus is 2,200 MW. In a 2022 equivalent event, the September projected shortfall turns into a surplus of 655 MW. Under similar extreme conditions, this summer could likely be managed with contingency resources and additional real-time market procurements projected for July through September." [27]

[27] Joint Agency Reliability Planning Assessment - SB 846 Combined Second and Third Quarterly Report 2024 Page 8 of 28 https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/summer-2021-reliability/tracking-energy-development/joint-agency-reliability-planning-assessment--sb-846-combined-second-and-third-quarterly-report-2024.pdf CARE-02 Page 3

We currently have the resources available without Diablo Canyon operating to meet grid operational needs so reliability is not a factor in determining whether the continued operation of the DCPP is needed. (**79-1-14** [Sarvey, Robert])

Comment: The SEIS relies on a flawed study by the CEC. As stated in the SEIS, "*Analyses conducted by the CEC also concluded that adequate renewable energy resources could not be brought online before the operating licenses for Diablo Canyon Units 1 and 2 expire (CEC 2023-TN10081)*.[28] The CEC analysis was dead wrong as the Summary of Compliance with Integrated Resource Planning (IRP) Order D.19-11-016 and Mid Term Reliability (MTR) D.21-06-035 Report mentioned above issued on October 9, 2024 details the procurement of adequate renewable resources to retire Diablo Canyon by June 2025. The October 9,2024 IRP Report details that LSE procurement will exceed the Diablo Canyon replacement procurement requirement by over 2,182 MW. [29]

[28] SEIS Page 2-14
[29] **Summary of Compliance with Integrated Resource Planning (IRP) Order D.19-11-016 and Mid Term Reliability (MTR) D.21-06-035 Procurement** Page 44.

The SEIS concludes that, *"If the NRC does not renew the Diablo Canyon operating licenses energy-planning decision-makers would have to choose a replacement power alternative similar to the ones evaluated in this SEIS.*[30] As can be seen from above energy planning decision makers in California have already chosen the renewables combination energy alternative and have succeeded in procuring the Diablo Canyon replacement generation so there is no need to renew the operating license for the DCPP. Since Diablo Canyon is not a zero-carbon resource due to its mining and processing of nuclear fuel and the operation of the back-up generators the renewables combination alternative is superior.

[30] SEIS Page 2-20 (**79-1-15** [Sarvey, Robert])

Comment: 1. Replacement Power Alternatives

Under NEPA, the NRC has an obligation to consider reasonable alternatives to the proposed action. The state of California and the California Energy Commission have already unsuccessfully attempted to replace the power from DCPP, and as a result have rejected the proposed alternatives as unviable, instead requiring DCPP to remain operational. The NRC does not have the authority or control over energy system decisions[9] and, therefore must also reject the proposed alternatives as unreasonable. In addition to state decision-making, there are energy system limitations that prevent the viability of the alternatives that must be considered. **The proposed alternatives are not viable and should be rejected, resulting in no viable alternatives to the proposed action.** In the face of evidence that California unsuccessfully planned to retire DCPP and changed course to require a continued operation, the NRC would have to supply evidence that the proposed alternatives are, in fact, viable.

[9] See, SEIS page 38, "the NRC has no role in the energy-planning decisions of power plant owners, State regulators, system operators, and, in some cases, other Federal agencies as to whether a particular nuclear power plant should continue to operate"

In 2016 California chose to retire DCPP and replace it with alternative clean energy. The NRC cited the California Energy Commission's (CEC) analysis in the SEIS: "Adequate renewable energy resources could not be brought online before the operating licenses for Diablo Canyon Units 1 and 2 expire (CEC 2023-TN10081). "[10] The renewables as an alternative so far have not been able to replace the capacity of DCPP as intended, and California has not been able to deploy sufficient additional capacity of any kind to meet grid reliability. The state has instead experienced significant electricity scarcity in recent years. Projected demand growth will further challenge the ability to deploy surplus generation capacity capable of realizing any of the proposed alternatives.

[10] SEIS, page 57.

In SEIS Section 2.3.2, Replacement Power Alternatives include purchased power and renewables combination. The NRC already states that those alternatives have their limitations in the SEIS. The purchased power "may also rely on older and less-efficient power plants operating at higher levels of power generation than current operations. "[11] It is also unsustainable because "Natural gas-fired powerplants can be a source of purchased power until 2045. " [12]

[11] See, SEIS page 58, "Until 2045, purchased power would likely come from the most common types of existing electric power generating technologies including nuclear power, natural gas-fired, coal, solar, and wind energy, some of which could be located outside of California."
[12] SEIS, page 58.

In SEIS Section 3.15.3.1, the impact of purchased power on climate change was concluded as "SMALL to MODERATE" because the GHG emission will be "negligible" after 2045 according to SB 100.[13] The conclusion for purchased power was based on the assumption that California's carbon neutrality goal can be achieved by SB 100. For the first 20 years, GHG emissions could be higher than the estimation because the calculation uses the 2022 California energy mix as a base, but the purchased power could include more fossil fuel plants from other states.

[13] SEIS, page 272.

The impact of renewable combination alternatives on climate change was "SMALL" because of "negligible" GHG emissions. This is also not plausible. According to the SEIS, "GHG emission sources during construction of the renewables combination alternative would be similar to the construction of an industrial facility and include construction equipment, engine exhaust, and workforce commuting."[14] However, the construction and most equipment GHG emissions of DCPP have already been emitted when it was built. Potential newly built renewable power facilities will have much more environmental impacts than the status quo option.

[14] SEIS, page 272.

There are more unaddressed limitations for the proposed replacement power alternatives. The NRC only considered the two replacement power alternatives because "California's 100 Percent Clean Energy Act of 2018 requires all energy generation to be renewable and zero-carbon after 2045 (State of California2018-TN9855). "[15] However, the NRC did not address the fact that if the renewal were not approved, slowing and impeding the safe and efficient deployment of nuclear clean energy could have far-reaching environmental consequences.

[15] SEIS, page 58.

The analysis for Replacement Power Alternatives should also be rejected for higher costs and lower reliability, consistent with other recent SEIS's.[16] The DCPP SEIS doesn't consider these factors at all and argues that purchasing power is a reasonable alternative. This is far beyond just an inconsistency; it rejects the very purpose of the proposed action (license renewal for grid reliability). Cost and reliability are more significant in California where supply and reliability are so extremely constrained that the legislature passed a law to keep DCPP online for those very reasons. These factors are sufficient to reject purchased power in other SEISs and are more than sufficient to support the same determination for DCPP.

[16] For example, the Virgil C. Summer Nuclear Station, Unit 1 SEIS claimed that "Purchased power is not a reasonable alternative to V.C. Summer SLR, therefore, due to its higher cost and lower reliability." Environmental Impact Statement for the Subsequent License Renewal of Virgil C. Summer Nuclear Station (**80-6** [Jiang, "Joy" Yue] [Stein, Adam])

Comment: 4. Other benefits of DCPP and impacts of alternatives

Additionally, the SEIS fails to adequately consider the critical ancillary services that DCPP provides, such as frequency response and grid inertia, which are essential for grid stability and reliability. These services were not sufficiently addressed in the renewable alternative, which fails to account for the full scope of reliability needs.

When it comes to land use and visual resources, the SEIS concluded the impact of both no-action alternatives and purchased power alternatives as SMALL [34], and MODERATE for the renewable alternative. The SEIS did not consider the potential land use of purchased power and argued it is hard to evaluate due to the complexity: “This alternative is not expected to create any new land use and visual impacts but could intensify environmental effects at existing energy generating facilities.” [35] In fact, the no-action alternative could increase land use and visual resources if new plants are under construction to fuel California’s energy demand. Furthermore, the SEIS did not sufficiently analyze the water use required for constructing and operating new energy facilities, nor did it address the impacts of new transmission infrastructure for the alternatives.

[34] SEIS, page 75.
[35] SEIS, page 75.

The SEIS is sometimes overly focused on the environmental impact of DCPP and ignores those aspects for the alternative analysis. For example, the SEIS considered SOx, NOx, and other pollutants when analyzing DCPP’s renewal, [36] but it only considered CO2 equivalent without mentioning other pollutants from the alternatives. [37] When it comes to air quality, the SEIS estimates commuting for DCPP workforce[38] while excluding that for the alternative analyses. This aspect should either be considered for both the proposed action and the alternatives or completely excluded from any analysis.

[36] SEIS, page 270-271.
[37] SEIS, page 272.
[38] See, SEIS page 84, “Engine exhaust emissions would be from heavy construction equipment and commuter, delivery, and support vehicular traffic traveling to and from the facility as well as within the site.”

A comprehensive life cycle analysis, which compares the environmental impacts of all the alternatives, is essential to fully understanding the broader implications of the proposed alternatives. Notably, nuclear energy, as provided by DCPP, emits significantly fewer GHGs than solar and other renewable sources when considering the full lifecycle, including manufacturing, construction, and waste management.

For these reasons and more the alternatives as framed do not meet the purpose of the proposal. A more thorough and balanced evaluation is necessary to ensure that all relevant factors, including environmental, economic, and reliability considerations, are properly addressed. (**80-9** [Jiang, "Joy" Yue] [Stein, Adam])

Comment: However, the proposed and no-action alternatives in the SEIS, do not necessarily meet the stated purpose. The continued operation of DCPP is crucial for meeting California's energy needs, ensuring grid reliability, and supporting the state's climate goal - carbon neutrality goal by 2045. A recent poll shows strong local and statewide support for DCPP's license renewal[40], and similar voices were conveyed in the public meeting held by NRC on this topic on November 14th, 2024. [41]

[40] See World Nuclear News, "Californian Support Grows for Diablo Canyon – Poll," 2022, https://www.world-nuclear-news.org/Articles/Californian-support-grows-for-Diablo-Canyon-poll.
[41] See U.S. Nuclear Regulatory Commission, "Public Meeting Schedule: Meeting Details,"2024, https://www.nrc.gov/pmns/mtg?do=details&Code=20241314.

The SEIS should fully account for the negative impacts of alternatives, ensuring that any potential delays or harm to decarbonization efforts are addressed in its final analysis. Currently, California has been unable to meet its renewable deployment objectives in GHG reductions and has been required to meet grid reliability by deploying additional natural gas generation. **These impacts should be accurately addressed as part of the alternative analyses.**
(**80-11** [Jiang, "Joy" Yue] [Stein, Adam])

Response: *The comments expressed concerns related to the NRC staff's analysis of alternatives in the SEIS and questioned whether the alternatives evaluated meet the purpose and need of the proposed action. Section 2.3 of this SEIS was revised to clarify that the alternatives analysis in this SEIS is consistent with NEPA Section 102(2)(C)(iii) and that the NRC presents "a reasonable range of alternatives to the proposed agency action, including an analysis of any negative environmental impacts of not implementing the proposed agency action in the case of a no action alternative, that are technically and economically feasible, and meet the purpose and need of the proposal."*

As explained in Section 2.3.2 of this SEIS, as a consequence of not implementing the proposed agency action (i.e., renewing the Diablo Canyon operating licenses) in the case of the no-action alternative, two replacement power alternatives were identified for detailed study, a purchased power (from existing energy generating facilities) alternative and a renewables combination alternative. However, the NRC's decision-making authority only extends to deciding whether to renew the Diablo Canyon operating licenses. Therefore, replacement energy alternatives represent options that energy-planning decision-makers may consider if the Diablo Canyon operating licenses are not renewed.

As explained in Section 2.3.2.1 of this SEIS, purchased power would likely come from the most common types of existing electric power generating technologies including other nuclear power plants, natural gas- and coal-fired power plants, and solar and wind energy installations, some of which could be located outside of California. Purchased power may also rely on older, less-efficient power plants operating at higher levels of power generation than current operations. The environmental effects of nuclear, natural gas-fired, and coal-fired power plants and of solar and wind energy facilities would be similar to those described under the common impacts sections in Chapter 3 of this SEIS for all resource areas.

As explained in Section 2.3.2.2 of this SEIS, PG&E did not consider renewable energy generation sources reasonable for replacing Diablo Canyon based on the criteria that the *replacement energy alternatives must be commercially viable on a utility scale and operational prior to the expiration of the operating licenses. In addition, analyses conducted by the California Energy Commission (CEC) also concluded that adequate renewable energy resources could not be brought online before the Diablo Canyon operating licenses expire (CEC 2023-TN10081).*

As stated in the purpose and need statement of this SEIS, the purpose and need for the proposed agency action is to provide energy-planning decision-makers with the option to continue nuclear power plant operations beyond the current licensing term to meet future system generating needs. In addition, unless there are findings in the NRC's safety or environmental review that would lead the NRC to reject an LR application, the NRC does not have a role in making energy-planning decisions about whether a particular nuclear power plant should continue to operate. The regulatory authority over licensee economics (including need for power, grid reliability, and the ability to procure or develop new replacement energy) falls within the jurisdiction of the State and, to some extent, the FERC.

While the consideration of licensee economics is not part of this NRC review, the environmental impacts of the proposed agency action and replacement energy alternatives are described in Chapter 3 of this SEIS and these impacts are summarized in Table 2-1.

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

A.2.5 Ecology – Aquatic Resources

Comment: 4. Section 3.7.5.1 (page 3-76, Line 28)
On April 17, 2024, the State Water Resources Control Board (SWRCB) adopted revised interim mitigation payment calculations. The default cost is now $12.51 per million gallons of intake water and is subject to annual increases. (**65-4** [Jones, Thomas P.])

Comment: 5. Section 3.7.5.1 (page 3-76, Line 33)
The interim mitigation payment for DCPP for the operating period October 1, 2021, through September 30, 2022, was $4,826,784.58. PG&E anticipates receiving the next invoice soon for the period October 1, 2022, through September 30, 2023. PG&E will pay this invoice and subsequent invoices pursuant to the updated mitigation fee requirements that were adopted by the SWRCB on April 17, 2024. (**65-5** [Jones, Thomas P.])

Comment: 6. Section 3.7.5.1 (page 3-77, Line 19)
The State of California once-through cooling (OTC) Policy expresses a preference for closed-cycle wet cooling systems as the selected best technology available (BTA) but allows for the Water Board to establish site-specific BTA requirements for nuclear power plants based on the results of special studies required under the Implementation Provisions (Section 3.D) of the OTC Policy. The SWRCB has determined, based on numerous studies, that there are no feasible alternatives to modify the DCPP OTC system, such as closed-cycle cooling, onshore mechanical intake fine mesh screening systems, or offshore modular wedge wire screens at DCPP. On April 17, 2024, the SWRCB updated the OTC mitigation fee amounts. PG&E is and will continue to demonstrate compliance with the OTC policy via payment of the interim mitigation fees through October 31, 2030, pursuant to California Senate Bill (SB) 846.
(**65-6** [Jones, Thomas P.])

Comment: ***Future Reevaluation of BTA Feasibility***
Page 3-75 states that the Bechtel Power Corporation assessed alternative cooling technologies or modifications for Diablo Canyon's existing once-through cooling system to support PG&E's compliance with California's Once-Through Cooling (OTC) Policy, but none of the evaluated alternatives were deemed feasible. Resulting from DCPP's inability to convert to a closed-cycle system or another best technology alternative, Senate Bill 846 and the SWRCB's Resolution No. 2023-0025 to their OTC Policy established the final compliance dates for Diablo Canyon Units 1 and 2 to be October 31, 2030. Unless provisions to the contrary are made to SB-846 and SWRCB's OTC Policy, DCPP would only be able to operate for six more years regardless of whether the operating license renewal for an additional 20 years was approved. The EPA recommends that PG&E consider committing to a feasibility reevaluation of cooling modification alternatives for DCPP's once-through cooling system, should provisions be made within the next 6 years that would allow for extended plant operations past 2030. While available technology does not currently exist, future technological advancements may occur, which DCPP could adopt to obtain BTA compliance with the state OTC Policy. (**83-3** [Donez, Francisco])

Response: *These comments concern the annual mitigation payments that PG&E pays under California's Once-Through Cooling (OTC) Policy and best technology available (BTA) determinations made by the State under this policy. The NRC staff has updated Section 3.7.5.1 of this SEIS to reflect the State Water Resources Control Board (SWRCB) revised interim mitigation payment calculations, which were published on April 17, 2024, at: https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2024/rs2024-0014.pdf. The staff also revised text in this section concerning BTA to reflect the SWRCB determination that there are no feasible alternatives to modify the Diablo Canyon cooling water intake system to achieve final compliance under the OTC Policy.*

Comment: 16. Section G.2.3-1 (page G-11, Line 14)

Suggested revision for clarity: "The SWRCB used the results of the studies to inform the decision to allow PG&E to continue operating DCPP through October 31, 2030, in accordance with California Senate Bill 846." The SWRCB did not use the results of these studies to inform its decision to require PG&E to cease operating DCPP by October 31, 2030. Instead, the SWRCB and SB 846 relied on previous studies and analyses and mitigation program (Resolution Number 2010-0020) to specify that the final compliance dates of the once-through policy for DCPP is October 31, 2030. (**65-16** [Jones, Thomas P.])

Response: *This comment requests that the NRC staff clarify statements concerning the SWRCB's use of aquatic studies in determining the final compliance date for Diablo Canyon under California's OTC Policy. The staff agrees with this comment and has updated Section G.2.3-1 of this SEIS to remove text stating that the SWRCB used the results of the 2012 and 2014 Bechtel studies to inform its decision to require PG&E to cease operating the Diablo Canyon once-through cooling system.*

Comment: MARINE ENVIRONMENT

Diablo's Once-Through Cooling Water System is out of compliance with the Clean Water Act. The facility circulates 2.5 billion gallons of seawater each day, releasing it back into the ocean 20° warmer and killing more than one billion fish in their early life stages.
(**21-7** [Anonymous, Anonymous])

Comment: Its release of warm water into the Pacific Ocean kills many millions of fish and thus reduces the economic and nutritional benefits of the central California fisheries.
(**24-4** [Woodcock, Charlene M.])

Comment: Impingement Mortality and Entrainment of Aquatic Organisms is discussed in section 3.7.5.1. "PG&E intends to comply with the OTC Policy by ceasing the use of Diablo Canyon's once-through cooling water intake system by a specified compliance date. On September 2, 2022, California Governor Gavin Newsom signed California Senate Bill 846 (State of California 2022-TN10038) into law. Effective September 2, 2022, Senate Bill 846 established a new OTC Policy compliance date for Diablo Canyon. Senate Bill 846 added Section 13193.5 to the Water Code, which specifies, in part: Notwithstanding any provision to the contrary in the State Water Resources Control Board's Water Quality Control Plan on the Use of Coastal and Estuarine Waters for Power Plant Cooling, as referenced in Section 2922 of Title 23 of the California Code of Regulations, the final compliance dates for Diablo Canyon Units 1 and 2 shall be 15 October 31, 2030." Furthermore, "...the SWRCB has determined under the OTC Policy that BTA [Best Technology Available] for Diablo Canyon is to cease the use of Diablo Canyon's once-through cooling water intake system by October 31, 2030. Until that time, the OTC Policy allows PG&E to pay an annual mitigation fee based on the volume of Pacific Ocean water that Diablo Canyon withdraws."

Yet, the NRC endorses a 20-year license extension, not 5 years. Will PG&E really be required to change their cooling system? No more waivers and extensions? (**29-5** [ZamEk, Jill])

Comment: Section 3.5.1.3.2 deals with the National Pollutant Discharge Elimination System. Diablo Canyon utilizes the once-through cooling system, which violates the Clean Water Act. But again and again, PG&E has been granted waiver after waiver and has been allowed to continue damaging the marine environment. And quote, "The current NPDES permit was issued on May 11, 1990, by the CCRWQCB and had a listed expiration of July 1, 1995. However, the permit has been under administrative extension," end quote. That's since 1995.

Again, slipshod. Impingement, mortality and entrainment of aquatic organisms is discussed in Section 3.7.5.1. The SWRCB has determined --this is a quote, "The SWRCB has determined under the OTC policy that BTA for Diablo Canyon is to cease the use of Diablo Canyon once-through cooling water intake system by October 31, 2030," end quote. Yet the NRC endorses a 20-year license extension, not five years.

So will PG&E really be required to change their cooling system finally? No more waivers and extensions? (**50-25-4** [ZamEk, Jill])

Comment: Section 3.1 - Affected Environment, Environmental Consequences, and Mitigating Actions: Page 3-1 of the Draft Supplement states that the NRC's review is based on the current site conditions that have resulted in part from the past several decades of Diablo Canyon operations. It also states that "environmental conditions have adjusted to the presence of the facility." This is not the case for some coastal resources affected by the facility's operations, for which the Commission will be applying standards under Chapter 3 of the Coastal Act to evaluate the effect of extended operations. For example, the facility's ongoing impacts on marine life (primarily those resulting from entrainment due to the intake of seawater for cooling) are typically evaluated by calculating an annual loss of marine life productivity that occurs during each year of facility operations. Our current assessment shows that these operations, which would end if not for license renewal, result each year in the equivalent of several hundred acres of lost marine productivity (see additional comments below on Sections 3.5 and 3.7). Please note, too, that the U.S. EPA has recommended that PG&E conduct an updated entrainment study to identify impacts that may be substantially different than those identified in PG&E's prior studies that are now more than 15 years old[1] We recommend this be reflected in Tables 3-1 and 3-2 and in the subsequent relevant descriptions of surface water and aquatic resource impacts.

[1] Importantly, entrainment impacts are evaluated on an annual basis - i.e., how much marine life productivity is lost during each year's operation - and any mitigation that may be required is based on the expectation that it provide compensatory productivity during each year of operation.

Additionally, page 3-7 acknowledges that PG&E's application for federal consistency certification is not yet complete. Coastal Commission staff is working with PG&E to resolve this issue and is nonetheless continuing to evaluate the partial application for consistency with the CCMP and is expecting PG&E to also submit a complete application for a CDP.
(**51-2** [Luster, Tom])

Comment: Section 3.7-Aquatic Resources: The document states on page 3-71 that aquatic resource impacts from license extension are expected to be small and on page 3-80 that operations would likely not destabilize or alter important attributes of the aquatic environment. It further states that several marine species have acclimated to the effects of facility operations (see, for example, page 3-122's discussion of sea otters). However, as noted above, each year of Diablo Canyon's cooling water intake operations results in the continual annual loss of marine life productivity equal to several hundred acres of nearshore coastal habitat. PG&E has partially mitigated for these losses from prior years through payment of an annual in-lieu mitigation fee through the state's once-through cooling program; however, that annual fee does not ensure consistency for purposes of the ongoing Coastal Act and CCMP review of the proposed 20-year license renewal. The Coastal Act and CCMP also have policies regarding protection of marine life that are different than those of the federal Clean Water Act referenced on page 3-74. Additionally, the supposed acclimation of marine life to an artificially-induced ecosystem does not allow for an accurate portrayal of likely impacts, and importantly, of the benefits that would accrue under a "no project" scenario. The Coastal Commission will be conducting its independent review of the expected marine life impacts resulting from license renewal.

Further, and as noted above, the expected update of Diablo Canyon's NPDES permit is likely to include several changes from the current permit, largely due to the changes in the state's water quality standards over the past 30+ years since the existing permit was approved. We recommend the Draft Supplement include a description of the likely or potential changes resulting from those modified water quality standards, such as changes to effluent limitations, thermal plume modeling, or others. (**51-8** [Luster, Tom])

Comment: Already, the illegal and environmentally detrimental once-through cooling system has been heating Diablo Cove for decades. The Coastal Commission demanded that the plant implement cooling towers but this was waived upon PG&E's 2016 agreement to shut down the plant in 2024/25. Now, PG&E has applied for a 20-year license. It cannot continue to destroy the marine environment for decades more. (**59-1** [Hisasue, Carole])

Comment: Finally, the Draft SEIS fails to address the potentially catastrophic effects on marine life of operating the once-through cooling system at Diablo Canyon for another 20 years. The NRC Staff seems to confuse the State's intention for Diablo Canyon to close after five years (and thereafter to cease harming marine life) with PG&E's intention, as established by the 20-

year operating term requested in its license renewal application, to operate Diablo Canyon for four times that length of time. (**63-4** [Curran, Diane])

Comment: 3. Failure to address environmental impacts of once-through cooling system
The Draft SEIS fails to address the potentially catastrophic effects on marine life of operating the once-through cooling system at Diablo Canyon for another 20 years. The NRC Staff seems to confuse the State's intention for Diablo Canyon to close after five years (and thereafter to cease harming marine life) with PG&E's intention, as established by its license renewal application for twenty more years of operation, to operate Diablo Canyon for four times that length of time. The Final SEIS must address the environmental impacts of operating the once through cooling system for the entire twenty years of the license renewal term, including the cumulative impacts of sixty years of entrainment, impingement, and thermal pollution. (**63-17** [Curran, Diane])

Comment: For the past 40 years, the antiquated cooling system at Pacific Gas & Electric Company's Diablo Canyon nuclear power plant has killed billions of fish, endangered marine mammals and sea turtles, and degraded the ocean environment near a marine sanctuary on the Central Coast of California.

According to PG&E, the plant's intake structure is 240 feet long, 100 feet wide, and 18 feet high and extends down some 30 feet below sea level. The intake structure is located at the shoreline in Intake Cove, a cove fragment constructed for the purpose of protecting the intake from the large seas in the Diablo Canyon area. Its' four 13,000-horsepower electric motors pump 1.7 million gallons of seawater per minute*, or up to 2.5 billion gallons per day*.

Every day, 24 hours per day, seven days per week, 365 days per year, Diablo Canyon circulates 2.5 BILLION gallons of seawater through its' OTC system. The plant's cooling system discharges water back into the cove 20 degrees (F) hotter, devoid of any life. Each year of operation, the plant sucks in more than a billion fish in early life stages while killing vast amounts of plankton, the foundation of life in our oceans.

In 2010, the State Water Board ordered all coastal power plants to phase out OTC systems, but PG&E obtained a temporary exemption and planned to fully decommission the plant by the end of 2025. Then, due to the passage of Senate Bill 846 in 2022 (which proposes operating the plant for an additional five years), the State Water Board extended the date for Diablo's compliance with the OTC rules to October 31, 2030, and the State Lands Commission extended the land leases to 2030 to coincide with this date.

If Diablo Canyon's operating licenses are extended *an additional 20 years*, PG&E will be required to build cooling towers or other alternative cooling systems by 2030 to comply with California's OTC regulations. A 2013 report by PG&E contractor, Bechtel Power Corp., projected that a closed-cycle cooling system would cost $6 to $12 BILLION; these costs have no doubt increased since 2013, and most certainly would be charged to California's ratepayers and taxpayers. A State Water Board subcommittee reviewed the Bechtel report and found no basis for further exemptions of Diablo Canyon from the OTC Policy.

According to the Bechtel report, construction of alternate cooling systems could take as long as 14 years and be subject to California Environmental Quality Act review, as well as other lengthy permitting processes. The Diablo Canyon Independent Safety Committee (DCISC) maintains that the extensive retrofitting necessary for any proposed closed-cooling systems would require

PG&E to file a license amendment request with the NRC. PG&E has argued previously that the cost to phase out OTC at Diablo Canyon is too high.

With rapid worldwide depletion of fisheries and aquatic biodiversity, it is unacceptable to allow this decimation of marine life to continue in order to produce approximately 9 percent of California's energy. If the impact is so "minimal" as the SEIS states, why did the State Water Board create a law to phase out these destructive OTC systems?

Additionally, the seawater intake structure is vulnerable to rising levels of ocean water brought on by global climate change. The water that cools the plant is warmed by 20 degrees (F) before being discharged back into the ocean, contributing to further ocean warming. Think about it: 2.5 billion gallons every single day for 20 more years. The math and the impacts are almost incalculable. This aging plant must be decommissioned now; no license extension should be allowed. For additional details on Diablo's adverse marine impacts, see: https://www.sanluisobispo.com/news/local/environment/article258804173.html
(**68-1** [Mansfield-Wells, Julie])

Comment: The SIES does not consider two important upgrade projects that will be required for extended operations of 20 years. Diablo Canyon has an unusual requirement not encountered by other Nuclear Power Plants that occurs during the relicensing period that is a Site-Specific Issue (Category 2) which the SEIS fails to recognize or analyze. If PG&E operates DCPP beyond 2030 PG&E will be required to retrofit the existing once-through cooling system at Diablo Canyon Power Plant (DCPP) with closed-cycle wet cooling towers
(**79-1-5** [Sarvey, Robert])

Comment: According to the SEIS, "PG&E performed an evaluation of the SSCs, in accordance with 10 CFR 54.21 (TN4878), to identify the need to undertake any major refurbishment activities that would be necessary to support the continued operation of Diablo Canyon during the proposed 20-year period of extended operation. As a result of its evaluation of SSCs, PG&E did not identify the need to undertake any major refurbishment or replacement activities associated with LR to support the continued operation of Diablo Canyon beyond the end of the existing operating licenses. Therefore, refurbishment activities are not discussed under the proposed action in Chapter 3 of this SEIS."[8]

[8] SEIS Page 2-11

Diablo Canyon has an unusual requirement not encountered by other Nuclear Power Plants that occurs during the relicensing period that is a Site-Specific issue (Category 2) which the SEIS fails to recognize or analyze. If PG&E operates DCPP beyond 2030 PG&E will be required to retrofit the existing once-through cooling system at Diablo Canyon Power Plant (DCPP) with closed-cycle wet cooling towers. This is a major refurbishment that has an estimated cost of 4.6 billion dollars.[9] PG&E estimates the following activities and costs for the retrofit of the DCPP to closed-cycle wet cooling towers.

[9] PG&E Diablo Canyon Once Through Cooling analysis https://www.nrc.gov/docs/ML1604/ML16048A207.pdf Page 9

<u>In Millions by Category of Work:</u>
$325 Site Work - excavation, retaining walls
$316 Demolition, replacement of buildings, roads, parking
$298 Recirculating water/make-up water pumps, tunnels

$269 Permitting, engineering, project management, security
$242 Cooling Towers
$199 Electrical systems, process/instrumentation, utility relocation
$189 Worker transportation, commute wages, parking
$131 Upgrades - condensers, sewage treatment, SCW
$ 56 Blowdown water treatment, mixing station, diffuser
$ 50 Plant shutdown and start-up
$2,075 Total Direct Costs
$ 614 Project Indirect Costs and Contingency
$2,689 Total Capital Costs
$1,800 Replacement Power (at $70 MWh)
$4,500 TOTAL PROJECT COSTS[10]

[10] ID at Page 10

While the SEIS indicates that the refurbishment impacts would be small the SEIS ignores the large impacts that will occur in 2030 when the DCPP will be required to mitigate its extreme entrainment impacts as identified by the California Regional Water Board even though the SEIS considers entrainment a small impact requiring no mitigation. (**79-1-11** [Sarvey, Robert])

Comment: Slightly less than 100% impingement is LARGE, not small. 100% entrainment out of 100% is LARGE, not small. (**81-6-12** [McClintock, Francene])

Comment: "Could adversely"? It definitely DOES adversely affect smaller, slower fish; early life stages; and less mobile organisms and life stages. (**81-6-15** [McClintock, Francene])

Comment: You need to compare BEFORE Diablo Canyon was built to now and you will see a major difference. (**81-7-1** [McClintock, Francene])

Comment: Once again, baseline should be BEFORE the plant was built.
(**81-7-7** [McClintock, Francene])

Comment: Once-Through Cooling System
Impingement & Entrainment Impact Uncertainty
Page 3-82 describes the NRC's weight-of-evidence approach for analysis on the potential impacts of impingement and entrainment. This approach relies on impingement studies from 1985-1986 paired with extrapolation analysis done in 2009, and entrainment studies completed in 1996-1999 and again in 2008-2009, to conclude that insignificant changes were found during the current operating license term (p. 3-80). In the 15 years since those most recent analyses were completed for both impingement and entrainment, conditions may have changed. New studies would make the impacts analysis more robust by either confirming consistency with past trends across the entirety of the current operating license term, or by introducing new information that may alter conclusions and adjust the sum of annual interim mitigation payments. If the NRC does not plan to conduct new studies to establish current baseline data and monitor rate changes, EPA recommends that the Final SEIS clearly state the uncertainty associated with not utilizing updated environmental monitoring data for the assessed impingement- and entrainment-related impacts. (**83-2** [Donez, Francisco])

Response: *Many comments addressed Federal Water Pollution Control Act (CWA) (33 U.S.C. 1251-1387-TN662) requirements concerning impingement mortality, entrainment, and the effects of thermal effluents on the aquatic environment. Some of these comments also* *discussed related issues, such as the State of California's OTC Policy, an EPA recommendation for PG&E to conduct an updated entrainment study, and how the NRC staff should assess the baseline environment. In California, the SWRCB and the Central Coast Regional Water Quality Board (CCRWQCB) issue permits related to the CWA, including National Pollutant Discharge Elimination System (NPDES) permits that regulate the withdrawal and discharge of cooling water. As part of issuing these permits, these agencies must ensure that the requirements of CWA Section 316(a) and (b), which concern impingement mortality, entrainment, and effects of thermal effluent discharges, are met. Functionally, these requirements are implemented through NPDES permits. Sections 3.5.1.3.2, 3.7.5.1, and 3.7.5.2 of this SEIS discuss these requirements, as well as the associated regulatory structure, in detail. Additionally, in California, the SWRCB adopted the OTC Policy in 2010. The OTC Policy establishes uniform, technology-based standards to implement CWA Section 316(b) and to reduce the harmful effects associated with cooling water intake structures on marine and estuarine life. As explained in Section 3.7.5.2 of this SEIS, PG&E intends to comply with the OTC Policy by ceasing the use of Diablo Canyon's once-through cooling water intake system by a specified compliance date, which is currently October 31, 2030. At this time, PG&E is in compliance with all requirements imposed under the CWA, the NPDES permit, and OTC Policy. In this SEIS, the NRC staff appropriately relied upon the expertise of the regulatory authorities (i.e., the SWRCB and the CCRWQCB), the permits issued and conditions imposed by these authorities, the design of Diablo Canyon's cooling water intake system, and the results of available ecological studies in order to assess the potential impacts of impingement mortality, entrainment, and thermal effects on aquatic organisms during the proposed LR term. The staff determined that these impacts would not destabilize nor noticeably alter any important attribute of the aquatic environment and that the period of potential impacts would be limited by the OTC Policy and, therefore, concluded that these impacts would be SMALL.*

With respect to comments on the baseline condition of the resource, according to the 2024 LR GEIS, the "affected environment" is the environment that currently exists at and around operating U.S. commercial nuclear power plants. Because existing conditions are at least partially the result of past construction and ongoing operations at the nuclear plants, as well as reasonably foreseeable environmental trends, the impacts of these past and ongoing activities and how they have shaped the environment are summarized in the LR GEIS. Thus, it is this existing environment that composes the environmental baseline against which the potential environmental effects (impacts) of Diablo Canyon LR are evaluated. The impacts of continued operations and any refurbishment during the LR term that are presented under the "Proposed Action" section are incremental to these baseline conditions, which include the effects of past and present actions at the plant. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.

With respect to comments on loss of marine life productivity, as part of its entrainment analysis in Section 3.7.5.1 of this SEIS, the NRC staff considered the results of available aquatic studies, including entrainment studies conducted at Diablo Canyon, to assess the impacts that the aquatic environment would experience during the proposed LR term. The Diablo Canyon entrainment studies used three population assessment approaches to evaluate potential population-level impacts: adult equivalent loss, fecundity hindcasting, and empirical transport modeling. Appendix G of this SEIS describes these studies in detail. The NRC staff relied on these methods, but the staff recognizes that there are additional ways to analyze impacts, such as calculating lost aquatic life productivity, as indicated by the commenter. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.

One commenter noted that the EPA has recommended that PG&E conduct an updated entrainment study. Such an entrainment study would be conducted in conjunction with requirements under Section 316(b) of the CWA, and the SWRCB and the CCRWQCB are the regulatory authorities that would implement any related study requirements. As indicated previously in this response, under the OTC Policy, PG&E is authorized to continue operating Diablo Canyon's cooling water intake structure through October 31, 2030. Until then, PG&E will pay an annual mitigation fee based on the volume of water withdrawn from the ocean and the pounds of fish impinged. The State has not required PG&E to conduct any additional entrainment studies under this resolution. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.

One commenter, the EPA, recommended that the SEIS clearly state the uncertainty associated with relying upon entrainment studies completed in 1996-1999 and again in 2008-2009. The NRC staff acknowledges this recommendation and has updated the Impingement Mortality and Entrainment Conclusion in Section 3.7.5.1 of this SEIS to clarify that its conclusions are based on data from 1986 (impingement) and 2009 (entrainment).

Comment: <u>3.7 Aquatic Resources 2024 Dredging</u>
According to the SEIS Dredging results in the direct removal of bottom habitats along with infaunal and epifaunal organisms of limited mobility inhabiting the affected substrates. Dredging also creates sediment plumes that increase water turbidity. Thus, dredging affects both the quantity and quality of fish habitat. The direct removal of substrates, sediments, and benthic organisms represent effects to habitat quantity. The resulting short-term reductions in biomass of benthic organisms and increased water turbidity represent effects on habitat quality. PG&E conducted dredging of the Intake Cove in summer 2024. In support of this effort, PG&E obtained a CWA Section 404 22 permit from the USACE prior to conducting dredging. Details on the dredging effort at the potential impacts to EFH can be found in PG&E's EFH assessment (Stantec 2023-TN10661). PG&E has no plans to dredge during the proposed license renewal period. Therefore, there would be no impacts to EFH in the affected area associated with dredging."

The SEIS ignores the fact that the dredging that was done in 2024 was necessary for extended operations and therefore a direct impact of the relicensing. As the Coastal Commission letter to PG&E states, "Our letter and subsequent phone conversations between Commission and PG&E staff also identified several elements of PG&E's proposed relicensing that would constitute "development" under the Coastal Act1 and that result in the proposed relicensing being subject to the Coastal Commission's review and approval of an application from PG&E for a coastal development permit ("CDP")."[72] The Coastal Commission letter continued to state, "The December 7th letter identifies several components of the proposed relicensing that would constitute known or potential development requiring the Commission's approval of a CDP application. The letter notes that these were not exhaustive, but include ... Dredging within the Diablo Canyon intake cove;2 * Construction of a new or expanded spent fuel facility; and, * Installing new or expanded structural components, equipment, or infrastructure as part of extended operations."

[72] California Coastal Commission May 2024 letter to PG&E, "Coastal Development Permit needed for PG&E's proposed relicensing of Diablo Canyon Nuclear Power Plant" Page 1,2 https://www.nrc.gov/docs/ML2412/ML24127A204.pdf

According to the Federal Register, "A two-page excerpt from a fact-finding report approved by the Diablo Canyon Independent Safety Committee at its September 13, 2023, meeting identifies a contemplated ocean dredging project for accumulated sediment in the Diablo Canyon Intake Cove necessitated by potential extended operation of the power plant. The area of concern was originally designed to have an average (base) depth of 36 to 38 feet. Over nearly 40 years of operations, about 16 to 20 feet of sand have accumulated in that area, significantly reducing the depth and increasing the velocity of seawater being drawn into the intake bays. The higher amount of sand and increased velocity of seawater makes it more difficult for divers to keep the intake racks and bays clear of debris. These conditions also make it more likely for kelp to be drawn into the intake and foul the racks or condensers. Kelp ingestion has the potential to cause the circulating water system to trip, which stops cooling of the steam turbine condensers and can place significant stress on plan systems, and possibly a turbine/reactor trip, due to inability to dump steam to the condensers. Concern about the potential to have the circulating water system trip due to kelp ingestion is the reason that the plant will reduce power during some winter storms. The attached document is inadequately evaluated by DOE/EIS-0555." [73]

[73] Federal Register January 2, 2024 https://www.energy.gov/sites/default/files/2024-01/GDOCivilNuclearCreditProgramDiabloCanyonRecordOfDecision.pdf (**79-2-5** [Sarvey, Robert])

Comment: Should the above description be changed to reflect the dredging of 26,000 cubic yards of RADIOACTiVE/CHEMICAL/OIL contaminated sand, sediment and kelp that was moved to the U.S. Army Corps of Engineers Nearshore Placement Area located south of the entrance to Morrow Bay and west of Morrow Bay State Park?" The above description is no longer accurate. PG&E was authorized to dredge up to 70,000 cubic yards (53,519 cubic m [m3]) of accumulated sand and sediment from within a 125,000 square foot (ft2) (11,613 square meter [m2]) dredge footprint at the north end of Intake Cove to a depth of -38 ft mean lower low water. (**81-8-2** [McClintock, Francene])

Comment: My conclusion is that you have expanded the adverse effects to affect the essential fish habitat (EFH) in a wider area and may in the future dump more radionuclides and chemicals at your new nuclear dump west of Morro Bay State Park and south of the Morro Bay entrance, whether that be during continued operation, decommissioning, or post a nuclear power accident. Page 3-123 "While Diablo Canyon continues to operate, public access to Intake Cove, Diablo Cove, and other nearshore marine areas will remain prohibited." What about west of Morro Bay State Park and south of the Morro Bay entrance? (**81-11-3** [McClintock, Francene])

Response: *These comments concern the effects of dredging on aquatic organisms. Some of the comments specifically refer to impacts of dredging on essential fish habitat (EFH). In the 2024 LR GEIS under Section 4.6.1.2.9, "Effects of Dredging on Aquatic Resources," it states, "This issue concerns the effects of dredging at nuclear power plants on aquatic resources during an initial LR or SLR term." The NRC's review of available information found that previous plant-specific ERs and SEISs classified the impact levels of dredging activities on populations or communities of aquatic organisms as "SMALL" at all plants where they occurred in part because maintenance dredging for nuclear power plant operations occurred infrequently, was of relatively short duration, and affected relatively small areas. Based on this information, the NRC concluded that the impact of dredging on aquatic resources would be "SMALL" for all nuclear plants and classified this as a Category 1 issue. During the staff's Diablo Canyon LR review, the staff considered whether there was any new and significant information that would change the LR GEIS's generic conclusion of SMALL with respect to Diablo Canyon LR. PG&E has no plans to dredge during the proposed LR term. Therefore, the staff adopted the LR GEIS's generic conclusion of SMALL for this issue. With respect to the effects of dredging on EFH, Section 3.8.4.3.4 of this SEIS states that there would be no impacts to EFH in the affected area for Diablo Canyon LR because no dredging would occur during the LR term.*

Additionally, dredging is permitted by the U.S. Army Corps of Engineers (USACE) under CWA Section 404, and the USACE is required to perform its own environmental review prior to issuing such a permit. For instance, PG&E conducted dredging of the Intake Cove during the current operating license term in the summer of 2024. As stated in Section 3.8.4.3.4 of this SEIS, in support of that effort, PG&E obtained a CWA Section 404 permit from the USACE prior to conducting dredging. The USACE prepared an EFH assessment, which it submitted to the National Marine Fisheries Service in support of EFH consultation. Coastal Zone Management Act (CZMA) permitting is also required for dredging at Diablo Canyon. In Section 3.5.1.3.2 of this SEIS, the staff discusses how the California Coastal Commission approved issuance of a Coastal Development Permit for the 2024 dredging.

These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.

Comment: "During travel through the cooling system, entrained organisms experience physical trauma and stress, pressure changes, excess heat, and exposure to chemicals (Mayhew et al. 2000-TN8458)." Should state "physical trauma and stress, pressure changes, excess heat, exposure to chemicals, AND RADIOACTIVITY". (**81-6-5** [McClintock, Francene])

Comment: This is the problem BASELINE should be how the ocean and marine life was BEFORE Diablo went on line. You are using 'today', which is post multiple years of murder to our ocean as a baseline. And yes, unless Diablo is closed immediately, the species richness, evenness and diversity will continue to decline. It's already 'baked in' because of the hazardous lifetimes of these radionuclides. And dumping them west of Morro Bay has only concentrated the nuclides into a radioactive dump in our ocean in California Marine District 118 that ensures a FOREVER decline in species richness, evenness, and diversity. (**81-6-13** [McClintock, Francene])

Comment: "The primary form of thermal impact of concern at Diablo Canyon is heat shock. Heat shock occurs when water temperature meets or exceeds the thermal tolerance of an aquatic species for some duration of the exposure (NRC 2024-TN10161)."
Just horrible and unnecessary! The thermal shock continues forever as the RADIOACTIVE NUCLIDES released into the water continuously bombard the aquatic species.
"Thermal plumes can also reduce the available aquatic habitat or alter habitat characteristics in a manner that results in cascading effects on the local aquatic community."
This should read "Thermal radioactive plumes..." (**81-7-2** [McClintock, Francene])

Comment: Should be LARGE. Does the Clean Water Act Section 316(a) Requirements for Point Source Discharges CWA Section 316(a) address the adverse environmental impacts associated with ACCUMULATION OF RADIOACTIVE discharges into waters of the United States? DOES IT CONSIDER BIOACCUMULATION? If not, it should. I'm not sure how many people in these agencies writing legislation and making policy decisions realize you are dumping RADIONUCLIDES into our oceans, WITH THE CONSEQUENCE OF FOREVER HEATING THEM UP as the RADIONUCLIDES DECAY. (**81-7-6** [McClintock, Francene])

Comment: New (RADIOACTIVE) thermal plume studies need to be performed at the new nuclear/ chemical dump site at the U.S. Army Corps of Engineers Nearshore Placement Area located south of the entrance to Morrow Bay and west of Morrow Bay State Park. This is especially true since "Diablo Canyon's thermal plume is detectable south of Diablo Cove during certain tidal conditions". That means the RADIOACTIVE thermal plume is subject to entering Intake Cove. "Diablo Cove: Diablo Cove lies to the north of Intake Cove. This cove receives Diablo Canyon's thermal effluent discharge of Pacific Ocean water that the plant withdraws from

Intake Cove for cooling purposes." And we all know that water is radioactive.
(**81-8-3** [McClintock, Francene])

Comment: IN CONCLUSION: I certainly hope this meets the NMFS definition of "adverse effect" under the MSA as (50 CFR 600.810 [TN1342]): "any impact that reduces quality and/or quantity of EFH" and they close Diablo Canyon.

"Thus, the quality of fish habitat in the area is extremely unlikely to be affected by radiological contamination. Accordingly, the NRC staff concludes that radionuclide discharges would result in no more than minimal adverse effects on EFH in the affected area."

NMFS please see through this lie. (**81-10-6** [McClintock, Francene])

Comment: Diablo Cove: Diablo Cove lies to the north of Intake Cove. This cove receives Diablo Canyon's
1
thermal effluent discharge of Pacific Ocean water that the plant withdraws from Intake Cove for
2
cooling purposes.

So the EIS definition of Diablo Cove is that it is 'north of Intake Cove' and that it receives Diablo Canyon's (TWO NUCLEAR REACTORS) thermal effluent discharge.

"Pacific Ocean: Based on NPDES plume surveys from 1986 to 1990 (PG&E 2008- TN10104), Diablo Canyon's thermal plume is primarily detectable between 0.5 and 1 mi (0.8 and 1.6 km) offshore (41 to 60 percent of survey samples) with a maximum extent of 2 mi (3.2 km) either north or south of Diablo Cove during certain tidal conditions."

The above should really read "Diablo Canyon's RADIOACTIVE thermal plume..." So this proves the radionuclides travel "south of Diablo Cove during certain tidal conditions". South of Diablo Cove is Intake Cove. There has to be some pulling in/
recirculation of the Diablo Cove radionuclides back in to Intake Cove "since the initial construction of the breakwater."

As established above, Intake Cove has accumulated oil and grease, chemical additives: chlorination, liquid sodium hypochlorite and a supplemental chemical, sodium bromide, total suspended solids, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature, turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity.

"PG&E decided to remove the accumulated sand and kelp by dredging Intake
Cove, which had not been performed since the initial construction of the breakwater."

Did PG&E decided to remove or cover up the radionuclides, oil and grease, chemical additives: chlorination, liquid sodium hypochlorite and a supplemental chemical, sodium bromide, total suspended solids, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature, turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity that had accumulated since 1984 by two nuclear reactors? (**81-10-7** [McClintock, Francene])

Response: *These comments concern exposure of the aquatic environment to radionuclides discharged as part of Diablo Canyon's thermal effluent. The NRC staff analyzed the issue of exposure of aquatic organisms to radionuclides in detail in Section 4.6.1.2.8 of the LR*

GEIS. The NRC staff concluded that the impacts of exposure of aquatic organisms to radionuclides during the LR term would be SMALL for all nuclear power plants and that this is a generic (Category 1) issue. During its Diablo Canyon LR review, the staff considered whether there was any new and significant information that would change the LR GEIS's generic conclusion of SMALL for Diablo Canyon LR. The NRC staff found no such information and, therefore, adopted the LR GEIS's generic conclusion for this issue. Additional information on radiological exposure and monitoring can be found in Section 3.11 of this SEIS. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.

Comment: The DSEIS states that the California Coastal Commission has not yet responded to the additional materials it requested from PG&E per the Commission's Dec. 7, 2023, notification of PG&E's incomplete application to determine the consistency of the extension of Diablo's operating permit with the Coastal Zone Management Act (CZMA). While the DSEIS may not be able to note the response of the Coastal Commission to PG&E's submission, it is obligated to address the concerns in the Commission's request for additional information based on how the proposed action would "affect any land or water use or natural resource of the coastal zone." Of those concerns, we note specifically:

"The certification cites PG&E's most recent entrainment [to draw in and transport something, like fish, by the flow of a fluid] study showing that Diablo Canyon's use of seawater for cooling results in a loss of productivity equal to almost 700 acres of rocky reef habitat each year. However, the actual loss is substantially higher, as that study used a calculation based on a 50% confidence level instead of the 95% confidence level now used by the Coastal Commission and other state agencies to determine the type and extent of entrainment impacts resulting from seawater intakes. Applying the 95% confidence level results in a loss of productivity during each year of operations roughly equal to that provided by well over 1,000 acres of reef habitat."

"PG&E and other resource agencies have identified that Diablo Canyon's thermal discharge is having adverse effects on nearby populations of black abalone, a species of special biological significance protected under the Endangered Species Act. Please provide relevant studies that describe those effects and identify the mitigation measures PG&E has implemented, or will implement, to avoid and reduce those effects." (**55-1** [Harvey, Susan])

Response: *This comment is about the California Coastal Commission and the applicant's application for federal consistency with the CZMA. Section 3.2.1.2 of this SEIS acknowledges the applicability of the CZMA to the proposed action of Diablo Canyon LR and also that the California Coastal Commission consideration of the related consistency certification is ongoing and has not been completed to date. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

A.2.6 Ecology – Terrestrial Resources

Comment: Section 3.6 -Terrestrial Resources: The Draft Supplement notes on page 3-60 that some of the Diablo Canyon lands are considered Environmentally Sensitive Habitat Areas ("ESHAs") under the Coastal Act and CCMP; however, it does not incorporate that designation in its descriptions or analyses of the various habitat areas in these lands. We recommend the document be revised to note that a significant proportion of the Diablo Canyon lands are considered ESHA, that the Coastal Act and CCMP allow for limited specified uses in those areas, that disturbance in those areas is generally considered significant, and that development activities in or adjacent to those areas would likely be subject to coastal development permit requirements. We recommend the Draft Supplement's description of terrestrial resources include a more comprehensive description of the ESHA within and adjacent to the project area and the expected and potential impacts to any nearby ESHA. (**51-7** [Luster, Tom])

Response: *Environmentally sensitive habitat areas (ESHAs) that have been documented within the Diablo Canyon site are identified in Figure 4.3-4 and Table 4.3-3 of the Diablo Canyon Power Plant Decommissioning Project Draft Environmental Impact Report (SLOC 2023-TN10105). Because the proposed action of Diablo Canyon LR does not involve any construction or development activities with the potential to affect ESHAs, ESHAs are not discussed in this SEIS. Potential impacts to ESHAs from activities other than LR at the Diablo Canyon site may subject to evaluation through applicable review processes, such as an application for a coastal development permit. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

Comment: Well, my main concern about the EIS as it stands now, is that the attention to the alternatives environmental impact, especially the 50 some square miles that would be needed for alternative solar power plants and the impact of wind turbines on raptors that others have already remarked is, in my opinion, not adequately addressed. (**49-13-5** [Snyder, Van])

Response: *The comment expressed concern for power alternatives land requirements and potential impacts of wind generation on raptors. Land use requirements for construction and operation of renewable power can vary depending on geographic and technological factors as well as siting requirements. The values used in this SEIS for the quantity of land required for renewable power are based on established estimates and reflect the increase in land required in comparison to the proposed action of Diablo Canyon LR, as described in Section 3.2.7 of this SEIS. Terrestrial resource impacts based on land requirements are described for geothermal, solar, and wind in Section 3.6.8 of this SEIS.*

The impacts on terrestrial habitats and biota from the construction and operation of wind farms would depend largely on the amount of land required, the location of the land, and the type of facility (see the wind discussion in Section 3.6.8 of this SEIS). Effects to raptors and other birds are described generically, because the specific locations of the wind farms are unknown. The NRC staff determined that the impacts on terrestrial resources from the wind component of the renewables combination alternative would be MODERATE to LARGE because construction would result in significant loss of vegetation and wildlife habitat and because operation would negatively impact bird and bat populations. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.

Comment: Second, given the large raptor population in the Diablo Canyon area, I found that Section 3.6.8 wind component to be quite relevant, considering the healthy population of peregrine falcons, eagles, raptors, hawks, and other threatened birds nesting or migrating within the Diablo Canyon study area.

I support the statement that "The NRC staff concludes that the impacts on terrestrial resources from the wind component of the renewable combination alternative would be moderate to large". It's not an unfair assumption that a wind farm built in this area would require obtaining federal take permits for these birds. And this is quite the opposite of the current land use of Diablo Canyon, which has provided the habitat for these species and other vulnerable coastal species to frankly, flourish. So I'm glad that that's highlighted. (**49-9-4** [Pittman, Brendan])

Response: *The comment expressed support for the analysis for raptors and migratory birds (SEIS Sections 3.6.3, 3.6.6, and 3.6.8). The commenter agreed that the construction of wind installations could have negative effects on these species and could potentially require Federal take permits. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

Comment: <u>3. Section 3.6.3.2 (page 3-57, Line 18)</u>
The oak tree impact avoidance, minimization, and mitigation plan was developed for implementation during DCPP decommissioning. (**65-3** [Jones, Thomas P.])

Response: *The comment clarified that the oak tree impact avoidance, minimization, and mitigation plan described in Section 3.6.3.2 of this SEIS was developed for implementation during Diablo Canyon decommissioning. The State of California and San Luis Obispo County consider individual oak trees to be a sensitive resource, and surveyors found 245 live oak coast trees that were at least 5 in. in diameter on the Diablo Canyon site (Terra Verde 2021-TN10101). The NRC staff agrees with the clarification that the oak tree plan applies to decommissioning only and has clarified this in the text of this SEIS.*

A.2.7 Federally Protected Ecological Resources

Comment: <u>7. Section 3.8.1.1 (page 3-91, Table 3-11)</u>
Monarch butterflies occur commonly throughout the California Central Coast region and are often observed flying south to north during the winter migration season. Overwintering roosting sites are protected in California, and it is correct that no overwintering roost sites are present at DCPP. However, monarchs are considered a "seasonal migrant" in the vicinity of DCPP and are known to pass through or over DCPP lands; individuals may temporarily roost or forage on DCPP lands in transit to Montana de Oro State Park or other overwintering roost sites. "Seasonal migrant" status should also be noted in Table 3-15 on page 3-119. Temporary stop-over roosts are typically only utilized less than one day, away from DCPP infrastructure, so the DSEIS effects analysis for this species remains accurate. (**65-7** [Jones, Thomas P.])

Response: *This comment indicated that monarch butterfly (Danaus plexippus) are seasonal migrants in the action area considered in the NRC staff's Endangered Species Act analysis for the proposed action (i.e., Diablo Canyon LR). The NRC staff agrees with this comment. Accordingly, the staff updated SEIS Table 3-11 to indicate that this species is known to pass through or over Diablo Canyon lands and that individuals may temporarily roost or forage within the action area in transit to Montana de Oro State Park or other overwintering roost sites. The staff also updated SEIS Table 3-15 to indicate that: (1) PG&E would continue applying herbicides according to labeled uses, but has no plans to apply herbicides in natural areas; (2) the contribution of Diablo Canyon operations to climate change related effects on monarch butterflies would be too small to be meaningfully measured, detected, or evaluated; and (3) continued preservation of the existing high-quality habitats in the action area would result in beneficial impacts on monarch butterflies. Finally, the NRC staff revised its effect determination to "not likely to adversely affect" for this species. The ESA does not require Federal agencies to seek the FWS's concurrence for "not likely to adversely affect" effect determinations for proposed species. Therefore, the NRC has no ESA Section 7(a)(2) obligations with respect to this species for this proposed action.*

Comment: 8. Section 3.8.1.1 (page 3-94, Line 24)
Terra Verde conducted additional surveys and prepared a California red-legged frog (CRLF) Survey Addendum in 2022 that has updated locations where CRLF were found, both in Diablo Creek and Tom's Pond. This should also be noted in Section 3.8.4.1.1 on page 3-120.
(**65-8** [Jones, Thomas P.])

Response: *This comment provided additional information about surveys performed on the Diablo Canyon site for the California red-legged frog that was not included in the draft SEIS. The NRC staff updated Section 3.8.1.2 of this SEIS to include this information.*

Comment: 9. Section 3.8.3-1 (page 3-117, Line 2)
Figure 3-7 shows an old sanctuary boundary. In September 2024, the National Oceanic and Atmospheric Administration published the Final Environmental Impact Statement for the Chumash Heritage National Marine Sanctuary, which updated the preferred sanctuary boundary. The sanctuary was formally designated on November 30, 2024, and the adopted boundary does not include the DCPP intake or discharge sites. (**65-9** [Jones, Thomas P.])

Comment: 1. 3.8.4.4. Chumash Heritage National Marine Sanctuary (document pages 3-138 to 139; pdf pages 204 to 205)
The DSEIS states the following: "In Section 3.8.3 of this SEIS, the NRC staff describes the proposed Chumash Heritage National Marine Sanctuary. Depending on the boundaries of the sanctuary, once designated, the sanctuary may include nearshore waters affected by Diablo Canyon operations, including operations during the proposed LR period."

Commission staff encourages NRC staff to update subsection 3.8.4.4. to reflect the Sanctuary's designation, and to identify whether the National Oceanic and Atmospheric Administration has taken any other actions, to date, as described on pages 3-138 through 3-139.
(**73-4** [Calvo, Lucinda])

Response: *These comments concern potential impacts of Diablo Canyon LR on the Chumash National Marine Sanctuary. The NRC staff considered this sanctuary, as it was proposed at the time, in the draft SEIS. The National Oceanic and Atmospheric Administration formally designated the sanctuary in November 2024, following the NRC's issuance of the draft SEIS. The NRC staff updated Sections 3.8.3 and 3.8.4.4 and Appendix C.1.3 of this SEIS to reflect the sanctuary's final designation. In the draft SEIS, the NRC staff contemplated that once designated, the sanctuary might include nearshore waters affected by Diablo Canyon operations, including operations during the proposed LR term. However, the final boundary encompasses 4,543 mi^2 (3,431 square nautical miles) of submerged lands and marine waters from approximately 2 mi (3.2 km) southeast of Diablo Canyon Intake Cove to Naples along the Gaviota Coast in Santa Barbara County. As explained in Section 3.8.4.4 of this SEIS, because of, in part, the final boundary of the sanctuary, the NRC staff did not identify any impacts that sanctuary resources could experience from the proposed action, and the NRC staff concluded that the proposed action would have no effect on sanctuary resources of the Chumash Heritage National Marine Sanctuary. Thus, the National Marine Sanctuaries Act does not require the NRC to consult with the National Oceanic and Atmospheric Administration for the proposed action.*

Comment: Why do you not expect the endangered or threatened species to occur onsite? How very convenient to just dismiss this list. (**81-5-11** [McClintock, Francene])

Comment: "None were found during 2020 surveys" is repeated in the above synopsis. Had they been found during earlier surveys? Surely they were there before Diablo was built. Are they all dead? Mutated? Have cancer or other diseases? (**81-5-12** [McClintock, Francene])

Response: *These comments questioned how the NRC staff determined which threatened and endangered species occur on the Diablo Canyon site. Tables 3-11 and 3-12 in Sections 3.8.1.2 and 3.8.1.3, respectively, of this SEIS identify the federally threatened and endangered species that potentially occur in the action area for the proposed action of Diablo Canyon LR. The NRC staff identified these species from PG&E's ER, the FWS's Information for Planning and Conservation database, the NMFS's critical habitat mapper, available ecological surveys, and other records. The NRC staff then considered whether suitable habitat for each species occurs in the action area and whether the species itself may occur in the action area based on life history requirements and ecological surveys conducted on the site. Several federally listed species were determined to occur or have the potential to occur in the action area. These species include the California red-legged frog, California condor, California least tern, Hawaiian petrel, marbled murrelet, short-tailed albatross, monarch butterfly, southern sea otter, black abalone, and several species of marine mammals, whales, and sea turtles. These determinations were also informed by the NRC staff's consultations with the FWS and the NMFS under the Endangered Species Act. The remaining species were determined not to occur in the action area based on lack of suitable habitat, occurrence records, or other information, as summarized in Tables 3-11 and 3-12. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.*

Comment: Diablo Canyon has adversely affected the sea otter since it was opened. Does the FWS know you dump radionuclides into the water, or did you forget to tell them? The proposed action will continue to expose the sea otter to gamma, beta and alpha radionuclides INSIDE and outside of their bodies. THAT'S SIGNIFICANT. (**81-8-11** [McClintock, Francene])

Comment: What about the gamma rays? What about the radionuclides in the thermal plume? What about the radionuclides in the food the whales eat? What about the Ni-63 and Fe-55 that settles to the bottom of the ocean and the whales eat it? Does the NMFS not know about this? Didn't you tell them?

From Pages 3-107 to 3-109
"Gray whales are frequently observed traveling alone or in small, mostly unstable groups, although large aggregations may be seen in feeding and breeding grounds. Like other baleen whales, long-term bonds between individuals are thought to be rare. Gray whales are primarily bottom feeders that consume a wide range of benthic and epibenthic invertebrates, such as amphipods. Gray whales suck sediment and food from the sea floor by rolling on their sides and swimming slowly along, filtering their food through coarse baleen plates on each side of their upper jaw. (NMFS 2024-TN10304)

Along the northern and central California coastline, humpback whales are common during their feeding season (summer and fall). Whales from the Central American DPS tend to be more frequently observed in the southern parts of the feeding grounds than the Mexico DPS whales. It is expected that almost all the Central American DPS whales feed in California and Oregon. Whales from the Mexico DPS also feed in Washington and Alaskan waters. Whales from the Hawaii DPS, which is unlisted under the ESA, have also been observed feeding in California waters; however, these whales primarily feed in Southeast Alaska, Northern British Columbia, northern Gulf of Alaska, and the Bering Sea (86 FR 21082-TN10264)...Humpback whales occur in the action area seasonally. The species has been regularly observed offshore of Diablo

Canyon since 1987, and sightings are most common in later summer to early winter. In one instance, a humpback whale was observed feeding as close to the Diablo Canyon action area as the seaward side of Diablo Rock (1,640 ft [500 m] from the discharge) (PG&E 2023-TN9822). From 2017 through 2020, Tenera conducted monthly to biweekly clifftop surveys of marine mammals at several locations within the action area. A total of seven humpback whales were observed over this time period (PG&E 2024-TN10611)." (**81-9-3** [McClintock, Francene])

Comment: 29,173.408 curies that Diablo Canyon Unit I and 2 has potentially dumped into the Diablo Cove. (I admit I do not have the actual stats at this time but you do).
"Over the period from 2018 to 2021, no Diablo Canyon-related radionuclides were detected at any of the sample locations (PG&E 2023-TN9822)"
WHERE DID THEY ALL GO?
Page 3-108
"Humpback whales consume a diverse diet of small schooling fish and krill. Known prey organisms include species representing Clupea (herring), Scomber (mackerel), Ammodytes (sand lance), Sardinops (sardine), Engraulis (anchovy), Mallotus (capelin), and krill such as Euphausia, Thysanoessa, and Meganyctiphanes. Humpback whales also exhibit flexible feeding strategies, sometimes foraging alone and sometimes cooperatively. During the winter, humpback whales subsist on stored fat and likely feed little or not at all (80 FR 22304-TN10265)."
Where do all the radionuclides go? INTO THE FOOD CHAIN. Into the Essential Fish Habitat (EFH). (**81-9-6** [McClintock, Francene])

Comment: Gamma rays? Beta rays? Ingested alpha, gamma and beta in their food? Was that discussed? (**81-9-7** [McClintock, Francene])

Comment: Please make sure you discuss the radioactivity that is present in Diablo Cove, in Intake Cove and now, since the dredging, the radioactivity that is west of Morro Bay State Park. Please discuss how the continued operation of Diablo Canyon will only increase the amount of radionuclides in our environment and subject all who are near (subjected to gamma and beta emissions) or ingest the gamma, beta and alpha emitting particles to ill health, mutation and death, inclusive of those caught in entrainment and how "released back to the ocean unharmed" is a false statement you keep repeating in this EIS. Please discuss the importance of bio-accumulation of radioactivity in the food chain. (**81-9-8** [McClintock, Francene])

Response: *These comments concern exposure of aquatic animals, including whales and sea otters, to radionuclides. The NRC staff analyzed the issue of exposure of aquatic organisms to radionuclides in detail in Section 4.6.1.2.8 of the LR GEIS. The NRC staff concluded that the impacts of exposure of aquatic organisms to radionuclides during the LR term would be SMALL for all nuclear power plants and that this is a generic (Category 1) issue. During its review of the proposed action (i.e., Diablo Canyon LR), the staff considered whether there was any new and significant information that would change the LR GEIS's conclusion of SMALL impacts to aquatic organisms from exposure to radionuclides with respect to Diablo Canyon LR. The NRC staff found no such information and, therefore, adopted the LR GEIS's conclusion for this issue. Additional information on radiological exposure and monitoring can be found in Section 3.11 of this SEIS. With respect to whales and sea otters, specifically, because these animals are also protected under the Endangered Species Act, the NRC consulted with the FWS and the NMFS under Section 7(a)(2) of that statute. The FWS and the NMFS concurred with the NRC's determinations that Diablo Canyon LR is not likely to adversely affect these species. Appendix C to this SEIS summarizes these consultations. These comments provided no new* *and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.*

Comment: What about the radionuclides in the thermal effluent causing withering syndrome? Diablo Canyon's RADIOACTiVE thermal effluent IS causing AND HAS caused black abalone mortalities. Tenera must also not be aware there are radionuclides in the water expelled from Diablo Canyon, or if they are, they did not take that into consideration. Didn't you tell them? (**81-8-14** [McClintock, Francene])

Response: *This comment concerns black abalone and withering syndrome. Sections 3.8.1.3 and 3.8.4.2.1 and Appendix G of this SEIS summarize studies and other available information on black abalone near Diablo Canyon. Black abalone began declining across California's coast in the 1980s due to withering syndrome. Ecological studies performed in the region indicate that in addition to withering syndrome, declines near Diablo Canyon were largely attributable to sea otter foraging activities. While some of the studies speculated that thermal effluent discharge from Diablo Canyon, once the plant began operating, may have contributed to declines, no studies clearly linked plant operation to the observed declines. As stated in Section 3.8.4.2.1 of this SEIS, some studies concluded that the black abalone reductions were probably not related to power plant operation, because elevated temperatures would be expected to also affect the smaller (younger) abalone, which are generally more thermally sensitive than adults whereas sea otters and other predators generally select for larger individuals. Researchers found that this indicated that sea otter predation was the likely cause of local declines. Additionally, the timeline of the observed population decline did not match the Diablo Canyon operational period. Based on these and other studies summarized in this SEIS, historic black abalone declines in the Diablo Canyon action area are largely attributable to withering syndrome and sea otter predation rather than to operation of the plant. With respect to the potential for radiological impacts on black abalone, see the previous response to comments 81-9-7 and 81-9-8 that addresses the impacts of exposure of aquatic organisms to radionuclides. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

Comment: ENDANGERED SPECIES
Numerous federally-listed species under the U.S. Fish and Wildlife Service have been found at the Diablo Canyon site. Continued operation of the plant for an additional 20 years would place undue burden on these endangered species. The NRC should choose the no-action alternative to preserve the biodiversity of the Diablo Canyon site. (**21-6** [Anonymous, Anonymous])

Response: *This comment concerns the impacts of Diablo Canyon LR on federally listed species under the FWS's jurisdiction. As the commenter points out, several federally listed species under the FWS's jurisdiction occur on the Diablo Canyon site. These include California red-legged frog, California condor, California least tern, Hawaiian petrel, marbled murrelet, short-tailed albatross, and southern sea otter. Additionally, the monarch butterfly, which is proposed for Federal listing, may occasionally occur on the site as a seasonal migrant. The NRC staff evaluated the potential impacts of Diablo Canyon LR on these species in Section 3.8.4.1 of this SEIS. The NRC staff determined that Diablo Canyon LR is not likely to adversely affect these species. For certain species, such as the California red-legged frog, PG&E has implemented specific protection measures (see Section 3.8.1.4.1.1 of this SEIS). Notably, for all species, the continued management of natural habitats on the Diablo Canyon site would be a beneficial impact that would preserve these habitats during the LR term. Following the issuance of the draft SEIS, the NRC staff consulted with the FWS in accordance with Section 7(a)(2) of the Endangered Species Act. The FWS concurred with the NRC staff's* *conclusions of "not likely to adversely affect" for the species mentioned above in this response in a letter dated December 20, 2024 (FWS 2024-TN11893). This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

A.2.8 General Editorial Comments

Comment: 3. Appendix B, Table B-2 Operating Permits and Other Requirements (document page B-9; pdf page 341)
This table correctly lists the Commission's lease, PRC 9347.1, as being for submerged lands associated with the DCPP intake and discharge coves; however, the lease is also for upland areas including those used for a storage facility, office facilities, intake electrical room, intake maintenance shop, equipment storage pad, and spare tri-bar storage. Staff recommends revising the text in the "Authorized Activity" column to "Lease of submerged lands of intake cove and discharge cove and portions of adjacent upland". (**73-3** [Calvo, Lucinda])

Response: *This comment from the California State Lands Commission provided clarification regarding the land areas associated with its lease. Appendix B, Table B-2, "Operating Permits and Other Requirements," has been updated to reflect that California State Lands Commission lease PRC 9347.1 also includes portions of adjacent upland areas.*

A.2.9 General Environmental Concerns

Comment: And, you know, just want to highlight the pristine coastline and the environmental stewardship programs that Diablo Canyon and PG&E currently undertakes.
(**49-9-5** [Pittman, Brendan])

Comment: All nuke plants (and some other plants as well) take in water and dump it back out hotter into our oceans, rivers and lakes. In the case of nuke plants, radionuclides are present in that water. Our earth is a closed loop system. The hot, radioactive water migrates to the ice and melts it. Plus radionuclides give off heat (some forever) as they decay. The CO2 traps the heat, but THE NUCLEAR INDUSTRY IS THE HEAT GENERATOR. How many plants use water to cool off their systems, using our precious water as a heat sink and a dumping ground for their chemical/radioactive waste? Diablo Canyon is allowed to release water and effluent up to 25 degrees F warmer than the intake temperature during normal operations and up to 50 degrees F warmer one hour/day during demussleing. Over the years, the intake temperature rises and so does the outflow temperature. THERE IS NO CAP on how hot the intake temperature can be. The policy just allows the 25 degrees F to 50 degrees F increase "over the intake temperature". That sets up a vicious cycle to continuously increase the temperature of our oceans which increases the "intake temperature". And that is what is happening as the ice is melting at the polar caps of our planet.

To get the entire world-wide oceanic, lake, river, stream picture:

Boiling water reactors operate at 285 degrees C = 545 degrees F Pressure water reactors operate at 315 degrees C = 599 degrees F Nuclear fission power plants: 440 plants world-wide (not counting the military) operating 24 hours/day, 7 days/week, 365 days/year with planned outages every 18-21 months to re-fuel and then start the radioactive heat process back up. All to boil water at 212 degrees F to produce steam that turns a turbine.

'It's like cutting butter with a chainsaw.'

Nuclear fusion:
150,000,000 degrees C is 270,000,032 degrees F. They have put a sun on planet earth and they call it a "clean energy source"!

It's time to stop heating this planet. Do not re-license Diablo Canyon Unit 1 and 2. (**81-1-6** [McClintock, Francene])

Comment: LARGE ENVIRONMENTAL IMPACT. Nuclear power is changing the climate, adding to the increasing planetary temperatures. You do not have the planet's permission to use the oceans as your HEAT SINK. You do not have the ocean's permission to heat it up. (**81-1-7** [McClintock, Francene])

Comment: So you are making 2.5 billion gallons of seawater radioactive every day. That's NOT OK. (**81-1-8** [McClintock, Francene])

Comment: Chlorine released into the seawater also. This is NOT OK. (**81-1-9** [McClintock, Francene])

Comment: Except on page 3-82 you add to the above statement, an allowance up to 50 degrees F one hour per day!: (**81-1-10** [McClintock, Francene])

Comment: You are heating the water. This rule allows you to heat the water forever no matter how hot the water gets. There is no temperature cap! You have made the "daily natural temperature of the ocean" into an unnatural temperature that is far higher than it used to be before nuclear power plants went online. Maine Yankee dumped 1,823.338 curies into Montsweag Bay over a five-year sample period. This was mostly Tritium. That Tritium's still out there releasing heat as it decays. (**81-1-11** [McClintock, Francene])

Comment: Fossil fuels are below ground and when you bring them to the surface and burn them, they ADD carbon to the atmosphere. Above ground ANNUAL plants are within the natural carbon cycle. They can be burned for fuel which emits the carbon but then when re-grown, they take in the carbon. Annual plants are considered to be at the least carbon neutral and some CARBON NEGATIVE. (**81-2-2** [McClintock, Francene])

Comment: There have been studies conducted in England that found radionuclides on farmland and in crops, up to one mile inland from the coast. This is due to radioactive fog. The grazing animals would also be exposed. Since Fukushima, we now have radioactive fog along the West coast affecting our crops in an ongoing, forever nature. Diablo Canyon Units 1 and 2 only add to our radioactive fog problem. (**81-2-8** [McClintock, Francene])

Comment: Closing Diablo Canyon would have LARGE beneficial effects to the immediate environment and to Utah and Texas. Closing Diablo Canyon would also decrease the curies in the proposed offsite high-level dump. (**81-2-9** [McClintock, Francene])

Comment: Air quality is impacted by radionuclide releases and the benefit to the environment would be LARGE if they were no longer released to the air we breathe. Breast cancer rates would plummet. Maine Yankee released 3,865.16 curies to the air over a five year sample period, mostly Xenon-133. Renewable diesel could be substituted for diesel #2 with air quality benefits. (**81-2-14** [McClintock, Francene])

Comment: Admits to earthquakes. (**81-3-1** [McClintock, Francene])

Comment: NOT prime farmland. It's radioactive. Also because of the radioactive fog, everything one mile inland is radioactive. Refer to the studies conducted on the coast of England. (**81-3-2** [McClintock, Francene])

Comment: The benefit to the environment soil would be LARGE. It would make the probability of a meltdown, which would contaminate the soil, decrease. (**81-3-4** [McClintock, Francene])

Comment: How dare you conclude that there won't be earthquakes that affects Diablo Canyon? I've felt nothing but earthquakes since I've moved to California. This is not a place to site a nuke plant, but then again no place is. (**81-3-5** [McClintock, Francene])

Comment: Also, it would be a LARGE benefit to the geology and soil to avoid a nuclear accident. (**81-3-9** [McClintock, Francene])

Comment: So, 2.5 billion gallons per day of seawater is being contaminated with radionuclides that will heat the water forever. This is in addition to the temperature rise to cool a 599 degree F core. This is DAMAGE to our water resources. (**81-3-12** [McClintock, Francene])

Comment: That's 830,397 MGY heated to 22 degrees F to 50 degrees F. That's why the oceans are warming and dying. (**81-3-15** [McClintock, Francene])

Comment: Plus, it's all made radioactive by your leaking nuclear power plants. Main Yankee dumped 1,823.338 curies into Montsweag Bay over a five year sample period. This was mostly Tritium. I do not have the Diablo Canyon stats so will use Maine Yankee releases as an example. 1,823.388 curies in 5 years times 8 equals 14,587.104 curies for one plant over 40 years of operation. 14,587.104 curies times two nuclear power plants equals 29,174.208 curies dumped into Diablo Cove since 1984. Tritium's hazardous life is 123.2 years to 246.4 years. So all the tritium released from Maine Yankee into Montsweag Bay and the tritium released into Diablo Cove is still around... somewhere. (**81-3-16** [McClintock, Francene])

Comment: Contamination of our planet. The heating of our planet. Man-made radioactive hot sea water. (**81-3-17** [McClintock, Francene])

Comment: This list should include radionuclides. All waters are clearly over their curie limit. Many radionuclides take a very long time to decay. The more radionuclides we produce, the more concentrated and radioactive the water is. (**81-3-18** [McClintock, Francene])

Comment: This permit expired July 1, 1995. Has Diablo been paying a fee for this "administrative extension"? Permits cost money. There should be a fee from July 1, 1995 until late 2026 inclusive of late fees (11 years) if there has not been a payment. (**81-4-1** [McClintock, Francene])

Comment: Does the Bay Foundation of Morro Bay understand they just dredged Intake Cove and placed that sediment and kelp, with it's assorted radionuclides and other chemical effluents from Outfall 002, Outfall 003, Outfall 004, Outfall 016, and Outfall 017 south of Morro Bay and west of Morro Bay State Park? (**81-4-2** [McClintock, Francene])

Comment: The zone of influence is world-wide. They are heating up the whole ocean. (**81-4-5** [McClintock, Francene])

Comment: 1,823.338 curies of radioactivity were dumped into Montsweag Bay by Maine Yankee over a 5 year sample time-frame. So if you take that number (I have not to date been able to get hold of the Diablo Canyon LLRW Annual Reports so I will use the Maine Yankee data), 1,823.338 curies times 8 (i.e. 5 years X 8=40 years) and then multiply by two for two reactors, you get 29,173.408 curies that Diablo Canyon Unit I and 2 has potentially dumped into the Diablo Cove. "Over the period from 2018 to 2021, no Diablo Canyon-related radionuclides were detected at any of the sample locations (PG&E 2023-TN9822)"
WHERE DID THEY ALL GO?

You need to take samples at Morro Bay where you dumped all that radioactive sand, sediment and kelp in 2024. If the radionuclides were not detected at the surface sample locations, then you need to test elsewhere. They were definitely released into the water. Radionuclides with hundreds of years of hazardous lives don't just disappear (Tritium: 123 to 246 years, Strontium-90: 288 to 576 years, Ni-63: 200-400 years). Did you check the nearby aquatic life? Did you check the aquatic life that swims? You are clearly testing in the wrong area. Oh yes, dispersion/dilution is your solution to radioactive pollution. And testing in surface waters only is part of your cover-up. Radioactive heavy metals don't float in surface water. Radioactive heavy metals SINK. (**81-4-7** [McClintock, Francene])

Comment: Radioactive gaseous releases fall to the ground and affect groundwater supplies. From Page 3-45: "Tritium subsequently detected in water from these wells was 25 attributed to rain washout of gaseous tritium released from the permitted plant vent discharges 26 (PG&E 2023-TN9822)." The wind flow pattern is predominantly to the south. That could affect the Avila Beach water supply and other locations. (**81-4-9** [McClintock, Francene])

Comment: Why not? That is what everyone should be looking for. These are Nuclear plants that produce radiation. (**81-4-11** [McClintock, Francene])

Comment: An example of radionuclides dumped into Outfall 1, Diablo Cove (five year reported sample): I do not have Diablo Canyon stats so will use Maine Yankee's. You need to double the totals as Diablo Canyon has TWO nuclear power plants).

Radionuclides dumped into the water by Maine Yankee (excludes high-level waste);

1986 releases into the water: SR-89 0.000073 curies, SR-90 0.000133 curies, CS-134 0.0000333 curies, CS-137 0.00176 curies, I-131 0.229 curies, Co-58 0.000007 curies, Co-60 0.0136 curies, Cr-51 0.000041 curies, Mo-49 0.00111 curies, Tc-99 0.000895 curies, I-133 0.0218 curies, Cs-136 0.000153 curies, Fe-55 0.0223 curies, Ag-110m 0.00104 curies, Nb-97 0.00288 curies, SB-124 0.000153 curies, Sb-125 0.00262 curies, I-135 0.000976 curies, entrained gases: Xe-133 1.14 curies, Xe-135 0.261 curies, Xe-133m 0.00817, Xe-131m 0.00323 curies, Xe-135m 0.00123 curies, Kr-85 0.000086 curies, **Tritium (H-3):** 349 curies
Total Activity released to water: 350.7 curies

1987 releases into water: **nuclides:** Sr-89 0.00299 curies, Sr-90 0.00327 curies, Cs-134 0.00922 curies, Cs-137 0.0388 curies, I-131 0.0859 curies, Co-58 0.148 curies, Co-60 0.163 curies, Mn-54 0.00344 curies, Cr-51 0.0134 curies, Zr-Nb95 0.00366 curies, Mo-99 0.00035 curies, Tr-99m 0.00043 curies, Ba/La-140 0.0057 curies, Ce-141 0.00045 curies, Fe-55 0.251 curies, Ag 110m 0.0228 curies, co-57 0.000288 curies, Sb-122 0.000076 curies, Xe-131m 0.0136 curies, Sb-124 0.0874 curies, Sb-125 0.0324 curies, I132 0.000021 curies, I-133 0.00371 curies, I-135 0.000197 curies, Sn-133 0.000378 curies, Xe-133 0.015 curies, Ru-103 0.00179 curies, Ce-139 0.000035 curies, Np-239 0.00004 curies, Sr-91 0.00008 curies, Y-91m

0.00009 curies, Y-92 0.000107 curies, **entrained gases:** Kr-85 0.00013 curies, Xe-133 1.47 curies, Xe-135 0.00787 curies, Xe135m 0.00005 curies, **Tritium (H-3)** 117.71 curies
Total Activity released to water: 120.095672 curies

1988 (I'm unable to locate this report)

1989 releases into water: **nuclides:** Antimony-124 0.0344 curies, Antimony-125 0.0249 curies, Barium/La-140 0.000826 curies, Cerium-144 0.00000676 curies, Cesium-134 0.00396 curies, Cesium-137 0.0160 curies, Chromium-51 0.00076 curies, Cobalt-57 0.0000425 curies, cobalt-58 0.0266 curies, cobalt-60 0.0347 curies, Iodine-131 0.005 curies, iodine-133 0.00115 curies, Iodine-135 0.0000221 curies, Iron-55 0.0218 curies, Manganese-54 0.00185 curies, Molybdenum-99 0.000169 curies, Ruthenium-103 0.000000932 curies, Silver-110m 0.00769 curies, Strontium-89 0.000708 curies, Strontium-91 0.0000513 curies, Technetium-99m 0.000415 curies, Tellurium-132 0.000000729 curies, Tellurium-133m 0.00000809 curies, Tin-113 0.0000988 curies, Yttrium-91m 0.0000578 curies, Zinc-65 0.0000000939 curies, Zirconium/Nb-95 0.0000487 curies, Barium-139 0.0000487 curies, lanthium-142 0.00000177 curies, Tellurium-134 0.00174 curies, **entrained gases:** Xenon-133 0.189 curies, Xenon-135 0.00169 curies, Xenon-131m 0.000627 curies, Xenon-133m 0.00223 curies, Krypton-87 0.0000104 curies, Krypton-85m 0.00000211 curies, Krypton-88 0.00000166 curies, **Tritium (H-3)** 422 curies
Total Activity released to water: 422.376 curies

1990 releases into water: **nuclides:** Antimony-122 0.000374 curies, Antimony-124 0.0442 curies, Antimony-125 0.0257 curies, Barium/Lanth-140 0.000659 curies, Cerium-141 0.0000552 curies, Cerium-144 0.000000246 curies, Cesium-134 0.00203 curies, Cesium-137 0.0163 curies, Chromium-51 0.00479 curies, Cobalt-57 0.0000328 curies, Cobalt-58 0.0223 curies, Cobalt -60 0.0121 curies, Iodine-131 0.0279 curies, Iodine-132 0.0000165 curies, Iodine-133 0.00199 curies, Iron-55 0.0197 curies, Manganese-54 0.000181 curies, Mercury-203 0.0000911 curies, Ruthenium -103 0.000000944 curies, Silver-110m 0.00448 curies, Strontium-89 0.00194 curies, Technetium-99m 0.00123 curies, Tin-113 0.0000271 curies, Zinc-65 0.00000266 curies, Zirconium/Nb-95 0.00032 curies, Lanthium-142 0.000000231 curies, Tellurium-131 0.000000917 curies, Cadmium-109 0.00025 curies, (Unidentified) 0.0000258 curies. **Entrained gases:** Xenon-133 4.5 curies, Xenon-135 0.00474 curies, Xenon-131m 0.0914 curies, Xenon-133m 0.0208 curies, Xenon-135m 0.0000867 curies, Krypton-87 0.0000258 curies, Krypton-85m 0.00018 curies, Krypton-88 0.000099 curies, Krypton-85 0.0071 curies, **Tritium (H3):** 243 curies
Total activity released to water: 248 curies

1991 releases into water: nuclides: SR-89 0.004154 curies, CS-134 0.00213 curies, Cs-137 0.0139 curies, I-131 0.243 curiesCO-58 0.0169 curies, Co-60 0.026 curies, Fe-59 0.000095 curies, Mn-54 0.000135 curies, Cr-51 0.00327 curies, Zr/Nb-95 0.000232 curies, Mo-99 0.000215 curies, Tc-99m 0.000634 curies, Ba/La-140 0.0012 curies, Ce-141 0.0000815 curies, Fe-55 0.0161 curies, SB-124. 0.0386 Curies, Sb-125 0.041 curies, Ag-110m 0.00214 curies, Ru-103 0.0000464 curies, Sn-113 0.000178 curies, Np-239 0.000190 curies, Sr-85 0.000332 curies, I-133 0.00184 curies, Ba-133 0.0000407 curies, I-135 0.000246 curies, Sb-122 0.0000553 curies, Te-132 0.000012 curies, Ce-144 0.0000136 curies, Co-57 0.00000937 curies, Na-24 0.00000459 curies, La-141 0.0000967 curies, **Entrained gases:** Xe-133 1.986 curies, Xe-135 0.00367 curies, Xe-131m 0.0516 curies, Xe-133m 0.0083 curies, Xe-135m 0.00013 curies, Kr-85m 0.000298 curies, Tritium (H3): 388.8 curies
Total activity released to water: 390.892 curies

Outfalls 002 through 005, 008, 009, and 013 through 017: The NPDES permit requires that the 45 discharged effluents must not violate the water quality objectives in Chapter II, General 46 Requirements in Chapter III, and Table B Toxic Materials Limitations in Chapter IV of the Water 47 Quality Control Plan for Ocean Waters of California, California Ocean Plan. Page 3-37 Outfalls 003, 004, 005, 008, 009, 013, 015, 016, and 017: The NPDES permit specifies 4 concentration limits on oil and grease.

Chemical additives: chlorination, Liquid sodium hypochlorite and a12 supplemental chemical, sodium bromide. (**81-4-12** [McClintock, Francene])

Comment: The tritium could be from the core, a leak in the pipes. Tritium is the main radionuclide you are dumping in the ocean. Keep monitoring the French drain system. (**81-5-1** [McClintock, Francene])

Comment: Dilution is the solution. The nuclear industry keeps adding radionuclides, so background levels are constantly rising. Another loophole that allows you to contaminate the water. We should use "background' to mean BEFORE nuclear bombs were invented. And, once again, the ocean is not only your "heat sink" but also your nuclear dump. (**81-5-2** [McClintock, Francene])

Comment: Just because you don't report it doesn't mean it's not happening. You just said you stopped monitoring the French drain system. So how would you know? There was tritium in the French drain system and you hypothesized that it was "a gaseous leak from venting". So, tritium is falling all around the USA on us when it rains. It's definitely in the fog. And as nuclear plants age, they release more radionuclides, not less, so this is not the time to be cutting back on monitoring radionuclides. (**81-5-3** [McClintock, Francene])

Comment: I beg to differ. I think the tritium found in the sump pumps of the Old Steam Generator shows you have a leak in the pipes. Did you bother to test for other radionuclides? What about the French drain system? "likely result from rain washout"? You are guessing, hypothesizing. Did you test for I-131 or NI-63 or CS-137 or FE-55 or CO-60 to rule out a leaking core? The older the plants, the more they leak. So if you didn't test to distinguish between gaseous effluents vs water radionuclides leaking from the pipes, then that means you are not reporting accurately. You have brushed aside the idea that the pipes may be leaking and just allowing all those radionuclides to drain into the ocean. Thus, your annual low-level radioactive waste reports will not include all the "extra" radionuclides leaking from the pipes and they will be inaccurate. Further testing is needed. (**81-5-5** [McClintock, Francene])

Comment: If you don't report it, that doesn't mean it doesn't exist. (**81-5-7** [McClintock, Francene])

Comment: LARGE. It allows the radioactive decay process to start and no further added curies is a good thing. (**81-5-9** [McClintock, Francene])

Comment: LARGE. Stops the radioactive releases into air, water and land. Allows for hazardous life cycles to begin without adding more nuclides. (**81-5-10** [McClintock, Francene])

Comment: Was this because of mutations? (**81-5-13** [McClintock, Francene])

Comment: LARGE. The sky used to be filled with birds when I was young. I just travelled to Big Sur, looked out over the ocean at the most protected cove, and saw three birds. The nuclear industry has killed everything. (**81-5-14** [McClintock, Francene])

Comment: Why are there bird injuries onsite? I see there is a firing range onsite.
(**81-5-15** [McClintock, Francene])

Comment: Another permit out of compliance. (**81-6-1** [McClintock, Francene])

Comment: And you are killing it by dumping radionuclides into the ocean. We need kelp farming to restore the krill, cool and clean-up the oceans. Close down Diablo Canyon Unit 1 and Unit 2. (**81-6-2** [McClintock, Francene])

Comment: Are all those dead sea lions, otters and seals I see on the beaches tested for radionuclides? This is important as the reality is that Fukushima has had a drastic effect on the Pacific Ocean. Diablo Canyon is only adding to that effect. (**81-6-3** [McClintock, Francene])

Comment: "Commercial fishing activities near Diablo Canyon fall under California Marine District 118 and includes the Morro Bay statistical area." Then why did you dump all that man-made poison off the coast west of Morro Bay State Park? "According to California commercial landings reports for this statistical area, the following species are typically harvested with at least 1,000 lbs (450 kg) in total landings annually:" (see above). We are eating poisons created and used by Diablo Canyon when we eat the fish. BIOACCUMULATION.
(**81-6-4** [McClintock, Francene])

Comment: "During this process, entrained organisms are subject to mechanical, thermal, and toxic stresses". Once again you forgot to mention radioactivity. And by the way, you are total murderers. All just to boil water to turn a turbine. (**81-6-7** [McClintock, Francene])

Comment: This should have never happened: (**81-6-9** [McClintock, Francene])

Comment: It is less biologically productive because radiation, impingement and entrainment has killed everything over the past 40 years of operation. (**81-6-14** [McClintock, Francene])

Comment: If you kill off the babies, then you have no adults. (**81-6-16** [McClintock, Francene])

Comment: Diablo Canyon discharges heated effluent to Diablo Cove, which flows into the Pacific Ocean.

Should read "Diablo Canyon discharges radioactive heated effluent to Diablo Cove, which flows into the Pacific Ocean. (**81-7-3** [McClintock, Francene])

Comment: Once again, another way nuclear power plants add heat to our atmosphere. We do not need more heat in our atmosphere that is trapped by CO2 from fossil fuels and nuclear power mining, milling, transport, etc. (**81-7-4** [McClintock, Francene])

Comment: When dealing with a nuclear power plant there should be consideration for "RADIOACTIVELY THERMAL", not just 'thermal'. (**81-7-5** [McClintock, Francene])

Comment: 50 degrees F every day for one hour is "allowed". No wonder our planet is in trouble. Do they clean the pipes every day? (**81-7-8** [McClintock, Francene])

Comment: The adverse environmental impacts are great, and the license should not be renewed.

Three nuclear reactors melted down at Fukushima in 2011 (Unit 1, Unit 2, and Unit 3) with three exploding (Unit 1, Unit 3 and Unit 4) and, in the case of reactor #3, it was MOX fuel that was spread throughout our atmosphere, with some particles landing on the arctic ice (and in Seattle and elsewhere). Unit 4 contained a spent fuel pool that exploded. Three of the reactor cores are leaking hot radionuclides into the Pacific Ocean forever. That heated Pacific Ocean water passes through the Bering Strait and melts the Arctic ice. Videos show Arctic ice melting from the Bering Strait, west side of the Arctic ice sheet in 2011 and on. 2012 is when Greenland almost completely melted from all the atmospheric heat released at Fukushima. 2011-2012 is also when the jet stream stalled and has been affected to this day from the heat consequences of GE American Mark 1 nuclear reactors in Japan that exploded. This should have closed down the industry but instead the cover-up began. Radiation monitors were turned off and food, water and product radiation "acceptable levels" were raised. There was then a push for Americans to consume MORE electricity, keep everything plugged in 24/7 (including your new Microsoft X-Box) and living off-grid has been violently discouraged. And now we have AI and cryptocurrency and the "threat" that there won't be enough power. Let's regain our senses and use renewables and alcohol as fuel and shut down the heat and cancer producing nuclear industry.

All nuke plants (and some other plants as well) take in water and dump it back out hotter into our oceans, rivers and lakes. In the case of nuke plants, radionuclides are present in that water. Our earth is a closed loop system. The hot, radioactive water migrates to the ice and melts it. Plus, radionuclides give off heat (some forever) as they decay. The CO_2 traps the heat, but THE NUCLEAR INDUSTRY IS THE HEAT GENERATOR. How many plants use water to cool off their systems, using our precious water as a heat sink and a dumping ground for their chemical/radioactive waste? Diablo Canyon is allowed to release water and effluent up to 25 degrees F warmer than the intake temperature during normal operations and spikes up to 50 degrees F warmer, ONE HOUR/DAY during demussleing. Over the years, the intake temperature rises and so does the outflow temperature. THERE IS NO CAP on how hot the intake temperature can be. The policy just allows the 25 degrees F to 50 degrees F increase "over the intake temperature". That sets up a vicious cycle to continuously increase the temperature of our oceans. And that is what is happening as the ice is melting at the polar caps of our planet.

To get the entire world-wide oceanic, lake, river, stream picture:

Boiling water reactors operate at 285 degrees C = 545 degrees F Pressure water reactors operate at 315 degrees C = 599 degrees F Nuclear fission power plants: 440 plants world-wide (not counting the military) operating 24 hours/day, 7 days/week, 365 days/year with planned outages every 18-21 months to re-fuel and then start the radioactive heat process back up. All to boil water at 212 degrees F to produce steam that turns a turbine.
'It's like cutting butter with a chainsaw.'

Nuclear fusion:
150,000,000 degrees C is 270,000,032 degrees F. They have put a sun on planet earth, and they call it a "clean energy source"!

This particular quote is re: Diablo Canyon.
"For nearly four decades, 2.5 billion gallons of water have been sucked into the plant each day. It has then been pumped back into the Pacific Ocean 19 degrees F warmer. This process kills enormous amounts of aquatic life, altering the marine environment of Diablo Cove, making it uninhabitable for many native species. The California Coastal Commission declared, "It would be fair to categorize Diablo Canyon as California's largest marine predator." " Kevin Kamps

Way too much heat generated by nuclear power plants. Shut Them Down! Now is the time to stop heating this planet. Do not re-license Diablo Canyon Unit 1 and 2.
(**81-7-9** [McClintock, Francene])

Comment: My judgement is that they have and continue to violate the NPDES permit. There will only be more discharges as aging nuclear power plants leak, and Diablo Canyon consists of two aging nuke plants. Didn't they violated the permit in 2024 when they dumped approximately 26,000 cubic yards of RADIOACTiVE/CHEMICAL/OIL contaminated sand, sediment and kelp at the U.S. Army Corps of Engineers Nearshore Placement Area located south of the entrance to Morrow Bay and west of Morrow Bay State Park? They created a nuclear dump in the ocean. Did they get a license for that? They got a permit for the dredging but don't you need a license to create a new nuclear/chemical dump? (**81-7-10** [McClintock, Francene])

Comment: "Changes within the discharge area are well-documented and well-understood."
Not true if radionuclides were not considered. (**81-7-11** [McClintock, Francene])

Comment: "The geographical extent of the biological changes due to the thermal discharge has stabilized, with ecologically significant changes limited to Diablo Cove."
Not true. Radionuclides continue to be added to the ocean so that is not a "stabilized" system. And you have involved the Morro Bay Area by creating a nuclear/chemical dump off the coast in the ocean outside of Diablo Cove. (**81-7-12** [McClintock, Francene])

Comment: "The discharge temperature has remained steady during plant operations and will remain steady until Diablo Canyon ceases power-generating operations."
That's not what happened at Fukushima in 2011. Three nuclear reactors blew up at Fukushima and, in the case of reactor #3, it was MOX fuel that was spread throughout our atmosphere, with some particles landing on the arctic ice (and in Seattle), melting the ice in an ongoing fashion. A spent fuel pool blew up adding more heat to the atmosphere. Plus the three melted cores are daily adding heat into the Pacific Ocean. The heat travels north through the Bering Strait furthering ice melt in the Arctic. The atmosphere was so hot in 2012 that Greenland almost melted. That's also when the jet stream changed by slowing down with wild swings to the north and south affecting our climate. NUCLEAR POWER DID ALL THAT. Add that to your "thermal studies". (**81-7-13** [McClintock, Francene])

Comment: "Further, thermal monitoring indicates that biological changes from Diablo Canyon's thermal effluent have stabilized and that ecologically significant changes are limited to Diablo Cove."

No, in 2024, you added a nuclear/chemical dump to the ocean west of Morro Bay State Park. And you will be adding more radionuclides to the water. That is NOT stabilization. As nuclear power plants age, they leak more radionuclides which cause more heat to be released to the atmosphere and water. There is also the possibility of an accident releasing the core temperature into our atmosphere, water and land. All nuclear power plants should be closed due to heat generation. Our environment cannot tolerate more heat. Continuing operation of Diablo Canyon adds a LARGE thermal impact to our planet. (**81-7-14** [McClintock, Francene])

Comment: Based on the above, the NRC staff concludes that the impacts of the no-action alternative on 1
aquatic resources would be SMALL.
The impacts of the no-action alternative on aquatic resources would be LARGE. You would stop adding to the heating of the oceans. You would stop producing more radionuclides that

contaminate the oceans, air, lands and aquifers. You would allow for radionuclides to start the decay process. You would allow for our planet to start to heal and stop further heating of our atmosphere. You would stop the added mutations that would result from the continued operation of the plants. You would avoid a nuclear accident in the future. You would avoid charging the ratepayers extra money as alternatives are cheaper. (**81-8-1** [McClintock, Francene])

Comment: You do not even mention the radioactive nuclides released into the air, water and on the land. (**81-8-7** [McClintock, Francene])

Comment: You want us to believe that tritium got into the sump pump from the radioactive gases released at your site. Don't you think that tritium and Xenon-133 would affect the frogs as well? No mention of radioactivity here when that is what you're primarily producing. (**81-8-8** [McClintock, Francene])

Comment: No where do you mention the radioactivity you release into the water that DOES affect the otters. The radioactivity is released into Diablo Cove and a percentage of that is recirculated into Intake Cove. A vicious circulatory cycle that concentrates the radionuclides. "...Altered behavior in the form of avoidance of the Intake Cove or Diablo Cove areas" would be the thing that SAVES the otter. Stop creating more radionuclides. Shut down Diablo Canyon. (**81-8-9** [McClintock, Francene])

Comment: Once again, no mention of radioactivity. (**81-8-12** [McClintock, Francene])

Comment: 1981 to 1982 would have matched the construction period. What did you throw in the water? "Tenera (1988-TN10247) concluded that the reductions were probably not related to power plant operation" but what about power plant construction? (**81-8-13** [McClintock, Francene])

Comment: This is such BS! Swimming in radioactivity and eating radioactive food is not a "high-quality nearshore marine habitat". (**81-8-16** [McClintock, Francene])

Comment: So you're willing to kill all the black abalone just to boil water?
Just like you killed the sunflower sea star:
Page 3-106
"In the 1980s, researchers collected sunflower sea stars at multiple intertidal sampling stations within the action area during pre- and post-operational surveys associated with CWA Section 316(a) demonstrations. However, the species was not particularly abundant and averaged about one sea star per station (Tenera 1988-TN10247). The species is now considered functionally extinct in California waters since sea star wasting disease caused a precipitous population decline roughly a decade ago (UCSC 2024-TN10613; Humboldt 2024-TN10614)." (**81-9-1** [McClintock, Francene])

Comment: Radioactivity affects all the above and RADIOACTIVITY IS THE ACTUAL PARAMETER OF CONCERN THAT YOU REPEATEDLY DO NOT TAKE INTO CONSIDERATION. (**81-9-2** [McClintock, Francene])

Comment: Diablo Canyon and the NRC are not interested in protecting the whales, that's my conclusion. (**81-9-4** [McClintock, Francene])

Comment: At least you admit that the (RADIOACTIVE) thermal changes are "primarily limited to Diablo Cove". That's an admission that they are also elsewhere, like Intake Cove and west of Morro Bay State Park. If you continue with re-licensing, then you will be ADDING more

biological changes, guaranteed, into the system, which is not stabilization.
Radionuclides are not stable by definition and continue to decay into their daughter products, emitting heat as well as alpha, beta, and gamma rays. (**81-9-5** [McClintock, Francene])

Comment: Please discuss how the nuclear industry has polluted this planet.
(**81-9-10** [McClintock, Francene])

Comment: Please discuss how the oceans are a closed loop system and how when you are constantly heating a closed loop system that the water just gets hotter and hotter, melting the Arctic and Antarctic. Discuss how you have no temperature caps on how high you can heat the water as it is all based on an intake temperature, that has no cap and only increases with every second of discharge into Diablo Cove. (**81-9-11** [McClintock, Francene])

Comment: Please discuss how your American GE Mark 1 nuclear power plants blew up at FUKUSHIMA, altering the jet stream, melting the Arctic ice and are continuously leaking radionuclides into the Pacific. Please discuss how MOX fuel landed in Seattle, on the Arctic ice and other areas and how the American radiation monitors were turned off so no one would know the extent of the radiation plume (which went world-wide). (**81-9-12** [McClintock, Francene])

Comment: Please discuss that all of this destruction of our planet is just so you can boil water at 212 degrees F to produce steam that turns a turbine. And please discuss how THAT is TOTALLY UNNECESSARY as there are other ways to produce electricity that are CARBON NEGATIVE and NOT LETHAL to our planet. (**81-9-14** [McClintock, Francene])

Comment: Fukushima contamination is enough for these species to deal with. You don't need to ADD ON to their man-made suffering/misery. (**81-9-15** [McClintock, Francene])

Comment: "...temperature disperses quickly upon discharge". Not true. The heated effluent discharges are radioactive, and radionuclides give off heat as they disintegrate, many of them forever. (**81-9-16** [McClintock, Francene])

Comment: TRITIUM: 12.32 years 1/2 life. 123.2 to 246.4 years hazardous life. Maine Yankee released 1,053.8 curies of Tritium into Montsweag Bay over the course of five years (1986,1987,1989, 1990, 1991). Since I don't have Diablo Canyon's tritium releases I will use Maine Yankee's average. (1,053.8 times 8 equals 40 years) times 2 reactors at Diablo Canyon. That equals 16,860.8 curies of liquid tritium over the course of Diablo Canyon's history. And that does not include the gaseous releases or the "leaked" releases that are not reported by either Maine Yankee or Diablo Canyon. I wonder where almost 17,000 curies of tritium went when it should be detectable for up to 246.4 years? Maine Yankee's tritium is still on the planet too. Maybe PG&E needs to test somewhere else. Or check their equipment? Maybe their radiation detector is turned off like they were after Fukushima blew-up. (**81-10-1** [McClintock, Francene])

Comment: And now all the man-made radionuclides are in our atmosphere AND in our water AND left on site AND draining into the Pacific Ocean. All those man-made radionuclides are IN US. Radionuclides were found in the car filters in Seattle. That means THEY ARE IN PEOPLE'S LUNGS. On all those kid's shoes, inside all those runner's lungs, who thought they were participating in a healthy activity. The nuclear industry's cover-up of this is appalling.

Those man-made radionuclides include Pu-241: 14.4 years 1/2 life (144 to 288+ years hazardous life) beta.
Decays to Americium-241: 432 year 1/2 life (4,320 years to 8,640 years hazardous life) Alpha,

gamma.
Decays to Neptunium-237: 2.14 million years 1/2 life (21.4 million years to 42.8 million years hazardous life) alpha. (**81-10-3** [McClintock, Francene])

Comment: Is the California Coastal Commission aware that this sand and kelp is radioactive and otherwise contaminated? Did they really know what they were doing when they issued this permit? It is interesting that the dredging was performed this year, before the licensing was complete and before decommissioning. (**81-10-8** [McClintock, Francene])

Comment: There are other radionuclides of concern:

Radionuclides dumped into the water by Maine Yankee (excludes high-level waste);
1986 releases into the water: SR-89 0.000073 curies, SR-90 0.000133 curies, CS-134 0.0000333 curies, CS-137 0.00176 curies, I-131 0.229 curies, Co-58 0.000007 curies, Co-60 0.0136 curies, Cr-51 0.000041 curies, Mo-49 0.00111 curies, Tc-99 0.000895 curies, I-133 0.0218 curies, Cs-136 0.000153 curies, Fe-55 0.0223 curies, Ag-110m 0.00104 curies, Nb-97 0.00288 curies, SB-124 0.000153 curies, Sb-125 0.00262 curies, I-135 0.000976 curies, entrained gases: Xe-133 1.14 curies, Xe-135 0.261 curies, Xe-133m 0.00817, Xe-131m 0.00323 curies, Xe-135m 0.00123 curies, Kr-85 0.000086 curies, **Tritium (H-3):** 349 curies
Total Activity released to water: 350.7 curies

1987 releases into water: nuclides: Sr-89 0.00299 curies, Sr-90 0.00327 curies, Cs-134 0.00922 curies, Cs-137 0.0388 curies, I-131 0.0859 curies, Co-58 0.148 curies, Co-60 0.163 curies, Mn-54 0.00344 curies, Cr-51 0.0134 curies, Zr-Nb95 0.00366 curies, Mo-99 0.00035 curies, Tr-99m 0.00043 curies, Ba/La-140 0.0057 curies, Ce-141 0.00045 curies, Fe-55 0.251 curies, Ag 110m 0.0228 curies, co-57 0.000288 curies, Sb-122 0.000076 curies, Xe-131m 0.0136 curies, Sb-124 0.0874 curies, Sb-125 0.0324 curies, I132 0.000021 curies, I-133 0.00371 curies, I-135 0.000197 curies, Sn-133 0.000378 curies, Xe-133 0.015 curies, Ru-103 0.00179 curies, Ce-139 0.000035 curies, Np-239 0.00004 curies, Sr-91 0.00008 curies, Y-91m 0.00009 curies, Y-92 0.000107 curies, **entrained gases:** Kr-85 0.00013 curies, Xe-133 1.47 curies, Xe-135 0.00787 curies, Xe135m 0.00005 curies, **Tritium (H-3)** 117.71 curies
Total Activity released to water: 120.095672 curies

1988 (I'm unable to locate this report)

1989 releases into water: **nuclides:** Antimony-124 0.0344 curies, Antimony-125 0.0249 curies, Barium/La-140 0.000826 curies, Cerium-144 0.00000676 curies, Cesium-134 0.00396 curies, Cesium-137 0.0160 curies, Chromium-51 0.00076 curies, Cobalt-57 0.0000425 curies, cobalt-58 0.0266 curies, cobalt-60 0.0347 curies, Iodine-131 0.005 curies, iodine-133 0.00115 curies, Iodine-135 0.0000221 curies, Iron-55 0.0218 curies, Manganese-54 0.00185 curies, Molybdenum-99 0.000169 curies, Ruthenium-103 0.000000932 curies, Silver-110m 0.00769 curies, Strontium-89 0.000708 curies, Strontium-91 0.0000513 curies, Technetium-99m 0.000415 curies, Tellurium-132 0.000000729 curies, Tellurium-133m 0.00000809 curies, Tin-113 0.0000988 curies, Yttrium-91m 0.0000578 curies, Zinc-65 0.0000000939 curies, Zirconium/Nb-95 0.0000487 curies, Barium-139 0.0000487 curies, lanthium-142 0.00000177 curies, Tellurium-134 0.00174 curies, **entrained gases:** Xenon-133 0.189 curies, Xenon-135 0.00169 curies, Xenon-131m 0.000627 curies, Xenon-133m 0.00223 curies, Krypton-87 0.0000104 curies, Krypton-85m 0.00000211 curies, Krypton-88 0.00000166 curies, **Tritium (H-3)** 422 curies
Total Activity released to water: 422.376 curies

1990 releases into water: **nuclides:** Antimony-122 0.000374 curies, Antimony-124 0.0442 curies, Antimony-125 0.0257 curies, Barium/Lanth-140 0.000659 curies, Cerium-141 0.0000552 curies, Cerium-144 0.000000246 curies, Cesium-134 0.00203 curies, Cesium-137 0.0163 curies, Chromium-51 0.00479 curies, Cobalt-57 0.0000328 curies, Cobalt-58 0.0223 curies, Cobalt -60 0.0121 curies, Iodine-131 0.0279 curies, Iodine-132 0.0000165 curies, Iodine-133 0.00199 curies, Iron-55 0.0197 curies, Manganese-54 0.000181 curies, Mercury-203 0.0000911 curies, Ruthenium -103 0.000000944 curies, Silver-110m 0.00448 curies, Strontium-89 0.00194 curies, Technetium-99m 0.00123 curies, Tin-113 0.0000271 curies, Zinc-65 0.00000266 curies, Zirconium/Nb-95 0.00032 curies, Lanthium-142 0.000000231 curies, Tellurium-131 0.000000917 curies, Cadmium-109 0.00025 curies, (Unidentified) 0.0000258 curies. **Entrained gases:** Xenon-133 4.5 curies, Xenon-135 0.00474 curies, Xenon-131m 0.0914 curies, Xenon-133m 0.0208 curies, Xenon-135m 0.0000867 curies, Krypton-87 0.0000258 curies, Krypton-85m 0.00018 curies, Krypton-88 0.000099 curies, Krypton-85 0.0071 curies, **Tritium (H3):** 243 curies
Total activity released to water: 248 curies

1991 releases into water: nuclides: SR-89 0.004154 curies, CS-134 0.00213 curies, Cs-137 0.0139 curies, I-131 0.243 curiesCO-58 0.0169 curies, Co-60 0.026 curies, Fe-59 0.000095 curies, Mn-54 0.000135 curies, Cr-51 0.00327 curies, Zr/Nb-95 0.000232 curies, Mo-99 0.000215 curies, Tc-99m 0.000634 curies, Ba/La-140 0.0012 curies, Ce-141 0.0000815 curies, Fe-55 0.0161 curies, SB-124. 0.0386 Curies, Sb-125 0.041 curies, Ag-110m 0.00214 curies, Ru-103 0.0000464 curies, Sn-113 0.000178 curies, Np-239 0.000190 curies, Sr-85 0.000332 curies, I-133 0.00184 curies, Ba-133 0.0000407 curies, I-135 0.000246 curies, Sb-122 0.0000553 curies, Te-132 0.000012 curies, Ce-144 0.0000136 curies, Co-57 0.00000937 curies, Na-24 0.00000459 curies, La-141 0.0000967 curies, **Entrained gases:** Xe-133 1.986 curies, Xe-135 0.00367 curies, Xe-131m 0.0516 curies, Xe-133m 0.0083 curies, Xe-135m 0.00013 curies, Kr-85m 0.000298 curies, Tritium (H3): 388.8 curies
Total activity released to water: 390.892 curies (**81-10-9** [McClintock, Francene])

Comment: All of the below listed radionuclides are present in "low-level" waste:

RADIONUCLIDE	HALF-LIFE	APPROXIMATE HAZARDOUS LIFE
Iodine-129	15,900,000 years	318,000,000 years
Technetium-99	213,000 years	4,260,000 years
Plutonium-239	24,000 years	480,000 years
Carbon-14	5,730 years	114,600 years
Americium-241	432 years	8,640 years
Cesium-137	30.17 years	603.4 years
Strontium-90	29 years	580 years
Tritium (H-3)	12.33 years	246.60 years
Cobalt-60	5.27 years	105.4 years
"Trash"	hours-12 years	days to 240 years (**81-10-10** [McClintock, Francene])

Comment: To re-cap what one reactor produced in 5 years, NOT COUNTING THE HIGH LEVEL WASTE: **Radioactive Curies dumped into the air and water - State of Maine Low-Level Radioactive Waste Activity Reports 1986, 1987, 1988, 1989, 1990, 1991 for the Maine Yankee Atomic Power Plant. (Excludes high level waste):**

1986: 1,075.1 curies released to the air
350.7 curies released to the water

1987: 783.773 curies released to the air
120.096 curies released to water

1988: 78.37 curies released to the air
291.283 curies released to water

1989: 23.5 curies released to the air
422.367 curies released to water

1990: 765 curies released to the air
248 curies released to the water

1991: 1,136.417 curies released to the air
390.892 curies released into the water

Radioactive Curies dumped and covered in the land (South Carolina and Washington) State of Maine Low-Level Radioactive Waste Reports 1986, 1987, 1988, 1989, 1990, 1991 for the Maine Yankee Atomic Power Plant (excludes high-level waste):

1986: 161.348 curies. Shipped, 250 estimate awaiting shipment
1987: 225.112 curies shipped, 112 curies estimate awaiting shipment
1988: 446.9964334 curies shipped, 14.257838 curies waiting shipment, 4.29 curies to a broker
1989: 259.31 curies shipped, 122 awaiting shipment, 7.94 curies to a broker
1990: 172.6 curies shipped, 1.462 curies awaiting shipment, 4.29 curies to a broker, mixed waste 0.0281 curies
1991: 345.355 curies shipped, 240 curies awaiting shipment, 0.969 curies to a broker, mixed waste 0.0281 curies

Radionuclides dumped into the air by Maine Yankee (excludes high level waste)

1986 releases into air: Kr-85 16.3 curies, Xe-133 1,050 curies, Xe-135 1.56 curies, Xe-131m 1.12 curies, Xe-133m 0.0117 curies, I-131 0.00216 curies (I-131 0.00751 curies?) Co-60 0.000003 curies, Zr-97 0.00031 curies, **Tritium (H-3)** 6.05 curies
Total Activity 1,075.1 curies

1987 releases into the air: Kr-85 5.188 curies, Kr-85m 0.000086 curies, Xe-133 755.8 curies, Xe-135 10.70 curies, Xe-133m 1.83 curies, Xe-131m 7.19 curies, I-131 0.00131 curies, I-133 0.00029 curies, Cs-134 0.00006 curies, Cs-137 0.000028 curies, Ru-103 0.00098 curies, Co-58 0.000004 curies, Co-60 0.000037 curies, **Tritium (H-3)** 3.062 curies
Total Activity 783.77271 curies

1988: (I'm unable to locate this report).

1989 releases into the air: Ar-41 0.054 curies, Kr-85 0.026 curies, Kr-87 0.027 curies, Kr-88 0.016 curies, Xe-131m 0.110 curies, Xe-133 16.1 curies, Xe-133m 0.179 curies, Xe-135 0.929 curies, Xe-135m 0.055 curies, Xe-138 0.025 curies, I-131 0.00015 curies, I-132 0.0001 curies I-133 0.0004 curies, I-134 0.000006 curies, I-135 0.0001 curies, Cs-137 0.000002 curies, Co-58 0.000008 curies, Co-60 0.000004 curies, Ru-103 0.000025 curies, **Tritium (H-3)** 5.95 curies
Total Activity: 23.5 curies

1990 releases into the air: **gases:** Argon-41 0.0781, Krypton-85 0.15 curies, Krypton 85-m 0.462 curies, Krypton-87 0.199 curies, Krypton-86 0.255 curies, Xenon-131m 6.33 curies, Xenon-133 723 curies, Xenon 133m 5.42 curies, Xenon-135 10.5 curies, Xenon-135m 0.141 curies, Xenon-138 0.0807 curies, **Iodines:** Iodine-131 0.00326 curies, Iodine 132 0.00316 curies, Iodine 133 0.000565 curies, iodine-135 0.0000349 curies. **Particulates:** Antimony-125 0.00159 curies, Cadmium-109 0.00116 curies, Cesium-134 0.000304 curies, Cesium-137 0.000531, Cobalt-58 0.000561 curies, Cobalt-60 0.0107 curies, Manganese-54 0.0000354 curies, Niobium-95 0.000000326 curies, Silver-110m 0.0000307 curies, Chromium-51 0.000278 curies, Cerium-144 0.0000301 curies, Cobalt-57 0.0000114 curies, **Tritium (H-3)** 17.6 curies
Total Activity: 765 curies

1991 releases into the air: **gases:** Kr-85 9.86 curies, Kr-85m 0.814 curies, Kr-87 0.0104 curies, Kr-88 0.0224 curies, Xe-133 1,087.85 curies, Xe-135 18.467 curies, Xe-135m 0.0089 curies, Xe-138 0.00241 curies, Xe-133m 2.856 curies, Ar-41 0.00203 curies, Xe-131m 7.378 curies, **Tritium (H-3)** 9.138 curies, **Particulates:** Sr-90 0.00000115 curies, Cs-134 0.00000898 curies, Cs-137 0.000126 curies, Co-58 0.0000173 curies, co-60 0.0000173 curies, Cd-109 0.000593 curies, **Iodines:** I-131 0.00646 curies, I-133 0.00426 curies
Total Activity: 1,136.417 curies (**81-10-11** [McClintock, Francene])

Comment: Radionuclides dumped into the water by Maine Yankee (excludes high-level waste);

1986 releases into the water: SR-89 0.000073 curies, SR-90 0.000133 curies, CS-134 0.0000333 curies, CS-137 0.00176 curies, I-131 0.229 curies, Co-58 0.000007 curies, Co-60 0.0136 curies, Cr-51 0.000041 curies, Mo-49 0.00111 curies, Tc-99 0.000895 curies, I-133 0.0218 curies, Cs-136 0.000153 curies, Fe-55 0.0223 curies, Ag-110m 0.00104 curies, Nb-97 0.00288 curies, SB-124 0.000153 curies, Sb-125 0.00262 curies, I-135 0.000976 curies, entrained gases: Xe-133 1.14 curies, Xe-135 0.261 curies, Xe-133m 0.00817, Xe-131m 0.00323 curies, Xe-135m 0.00123 curies, Kr-85 0.000086 curies, **Tritium (H-3):** 349 curies
Total Activity released to water: 350.7 curies

1987 releases into water: **nuclides:** Sr-89 0.00299 curies, Sr-90 0.00327 curies, Cs-134 0.00922 curies, Cs-137 0.0388 curies, I-131 0.0859 curies, Co-58 0.148 curies, Co-60 0.163 curies, Mn-54 0.00344 curies, Cr-51 0.0134 curies, Zr-Nb95 0.00366 curies, Mo-99 0.00035 curies, Tr-99m 0.00043 curies, Ba/La-140 0.0057 curies, Ce-141 0.00045 curies, Fe-55 0.251 curies, Ag 110m 0.0228 curies, co-57 0.000288 curies, Sb-122 0.000076 curies, Xe-131m 0.0136 curies, Sb-124 0.0874 curies, Sb-125 0.0324 curies, I132 0.000021 curies, I-133 0.00371 curies, I-135 0.000197 curies, Sn-133 0.000378 curies, Xe-133 0.015 curies, Ru-103 0.00179 curies, Ce-139 0.000035 curies, Np-239 0.00004 curies, Sr-91 0.00008 curies, Y-91m 0.00009 curies, Y-92 0.000107 curies, **entrained gases:** Kr-85 0.00013 curies, Xe-133 1.47 curies, Xe-135 0.00787 curies, Xe135m 0.00005 curies, **Tritium (H-3)** 117.71 curies
Total Activity released to water: 120.095672 curies

1988 (I'm unable to locate this report)

1989 releases into water: **nuclides:** Antimony-124 0.0344 curies, Antimony-125 0.0249 curies, Barium/La-140 0.000826 curies, Cerium-144 0.00000676 curies, Cesium-134 0.00396 curies, Cesium-137 0.0160 curies, Chromium-51 0.00076 curies, Cobalt-57 0.0000425 curies, cobalt-58 0.0266 curies, cobalt-60 0.0347 curies, Iodine-131 0.005 curies, iodine-133 0.00115 curies, Iodine-135 0.0000221 curies, Iron-55 0.0218 curies, Manganese-54 0.00185 curies, Molybdenum-99 0.000169 curies, Ruthenium-103 0.000000932 curies, Silver-110m 0.00769 curies, Strontium-89 0.000708 curies, Strontium-91 0.0000513 curies, Technetium-99m 0.000415 curies, Tellurium-132 0.000000729 curies, Tellurium-133m 0.00000809 curies, Tin-113 0.0000988 curies, Yttrium-91m 0.0000578 curies, Zinc-65 0.0000000939 curies, Zirconium/Nb-95 0.0000487 curies, Barium-139 0.0000487 curies, lanthium-142 0.00000177 curies, Tellurium-134 0.00174 curies, **entrained gases:** Xenon-133 0.189 curies, Xenon-135 0.00169 curies, Xenon-131m 0.000627 curies, Xenon-133m 0.00223 curies, Krypton-87 0.0000104 curies, Krypton-85m 0.00000211 curies, Krypton-88 0.00000166 curies, **Tritium (H-3)** 422 curies

Total Activity released to water: 422.376 curies (**81-10-12** [McClintock, Francene])

Comment: 1990 releases into water: **nuclides:** Antimony-122 0.000374 curies, Antimony-124 0.0442 curies, Antimony-125 0.0257 curies, Barium/Lanth-140 0.000659 curies, Cerium-141 0.0000552 curies, Cerium-144 0.000000246 curies, Cesium-134 0.00203 curies, Cesium-137 0.0163 curies, Chromium-51 0.00479 curies, Cobalt-57 0.0000328 curies, Cobalt-58 0.0223 curies, Cobalt -60 0.0121 curies, Iodine-131 0.0279 curies, Iodine-132 0.0000165 curies, Iodine-133 0.00199 curies, Iron-55 0.0197 curies, Manganese-54 0.000181 curies, Mercury-203 0.0000911 curies, Ruthenium -103 0.000000944 curies, Silver-110m 0.00448 curies, Strontium-89 0.00194 curies, Technetium-99m 0.00123 curies, Tin-113 0.0000271 curies, Zinc-65 0.00000266 curies, Zirconium/Nb-95 0.00032 curies, Lanthium-142 0.000000231 curies, Tellurium-131 0.000000917 curies, Cadmium-109 0.00025 curies, (Unidentified) 0.0000258 curies. **Entrained gases:** Xenon-133 4.5 curies, Xenon-135 0.00474 curies, Xenon-131m 0.0914 curies, Xenon-133m 0.0208 curies, Xenon-135m 0.0000867 curies, Krypton-87 0.0000258 curies, Krypton-85m 0.00018 curies, Krypton-88 0.000099 curies, Krypton-85 0.0071 curies, **Tritium (H3):** 243 curies
Total activity released to water: 248 curies

1991 releases into water: nuclides: SR-89 0.004154 curies, CS-134 0.00213 curies, Cs-137 0.0139 curies, I-131 0.243 curiesCO-58 0.0169 curies, Co-60 0.026 curies, Fe-59 0.000095 curies, Mn-54 0.000135 curies, Cr-51 0.00327 curies, Zr/Nb-95 0.000232 curies, Mo-99 0.000215 curies, Tc-99m 0.000634 curies, Ba/La-140 0.0012 curies, Ce-141 0.0000815 curies, Fe-55 0.0161 curies, SB-124. 0.0386 Curies, Sb-125 0.041 curies, Ag-110m 0.00214 curies, Ru-103 0.0000464 curies, Sn-113 0.000178 curies, Np-239 0.000190 curies, Sr-85 0.000332 curies, I-133 0.00184 curies, Ba-133 0.0000407 curies, I-135 0.000246 curies, Sb-122 0.0000553 curies, Te-132 0.000012 curies, Ce-144 0.0000136 curies, Co-57 0.00000937 curies, Na-24 0.00000459 curies, La-141 0.0000967 curies**, Entrained gases:** Xe-133 1.986 curies, Xe-135 0.00367 curies, Xe-131m 0.0516 curies, Xe-133m 0.0083 curies, Xe-135m 0.00013 curies, Kr-85m 0.000298 curies, **Tritium (H3):** 388.8 curies
Total activity released to water: 390.892 curies (**81-10-13** [McClintock, Francene])

Comment: Radionuclides dumped in the land (South Carolina, Washington) from Maine Yankee (excludes high-level waste):
1986 shipped: **compacted trash or solids and dry activated waste:** Co-60 0.212 curies, Cs-137 0.053 curies, Ni-63 0.393 curies, Fe-55 0.404 curies, **another shipment of compacted trash or solids and dry activated waste:** Co-60 4.118 curies, Cs-137 3.824 curies, Ni-63 8.531 curies, Fe-55 8.531 curies, **solidified evaporator bottom/concentrates:** Co-60 0.807 curies, Fe-55 0.912 curies, Ni-63 1.544 curies, H-3 0.246 curies, Co-60 31.321 curies, Cs-137 44.360 curies, Fe-55 13.047 curies, Ni-63 43.054 curies.
Total shipped activity: 161.348 curies

Another estimated 250 curies of compacted trash or solids or dry activated waste waiting to be shipped. Radionuclides not specified.

1987 shipped**: compacted trash or solids:** Co-60 0.18 curies, Cs-137 0.38 curies, Cs-134 0.11 curies, Ni-63 0.30 curies, Fe-55 0.34 curies, **solidified ion exchange resins:** Ni-63 34.9 curies, Co-60 21.4 curies, Fe-55 9.72 curies, Cs-137 8.82 curies, H-3 37.6 curies, **dewatered ion exchange resins:** Ni-63 46.79 curies, Co-60 29.79 curies, Cs-137 19.41 curies, Fe-55 11.572 curies, H-3 1.23 curies, Mn-54 1.47 curies Cs-134 1.10 curies
Total shipped activity: 225.112 curies

Another estimated 112 curies of compacted trash or solids, solidified filter media, and dry activated waste waiting to be shipped. Radionuclides not specified.

1988: (I'm unable to locate this report)

1989 shipped: **compacted trash or solids:** Co-60 71.1 curies, Fe-55 45.7 curies, Cs-137 41.9 curies, Cs-134 30.1 curies, Ni-63 27.9 curies, **dewatered filter media:** Co-58 17.1 curies, Cr-51 8.19 curies, Sb-125 2.9 curies, C-14 2.87 curies, Sb-124 2.75 curies, **dewatered ion exchange resins:** Mn-54 2.41 curies, Ce-144 1.74 curies, Zr-95 1.16 curies, Sr-90 0.8 curies, Ag-110m0.76 curies, **solidified evaporator bottom/concentrates:** Ce-141 0.66 curies, Pu-241 0.32 curies, Co-57 0.26 curies, Fe-59 0.13 curies, Tritium (H3) 0.09 curies, Tc-99 0.05 curies, Ni-59 0.03 curies, Nb-94 0.01 curies, (?Cm-242 curies?), Pu-239/240 0.005 curies, Pu-238 0.003 curies, Am-241 0.002 curies, I-129 0.001 curies
Total shipped activity: 259.31 curies

Another 122 curies of compacted trash or solids, ion exchange resins and dewatered filter media waiting for shipment. 7.94 curies sent to a broker. 0.000061 curies of mixed waste in barrels on site.

1990: shipped: **dewatered filter media:** Co-60 1.3 curies, Fe-55 0.74 curies, Zr-95 0.26 curies, Co-58 0.25 curies, Sb-124 0.22 curies, Sb-125 0.14 curie, C-14 0.13 curie, Ag-110 0.089 curie, Ni-63 0.082 curies, Ru-106 0.061 curies, Ru-103 0.55 curies,Mn-54 0.047 curies, Sb-113 0.042m curies, Fe-59 0.036 curies, Cs-137 0.011 curies, Pu-241 0.0037 curies, Sr-90 0.00049 curies, H-3 0.0004 curies, Tc-99 0.00081 curies, I-129 0.000014 curies, **non-compacted trash or solids:** Cs-137 0.18 curies, Fe-55 0.025 curies, Sr-89 0.016 curies, N-63 0.01 curies, Ru-106 0.0061 curies, Ce-144 0.0059 curies, Co-60 0.0025 curies, Pu-241 0.0018 curies, C-14 0.0003 curies, H-3 0.0000047 curies, Fe-55 2.3 curies, C0-60 2 curies, Ni-63 0.14 curies, Co-58 0.72 curies, Cs-137 0.65 curies, Ru-106 0.49 curies, Cr-51 0.30 curies, Zr-95 0.14 curies, Sb-125 0.099 curies, Ce-144 0.087 curies, Sr-90 0.019 curies, C-14 0.00082 curies, H-3 0.0007 curies, **another shipment of non-compacted trash or solids:** Cs-137 0.028 curies, Ni-63 0.0065 curies, Fe-55 0.0061 curies, Co-60 0.0029 curies, Co-58 0.0027 curies, Sr-99 0.0027 curies, Cr-51 0.00051 curies, C-14 0.000052 curies, H-3 0.0000082 curies, **Dewatered Ion Exchange resins:** C0-58 59 curies, Cs-137 44.7 curies, C0-60 29 curies, Fe-55 11.8 curies, Cs-134 9.3 curies, Sb-124 2.8 curies, Ni-63 2.8 curies, C-14 1.3 curies, Sr-90 1.2 curies, H-3 0.017 curies, I-129 0.0017 curies.
Total shipped activity: 172.6 curies

Another 1.462 curies of non-compacted trash or solids and dewatered filtered media waiting to be shipped. 4.29 curies of compacted nd non-compacted trash and solids transferred to a broker. 0.002286 curies of mixed waste in barrels on site.

1991 shipped: **non-compacted trash or solids:** Fe-55 1.613 curies, Ni-63 1.499 curies, C0-60 1.413 curies, C0-58 0.612 curies, Cs-137 0.561 curies, Ru-106 0.219 curies, H-3 0.144 curies, Cr-51 0.112 curies, Ag-110m 0.092 curies, Sb-125 0.0582 curies, Zr-95 0.0466 curies, Ce-144 0.0366 curies, Cs-134 0.0254 curies, Sr-90 0.0174 curies, C-14 0.00255 curies, Sr-89 0.00254 curies, Ce-141 0.00131 curies, Pu-239/240 0.000787 curies, Am-241 0.000714 curies, Pu-241 0.00036 curies, Zn-65 0.000175 curies, C0-57 0.00011 curies, Pu-238 0.00000917 curies, **dewatered filter media:** C0-58 8.70 curies, Pm-147 4.45 curies, Cr-51 3.41 curies, C0-60 2.79 curies, Ni-63 1.39 curies, Fe-55 1.16 curies, Nb-95 0.352 curies, Zr-95 0.331 curies, C-14 0.247 curies, Cs-137 0.198 curies, Sb-124 0.195 curies, Sb-125 0.140, Ag-110m 0.0850, Cs-134 0.0766, Ce-144 0.0565 curies, Pu-241 0.0103 curies, Sr-90 0.00448 curies, Ru-106 0.00228 curies, H-3 0.000672 curies, Tc-99 0.000263 curies, Am-241 0.000127 curies, Cm-243/244 0.000118 curies, Pu-239/240 0.000108 curies, PU-238 0.000099 curies, I-129 0.00000316 curies, **dewatered ion exchange resins:** Cs-137 149.55 curies, Ni-63 80.29 curies, C0-60 46.2 curies, Cs-134 22.36 curies, Fe-55 8.49 curies, Cr-51 2.91 curies, Ru-106 1.68 curies, C0-58 1.033 curies, Sr-90 0.732 cureis, Mn-54 0.521 curies, Sb-125 0.5009 curies, C-14 0.2143 curies, Ce-144 0.199 curies, Fe-59 0.103 curies, Nb-94 0.0985 curies, Pm-147 0.0668 curies, Sr-89 0.483 curies, Pu-241 0.0404 curies, Zn-65 0.0105 curies, H-3 0.00632 curies, Np-237 0.00188 curies, Pu-239/240 0.000497 curies, Am-241 0.0002564 curies, Pu-238 0.0001708 curies, Cm-243/244 0.000153 curies, I-129 0.0000627 curies, Tc-99 0.00000612 curies
Total activity: 315.056 curies
0.03441 curies awaiting shipment, 0.969 curies sent to a broker, 0.0281 curies of mixed waste in barrels on site. (**81-10-14** [McClintock, Francene])

Comment: Because of the dredging, some percent of the radionuclides and chemicals have been moved to west of Morro Bay State Park. In essence a new radioactive/chemical waste dump has been created in the ocean. Don't you need a license for that? The permit was for dredging, not creating a new nuclear/chemical dump.

"Approximately 26,000 cubic yards of material was removed from the cove and placed at the U.S. Army Corps of Engineers (USACE) Nearshore Placement Area located south of the entrance to Morrow Bay and west of Morrow Bay State Park (PG&E 20226)"
There also must be new thermal plumes west of Morro Bay State Park and south of the Morro Bay entrance so the NPDES needs to perform new thermal plume studies.
"Dredging activities were monitored by the National Marine Fisheries Service"

Does the National Marine Fisheries Service know this sand and kelp is radioactive and full of chemicals? (**81-11-1** [McClintock, Francene])

Comment: The 'affected area' has been expanded to include west of Morro Bay State Park and south of the Morro Bay entrance since the dredging of 2024. (**81-11-2** [McClintock, Francene])

Comment: You already have affected, destroyed, caused the loss of and injured sanctuary resources. Continued operation will only make things worse. (**81-11-5** [McClintock, Francene])

Comment: Radionuclides and radiation is invisible. (**81-11-6** [McClintock, Francene])

Comment: So the high-level waste will stay where it is or be trucked out? No new rail line connection?
Previously disturbed areas now includes the Pacific Ocean off of Morro Bay and Morro Bay State Park. Close to Morro Rock. (**81-11-7** [McClintock, Francene])

Comment: The extension of the LR affects more land than the 750 ac described above. The area of potential effects (APE) should include all lands downwind of a nuclear accident. That would include Monterey, Santa Barbara, Ventura and Los Angeles Counties, which is of an astronomical historical and financial concern.
Page 3-149
"...earlier undocumented work occurred by the Los Angeles County Museum in the late 1920s (Enright et al. 2021-TN10293)."

Perhaps the Los Angeles County Museum could help you expand your APE.
(**81-11-10** [McClintock, Francene])

Comment: It is the nuclear power rates that have doubled in the last year in California and are only expected to rise as the aging power plants need repairs. (**81-12-14** [McClintock, Francene])

Comment: Here is "New and Significant Information" I have not seen you mention in this EIS: "CARBON NEGATIVE". A way to turn a turbine that is CARBON NEGATIVE and could be used past 2045 in the State of California (**81-13-6** [McClintock, Francene])

Comment: Alcohol could replace all fossil fuels on this planet, inclusive of electricity generating plants. Existing electricity plants that already have access to the grid (and automobiles) can be modified to run on alcohol. That would eliminate construction of new plants. (**81-13-7** [McClintock, Francene])

Comment: Amazing. Renewable technologies are not glaringly bad for living ecosystems/ human beings like the obvious health risks associated with nuclear power and fossil fuels. (**81-13-9** [McClintock, Francene])

Response: *These comments expressed general concerns on topics including water supply and quality, waste management, ecological impacts on habitats and species, and other potential environmental impacts of the proposed action of Diablo Canyon LR. The NRC staff considered the topics identified in these comments, among other matters, in this SEIS. The affected environment at Diablo Canyon is described in Chapter 3 of this SEIS, along with the environmental consequences of Diablo Canyon LR. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.*

Comment: Section 2.2.2 - Refurbishment Activities: The Draft Supplement at pages 2-10 and 2-11 states that as a result of PG&E's evaluation of the facility's structures, systems, and components ("SSCs"), it did not identify the need to undertake any major refurbishment or replacement activities to support the continued operation of Diablo Canyon as part of license renewal. However, PG&E has more recently identified several proposed additional Coastal Commission development activities that would be incorporated into the facility's period of extended operations and that would be subject to review and approval of CDPs by the Commission and/or San Luis Obispo County. These include partial relocation of a road near an area used for onsite transport of spent fuel, slope stabilization work, refurbishment and expansion of a retaining wall, installation of new charging equipment, and others. PG&E has also stated that it may soon propose several additional activities. We recommend the NRC incorporate and analyze these projects as part of a subsequent Draft Supplement. (**51-1** [Luster, Tom])

Comment: The Draft Supplement states on page 3-27 that the NRC staff did not identify any new and significant information related to geology and soils that would change the environmental impact determination stated in the LR GEIS (NRC 2024-TN10161) for this Category 1 generic issue and that no significant impacts on geology and soils are anticipated during the LR term that would be different from those occurring during the current license term. As noted above, however, PG&E has identified at least two planned projects that involve geologic considerations - relocation due to coastal erosion of part of a road in an area used to transport spent fuel and repair of a slope failure within the Owner Controlled Area - that we recommend be evaluated as part of a subsequent Draft Supplement. (**51-3** [Luster, Tom])

Response: *These comments relate to planned activities on the Diablo Canyon site. The NRC's regulations at 10 CFR 51.53(c)(2) prescribe the content of environmental reports (ERs) that applicants seeking LR must submit to the NRC, including that applicants must describe in detail the affected environment around the plant, the modifications directly affecting the environment or any plant effluents, and any planned refurbishment activities. As summarized in Section 2.1.2 of this SEIS, the NRC considers refurbishment to encompass the replacement and repair of major systems, structures, and components to ensure the safe and economic operation of nuclear power plants beyond the current license term. In its ER, as indicated in Section 2.1.2 of this SEIS, PG&E did not identify any major refurbishment or replacement activities needed to support the continued operation of Diablo Canyon beyond the existing operating license term. Other activities would not be part of the proposed action. NRC licensees may perform certain operation and maintenance work including construction of new facilities that have no nexus to nuclear safety or NRC-licensed activities without approval from the NRC. Any planned activities that would have a nexus to nuclear safety would be evaluated separately by the NRC as an independent licensing action.*

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

A.2.10 Geologic Environment

Comment: There are also at least two other recent sources of information that we recommend the NRC incorporate into its Draft Supplement analyses. First, California's Independent Peer Review Panel ("IPRP") evaluated PG&E's recent 2024 Updated Seismic Assessment and identified several aspects of PG&E's seismic evaluations that would benefit from additional data collection and analysis to better characterize seismic risks at and near Diablo Canyon. We have attached to this letter a technical memorandum prepared by the Commission staff's engineering geologist describing the IPRP's evaluation and the additional information it requested PG&E provide by October 26, 2024. We recommend that the NRC's analyses incorporate the IPRP's review and any forthcoming response provided by PG&E. Commission staff has also requested PG&E provide this information as part of its complete application for federal consistency certification and for a CDP. (**51-4** [Luster, Tom])

Comment: This technical memorandum focuses on the seismic source characterization aspects of the NRC NUREG-1437, Supplement 62 draft report. In Chapter 3 (Section 3.4.5), the report briefly summarizes the seismic setting and history. That section identifies the Hosgri fault as primary contributor to the Diablo Canyon Power Plant (DCPP) seismic hazard, followed by the San Luis Bay, Los Osos, and Shoreline faults. Though we agree that the current understanding of the seismic hazard at the DCPP indicates that approximate ranking of seismic sources, we wish to draw the NRC's attention to a broader range of concerns regarding Pacific Gas and Electric's recent update to their seismic hazard assessment for the DCPP (PG&E, 2024).

The California Coastal Commission participates in the Independent Peer Review Panel for Seismic Hazard Studies of the Diablo Canyon Nuclear Power Plant (IPRP), a multi-agency panel of seismic hazard specialists from the California Geological Survey, California Coastal Commission, California Energy Commission, California Seismic Safety Commission, California Public Utilities Commission, County of San Luis Obispso, and Governor's Office of Emergency Services. In August 2024, the IPRP issued IPRP Report No. 16 (IPRP, 2024) that provided peer review comments regarding the seismic source characterization summarized in the PG&E (2024) report. The report included a request that PG&E respond within 60 days; so far, there has been no written response from PG&E. The topics addressed in the IPRP report include the Hosgri fault slip rate, fault geometry models and characterization of seismic hazard at the Irish Hills, relevant data not included in the PG&E (2024) report, and ground motions. This memorandum summarizes those comments in the hope that the NRC will understand the full range of our concerns about the PG&E (2024) report. The full IPRP report is available at https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/electric-costs/diablo-canyon-independent-peer-review-panel-reports/iprp-report-16-pge-dcsa-update-review.pdf.

Hosgri Fault Slip Rate

PG&E (2024) proposes a slip rate model for the Hosgri fault that gives varied weights to four different slip rate sites. It is our opinion that only one of these sites (the Cross Hosgri Slope, CHS) provides high quality slip rate data that are relevant to the current hazard model for the DCPP. The CHS site is an offshore paleoshoreline dated at approximately 12 ka with a well-defined fault offset. Those data yield a slip rate of 2.6 +/-0.8 mm/yr with a high degree of confidence. The results of the CHS study were published in peer-reviewed journal articles (Johnson, et al., 2014; Kleusner, et al., 2023; Medri, et al., 2023).

The three other slip rate sites used by PG&E (2024) are the San Simeon, Estero Bay, and Point Sal sites. The detailed summary of data for these sites comes from previous technical reports by PG&E (2014, 2015). The slip rate from the San Simeon site comes from offset of an onshore marine terrace that is dated to marine isotope stage 7 (~210ka) based on correlation that was not independently verified with other dating methods. This marine terrace has a sinuous rather than straight-line character that leads to large uncertainties in the offset measurement. The preferred slip rate reported for the San Simeon site is 1.8 mm/yr.

The offset paleo-channels at the offshore Estero Bay site are bracketed by unconformities that lack angular discordance and, thus, might not be unconformities. The dating of these channels relies on correlation of the bracketing "unconformities" with unconformities of known age. The mean age of the offset channel is thought to be 840 +690/-250 ka, indicating very large uncertainties. The measured channel offsets also have large uncertainties. The slip rate estimates for the Estero Bay site range from 0.39 to 4.71 mm/yr with a preferred value of 1.75 - 1.90 mm/yr.

The offshore Point Sal site has a variety of offset paleo-channels that are difficult to match across the fault, but the researchers chose one channel that they concluded is offset 550 to 700m (preferred value of 600-650m) and another channel that appears to be offset 500-550m. They estimated the ages of the channels based on correlation of the bracketing unconformities with sea level low stands which yields three possible ages, 138 ka, 342 ka, and 1.4 Ma. The researchers identified 342 ka as the preferred age. These drastically different age estimates yield three very different slip rates (4.35-4.71 mm/yr, 1.75-1.90 mm/yr, and 0.43-0.46 mm/yr) with a preferred value of 1.8 +/-0.4 mm/yr.

Clearly, the San Simeon, Estero Bay, and Point Sal studies have very large uncertainties and yield slip rate data for the Hosgri fault that partly reflects fault slip hundreds of thousands of years ago. Those studies were not published in a peer-reviewed journal. The Holocene slip rate data from the CHS site reaches a much higher scientific standard. Since fault slip rates can and do change over time, a Holocene slip rate is more representative of the current slip on the fault than a slip rate that may reflect a different phase in the evolution of the fault. Prior to the offshore research that recognized and characterized the CHS site, the other three sites provided the only available slip rate data for the Hosgri fault. With the publication of the CHS data, the understanding of the Hosgri fault has taken a big step forward, and the lower quality sites are no longer useful. Therefore, the IPRP recommended that PG&E give 100% weight to the CHS site in their seismic hazard model for the Hosgri fault. (**51-10** [Luster, Tom])

Comment: Irish Hills
The DCPP is located at the west end of the west-northwest striking uplift known as the Irish Hills. This uplift is bounded on the north by the Los Osos fault and on the south by a set of faults known as the South Boundary Zone (including the San Luis Bay, Wilmar Avenue, and San Luis Range faults). PG&E (2015) identified three fault block geometry models for the faults that bound the Irish Hills. The first is the Outward-Vergent (OV) model that posits oblique reverse-dextral slip on the Los Osos fault with uplift of the Irish Hills the result of reverse slip accompanied by strike slip motion on both the south-dipping Los Osos fault and the north-dipping San Luis Bay fault. The Southwest-Vergent (SW) model calls for uplift of the Irish Hills by thrust/reverse slip on the San Luis Bay fault and other Southwest Boundary Zone faults that dip approximately 45° northeast. The Northeast Vergent (NE) model calls for uplift of the Irish Hills by northeast-vergent reverse slip on the Los Osos fault that dips approximately 50° to the southwest. PG&E (2015) gave the OV and SW fault block geometry models 40% weight (each) and the NE model 20% weight in their logic tree. The PG&E (2024) report restated the fault block geometry models from the PG&E (2015) report, because new data were not available to improve on these initial hypotheses.

Currently, the fault geometry model for the Irish Hills remains unresolved and warrants further investigation to characterize these seismic sources. Based on the demonstrated success of offshore low-energy seismic reflection methods, the IPRP recommended additional investigation of the faults that bound the Irish Hills in the offshore setting. In fact, preliminary data from offshore studies (Watt, et al., 2015) show that the offshore Los Osos fault is a broad zone that includes vertical faults and flower structures, indicating a possible strike slip fault geometry rather than the hypothesized reverse/thrust fault geometry. More detailed offshore investigation using low-energy seismic reflection methods may provide a better understanding of fault geometries and could identify offset features, such as paleo-shorelines, that could improve slip rate estimates for these faults. The Los Osos fault seems particularly promising, based on the results of initial studies. Additional onshore investigation is also needed to evaluate the potential contribution of the faults that bound the Irish Hills.

New Data Not Addressed in the PGE (2024) Report
The IPRP identified two relevant studies that were not discussed in the PG&E (2024) report, and this raises a question about the completeness of PG&E's review of available data. A study by McGregor and Onderdonk (2021) concluded that the Casmalia fault (located approximately 27 km south of the DCPP) is a thrust fault with a slip rate of 5.6 to 6.7 mm/yr. This slip rate is an order of magnitude greater than the 0.5 mm/yr value used by PG&E (2015) in their seismic source characterization. Given the proximity of the Casmalia fault to the DCPP, the new slip rate data has implications for seismic hazard that should have been addressed in the PG&E (2024) report. These new data have implications for regional deformation models, because the nearby

Casmalia Hills may represent an analog to the Irish Hills in addition to a seismic source with potential kinematic connections to the Hosgri fault and other faults in the vicinity of DCPP.

A NRC-commissioned study (CNWRA, 2016) of offshore seismic reflection data reported that Hosgri fault slip rates have increased during the past million years. This suggests that rates older than Holocene are not representative of the current seismic hazard. Clearly, that study should have been considered in the PG&E (2024) report, because the study results could inform the weighting of Hosgri fault slip rates.

Based on the discovery of the two above studies that were not included in PG&E (2024) report, the IPRP expressed concern that other studies might have been missed and requested that PG&E conduct a comprehensive review that includes all fault studies in the region since the previous assessment (PG&E, 2015). That review should address the implications for the seismic hazard at the DCPP, including newly developed slip rates on faults in the region that may inform deformation rates of faults in the vicinity of Diablo Canyon. (**51-11** [Luster, Tom])

Comment: Ground Motions
The IPRP found that the methods used to estimate ground motions for the DCPP site appear appropriate for the current seismic source characterization, and PG&E's evaluation of new data and new ground motion models appears adequate. However, the results of site-specific ground motion hazard should be recalculated once changes are made to the seismic source characterization inputs.

The IPRP encouraged efforts to improve the characterization of site conditions in terms of VS profile and kappa estimate. They also suggested the use of more traditional site response models to supplement existing analyses and encouraged continued efforts to reduce uncertainty in empirical site factors, including further improving the non-ergodic ground motion modeling approach and data. In addition, they expressed a need for updated analysis of seismic hazard model inputs ranking sensitivity of ground motion hazards to uncertainties in revised input parameters.

Conclusions
Based on review of the PG&E (2024) report, the IPRP concluded that PG&E should reconsider their weighting of slip rates for the Hosgri fault and adopt a 100% weighting for the CHS slip rate. Significant uncertainties remain regarding the characterization of faults surrounding the Irish Hills, and additional investigation is needed to better understand both fault geometry and seismic hazard. PG&E should review all fault studies within the region surrounding the DCPP and include the data from those studies in their evaluation of seismic hazard. Though PG&E has utilized appropriate methods to estimate ground motions at the DCPP site, additional improvements could be made, and ground motion estimates should be recalculated in response to changes in seismic source characterization.

References
CNWRA, 2016. Independent Evaluation of the Hosgri Fault Slip Rate based on a Structural Analysis of the Pull-Apart Basin Linking the Hosgri and San Simeon Fault Systems, prepared for U.S. Nuclear Regulatory Commission, Contract No. NRC-HQ;50-14-E-0001, Center for Nuclear Waste Regulatory Analyses, San Antonio, Texas, report dated August 5, 2016, 40 pages.
Independent Peer Review Panel (IPRP), 2024, Initial Review of the PG&E “Updated Seismic Assessment, February 2024” by the Independent Peer Review Panel for Seismic Hazard Studies of the Diablo Canyon Nuclear Power Plant, Report No. 16, report dated August 26, 2024, 44 pages.

Johnson, S. Y., S. R. Hartwell, and P. Dartnell. 2014. "Offset of latest Pleistocene shoreface reveals slip rate on the hosgri strike-slip fault, offshore central California." Bulletin of the Seismological Society of America, v. 104, p. 1650-1662.
Kluesner, J.W., Johnson, S.Y., Nishenko, S.P., Medri, E., Simms, A.R., Greene, H.G., Gray, H.J., Mahan, S.A., Padgett, J.S., Krolczyk, E.T., Brothers, D.S., and Conrad, J.E. 2023. "High-resolution geophysical and geochronological analysis of a relict shoreface deposit offshore central California: Implications for slip rate along the Hosgri fault." Geosphere v.19, no. 6, p.1788-1811.
Medri, E., Simms, A.R., Kluesner, J., Johnson, S.Y., Nishenko, S.P., Greene, H.G., and Conrad, J.E., 2022, Subaqueous clinoforms created by sandy wave-supported gravity flows: Lessons from the central California shelf: Marine Geology, v. 456, https://doi.org/10.1016/j.margeo .2022.106977.
McGregor, I.S., and Onderdonk, N.W., 2021, Late Pleistocene rates of rock uplift and faulting at the boundary between the southern Coast Ranges and the western Transverse Ranges in California from reconstruction and luminescence dating of the Orcutt Formation: Geosphere, v. 17, no. 3, p. 932– 956, https://doi .org /10.1130/GES02274.1.
Pacific Gas and Electric Company (PG&E), 2014, Chapter 3, Offshore low-energy seismic reflection studies in Estero Bay, San Luis Bay, and Point Sal Areas, PG&E Technical Report GEO. DCPP.TR.14.02, 178 pages.
Pacific Gas and Electric Company (PG&E), 2015, Seismic Source Characterization for the Diablo Canyon Power Plant, San Luis Obispo County, California, technical report, dated March 2015, 652 pages.
Pacific Gas and Electric Company (PG&E), 2024, Diablo Canyon Updated Seismic Assessment, Response to Senate Bill 841, technical report, dated February 1, 2024, 392 pages.
Watt, J. T., Johnson, S. Y., Hartnell, S. R, and Roberts, M., 2015, Offshore geology and Geomorphology from Point Pedras Blancas to Pismo Beach, San Luis Obispo County, California: U. S. Geological Survey Scientific Investigations Map 3327. (**51-12** [Luster, Tom])

Comment: PG&E's studies of earthquake hazards at the Diablo Canyon site have been defective from day one and remain so sixty years later. When PG&E first applied for an operating license for Diablo, it assured the Atomic Energy Commission (predecessor of the Nuclear Regulatory Commission) that there were no earthquake faults nearby. This, despite the fact that the oil industry had identified the Hosgri Fault, located a mere two and a half miles from the plant, in 1969. Turns out, PG&E had only looked for earthquake faults on the landward side of the plant site, not in the ocean. But once the Hosgri was identified, the USGS as well as PG&E investigated further, and the more they looked, the more faults they found. The Shoreline fault, discovered in 2008, comes within 300 meters of the reactors.

But PG&E's research still fails to earn a passing grade from the Independent Peer Review Panel (IPRP) of the CA Public Utilities Commission. That body's 16th report, issued August 26, 2024, makes numerous requests of PG&E to upgrade its seismic studies.
(**76-1** [Swanson, Lucy Jane])

Response: *These comments concern new information regarding the assessment of seismic hazard at Diablo Canyon. In Section 3.4.5 of the draft SEIS, the NRC staff described its review of PG&E's updated seismic analysis, which had not been publicly released when the LR application was submitted to the NRC. The staff reviewed new data on fault slip rates and concluded that the new information would not have impacts on the geologic environment that differ from impacts occurring during the current license term. Commenters describe an independent peer review of PG&E's updated seismic analysis commissioned by the California Public Utilities Commission and recommend that the NRC staff include the peer review panel's* *report and PG&E's response in the seismic setting description of the final SEIS. The NRC staff reviewed pertinent portions of the peer review report and PG&E's response to determine whether these documents contained new and significant information that would change the staff's assessment of the affected geologic environment at and adjacent to the Diablo Canyon site. The staff determined that the new information does not materially affect the staff's conclusion that impacts of LR related to geology and soils would be SMALL for Diablo Canyon. Section 3.4.5 of this SEIS was revised to acknowledge the NRC staff's review of the independent peer review panel report and PG&E's response. In addition, Section 3.4.5 of this SEIS was revised to include a paragraph describing the distinction between the scope of the NRC's LR environmental review of geology and the NRC's ongoing regulatory oversight of plant safety. Separate from the LR environmental review of this SEIS, the NRC staff will continue to evaluate new seismic data bearing on potential earthquake hazards at the site as it becomes available to ensure continued safe plant operation.*

A.2.11 Greenhouse Gas Emissions and Climate Change

Comment: I would also like to highlight some items in the SEIS that I support. One, I commend the Commission for highlighting the greenhouse gas impacts of a plant's operation provided in Section 3.15.3.1.

I think that's really important when we talk about a power plant operation's emissions and cleanliness, which often comes up in these public meetings. A lot of folks say that nuclear power is not clean. And this really gets at the heart of that argument. (**49-9-3** [Pittman, Brendan])

Comment: I wanted to thank you all for the work that you're doing on this report. I want to offer my support for the continued scrutiny that you put us under. Because nuclear power can be done safely, but it's required that in order to do so, it just needs a lot of oversight and a lot of transparency.

And I wanted to sort of reiterate my general point that the environmental impact of climate change is orders of magnitude worse than, for example, the seawater issue that the last commenter brought up or multiple other issues that are brought up about the operation of Diablo Canyon.

And we are not on track to meet the goals set by climate scientists for the increase of sea surface temperature above pre-industrial levels. We need to remember that nuclear and renewable energy sources are on the same team, the goal is to reduce our carbon emissions. That is the crucial environmental issue we need to put all of our attention on. (**49-17-1** [Burnham, Christopher])

Comment: First, we want to say thank you for recognizing that no additional --or that the existing work for the 2016 application is still accurate, and we don't need a significant change, or there's not a need for additional information to address those concerns. We appreciate that you recognized and commented on greenhouse gas emissions and their impacts from plant operation in this report. That's an important improvement and update. (**50-45-3** [Clay, Jennifer])

Response: *The commenters expressed support for the greenhouse gas (GHG) emissions and climate change evaluation included in this SEIS. The comments are general in nature and, therefore, will not be evaluated further. Section 3.15.3.1 of this SEIS evaluates GHG emissions from the proposed action and alternatives and Section 3.15.3.2 of this SEIS evaluates climate change impacts on environmental resources directly affected by* *the continued operation of Diablo Canyon during the LR term. No changes were made to the SEIS as a result of these comments.*

Comment: And as far as climate change goes, global warming is good for humans. Without global warming, we'd have no civilization, because after the last ice age, global warming made it possible to grow crops in Iraq, Mexico, China, and Egypt; and therefore, civilization developed.

And Canada, the USSR and Russia, Alaska and Greenland, will become wonderful places to live, they have arable land, plenty of fresh water, and if the earth warms up, those places will become nice places to live. And that's where the most land mass on earth is. So don't fight global warming, enjoy it. (**49-4-5** [Kirkland, Gary])

Response: *The commenter expressed advantages of a changing climate. The comment is general in nature and, therefore, will not be evaluated further. No changes were made to the SEIS as a result of this comment.*

Comment: 13. Section 3.15-3 (page 3-205, Table 3-33)
Footnote "a" is not clear on the units of measure for the values in the table. The footnote says greenhouse gas emissions are reported in metric tons and converted to short tons, so it seems to imply that NRC converted reported values to short tons. However, the values are those reported by PG&E in metric tons. The combustion sources values match those reported in the PG&E 2024-TN10032 (i.e., RCI GHG-2). The workforce commuting values are those reported by PG&E in the ER Table 3.3-11 using the calculation noted in footnote "c." It is suggested that the units of measure be identified in the table title or header and the footnote wording be clarified. (**65-13** [Jones, Thomas P.])

Response: *The commenter requested that Table 3-33 in the SEIS be revised to correctly identify if GHG emissions are in tons or metric tons. The NRC staff agrees with this comment. Table 3-33 of the SEIS incorrectly presented GHG emissions in metric tons. The NRC staff has updated Table 3-33 to present all values in tons and to clarify that the units are tons.*

Comment: 14. Section 3.15-3 (page 3-207. Table 3-34)
In Table 3-34, the value for the proposed action is 1,152 CO_{2eq} tons/yr, the same value presented in Table 3-33 for combustion sources for 2023. The footnote for Table 3-33 implies that unit of measure is short tons; however, the values in Table 3-33 match those reported by PG&E as metric tons. It is suggested that units of measure be confirmed or revised as appropriate. (**65-14** [Jones, Thomas P.])

Response: *The commenter noted that the units in Table 3-34 in the SEIS should be in tons, but the values presented appear to be in metric tons. The NRC staff agrees with this comment. Table 3-34 of the SEIS incorrectly presented GHG emissions from the proposed action and the no-action alternative in metric tons. The NRC staff has revised Table 3-34 to present GHG emissions from the proposed action and the no-action alternative in tons.*

Comment: There may be a tipping point in our future where large melts in the ice occur rapidly as the methane is released and CO_2 traps the heat (produced from nuclear power plants) causing rapid sea level rise world-wide. (**81-3-14** [McClintock, Francene])

Response: *The comment expressed concerns related to ice sheet melting, the release of methane emissions to the atmosphere from melting glaciers, the contribution of methane to climate change, and sea level rise. The comment is general in nature and, therefore, will not be* *evaluated further. Section 3.15.3.1 of this SEIS considers the impacts of GHG emissions on climate change from the proposed action and Section 3.15.3.2.2 of this SEIS considers the impacts of sea level rise. No changes were made to the SEIS as a result of this comment.*

Comment: Though in the no-project alternative GHG emissions were significantly lower than in a 2022 study conducted by Stanford and MIT (**49-11-2** [Wurtz, Carl])

Response: *The comment noted that the quantified emissions presented under the no-action alternative (i.e., not renewing the Diablo Canyon licenses) in the SEIS were lower than those presented in a joint study from Stanford University and the Massachusetts Institute of Technology (MIT). The comment did not identify the exact report and mentions a "2022 study." The NRC staff located the following 2021 report authored by a team from Stanford University and MIT (referred to as the 2021 Stanford and MIT study in this response): Aborn J., Baik E., Benson S., Bouma AT., Buogiorno J., Lienhard V JH., Parsons J., and Wei QJ. 2021. An Assessment of the Diablo Canyon Nuclear Plant for Zero-Carbon Electricity, Desalination, and Hydrogen Production.*

The 2021 Stanford and MIT study is not comparable to the scope of impacts considered under the no-action alternative in the SEIS. As discussed in Section 2.3.1 of this SEIS, under the no-action alternative, the NRC would not renew the Diablo Canyon operating licenses and Diablo Canyon Units 1 and 2 would shut down on or before their licenses' expiration dates. The no-action alternative would result in the total cessation of electrical power production at Diablo Canyon. As discussed in Section 3.15.3.1.2 of this SEIS, the scope of impacts considered under the no-action alternative includes the immediate impacts resulting from activities at Diablo Canyon that would occur between plant shutdown and the beginning of decommissioning. The 2021 Stanford and MIT study analyzed carbon emissions from delaying the retirement of Diablo Canyon to the year 2035 and 2045 by assessing carbon emissions with and without Diablo Canyon operating by modeling California's electric grid composition. The 2021 Stanford and MIT study concluded that (1) continued operations of Diablo Canyon from 2025 to 2030 would result in a total emissions savings of up to 35 million tons of CO_2 or an average emissions savings of 7 million tons of CO_2 per year and (2) continued operations of Diablo Canyon from 2025 to 2045 would result in a total emissions savings of up to 50 million tons of CO_2 or an average emissions savings of 2.5 million tons of CO_2.

The scope of the no-action alternative does not include the environmental impacts of replacement power if the Diablo Canyon licenses are not renewed. However, the SEIS does evaluate the impacts of two replacement energy alternatives to the proposed action of Diablo Canyon LR: (1) purchased power and (2) renewables combination (i.e., wind and solar energy with battery storage, geothermal energy, and demand-side management). Sections 3.15.3.1.3 and 3.15.3.1.4 and Table 3-34 of this SEIS present GHG emissions of the replacement power alternatives considered and whether the alternatives would result in an increase or decrease in GHG emissions if they were to replace Diablo Canyon's generating capacity. As discussed in the SEIS, the replacement power alternatives represent possible options that energy-planning decision-makers may need to consider if the Diablo Canyon operating licenses are not renewed.

No changes were made to the SEIS as a result of this comment.

Comment: The SEIS fails to account for the GHG and air quality impacts from the mining and processing of the uranium fuel. The SEIS GHG analysis does not follow NRC guidance on estimating GHG emissions from nuclear plant operation as directed in its "Staff Guidance for

Greenhouse Gas and Climate Change Impacts for New Reactor Environmental Impact Statements."[2]

[2] Staff Guidance for Greenhouse Gas and Climate Change Impacts for New Reactor Environmental Impact Statements https://www.nrc.gov/docs/ML1410/ML14100A157.pdf (**79-1-3** [Sarvey, Robert])

Comment: GHG Emissions

NRC provides guidance on estimating GHG emissions from nuclear plant operation in its "Staff Guidance for Greenhouse Gas and Climate Change Impacts for New Reactor Environmental Impact Statements."[31] The guidance document estimates that the lifetime GHG emissions for a 1,000 MW reactor are approximately 10,500,000 MT CO2E or about 37.5 g CO2eq/kWh.[32] Over a 20 year license extension the two units at Diablo Canyon could produce up to 10,500,000 MT CO2E.

[31] Staff Guidance for Greenhouse Gas and Climate Change Impacts for New Reactor Environmental Impact Statements https://www.nrc.gov/docs/ML1410/ML14100A157.pdf
[32] [32] Staff Guidance for Greenhouse Gas and Climate Change Impacts for New Reactor Environmental Impact Statements https://www.nrc.gov/docs/ML1410/ML14100A157.pdf Page 7 of 16

The plants fuel cycle and operational requirements not only emit large amounts of GHG emissions DCPP has other significant environmental impacts. The NRC's June 2023 Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) includes Table S-3 from 10 CFR 51.51 which provides environmental impacts on Uranium Fuel Cycle Data.[33] The GEIS states that,

"Every environmental report prepared for the construction permit stage of a light-water-cooled nuclear power reactor, and submitted on or after September 4, 1979, shall take Table S-3, Table of Uranium Fuel Cycle Environmental Data, as the basis for evaluating the contribution of the environmental effects of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials and management of low level wastes and high level wastes related to uranium fuel cycle activities to the environmental costs of licensing the nuclear power reactor. Table S-3 shall be included in the environmental report and may be supplemented by a discussion of the environmental significance of the data."

[33] Attachment a NRC's June 2023 Generic Environmental Impact Statement for License Renewal of Nuclear Plants https://www.nrc.gov/docs/ML1310/ML13106A241.pdf Page 516-518 of 677 (**79-1-16** [Sarvey, Robert])

Response: *The comments expressed concern that the SEIS does not consider GHG emissions from the uranium fuel cycle as part of the proposed action (i.e., Diablo Canyon LR) and does not follow NRC's guidance in "Staff Guidance for Greenhouse Gas and Climate Change Impacts for New Reactor Environmental Impact Statements" (NRC 2014-TN3768). Regarding the concern that the SEIS does not consider GHG emissions from the uranium fuel cycle, the NRC staff recognizes that GHG emissions can be categorized into direct (those that are owned or controlled by an organization) and indirect (including those from upstream and downstream activities such as from the uranium fuel cycle) emissions. The NRC staff has updated*

Section 3.15.3 of this SEIS to discuss GHG emissions factors from the nuclear lifecycle, which includes the uranium fuel cycle and plant construction, operation, and decommissioning.

With respect to the concern that the GHG analysis does not apply the NRC's guidance in "Staff Guidance for Greenhouse Gas and Climate Change Impacts for New Reactor Environmental Impact Statements" (NRC 2014-TN3768), this document provides a framework for the evaluation of GHG emissions in the environmental reviews for new reactors. For this SEIS, however, the NRC staff conducted its GHG emissions analysis in accordance with its guidance in NUREG-1555, Supplement 1, Revision 2, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal" (NRC 2024-TN10251). NUREG-1555, Supplement 1, Revision 2 provides guidance to the NRC staff when conducting environmental reviews of applications for the initial and subsequent renewal of nuclear power plant operating licenses. As discussed in the SEIS, the proposed action is the initial renewal of the Diablo Canyon licenses; therefore, it was appropriate for the NRC staff to follow the guidance in NUREG-1555 Supplement 1, Revision 2. No changes were made to the SEIS as a result of this concern.

Comment: Finally, I recommend that the greenhouse gas emissions estimated for each alternative should be included in Table 2-1. Given the level of concern about climate change, that evaluation should be given a high profile. (**52-5** [Hopf, James])

Response: *The comment recommended that Table 2-1 of the SEIS list the estimated GHG emissions of the proposed action and alternatives. The NRC staff disagrees with this comment. The purpose of Table 2-1 is to summarize the conclusions regarding the environmental impacts of the proposed action, no-action alternative, purchased power alternative, and renewables combination alternative. The analysis and specifics that support how these impact levels were reached are provided in Chapter 3 of this SEIS across all environmental resource areas. For this reason, the quantified GHG emissions are not presented in Table 2-1. No changes were made to the SEIS as a result of this comment.*

Comment: Secondly, the logic behind the greenhouse gas evaluation discussed in Section 3.15.3 is flawed and thus some of the CO2 emissions estimates shown in Tables 3.34 are inaccurate.

The no-action case is meaningless, as I discussed earlier. And the CO2 emissions associated with the renewable combination alternative are not negligible.

Only considering operation of existing renewable sources is not appropriate. To replace Diablo's power with renewables, renewable generation will have to be built. Thus, the renewable alternative should include CO2 emissions associated with renewable energy construction. (**49-3-3** [Hopf, James])

Comment: If it did so, its emissions would be much higher than the emissions associated with continued operation of Diablo Canyon.

Finally, I recommend that the greenhouse gas emissions estimated for each alternative should be included in Table 2.1. Given the level of concern about climate change, that evaluation should be given a high profile. Thank you, very much. (**49-3-5** [Hopf, James])

Comment: Secondly, the greenhouse gas evaluation discussed in Section 3.15.3, and the CO_2 emissions estimates in Table 3-34, should be revised to more accurately estimate the CO_2

emissions associated with actual alternatives to continued Diablo operation, i.e., the CO_2 emissions from potential replacement power sources. The currently defined "no action" case should not be presented, as discussed above, and the CO_2 emissions associated with the Renewable Combination Alternative are not negligible.

The Renewable Combination Alternative will involve significant CO_2 emissions, beyond the tiny emissions associated from operation of existing renewable sources. To replace Diablo's power with renewables, renewable generation will have to be increased, i.e., built. Thus, the renewable alternative should include CO_2 emissions associated with construction.

As shown in the Our World in Data chart above, analyses show that the overall CO_2 emissions of renewable sources are slightly higher than those of new nuclear. The (going forward) CO_2 emissions associated with operating an existing nuclear plant would be much lower, i.e., far lower than the emissions associated with building and operating renewable generation. (It should be noted that the CO_2 emissions for both nuclear and renewable generation are very small, even if construction is included.) (**52-3** [Hopf, James])

Comment: 4. Table 3-34, *the EIS incorrectly assumes that after 2045 the emissions are negligible. This fails to acknowledge the state's inability to procure energy capacity and assumes the lost power from nuclear and gas will be replaced with clean energy sources.* (**67-4** [Ortiz-Wines, Paris])

Response: *The comments expressed concerns related to the GHG emissions analysis presented in the SEIS. Specifically, the comments (1) recommended that the no-action alternative not be included in the SEIS because it does not evaluate the impacts of the power generation that would replace Diablo Canyon and, therefore, the GHG emissions presented in the SEIS for the no-action alternative are allegedly incorrect; (2) requested that the renewables combination alternative include GHG emissions associated with construction; and (3) disagreed that GHG emissions will be negligible for the purchased power alternative after 2045 because this alternative allegedly overestimates the state's ability to procure renewable energy capacity by 2045.*

With respect to the recommendation to not include the no-action alternative and the assertion that the GHG emissions of the no-action alternative are incorrect, the NRC staff disagrees. As discussed in Section 2.3.1 of this SEIS, under the no-action alternative, the NRC would not renew the Diablo Canyon operating licenses and Diablo Canyon Units 1 and 2 would shut down on or before their license expiration dates. The no-action alternative would result in the total cessation of electrical power production at Diablo Canyon. As discussed in Section 3.15.3.1.2 of this SEIS, the scope of impacts considered under the no-action alternative includes the immediate impacts resulting from activities at Diablo Canyon that would occur between plant shutdown and the beginning of decommissioning. The scope of the no-action alternative does not include the environmental impacts of replacement power if the Diablo Canyon licenses are not reviewed. However, Section 2.3.1 of this SEIS acknowledges that the no-action alternative would likely create a need for replacement power. Therefore, the SEIS does evaluate the impacts of two replacement energy alternatives to the proposed action of Diablo Canyon LR: (1) purchased power and (2) power from a combination of renewable resources (i.e., wind and solar energy with battery storage, geothermal energy, and demand-side management). Sections 3.15.3.1.3 and 3.15.3.1.4 and Table 3-34 of this SEIS present GHG emissions of the replacement energy alternatives. No changes were made to the SEIS as a result of this comment.

Regarding the request to include GHG emissions from construction of the renewables combination alternative, the NRC staff recognizes that GHG emission can be categorized into direct and indirect emissions. Indirect emissions include those associated with an organization's activities but that are emitted from sources owned by other entities, including those from upstream (e.g., construction) and downstream (e.g., decommissioning) activities. For this reason, in Section 3.15.3.1.4 of this SEIS, the NRC staff discussed lifecycle GHG emission factors to account for the direct and indirect GHG emissions associated with the renewables combination alternative. Section 3.15.3.1.4 of this SEIS specifically discusses what percentage of the lifecycle emissions that construction of a solar or wind facility is responsible for. No changes were made to the SEIS as a result of this comment.

Regarding the concern that the GHG emissions after 2045 for the purchased power alternative will not be negligible because the state of California will not be able to procure renewable energy capacity by 2045, as discussed in the SEIS, the replacement power alternatives represent possible options that energy-planning decision-makers may need to consider if the Diablo Canyon operating licenses are not renewed. The purpose and need for the proposed action is to provide energy-planning decision-makers with the option to continue nuclear power plant operations beyond the current licensing term to meet future system generating needs. The regulatory authority over licensee economics (including need for power, grid reliability, and the ability to procure or develop new replacement energy) falls within the jurisdiction of the State and, to some extent, the FERC. California's 100 Percent Clean Energy Act of 2018 requires all energy generation to be renewable and zero-carbon after 2045 (State of California 2018-TN9855). Electricity generated by eligible renewable energy can be located within or outside the State of California. California's 100 Percent Clean Energy Act of 2018 explicitly states that electricity generated outside of California and purchased and supplied to California end users can be counted towards meeting the goal of the Act. For these reasons, it is reasonable for the NRC staff to assume that after 2045 energy generation will be zero-carbon and therefore negligible. No changes were made to the SEIS as a result of this comment.

A.2.12 Historic and Cultural Resources

Comment: <u>10.Section 3.9.1.1 (page 3-142, Line 7)</u>
Greenwood's excavation took place in 1968 and was reported in 1972. (**65-10** [Jones, Thomas P.])

Comment: <u>11.Section 3.9.3 (page 3-151, Lines 7 and 11)</u>
PG&E has one professional archaeologist dedicated to DCPP (including the Land Stewardship Team) and several others in the region. (**65-11** [Jones, Thomas P.])

Comment: <u>12.Section 3.9.3 (page 3-151, Lines 11 -12)</u>
Suggest editing the sentence for clarity " ... provides recommendations for avoiding impacts to cultural resources and <u>oversees implementation of protection measures.</u>"
(**65-12** [Jones, Thomas P.])

Response: *The comments provide proposed editorial corrections to the SEIS. The NRC staff agrees with the comments and has revised Sections 3.9.1.1 and 3.9.3 of the SEIS accordingly.*

Comment: I. Corrections to Historic and Cultural Resource Descriptions
In Attachment A to this letter, *ytt* provides recommended revisions to the Historic and Cultural Resources descriptions in the DSEIS. Most of these edits, which appear in strikethroughs and red font, provide correction regarding appropriate tribal names, the relationship of *ytt*'s Northern

(*tiłhini*) Chumash ancestors to the Project site, and features within the Project area. In addition to these redline edits, *ytt* has three additional comments:

- In the second paragraph of Section 3.9.1.8 (Historic Period (1820s to Present)), the DSEIS states, "It is important to note that in some instances, the Northern Chumash are referred to as the *Obispeño*, which denotes the group's association with the *San Luis Obispo de Tolosa* mission. Descendants consider the term derogatory, preferring to use *yak tit^{y}u tit^{y}u* instead." As Attachment A explains, the second sentence in this quoted language should say "preferring to use *yak tit^{y}u tit^{y}u yak tiłhini* instead." With that correction, *ytt* further asks that NRC move this explanation to Section 3.9.1.7 (Post-Contact/Ethnographic Period), where the term "Obispeño" is used for the first time in a historic context. After explaining the relationship between these terms at the outset of Section 3.9 (Historic and Cultural Resources), the NRC should use the preferred term *tiłhini* except where the DSEIS refers to past archaeological or ethnographic studies that utilize the term "Obispeño." Attachment A gives several examples of this correction.

- Section 3.9.2 (Historic and Cultural Resources at Diablo Canyon) mentions Morro Rock as being the location of the Solstice Ceremony, but Morro Rock is not in the Project area and is not relevant to the DSEIS analysis. *ytt* strongly recommends that the NRC remove this reference from the document. If NRC declines to do so, Attachment A provides suggested edits to at least make the reference more accurate.

- Section 3.9.3 (Procedures and Integrated Cultural Resources Management Plan) references the 1980 Archaeological Resources Management Plan, which was developed for the avoidance and protection of site SLO-2 during the initial licensing for the Diablo Canyon Power Plant. This Plan must be updated based on current information regarding the appropriate lineal descendant tribe for the Project area, which is the *yak tit^{y}u tit^{y}u yak tiłhini* Northern Chumash Tribe.

As the DSEIS acknowledges, the Santa Barbara Museum of Natural History performed a genealogical study in 2020 to "identify descendants of Northern Chumash people who belonged to rancherías (native villages) that once existed in the Diablo Canyon Lands area." DSEIS at 3-150. "The ethnographic study determined that the YTT had the strongest case for cultural affiliation with the Diablo Canyon Lands…Members of the YTT could not only trace their ancestry back to one of the five rancherías but could also demonstrate continuity and identity as a Northern Chumash community that has been in the San Luis Obispo area from colonial times to the present day." *Id.*

[NHPA] Section 106, which the NRC seeks to satisfy through its NEPA process, requires an agency to consult with the tribe that "attach[es] religious and cultural significance to affected historic properties." 36 C.F.R. § 800.8(c)(1)(iii). Here, as the true people and lineal descendants of the ancestral Northern (*tiłhini*) Chumash villagers within what are now known as the Diablo Canyon Lands, the *ytt* Tribe must be recognized as such in the 1980 Archaeological Resources Management Plan (ARMP) governing continued cultural resource compliance on the site and must be consulted in the event of new cultural resource discoveries, decisions, and treatments. Similarly, if NRC follows the California State Historic Preservation Office's (SHPO) recommendations and requires PG&E to develop a Programmatic Agreement to address future cultural resource issues, PG&E must enter that Programmatic Agreement with *ytt* as the appropriate tribe for cultural resource consultation purposes. *See* DSEIS at 3-152.
(**82-1** [Gibbons, Tori])

Response: *The comments recommended that the NRC staff revise Section 3.9 of the SEIS to include editorial corrections that provide appropriate tribal names, clarify the use of the term*

Obispeño, and remove from Section 3.9.2 of the SEIS the reference to Morro Rock as it is not within the project area, consult with the yak tit^{y}u tit^{y}u yak tiłhini (ytt), and update the 1980 archaeological resources management plan (ARMP) to require consultation with the ytt. The NRC staff updated the text in Section 3.9 to incorporate references to tiłhini, as appropriate. However, many of the recommended revisions were not incorporated as it would have introduced an inconsistency with the cited reference.

Regarding the use of the term Obispeño, the NRC staff moved text from Section 3.9.1.7 to Section 3.9.1 to note that, in some instances, the Northern (tiłhini) Chumash are referred to as the Obispeño, which denotes the group's association with the San Luis Obispo de Tolosa mission; however, descendants consider the term derogatory, preferring to use tiłhini. The NRC staff clarified that the term Obispeño would only be used in the SEIS as referenced in cited archaeological or ethnographic studies and modified where appropriate.

For the comment pertaining to Morro Rock, the Santa Ynez Band of Chumash Indians have historic ties to the region and stated that the Chumash original territory lies along the coast of California, between Malibu and Paso Robles, as well as on the Northern Channel Islands. The information pertaining to Morro Rock was included to highlight important cultural resources within the region that are significant to other consulting Tribes. As a result, the NRC staff moved the text to Section 3.9.1.7 and clarified in the SEIS that the region around Diablo Canyon is an area of interest to the Santa Ynez Band of Chumash Indians and noted that Morro Rock and the surrounding sites are considered as sacred.

Regarding consultation, the NRC staff complied with the requirement to consult with any federally recognized Indian Tribe that attaches religious and cultural significance to historic properties that may be affected by the undertaking and the provision that additional organizations with a demonstrated interest in the undertaking may participate as consulting parties due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties by initiating consultation with the Santa Ynez Band of Chumash, the Tule River Tribe, the ytt, the Coastal Band of the Chumash Nation, the Salinan Tribe of Monterey and San Luis Obispo counties, the Northern Chumash Tribal Council, and the San Luis Obispo County Chumash Indians.

Regarding requiring updates to the 1980 ARMP, any revisions to the ARMP are the responsibility of PG&E. Any updates or modifications would be separate from the proposed action of LR. Moreover, the ARMP only discusses site SLO-02, and PG&E has several procedures and management plans in place to protect cultural resources, historic districts, and human remains on the Diablo Canyon site. PG&E complies with California Health and Safety Code 7050.5 and California Public Resources Code 5097.98 to notify the coroner and the Native American Heritage Commission to assist in determining the appropriate lineal descendant Tribe(s) for Diablo Canyon Lands depending on the location of potentially identified features. Per PG&E's best management practices, PG&E also coordinates and engages with the Santa Ynez Band of Chumash Indians and the ytt regarding any historic and cultural resource issues on the Diablo Canyon site. This would continue whether the ARMP is updated or a new one is established, and it is not dependent on LR. Therefore, no changes were made to the SEIS as a result of this comment.

Regarding the SHPO recommendation related to a programmatic agreement, that recommendation was related to the future decommissioning of Diablo Canyon and not with the proposed action of LR. Therefore, this comment is not within the scope of this proposed action, and no changes were made to the SEIS.

Comment: I want to emphasize that yak tit^{y}u tit^{y}u yak tiłhini Tribe is the only organization with a legitimate claim to the land surrounding Diablo Canyon, and the appropriate party for a tribal consultation on these matters.

The Northern Chumash Tribal Council, while the non-profit supporting Native American sentiments, does not represent indigenous Californians in this context. It should not be involved in consultation specific to Diablo Canyon, you know. In my work and studying California's energy system, you have to also study tribal groups. And, you know, that can get a little bit complicated, but at the end of the day, it's not hard to identify the actual tribal groups at stake here and ytt Northern Chumash Tribe is the right people for the NRC to be talking to. (**49-19-2** [Pickering, Ryan])

Comment: I would like to emphasize the importance of consulting with the yak tit^{y}u tit^{y}u yak tiłhini (ytt) Northern Chumash Tribe, the only tribal group in the region with a verified ancestral claim to the ancient sites once known as tstyiwi (now known as The Pecho Coast) in San Luis Obispo County.

yak tit^{y}u tit^{y}u yak tiłhini are also known as tiłhini, Obispeño, tiłhinan Chumash, ytt, YTT, y.t.t., and ytt Northern Chumash.

The name tilhini means "place of the full moon" and was both the name of their capital city and their language. Their full tribal name, yak tit^{y}u tit^{y}u yak tiłhini, translates to "the people (yak tit^{y}u tit^{y}u) of the full moon (tiłhini)."

yak tit^{y}u tit^{y}u yak tiłhini Northern Chumash Tribe is led by a seven-member Tribal Council, chaired by Mona Olivas Tucker, and supported by their nonprofit organization, the ytt Northern Chumash Nonprofit. Their verified lineage is formally recognized under:

- California Law SB846 (2022),
- CPUC Tribal Lands Policy Application (2021), and
- The Governor's Historic Preservation Award (2018).

The tribe's ancestral ties to the region are also reflected in the PG&E Nuclear Education Center, where their artifacts are featured as part of its exhibit.

Ensuring the inclusion of yak tit^{y}u tit^{y}u yak tiłhini in the NRC's consultation process honors their history, cultural heritage, and connection to the land surrounding Diablo Canyon Power Plant. (**84-2** [Pickering, Ryan])

Response: *The NRC staff acknowledges the comments, and its consultations in support of the Diablo Canyon LR environmental review are consistent with applicable laws and regulations. Section 101(d)(6)(B) of the National Historic Preservation Act of 1966, as amended (NHPA), and the regulations in Title 36 of the Code of Federal Regulations (36 CFR) Part 800, specifically, 36 CFR 800.2(c)(2)(ii), provide that Federal agencies must consult with any federally recognized Indian Tribe that attaches religious and cultural significance to historic properties that may be affected by an undertaking (i.e., the proposed action of Diablo Canyon LR). Separately, 36 CFR 800.2(c)(5) provides that additional organizations with a demonstrated interest in the undertaking may participate as consulting parties due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties (e.g., LR applicants, local governments, local historical societies, State-recognized Tribes, etc.). Accordingly, in January 2024, the NRC* *initiated consultation with, among others, the Santa Ynez Band of Chumash, the Tule River Tribe, the yak tityu tityu yak tiłhini (ytt), the Coastal Band of the Chumash Nation, the Salinan Tribe of Monterey and San Luis Obispo counties, the Northern Chumash Tribal Council, and the San Luis Obispo County Chumash Indians.*

Section 3.9.2.5 of the SEIS provides an overview of ethnographic surveys conducted in the vicinity of Diablo Canyon, including a 2020 genealogical survey conducted by the Santa Barbara Museum of Natural History. The purpose of that study was to identify descendants of Northern Chumash people who belonged to rancherías (native villages) that once existed in the Diablo Canyon Lands area. As noted in the SEIS, the study determined that the ytt had the strongest case for cultural affiliation with the Diablo Canyon Lands (Johnson 2020-TN10045). No changes were made to the SEIS as a result of these comments.

Comment: II. Corrections to Historic and Cultural Resource Findings
On a similar note, the DSEIS's Section 3.9.4.2 regarding its Historic and Cultural Resource Findings should be revised to state that while no new construction or modifications are expected to occur from a license renewal, the agency has made new findings regarding the true people and appropriate lineal descendant tribe for the Diablo Canyon Lands. As the NRC acknowledges (DSEIS at 3-150 to -151), the 2020 Johnson Report provides definitive evidence that *ytt* is the appropriate culturally affiliated descendant tribe to whom deference should be given with regard to cultural resources within the Project site. This position should be made explicit in NRC's Findings section as well. (**82-2** [Gibbons, Tori])

Response: *The comment recommended that the NRC staff revise the impact findings in Section 3.9.4.2 of the SEIS to state that the ytt is the appropriate culturally affiliated descendant tribe to whom deference should be given with regard to cultural resources within the Diablo Canyon site. The NRC staff disagrees with the comment. The findings in Section 3.9.4.2 follow the documentation standards described in 36 CFR 800.11. Specifically, the findings in Section 3.9.4.2 address potential effects to historic properties from the implementation of the undertaking and further address impacts to historic and cultural resources considered under NEPA. Therefore, the information regarding the ytt is in the appropriate section of the SEIS, and no changes were made to the SEIS as a result of this comment.*

Comment: III. Recognition of Faunal Tribal Cultural Resources
The DEIS includes a discussion of the Project's potential impacts on the federally endangered black abalone, ultimately concluding that the license renewal is not likely to adversely affect the species or adversely modify critical black abalone habitat. See DSEIS at xxiv (Table ES-1). While *ytt* understands the NRC's justification for reaching these conclusions, the Tribe urges the agency to take a broad view of the species not just from a biological perspective, but also as a tribal cultural resource.

The Northern (*tiłhini*) Chumash people have a profound cultural relationship with tspeteʔ, known in English as the abalone. *ytt*'s members hold memories of our relatives diving and collecting abalone, pounding the meat to eat, and leaving a tall mound of abalone shells in the backyard. *ytt*'s foodways are medicine for our bodies; they give us health, strength, and life. After thousands of years, our bodies and DNA are adapted to this local diet, evolving to require it for optimal physical and spiritual health. Not only does abalone provide a traditional food source, but it also represents a richness and presence of certain life—a specific terrain and habitat that goes hand-in-hand with abalone. Where there is abalone, *ytt*'s people have found kelp for tools; eelgrass for clothing; seaweed and sea vegetables for food; muscles, sea urchins, and crabs for food; fish, sharks, otters and sea lions for food, oil, clothing, furniture, tools;

olivella snails to manufacture shell money beads for trade; birds for food, musical instruments, and ceremony; and rocks for tools and places for prayer.

The abalone shell continues to be used by *ytt*'s members in many ways, including beads, pendants, buttons and ornaments for necklaces, earrings, hair pieces, bags, baskets, boats, tools, furniture, game pieces, and more. Abalone have long been found and are still used in association with burials, prayer, and ceremony. Abalone has been gifted and traded in our homeland with inland villages, and to neighboring tribes around us, and also far away to tribes in the mountains. This network shows the relationships of our kinship groups and traditional commerce train routes.

Over time, human activities have had a tremendous negative impact on the abalone population and its habitat. As the original land stewards of this coastline, *ytt* has an innate responsibility to restore, revitalize, and protect our unique and diverse ecosystems for a healthy future on land and in the water. We are committed to restoring our relationship to our ancestral homeland gathering places and healing through well-balanced land management plans that prioritize and implement our traditional eco-cultural knowledge and practices. For these reasons, *ytt* requests that the NRC revise its DSEIS to take a more holistic view of the black abalone that includes consideration of this species as a tribal cultural resource. *ytt* further asks that where black abalone stewardship and management processes currently exist, the NRC, National Marine Fisheries Service (NMFS), and PG&E involve *ytt* and incorporate the Tribe's traditional ecological knowledge to better protect this sensitive and invaluable species. (**82-3** [Gibbons, Tori])

Response: *The comment requested that the NRC staff consider impacts to black abalone not just from a biological perspective, but also as a tribal cultural resource. The NRC staff agrees with this comment and has updated Section 3.9.2 of the SEIS to include discussion of the importance of tspeteʔ (abalone) as a tribal cultural resource to the ytt. The NRC staff has also updated Section 3.7.1.5 to include information on the abalone's cultural significance to the ytt in the discussion of subtidal invertebrates and other important ecological features of the site. In connection with its Endangered Species Act of 1973, as amended (ESA), Section 7 consultation with the National Marine Fisheries Service (NMFS), the NRC staff shared the ytt's letter and discussed the cultural significance of the abalone with the NMFS to ensure that the agency is also aware of the ytt's perspectives.*

Comment: IV. Revisions to Recommendations
At the end of the DSEIS, the NRC recommends that "the adverse environmental impacts of [License Renewal] for Diablo Canyon are not great that preserving the option of LR for energy-planning decision-makers would be unreasonable." DSEIS at 4-1. The NRC should revise this recommendation to be contingent on PG&E updating its existing Archaeological Resources Management Plan in partnership with the *ytt* Tribe, who are the documented descendants of the indigenous people from the Project area. Moving forward with license renewal is only reasonable if the agency and applicant acknowledge and incorporate the latest information about the Project site, including the tribal and cultural findings from the 2020 Johnson Report. Though the license renewal itself may not alter Project operation or require construction, future actions—such as independent spent fuel storage installation—could involve additional impacts on tribal and cultural resources. For this reason, and because the 1980 Plan was created in response to PG&E's initial license application, the NRC should use this license renewal opportunity to require that the Archaeological Resources Management Plan be appropriately updated to name *ytt* as the lineal descendant tribe.

Relatedly, *ytt* also encourages the NRC to require PG&E to undertake additional cultural resource surveying at the site in partnership with *ytt* to promote additional understanding of this culturally sensitive area. (**82-4** [Gibbons, Tori])

Response: *The comment stated that the NRC should require the ARMP to be updated to include the ytt even though the proposed action of LR does not alter plant operation or require construction. The NRC cannot require changes to the ARMP because doing so is not within the NRC's authority. Moreover, the NRC staff's recommendation that the adverse environmental impacts of LR for Diablo Canyon are not so great that preserving the option of LR for energy-planning decision-makers would be unreasonable is not affected by the ARMP remaining unchanged. The ARMP is the responsibility of PG&E. Any updates or modifications would be separate from the proposed action of LR. Moreover, the ARMP only discusses site SLO-02, and PG&E has several procedures and management plans in place to protect cultural resources, historic districts, and human remains on the Diablo Canyon site. PG&E complies with California Health and Safety Code 7050.5 and California Public Resources Code 5097.98 to notify the coroner and the Native American Heritage Commission to assist in determining the appropriate lineal descendant Tribe(s) for Diablo Canyon Lands depending on the location of potentially identified features. Per its best management practices, PG&E also coordinates and engages with the Santa Ynez Band of Chumash Indians and the ytt regarding any historic and cultural resource issues on the Diablo Canyon site that may be impacted by plant operation (as discussed in the SEIS, LR will have no impact on historic and cultural resources and no adverse effect to historic properties). This would continue whether the ARMP is updated or a new one is established, and it is not dependent on LR. Therefore, requiring the requested update to the ARMP is both not within the NRC's authority and would not impact the staff's recommendation regarding LR. Accordingly, no changes were made to the SEIS as a result of this comment.*

Comment: The *ytt* Tribe appreciates the NRC's efforts thus far to engage in meaningful discussion about the highly sensitive and plentiful historic and cultural resources located in *ytt*'s ancestral territory within the Diablo Lands and looks forward to continuing those discussions. Please also provide *ytt* with written responses to these comments so that the Tribe can better understand how the NRC has revised its EIS analysis in response to the Tribe's input. (**82-5** [Gibbons, Tori])

Response: *The NRC acknowledges this comment. The NRC met with the ytt to discuss updates to the SEIS on April 24, 2025, and will provide a letter documenting the NRC's responses to the ytt's comments.*

A.2.13 Human Health-Nonradiological

Comment: Not anymore as you just dredged 'the north end of Intake Cove' and moved it west of Morro Bay State Park and south of the Morro Bay entrance. (**81-12-3** [McClintock, Francene])

Comment: No longer an accurate statement since the dredging of Intake Cove and the placement of Intake Cove's contents elsewhere. (**81-12-5** [McClintock, Francene])

Response: *One commenter expressed concerns about the microbiological non-radiological human health impacts specifically from dredging activities. All human health impacts are described in Section 3.11 of this SEIS including non-radiological human health impacts. As discussed in Section 3.11.3 of this SEIS, Diablo Canyon uses a once-through cooling system that intakes and discharges water to the Pacific Ocean. This area is not accessible to the public. In addition, the access restrictions limit public exposure to thermophilic microorganisms in the* *receiving waters of the plant. Therefore, the NRC staff concludes that the Category 2 issue of microbiological hazards to the public is not applicable to Diablo Canyon LR, that further review of the issue is not warranted, and that continued operation is not expected to result in adverse effects with respect to the issue.*

Additionally, dredging is permitted by the USACE under CWA Section 404, and the USACE is required to perform its own environmental review prior to issuing such a permit. For instance, PG&E conducted dredging of the Intake Cove during the current operating license period in the summer of 2024. As stated in Section 3.8.4.3.4 of the SEIS, in support of this effort, PG&E obtained a CWA Section 404 permit from the USACE prior to conducting dredging. PG&E has no plans to dredge during the proposed LR period.

These comments provide no new and significant information; therefore, no changes were made the SEIS as a result of these comments.

A.2.14 Human Health-Radiological

Comment: Fear of arbitrarily small doses and dose rates of ionizing radiation is irrational. It was fabricated for economic and political reasons by a century of scientific misconduct, largely funded by the Rockefeller Brothers Foundation, as explained by a documentary interview with Prof. Edward Calabrese (Toxicology, University of Massachusetts at Amherst), which is available at https://hps.org/hpspublications/historylnt/episodeguide.html. (**17-7** [Snyder, Van])

Comment: Please discuss the importance of INTERNAL emitters once radioactive food, water, and air has entered the living being and living plants. (**81-9-9** [McClintock, Francene])

Comment: The above is describing workers performing underwater activities at Intake Cove. All those risks have now been transferred to west of Morro Bay State Park and south of the Morro Bay entrance. The workers should be wearing protective gear against radionuclides. (**81-12-4** [McClintock, Francene])

Comment: Any dose is an overdose. (**81-12-7** [McClintock, Francene])

Comment: The above is the best-case scenario. Please shut them down. (**81-12-8** [McClintock, Francene])

Comment: Acceptable radiation levels in America were raised after the Fukushima reactors blew up. Background levels as well have risen since the first atomic bomb. The background level used should be the one that existed BEFORE the first atomic bomb explosion. Then all would properly see how contaminated our food and water really are. (**81-12-10** [McClintock, Francene])

Comment: This is a total fallacy. The control sample is radioactive from all the previous nuclear power and atomic bomb releases. There is no such thing as "areas beyond the influence of the nuclear power plant or any nuclear facility". We are all radioactive and so is this planet. Man-made radionuclides can be found in baby teeth. (**81-12-11** [McClintock, Francene])

Comment: Not true. Diablo Canyon would continue releasing its' radionuclides into the air, water and land and bioaccumulation would continue, which is the CONCENTRATION of these radionuclides in our food chain. (**81-12-12** [McClintock, Francene])

Comment: This is a horrible excuse to continue a cancer factory that affects many lives greater than a 50-mile radius. (**81-12-13** [McClintock, Francene])

Response: *Multiple comments expressed concerns about doses received by workers and the public from radiological emissions. One commenter also stated that people have unfounded concerns for arbitrarily small doses. The issues of radiological exposure to workers and the public have been determined generically in the LR GEIS to have SMALL impacts for all nuclear power plant LRs. The human health impacts from radiological exposures and risks are discussed in Sections 3.11.1 and 3.13.1 of this SEIS and the radiological environmental monitoring program is discussed in Section 3.13.1.5 of this SEIS.*

For information about the biological effects of radiation and the NRC's exposure limits, please see the Backgrounder on Biological Effects of Radiation, which is available on the NRC's public website at https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/bio-effects-radiation.html, and for additional information on radiation protection and radiation and its health effects visit https://www.nrc.gov/about-nrc/radiation.html.

These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.

A.2.15 Hydrology-Groundwater Resources

Comment: But there may be a leak in the vault. The sump pumps tested for tritium, but you did not test for other radionuclides. (**81-13-1** [McClintock, Francene])

Response: *As described in Section 3.4.6.2 of the ER, rain intrusion into the old steam generator storage facility at Diablo Canyon occasionally results in water collecting in the long-term storage vault sumps. As described in the ER, the sumps are inspected quarterly and, if standing water is observed in the sumps, the water is sampled for gamma emitting radionuclides and for tritium. Results are reported to the NRC in the annual radiological environmental operating reports and indicate that no radionuclides other than tritium have been detected in water sampled from the vault sumps during the six years from 2018 to 2023. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

A.2.16 Hydrology-Surface Water Resources

Comment: The water discharged from Diablo Canyon's cooling system is returned to the ocean at an elevated temperature, typically 18 to 20 degrees Fahrenheit (about 10 to 11 degrees Celsius) above the ambient ocean temperature. This warmer water disperses gradually as it re-enters the sea, but it does create a localized thermal plume in the vicinity of the discharge area. We need to upgrade the cooling system in return to the ocean. Also: consider the quality of the water returned (**20-1** [Asad, Khaled])

Comment: Diablo Canyon should not have its permit extended because it is out of compliance with the Clean Water Act. (**24-3** [Woodcock, Charlene M.])

Comment: Section 3.5.1.3.2 deals with the National Pollutant Discharge Elimination System Diablo Canyon utilizes the Once-Through Cooling system which violates the Clean Water Act. But again and again, PG&E has been granted waiver after waiver and has been allowed to continue damaging the marine environment.

"...in 2021, there was a settlement between PG&E and the CCRWQCB associated with historical and ongoing thermal discharge impacts from Diablo Canyon cooling water discharge. The settlement, associated with Case No. 21CV-0111, was reached in May 2021 in the California Superior Court, County of San Luis Obispo. PG&E made a one-time payment to the Bay Foundation of Morro Bay to benefit water quality and the environment on California's Central Coast. The Consent Judgement did not specifically conclude if PG&E violated its NPDES permit."

And...
"The current NPDES permit was issued on May 11, 1990, by the CCRWQCB, and had a listed expiration of July 1, 1995. However, the permit has been under administrative extension and is listed as currently active on the SWRCB database (SWRCB 2024-TN10087). According to PG&E, the NPDES permit is anticipated to be re-issued in late 2026 (PG&E 2023-TN9822). PG&E confirmed that during its discussions with the CCRWQCB, the Board did not indicate that any changes to Diablo Canyon's NPDES permit would be required (PG&E 2024-TN10032)."

Again: slipshod. The permit has been under administrative extension since 1995.
(**29-4** [ZamEk, Jill])

Comment: So, the DSEIS included that the once-through cooling systems would cease operations in 2030, sooner than the proposed relicense term of 20 years. And I'm just wondering if someone on this call could expand on that sequencing, if the license renewal were approved, would the cooling system also be like grandfathered in with that? Or is there some connection there that I might have missed from my first read-through? (**49-6-1** [Nelson, Chloe])

Comment: And Diablo's once-through cooling water system is out of compliance with the Clean Water Act. This facility circulates 2.5 billion gallons of sea water each day, releasing it back into the ocean 20 degrees warmer and killing more than one billion fish in the early life stages.
(**49-16-3** [Tanner, Jennifer])

Comment: Section 3.5 - Water Resources: Page 3-31 of the Draft Supplement describes potential flood hazards along the Diablo Canyon shoreline, including those resulting from tsunami, wind generated storm waves, storm surge, and tides. PG&E's 2016 analysis found that the cumulative effects of a probable maximum storm surge and seiche with wind-wave activity combined with an antecedent 10 percent exceedance high tide yielded wave heights of 41.7 and 9.9 feet above mean sea level ("MSL") outside and inside the breakwaters, respectively. The estimated wave heights along the coastline were 43 to 75 feet below the power block elevation of 85 feet MSL. We recommend the Draft Supplement either clarify that these estimates included various projections of sea level rise ("SLR") in conjunction with storm (annual, 10-year, 20-year, and/or 50 year) activity and non-storm activity over the next 20 years or that the analyses be revised to include the most recent SLR and storm activity projections, including the Extreme Risk Aversion (H++) scenario applicable to critical infrastructure projects such as Diablo Canyon.

Additionally, page 3-36 discusses the state Regional Water Quality Control Board's expected review of an updated NPDES permit for Diablo Canyon and states that PG&E does not expect an updated permit to be different than the current one. However, the state's water quality standards have undergone several substantial changes since PG&E received its current NPDES permit more than 30 years ago, and we understand that an updated NPDES permit will need to incorporate those changes, several of which could result in necessary changes to Diablo Canyon's effluent limitations and operational requirements. We recommend the Draft

Supplement describe the water quality standards changes and evaluate any likely modifications to Diablo Canyon that may result from these changes. Please note, too, that the U.S. EPA has recommended that PG&E conduct an updated entrainment study for use in the Regional Board's upcoming review. This updated study is expected to better characterize the loss of marine life productivity associated with extended cooling water intake operations. (**51-6** [Luster, Tom])

Comment: 2. Section 3.5.1.3.2 (page 3-36, Line 8)
While it is true that the Central Coast Regional Water Quality Control Board did not specify required changes to Diablo Canyon Power Plant's (DCPP's) National Pollutant Discharge Elimination System (NPDES) permit during license renewal coordination prior to the May 2024 Responses to *NRC Requests for Additional Information on the Diablo Canyon Power Plant License Renewal Application Environmental Report*, coordination regarding the NPDES permitting process is ongoing and specific NPDES requirements for DCPP may be refined based on the current California Ocean Plan (last revised in 2019) or other information considered during the permitting process. (**65-2** [Jones, Thomas P.])

Comment: 2. Page 3-36, lines 7-10 read: "According to PG&E, the NPDES permit is anticipated to be re-issued in late 2026 (PG&E 2023-TN9822). PG&E confirmed that during its discussions with the CCRWQCB, the Board did not indicate any changes to Diablo Canyon's NPDES permit would be required (PG&E 2024- TN10032)."

CCRWCB comment: The CCRWQCB is in the process of updating the NPDES permit and has not yet determined the full extent of changes the new permit will include relative to the 1990 permit. However, the CCRWQCB anticipates at least the following changes: an updated reasonable potential analysis that may result in additional and/or modified effluent limitations; various updates to be consistent with California's current Ocean Plan, including updated toxicity requirements; various updates to be consistent with the CCRWQCB's current Basin Plan; an updated monitoring and reporting program; and updated regulatory references. (**71-2** [Lodge, Ryan E.])

Comment: Diablo Canyon has significant impacts to water resources. According to PG&E's website the Diablo Canyon's average fresh water use in the three-year period of 2018 to 2020 was 422-acre feet of well water per year.[43] Diablo Canyon releases 24,000,000 gallons of brine per month on average to the ocean.[44] Diablo Canyon has a maximum discharge of 2.5 billion gallons per day, set by the facility's Clean Water Act permit. The Regional Quality Water Board found that Diablo Canyon discharge resulted in major reductions in species populations and assemblages in Diablo Cove, including almost complete loss of foliose algae and intertidal fish.[45] Millions of larvae are sucked into the once through cooling system. The California Regional Water Quality Control Board Central Coast Region staff estimates the following entrainment losses due to Diablo Canyons water withdrawal.

[43] https://www.pgecorp.com/corp_responsibility/reports/2021/pl04_water.html
[44] https://www.dcisc.org/download/events/41_1-f-diablo-canyon-independent-safety-committee-20230628-agenda-packet.pdf Page 66 of 135
[45] https://www.waterboards.ca.gov/centralcoast/water_issues/programs/diablo_canyon/docs/07_10_03_hearing/testimony/071003dcpptestimonyfinal.pdf Page 4 of 21
[46] https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/diablo_canyon/docs/2000_07_13_diablo_staff_report.pdf Page 3 (**79-1-17** [Sarvey, Robert])

Comment: <u>NPDES Permit</u>

Diablo Canyon Clean Water Violations
On June 18, 2021, the Central Coast Regional Water Quality Control Board and the Pacific Gas and Electric Company reached a $5.9 million settlement to resolve alleged violations of PG&E's National Pollutant Discharge Elimination System permit from discharges of once-through cooling water into the Pacific Ocean from its Diablo Canyon nuclear power plant. The settlement funds will be used for water quality projects that benefit the region.

Regulators alleged releases of once-through cooling water from Diablo Canyon into the Pacific Ocean constituted violations of PG&E's National Pollutant Discharge Elimination System permit. PG&E agreed to the settlement following a Central Coast water board investigation of alleged permit violations associated with the thermal component of the plant's discharge since it first began releasing once-through cooling water in 1985.

PG&E still does not have a current valid NPDES permit. (**79-1-20** [Sarvey, Robert])

Comment: Intake Cove is inclusive of Outfall 002, Outfall 003 (close), Outfall 004, Outfall 016, and Outfall 017. Not sure what ALL is dumped through Outfall 002, Outfall 003 and Outfall 004 but it looks like oil and grease. Chemical additives: chlorination, liquid sodium hypochlorite and a supplemental chemical, sodium bromide are also dumped through Outfall 003 (close enough that it may have been included in the dredging) and Outfall 004 as well as through Outfall 016 and Outfall 017. (**81-4-3** [McClintock, Francene])

Comment: So the stormwater also is discharged into Intake Cove which includes "total suspended solids, oil and grease, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature, turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity. Discharge of oil." (**81-4-4** [McClintock, Francene])

Comment: "Diablo Cove: arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, silver, zinc, cyanide, total residual chlorine, ammonia, toxicity, non-chlorinated phenolic compounds, chlorinated phenolics, and radioactivity. In addition to the once-through cooling water, service cooling water and in-plant waste streams are also discharged through Outfall 001 and are labeled Discharge 001A, 001B, 001D through 001N, and 001P. Discharges 001D, 001F through 001M, and 001P have specified concentration limits for suspended solids and oil and grease. When metal cleaning operations occur, discharges 001D, 001F, 001L, and 001M have specified concentration limits for total copper and total iron. Discharge 001N has specified concentration limits for suspended solids, settleable solids, and oil and grease.

The NPDES permit for Diablo Canyon Units 1 and 2 allows PG&E to discharge via external Outfalls 001 through 017 (Figure 3-3). Cooling water and industrial process wastewater from Diablo Canyon are discharged to the Pacific Ocean in accordance with Diablo Canyon NPDES Permit No. CA0003751, Order No. 90-09 (PG&E 2023-TN9822). The receiving water bodies are the Pacific Ocean and Diablo Creek. The NPDES permit also authorizes 13 additional outfalls that are internal. External Outfalls 004 through 015 are related to stormwater runoff. Outfall 001 discharges to Diablo Cove, Outfalls 002 and 004 discharge to Intake Cove, Outfall 003 discharges to the Pacific Ocean, Outfalls 005, 006, 016, and 017 discharge to the South Cove, Outfall 007 discharges to the Pacific Ocean, and Outfalls 008, 009, 010, 011, 012, 013, 014 and 015 discharge to Diablo Creek.

Intake Cove has accumulated oil and grease, chemical additives: chlorination, liquid sodium hypochlorite and a supplemental chemical, sodium bromide, total suspended solids, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature,

turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity plus radionuclides."
So all of the above are in the Diablo Cove heated effluent discharges and have been concentrated over the years in the sand and sediment. This EIS did not explain what was discharged from two of the outfalls into Intake Cove. A good percentage of all of the above are also concentrated in Intake Cove and now, because of the dredging, concentrated south of the entrance to Morro Bay and west of Morro Bay State Park. (And don't forget all the radionuclides!) (**81-11-4** [McClintock, Francene])

Response: *These comments generally expressed concerns related to the Diablo Canyon National Pollutant Discharge Elimination System (NPDES) permit. Diablo Canyon is operating under an administrative extension to the NPDES permit issued in May 1990. This permit is included in the ER as Attachment B and contains discharge limits as well as monitoring and reporting requirements. The NRC staff considered the discharge from Diablo Canyon in its assessment of impacts to surface water during the proposed LR term (see Section 3.5.3 of this SEIS). There have not been any self-reported violations associated with Diablo Canyon's NPDES permit over the 5-year reporting period from 2018 to 2022. PG&E is working with the Central Coast Regional Water Quality Board to renew the NPDES permit for the continued operation of Diablo Canyon. Specific NPDES requirements may be refined from that in the current permit based on the 2019 California Ocean Plan and other information considered during the permitting process. NRC has no role in the NPDES permit renewal process.*

With respect to flooding, the basis for the values presented in Section 3.5.1.1.2 of this SEIS can be found in the references cited. The purpose of the NRC's environmental review is to document the potential effects from continued nuclear power plant operation during the LR term on the environment. Safety concerns including the impacts from storms and flooding on the day-to-day operations of the facility are addressed separately under the NRC's ongoing reactor licensing and oversight programs.

Regarding Diablo Canyon's once-through cooling system, PG&E is in compliance with the interim mitigation requirements in Section 2.C(3)(b) of California's OTC Policy. PG&E demonstrates compliance with the interim mitigation requirements by providing funding to the Ocean Protection Council or State Coastal Conservancy to fund appropriate mitigation projects (https://www.nrc.gov/docs/ML2413/ML24137A314.pdf).

The NPDES process does not regulate radionuclide discharges. The NRC requires nuclear power plants to monitor and report all radiological effluents discharged to the environment. These results are summarized in "Annual Radioactive Effluent Release Reports," which lists the quantities of radionuclides released from the site in liquid and gaseous effluents for each calendar year. Additionally, "Annual Radiological Environmental Operating Reports" present measurements of radioactive materials found in the local environment, including surface water. These reports are publicly available at https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/diab1-2.html. In response to these comments, Section 3.5.1.3.2 of this SEIS was revised to reflect that the NPDES permit renewal process, including the assessment of refined permit conditions, is ongoing. Additionally, corrections were made to citations in Section 3.5.1.1.2 of this SEIS.

Comment: 1. Section 3.5.1.3.1 (page 3-35, Line 24-25)
The 2020/2022 Integrated report 303(d) list for San Luis Obispo Creek includes benthic community effects, chloride, E. coli, nitrate, dissolved oxygen, sodium, and toxicity. The DSEIS included fecal coliform and urea and omitted dissolved oxygen. (**65-1** [Jones, Thomas P.])

Response: *Section 3.5.1.3 of this SEIS was revised to correct a typographical error and to update the listing of impaired waters based on the 2022-2024 303(d) list published by the California State Water Board (https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/2024-integrated-report.html).*

Comment: 1. Page 3-36, line 4 reads: "NPDES Permit No. CA0003571" CCRWCB comment: Please update to NPDES Permit No. CA0003751. (**71-1** [Lodge, Ryan E.])

Comment: 3. Page 3-36, lines 20-22 read: "There have not been any violations associated with Diablo Canyon wastewater discharges over the 5-year reporting period from 2018-2022 (PG&E 223-21TN9822).

CCRWQCB comment: PG&E has not self-reported any effluent limit violations over the 5-year reporting period from 2018-2022. The CCRWQCB will conduct a detailed compliance evaluation during the NPDES permit renewal process. (**71-3** [Lodge, Ryan E.])

Comment: 4. Page 3-36, lines 41-43 read: "When metal cleaning operations occur, discharges 001D, 001F, 001L, and 001M have specified concentration limits for total copper and total iron." CCRWQCB comment: Consistent with the NPDES permit, please update to: "When metal cleaning operations occur, discharges 001D, 001F, 001I, 001L, and 001M have specified concentration limits for total copper and total iron." (**71-4** [Lodge, Ryan E.])

Response: *The SEIS was updated with corrections and clarifications related to NPDES permit No. CA0003751. Specifically, the updates corrected an instance of the incorrect NPDES permit number, clarified that there have been no self-reported NPDES permit violations over the 2018-2022 period, and added Internal Outfall 001I to the list of outfalls that have concentration limits for total copper and iron during metal cleaning operations.*

Comment: As established above, Intake Cove has accumulated oil and grease, chemical additives: chlorination, liquid sodium hypochlorite and a supplemental chemical, sodium bromide, total suspended solids, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature, turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity.

The dredge footprint "at the north end of Intake Cove". North of Intake Cove is the out-flow area that is full of radionuclides. There has to be some pulling in/recirculation of the Diablo Cove radionuclides back into Intake Cove "since the initial construction of the breakwater." NRC's definition of 'north of Intake Cove' from page 3-88 of this EIS:

"Diablo Cove: Diablo Cove lies to the north of Intake Cove. This cove receives Diablo Canyon's thermal effluent discharge of Pacific Ocean water that the plant withdraws from Intake Cove for cooling purposes."

From Page 3-88

Pacific Ocean: Based on NPDES plume surveys from 1986 to 1990 (PG&E 2008- TN10104), Diablo Canyon's thermal plume is primarily detectable between 0.5 and 1 mi (0.8 and 1.6 km) offshore (41 to 60 percent of survey samples) with a maximum extent of 2 mi (3.2 km) either north or south of Diablo Cove during certain tidal conditions."

The above should really read "Diablo Canyon's RADIOACTIVE thermal plume..." So this proves the radionuclides travel "south of Diablo Cove during certain tidal conditions". South of Diablo Cove is Intake Cove.

"PG&E decided to remove the accumulated sand and kelp by dredging Intake Cove, which had not been performed since the initial construction of the breakwater."

"2.1.2 Nuclear Reactor Systems
The Diablo Canyon Unit 1 operating license was issued on November 2, 1984, and the Diablo Canyon Unit 2 operating license was issued on August 26, 1985."

So, this dredging covers TWO nuclear power plants over a 40-year period. That's a lot of radionuclides! That's also a lot of oil and grease, chemical additives: chlorination, liquid sodium hypochlorite and a supplemental chemical, sodium bromide, total suspended solids, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature, turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity.

"Approximately 26,000 cubic yards of material was removed from the cove and placed at the U.S. Army Corps of Engineers (USACE) Nearshore Placement Area located south of the entrance to Morrow Bay and west of Morrow Bay State Park (PG&E 2024-TN10226)."

The Bay Foundation of Morro Bay (and the rest of Southern California) should sue for the health consequences that are ongoing since 2024 (really since 1984). Is the Bay Foundation aware that this sediment, sand and kelp is radioactive and full of 40 years' worth of contaminants? Tritium's hazardous life is 123.2 years to 246.4 years. Are they not able to sue because it was placed on a U.S. Army Corps of Engineers Nearshore Placement area?
(**81-4-6** [McClintock, Francene])

Response: *The comments expressed concerns related to the dredging of intake cove in 2024. The NRC is not involved in permitting dredging activity or the disposal of dredged materials. Such permitting is under the purview of California state agencies and the USACE. Part of the permitting process includes an impact determination of the proposed dredging activities. Prior to performing the dredging, PG&E conducted sampling and analysis of the dredged material following the provisions outlined in the Inland Testing Manual or the Ocean Disposal Manual and the USACE Regional Guidance Letter 06-02. The results of the pre-dredging sampling had to be approved by the USACE before PG&E was authorized to perform the intake cove dredging project (https://www.nrc.gov/docs/ML2413/ML24137A314.pdf). As part of the permitting process, the USACE approved the disposal of the dredged material at the USACE Nearshore Placement Area. Moreover, as documented in the LR GEIS (NRC 2024-TN10161), the effects of dredging on surface water quality were generically determined to be SMALL for all nuclear power plant LRs. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.*

Comment: 5. Page 3-38, lines 19-40 discus stormwater permitting requirements. Lines 35-39 read "Constituents include total suspended solids, oil and grease, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature, turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity. The SWPPP outlines sampling locations, frequencies, and reporting requirements (PG&E 2023-TN9822)."

CCRWQCB comment: Please update the language to read: "Constituents include, but are not limited to, total suspended solids, oil and grease, metals, tritium, gamma emitters, total organic carbon, biochemical oxygen demand, temperature, turbidity, polycyclic aromatic hydrocarbons, and chronic toxicity. The SWPPP outlines sampling locations, frequencies, and monitoring and reporting requirements." (**71-5** [Lodge, Ryan E.])

Response: *Section 3.5.1.3 of this SEIS has been revised as suggested by the commenter to clarify the SWPPP monitoring requirements.*

A.2.17 Land Use and Visual Resources

Comment: 1. 3.2.1.1 Onsite Land Use (document page 3-6; pdf page 72)
The DSEIS states here that the Diablo Canyon property and lands are "owned and controlled by PG&E"; however, the State of California owns, and the State Lands Commission manages a portion of the upland adjacent to the shoreline pursuant to a Boundary Line Agreement established between CSLC and PG&E during DCPP construction.

Commission staff recommends adding text to this paragraph: "A portion of the Diablo Canyon upland property adjacent to the shoreline, as well as offshore lands underlying the DCPP intake and discharge coves, are owned by the State of California and are under the jurisdiction of the California State Lands Commission." (**73-1** [Calvo, Lucinda])

Comment: 2. 3.2.1.2 Coastal Zone (document page 3-7; pdf page 73)
The DSEIS here describes the Coastal Zone Management Act and California Coastal Commission (CCC) regulatory jurisdiction.

The DSEIS would benefit from also including a description of State Lands Commission land ownership and leasing jurisdiction, which is another significant land use control in this area. For an example of such a discussion, staff recommends consulting section 1.3.2.2 of the San Luis Obispo County DCPP Decommissioning Draft Environmental Impact Report (County DEIR).[1] A copy of the section is appended to this letter for NRC staff's convenience.

[1] See pages 1-11 through 1.12. Available at:
https://www.slocounty.ca.gov/departments/planning-building/grid-items/community-engagement/active-planning-projects/diablo-canyon-power-plant-decommissioning-(1)/draft-environmental-impact-report/1-introduction.

Should NRC staff wish to consider including a figure to illustrate Commission jurisdiction at DCPP, staff recommends referring to Figure 1-4 of the County DEIR, which provides a general visual depiction of both offshore and upland areas within Commission jurisdiction:[2]

[2] See page 1-12. Available at the same link as Note 1
(https://www.slocounty.ca.gov/departments/planning-building/grid-items/community-engagement/active-planning-projects/diablo-canyon-power-plant-decommissioning-(1)/draft-environmental-impact-report/1-introduction.). (**73-2** [Calvo, Lucinda])

Response: *The NRC staff agrees with these comments and has added context for the California State Lands Commission lands onsite. The added text states that "A portion of the Diablo Canyon upland property adjacent to the shoreline, as well as offshore lands underlying the Diablo Canyon intake and discharge coves, are owned by the State of California and are under the jurisdiction of the California State Lands Commission."*

Comment: The land-use impacts for renewables are also likely underestimated, I think, in the draft size. So, estimates from DOE, which were cited, tend to rely on older projects and idealized hypothetical projects, future technologies. When you measure the land-use from real-world operating renewables projects, the land-use is much higher.

So based on research that I did, it was co-authored in 2022 in the journal PLOS ONE, we found that to generate a terawatt-hour of electricity, it takes about six times the land if you use wind power, and 300 times the land to rely on solar PV compared to nuclear. And that includes the full lifecycle of nuclear, including mining.

However, to maintain reliability, you need to significantly overbuild renewables capacity by 5 to 10 percent, so the land impact could be much larger.

Now, we obviously have a lot of land in California, maybe not in downtown San Luis Obispo, but we do have a lot of land. But more land consumption means more communities are impacted and there's more opportunity for opposition. (**50-13-3** [Lovering, Jessica])

Response: *The comment expressed concerns related to land use requirements for renewables projects. Land use requirements for construction and operations of renewable power can vary depending on geographic and technological factors as well as siting requirements. The values used in the SEIS for the quantity of land required for renewable power are based on established estimates and reflect the increase in land required in comparison to the proposed action of Diablo Canyon LR. Section 3.10.9 of this SEIS provides additional information related to the potential socioeconomic impacts of the replacement power alternatives. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

Comment: **<u>3.2.1.2 Coastal Zone</u>**

The SEIS recognizes that the California Coastal Commission has authority over Coastal Zone management. The draft EIS also reports that PG&E has not received a coastal zone permit for extended operations and is now operating beyond its CCC permit.[47]

[47] SEIS Page 3-7

PG&E submitted a Federal consistency certification to the NRC and to the California Coastal Commission (CCC) stating its position that continued operation of [Diablo Canyon] complies with California's coastal management program and will be conducted in a manner consistent with such program. In response, on December 7, 2023, the CCC informed PG&E that it needs more information before it can consider the Diablo Canyon license renewal consistency certification. Discussions between PG&E and the CCC are ongoing; to date, the CCC has not notified the NRC and PG&E whether it concurs with or objects to the consistency certification.[48]

[48] SEIS Page 3-7

Since this document was issued on October 25, 2024 surely the NRC staff must know that the Coastal Commission has docketed in the ADAMS website a September 14, 2024 letter from Tim Luster to PG&E entitled, "Incomplete Consistency Certification for Pacific Gas & Electric Company's ("PG&E's) Requested Nuclear Regulatory Commission License Renewal for Diablo Canyon Power Plant, San Luis Obispo County."[49] The letter informed PG&E that, "At this point in our review, however, your application remains incomplete, for the reasons provided below. Pursuant to the Coastal Zone Management Act's ("CZMA") implementing regulations at 15 CFR 930.58, we will need the information requested herein and in those previous letters to allow the Coastal Commission to adequately consider any likely coastal effects of the proposed federal action. Accordingly, and pursuant to 15 CFR 930.60(a), the Commission's six-month review period has not commenced and will not commence until we receive the missing necessary data and information.

[49] ADAMS Ascension # ML 24260A122

Despite not having the Coastal Commission permit PG&E has already completed many of the upgrades that the Coastal Commission permit is adjudicating in violation of the law. (**79-1-7** [Sarvey, Robert])

Response: *The comment expressed concerns related to coastal zone management. The NRC staff acknowledges that the California Coastal Commission's 180-day review timeframe has not commenced because it has not deemed the application to be complete. PG&E submitted a request for federal consistency certification on November 7, 2023, and is currently coordinating with the California Coastal Commission regarding this action. The NRC does not have any direct involvement in this process. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

A.2.18 Spent Nuclear Fuel

Comment: The SEIS fails to recognize that the ISFSI will need to be expanded to accommodate and additional 227 tons of spent fuel and also to store the with its associate impacts to land air and water must be analyzed in the SEIS. (**79-1-6** [Sarvey, Robert])

Comment: Expansion of the ISFSI
One of the upgrade projects that the SEIS fails to recognize or analyze is the expansion of the ISFSI. PG&E has estimated that if the upgrades are approved PG&E will need to store an additional 227 metric tons of spent fuel.[11] The problem is the spent fuel storage pads are not large enough to accommodate the additional 227 tons of additional spent fuel.

[11] https://adams.nrc.gov/wba/view Ascension Number ML 23076A093 Diablo Canyon email Estimate of Spent Fuel in Tons.

As PG&E reported to the NRC in PG&E Letter DIL-18-019, "to support the plan for plant decommissioning, in addition to the spent fuel casks located on the ISFSI pad after shutdown, additional casks are expected to be used for greater than-Class-C (GTCC) waste storage. **The present ISFSI was not sized for both spent fuel and GTCC waste casks when licensed.** Remedies include an additional partial storage pad or changes made to the current storage system that will be subject to updated licensing with the NRC"[12] PG&E further states in the letter that “The Diablo Canyon ISFSI design consists of 7 storage pads containing space for 20 fuel storage casks each. The quantity of fuel to fill these casks is the authorized limit as defined in Materials License No. SNM-2511, namely 2,100 metric tons of uranium of intact spent fuel assemblies, damaged fuel assemblies and fuel debris. No changes to this limit are planned during the plant operating period. *To support the plant decommissioning period, a license amendment to incorporate storage of GTCC waste is expected."*[13]

[12] PG&E Letter DIL 18-019 https://www.nrc.gov/docs/ML1835/ML18351A368.pdf Page 5 of 13
[13] PG&E Letter DIL 18-019 https://www.nrc.gov/docs/ML1835/ML18351A368.pdf Page 5 of 13

According to Coastal Commission staff, "The ISFSI was designed to hold 140 Holtec canisters/casks and currently holds 58 of those canisters/casks, which collectively store a total of 1,856 fuel assemblies. The spent fuel pools currently store about 1,800 assemblies and PG&E estimates that by the end of the current August 2025 license period, there will be a total of 2,542 assemblies in the pools. If PG&E's current permit amendment request is approved, it would be able to transfer these assemblies from the pools to the proposed Orano storage units within the existing ISFSI. It could also continue to use the current Holtec storage system or a combination of both systems. With those final 2,542 assemblies, the ISFSI would reach its remaining capacity for storage of fuel associated with power plant operations. [14]

[14] "PG&E estimates that the new Orano units can hold a total of 2,553 fuel assemblies and that there will be 2,542 assemblies needing storage by August 2025. This would allow for storage of 11 additional assemblies; however, each refueling cycle at Diablo Canyon generates several dozen spent fuel assemblies so would exceed the amount that could be stored at the ISFSI." California Coastal Commission STAFF REPORT: ISFSI PERMIT AMENDMENT Application No.: A-3-SLO-04-035-A1 https://documents.coastal.ca.gov/reports/2023/5/F9a/F9a-5-2023-report.pdf Page 15 of 30

With extended operations the concrete pad for the ISFSI will need to be expanded to accommodate the additional 227 metric tons of spent fuel from extended operations.[15]

[15] https://adams.nrc.gov/wba/view Ascension Number ML 23076A093 Diablo Canyon email Estimate of Spent Fuel in Tons. (**79-1-12** [Sarvey, Robert])

Response: *The comments expressed concerns related to the Diablo Canyon ISFSI and onsite storage of spent nuclear fuel. PG&E stores spent nuclear fuel in the Diablo Canyon Unit 1 and Unit 2 spent fuel pools and in an onsite ISFSI. As stated in Section 3.13.1.4 of this SEIS, "The ISFSI and the spent fuel pools are sized to accommodate all spent nuclear fuel generated through the LR period."*

The Diablo Canyon ISFSI is licensed under a 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste" (TN4884), site-specific license. By letter dated March 9, 2022, PG&E requested renewal of this license (special nuclear materials [SNM] License No. SNM-2511) for an additional 40 years (PG&E 2022-TN10200). In accordance with 10 CFR Part 51, the NRC staff's environmental review of that proposed renewal of the Diablo Canyon ISFSI license is documented in an environmental assessment that is separate from this SEIS (ML24296A038). PG&E did not propose any changes in authorized operations for the Diablo Canyon ISFSI or request approval of any new construction or expansion of the existing ISFSI footprint in its ISFSI renewal application.

As stated in Section 3.13.1.4 of this SEIS, PG&E currently does not have plans for construction around the existing ISFSI site or outside the ISFSI pad for additional storage of spent fuel. If dry storage capacity needs to be increased, previously disturbed land on the site is likely to be sufficient for the expansion. The NRC staff understands that PG&E is allowed under a 10 CFR Part 72 general license as part of its 10 CFR Part 50 licenses to build additional ISFSI capacity as necessary (see 10 CFR 72.210).

To the extent that the comments address Category 1 issues related to spent nuclear fuel onsite storage, they provide no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.

Comment: 15. Section 3.16-1 (page 3-214, Line 20)
The DSEIS states "there remains enough storage in the existing independent spent fuel storage installation (ISFSI) to accommodate spent fuel generated during the license renewal (LR) period." To clarify, there remains enough storage capacity in the existing ISFSI **and spent fuel pools** to accommodate the spent fuel generated during the LR period. (**65-15** [Jones, Thomas P.])

Response: *The text in Section 3.16.1 of this SEIS has been updated to reflect that there remains enough storage capacity in the existing ISFSI and spent fuel pools to accommodate the spent fuel generated during the Diablo Canyon LR period.*

A.2.19 Socioeconomics

Comment: The NRC mission statement is as follows: "The NRC licenses and regulates the Nation's civilian use of radioactive materials to provide reasonable assurance of adequate protection of public health and safety and to promote the common defense and security and to protect the environment."

Yet section 3.10 focuses on socioeconomics -regional employment, income, housing, and tax revenues. The inclusion of socioeconomic factors confuses me, for it is not included in the NRC's mission statement, nor does it pertain to the assurance of adequate protection of public health and safety. Quite the contrary -economic and social factors should not influence the decision in a license renewal process. (**29-6** [ZamEk, Jill])

Response: *The NRC's regulations implementing NEPA in 10 CFR Part 51 require that this SEIS describe the affected environment and the impact of the proposed action of Diablo Canyon LR on that environment. This includes a discussion of socioeconomic impacts on regional employment, income, housing, and tax revenue, among others. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

Comment: Section 3.10 explains the 2016 Joint Proposal Agreement which was to permanently cease operations in 2024 and 2025. "As part of this agreement, PG&E agreed to a Community Impact Mitigation Plan with local jurisdictions to ease the impacts of the impending closure of Diablo Canyon (PG&E 2023-TN9822). The Community Impact Mitigation Plan included an Essential Services Mitigation Fund totaling $75 million paid to the county in annual installments through 2025 in the amount of $9,375,000 (PG&E 2024-TN10032). The second part is an Economic Development Fund one-time payment of $10 million paid to the county intended to fund regional economic development and job creation (PG&E 2023-TN9822). Due to the Joint Proposal Agreement and legislation in California Senate Bill 1090, the unitary tax paid by PG&E for Diablo Canyon was set on a linear path to zero by August 2025 (the planned permanent cessation of Unit 2). As of the publication of this draft SEIS, legislation regarding a new tax structure for Diablo Canyon has not been introduced."

That money has been spent. Does this mean that the ratepayers will be on the hook AGAIN for easing the economic losses when the plant finally closes? (**29-7** [ZamEk, Jill])

Comment: Let's see. Section 3.10 explains the 2016 joint proposal agreement which was to permanently cease operations in 2024 and 2025. And quote, "The community impact mitigation plan included an essential services mitigation fund totaling $75 million paid to the county in annual installments through 2025 in the amount of $9,375,000. The second part is an economic development fund one-time payment of $10 million paid to the county intended to fund regional economic development and job creation. As the publication of this draft SEIS legislation regarding a new tax structure for Diablo Canyon has not been introduced," end quote.

My question, that money has been spent. Does this mean that the rate payers will be on the hook again for easing the economic losses when the plant finally closes, if indeed it gets the extension? (**50-25-5** [ZamEk, Jill])

Response: *These comments expressed concerns regarding the possibility of future payments to local jurisdictions and potentially increasing regional electric rates to ratepayers. The NRC's statutory authority is limited to regulating radioactive materials to protect the public health and safety and the common defense and security. Therefore, as it relates to these issues, the NRC has requirements for licensees to establish financial qualifications for the construction and operation of nuclear power plants (10 CFR 50.33) and to provide reasonable assurance that funds will be available for the decommissioning of nuclear power plants (10 CFR 50.75). Issues related to rate setting and taxes, loans, or other governmental payments are not within the NRC's authority and, therefore, are not considered in the SEIS. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.*

Comment: AGRICULTURE and ECONOMIC DATA
Site-specific agricultural and economic data were used by PG&E from 2012. These data are outdated, and the NRC should demand updated analysis. (**21-5** [Anonymous, Anonymous])

Response: *The Census of Agriculture is taken every 5 years and released a couple of years later after data is compiled and analyzed. The NRC staff used the 2017 Census of Agriculture in the SEIS. The NRC staff also used the latest U.S. Census Bureau American Community Survey 5-Year Estimates available for regional economic data in the SEIS. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

Comment: the inadequacy of the sections on transportation, for failing to recognize current incidents of congestion, their likely exacerbation with industrialization of Port San Luis to serve offshore wind arrays and with a construction project on Highway 101 through Shell Beach that could cause chronic backups for a couple of years. (**54-2** [Greening, Eric])

Response: *As discussed in Section 3.9.6 of the ER, all relevant roads along the Diablo Canyon commute route are within an acceptable 'Level of Service' threshold as defined by San Luis Obispo County and the California Department of Transportation and no additional workers/commuters are expected from the proposed action during the proposed LR term. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

Comment: In the document, details on transportation impacts are limited; concluding that transportation impacts for three out of the four alternatives would be considered "small." However, as seen in Figure 1, the transportation impacts of the "Renewables Combination" alternative range from small to large. The document states that this alternative is not considered viable since "replacement energy alternatives must be viable prior to the expiration of the current 24 operating licenses" (p.2-14). Should this alternative be chosen, we request additional analysis be completed and distributed.

Figure 1: Table 2-1
Table 2-1 Summary of Environmental Impacts of the Proposed Action and 2 Alternatives to the Proposed Action (Continued)
Resource Area: Transportation
Proposed Action-License Renewal: SMALL
No Action: SMALL
Purchased Power: SMALL
Renewables Combination: SMALL to LARGE
Resource Area: Human Health
Proposed Action-License Renewal: SMALL [g]
No Action: SMALL [g]
Purchased Power: SMALL [g]
Renewables Combination: SMALL [g]
Resource Area: Environmental Justice
Proposed Action-License Renewal: [h]
No Action: [i]
Purchased Power: [i]
Renewables Combination: [i]
Resource Area: Waste Management
Proposed Action-License Renewal: SMALL
No Action: SMALL
Purchased Power: SMALL
Renewables Combination: SMALL
(**64-1** [Sanders, Sara])

Response: *Transportation impacts for construction and operations of renewable power facilities can vary depending on a number of factors, including the types of facilities, the timeframe for construction, and the specific locations selected for siting. As part of its environmental review of the proposed action, the NRC staff evaluated a renewables combination alternative for the purpose of comparative analysis to the proposed action; however, the NRC's LR decision-making authority for the proposed action is limited to deciding whether to renew the Diablo Canyon operating licenses. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

A.2.20 Uranium Fuel Cycle

Comment: One is the sourcing of the uranium, the sourcing of the fuel. If you're aware of the current controversy over uranium mining in the Grand Canyon area or the health issues that afflicted the Navajo nation, you know that there are significant environmental impacts to the sourcing of 20 years' worth of fuel.

Even if those are not impacts directly in the location of Diablo, they are impacts and they need to be considered, they need to be mitigated, they need to be in the background of the decision-making process. (**49-1-2** [Greening, Eric])

Comment: One, I think relative to the impacts of uranium mining and the fact that they need to be studied, the speaker before Dawn Ortiz-Legg, the speaker from San Diego, I think, was very eloquent in defending that need.

And it simply is a thorough environmental impact statement looks at all of the impacts that are inherent in a further 20 years of operation. And that includes the fuel is going to come from somewhere and its extraction at that somewhere has impacts, and those impacts cannot be ignored in a thorough EIS. (**49-23-1** [Greening, Eric])

Comment: raising two principal issues: the need to consider the impacts of the sourcing of 20 years' worth of fuel—the Uranium mining and its impact on miners and communities—as part of the impacts of this project. (**54-1** [Greening, Eric])

Comment: Table S-3 details the maximum environmental impacts from the fuel cycle that should be considered in the environmental report.[34] According to Table S-3[35] "The Maximum Annual Emissions" of criteria pollutants from the nuclear fuel cycle for one year for a 1,000 MW reactor would be 4,400 metric tons a year of SO_X, 1,190 metric tons a year of NO_x and 1,154 metric tons of particulate matter.[36] These estimates can change depending on quality of the uranium ore, the source of electricity, and the uranium processing methods. Regardless of other variables uranium mining produces an estimated 240,000 metric tons of tailings and 91,000 metric tons of solids per year to provide fuel for one year for a 1,000 MW reactor. The mining of uranium ore has significant environmental and health impacts to Indian tribes located near the mines.

[34] Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report NRC February 2023
[35] Appendix 1 to these comments
[36] Exhibit A NRC's June 2023 Generic Environmental Impact Statement for License Renewal of Nuclear Plants https://www.nrc.gov/docs/ML1310/ML13106A241.pdf Page 516 of 677
(**79-1-17** [Sarvey, Robert])

Response: *The comments expressed concerns about considering the environmental impacts of uranium mining. As stated in Section 3.15.1.1 of this SEIS, the uranium fuel cycle including uranium mining is evaluated in Section 4.14.1 of the LR GEIS. The LR GEIS describes in detail the generic impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes. As discussed in the LR GEIS, the generic issues related to the uranium fuel cycle would not be affected by continued operations associated with LR. As part of its review of the Diablo Canyon LR application, the NRC staff considered whether there was any new and significant information that would change that LR GEIS conclusion with respect to Diablo Canyon LR. The NRC staff found no such information and, therefore, adopted the LR GEIS conclusion for this issue. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.*

Comment: The nuclear power plants and nuclear power is NOT CARBON-FREE. Nuclear power also generates RADIOACTIVE CARBON-14, trillions of curies of it.
(**81-13-8** [McClintock, Francene])

Response: *The comment expressed concerns related to carbon and carbon-14 (C-14) generation. Section 3.11.1 of this SEIS describes the assessment of the radiological exposures and risks to human health. It includes information about radioactive waste as well as the radiological environmental monitoring program (REMP).*

The NRC requested that all nuclear power plant licensees report C-14 emissions beginning with the 2010 monitoring reports. These emissions have been included in dose calculations provided in the annual reports submitted to the NRC. More details about the radioactive effluent releases and resultant calculated doses are provided in Section 3.13.1.2 of this SEIS. In addition, as referenced by the NRC staff throughout Section 3.13.1.2 of the SEIS, the results of PG&E's effluent releases and radiological environmental monitoring program are summarized each year in annual monitoring reports. The reports are available at https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/diab1-2.html. Air emissions, including emissions of radionuclides, were evaluated by the NRC staff in the LR GEIS and were determined to be Category 1 issues generic to all nuclear power plants. In addition, Section 3.15.3 of this SEIS discusses greenhouse gases and climate change. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.

A.2.21 Waste Management-Radioactive Waste

Comment: RADIOACTIVE WASTE
Extended operation of Diablo Canyon means the generation and onsite storage of even more high-level radioactive waste in an active earthquake area. (**21-8** [Anonymous, Anonymous])

Comment: The nuclear industry, in spite of immense public funding, has never achieved a safe, viable plan for the storage of all the radioactive waste its plants produce. This alone is reason, as California voters decided years ago, to cease building new plants and to close existing nuclear power plants. (**24-6** [Woodcock, Charlene M.])

Comment: So, I tell you, I've only heard spent fuel mentioned twice. This young lady over here mentioned it once. Somebody else mentioned it. I'm actually shocked, and everybody should be shocked, that licensing agreements like this can go through without even mentioning what to do with the spent fuel.

We were kicking the can down the road. It's been being kicked down the road for over 60 years now and yet nobody's saying anything about the spent fuel or what to do with it. The babies that are in this room and the young engineers that are here and stuff like that. You've got your kids growing up. We're just going to pass it to them. It was passed to us. (**50-26-2** [Salazar, Rudy])

Comment: With this licensing, I would like to say, why don't we have a component in here about moving this spent fuel before we relicense this plant? Let's move this to higher ground. Right now, if they open up a place, let's say they open up Yucca Mountain, or an interim storage facility somewhere across the United States to put this, it would take 70 to 100 years to move all this spent fuel out of this location because it's all in a queue. (**50-26-4** [Salazar, Rudy])

Comment: It would also have to address the impact of storing highly toxic radioactive waste on-site for generations. (**59-3** [Hisasue, Carole])

Comment: As a concerned citizen and neighbor of Diablo Canyon Nuclear Utility Plant, I submit these comments and questions to this regulatory commission. Over the last four decades the high (and low) level radioactive waste has been accumulating in an ever-increasing rate on the plant grounds with no place to safely store it for the thousands of years it remains one of the most deadly substances on our Earth.

To date there is no repository that is operational. If people are given accurate and comprehensive information, it is highly unlikely that anyone would want a nuclear waste dump in their vicinity. No matter where it is diplomatically determined, there is no guarantee that it will be safely stored and guarded for millennia. (**61-1** [Brown, Marilyn E.])

Comment: You forgot to mention the off-site land use in Utah and Texas. You forgot to mention the proposed high-level dumpsite. Because of off-site land use the environmental benefits of shutting down Diablo Canyon are LARGE. All the dumps in history are leaking. Maine Yankee sent a total of 2,368.2393 curies to Barnwell, South Carolina and brokers over a 5-year sample period. Larger curie counts included CS-134, Ni-63, Co-60, FE-55, Co-58 and CS-134. (**81-2-7** [McClintock, Francene])

Comment: LARGE impact as closing down the reactor will start the process of radioactive decay. STOP making more curies. (**81-2-11** [McClintock, Francene])

Comment: It has a LARGE impact on the land. You forgot to mention all the nuclear waste you send to nuclear dumps in Utah and Texas. What impact does that have on the soil? All nuclear dumps leak. This info should be included in this assessment. (**81-3-7** [McClintock, Francene])

Comment: LARGE. Be responsible for the waste you produce and send to other states. (**81-3-8** [McClintock, Francene])

Comment: A low percentage by volume but a high percentage by curies. Curies instead of volume should be used as the 'curie' is the measurement of radioactivity and provides us with a more accurate description of the nuclear waste. It is curies that we must attempt to isolate from the biosphere. If the volume were an accurate description of this waste, we would be sending the waste to a municipal landfill instead of constructing a nuclear dump. Using volume depictions is a cover-up tactic used by the nuclear industry to make people think there is no harm. (**81-12-15** [McClintock, Francene])

Comment: And that is the failure of the NRC. You just keep allowing more and more of this nuclear waste to be generated. The way to stop this madness of curies accumulation and the poisoning of this planet is to start closing down these plants. You instead have allowed them to keep this high-level waste on-site near the ocean and have sanctioned their concrete platforms and radioactive gas/heat releases. All adding to the heating of our planet and the melting of our ice-caps. All adding to the cancers, diseases and suffering by all living creatures on this one-of a kind blue ball in our planetary system. You, NRC, have made this planet uninhabitable for life forms into the future so much so that we have people on this planet planning to escape to another planet to survive. How sick are you people that you make such decisions that influence the very existence of life on this planet? (**81-13-3** [McClintock, Francene])

Response: *The comments discussed low level radioactive waste (LLW) that may be shipped to licensed disposal facilities. The NRC requires that all licensees implement measures to minimize, to the extent practicable, the generation of radioactive waste (10 CFR 20.1406). Most of the LLW generated at reactor sites continues to be shipped offsite for disposal, either immediately after generation or after a brief storage period onsite. Storage and disposal of LLW are conducted in accordance with NRC regulations and any applicable State or local requirements. The NRC believes that the comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts on the environment from LLW storage and disposal will remain SMALL during the term of a renewed* *license. The impact of LLW storage and disposal during the renewal term is considered SMALL for all sites and is designated as a Category 1 issue.*

The comments expressed concerns related to the generation and long-term storage of high-level radioactive waste and spent nuclear fuel. The onsite storage of spent nuclear fuel is a Category 1 issue. The NRC's analysis of onsite storage is presented Section 4.11.1.2 of the LR GEIS. During the LR term, which corresponds to part of the licensed life for operation of a reactor described in NUREG-2157, "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel," the expected increase in the volume of spent nuclear fuel from an additional 20 years of operation can be safely accommodated onsite during the LR term through dry or pool storage at all plants. For the period after the licensed life for reactor operations, the impacts of onsite and away-from-reactor (offsite) storage of spent nuclear fuel during the continued storage period are discussed in NUREG-2157 and are as stated in 10 CFR 51.23(b). NUREG-2157 addresses the impacts of three storage timeframes: short-term, long-term, and indefinite storage.

The offsite radiological impacts of spent nuclear fuel and high-level waste disposal is also a Category 1 issue. The NRC's analysis is presented Section 4.11.1.3 of the LR GEIS. Per 10 CFR Part 51, the Commission concludes that the impacts presented in NUREG-2157 would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent nuclear fuel and high-level waste disposal, this issue is considered a Category 1 issue. The ultimate disposal of spent fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of LR.

These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.

A.2.22 Process – NEPA

Comment Summary: This comment expresses concern regarding the SEIS and whether it meets the requirements of NEPA as amended by the Fiscal Responsibility Act of 2023.

Comment: (80-4)

Response: *As evaluated in SECY-24-0046, "Implementation of the Fiscal Responsibility Act of 2023 National Environmental Policy Act Amendments" (NRC 2024-TN11945), the NRC is in compliance with the requirements of the NEPA amendments. As part of its evaluation effort, the NRC staff identified opportunities to enhance clarity, reliability, efficiency, and transparency in the NRC's regulations and procedures. These options to revise the NRC's implementing regulations in 10 CFR Part 51 and update NRC guidance and policies are currently under review by the Commission. The NRC staff has considered specific recommendations provided on the draft SEIS in other areas of Appendix A. This comment provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of this comment.*

Comment Summary: These comments express concern that the environmental impact assessment of alternatives in the SEIS is inadequate.

Comments: (17-1) (63-14)

Response: *The NRC does not promote any particular form of energy generation, including nuclear power. The purpose and need for the proposed action is to determine the acceptability of providing an option to continue plant operations beyond the current license term to meet future system generating needs, as such needs may be determined by State, utility, system, and, where authorized, Federal (other than NRC) decision-makers. Ultimately, those decision-makers will decide whether to carry out the proposed action and continue operating the plant for up to an additional 20 years, if the NRC renews the license, or shut down the plant and choose an alternative power generation source to meet future system generating needs. However, the NRC staff does examine energy alternatives as part of its environmental review responsibilities under NEPA as implemented in accordance with 10 CFR Part 51 and compares the impacts of those alternatives with the environmental impacts of the proposed action of LR. Chapter 2 of this SEIS describes the proposed action and alternatives.*

The SEIS appropriately tiers off of the related generic environmental impact statement, NUREG-1437, Revision 2, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," and does not improperly segment the NEPA analysis. Chapter 3 of this SEIS describes the affected environment for each resource area and then describes and assesses the potential direct, indirect, and cumulative environmental impacts of the proposed action and alternatives to the proposed action on 80 environmental issues related to plant operation. The SEIS also describes mitigation measures, where applicable, for identified environmental impacts. The SEIS documents the NRC staff's analyses of the impacts of the proposed action and alternatives to the proposed action, based on an extensive review of all pertinent information.

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

Comment Summary: These comments are related to the development of a plant-specific SEIS for the Diablo Canyon license renewal and its relationship to the LR GEIS. The comments express concerns about the SEIS being characterized as generic and that it is not covering the full scope of the impacts. There is also criticism that the SEIS does not adequately describe the impacts as required by the 2024 LR GEIS.

Comments: (49-1-1) (79-1-2)

Response: *As a supplement to the LR GEIS, the SEIS relies on tiering from the LR GEIS and does not need to repeat all analyses and conclusions presented in the LR GEIS. As explained in the SEIS, the LR GEIS reached generic conclusions for 59 environmental issues associated with nuclear power plant LR. These are identified as Category 1 issues in the LR GEIS. In conducting its plant-specific review, which is summarized in the SEIS, the NRC staff considers all the information collected, including public comments provided during the scoping phase, to determine whether there is any new and significant information related to any LR GEIS Category 1 issues. If new and significant information is identified, then the NRC staff will perform a site-specific evaluation of the impacts related to that information. Otherwise, the NRC staff appropriately relies on the conclusions of the LR GEIS for the Category 1 issues. The NRC staff also performs plant-specific analyses for Category 2 and uncategorized issues that are applicable to each plant.*

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

A.2.23 Process-Licensing Action

Comment Summary: The comments critique the draft SEIS over perceived discrepancies between the SEIS and California's legislative directives. One commenter highlights that the California legislature and Governor have authorized a 5-year extension for the plant and opposes further extensions until issues with the current one are addressed and permitted. One comment states the purpose of providing baseload power generation for an additional 20 years contradicts California Senate Bill (SB) 846, which is a temporary solution to a grid reliability issue and aims for 100% renewable energy by 2030. Other commenters feel that the SEIS's purpose statement is too broad and results in biased consideration of alternatives and does not meaningfully address the no-action alternative. These commenters urge the NRC staff to revise the purpose and need statement in the SEIS to align with California's legislation and to conduct a thorough assessment to determine if sufficient electricity capacity exists to compensate if Diablo Canyon closes.

Comments: (50-43-8) (63-3) (63-8) (63-12)

Response: *These comments noted the difference in time periods between the 20-year LR period considered by the NRC staff's review and the timeframe currently allowed for continued operations under SB 846. Per 10 CFR 54.31(b), applicants can submit an LR application for a term not to exceed 20 years beyond the expiration of their current operating license or combined license. The LR process includes a clear set of requirements as specified in 10 CFR Part 54 and 10 CFR Part 51, which are designed to assure safe facility operation and protection of the environment for up to an additional 20 years. Studies and experience to date have shown that commercial nuclear power plants can be safely operated for more than 40 years. As a result, the NRC has provided an option in 10 CFR Part 54, which allows owners of nuclear power plants to seek LR for up to an additional 20 years with no limitations on the number of times the license may be renewed.*

The NRC staff is aware of the provisions of SB 846 and its intent to preserve the option of extended operations until October 31, 2029, and October 31, 2030, for Diablo Canyon Units 1 and 2, respectively. The 20-year LR under consideration is not inconsistent with SB 846, as it would continue to preserve the option of Diablo Canyon operations for energy-planning decision-makers through that period. The purpose and need for the proposed action is to provide an option that allows for baseload power generation capability beyond the term of the current operating licenses to meet future system generating needs. The NRC has no role in the energy-planning decisions of power plant owners, State regulators, system operators, and, in some cases, other Federal agencies as to whether a particular nuclear power plant should continue to operate. Diablo Canyon operations will continue to be subject to all applicable Federal, State, and local requirements.

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

Comment Summary: These comments are positive, general compliments on the time and effort put into preparing the SEIS and the thoroughness of the document.

Comments: (49-9-1) (49-11-1) (49-11-3) (49-15-1) (50-45-1)

Response: *These comments provide overall positive feedback on the draft SEIS. These comments are general in nature and provide no new and significant information; therefore, no changes were made to the SEIS as a result of these comments.*

Comment Summary: These comments express general concern about the adequacy of the environmental considerations in the SEIS and the failure of the SEIS to fulfill NEPA requirements.

Comments: (26-1) (49-13-1) (63-1)

Response: *These comments expressed concerns regarding the adequacy of the draft SEIS in documenting the environmental impacts of the proposed action or alternatives to the proposed action. These comments are general in nature and provide no new and significant information; therefore, no changes were made to the SEIS as a result of these comments.*

Comment Summary: The U.S. Environmental Protection Agency noted that it did not identify significant public health, welfare, or environmental quality concerns to be addressed in the final SEIS for the Diablo Canyon license renewal.

Comments: (83-1)

Response: *The U.S. Environmental Protection Agency noted that it did not identify significant public health, welfare, or environmental quality concerns to be addressed in the final SEIS for the Diablo Canyon LR. The NRC staff considered the recommendations provided on the draft SEIS within other resource areas in Appendix A. No changes were made to the SEIS as a result of this comment.*

A.2.24 Outside Scope - Emergency Preparedness

Comment Summary: These comments express concerns about the adequacy of the transportation network in the event of an evacuation from the Diablo Canyon area in case of a nuclear accident. The draft SEIS is criticized for providing evacuation time estimates that are deemed unrealistic and for relying on outdated traffic studies. Commenters urge the NRC to demand updated, real-time traffic studies to accurately assess evacuation scenarios. Specific concerns include congestion on exit routes, road construction, area population growth, traffic conditions, and future congestion from other road projects. Commenters urge evaluation of the area's ability to manage evacuations in the event of an earthquake or tsunami. There is also a comment on the failure to consider shelter-in-place scenarios if there is radiation contamination and a question about the number of workers that would be present during a nuclear accident. One commenter expressed concerns that a member of the Diablo Canyon Independent Safety Committee proposed to prewrite a press release that everything is safe in case of a nuclear accident at Diablo Canyon.

Comments: (21-4) (26-3) (31-4) (49-1-3) (49-23-3) (54-3) (81-11-8) (81-13-11)

Response: *These comments expressed concern regarding emergency preparedness and/or emergency response actions, such as transportation complications during an emergency evacuation, coordination of emergency procedures and security, or the adequacy of emergency plans. Emergency preparedness and security are applicable to the current operating licenses for* *each nuclear power plant and are subject to ongoing NRC oversight of the existing or future renewed operating licenses. However, these issues are outside the scope of the NRC's LR environmental review process.*

The NRC staff has an ongoing program for determining the adequacy of offsite emergency plans and is supported in that role by the Federal Emergency Management Agency. Emergency preparedness and physical security plans are required at all nuclear power plants and require specified levels of protection from each licensee regardless of plant design, construction, or license date. Requirements related to emergency planning are set forth in the NRC's regulations in 10 CFR 50.47 and in Appendix E to 10 CFR Part 50. Requirements related to physical security are set forth in the NRC's regulations in 10 CFR Part 73, "Physical protection of plants and materials." These requirements apply to all operating licenses and will continue to apply to facilities with renewed licenses. The NRC has regulations in place to ensure that emergency preparedness and security plans are updated throughout the life of all nuclear power plants. For example, under Appendix E to 10 CFR Part 50, nuclear power plant licensees are required to update their evacuation time estimates after every U.S. Census, or when changes in population would increase the estimate by either 25 percent or 30 minutes, whichever is less. Additionally, the NRC assesses the capabilities of the nuclear power plant licensee to protect the public by requiring the performance of a full-scale exercise, including the participation of various Federal, State, and local government agencies, at least once every 2 years. These exercises are performed to maintain the skills of the emergency responders and to identify and correct weaknesses.

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

A.2.25 Outside Scope – Energy Costs

Comment Summary: These comments express concerns about the financial costs from initial construction and to continue operating for another 5 to 20 years and their impact on California ratepayers. One commenter also stated that renewing the licenses will prevent the development of other power supply projects. Other commenters are concerned about energy costs and rates and how operating costs are passed on to the rate payers.

Comments: (17-4) (50-43-3) (63-15) (81-6-11) (81-13-12)

Response: *The economic costs and benefits of renewing an operating license are outside the scope of the NRC staff's environmental review. The NRC regulation at 10 CFR § 51.95(c)(2) states, in part, "The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation." The purpose and need for the proposed action is to provide an option to continue nuclear power plant operations beyond the current licensing term to meet future system generating needs, as such needs may be determined by the licensee, State, utility, system, and, where authorized, Federal (other than NRC) decision-makers. The NRC does not make recommendations regarding the impacts on tax and ratepayers. The regulatory authority over licensee economics falls within the jurisdiction of the State and, to some extent, the Federal Energy Regulatory Commission. These comments* *provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.*

A.2.26 Outside Scope – Miscellaneous

Comment Summary: These comments raise concerns and criticisms related to nuclear power, specifically focusing on the perceptions of nuclear waste and the operations of PG&E. One commenter argued that spent nuclear fuel should not be considered waste as it could be a valuable resource. There is praise for the thoroughness of the SEIS related to decommissioning. Other comments include concerns about the inadequacy of property insurance coverage for areas near nuclear plants due to limitation set by the Price-Anderson Act. Critiques of PG&E are extensive, citing what the commenters stated are a criminal history, negligence, violations in nuclear material handling, and efforts to mislead federal regulators. Specific incidents and regulatory violations that have triggered fines and penalties are also mentioned in the comments. Concerns about nuclear waste disposal are also highlighted. There is a broader critique of the nuclear industry's environmental impact, including allegations of radioactive contamination and its effects, calls for using alternative fuels to improve air quality, and the need for better safety practices.

Comments: (48-2) (49-11-4) (76-4) (79-1-1) (79-2-6) (79-2-9) (79-2-11) (81-2-3) (81-2-3) (81-2-5) (81-2-6) (81-2-13) (81-2-15) (81-3-3) (81-5-6) (81-6-10) (81-8-4) (81-9-13) (81-12-2) (81-12-16) (81-13-2)

Response: *These comments are outside the scope of the NRC staff's environmental review and do not provide specific information related to the environmental effects of the proposed action; therefore, they will not be evaluated further. No changes were made to the SEIS as a result of these comments.*

Comment Summary: One commenter highlighted a series of regulatory violations and safety concerns associated with Diablo Canyon and PG&E. The comments note several instances involving notices of violation issued by the NRC. The commenter also alleged a history of negligence from PG&E and various legal issues concerning safety and compliance at Diablo Canyon. The overarching concern is about inconsistent NRC oversight and PG&E's potential endangerment of the public.

Comments: (79-2-7) (79-2-8) (79-2-10)

Response: *These comments raise concerns about past violations and the NRC's oversight of Diablo Canyon operations. Regarding nuclear safety, the NRC provides continuous oversight for the safe operation of nuclear power plants through its ongoing Reactor Oversight Process to verify that they are being operated and maintained in accordance with NRC regulations. This oversight includes having full-time NRC inspectors located at the plant and periodic safety inspections conducted by NRC inspectors based in an NRC Regional Office. The inspections look at a licensee's compliance with the NRC's regulations, which include the following: plant safety (routine and accident scenarios), radiation protection of plant workers and members of the public, radioactive effluent releases, radiological environmental monitoring, emergency preparedness, radioactive waste storage and transportation, quality assurance, and training. Should the NRC discover an unsafe condition or violation, it will take appropriate action to protect the public health and safety.*

These comments do not provide any specific new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

A.2.27 Outside Scope – Need for Power

Comment Summary: The comments present varying perspectives on the potential replacement of Diablo Canyon with solar energy and California's overall energy needs. One commenter highlighted financial challenges and possible increases in carbon emissions without nuclear power. Another commenter argued that Diablo Canyon is unnecessary. This view is supported by other comments that claim that the state now has sufficient energy resources to meet demand without nuclear power. Concerns are also raised by commenters about the impact on renewable energy infrastructure and the financial implications of Diablo Canyon's continued operations, suggesting that alternatives could be more cost-effective.

Comments: (17-3) (21-9) (49-16-4) (50-43-7) (63-9) (63-13) (63-16)

Response: *The purpose and need for the proposed action is to provide energy-planning decision-makers with the option to continue nuclear power plant operations beyond the current licensing term to meet future system generating needs. As stated in the purpose and need statement of this SEIS, unless there are findings in the NRC's safety review or findings in the NRC's environmental analysis that would lead the NRC to reject an LR application, the NRC does not have a role in making energy-planning decisions about whether a particular nuclear power plant should continue to operate. The regulatory authority over licensee economics (including the need for power and grid reliability) falls within the jurisdiction of the State and, to some extent, the Federal Energy Regulatory Commission. These comments provided no new and significant information, and the NRC staff made no changes to the SEIS as a result of these comments.*

A.2.28 Outside Scope – Other Non-LR Actions

Comment Summary: These comments describe a potential option for the long-term storage of nuclear waste on the commenter's property in Randsburg, California.

Comments: (50-26-1) (50-26-3) (50-26-5)

Response: *The ultimate disposal of spent fuel in a potential future geologic repository would require a separate and independent licensing action that is outside the regulatory scope of LR. No changes were made to the SEIS as a result of these comments.*

Comment Summary: These comments were supportive of continued operations at Diablo Canyon and suggested that additional units could be constructed to either add additional generating capacity or to replace the two units that are currently operating.

Comments: (49-4-2) (50-35-1)

Response: *The construction and operation of additional units at Diablo Canyon would require a separate and independent licensing action that is outside the regulatory scope of LR. These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.*

Comment Summary: These comments are related to the reprocessing of spent nuclear fuel. The commenter discussed how fuel waste could be reprocessed to create more fuel for reactors, noting that funds from the Nuclear Waste Fund cannot be used for this purpose.

Comments: (17-2) (49-13-3)

Response: *These comments are related to the reprocessing of spent nuclear fuel. In SRM-SECY-13-0093, "Reprocessing regulatory framework-status and next steps," the Commission directed the NRC staff to pursue a new reprocessing-specific rule, contained in a new part of the NRC's regulations, for a regulatory framework for licensing a reprocessing facility. However, on March 5, 2021, in SECY-21-0026, "Discontinuation of rulemaking-spent fuel reprocessing," the NRC staff requested approval from the Commission to discontinue the spent fuel reprocessing rulemaking based on the limited interest expressed or expected from industry to build any type of facility involving reprocessing technologies in the near term. This issue is not within the scope of the LR environmental review and will not be evaluated further in the development of this SEIS.*

A.2.29 Outside Scope – Safety

Comment Summary: These comments express concerns related to the safety of continued operations at Diablo Canyon, including reactor vessel embrittlement, fire events, and emergency diesel generator reliability. Commenters highlight that the Unit 1 reactor vessel is vulnerable to embrittlement. There are also concerns about the plant's fire protection systems, citing past fire incidents. Additionally, issues with the reliability of emergency diesel generators are noted, with commenters noting operational failures and vulnerabilities that could be exploited in emergency situations. Alongside these technical concerns, comments question the readiness of the plant's critical safety systems and advocate for comprehensive safety reviews and potential cessation of operations. Concerns extend to potential seismic impacts, corrosion, and the adequacy of communication about safety to the public.

Comments: (21-3) (29-1) (49-4-3) (49-13-4) (50-23-1) (50-25-1) (50-30-1) (50-30-3) (50-43-2) (50-43-4) (50-43-6) (76-3) (79-1-21) (79-2-3) (79-2-4) (81-1-12) (81-1-13) (81-4-8) (81-4-10) (81-10-2) (81-10-4) (81-11-9) (81-12-1)

Response: *Diablo Canyon safety matters are outside the scope of the environmental review. The safety review associated with the LR is conducted in accordance with 10 CFR Part 54, and the results of that review are documented in a safety evaluation issued separately from this SEIS. That safety review is limited by regulation to safety issues related to the aging management of structures, systems, and components and does not encompass ongoing safety issues. The safety evaluation is publicly available on the NRC's Diablo Canyon LR project website at https://www.nrc.gov/reactors/operating/licensing/renewal/applications/diablo-canyon.html.*

Comments concerning safety issues related to aging management were provided to the safety reviewers for consideration in the safety evaluation, as appropriate.

These comments provided no new and significant information related to the environmental effects of the proposed action; therefore, no changes have been made to the SEIS as a result of these comments.

Comment Summary: These comments express concerns related to seismic and other natural hazards, pointing to new seismic and geographic information that has come to light since the plant was originally licensed. Commenters stated that PG&E's updated seismic assessment is inadequate and noted that the NRC staff should examine and evaluate the findings of Dr. Peter Bird, which indicate increased chances that an earthquake will cause catastrophic damage. It is noted that a 10 CFR 2.206 petition was filed by several organizations requesting that the NRC exercise its supervisory authority to order the immediate closure of Diablo Canyon. Commenters pointed to new seismic evidence that allegedly shows that earthquake faults that run under the plant are vertical thrust faults and that this could result in more ground motion than originally considered. Concerns raised by the Diablo Canyon Independent Peer Review Panel are also cited as evidence that PG&E's updated seismic assessment is deficient. Other commenters noted tsunami risks and draw comparisons to the Fukushima Daiichi plant in Japan.

Comments: (17-6) (21-2) (24-2) (25-1) (25-3) (26-2) (26-4) (29-3) (30-2) (31-1) (31-3) (32-2) (43-5) (49-13-2) (49-16-2) (49-23-2) (51-5) (54-4) (54-5) (55-2) (59-2) (61-2) (63-2) (63-6) (63-7) (63-18) (63-19) (70-1) (76-2) (77-1) (79-1-9) (79-1-10) (79-1-19) (79-2-2) (81-2-12) (81-3-6) (81-3-13)

Response: *These comments expressed concerns related to seismic and other natural hazards. The NRC is aware of the significant ongoing research to improve understanding of the seismic record, fault geometry, and seismicity rates in San Luis Obispo County, California, and throughout the United States. Furthermore, the NRC requires all licensees to take into account changes in seismic hazards to maintain safe operating conditions at all nuclear power plants at all times. In accordance with its regulations, the NRC's ongoing safety oversight process, which includes seismic safety, is separate from the LR process. This process ensures that seismic hazards do not pose an undue risk during the current license term and any LR term.*

The NRC staff is aware of the petition filed on March 4, 2024, by the San Luis Obispo Mothers for Peace, Friends of the Earth, and Environmental Working Group requesting that the NRC exercise its supervisory authority to order the immediate closure of Diablo Canyon due to "the unacceptable risk of a seismically induced severe accident." This petition remains under review by the NRC's assigned Petition Review Board.

These comments do not provide any new and significant information related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of these comments.

A.2.30 Outside Scope – Security

Comment Summary: The comment notes that PG&E might request approval to reduce the security zone around its facility and recommends that the NRC analyze the potential impacts of this reduction on coastal resources and public access.

Comments: (51-9)

Response: *The 2,000-yard security zone surrounding Diablo Canyon, outlined in 33 CFR 165.1155, was established by the U.S. Department of Homeland Security and the U.S. Coast Guard in response to the terrorist attacks of September 11, 2001. This requirement is specific to Diablo Canyon, and it does not fall within the scope of the NRC's LR environmental review. Any requested changes to the security zone would require review and approval by the appropriate agencies. This comment does not provide any new and significant information* *related to the environmental effects of the proposed action; therefore, no changes were made to the SEIS as a result of this comment.*

A.2.31 Opposition to Licensing Action

Comment Summary: Commenters expressed opposition to nuclear power or the Diablo Canyon license renewal.

Comments: (1-1) (2-1) (15-1) (18-1) (19-1) (21-1) (24-1) (24-5) (24-7) (27-1) (27-2) (29-8) (31-1) (31-2) (31-5) (32-1) (32-3) (49-7-1) (49-16-1) (49-16-5) (49-21-1) (50-21-1) (50-25-6) (50-31-2) (50-43-1) (57-1) (58-1) (60-1) (63-5) (81-1-1) (81-1-2) (81-1-3) (81-1-14) (81-1-15) (81-1-16) (81-2-1) (81-2-10) (81-3-10) (81-5-4) (81-5-8) (81-6-6) (81-6-8) (81-8-5) (81-8-6) (81-8-10) (81-10-5) (81-12-6) (81-13-4) (81-13-5) (81-13-10)

Response: *The comments oppose Diablo Canyon LR and are general in nature. The comments provide no new and significant information; therefore, no changes were made to the SEIS in response to these comments.*

A.2.32 Support of Licensing Action

Comment Summary: Commenters expressed support for nuclear power or the Diablo Canyon license renewal.

Comments: (3-1) (4-1) (5-1) (7-1) (8-1) (9-1) (10-1) (11-1) (12-1) (13-1) (14-1) (16-1) (22-1) (23-1) (28-1) (30-1) (33-1) (34-1) (35-1) (36-1) (37-1) (38-1) (39-1) (40-1) (41-1) (42-1) (43-1) (44-1) (45-1) (46-1) (47-1) (48-1) (49-2-1) (49-3-1) (49-4-1) (49-4-4) (49-4-6) (49-5-1) (49-8-1) (49-9-2) (49-10-1) (49-11-5) (49-12-1) (49-14-1) (49-18-1) (49-19-1) (49-19-4) (49-20-1) (49-22-1) (49-24-1) (50-1-1) (50-2-1) (50-3-1) (50-4-1) (50-5-1) (50-6-1) (50-7-1) (50-8-1) (50-9-1) (50-10-1) (50-11-1) (50-12-1) (50-14-1) (50-15-1) (50-16-1) (50-17-1) (50-17-2) (50-18-1) (50-19-1) (50-20-1) (50-22-1) (50-23-2) (50-23-3) (50-24-1) (50-27-1) (50-28-1) (50-29-1) (50-32-1) (50-33-1) (50-34-1) (50-36-1) (50-37-2) (50-38-1) (50-39-1) (50-40-1) (50-41-1) (50-42-1) (50-44-1) (50-45-2) (50-46-1) (50-47-1) (50-48-1) (50-49-1) (50-50-1) (50-51-1) (50-52-1) (50-53-1) (50-54-1) (50-55-1) (50-56-1) (52-1) (53-1) (56-1) (56-4) (62-1) (67-1) (67-5) (69-1) (72-1) (74-1) (74-4) (75-1) (78-1) (80-1) (80-1) (80-10) (84-2)

Response: *The comments support Diablo Canyon LR and are general in nature. The comments provide no new and significant information; therefore, no changes were made to the SEIS in response to these comments*.

A.3 References

10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." TN4878.

10 CFR Part 72. *Code of Federal Regulations*, Title 10, *Energy*, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste." TN4884.

50 CFR Part 600. *Code of Federal Regulations*. Title 50, *Wildlife and Fisheries*, Part 600, "Magnuson-Stevens Act Provisions." TN1342.

80 FR 22304. April 21, 2015. “Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*) and Proposed Revision of Species-Wide Listing.” Proposed Rule; 12-month findings, *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10265.

86 FR 21082. April 21, 2021. “Endangered and Threatened Wildlife and Plants: Designating Critical Habitat for the Central America, Mexico, and Western North Pacific Distinct Population Segments of Humpback Whales.” Final Rule, *Federal Register*, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce. TN10264.

89 FR 4631. January 24, 2024. “Notice of Intent to Conduct Scoping Process and Prepare Environmental Impact Statement; Pacific Gas and Electric Company; Diablo Canyon Nuclear Power Plant, Units 1 and 2.” *Federal Register*, U.S. Nuclear Regulatory Commission. TN10001.

89 FR 87366. November 1, 2024. “Environmental Impact Statements; Notice of Availability.” *Federal Register*, Environmental Protection Agency. TN11731.

89 FR 87433. November 1, 2024. “Pacific Gas and Electric Company; Diablo Canyon Nuclear Power Plant, Units 1 and 2; Draft Supplemental Environmental Impact Statement.” *Federal Register*, U.S. Nuclear Regulatory Commission. TN11730.

CEC (California Energy Commission). 2023. *Draft Senate Bill 846 Diablo Canyon Power Plant Extension Cost Comparison*. CEC-200-2023-013-SD, Sacramento, California. TN10081.

Enright, E., J. Kidwell, R. Hanes, D. Douglas, and D. McDougal. 2021. *Diablo Canyon Decommissioning Cultural Resource Inventory and Study Plan.* Applied EarthWorks, Inc. and ERM, San Luis Obispo, California. TN10293.

Federal Water Pollution Control Act of 1972 (commonly referred to as the Clean Water Act). 33 U.S.C. § 1251 *et seq.* TN662.

FWS (U.S. Fish and Wildlife Service). 2024. Letter from J. Brandt, Asst. Field Supervisor, U.S. Fish and Wildlife Service, to B. Arlene, Conservation Biologist & ESA Consultation Coordinator, Nuclear Regulatory Commission, dated December 20, 2024, regarding “Informal Consultation for the Diablo Canyon Units 1 and 2 Proposed License Renewal, San Luis Obispo County, California.” Ventura, California. ADAMS Accession No. ML25006A097. TN11893.

Humboldt (California State Polytechnic University, Humboldt). 2024. “Saving Sunflower Sea Stars.” Arcata, California. Accessed October 7, 2024, at https://now.humboldt.edu/news/saving-sunflower-sea-stars#:~:text=Once%20common%20in%20the%20Pacific,Coast%20were%20devastated%20by%20disease. TN10614.

Johnson, J.R. 2020. *Descendants of Native Rancherias in the Diablo Lands Vicinity, A Northern Chumash Ethnohistorical Study*. Santa Barbara Museum of Natural History, Santa Barbara, California. TN10045.

Mayhew, D.A., L.D. Jensen, D.F. Hanson, and P.H. Muessig. 2000. "A comparative review of entrainment survival studies at power plants in estuarine environments." *Environmental Science & Policy* (3) Supplement 1:295-301, Hunt Valley, Maryland. TN8458.

National Environmental Policy Act of 1969 (NEPA), as amended. 42 U.S.C. § 4321 *et seq.* TN661.

NMFS (National Marine Fisheries Service). 2024. "Essential Fish Habitat Mapper." Silver Spring, Maryland. Accessed July 30, 2024, at https://www.habitat.noaa.gov/apps/efhmapper/?page=page_4&views=view_16. TN10304.

NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Volumes 1 and 2, NUREG-1437, Washington, D.C. ADAMS Accession Nos. ML040690705, ML040690738. TN288.

NRC (U.S. Nuclear Regulatory Commission). 2007. Memorandum and Order in the Matter of Amergen Energy Company, LLC (License Renewal for Oyster Creek Nuclear Generating Station). CLI-07-08, Washington, D.C. ADAMS Accession No. ML21145A372. TN6957.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Attachment 1: Staff Guidance for Greenhouse Gas and Climate Change Impacts for New Reactor Environmental Impact Statements, COL/ESP-ISG-026*. Washington, D.C. ADAMS Accession No. ML14100A157. TN3768.

NRC (U.S. Nuclear Regulatory Commission). 2024. *February 2024 Environmental Scoping Meetings Related to the Diablo Canyon License Renewal Application*. Washington, D.C. ADAMS Accession Package No. ML24108A144. TN10209.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from S.S. Koenick, Chief, Environmental Project Manager Branch 1, Division of Rulemaking, Environment, and Financial Support, Office of Nuclear Material Safety and Safeguards, to A. Peck, Acting Senior Vice President, Generation and Chief Nuclear Officer, Pacific Gas and Electric Company, Diablo Canyon Nuclear Power Plant, dated September 20, 2024, regarding "Issuance of Supplemental Environmental Impact Statement Scoping Process Summary Report Related to the Diablo Canyon Nuclear Power Plant, Units 1 and 2 License Renewal Application (EPID Number: L-2023-LNE-0004)." Washington, D.C. ADAMS Accession Package No. ML24240A017. TN10608.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volume 1-3, Revision 2, Washington, D.C. ADAMS Accession No. ML24087A133. TN10161.

NRC (U.S. Nuclear Regulatory Commission). 2024. Official Transcript of Proceedings, November 14, 2024, "Public Meeting to Receive Comments on the Draft Supplemental Environmental Impact Statement for the License Renewal of Diablo Canyon Units 1 and 2." Washington, D.C. ADAMS Accession No. ML24346A024. TN11732.

NRC (U.S. Nuclear Regulatory Commission). 2024. "SECY-24-0046: Implementation of the Fiscal Responsibility Act of 2023 National Environmental Policy Act Amendments." Washington, D.C. ADAMS Accession No. ML24078A013. TN11945.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal, Final Report*. NUREG-1555, Revision 2, Washington, D.C. ADAMS Accession No. ML23201A227. TN10251.

NREL (National Renewable Energy Laboratory). 2022. "Annual Technology Baseline, Utility-Scale PV." Golden, Colorado. Accessed March 23, 2024, at https://atb.nrel.gov/electricity/2022/utility-scale_pv. TN9823.

PG&E (Pacific Gas & Electric Company). 2008. *Diablo Canyon License Renewal Feasibility Study Environmental Report, Technical Data Report, Heat Shock*. Revision 0, Avila Beach, California. ADAMS Accession No. ML11166A151. TN10104.

PG&E (Pacific Gas & Electric Company). 2022. Letter from M.R. Zawalick, Vice President, to NRC Document Control Desk, dated March 9, 2022, regarding "License Renewal Application for the Diablo Canyon Independent Spent Fuel Storage Installation." PG&E Letter DIL-22-003, Avila Beach, California. ADAMS Accession No. ML22068A189. TN10200.

PG&E (Pacific Gas & Electric Company). 2023. Letter from P. Gerfen, Senior Vice President and Chief Nuclear Officer, to NRC Document Control Desk, dated November 7, 2023, regarding "Diablo Canyon Units 1 and 2, Docket No. 50-275, OL-DPR-80, Docket No. 50-323, OL-DPR-82, License Renewal Application." Avila Beach, California. ADAMS Accession No. ML23311A154. TN9822.

PG&E (Pacific Gas & Electric Company). 2024. Letter from T.P. Jones, Senior Director, Regulatory, Environmental, & Repurposing, to NRC Document Control Desk, dated August 28, 2024, regarding "Diablo Canyon Power Plant Decommissioning Draft Biological Assessment and Draft Essential Fish Habitat Assessment." PG&E Letter DCL-24-082, Avila Beach, California. ADAMS Accession No. ML24241A271. TN10611.

PG&E (Pacific Gas & Electric Company). 2024. Email from T. Rebel, PG&E, to K. Conway, NRC, dated July 10, 2024, regarding "Dredge Data and File Location on Certrec." Avila Beach, California. ADAMS Accession No. ML24199A063. TN10226.

PG&E (Pacific Gas & Electric Company). 2024. Letter from M.R. Zawalick, Vice President, Business and Technical Services, to NRC Document Control Desk, dated May 16, 2024, regarding "Responses to NRC Requests for Additional Information on the Diablo Canyon Power Plant License Renewal Application Environmental Report." PG&E Letter DCL-24-052, Avila Beach, California. ADAMS Accession No. ML24137A314. TN10032.

San Luis Obispo Peace v. Nuclear Regulatory Commission (San Luis Obispo Mothers for Peace v. NRC*). 2006.* 449 F.3d 1016 (9th Cir. 2006). U.S. Court of Appeals Ninth Circuit Decision, June 2, 2006. TN6959.

SLOC (San Luis Obispo County). 2023. "Diablo Canyon Power Plant Decommissioning Project, Draft Environmental Impact Report." San Luis Obispo, California. Accessed June 25, 2024, at https://www.slocounty.ca.gov/departments/planning-building/grid-items/community-engagement/active-planning-projects/diablo-canyon-power-plant-decommissioning-(1)/draft-environmental-impact-report. TN10105.

Stantec (Stantec Consulting Services Inc.). 2023. *Diablo Canyon Power Plant Intake Cove Dredging Project, Administrative Draft Environmental Assessment*. San Francisco, California. TN10661.

State of California. 2018. *Senate Bill No. 100, California Renewables Portfolio Standard Program: emissions of greenhouse gases*. Sacramento, California. TN9855.

State of California. 2022. *Senate Bill No. 846, Diablo Canyon powerplant: extension of operations*. Sacramento, California. TN10038.

SWRCB (State Water Resources Control Board). 2024. "California Integrated Water Quality System Project (CIWQS), Facility At-A-Glance Report." Washington, D.C. Accessed June 17, 2024, at https://ciwqs.waterboards.ca.gov/ciwqs/. TN10087.

Tenera (Tenera Environmental Services). 1988. *Pacific Gas and Electric Company*, *Diablo Canyon Power Plant, Final Report, Thermal Effects Monitoring Program, Volume 1*. Berkely, California. ADAMS Accession No. ML1166A219. TN10247.

Terra Verde (Terra Verde Environmental Consulting, LLC). 2021. *Preliminary Oak Tree Inventory and Mitigation Plan for Pacific Gas & Electric, Diablo Canyon Power Plant Decommissioning Project*. San Luis Obispo, California. TN10101.

UCSC (University of California Santa Cruz). 2024. "Multi-Agency Rocky Intertidal Network (MARINe), SSWS Updates." Santa Cruz, California. Accessed October 7, 2024, at https://marine.ucsc.edu/data-products/sea-star-wasting/updates.html#:~:text=Sea%20star%20observations%20submitted%20over,us%20in%20CA%20since%202018. TN10613.

APPENDIX B

APPLICABLE LAWS, REGULATIONS, AND OTHER REQUIREMENTS

Several Federal laws and regulations affect environmental protection, health, safety, compliance, and consultation at every U.S. Nuclear Regulatory Commission (NRC) licensed nuclear power plant. Some of them require permits by or consultation with other Federal agencies or State, Tribal, or local governments. Certain Federal environmental requirements have been delegated to State authorities for enforcement and implementation. Furthermore, States have also enacted laws to protect public health and safety and the environment. It is the NRC's policy to make sure that nuclear power plants are operated in a manner that provides adequate protection of public health and safety and protection of the environment through compliance with applicable Federal and State laws, regulations, and other requirements, as appropriate.

The Atomic Energy Act of 1954, as amended (AEA) (42 *United States Code* [U.S.C.] 2011 et seq.-TN663), and the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801 et seq.-TN4466), give the NRC the licensing and regulatory authority for commercial nuclear energy use. They allow the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under these statutes through regulations set forth in Title 10, "Energy," of the *Code of Federal Regulations* (CFR). The AEA also authorizes the NRC to enter into an agreement with any State that allows the State to assume regulatory authority for certain activities (see 42 U.S.C. 2021-TN10029). California entered into an agreement with the NRC in April 1962 to assume regulatory responsibility over certain byproduct, source, and quantities of special nuclear materials not sufficient to form a critical mass. The Radiologic Health Branch in the California Department of Public Health administers the California Agreement State Program.

In addition to carrying out some Federal programs, State legislatures develop their own laws. State statutes can supplement, as well as implement, Federal laws for the protection of air, surface water, and groundwater. State legislation may address solid waste management programs, locally rare or endangered species, and historic and cultural resources.

The U.S. Environmental Protection Agency (EPA) has the primary responsibility to administer the Federal Water Pollution Control Act of 1972 (33 U.S.C. 1251 et seq., herein referred to as the Clean Water Act [CWA]-TN662). The National Pollutant Discharge Elimination System (NPDES) program addresses water pollution by regulating the discharge of potential pollutants to waters of the United States. The EPA allows for primary enforcement and administration through State agencies if the state program is at least as stringent as the Federal program.

B.1 Federal and State Requirements

Diablo Canyon is subject to various Federal and State requirements. The applicant may prepare and submit for several regulatory approvals or permits prior to the NRC license renewal (LR) approval. As a convenient source of references of environmental requirements, Table B-1 lists principal Federal, State, and local approvals applicable to the Diablo Canyon LR.

Table B-1 Federal and State Requirements

Activity	Law/Regulation	Requirements
Current operating license and license renewal	Atomic Energy Act, 42 U.S.C. 2011 et seq.	The Atomic Energy Act of 1954, as amended (AEA), and the Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801 et seq.) give the U.S. Nuclear Regulatory Commission (NRC) the licensing and regulatory authority for commercial nuclear energy use. They allow the NRC to establish dose and concentration limits for protection of workers and the public for activities under NRC jurisdiction. The NRC implements its responsibilities under these statutes through regulations set forth in Title 10, "Energy," of the *Code of Federal Regulations* (CFR).
Current operating license and license renewal	National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq.	The National Environmental Policy Act of 1969, as amended (NEPA), requires Federal agencies to integrate environmental values into their process by considering the environmental impacts of proposed Federal actions and reasonable alternatives to those actions. NEPA establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the policy. NEPA Section 102(2) contains action-forcing provisions to ensure that Federal agencies follow the letter and spirit of the Act. For major Federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of NEPA requires Federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and other specified information.
Current operating license and license renewal	10 CFR Part 20	Regulations in 10 CFR Part 20, "Standards for Protection Against Radiation," establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the NRC. These regulations are issued under the AEA and the Energy Reorganization Act of 1974, as amended. The purpose of these regulations is to control the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations in this Part.

Table B-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
Current operating license and license renewal	10 CFR Part 50	Regulations in 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” are NRC regulations issued under the AEA and Title II of the Energy Reorganization Act of 1974, as amended, to provide for the licensing of production and utilization facilities, including nuclear power reactors.
Current operating license and license renewal	10 CFR Part 51	Regulations in 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” contain the NRC’s regulations that implement NEPA.
License renewal	10 CFR Part 54	NRC regulations in 10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants,” govern the issuance of renewed operating licenses for nuclear power plants licensed under Sections 103 or 104b of the AEA and Title II of the Energy Reorganization Act of 1974, as amended. The regulations focus on managing adverse effects of aging. The rule is intended to ensure that important systems, structures, and components will continue to perform their intended functions during the license renewal period.
Air quality protection	Clean Air Act, 42 U.S.C. 7401 et seq.	The Clean Air Act (CAA) is intended to protect and enhance the quality of the nation’s air resources so as to promote the public health and welfare and the productive capacity of its population. The CAA establishes requirements to ensure maintenance of air quality standards and authorizes individual States to manage permits. Section 118 of the CAA requires each Federal agency with jurisdiction over properties or facilities engaged in any activity that might result in the discharge of air pollutants to comply with all Federal, State, inter-State, and local requirements with regard to the control and abatement of air pollution. Section 109 of the CAA directs the EPA to set National Ambient Air Quality Standards for criteria pollutants. The EPA has identified and set National Ambient Air Quality Standards for the following criteria pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. Section 111 of the CAA requires the establishment of national performance standards for new or modified stationary sources of atmospheric pollutants. Section 160 of the CAA requires that specific emission increases must be evaluated before permit approval to prevent significant deterioration of air quality. Section 112 requires specific standards for release of hazardous air pollutants (including radionuclides). These standards are implemented through plans developed by each State and approved by the EPA. The CAA requires sources to meet standards and obtain permits to satisfy those standards. Nuclear power plants may be required to comply with the CAA Title V, Sections 501–507, for sources subject to new source performance standards or

Table B-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
		sources subject to national emission standards for hazardous air pollutants. The EPA regulates the emissions of air pollutants using 40 CFR Parts 50 to 99.
Water resources protection	Clean Water Act, 33 U.S.C. 1251 et seq., and the NPDES (40 CFR Part 122)	The Clean Water Act (CWA) was enacted to restore and maintain the chemical, physical, and biological integrity of the Nation's water. The CWA requires all branches of the Federal Government with jurisdiction over properties or facilities engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with Federal, State, inter-State, and local requirements. As authorized by the CWA, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The NPDES program requires all facilities that discharge pollutants from any point source into waters of the United States to obtain an NPDES permit. A nuclear power plant may also participate in the NPDES General Permit for Industrial Stormwater due to stormwater runoff from industrial or commercial facilities to waters of the United States. The EPA is authorized under the CWA to directly implement the NPDES program; however, the EPA has authorized many States to implement all or parts of the national program. Section 401 of the CWA requires that an applicant for a Federal license or permit to conduct any activity that may result in any discharge into navigable waters must provide the Federal licensing or permitting agency with a certification (or waiver) from the State or appropriate water pollution control agency in which the discharge originates or will originate. This water quality certification implies that discharges from the activity or project to be licensed or permitted will comply with all limitations necessary to meet established State water quality requirements (40 CFR Part 121). The U.S. Army Corps of Engineers is the lead agency for enforcement of CWA wetland requirements (33 CFR Part 320). Under Section 401 of the CWA, the EPA or a delegated State agency has the authority to review and approve, condition, or deny all permits or licenses that might result in a discharge to waters of the State, including wetlands.
Water resources protection	Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et seq.)	Congress enacted the Coastal Zone Management Act (CZMA) in 1972 to address the increasing pressures of over- development upon the Nation's coastal resources. The National Oceanic and Atmospheric Administration administers the CZMA. The CZMA encourages States to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as

Table B-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
		wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. Participation by States is voluntary. To encourage States to participate, the CZMA makes Federal financial assistance available to any coastal State or territory, including those on the Great Lakes, as long as the State or territory is willing to develop and implement a comprehensive coastal management program.
Water resources protection	*California Code of Regulations* (CCR), Title 23, "Waters," Division 3, "State Water Resources Control Board and Regional Water Quality Control Boards," Chapter 9, "Waste Discharge Reports and Requirements"	This section of the CCR implements the NPDES requirements of the CWA.
Water resources protection	CCR, Title 23, "Waters," Division 3, "State Water Resources Control Board and Regional Water Quality Control Boards," Chapter 28, "Certifications"	This section of the CCR implements requirements of Section 401 of the CWA.
Water resources protection	CCR, Title 14, "Natural Resources," Division 5.5, "California Coastal Commission"	This section of the CCR implements California's Coastal Management Program, consistent with the CZMA.
Waste management and pollution prevention	Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq.	The Resource Conservation and Recovery Act requires the EPA to define and identify hazardous waste; establish standards for its transportation, treatment, storage, and disposal; and require permits for persons engaged in hazardous waste activities. Section 3006, "Authorized State Hazardous Waste Programs" (42 U.S.C. 6926), allows States to establish and administer these permit programs with EPA approval. EPA regulations implementing the Resource Conservation and Recovery Act are found in 40 CFR Parts 260 through 283. Regulations imposed on a generator or on a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.
Waste management and pollution prevention	Pollution Prevention Act, 42 U.S.C. 13101 et seq.	The Pollution Prevention Act establishes a national policy for waste management and pollution control that focuses first on source reduction, then on environmental issues, safe recycling, treatment, and disposal.

Table B-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
Waste management and pollution prevention	Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.-TN740)	The Nuclear Waste Policy Act provides for the research and development of repositories for the disposal of high-level radioactive waste, spent nuclear fuel, and low-level radioactive waste. Title I includes the provisions for the disposal and storage of high-level radioactive waste and spent nuclear fuel. Subtitle A of Title I delineates the requirements for site characterization and construction of the repository and the participation of States and other local governments in the selection process. Subtitles B, C, and D of Title I deal with the specific issues for interim storage, monitored retrievable storage, and low-level radioactive waste.
Waste management and pollution prevention	Low-Level Radioactive Waste Policy Act of 1980, as amended (42 U.S.C. 2021b et seq.-TN6606)	The Low-Level Radioactive Waste Policy Act amended the AEA to improve the procedures for implementation of compacts that provide for the establishment and operation of regional low-level radioactive waste disposal facilities. It also allows Congress to grant consent for certain inter-State compacts. The amended act sets forth the responsibilities for disposal of low-level waste by States or inter-State compacts. The act states the amount of waste that certain low-level waste recipients can receive over a set time period. The amount of low-level radioactive waste generated by both pressurized and boiling water reactor types is allocated over a transition period until a local waste facility becomes operational.
Waste management and pollution prevention	Hazardous Materials Transportation Act, as amended (49 U.S.C. 5101 et seq.-TN6605)	The Hazardous Materials Transportation Act regulates the transportation of hazardous material (including radioactive material) in and between states. According to the act, States may regulate the transport of hazardous material as long as their regulation is consistent with provisions of the act or U.S. Department of Transportation regulations provided in 49 CFR Parts 171 through 177 (TN5466). Other regulations regarding packaging for transportation of radionuclides are contained in 49 CFR Part 173, Subpart I.
Protected species	Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668d et seq.	The Bald and Golden Eagle Protection Act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald or golden eagles, including their parts (including feathers), nests, or eggs. The Act defines “take” as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. Regulations further define “disturb” as to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Table B-1 Federal and State Requirements (Continued)

Activity	Law/Regulation	Requirements
Protected species	Endangered Species Act, 16 U.S.C. 1531 et seq.	The Endangered Species Act was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7, "Interagency Cooperation," of the Act requires Federal agencies to consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service (NMFS) on Federal actions that may affect listed species or designated critical habitats.
Protected species	Magnuson–Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801-1884	The Magnuson–Stevens Fishery Conservation and Management Act governs marine fisheries management in U.S. Federal waters. The Act created eight regional Fishery Management Councils and includes measures to rebuild overfished fisheries, protect essential fish habitat, and reduce bycatch. Under Section 305 of the Act, Federal agencies are required to consult with the NMFS for any Federal actions that may adversely affect essential fish habitat.
Protected species	Migratory Bird Treaty Act, 16 U.S.C. 703-712 et seq.	The Migratory Bird Treaty Act (MBTA) implements four international conservation treaties that the U.S. entered with Canada (1916), Mexico (1936), Japan (1972), and Russia (1976). The MBTA has been amended with the signing of each treaty, as well as when any of the treaties were subsequently amended. To ensure that populations of all protected migratory birds are sustained, the MBTA prohibits the take of protected migratory bird species without prior authorization from U.S. Fish and Wildlife Service. Under the MBTA, "take" includes killing, capturing, selling, trading, and transport of protected migratory bird species.
Historic preservation and cultural resources	National Historic Preservation Act, 54 U.S.C. 300101 et seq.	The National Historic Preservation Act was enacted to create a national historic preservation program, including the National Register of Historic Places and the Advisory Council on Historic Preservation. Section 106 of the Act requires Federal agencies to consider the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation regulations implementing Section 106 of the Act are found in 36 CFR Part 800, "Protection of Historic Properties." The regulations call for public involvement in the Section 106 consultation process, including involvement from Indian Tribes and other interested members of the public, as applicable.

AEA = Atomic Energy Act; CAA = Clean Air Act; CCR = *California Code of Regulations*; CFR = *Code of Federal Regulations*; CWA = Clean Water Act; CZMA = Coastal Zone Management Act; EPA = U.S. Environmental Protection Agency; MBTA = Migratory Bird Treaty Act; NEPA = National Environmental Policy Act; NMFS = National Marine Fisheries Service; NPDES = National Pollutant Discharge Elimination System; NRC = U.S. Nuclear Regulatory Commission.

B.2 Operating Permits and Other Requirements

Table B-2 lists the permits and licenses issued by Federal, State, and local authorities for activities at Diablo Canyon, as identified in Chapter 9 of the environmental report.

Table B-2 Operating Permits and Other Requirements

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Operating license for Diablo Canyon Unit 1	U.S. Nuclear Regulatory Commission (NRC)	DPR-80	Issued: 11/2/1984 Expiration: 11/2/2024	Operation of Diablo Canyon Unit 1
Operating license for Diablo Canyon Unit 2	NRC	DPR-82	Issued: 8/26/1985 Expiration: 8/26/2025	Operation of Diablo Canyon Unit 2
General license for storage of spent fuel and high-level waste	NRC	SNM-2511	Issued: 3/22/2004 Expiration: 3/22/2024 Application for renewal submitted 3/9/2022	Receipt, possession, storage, and transfer of spent fuel and high-level radioactive waste
Hazardous materials registration	U.S. Department of Transportation	061022550296EG HM Company ID: 7638	Effective: 7/01/2022 Expiration: 6/30/2025	Hazardous materials shipments
NPDES Permit	Central Coast Regional Water Quality Control Board	CA0003751, Order 90-09	Issued: 5/11/1990 Expiration: 7/1/1995 Current Status: Administratively Extended	Plant industrial wastewater and thermal discharge to the Pacific Ocean and Diablo Creek
Biological Opinion and Incidental Take Statement	National Marine Fisheries Service	N/A	Issued: 9/18/2006 Expiration: 8/26/2025	Take including possession and disposition of impinged or stranded sea turtles
Right-of-Way Lease Amendment	U.S. Department of the Interior, Bureau of Land Management	CACA 55237	Issued: 6/17/2014 Expiration: 12/31/2042	Right-of-way for breakwaters and filled area
Migratory Bird Special Purpose Utility Permit – Electrical	U.S. Fish and Wildlife Service	MB057942-3	Issued: 5/30/2019 Expiration: 3/31/2021 Current Status: New permit applied for but not yet received	Required to collect, transport, and temporarily possess migratory birds found dead on utility property, structures, and rights-of-way as well as, in emergency circumstances, relocate or destroy active nests.

Table B-2 Operating Permits and Other Requirements (Continued)

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Scientific Collecting Permit, Specific Use	California Department of Fish and Wildlife	Permit ID: S-190090002-19296-001	None identified on permit	Public outreach collecting
Special Use Permit	California Department of Fish and Wildlife	N/A	Effective: 12/31/1999 valid until revoked	Selective kelp removal from Diablo Canyon intake cove and breakwaters
Scientific Collecting Permit, General Use	California Department of Fish and Wildlife	Permit ID: GM-212940003-21298-001	None identified on permit	Scientific collection activities in the marine environment
Assistance for sea otter mortality monitoring	California Department of Fish and Wildlife	N/A	Issued: 9/15/2021 Valid until revoked	Allows Diablo Canyon staff or contractors to secure and/or collect any sea otter carcasses found on site
Scientific Collecting Permit, Specific Use	California Department of Fish and Wildlife	Permit ID: S-190090002-22-304-001	Effective: 1/20/2023 Expiration: 1/19/2026	Annual take of approved wildlife, scientific purposes
RCRA Equivalent Hazardous Waste Treatment Storage & Disposal Facility Permit	California Department of Toxic Substances Control	EPA ID: CAD077966349	Effective: 9/26/2018 Expiration: 9/26/2028	Operation of plant hazardous waste storage units
Lease	California State Lands Commission	PRC 9347.1	Effective: 6/28/2016 Expiration: 8/26/2025 Extended through 10/31/2030	Lease of submerged lands of intake cove and discharge cove and portions of adjacent upland areas
Once-Through Cooling (OTC) Policy	California State Water Resources Control Board	N/A	Amended: 10/19/2021 Compliance Due Date: 10/30/2030	Allows fee payment for surface water withdrawal for OTC in lieu of conversion to closed-cycle cooling (cooling towers)
State General Industrial Storm Water Discharge Permit, Order 2014-0057-DWQ (Industrial General Permit)	California State Water Resources Control Board	Waste Discharger Identification: 340I018248	Effective: 7/1/2020 Annual fee required for permit participation and coverage and does not expire	Site stormwater discharges to Diablo Creek and the Pacific Ocean
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 1980-2	Issued: 10/15/2015 Expiration: June 2024 Renewed Annually upon Inspection	Operation of Diablo Canyon FLEX Emergency Portable Diesel ICE Backup Generators

Table B-2 Operating Permits and Other Requirements (Continued)

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 1944-1	Issued: 9/9/2014 Expiration: June 2024 Renewed Annually upon Inspection	Operation of Diablo Canyon FLEX Emergency Portable Diesel ICE Compressor Units
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 1845-2	Issued: 8/3/2015 Expiration: June 2024 Renewed Annually upon Inspection	Operation of Diablo Canyon FLEX Emergency Portable Diesel ICE Water Pumps
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 1065-8	Issued: 8/10/2018 Expiration: June 2024 Renewed Annually upon Inspection	Operation of Diablo Canyon FLEX Emergency Portable Diesel ICE Engines for General Plant Maintenance
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 338-1	Issued: 9/15/1997 Expiration: June 2024 Renewed Annually upon Inspection	Operation of Paint Spray Booth
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 533-2	Issued: 2/11/2004 Expiration: June 2024 Renewed Annually upon Inspection	Operation of Plant Abrasive Blast Facility
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 546-2	Issued: 3/25/2013 Expiration: June 2024 Renewed Annually upon Inspection	Operation of Plant Non-retail gasoline dispensing facility
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 415-4	Issued: 7/25/2019 Expiration: June 2024 Renewed Annually upon Inspection	Operation of Plant Portable Sandblasting Equipment
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 49	Issued: 11/17/1998 Expiration: June 2024 Renewed Annually upon Inspection	Operation of the Diablo Canyon Auxiliary Boiler Unit
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 919-5	Issued: 7/24/2020 Expiration: June 2024 Renewed Annually upon Inspection	Operation of the Diablo Canyon Stationary Emergency Diesel Generators (EDGs, SEDG, B113)

Table B-2 Operating Permits and Other Requirements (Continued)

Permit	Responsible Agency	Number	Expiration Date	Authorized Activity
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 1820-1	Issued: 1/11/2012 Expiration: June 2024 Renewed Annually upon Inspection	Operation of the JIC Stationary EDG
Permit to Operate	San Luis Obispo County Air Pollution Control District	Permit No. 1946-1	Issued: 9/2/2014 Expiration: June 2024 Renewed Annually upon Inspection	Operation of the KRC Stationary EDG
Permit to Operate	San Luis Obispo County Air Pollution Control District	Exemption No. 2365-1	Issued: 1/5/2024 Expiration: June 2024 Renewed Annually upon Inspection	Operation of 25 to 50 horsepower diesel engines (primarily used for back-up/emergency generators)
Domestic Water Supply Permit	San Luis Obispo County Environmental Health Services	Public Water System No. 4000589	Issued: 5/26/2005 Does not expire	Approved sources for potable water supply
Authorization HazMat Business Plan Program	San Luis Obispo County Environmental Health Services Division	ID: FA0010621 CERS ID: 10598767 HM ID: 0726 PR0016555	Expiration: 3/1/2025 Renewed Annually upon inspection and fee payment	KRC Hazmat Handling and Aboveground Petroleum Storage Tank
Permits to Operate Authorizations HazMat Business Plan Program & SPCC (Spill Prevention, Control, and Countermeasure) Facility	San Luis Obispo County Environmental Health Services Division	ID: FA0002829 CERS ID: 10435975 UST ID: 0301 PR0002823 AST ID: 1201 PR0015253 HM ID: 0728 PR0002022 HW ID: 1126 PR0002512	Expiration: 3/1/2025 Renewed Annually upon inspection and fee payment	Operation of Diablo Canyon EDG Underground Diesel Storage Tanks and aboveground petroleum storage tanks, hazmat handling, hazardous waste generation

EDG = emergency diesel generator; N/A = not available; NPDES = National Pollutant Discharge Elimination System; NRC = U.S. Nuclear Regulatory Commission; OTC = Once-Through Cooling (Policy); RCRA = Resource Conservation and Recovery Act of 1976, as amended; SNM = special nuclear material; SPCC = Spill Prevention, Control, and Countermeasure.

B.3 References

42 U.S.C. § 2021. U.S. Code Title 42, Public Health and Welfare, Section 2021, “Cooperation with States.” TN10029.

Atomic Energy Act of 1954. 42 U.S.C. § 2011 et seq. Public Law 112-239, as amended. TN663.

Energy Reorganization Act of 1974, as amended. 42 U.S.C. § 5801 et seq. TN4466.

Federal Water Pollution Control Act of 1972 (commonly referred to as the Clean Water Act). 33 U.S.C. § 1251 et seq. TN662.

APPENDIX C

CONSULTATION CORRESPONDENCE

C.1 Endangered Species Act Section 7 Consultation

As a Federal agency, the U.S. Nuclear Regulatory Commission (NRC) must comply with the Endangered Species Act of 1973 (ESA), as amended (16 *United States Code* [U.S.C.] 1531 et seq.-TN1010), as part of any action authorized, funded, or carried out by the agency. In this case, the proposed agency action is whether to issue renewed facility operating licenses for the continued operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon). The proposed action would authorize Pacific Gas & Electric Company to operate Diablo Canyon for an additional 20 years beyond the terms of the current operating licenses. Under Section 7 of the ESA, the NRC must consult with the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) ("the Services" [collectively] or "Service" [individually]), as appropriate, to ensure that the proposed action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

C.1.1 Federal Agency Obligations under Section 7 of the Endangered Species Act

The ESA and the regulations that implement ESA Section 7 at Title 50 of the *Code of Federal Regulations* (CFR) Part 402 (50 CFR Part 402-TN4312) describe the consultation process that Federal agencies must follow in support of agency actions. As part of this process, the Federal agency shall either request that the Services (1) provide a list of any listed or proposed species or designated or proposed critical habitats that may be present in the action area or (2) request that the Services concur with a list of species and critical habitats that the Federal agency has created (50 CFR 402.12(c)). If any such species or critical habitats may be present, the Federal agency prepares a biological assessment to evaluate the potential effects of the agency action and determine whether the species or critical habitats are likely to be adversely affected by the action (50 CFR 402.12(a); 16 U.S.C. 1536(c)-TN4459).

Biological assessments are required for any agency action that is a "major construction activity" (50 CFR 402.12(b) (TN4312). A major construction activity is a construction project or other undertaking having construction-type impacts that is a major Federal action significantly affecting the quality of the human environment under the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.) (NEPA) (51 FR 19926-TN7600). Federal agencies may fulfill their obligations to consult with the Services under ESA Section 7 and to prepare a biological assessment, if required, in conjunction with the interagency cooperation procedures required by other statutes, including NEPA (50 CFR 402.06(a)) (TN4312). In such cases, the Federal agency should include the results of ESA Section 7 consultation(s) in the NEPA document (50 CFR 402.06(b)).

C.1.2 Biological Evaluation

The proposed action of Diablo Canyon LR does not require the preparation of a biological assessment because it is not a major construction activity. Nonetheless, the NRC staff must consider the impacts of this action on federally listed species and designated critical habitats. In cases where the staff finds that LR "may affect" ESA-protected species or habitats, ESA Section 7 requires the NRC to consult with the relevant Service(s).

To support such consultations, the NRC staff has incorporated its analysis of the potential impacts of the proposed LR into Section 3.8 of this supplemental environmental impact statement (SEIS). The NRC staff refers to its ESA analysis as a “biological evaluation.”

The NRC staff structured its biological evaluation in accordance with the Services’ suggested biological assessment contents described at 50 CFR 402.12(f) (TN4312). Section 3.8.1.1 of this SEIS describes the action area as well as the ESA-protected species and critical habitats potentially present in the action area. Section 3.8.4 assesses the potential effects of the proposed action of Diablo Canyon LR on the ESA-protected species and critical habitats present in the action area and contains the NRC’s effect determination for each of those species and habitats. Finally, Sections 3.8.5 through 3.8.8 address the potential effects of the no-action alternative and the replacement power alternatives. The results of the NRC staff’s analysis are summarized below in Table C-1 and Table C-2.

Table C-1 Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal

Species or Critical Habitat	Federal Status[(a)]	Potentially Present in the Action Area?	Effect Determination[(b)]	FWS Concurrence Date[(c)]
California red-legged frog	FT	Yes	NLAA	12/20/2024
California tiger salamander	FT	No	NE	N/A
foothill yellow-legged frog	FT	No	NE	N/A
California clapper rail	FE	No	NE	N/A
California condor	FE	Occasionally	NLAA	12/20/2024
California least tern	FE	Occasionally	NLAA	12/20/2024
Hawaiian petrel	FE	Occasionally	NLAA	12/20/2024
least Bell’s vireo	FE	No	NE	N/A
marbled murrelet	FT	Occasionally	NLAA	12/20/2024
short-tailed albatross	FE	Occasionally	NLAA	12/20/2024
western snowy plover	FT	No	NE	N/A
Western yellow-billed cuckoo	FT	No	NE	N/A
tidewater goby	FE	No	NE	N/A
monarch butterfly	FPT	No	NLAA	N/A
vernal pool fairy shrimp	FT	No	NE	N/A
giant kangaroo rat	FE	No	NE	N/A
southern sea otter	FT	Yes	NLAA	12/20/2024
California jewelflower	FE	No	NE	N/A
Chorro Creek bog thistle	FE	No	NE	N/A
Indian knob mountainbalm	FE	No	NE	N/A
marsh sandwort	FE	No	NE	N/A
Morro manzanita	FT	No	NE	N/A
Pismo clarkia	FE	No	NE	N/A
salt marsh bird’s-beak	FE	No	NE	N/A
spreading navarretia	FT	No	NE	N/A

Table C-1 Effect Determinations for Federally Listed Species Under U.S. Fish and Wildlife Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Species or Critical Habitat	Federal Status[(a)]	Potentially Present in the Action Area?	Effect Determination[(b)]	FWS Concurrence Date[(c)]

(a) Indicates protection status under the Endangered Species Act. FE = federally endangered; FPT = proposed for federal listing as threatened; and FT = federally threatened.
(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and NMFS Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). NE = no effect and NLAA = may affect but is not likely to adversely affect.
(c) The ESA does not require Federal agencies to seek FWS concurrence for "no effect" determinations. N/A = not applicable.

Table C-2 Effect Determinations for Federally Listed Species Under National Marine Fisheries Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal

Species or Critical Habitat	Federal Status[(a)]	Potentially Present in the Action Area?	Effect Determination[(b)]	NMFS Concurrence Date[(c)]
Chinook salmon, California Coastal evolutionarily significant unit (ESU)	FT	No	NE	N/A
Chinook salmon, Central Valley Spring-Run ESU	FT	No	NE	N/A
Chinook salmon, Sacramento River Winter-Run ESU	FE	No	NE	N/A
Chinook salmon, Upper Klamath and Trinity Rivers ESU	FC	No	NE	N/A
green sturgeon	FT	No	NE	N/A
scalloped hammerhead shark	FE	No	NE	N/A
steelhead, California Central Valley distinct population segment (DPS)	FT	No	NE	N/A
steelhead, Central California Coast DPS	FT	No	NE	N/A
steelhead, Northern California DPS	FT	No	NE	N/A
steelhead, South-Central DPS	FT	No	NE	N/A
steelhead, Southern California DPS	FE	No	NE	N/A
black abalone	FE	Yes	NLAA	4/22/2025[(d)]
sunflower sea star	FPT	No	NE	N/A
blue whale	FE	No	NE	N/A
fin whale	FE	No	NE	N/A
gray whale, Eastern North Pacific DPS	DL	Yes	N/A	N/A
gray whale, Western North Pacific DPS	FE	Yes	NLAA	4/22/2025
Guadalupe fur seal	FT	No	NE	N/A

Table C-2 Effect Determinations for Federally Listed Species Under National Marine Fisheries Service Jurisdiction for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Species or Critical Habitat	Federal Status[(a)]	Potentially Present in the Action Area?	Effect Determination[(b)]	NMFS Concurrence Date[(c)]
humpback whale, Central American DPS	FE	Yes	NLAA	4/22/2025
humpback whale, Mexico DPS	FT	Yes	NLAA	4/22/2025
killer whale	FE	No	NE	N/A
North Pacific right whale	FE	No	NE	N/A
sei whale	FE	No	NE	N/A
sperm whale	FE	No	NE	N/A
stellar sea lion	DL	Yes	N/A	N/A
green sea turtle, East Pacific DPS	FT	Yes	LAA	4/22/2025
leatherback sea turtle	FE	Rarely	LAA	4/22/2025
loggerhead sea turtle, North Pacific DPS	FE	Rarely	LAA	N/A
Pacific olive ridley sea turtle, Mexico's Pacific Coast breeding population	FE	Rarely	LAA	4/22/2025
Pacific olive ridley sea turtle, all other populations	FT	Rarely	LAA	4/22/2025
Critical habitat of the black abalone	FD	Yes	NLDAM	4/22/2025
Critical habitat of the humpback whale	FD	Yes	NLDAM	4/22/2025
Critical habitat of the leatherback sea turtle	FD	Yes	NLDAM	4/22/2025

(a) Indicates protection status under the Endangered Species Act. DL = delisted; FC = candidate for Federal listing; FD = federally designated (critical habitat); FE = federally endangered; FPT = federally proposed for listing as threatened; and FT = federally threatened.

(b) The NRC staff makes its effect determinations for federally listed species in accordance with the language and definitions specified in the FWS and NMFS Endangered Species Consultation Handbook (FWS and NMFS 1998-TN1031). LAA = may affect and is likely to adversely affect; NE = no effect; NLAA = may affect but is not likely to adversely affect; and NLDAM = may affect but is not likely to destroy or adversely modify.

(c) The ESA does not require Federal agencies to seek NMFS concurrence for "no effect" determinations. N/A = not applicable.

(d) In its biological opinion, the NMFS concluded that the proposed Diablo Canyon LR would have limited effects on black abalone at the population and species level; therefore, the NMFS did not concur with the NRC's NLAA determination.

C.1.3 Chronology of Ecological Consultations

Endangered Species Act Section 7 Consultation with the U.S. Fish and Wildlife Service

Following issuance of the draft SEIS, the NRC sought and received the FWS's concurrence for the species for which the NRC determined that the proposed action of Diablo Canyon LR may affect but is not likely to adversely affect in accordance with 50 CFR 402.13(c) (TN4312). Consultation concluded on December 20, 2024, with FWS's concurrence with the NRC's findings. Table C-3 below lists correspondence with the FWS related to this consultation.

Table C-3 Correspondence Related to Endangered Species Act Consultation with the U.S. Fish and Wildlife Service for Diablo Canyon License Renewal

Date	Subject	ADAMS Accession No.[(a)]
10/30/2024	NRC to FWS, Request for informal ESA consultation and concurrence with not likely to adversely affect determinations for Diablo Canyon LR	ML24276A148
11/26/2024	FWS to NRC, Receipt of informal consultation request	ML25042A240
11/27/2024	FWS to NRC, Request for additional information	ML25042A241
12/11/2024	PG&E to FWS, Response to request for additional information	ML25042A245
12/20/2024	FWS to NRC, Concurrence with not likely to adversely affect determinations and conclusions of informal consultation	ML25006A097

ADAMS = Agencywide Documents Access and Management System; ESA = Endangered Species Act of 1973, as amended; FWS = U.S. Fish and Wildlife Service; LR = license renewal; NRC = U.S. Nuclear Regulatory Commission; PG&E = Pacific Gas & Electric Company.
(a) Access these documents through the NRC's ADAMS at http://adams.nrc.gov/wba/.

Endangered Species Act Section 7 Consultation with the National Marine Fisheries Service

Following issuance of the draft SEIS, the NRC initiated formal consultation with the NMFS in accordance with 40 CFR 402.14 (TN4312).Consultation concluded on April 22, 2025, with the NMFS's issuance of a biological opinion. Table C-4 below lists correspondence with the NMFS related to this consultation.

Table C-4 Correspondence Related to Endangered Species Act Consultation with the National Marine Fisheries Service for Diablo Canyon License Renewal

Date	Subject	ADAMS Accession No.[(a)]
10/30/2024	NRC to NMFS, Request for formal ESA consultation and abbreviated EFH consultation for Diablo Canyon LR	ML24275A062
12/10/2024	NMFS to NRC, Request for additional information	ML25042A243
12/17/2024	NRC to NMFS, Response to request for additional information	ML25042A234
1/16/2025	NRC to NMFS, Consideration of black abalone in formal consultation	ML25042A236
1/30/2025	NRC to NMFS, Consideration of black abalone in formal consultation	ML25042A238
4/22/2025	NMFS to NRC, Final biological opinion and EFH consultation response	ML25111A195

ADAMS = Agencywide Documents Access and Management System; EFH = essential fish habitat; ESA = Endangered Species Act of 1973, as amended; LR = license renewal; NMFS = National Marine Fisheries Service; NRC = U.S. Nuclear Regulatory Commission.
(a) Access these documents through the NRC's ADAMS at http://adams.nrc.gov/wba/.

Magnuson–Stevens Act Essential Fish Habitat Consultation

The NRC must comply with the Magnuson–Stevens Fishery Conservation and Management Act of 1976 (MSA), as amended (16 U.S.C. 1801 et seq.-TN9966), for any actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect any essential fish habitat (EFH) identified under the MSA.

In Sections 3.8.2 and 3.8.4.3 of this SEIS, the NRC staff determined that the proposed action of Diablo Canyon LR will result in no more than minimal adverse effects on the EFH of all life stages of four federally managed species groups: coastal pelagic species complex, euphausiids (krill), groundfish, and highly migratory species. Following issuance of the draft SEIS, the NRC engaged in EFH consultation with the NMFS in accordance with 50 CFR 600.920. Table C-5 below lists correspondence with the NMFS related to this consultation.

Table C-5 Correspondence Related to Essential Fish Habitat Consultation with the National Marine Fisheries Service for Diablo Canyon License Renewal

Date	Subject	ADAMS Accession No.[(a)]
10/30/2024	NRC to NMFS, Request for formal ESA consultation and abbreviated EFH consultation for Diablo Canyon LR	ML24275A062
4/22/2025	NMFS to NRC, Final biological opinion and EFH consultation response	ML25111A195

ADAMS = Agencywide Documents Access and Management System; EFH = essential fish habitat; ESA = Endangered Species Act of 1973, as amended; LR = license renewal; NMFS = National Marine Fisheries Service; NRC = U.S. Nuclear Regulatory Commission.
(a) Access these documents through the NRC's ADAMS at http://adams.nrc.gov/wba/.

National Marine Sanctuaries Act Consultation

The National Marine Sanctuaries Act of 1966, as amended (NMSA) (16 U.S.C. § 1431 et seq.-TN4482), authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or aesthetic qualities as national marine sanctuaries. Under Section 304(d) of the act, Federal agencies must consult with the National Oceanic and Atmospheric Administration's (NOAA's) Office of National Marine Sanctuaries if a Federal action is likely to destroy, cause the loss of, or injure any sanctuary resources.

In Section 3.8.4.4 of this SEIS, the NRC staff concludes that the proposed action of Diablo Canyon LR would have no effect on sanctuary resources of the Chumash Heritage National Marine Sanctuary. Thus, the NMSA does not require the NRC to consult with NOAA for the proposed action.

C.2 National Historic Preservation Act

The National Historic Preservation Act of 1966, as amended (NHPA) (54 U.S.C. 306108 et seq.-TN4839), requires Federal agencies to consider the effects of their undertakings on historic properties and consult with applicable State and Federal agencies, Tribal groups, individuals, and organizations with a demonstrated interest in the undertaking before taking action. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places. The NHPA Section 106 review process is outlined in regulations issued by the Advisory Council on Historic Preservation in 36 CFR Part 800, "Protection of Historic Properties" (TN513). In accordance with 36 CFR 800.8(c), "Use of the NEPA Process for Section 106 Purposes," the NRC has elected to use the NEPA process to comply with its obligations under Section 106 of the NHPA.

Table C-6 lists the chronology of consultation and consultation documents related to the NRC's NHPA Section 106 review of the proposed action of Diablo Canyon LR.

Table C-6 National Historic Preservation Act Consultation Correspondence for Diablo Canyon Nuclear Power Plant License Renewal

Date	Correspondence Description	ADAMS Accession No.
01/24/2024	Letter to Chairman Neil Peyron, Tule River Tribe - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24017A249
01/24/2024	Letter to Chairman Kenneth Kahn, Santa Ynez Band of Chumash Indians - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24012A036
01/24/2024	Letter to Council Lead Gary Pierce, Salian Tribe of Monterey and San Luis Obispo Counties - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24024A161
01/24/2024	Letter to Tribal Council, San Luis Obispo County Chumash Indians - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24024A175
01/24/2024	Letter to Chair Gabe Frausto, Coastal Band of Chumash Indians - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24024A156
01/24/2024	Letter to Chairwoman Mona Olivas Tucker, *yak titʸu titʸu yak tiłhini* Northern Chumash Indians - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24024A165
01/24/2024	Letter to Chairwoman Violet Sage Walker, Northern Chumash Tribal Council - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24012A158
01/24/2024	Letter to Reid Nelson, Executive Director, Advisory Council on Historic Preservation (ACHP) - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24012A006
01/24/2024	Letter to Julianne Polanco, Director, State Historic Preservation Officer (SHPO) - Request for Scoping Comments Concerning the Environmental Review of Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24012A055
05/28/2024	Memo to M. Rome - Summary of March 20, 2024, Meeting Between U.S. Nuclear Regulatory Commission (NRC) and the California Office of Historic Preservation	ML24109A191
05/28/2024	Memo to M. Rome - Summary of March 23, 2024, Meeting Between NRC and the Santa Ynez Band of Chumash Indians	ML24109A188

Table C-6 National Historic Preservation Act Consultation Correspondence for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Date	Correspondence Description	ADAMS Accession No.
06/03/2024	Memo to M. Rome - Summary of April 5, 2024, Meeting Between NRC and the yak titʸu titʸu yak tiłhini Northern Chumash	ML24143A120
06/04/2024	Memo to M. Rome - Summary of February 8, 2024, Meeting Between NRC and the yak titʸu titʸu yak tiłhini Northern Chumash	ML24127A133
06/04/2024	Memo to M. Rome - Summary of March 21, 2024, Meeting Between NRC and the yak titʸu titʸu yak tiłhini Northern Chumash	ML24155A205
06/21/2024	Memo to M. Rome - Summary of May 10, 2024, Meeting Between NRC and the Santa Ynez Band of Chumash Indians	ML24143A134
07/01/2024	Memo to M. Rome - Summary of April 4, 2024, Meeting Between NRC and the California Office of Historic Preservation	ML24157A025
10/25/2024	Memo to M. Rome - Summary of September 30, 2024, Meeting Between NRC and the yak titʸu titʸu yak tiłhini Northern Chumash Tribe	ML24275A216
11/01/2024	Letter to Chairwoman Charmaine McDarment, Tule River Tribe – Notice of Availability of Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24302A191
11/01/2024	Letter to Chairman Kenneth Kahn, Santa Ynez Band of Chumash Indians – Notice of Availability of Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24302A194
11/01/2024	Letter to Council Lead Gary Pierce, Salian Tribe of Monterey and San Luis Obispo Counties – Notice of Availability of Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24302A193
11/01/2024	Letter to Tribal Council, San Luis Obispo County Chumash Indians – Notice of Availability of Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24302A196
11/01/2024	Letter to Chair Gabe Frausto, Coastal Band of Chumash Indians – Notice of Availability of Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24302A192
11/01/2024	Letter to Chairwoman Mona Olivas Tucker, *yak titʸu titʸu yak tiłhini* Northern Chumash Indians – Notice of Availability of Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24302A195
11/01/2024	Letter to Chairwoman Violet Sage Walker, Northern Chumash Tribal Council – Notice of Availability of Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24302A197
11/01/2024	Letter to Reid Nelson, Executive Director, ACHP – Notice of Availability of Draft Supplemental Environmental Impact	ML24302A260

Table C-6 National Historic Preservation Act Consultation Correspondence for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Date	Correspondence Description	ADAMS Accession No.
	Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	
11/01/2024	Letter to Julianne Polanco, Director, SHPO – Notice of Availability of Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML24302A260
11/20/2024	NRC Staff Meeting with Representatives from the *yak titʸu titʸu yak tiłhini* Northern Chumash Tribe Regarding the Tribe's Preliminary Comments Regarding the NRC's Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML25150A349
12/13/2024	Comment Letter from Tori Gibbons on behalf of Shute, Mihaly & Weinberger LLP Representing the *yak titʸu titʸu yak tiłhini* Northern Chumash Tribe Regarding the NRC's Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML25008A048
04/22/2025	NRC Staff Meeting with Representatives from Pacific Gas and Electric Company Regarding Comments on the NRC's Draft Supplemental Environmental Impact Statement and Overview of NHPA Section 106 Consultation	ML25148A294
04/24/2025	NRC Staff Meeting with Representatives from the *yak titʸu titʸu yak tiłhini* Northern Chumash Tribe Regarding the Tribe's Preliminary Comments on the NRC's Draft Supplemental Environmental Impact Statement for Diablo Canyon Nuclear Power Plant Units 1 and 2, License Renewal	ML25150A349
05/15/2025	NRC Staff Meeting with Representatives from the *yak titʸu titʸu yak tiłhini* Northern Chumash Tribe and Pacific Gas and Electric Company	ML25150A040

C.3 References

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties." TN513.

50 CFR Part 402. *Code of Federal Regulations,* Title 50, *Wildlife and Fisheries*, Part 402, "Interagency Cooperation—Endangered Species Act of 1973, as amended." TN4312.

51 FR 19926. 1986. "Interagency Cooperation - Endangered Species Act of 1973, as amended." Final Rule, *Federal Register*, Fish and Wildlife Service, Interior; National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Commerce. TN7600.

16 U.S.C. § 1536. Endangered Species Act, Section 7, "Interagency Cooperation." TN4459.

16 U.S.C. § 1801 et seq. Conservation, Chapter 38, "Fishery Conservation and Management." TN9966.

54 U.S.C. § 306108. National Historic Preservation Act Section 106, "Effect of Undertaking on Historic Property." TN4839.

Endangered Species Act of 1973. 16 U.S.C. § 1531 et seq. TN1010.

FWS and NMFS (U.S. Fish and Wildlife Service and National Marine Fisheries Service). 1998. *Endangered Species Act Consultation Handbook, Procedures for Conducting Section 7 Consultation and Conference*. Washington, D.C. ADAMS Accession No. ML14171A801. TN1031.

National Marine Sanctuaries Act, as amended. 16 U.S.C. § 1431 et seq. TN4482.

APPENDIX D

CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and external parties as part of the agency's environmental review of the license renewal application for Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon). This appendix does not include consultation correspondence or comments received during the scoping process. For a list and discussion of consultation correspondence, see Appendix C of this supplemental environmental impact statement. For scoping comments, see Appendix A of this supplemental environmental impact statement and the NRC's "Scoping Summary Report" (Agencywide Documents Access and Management System [ADAMS] Accession No. ML24240A023; NRC 2024-TN10608). All documents are available electronically from the NRC's Public Electronic Reading Room found at https://www.nrc.gov/reading-rm.html. From this site, the public can gain access to ADAMS, which provides text and image files of the NRC's public documents. The ADAMS accession number for each document is included in the following table.

D.1 Environmental Review Correspondence

Table D-1 lists the environmental review correspondence, by date, beginning with the request by Pacific Gas and Electric Company to renew the Diablo Canyon operating licenses.

Table D-1 Environmental Review Correspondence for Diablo Canyon Nuclear Power Plant License Renewal

Date	Correspondence Description	ADAMS Accession No. or *Federal Register* Citation
11/07/2023	Pacific Gas and Electric Company – Application for Renewal of Operating Licenses for Diablo Canyon Nuclear Power Plant, Units 1 and 2	ML23311A154
11/14/2023	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 - Receipt and Availability of the License Renewal Application	ML23293A105
11/20/2023	Pacific Gas and Electric Company; Diablo Canyon Nuclear Power Plant, Units 1 and 2	88 FR 80780
12/19/2023	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 - Determination of Acceptability and Sufficiency for Docketing and Notice of Opportunity to Request a Hearing	ML23341A004
12/19/2023	License Renewal Application; Pacific Gas and Electric Company; Diablo Canyon Nuclear Power Plant, Units 1 and 2	88 FR 87817
01/08/2024	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 - License Renewal Application Online Reference Portal	ML23355A095
01/22/2024	Public Meeting Announcement: Environmental Scoping Meeting Related to the Diablo Canyon Nuclear Power Plant, Units 1 and 2, License Renewal Application	ML24030A806
01/22/2024	Public Meeting Announcement: Environmental Scoping Meeting Related to the Diablo Canyon Nuclear Power Plant, Units 1 and 2, License Renewal Application	ML24022A104

Table D-1 Environmental Review Correspondence for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Date	Correspondence Description	ADAMS Accession No. or *Federal Register* Citation
01/24/2024	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 - Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process	ML24003A890
01/24/2024	Notice of Intent to Conduct Scoping Process and Prepare Environmental Impact Statement; Pacific Gas and Electric Company; Diablo Canyon Nuclear Power Plant, Units 1 and 2	89 FR 4631
01/26/2024	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 - License Renewal Application Schedule Letter	ML24018A015
02/01/2024	February 1, 2024, Diablo Canyon License Renewal Application Public Environmental Scoping Meeting Presentation	ML24030A467
02/08/2024	February 8, 2024, Diablo Canyon License Renewal Application Public Environmental Scoping Meeting Presentation	ML24036A338
02/27/2024	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 – License Renewal Regulatory Audit Regarding the Environmental Review of the License Renewal Application	ML24056A002
04/18/2024	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 – Summary of the March 2024 Environmental Audit Related to the Review of the License Renewal Application Environmental Report	ML24106A290
05/08/2024	Meeting Summary: Public Scoping Meeting for the Environmental Review of the License Renewal Application for Diablo Canyon Nuclear Power Plant, Units 1 and 2	ML24108A144
05/16/2024	Pacific Gas and Electric Company Response to Diablo Canyon Nuclear Power Plant License Renewal Environmental Report Requests for Additional Information and Requests for Confirmation of Information	ML24137A314
05/20/2024	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 – License Renewal Regulatory Audit Regarding the Severe Accident Mitigation Alternatives Review for the License Renewal Application	ML24117A013
07/02/2024	Email to T. Rebel – Summary of June 27, 2024, Clarification Call Regarding Response to Request for Confirmation of Information AQN-3	ML24187A138
07/16/2024	Letter to Paula Gerfen – Diablo Canyon Nuclear Power Plant, Units 1 and 2 – Summary of the June 2024 Audit Regarding License Renewal Application Severe Accident Mitigation Alternatives Review	ML24187A131
08/15/2024	Pacific Gas and Electric Company Response to Diablo Canyon Nuclear Power Plant License Renewal Severe Accident Mitigation Alternatives Requests for Additional Information and Requests for Confirmation of Information	ML24229A120
09/20/2024	Letter to Adam Peck – Issuance of Supplemental Environmental Impact Statement Scoping Process Summary Report Related to the Diablo Canyon Nuclear Power Plant, Units 1 and 2, License Renewal Application	ML24240A017

Table D-1 Environmental Review Correspondence for Diablo Canyon Nuclear Power Plant License Renewal (Continued)

Date	Correspondence Description	ADAMS Accession No. or *Federal Register* Citation
10/28/2024	Letter to Adam Peck – Notice of Availability of Draft Supplement 62 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants	ML24284A311
10/31/2024	Public Meeting Announcement: November 14, 2024, Public Meeting to Receive Comments on the Draft Supplemental Environmental Impact Statement for the License Renewal of Diablo Canyon Units 1 and 2	ML24319A049
10/31/2024	Public Meeting Announcement: November 20, 2024, Public Meeting to Receive Comments on the Draft Supplemental Environmental Impact Statement for the License Renewal of Diablo Canyon Units 1 and 2	ML24322A004
11/01/2024	Notice of Availability of Draft Supplemental Environmental Impact Statement; Pacific Gas and Electric Company; Diablo Canyon Nuclear Power Plant, Units 1 and 2	89 FR 87433
11/14/2024	November 14, 2024, Draft Supplemental Environmental Impact Statement Public Meeting Presentation	ML24319A009
11/20/2024	November 20, 2024, Draft Supplemental Environmental Impact Statement Public Meeting Presentation	ML24320A103
12/16/2024	Meeting Summary: Public Meetings to Receive Comments on the Draft Supplemental Environmental Impact Statement for the License Renewal of Diablo Canyon Units 1 and 2	ML24346A029

APPENDIX E

PROJECTS AND ACTIONS CONSIDERED IN THE CUMULATIVE IMPACTS ANALYSIS

The cumulative impacts analysis has been provided in Section 3.16 of this supplemental environmental impact statement (see Section 3.16, “Cumulative Effects of the Proposed Agency Action”).

APPENDIX F

ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS

F.1 Introduction

Pacific Gas and Electric Company (PG&E, the applicant) submitted an assessment of severe accident mitigation alternatives (SAMAs) for Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon) in Section 4.15 and Attachment G of its Environmental Report (ER) (PG&E 2023-TN9822). This assessment was based on the most recent revision to the Diablo Canyon probabilistic risk assessment (PRA), including models for internal events, internal flooding, fire, and seismic, and a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System (WinMACCS) computer code, as well as insights from the Diablo Canyon individual plant examination (IPE) (PG&E 1992-TN10662) and individual plant examination of external events (IPEEE) (PG&E 1994-TN10620). In identifying and evaluating potential SAMAs, PG&E considered SAMAs that addressed the major contributors to core damage frequency (CDF), population dose at Diablo Canyon, and offsite economic cost, as well as insights and SAMA candidates found to be potentially cost beneficial from the analysis of other pressurized-water reactor (PWR) nuclear power generating stations. PG&E initially identified a list of 21 potential SAMA candidates after eliminating those candidates that (1) were not applicable to Diablo Canyon, (2) had already been implemented at Diablo Canyon, (3) were combined with another SAMA candidate, or (4) were expected to have a very low benefit. This list was further reduced to 13 unique SAMA candidates by eliminating SAMAs that had an excessive implementation cost but with an additional 5 SAMA candidates being retained after considering the impact of uncertainty on CDF. Of these 18 unique SAMA candidates, PG&E concluded in the ER that two SAMA candidates are potentially cost beneficial.

As a result of the review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC) staff issued a request for additional information (RAI) to PG&E by letter dated July 16, 2024 (NRC 2024-TN10308). The following key questions were involved:

- the history and impact of major changes to PRA models
- the status of the Level 1 PRA model relative to peer review certification, current and planned future design and operating features, and modeling of Diverse and Flexible Mitigation Capability (FLEX)
- the grouping and quantification of sequences in the Level 2 analysis, selection of representative sequences for each Source Term Category (STC) in the Level 2 analysis, and determination of the magnitude of release for each STC
- clarifications of the adequacy of the treatment of external events in the SAMA analysis, including the impact of new seismic hazard information
- selection of input parameters to the Level 3 analysis
- the use of the results of PRA importance analysis to identify Diablo Canyon-specific SAMA candidates
- the consideration of generic PWR enhancements in identifying SAMA candidates
- the consideration of the contribution of external events in the assessment of SAMA benefits

- further information on the cost-benefit analysis of specific candidate SAMAs and low-cost alternatives

PG&E submitted additional information by letter dated August 15, 2024 (PG&E 2024-TN10619). In response to the NRC staff RAI, PG&E provided further information on the following:

- the history and impact of major changes to PRA models
- the peer review history and Facts and Observations (F&Os) closure for the PRA models
- the modeling of FLEX
- the development of the Level 2 containment release model
- the treatment and inclusion of external events, including the impact of updated seismic hazard information on the SAMA analysis
- the basis for inputs to the Level 3 analysis
- the identification and screening of SAMA candidates
- the results of an updated cost-benefit analysis
- the cost of various SAMAs and potential low-cost alternatives

PG&E's response addressed the NRC staff's concerns and did not result in the identification of any additional potentially cost-beneficial SAMAs.

An assessment of the SAMAs for Diablo Canyon is presented below. Guidance for the SAMA analysis submittal is provided in NEI 05-01, Revision A, "Severe Accident Mitigation Alternatives (SAMA) Guidance Document" (NEI 2005-TN1978), which is endorsed by the NRC in Regulatory Guide 4.2, Supplement 1 (NRC 2013-TN4791).

F.2 Estimates of Risk for Diablo Canyon

Section F.2.1 summarizes PG&E's estimates of offsite risk at Diablo Canyon. The summary is followed by the NRC staff's review of PG&E's risk estimates in Section F.2.2.

F.2.1 PG&E's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the Diablo Canyon SAMA analysis: (1) the Diablo Canyon Level 1 and 2 PRA model, which is an updated version of the Diablo Canyon IPE (PG&E 1992-TN10662), which, in turn, was an update of the earlier model completed for the Long Term Seismic Program (LTSP) (PG&E 1988-TN10634), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PRA model) developed specifically for the Diablo Canyon SAMA analysis. The scope of the Diablo Canyon PRA used for the SAMA analysis (DC05A) includes internal flooding, fire, and seismic events but does not include other external events.

The Diablo Canyon Unit 1 total CDF from the DC05A model is approximately 8.80×10^{-5} per year. This total CDF includes contributions from internal events as well as internal flooding events, fire events, and seismic events. The Diablo Canyon internal events CDF, excluding internal flooding events, is approximately 4.76×10^{-6} per year as determined from quantification of the Level 1 PRA model for Unit 1. The Diablo Canyon CDF estimates for internal flooding events, fire events, and seismic events are 7.61×10^{-6} per year, 4.60×10^{-5} per year, and

2.96×10^{-5} per year, respectively, as determined from quantification of the Level 1 PRA model for Unit 1. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that the Unit 1 risk estimates bound those of Unit 2 and that owing to similarities between the units, the Unit 1 risk models provide a reasonable basis for the SAMA analysis, the results of which apply to both units. PG&E also clarified that the SAMA analysis makes use of a universal truncation limit of 1.00×10^{-13} per year as a means of reducing the model quantification time without significantly impacting the results, leading to a total CDF of 8.68×10^{-5} per year (as opposed to the total CDF of 8.80×10^{-5} per year reported in the ER and stated above). The applicant demonstrated through the use of a sensitivity study that the higher universal truncation limit has an insignificant impact on the results of the SAMA analysis when compared to those results obtained using risk models that employ truncation limits achieving convergence consistent with the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) PRA Standard RA-Sa-2009 (ASME/ANS 2009-TN6220). As such, risk results making use of the higher universal truncation limit were used as the baseline CDFs in the SAMA evaluations (PG&E 2023-TN9822).

In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E indicated that the PRA model used for the SAMA analysis reflects the Diablo Canyon as-built, as-operated configuration as of April 30, 2021, with regard to design changes, and August 4, 2021, with regard to procedural changes. PG&E stated that there have not been any major plant modifications or changes since the release of the Diablo Canyon PRA model DC05A used in the SAMA analysis nor are there any planned major plant modifications or changes that could adversely impact the SAMA analysis.

PG&E did not explicitly include the contribution from other (high winds, floods, and other) external events within the Diablo Canyon risk estimates; however, it did account for the potential risk reduction benefits associated with these external events by multiplying the estimated benefits for all other quantified events (i.e., internal events, internal flooding events, fire events, and seismic events) by a factor of 1.018. This is discussed further in Sections F.2.2 and F.6.2.

In the ER and in response to an NRC staff RAI (PG&E 2024-TN10619), PG&E provided the breakdown of CDF by initiating event in Table F-1, Table F-2, Table F-3, and Table F-4 for internal events (excluding internal floods), internal flooding events, fire events, and seismic events, respectively. While not listed explicitly in Table F-1 because they can occur as a result of multiple initiators, PG&E stated that station blackouts (SBOs) contribute about 3.3 percent (1.57×10^{-7} per year) to the total internal events CDF, and anticipated transients without scram (ATWS) contribute about 0.5 percent (2.22×10^{-8} per year) to the total internal events CDF (PG&E 2024-TN10619).

The Level 2 Diablo Canyon PRA model that forms the basis for the SAMA evaluation is an updated version of the IPE Level 2 model. The Diablo Canyon Level 2 model includes two types of considerations: (1) a deterministic analysis of the physical processes for a spectrum of severe accident progressions and (2) a probabilistic analysis component in which the likelihood of the various outcomes is assessed. The Level 2 analysis is linked to the Level 1 model by assigning each Level 1 core damage sequence to a plant damage state (PDS). The PDSs are then grouped into 16 key plant damage states (KPDSs). The Level 2 model then uses a containment event tree (CET), containing only phenomenological events, to quantify the frequency of each KPDS.

Table F-1 Core Damage Frequency for Internal Events (Excluding Internal Flooding) at Diablo Canyon Nuclear Power Plant

Initiating Event	CDF (per year)	% CDF Contribution
Small Break LOCA (Non-Isolable)	1.12×10^{-6}	24
Non-Isolated Steam Generator Tube Rupture for Level 2	8.44×10^{-7}	18
Loss of Offsite Power (Severe Weather)	3.39×10^{-7}	7
Loss of Auxiliary Saltwater Initiator	2.90×10^{-7}	6
Loss of Offsite Power (Grid Related)	2.79×10^{-7}	6
RCP Seal Catastrophic Seal Failure	2.29×10^{-7}	5
Reactor Trip	2.23×10^{-7}	5
Medium LOCA	2.00×10^{-7}	4
Loss of Offsite Power (Switchyard Related)	1.93×10^{-7}	4
Loss of Condenser Vacuum	1.35×10^{-7}	3
Loss of Switchgear Ventilation	1.14×10^{-7}	2
Excessive LOCA	1.07×10^{-7}	2
Loss of Offsite Power (Plant Centered)	1.05×10^{-7}	2
Other Initiating Events[a]	5.82×10^{-7}	12
Total CDF (Internal Events)	4.76×10^{-6}	**100[b]**

CDF = core damage frequency; LOCA = loss-of-coolant accident; RCP = reactor coolant pump.
(a) Multiple initiating events with each contributing less than 3 percent.
(b) Sum of contributors does not add up to 100 percent due to round off error.

Table F-2 Core Damage Frequency for Internal Flooding Events at Diablo Canyon Nuclear Power Plant

Flood Area	CDF (per year)	% CDF Contribution
Fuel Handling Building	3.16×10^{-6}	42
Battery, Inverter, and DC Switchgear, F Bus	1.10×10^{-6}	14
Hallway Outside Diesel Generator Rooms	8.43×10^{-7}	11
Containment Penetration Area, 100'	8.07×10^{-7}	11
Unit 1 Main Turbine Building, 85', 104', and 119'	3.32×10^{-7}	4
Motor-Driven Auxiliary Feedwater Pump Room	2.38×10^{-7}	3
Other Flood Areas[a]	1.13×10^{-6}	15
Total CDF (Internal Flooding Events)	7.61×10^{-6}	**100[b]**

CDF = core damage frequency; DC = direct current.
(a) Multiple flood areas with each contributing less than 3 percent.
(b) Sum of contributors does not add up to 100 percent due to round off error.

Table F-3 Core Damage Frequency for Fire Events at Diablo Canyon Nuclear Power Plant

Initiating Event	CDF (per year)	% CDF Contribution
7A (Cable Spreading Room)	1.25×10^{-5}	27
5A4 (480V Non-Vital Switchgear and Hot Shutdown Panel Area 100')	4.92×10^{-6}	11
6A3 (Battery, Inverter and DC Switchgear, H Bus)	3.10×10^{-6}	7
14A (Unit 1 Main Turbine Building 85', 104', and 119')	2.82×10^{-6}	6
Other Fire Areas[(a)]	2.27×10^{-5}	49
Total CDF (Fire Events)	4.60×10^{-5}	**100[(b)]**

CDF = core damage frequency; DC = direct current.
(a) Multiple fire areas with each contributing less than 5 percent.
(b) Sum of contributors does not add up to 100 percent due to round off error.

Table F-4 Core Damage Frequency for Seismic Events at Diablo Canyon Nuclear Power Plant

Initiating Event	CDF (per year)	% CDF Contribution
Seismic Level 13 (3.0–3.5g)	6.60×10^{-6}	22
Seismic Level 15 (4.0–6.0g)	4.26×10^{-6}	14
Seismic Level 14 (3.5–4.0g)	3.90×10^{-6}	13
Seismic Level 11 (2.5–2.75g)	3.90×10^{-6}	13
Seismic Level 12 (2.75–3.0g)	2.70×10^{-6}	9
Seismic Level 10 (2.25–2.5g)	2.26×10^{-6}	8
Seismic Level 9 (2.0–2.25g)	2.21×10^{-6}	7
Seismic Level 1 (0.2–0.35g)	1.12×10^{-6}	4
Other Initiating Events[(a)]	2.65×10^{-6}	9
Total CDF (Seismic Events)	2.96×10^{-5}	**100[(b)]**

CDF = core damage frequency.
(a) Multiple initiating events with each contributing less than 5 percent.
(b) Sum of contributors does not add up to 100 percent due to round off error.

The CET considers the influence of physical and chemical processes on the integrity of the containment and on the release of fission products once core damage has occurred. The quantified CET sequences are binned into a set of 37 release categories, which are subsequently grouped into six STCs that provide the input to the Level 3 consequence analysis. The frequency of each STC was obtained by summing the frequency of the individual accident progression CET endpoints, or release categories, binned into the STC. Two additional release categories, further discussed in Section F.2.2.3, were defined for “unaccounted for” Level 2 sequences and fire-induced main control room abandonment sequences. Source terms were developed for each of the six STCs using the results of Modular Accident Analysis Program (MAAP 5.02) computer code calculations. The results of this analysis for Diablo Canyon are provided in Table G.3-11 of ER Appendix E (PG&E 2023-TN9822).

PG&E computed offsite consequences for potential releases of radiological material using the MACCS, Version 3.10.0, computer code and analyzed exposure and economic impacts from its determination of offsite and onsite risks. Inputs for these analyses include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution and growth within a 50 mi (80 km) radius, emergency response evacuation modeling, and local economic data. Radionuclide inventory in the reactor core is based on a plant-specific evaluation and corresponds to 3,411 megawatts thermal (MWt) (PG&E 2023-TN9822, Attachment G). The estimation of onsite impacts (in terms of clean-up and decontamination costs and occupational dose) is based on guidance in NUREG/BR–0184, "Regulatory Analysis Technical Evaluation Handbook" (NRC 1997-TN676). Additional details on the input parameter assumptions are discussed below.

In Table G.3-12 of the ER, the applicant estimated the dose risk to the population within 50 mi (80 km) of the Diablo Canyon site to be 0.369 person-Sieverts (Sv) per year (36.9 person-rem per year) for internal events, internal flooding events, fire events, and seismic events combined (PG&E 2023-TN9822). The population dose risk (PDR) and offsite economic cost risk (OECR) contributions by containment release mode are summarized in Table F-5. Small and large early releases provide the greatest contribution, totaling approximately 89 percent of the PDR and 97 percent of the OECR, respectively.

In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that the sum of the frequencies for all tabulated source term categories (i.e., 8.45×10^{-5} per year, as shown in Table F-5) does not equal the total CDF (i.e., 8.68×10^{-5} per year, as discussed above) because as sequences progress from the Level 1 core damage end states through the Level 2 CET, they are further fragmented, and a portion of the sequence frequencies fall below the set truncation limit and are removed from further consideration. The applicant demonstrated through the use of a sensitivity study that such sequences have an insignificant impact on the results of the SAMA analysis. The population dose and the offsite economic cost were found to increase by about 3 percent. Given the small change in the population dose and offsite economic cost, the NRC staff concludes that this is reasonable for the purposes of the SAMA evaluation.

Table F-5 Base Case Mean Population Dose Risk and Offsite Economic Cost Risk at Diablo Canyon Nuclear Power Plant

Release Category: ID[(a)]	Release Category: Frequency (per year)	Population Dose Risk: person-rem/yr[(b)]	Population Dose Risk: % Contribution	Offsite Economic Cost Risk: $/yr	Offsite Economic Cost Risk: % Contribution
ST1 (Large Early)	4.63×10^{-6}	4.12	11.17	7.23×10^{4}	14.6
ST2 (Small Early)	3.79×10^{-5}	28.7	77.89	4.10×10^{5}	82.6
ST3 (Late)	4.01×10^{-5}	3.12	8.46	6.17×10^{3}	1.24
ST4 (Bypass w/AFW)	1.88×10^{-6}	0.585	1.59	4.21×10^{3}	0.85
ST5 (Interfacing System LOCA)	4.74×10^{-8}	0.329	0.89	3.35×10^{3}	0
ST6 (Intact)	3.61×10^{-8}	negligible	negligible	negligible	negligible
Total	**8.45×10^{-5} (c)**	**36.9(c)**	**100 (d)**	**4.96×10^{5}(c)**	**100(d)**

AFW = Auxiliary Feedwater, ID = identification; LOCA = loss-of-coolant accident.
(a) Release Category descriptions provided in response to an NRC staff RAI (PG&E 2024-TN10619).
(b) Unit Conversion Factor: 1 Sv = 100 rem.
(c) Sum of contributors may not add up to Total due to round off error.
(d) Sum of contributors may not add up to 100 percent due to round off error.

F.2.2 Review of PG&E's Risk Estimates

PG&E's determination of offsite risk at Diablo Canyon is based on three major elements of analysis:

- the Level 1 risk models completed for the LTSP (PG&E 1988-TN10634), Level 1 and 2 risk models that form the bases for the 1992 IPE submittal (PG&E 1992-TN10662), and the external event analyses of the 1994 IPEEE submittal (PG&E 1994-TN10620)
- the major modifications and upgrades to the IPE and IPEEE models that have been incorporated in the Diablo Canyon PRA as well as updates to the analysis of other external events
- the combination of offsite consequence measures from MACCS analyses with release frequencies and radionuclide source terms from the Level 2 PRA model

Each analysis element was reviewed to determine the acceptability of PG&E's risk estimates for the SAMA analysis, as summarized further in this section.

F.2.2.1 Internal Events CDF Model

The first Diablo Canyon PRA was completed to fulfill a requirement of the LTSP, which was added as a license condition for the Diablo Canyon operating licenses. The results of the NRC review of the LTSP PRA are documented in Supplement 34 to NUREG-0675 (NRC 1991-TN10635) and in a supporting report (NRC 1994-TN10636). The NRC staff concluded that the internal events Level 1 portion of the PRA was an acceptable and reasonable basis to address the LTSP license condition.

The NRC staff's review of the Diablo Canyon IPE is described in an NRC report dated June 30, 1993 (NRC 1993-TN10637). Figure 11.6 of NUREG-1560, Volume 2, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance Parts 2–5, Final Report" (NRC 1997-TN7812), shows that the IPE-based total internal events CDF for Westinghouse four-loop plants ranges from 2×10^{-6} per year to 2×10^{-4} per year, with Section 11.3.5.1 indicating an average CDF for the group of 6×10^{-5} per year. The internal events, including internal flooding, CDF value from the 1992 Diablo Canyon IPE (8.8×10^{-5} per reactor-year) is consistent with the values reported at that time for other Westinghouse four-loop plants. Other plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes, which in many cases, has resulted in substantially reduced CDFs compared to those reported in the IPE. The Diablo Canyon CDF results for internal events and internal flooding events used for the SAMA analysis (4.76×10^{-6} and 7.61×10^{-6}, respectively, or approx. 1.24×10^{-5} in total) are in the range reported in previous SAMA analyses for other similar plants.

From its review of the Diablo Canyon IPE submittal, the NRC staff concluded that the licensee's IPE process was capable of identifying the most likely severe accidents and severe accident vulnerabilities and, therefore, that the Diablo Canyon IPE met the intent of Generic Letter 88-20 (NRC 1993-TN10637). Although no vulnerabilities were identified in the IPE, a number of improvements were identified by PG&E. The NRC staff IPE safety evaluation report (SER) indicated that several improvements had been implemented.

There have been numerous revisions to the Diablo Canyon IPE Level 1 model since the 1988 LTSP and 1992 IPE submittals leading up to the utilization of Diablo Canyon PRA model DC05A for the SAMA analysis. A listing and description of the changes made to the Diablo Canyon PRA because these submittals are provided within Section G.2.1 of the ER (PG&E 2023-TN9822). In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified the impact of these changes to the Diablo Canyon PRA on CDF. A comparison of the internal events, including internal flooding, CDF between the 1992 IPE and the DC05A model indicates a significant decrease in the total CDF (from 8.8×10^{-5} per year to 1.24×10^{-5} per year).

The NRC staff considered the peer reviews, F&Os closure reviews, and other assessments performed to provide assurance of the quality of the Diablo Canyon PRA, and the potential impact of the review findings on the SAMA evaluation. The following summarizes the most relevant PRA peer reviews and other assessments related to those aspects of the model that address internal events and internal flooding events:

- In December 2012, a full-scope peer review was performed on the Level 1 and Level 2/Large Early Release Frequency (LERF) models addressing internal events as well as on the internal flooding model. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that this peer review was conducted using the ASME/ANS PRA Standard RA-Sa-2009 (ASME/ANS 2009-TN6220) and NRC Regulatory Guide 1.200, Revision 2 (NRC 2009-TN6211) in accordance with the NEI 05-04 process (NEI 2008-TN10638).
- In July 2023, a focused-scope peer review of select Level 2/LERF and internal flooding supporting requirements (SRs) was performed. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that the peer review addressed those SRs from the 2012 peer review that had only been met at Capability Category I and was conducted using the ASME/ANS PRA Standard RA-Sa-2009 (ASME/ANS 2009-TN6220) and in accordance with the NEI 17-07 process (NEI 2019-TN10639).
- In July 2023, an F&O closure review was conducted using NEI Appendix X guidance for closeout of F&Os (NEI 2017-TN10358). In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that this review included all finding-level F&Os. Additionally, PG&G explained that the closure review was conducted using NEI Appendix X guidance for closeout of F&Os (NEI 2017-TN10358) in accordance with NRC expectations and conditions of its use (NRC 2017-TN10368, NRC 2017-TN10369).

The ER explains that all F&Os from the peer reviews and focused-scope peer reviews were formally closed using the F&O closure review process and that affected SRs were assessed at Capability Category II or greater. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that the Diablo Canyon PRA model DC05A used in the SAMA analysis incorporates the dispositions to all the formally closed F&Os. Within the ER, PG&E indicates that the SAMA analysis utilizes a full scope Level 2 analysis instead of the limited Level 2 analysis contemplated by peer review SRs to evaluate LERF. This is discussed further in Section F.2.2.3.

The ER indicates that FLEX strategies are credited in the PRA. In an NRC staff RAI (NRC 2024-TN10308), challenges and strategies were identified for incorporating FLEX equipment into a PRA model in support of risk-informed decision-making and PG&E was asked to describe and justify that the PRA modeling of FLEX strategies addresses the NRC concerns. In response to the RAI (PG&E 2024-TN10619), PG&E clarified that FLEX strategies are credited in the PRA utilizing guidance from NEI 12-06 (NEI 2016-TN10640) and further explained that this modeling was done consistent with NRC guidance (NRC 2022-TN10641), except for the treatment of extended loss of alternating current (AC) power (ELAP) declaration. PG&E performed a sensitivity analysis crediting FLEX strategies consistent with NRC guidance (NRC 2022-

TN10641). The population dose and the offsite economic cost were found to increase by 3 percent. Given the small or negligible change in the population dose and offsite economic cost, the NRC staff concludes that use of the existing PRA model is reasonable for the purposes of the SAMA evaluation. The impact of this issue on the SAMA analysis is further addressed in Section F.6.2.

The ER provides a brief discussion of the Diablo Canyon maintenance process that ensures that the applicable PRA model is an accurate reflection of the as-built and as-operated plant. This process includes procedures for the PRA maintenance and update process, activities related to PRA quality, and routine PRA model updates to reflect the current plant configuration and additional plant operating history and component data.

Given that the Diablo Canyon internal events, including internal flooding, Level 1 PRA model has been peer-reviewed and the peer review findings were all closed using a process acceptable to the NRC, that PG&E has in place procedures to assure the technical quality of the PRA, and that PG&E has satisfactorily addressed NRC staff questions regarding the PRA, the NRC staff concludes that the internal events Level 1 PRA model is of sufficient quality to support the SAMA evaluation.

F.2.2.2 External Events

NEI 05-01A allows the use of an external events multiplier on the maximum benefit and on the upper bound estimated benefits for individual SAMA candidates during the Phase II screening if external events are not included in the PRA utilized for SAMA analysis (NEI 2005-TN1978). As stated above, the Diablo Canyon PRA utilized for the SAMA analysis includes fire events and seismic events, as well as internal events and internal flooding events. In the ER, as clarified by the response to an NRC staff RAI (PG&E 2024-TN10619), PG&E explained that an updated analysis was performed in place of the Diablo Canyon IPEEE to assess the impact of other (high winds, flooding, and other) external events.

The final Diablo Canyon IPEEE was submitted in June 1994 (PG&E 1994-TN10620) in response to Supplement 4 of Generic Letter 88-20 (NRC 1991-TN10360) and was based on the external events portion of the prior LTSP PRA (PG&E 1988-TN10634). The IPEEE consisted of a seismic PRA, a fire PRA, and an initial screening analysis of other external events with a more detailed analysis of unscreened events. No fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events were identified in the Diablo Canyon IPEEE. However, one enhancement related to fire events was identified as part of the IPEEE process. This has been implemented (PG&E 2023-TN9822). In the NRC staff's safety evaluation of the Diablo Canyon IPEEE, the NRC staff concluded that the submittal met the intent of Supplement 4 to Generic Letter 88-20, and that the licensee's process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 1997-TN10642).

<u>Seismic Events</u>

The Diablo Canyon IPEEE seismic analysis utilized a seismic PRA approach following NRC guidance (NRC 1991-TN10361) and represented an update of the LTSP seismic PRA. There have been numerous revisions to the Diablo Canyon seismic PRA since the 1988 LTSP and the 1994 IPEEE submittals leading up to the utilization of Diablo Canyon PRA model DC05A for the SAMA analysis. The historical development of the seismic PRA model, including a description of changes, is provided within Section G.2.1 of the ER (PG&E 2023-TN9822).

In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified the impact of these changes to the Diablo Canyon PRA on CDF.

Similar to Section F.2.2.1, the NRC staff considered the peer reviews, F&Os closure reviews, and other assessments performed to provide assurance of the quality of the Diablo Canyon PRA, and the potential impact of the review findings on the SAMA evaluation. The following summarizes the most relevant PRA peer reviews and other assessments related to those aspects of the model that address seismic events:

- In June 2017, a full-scope peer review was performed on the seismic PRA model. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that this peer review was conducted using the ASME/ANS PRA Standard RA-Sb-2013 (ASME/ANS 2013-TN10372) and in accordance with the NEI 12-13 process (NEI 2012-TN10643).
- In February 2018, an F&O closure review was conducted using NEI Appendix X guidance for closeout of F&Os (NEI 2017-TN10358). In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that this review included all finding-level F&Os. Additionally, PG&E explained that the closure review was conducted using NEI Appendix X guidance for closeout of F&Os (NEI 2017-TN10358) in accordance with NRC expectations and conditions of its use (NRC 2017-TN10368, NRC 2017-TN10369).

The ER explains that all F&Os from the peer review were formally closed using the F&O closure review process. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that the Diablo Canyon PRA model DC05A used in the SAMA analysis incorporates the dispositions to all the formally closed F&Os.

Following the accident at the Fukushima Dai-ichi Nuclear Power Plant, PG&E conducted additional seismic walkdowns at Diablo Canyon. The NRC staff concluded that the licensee, through the implementation of the walkdown guidance activities and in accordance with plant processes and procedures, verified the plant configuration with the current seismic licensing basis; addressed degraded, nonconforming, or unanalyzed seismic conditions; and verified the adequacy of monitoring and maintenance programs for protective features. Furthermore, the NRC staff noted that no immediate safety concerns were identified (NRC 2014-TN10644).

The NRC staff notes that PG&E's response to the Fukushima Near Term Task Force Recommendation 2.1 for a Seismic Hazard and Screening Report was found acceptable, confirming the licensee's conclusion that the Ground Motion Response Spectrum for the Diablo Canyon site exceeds the Safe Shutdown Earthquake in the 1 to 10 Hz range and above 10 Hz. As such, a seismic PRA report, which would also assess high frequency ground motion effects, and a limited-scope evaluation for the spent fuel pool were merited (NRC 2016-TN10645). The spent fuel pool evaluation was subsequently resolved (NRC 2018-TN10646, NRC 2020-TN7284). Additionally, based on the results and risk insights of PG&E's seismic PRA report, the NRC staff concluded that no further response or regulatory actions was required related to the seismic hazard reevaluation activities requested by Enclosure 1 of the 10 CFR 50.54(f) letter (NRC 2019-TN10647, NRC 2020-TN7284).

The NRC staff also notes that PG&E submitted in April 2018 its Seismic Mitigating Strategies Assessment (MSA) Report concluding that the FLEX for Diablo Canyon can be implemented as designed and that no further seismic evaluations were necessary (PG&E 2018-TN10648). As part of its review of the seismic PRA report, the NRC staff evaluated the mitigation strategies and concluded that no further response or regulatory actions were required related to the seismic hazard reevaluation activities requested by Enclosure 1 of the 10 CFR 50.54(f) letter (NRC 2020-TN7284).

In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E confirmed that a seismic hazard evaluation and analysis update for Diablo Canyon, as documented in a report titled "Diablo Canyon Updated Seismic Assessment: Response to Senate Bill 846," was performed and released on March 6, 2024. PG&E performed a sensitivity analysis to assess the impact of this new information on the Diablo Canyon risk estimates. The population dose and the offsite economic cost were found to increase by about 6 percent. Given the small change in the population dose and offsite economic cost, the NRC staff concludes that use of the existing PRA model is reasonable for the purposes of the SAMA evaluation. The impact of this issue on the SAMA analysis is further addressed in Section F.6.2.

Considering that a Diablo Canyon seismic PRA was used to directly assess the impact of SAMAs, that the seismic PRA has been peer reviewed with all F&Os closed out for the SAMA analysis, that the seismic PRA uses representative seismic hazard curves, and that the spent fuel pool evaluation and high frequency exceedance issues have been resolved, the NRC staff concludes that the seismic PRA, as discussed above, is acceptable for use in the assessment of SAMAs.

Fire Events

The Diablo Canyon IPEEE fire analysis utilized a fire PRA following NRC guidance (NRC 1991-TN10361) and represented an update of the LTSP fire PRA. There have been numerous revisions to the Diablo Canyon fire PRA since the 1988 LTSP and the 1994 IPEEE submittals leading up to Diablo Canyon PRA model DC05A, which is utilized for the SAMA analysis and is based on the guidance of NUREG/CR-6850 and other NRC-endorsed or -approved documents. The historical development of the fire PRA model, including a description of changes, is provided within Section G.2.1 of the ER (PG&E 2023-TN9822). In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified the impact of these changes to the Diablo Canyon PRA on CDF.

The NRC staff notes that the Diablo Canyon fire PRA model was reviewed by the NRC as part of the Diablo Canyon National Fire Protection Association Standard (NFPA) 805 license amendment request (LAR) dated June 26, 2013 (PG&E 2013-TN10649). That review was concluded on April 14, 2016 (NRC 2016-TN10650). Based on its review, the NRC staff concluded that the Diablo Canyon fire PRA is of sufficient technical adequacy and that its quantitative results, considered together with the sensitivity studies, can be used to demonstrate that the change in risk due to the transition to NFPA 805 meets the acceptance guidelines in RG 1.174, Revision 2 (NRC 2011-TN10651, NRC 2016-TN10650).

Similar to Section F.2.2.1, the NRC staff considered the peer reviews, F&Os closure reviews, and other assessments performed to provide assurance of the quality of the Diablo Canyon PRA, and the potential impact of the review findings on the SAMA evaluation. The following summarizes the most relevant PRA peer reviews and other assessments related to those aspects of the model that address fire events:

- In January 2008, a full-scope peer review was performed on the fire PRA model. As clarified in Section G.2.3.2.3 of the ER, this peer review was conducted using a predecessor (ANSI/ANS 2007-TN10663) to the ASME/ANS PRA Standard RA-Sa-2009 (ASME/ANS 2009-TN6220) and in accordance with the process described in draft Version E of NEI

07-12 (NEI 2010-TN10652). However, at the time of the peer review, certain technical elements of the fire PRA had not been completed.

- In December 2010, a follow-on peer review was performed to address those technical elements that were not reviewed in the 2008 peer review and was conducted using the ASME/ANS PRA Standard RA-Sa-2009 (ASME/ANS 2009-TN6220). In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E indicated that that this peer review was performed in accordance with the NEI 07-12 process (NEI 2010-TN10652). Section G.2.3.2.3 of the ER clarifies that this review included any SRs that were judged to not meet the PRA Standard and that were associated with Findings-category F&Os issued in the 2008 review. The 2010 peer review also addressed SRs that were not in the PRA Standard used in the 2008 peer review (ANSI/ANS 2007-TN10663) but were added to the ASME/ANS PRA Standard RA-Sa-2009.
- In August 2018, a focused-scope peer review was performed on the Fire Scenario Selection and Analysis (FSS) and Circuit Failure Analysis (CF) technical elements. Section G.2.3.2.3 clarifies that this peer review was performed after the fire PRA model was upgraded to incorporate new NRC-endorsed guidance on the treatment of obstructed plumes, crediting incipient detection, and addressing ground fault equivalent hot shorts. No F&Os were identified, and all associated SRs were assessed at Capability Category II or greater.
- In September 2018, an F&O closure review was conducted using NEI Appendix X guidance for closeout of F&Os (NEI 2017-TN10358). In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that this review included all finding-level F&Os. Additionally, PG&E explained that the closure review was conducted using NEI Appendix X guidance for closeout of F&Os (NEI 2017-TN10358) in accordance with NRC expectations and conditions of its use (NRC 2017-TN10368, NRC 2017-TN10369).

The ER explains that all F&Os from the peer review were formally closed using the F&O closure review process. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that the Diablo Canyon PRA model DC05A used in the SAMA analysis incorporates the dispositions to all the formally closed F&Os.

Considering that a Diablo Canyon fire PRA has been significantly upgraded since the IPEEE using NRC-endorsed guidance, that the fire PRA was used to directly assess the impact of SAMAs, and that the fire PRA has been peer reviewed with all F&Os closed out for the SAMA analysis, the NRC staff concludes that the fire PRA, as discussed above, is acceptable for use in the assessment of SAMAs.

High Winds, Floods, and Other External Events

The PG&E IPEEE analysis of high winds, floods, and other external events was an update of the analysis of these events in the LTSP PRA. The update included a review of Diablo Canyon's consistency with the applicable NRC Standard Review Plan (SRP) (NRC 1975-TN10359) requirements for high winds, floods, and other external events, a review of other plant documentation, design changes, calculations, and a confirmatory walkdown. The results of the IPEEE analysis of these events indicated that each of the events identified in NUREG-1407 (NRC 1991-TN10361) had a core damage contribution of less than the screening criterion of 1×10^{-6} per year (PG&E 1994-TN10620).

In Section G.5.1.7 of the ER and in response to an NRC staff RAI (PG&E 2024-TN10619), PG&E further explained that the analysis of external events was revisited in November 2016 using a graded screening process consistent with the NRC SRP and the ASME/ANS PRA Standard RA-Sb-2013 (ASME/ANS 2013-TN10372). Table F-6 provides the CDF contributions for those external events hazards for which bounding quantitative estimates were developed. The updated analysis, therefore, confirmed that the conclusions of the IPEEE remain valid and that these hazards, whether qualitatively screened or quantitively estimated through bounding analysis, are not significant contributors to external events risk.

Table F-6 Diablo Canyon Nuclear Power Plant External Events (Non-Seismic) Contributors

Initiating Event	CDF (per year)
Aircraft Hazards	7.43×10^{-7}
Tornado Strike	3.92×10^{-8}
Tornado Missile	2.05×10^{-7}
Hurricane	5.05×10^{-7}
Transportation Hazards – Ship Impact on Intake Structure	2.90×10^{-8}
Transportation Hazards – Breakwater Blockage	2.91×10^{-8}
Heavy Load Drop	1.77×10^{-10}
External Flooding – Wave Run Up[b]	2.2×10^{-8}
External Flooding – Wave Splash Back[b]	2.0×10^{-8}
Total External Events CDF (Non-Seismic)[a]	1.59×10^{-6}

CDF = core damage frequency.
(a) Sum of contributors may not add up to Total due to round off error.
(b) This hazard was added in response to an NRC staff RAI (PG&E 2024-TN10619).

The NRC staff noted in an RAI (NRC 2024-TN10308) that NRC Regulatory Issue Summary 2015-06 identified several instances in which nuclear power plants were determined to not conform with their tornado-generated missile licensing basis and asked PG&E to discuss any changes to the Diablo Canyon site or surrounding environment or to Diablo Canyon that would change the conclusions of the IPEEE regarding tornado-generated missiles and which could impact the SAMA analysis. PG&E responded that an analysis of tornado-generated missiles was performed to confirm that the conclusions of the IPEEE remain valid—namely, that the contribution to CDF from this external hazard remains less than 1×10^{-6} per year (PG&E 2024-TN10619).

Following the accident at the Fukushima Dai-ichi Nuclear Power Plant, PG&E conducted additional external flood walkdowns as requested by the NRC's 10 CFR 50.54(f) letter request for information (NRC 2012-TN2198). Based on its review of PG&E's submittal, the NRC staff concluded that the licensee's implementation of the flooding walkdown methodology meets the intent of the walkdown guidance and that the licensee, through the implementation of the walkdown guidance activities and in accordance with plant processes and procedures, verified the plant configuration with the current flooding licensing basis; addressed degraded, nonconforming, or unanalyzed flooding conditions; and verified the adequacy of monitoring and maintenance. Furthermore, the NRC staff noted that the licensee's walkdown results, which were verified by the staff's inspection, identified no immediate safety concerns (NRC 2014-TN10653).

As part of implementing lessons learned from the accident at the Fukushima Dai-ichi Nuclear Power Plant, the NRC issued a 10 CFR 50.54(f) letter request for information (NRC 2012-

TN2198). Enclosure 2 to that letter requested licensees to reevaluate flood-causing mechanisms using present-day methodologies and guidance. Concurrently with the reevaluation of flooding hazards, licensees were required to develop and implement mitigating strategies in accordance with NRC Order EA-12-049, “Requirements for Mitigation Strategies for Beyond-Design-Basis External Events” (NRC 2012-TN3237).

PG&E submitted the Diablo Canyon reevaluated flood hazard assessment on February 8, 2016 (PG&E 2016-TN10660), and the NRC staff provided its assessment of the reevaluation on December 18, 2017 (NRC 2017-TN10659). In its assessment, the NRC staff confirmed the licensee’s determination that (1) the reevaluated flood hazard results for local intense precipitation (LIP) are not bounded by the current design basis flood hazards and (2) that additional assessments of plant response need to be performed for LIP flood-causing mechanisms.

PG&E submitted the flooding MSA for Diablo Canyon on April 6, 2017 (PG&E 2017-TN10658), and the NRC staff provided its assessment of the submittal on December 18, 2017 (NRC 2017-TN10657). The NRC staff assessment confirmed that the licensee’s flood hazard MSA was performed consistent with applicable guidance. Further, based on the licensee’s appropriate hazard characterization, the methodology used in the MSA evaluation, and the description of its strategies (i.e., existing FLEX strategies and changes and modifications to the site), the staff concluded that the licensee has demonstrated that the mitigation strategies, if appropriately implemented, are reasonably protected from reevaluated flood hazard conditions for beyond-design-basis external events.

On July 19, 2017, PG&E submitted its focused evaluation of the external flooding mechanisms for which the reevaluated flooding hazards are not bounded by the current design basis (PG&E 2017-TN10656). PG&E’s evaluation concluded that permanent passive protection is in place for the LIP flood-causing mechanism. The NRC staff’s evaluation of this submittal concluded that the licensee has demonstrated that effective flood protection exists for LIP flood mechanisms during a beyond-design-basis external flooding event at Diablo Canyon (NRC 2020-TN7284).

The NRC staff noted in an RAI that this flooding focused evaluation was a deterministic (that is, not a probabilistic) evaluation and asked PG&E to provide a discussion of these external flood hazards and the associated impact on Diablo Canyon to support the assertion that they would not contribute to the external events multiplier nor lead to any SAMAs being cost beneficial (NRC 2024-TN10308). PG&E responded that a graded screening process was implemented consistent with the NRC SRP and the ASME/ANS PRA Standard RA-Sb-2013 (ASME/ANS 2013-TN10372). The applicant further clarified that this analysis encompassed external flooding hazards, demonstrating, either qualitatively or quantitively through bounding risk estimates, that such hazards are not significant contributors to external events risk.

Considering that the NRC staff concluded that the flooding protection measures implemented at Diablo Canyon provide effective measures for protection against beyond-design-basis external flooding events, that the NRC staff has concluded that flooding mitigation strategies implemented at Diablo Canyon are reasonably protected from reevaluated flood hazard conditions, that the reevaluated flood hazard conditions were conservatively assessed, and that the contribution to CDF from qualitatively screened external events is negligible, the NRC staff concludes that including a CDF contribution for hazards with quantitative bounding estimates in the development of the external events multiplier is acceptable. Furthermore, the NRC staff concludes that no additional external flooding SAMAs need to be considered because PG&E has implemented the NRC-mandated safety enhancements from the lessons learned from the Fukushima Dai-ichi accident and has completed its response to the 10 CFR 50.54(f) letter for Diablo Canyon (NRC 2020-TN7284).

External Events Multiplier

As stated in the ER (PG&E 2023-TN9822), a multiplier of 1.018 was used to adjust the risk benefit associated with a SAMA to account for external (excluding seismic) events. This multiplier was based on a total CDF of 8.84×10^{-5}, which is the sum of the CDF for internal events, internal flooding, fire, and seismic contributors of 8.68×10^{-5} per year and the CDF for non-seismic external event hazards of 1.59×10^{-6} per year from Table F-6. The external events multiplier was therefore calculated by PG&E to be 1.018 (8.84×10^{-5} per year/8.68×10^{-5} per year).

Considering the assumptions and uncertainties associated with this analysis, the NRC staff considers the external events multiplier of 1.018 to be reasonable for the SAMA analysis.

F.2.2.3 Level 2 Fission Product Release Analysis

The NRC staff reviewed the general process used by PG&E to translate the results of the Level 1 PRA into containment releases, as well as the results of the Level 2 analysis, as described in the ER and in responses to an NRC staff RAI (PG&E 2024-TN10619). As discussed in Section F.2.1, the Level 2 Diablo Canyon PRA model that forms the basis of the SAMA evaluation is an updated version of the IPE model.

The Level 2 analysis is linked to the Level 1 model by assigning each Level 1 core damage sequence to a PDS. The PDS bins are characterized by the thermodynamic conditions in the reactor coolant system and in the containment at the time of core damage and the availability of both passive and active plant features that can terminate or mitigate the radioactive releases to the environment. Five characteristics make up the definition of PDS: (1) reactor coolant system pressure, (2) steam generator cooling, (3) Reactor Water Storage Tank injected or not, (4) containment spray and heat removal, and (5) containment integrity at time of vessel melt-through. There are 384 theoretically possible combinations of the various values of the five characteristics, but substantially fewer are actually possible given that many are precluded by plant design, modeling assumptions, and/or type of initiating event. To make the analysis more tractable, however, the PDSs are grouped into 16 KPDSs and assigned a representative accident sequence. As discussed in response to an NRC staff RAI (PG&E 2024-TN10619), the grouping process is done using conservative guidelines to ensure that the KPDSs are bounding from a Level 2 perspective. ER Table G.2-3 presents the results of the PDS binning into the KPDSs.

The Level 2 model then uses a single CET, containing only phenomenological events, to quantify the frequency of each KPDS. The status of systems important to the timing and magnitude of radioactive releases is contained in the Level 1 event trees and thereby passed into the CET via the definition of each KPDS. The top events of the CET represent events that consider the influence of physical and chemical processes on the integrity of the containment and on the release of fission products once core damage has occurred. A list of the 30 CET functional events and their descriptions used for the Level 2 analysis are provided in ER Figure G.1-10 (PG&E 2023-TN9822). SBO and non-SBO Level 1 sequences are processed by the single CET.

The CET end points represent the outcomes of possible containment accident progression sequences with each end point representing a complete sequence from initiator to release to the environment. Associated with each CET end point or end state is an atmospheric radionuclide source term including the timing, magnitude, and other conditions associated with the release. Because of the large number of CET end points, they are grouped into release categories. PG&E binned the quantified CET sequences into a set of 37 release categories. Binning logic, which is described in ER Section G.2.2.4.1 and summarized by ER Table G.2-5, considers containment bypass, reactor coolant system (RCS) pressure at vessel failure, the time and size of containment failure, status of the containment spray system, and debris coolability. As discussed in the ER, two additional release categories were defined for “unaccounted for” Level 2 sequences and fire-induced main control room abandonment sequences. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that the former release category is defined to capture frequencies of those sequences not assigned to other categories.

PG&E subsequently grouped the 39 individual release categories into six STCs that provide the input to the Level 3 consequence analysis. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E defined each of the six release category groups, or STCs, in terms of their characteristics, such as release timing and magnitude. The two additional release categories that were defined for “unaccounted for” Level 2 sequences and fire-induced main control room abandonment sequences were conservatively mapped to the STC leading to a large early release. PG&E defined the six STCs as follows: Large Early Releases (ST1), Small Early Releases (ST2), Late Releases (ST3), Containment Bypasses (ST4), Interfacing System LOCA (ST5), and Long-Term Containment Intact (ST6). The INTACT release category is for accident sequences in which there is no containment failure.

The six STCs and their frequencies are provided in ER Table G.3-12. The frequency of each STC was obtained by summing the frequency of the individual accident progression CET endpoints, or release categories, binned into the STC. The NRC staff noted that the sum of the frequencies for all tabulated source term categories does not equal the total CDF reported in the ER, but as explained in Section F.2.1 and in response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that this results from truncation effects that have an insignificant impact on the SAMA evaluation. Additionally, the NRC staff observed in an RAI that the frequency of release category group ST1, leading to a large early release, was 4.63×10^{-6} per year, while the Unit 1 LERF is reported as 6.81×10^{-6} per year (NRC 2024-TN10308). In response to this RAI (PG&E 2024-TN10619), PG&E clarified that the LERF frequency conservatively includes the frequencies from release category groups ST1, ST4, and ST5.

Per the ER (PG&E 2023-TN9822), MAAP 5.02 was used to determine the progression of the various Level 2 sequences and the resulting timing and magnitude of fission product releases. Source terms were developed for each of the six STCs, and the results of this analysis for Diablo Canyon are provided in Table G.3-11 of ER Appendix E (PG&E 2023-TN9822). In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E explained the logic used in the selection of the representative MAAP case for each release category group, summarizing that the best representative case, in terms of frequency and release magnitude, with the potential for conservatism was used for each STC.

The NRC staff noted in an RAI that while the Diablo Canyon SAMA analysis ultimately applies the results developed using MAAP, ER Section G.2.2.4.2 indicates that PG&E elected to generate an alternate set of source terms and related parameters using the ZISOR methodology. In response to this RAI (PG&E 2024-TN10619), PG&E clarified that the ZISOR results were provided for historical perspective and that the Diablo Canyon MAAP model represents a detailed, plant-specific analysis that yields results of higher fidelity and is consistent with current industry practice.

The NRC staff noted in an RAI that MAAP cases developed for individual release categories and reported in ER Table G.2-8 were limited to 50 hours after event initiation, which may not be sufficient should releases still be increasing after that time (NRC 2024-TN10308). In response to this RAI (PG&E 2024-TN10619), PG&E clarified that MAAP cases for all six STCs were not limited to 50 hours and were run until they exhibited a plateau for Cesium Iodide (CsI) release. The applicant performed an additional review for other important radioisotope groups important to dose and determined that two STCs, ST1 and ST6, had radioisotope groups that were still somewhat increasing with time at the end of the MAAP calculations. As a result, PG&E assessed the impact on the SAMA analysis from extending the run time to 48 hours after declaration of a general emergency and determined this impact to be negligible, specifically, less than 0.001 percent increase in the total population dose and offsite economic cost.

In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E stated, with regard to the Level 2 PRA, that although the focus of internal events peer reviews was LERF, they included a review of the Level 2 and CET modeling. Additionally, PG&E clarified that Level 2 analyses have been prepared, reviewed, and approved by various experts, including qualified Diablo Canyon PRA personnel and industry PRA experts with Diablo Canyon PRA model experience.

Based on its review of the Level 2 methodology that is in accordance with the NEI 05-01A guidance, PG&E's responses to NRC staff RAIs, and the bases for determining that the resolution to internal PG&E and independent peer reviews of the Level 2 model would not impact the SAMA results, the NRC staff concludes that the Level 2 PRA, as used in the SAMA analysis, provides an acceptable basis for evaluating the benefits associated with various SAMAs.

F.2.2.4 Level 3 Consequence Analysis

PG&E used the WinMACCS computer code, Version 3.10.0, and a core inventory from a plant-specific calculation to determine the offsite consequences from potential releases of radioactive material (PG&E 2023-TN9822). PG&E calculated the core inventory for 3,411 MWt, which is the licensed power level for Diablo Canyon (NRC 2010-TN8607).

The NRC staff reviewed the process used by PG&E to extend the containment performance (Level 2) portion of the PRA to an assessment of offsite consequences (Level 3 PRA model). Source terms used to characterize fission product releases for the applicable containment release categories and the major input assumptions used in the offsite consequence analyses were considered. In ER Section G.3.5, PG&E clarified that the core inventory used in the SAMA radiological dose calculations reflects the current and anticipated Diablo Canyon fuel management and burnup approach during the period of extended operation.

Additional plant-specific input to the Level 3 assessment includes the core release fractions and source terms for each release category, site-specific meteorological data, projected population distribution and expected growth out to the year 2045 within a 50 mi (80 km) radius, emergency evacuation modeling, and economic data. This information is provided in Section G.3 of Attachment G to the ER (PG&E 2023-TN9822).

According to the ER, PG&E considered site-specific meteorological data for the calendar years 2002, 2004, 2006, and 2022. PG&E explained that the 2022 data set was used to support the SAMA analysis as it was found to be the most conservative of the four data sets, resulting in the highest PDR and OECR. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E explained that all hourly meteorological data used in the consequence analysis (i.e., wind direction, temperatures used to develop the atmospheric stability factor, and precipitation) were collected using the Diablo Canyon meteorological monitoring system.

Missing meteorological data were obtained by interpolation (if the data gap was less than 6 hours) or by substitution (that is, using data from the same hour and a nearby day if the data gap was 6 or more consecutive hours). After reviewing the meteorological data for reasonableness, PG&E determined that less than 0.1 percent and 0.3 percent of wind speed and direction data were revised via interpolation and substitution, respectively. Over the period of collection, less than one percent of temperature data were missing, with the hours of missing data filled by substitution. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that there were no missing precipitation data but that the data were assessed for reasonableness.

For atmospheric mixing height data, the NRC staff noted in an RAI that values are based on 1972 U.S. Environmental Protection Agency (EPA) data (NRC 2024-TN10308). In response to this RAI (PG&E 2024-TN10619), PG&E clarified that atmospheric mixing height data for Diablo Canyon are limited and determined that the only other data applicable to Diablo Canyon were from EPA sources for the eight-year period between 1984 and 1991. The applicant performed two sensitivity studies applying the minimum and maximum mixing layer heights obtained over the eight-year period. With the maximum mixing layer heights, the offsite economic cost was reported to increase by 3.1 percent, and with the minimum heights, the offsite economic cost was reported to increase by 4.8 percent. For both cases, the total population dose risk was reported to increase by 2.4 percent. Given the small or negligible change in the population dose and offsite economic cost, the NRC staff concludes that the assumption related to mixing layer heights is reasonable and acceptable for the purposes of the SAMA evaluation.

The sources of data and models for atmospheric dispersion used by the applicant are consistent with standard industry practice and are acceptable for calculating consequences from potential airborne releases of radioactive material. Because multiple years of meteorological data were considered by the applicant and the annual data set that resulted in the largest total population dose and offsite economic cost was selected for the SAMA analysis, the NRC staff finds that the data selection was performed in accordance with NEI 05-01A, and thus, the meteorological data are appropriate for use in the SAMA analysis.

PG&E projected population distribution and expected growth within a radius of 50 mi (80 km) out to the year 2045 to account for the time remaining on the original operating licenses plus a 20-year period of extended operation (PG&E 2023-TN9822). The PG&E assessment used U.S. Census 2010 data and scaled the population data to 2045 using county-level projection estimates for California. Transient populations were included in the projections. The total projected population of the 50 mi (80 km) zone of analysis is 509,281, and the distribution of the 2045 total population is summarized in Table G.3-5 of the ER. The NRC staff considers the methods and assumptions for estimating population to be reasonable and acceptable for the purposes of the SAMA evaluation because its review of PG&E's assessment determined that PG&E considered appropriate data sources, used a reasonable approach for applying data, and followed NRC guidance (NEI 2005-TN1978).

PG&E assumed that 99 percent of the population within the emergency planning zone (EPZ) would evacuate (PG&E 2023-TN9822). This assumption is more conservative relative to the NUREG-1150 study (NRC 1990-TN525), which assumed evacuation of 99.5 percent of the population within the 10-mile EPZ. While PG&E did not perform a sensitivity analysis on the time to declaration of an emergency, PG&E conservatively added an additional 30 minutes to the evacuation times from the Diablo Canyon evacuation time estimate study, as discussed in ER Section G.3.6, to account for processing time by offsite officials within the SAMA evaluations.

PG&E assumed that the delay time for the population to evacuate following a declaration of an emergency is 101 minutes for the first cohort and 176 minutes for the second cohort (PG&E 2023-TN9822). PG&E performed a sensitivity analysis assuming the delay time was doubled for each cohort. The population dose was reported to increase by 2 percent, and the offsite economic cost was reported to be unchanged. Given the small or negligible change in the population dose and offsite economic cost, the NRC staff concludes that the assumption related to the delay time to evacuate is reasonable and acceptable for the purposes of the SAMA evaluation.

PG&E also considered a sensitivity analysis on evacuation speed, which was assumed to be 2.5 meters per second (m/s) (5.6 mph) for the first cohort and 1.8 meters per second (4.0 mph) for the second cohort in the base case used to support the SAMA evaluations (PG&E 2023-TN9822). PG&E performed sensitivity analyses that both increased and reduced the evacuation speeds for each cohort by a factor of 2. When the evacuation speed was increased, the population dose was reported to decrease by 2 percent, and when it was decreased, the population dose was reported to increase by 4 percent. For both cases, the offsite economic cost was reported to be unchanged. Given the small or negligible change in the population dose and offsite economic cost, the NRC staff concludes that the assumption related to the evacuation speed is reasonable and acceptable for the purposes of the SAMA evaluation.

PG&E assumed that the rate of release of sensible heat in each plume segment was in the range of 1×10^6 to 1×10^7 watts (PG&E 2023-TN9822). PG&E performed sensitivity analyses assuming that the rate of release of sensible heat in each plume segment was zero watts or, in other words, that there was no buoyant plume rise. The population dose was increased by one percent, and the offsite economic cost was increased by two percent. Given the small or negligible change in the population dose and offsite economic cost, the NRC staff concludes that the assumption regarding the rate of release of sensible heat in plume segments is reasonable and acceptable for the purposes of the SAMA evaluation.

PG&E assumed that the height of the release of the plumes was at mid-containment or 33.3 m (109.2 ft) (PG&E 2023-TN9822). PG&E performed sensitivity analyses assuming the height of the release of the plumes was at the ground surface (ground release) and at the top of containment or 66.6 meters (218.5 feet). The population dose increased by 0.2 percent for the ground release and decreased by 1 percent for the top of containment release. The offsite economic cost decreased by 0.3 percent for the ground release and decreased by two percent for the top of containment release. Given the small change in the population dose and offsite economic cost, the NRC staff concludes that the plume release height assumption is reasonable and acceptable for the purposes of the SAMA evaluation.

NUREG/CR-7270 (NRC 2022-TN10655) defines the intermediate phase as the time period that immediately follows the early phase and as having a duration from zero to one year. PG&E assumed that the intermediate phase was 6 months (PG&E 2023-TN9822). PG&E performed sensitivity analyses assuming the intermediate phase at one week and at one year. The population dose increased by 9 percent for one week and decreased by 16 percent for 1 year. The offsite economic cost decreased by 19 percent for 1 week and increased by 103 percent for 1 year. The change in the population dose is small, and the change in the maximum averted cost risk is bounded by the uncertainty analysis results discussed in Section F.6.2. Thus, the staff considers the MACCS values that were used by the applicant to be reasonable for the SAMA analysis.

The site-specific regional economic and agricultural data were provided from the 2012 U.S. Census of Agriculture, SECPOP (Version 4), and the U.S. Bureau of Labor Statistics. Data were obtained for all of the counties that are all or in part within a 50 mi (80 km) radius of the Diablo Canyon site. ER Table G.3-6 summarizes economic parameter inputs used in the Level 3 analysis in support of SAMA evaluations. Economic costs for evacuation, relocation, and decontamination were scaled to year 2022 costs from values in or based on NUREG/CR-7270 (NRC 2022-TN10655) using the ratio of the associated yearly consumer price index (CPI) values. The average cost of decontamination labor was scaled to 2022 costs from the 2012 value obtained from NUREG/CR-7270 using the ratio of the 2022 and 2012 CPI values. The staff considers the MACCS2 values, adjusted to 2022 costs using the CPI, used by the applicant to be reasonable for the SAMA analysis.

As indicated in ER Table G.3-6, PG&E applied values of 365 days for the decontamination time (TIMDEC) and $100,000 per person for the non-farmland decontamination costs (CDNFRM) (PG&E 2023-TN9822). Given that these values bound the sensitivity analysis values recommended in Commission Order CLI-16-07 (NRC 2016-TN4631), the NRC staff concludes that the TIMDEC and CDNFRM values are reasonable and acceptable for the purposes of the SAMA evaluation.

In summary, the NRC staff reviewed PG&E's assessments of the source term, radionuclide releases, meteorological data, projected population distribution, emergency response, and regional economic and agricultural data and evaluated PG&E's responses to NRC staff RAIs, as previously described in this subsection. Based on its review, the NRC staff concludes that PG&E's consequence analysis is acceptable and that PG&E's methodology to estimate offsite consequences for Diablo Canyon and consideration of parameter sensitivities provide an acceptable basis to assess the risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its assessment of offsite risk on the CDFs, population doses, and offsite economic costs reported by PG&E.

F.3 Potential Plant Improvements

The process for identifying potential plant improvements (SAMAs), an evaluation of that process, and the improvements evaluated by PG&E are discussed in this section.

F.3.1 Process for Identifying Potential Plant Improvements

PG&E's process for identifying potential plant improvements consisted of the following elements (PG&E 2023-TN9822):

- review of SAMAs identified in industry documents, specifically NEI 05-01A (NEI 2005-TN1978), as discussed in response to an NRC staff RAI (PG&E 2024-TN10619)
- review of potential plant improvements identified in the Diablo Canyon IPE and IPEEE

- review of SAMA analyses for other PWR plants
- review of the risk-significant events in the current Diablo Canyon PRA Levels 1 and 2 models

Based on this process, PG&E identified a number of potential plant improvements, subjecting them to qualitative and bounding quantitative screening and eliminating those from further consideration using the following criteria:

6. The SAMA modified features are not applicable to Diablo Canyon.
7. The SAMA has already been implemented at Diablo Canyon.
8. The SAMA is similar in nature and could be combined with another SAMA candidate.
9. The SAMA is expected to have a very low benefit (small or no contribution to risk).

Based on this screening, PG&E identified an initial set of 21 candidate SAMAs, referred to as Phase I SAMAs within the applicant's ER (PG&E 2023-TN9822). This set of Phase I SAMAs was further reduced to 13 SAMAs after eliminating those that had an excessive implementation cost (in excess of the maximum averted cost-risk). These remaining 13 SAMAs, referred to as Phase II SAMAs within the applicant's ER, are evaluated in Section G.6 of Attachment G to the ER. As discussed in Section F.6.2, PG&E also considered possible increases in benefits from analysis uncertainties on the results of the SAMA assessment, leading to the retention of an additional 5 Phase I SAMA candidates that underwent Phase II evaluations in Section G.7.2 of Attachment G to the applicant's ER. In Phase II, a detailed evaluation was performed for each of the 18 remaining SAMA candidates, as discussed in Sections F.4 and F.6 below.

F.3.2 Review of PG&E's Process

The initial SAMA list was developed primarily from the cost-beneficial SAMAs from 8 previous PWR license renewal applications and from Diablo Canyon-specific assessments. Additionally, while the Diablo Canyon IPE and IPEEE did not identify any vulnerabilities requiring enhancements, all the plant enhancements identified in these documents have been implemented except one (PG&E 2023-TN9822). PG&E determined through further investigation that the one enhancement not implemented was found to not be necessary on account of existing capabilities and procedures being considered sufficient. Finally, a review of the Diablo Canyon PRA Levels 1 and 2 results was performed to identify any additional SAMAs and confirm that all important events had been addressed. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified that the SAMAs identified in industry documents, specifically NEI 05-01A (NEI 2005-TN1978), were consulted to inform the generation of plant-specific SAMAs for dominant risk contributors.

In Table G.5-1 of the ER (PG&E 2023-TN9822), PG&E provided a tabular listing of the Level 1 PRA split fractions having CDF importance down to a risk reduction worth (RRW) of 1.025. This listing included consideration of internal events, including internal flooding, as well as fire and seismic events. In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E clarified the process used to review split fractions and ensure that SAMAs are evaluated for each dominant risk contributor, as defined by NEI 05-01. This process included a robust review of associated accident sequences as well as systems, structures, and components (SSCs) and operator actions that may affect multiple split fractions. PG&E further explained that the results of the review also provided validation for the cutoff value used to determine what a dominant risk contributor is in the context of the SAMA analysis as no new contributors were being identified for split fractions near the 1.025 RRW threshold.

In Tables G.5-2A and G.5-2B of the ER (PG&E 2023-TN9822), PG&E also provided and reviewed the split fractions having early (STCs 1 and 2) and late (STC 3) release frequency importance, down to an RRW of 1.025. These release category groups combine to represent over 98 percent of the PDR and 99 percent of the OECR for approximately 50 percent of the Level 2 frequency. Exclusion of the other results from the Level 2 review allows the contributors that are most important to PDR and OECR to rise to the top of the importance list.

As discussed above in Section F.2.2.2, the Diablo Canyon external flooding focused evaluation demonstrated that there was adequate physical margin for the LIP hazard. Considering that permanent, passive protection is in place at Diablo Canyon for these conservatively analyzed floods, the contribution to CDF from external flooding, as clarified in the response to an NRC staff RAI (PG&E 2024-TN10619), is negligible. Furthermore, the NRC staff notes that no additional external flooding SAMAs need to be considered because PG&E has implemented the NRC-mandated safety enhancements from the lessons learned from the Fukushima Dai-ichi accident and has completed its response to the 10 CFR 50.54(f) letter for Diablo Canyon (NRC 2020).

The NRC staff questioned the applicant about additional potentially lower-cost alternatives to a number of the SAMAs (NRC 2024). In response to an NRC staff RAI (PG&E 2024-TN10619), PG&E explained that consistent with NEI 05-01A (NEI 2005-TN1978), PG&E's process considered potentially lower-cost SAMAs involving procedure changes or enhancements to programs, including training and surveillance programs, as well as non-permanent hardware changes, such as temporary connections using commercial grade equipment. The applicant further clarified that existing FLEX strategies already address many of the contributors to risk for which there is time to deploy lower-cost alternatives, such as portable generators, pumps, and temporary crossties.

The NRC staff notes that the set of SAMAs submitted is not all-inclusive because additional, possibly even less expensive, alternatives can always be proposed. However, the staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements likely would not cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered.

The NRC staff concludes that PG&E used a systematic and comprehensive process for identifying potential plant improvements for Diablo Canyon, which included reviewing a list of generic industry SAMAs (NEI 2005-TN1978); reviewing insights from the Diablo Canyon plant specific risk studies, including internal initiating events as well as fire, seismic, and other external initiated events; considering cost-beneficial plant improvements from previous SAMA analyses; and satisfactorily addressing the NRC staff's questions regarding the SAMA identification process. The staff further concludes that the set of SAMAs evaluated in the ER, together with those evaluated in response to staff inquiries, is reasonably comprehensive and acceptable.

F.4 Risk Reduction Potential of Plant Improvements

In the ER, and in response to an NRC staff RAI, the applicant evaluated the risk-reduction potential of the 18 SAMAs that were not screened out in the Phase I analysis and were retained for the Phase II evaluation. This includes the five additional SAMAs that underwent Phase II evaluations as a means to address possible increases in benefits from analysis uncertainties on the results of the SAMA assessment, as discussed in Section F.6.2. The SAMA evaluations were performed using generally conservative assumptions (e.g., the SAMA is assumed to completely eliminate the associated risk).

Table F-7 lists the assumptions considered to estimate the risk reduction for each of the evaluated SAMAs; the estimated risk reduction in terms of percent reduction in CDF, PDR, and OECR; the estimated total benefit (present value) of the averted risk, and the estimated implementation cost. The estimated benefits reported in Table F-7 reflect the combined benefit in both internal and external events. The determination of the implementation costs and benefits for the various SAMAs are further discussed in Sections F.5 and F.7, respectively. The SAMAs **identified in bold in** Table F-7 were found to be potentially cost beneficial; the other listed SAMAs were determined not to be potentially cost beneficial, which is further discussed in Section F.6.

PG&E used model re-quantification to determine the potential benefits for each SAMA. The CDF, PDR, and OECR were estimated using the DC05A model. The changes made to the model to quantify the impact of SAMAs are detailed in Sections G.6 and G.2.7 of Attachment G to the ER (PG&E 2023-TN9822). Bounding evaluations were performed to address each of the Phase II SAMA candidates.

The NRC staff review of the assumptions and risk reduction potential for the SAMAs led to an RAI related to SAMAs 12 and 13 (NRC 2024-TN10308). In response (PG&E 2024-TN10619), PG&E clarified that the benefits associated with SAMAs 12 and 13 were only realized for the most dominant subset of those accident sequences that could potentially benefit from these SAMAs, underestimating their associated benefit. As a result, PG&E extended modeling changes to all applicable split fractions within the risk models and provided updated cost-benefit evaluations, as summarized in Table F-7. The applicant also reviewed other SAMAs and confirmed that their benefits were applied to all applicable sequences. The impact of this issue on the SAMA analysis is further addressed in Section F.6.2.

The NRC staff concludes that, with the above clarifications, the consideration of risk reduction potential of plant improvements by PG&E is sufficient and appropriate for use in the SAMA evaluation because it is technically sufficient and meets the guidance provided in NEI 05-01A.

Table F-7 Severe Accident Mitigation Alternative Cost/Benefit Analysis for Diablo Canyon Nuclear Power Plant[(a)]

SAMAs	Analysis Assumptions	% Risk Reduction			Internal and External Benefit	Internal and External Benefit with Uncertainty	Implementation Cost
		CDF	PDR	OECR			
1[(d)] – Use Alternate Engine-Driven High Pressure (HP) Pump for Secondary Side Makeup	Reduce Auxiliary Feedwater (AFW) split fractions by a factor of 100 and eliminate the turbine-driven AFW split fraction assigned for seismic events.	43.6	36.0	33.6	$5,267,856	$13,696,426	$35,986,656
2 – Backup Air System for Power Operated Relief Valve (PORV) PCV-474	Remove dependency on instrument air from associated bleed and feed scenarios.	2.5	3.4	3.6	$486,206	$1,264,136	$4,700,106
4 – Provide an Auto Trip Function for the Reactor Coolant Pumps (RCPs) on High Seal Temperature	Eliminate complications associated with fire-induced damage to instrumentation on related operator actions.	3.2	3.9	4.0	$557,153	$1,448,598	$8,945,208
5[(d)] – Use Alternate Engine-Driven HP Pump for Secondary Side Makeup (SAMA 1) and Protect Pressurizer Heater and PORV Cables in Fire Area 13C	Apply SAMA 1 assumptions and completely eliminate fire risk in Fire Area 13C.	44.0	36.4	34.0	$5,334,551	$13,869,833	$37,924,896
6 – Protect Cable Related to Instrumentation Required to Support Bleed and Feed Operation in Fire Area 5A4	Completely eliminate fire-induced failures of instrumentation in Fire Area 5A4.	2.1	1.1	0.9	$170,021	$442,055	$2,390,496
7 – Protect Cable Related to All 4 Steam Generator (SG) Atmospheric Dump Valve (ADVs), AFW Level Control Valves to SGs 2 and 3, and Charging System HCV-142 in Fire Area 5A4	Completely eliminate all fire-induced failures of associated components in Fire Area 5A4.	5.6	2.7	2.0	$419,169	$1,089,839	$8,625,168

Table F-7 **Severe Accident Mitigation Alternative Cost/Benefit Analysis for Diablo Canyon Nuclear Power Plant[a] (Continued)**

SAMAs	Analysis Assumptions	% Risk Reduction			Internal and External Benefit	Internal and External Benefit with Uncertainty	Implementation Cost
		CDF	PDR	OECR			
8 – Protect Cables and Components Required for Operation of AFW Motor Driven Pump In Fire Area 14A	Completely eliminate all fire-induced failures of pump in Fire Area 14A.	9.6	10.3	10.1	$1,474,639	$3,834,061	$1,679,808
9 – Install an Automatic Suppression System (Nitrogen-Water Mist) in Fire Areas 6A1, 6A2, and 6A3	Completely eliminate all fire risk in Fire Areas 6A1, 6A2, and 6A3.	1.5	1.1	1.0	$167,315	$435,019	$12,372,432
11 – Change Procedures to Explicitly Address Vulnerability of Automatic Safety Injection (SI)	Improve the degraded split fraction to assume availability of instrumentation used to diagnose the need for manual SI actuation.	4.1	5.9	6.2	$838,549	$2,180,227	$564,513
12 – Install a Seismically Qualified Extended Loss of AC Power (ELAP) Battery	Replace split fractions to represent those associated with battery failure.[b]	4.8[c]	6.9[c]	7.8[c]	$1,021,116[c]	$2,654,902[c]	$8,237,520[c]
13 – Backup Air System to PORV PCV-474 and Crosstie Battery Chargers To Vital Busses	Eliminate instrument air dependency and allow for automatic alignment to other power supplies. [b]	8.3[c]	6.9[c]	7.3[c]	$1,071,475[c]	$2,785,835[c]	$12,706,778[c]
14[d] – Fully Automate Bleed and Feed Initiation	Eliminate associated operator error and replace with failure probability of representative hardware system.	7.8	6.0	5.5	$883,575	$2,297,295	$20,012,328
15 – Protect EDGs from Water Spray Damage	Completely eliminate risk of scenarios that lead to spray damage.	1.2	0.9	0.8	$134,932	$350,823	$9,497,376

Table F-7 Severe Accident Mitigation Alternative Cost/Benefit Analysis for Diablo Canyon Nuclear Power Plant[(a)] (Continued)

SAMAs	Analysis Assumptions	% Risk Reduction CDF	PDR	OECR	Internal and External Benefit	Internal and External Benefit with Uncertainty	Implementation Cost
16 – Remove the Domestic Water Piping for Eyewash Stations in Areas 6-B-1, 6-B-2, 6-B-3, 6-A-1, 6-A-2, and 6-A-3, and Install Portable Eyewash Units	Completely eliminate risk of associated flooding scenarios.	0.1	0.1	0.1	$19,252	$50,055	$275,230
17[(d)] – Seismically Qualified Alternate 480V AC Emergency Diesel Generator (EDG) to Support Long-Term AFW Operation and a Seismically Qualified 480V AC Self-Cooled Motor Driven Pump for RCS Makeup	Replace split fraction and failure probabilities to represent those of a lower magnitude seismic event.[(b)]	7.5	8.1	7.9	$1,153,966	$3,000,312	$20,416,128
20 – Install Flood Sensors to Mitigate Fire Protection System Pipe Breaks	Completely eliminate risk of associated flooding scenarios.	2.2	0.5	0.1	$86,653	$225,298	$14,415,660
21[(d)] – Automate the Transition of the RCS Injection System to Recirculation Mode	Eliminate associated operator error and replace with failure probability of representative hardware system.	1.7	1.0	0.8	$153,357	$398,728	$15,924,702
22 – Use Fire Water System as Backup for SG Inventory	Replace split fraction representing loss of all AFW support with that of a representative redundant system (except when fire water storage tank is failed by seismic events).	20.7	17.7	16.6	$2,579,656	$6,707,106	$9,626,592

AC = alternating current; ADV = Atmospheric Dump Valve; AFW = Auxiliary Feedwater; CDF = core damage frequency; EDG = Emergency Diesel Generator; ELAP = Extended Loss of AC Power; HP = High Pressure; n/a = not applicable or not available; OECR = offsite economic cost risk; PDR = population dose risk; PORV = Power Operated Relief Valve; RCP = Reactor Coolant Pumps; RCS = Reactor Coolant System; SAMA = severe accident mitigation alternative; SG = Steam Generator; SI = Safety Injection.

(a) SAMAs in bold are potentially cost beneficial.
(b) Analysis assumptions were clarified in response to an NRC staff RAI (PG&E 2024-TN10619).
(c) Information provided in response to an NRC staff RAI (PG&E 2024-TN10619).
(d) SAMA underwent a Phase II evaluation to assess possible increases in benefits from analysis uncertainties.

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F.5 Cost Impacts of Candidate Plant Improvements

As enumerated in Table F-7, PG&E estimated the costs of implementing the 18 SAMAs for which a Phase II evaluation was performed using a site-specific cost estimating process. PG&E provided cost estimates for implementation of the Diablo Canyon SAMAs in Table G.5-3 of Attachment G to the ER (PG&E 2023-TN9822).

In Section G.6 of the ER (PG&E 2023-TN9822), PG&E clarified that the cost estimates used in the Phases I and II SAMA analyses are Diablo Canyon specific and include costs for training, procedure revisions, and simulator modifications. Estimates were developed by the nuclear power plant's cost estimator tool, based on the conceptual scope of the designs provided to the estimator by the Diablo Canyon SAMA team, and consistent with guidance in NEI 05-01A (NEI 2005-TN1978). The cost estimates did not include the cost of replacement power during extended outages, if required to implement the modifications, nor did the cost estimates include contingency costs associated with unforeseen implementation obstacles. Additionally, Diablo Canyon-specific implementation costs were estimated in 2023 U.S. dollars with no allowances for escalation, including during implementation. Lastly, as clarified in Section G.4.6.3 of the ER, implementation costs were originally developed on a site basis and divided by 2 for use in the SAMA analysis as a means of accounting for any economy of scale that may result from implementing the same SAMA at both units.

The NRC staff reviewed the applicant's cost estimates, presented in Table G.5-3 of Attachment G to the ER (PG&E 2023-TN9822). For certain improvements, the NRC staff also compared the cost estimates to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors. The NRC staff also reviewed the basis for the cost estimates during the NRC audit of the SAMA analysis (NRC 2024-TN10308).

The NRC staff concludes that the cost estimates provided by PG&E are sufficient for use in the SAMA evaluation because economic viability of the proposed modification could be adequately gauged, and the process meets the guidance in NEI 05-01A.

F.6 Cost-Benefit Comparison

PG&E's cost-benefit analysis and the NRC staff's review are described in the following sections.

F.6.1 PG&E's Evaluation

The methodology used by PG&E was based primarily on NRC guidance for performing cost-benefit analysis, i.e., NUREG/BR–0184 (NRC 1997-TN676), which is referenced in NEI 05-01A. As described in Sections G.4 and G.6 of the ER (PG&E 2023-TN9822), the net value was determined for each SAMA according to the following formula:

$$\text{Net Value} = (\text{APE} + \text{AOC} + \text{AOE} + \text{AOSC}) - \text{COE}$$

where:

APE (averted public exposure) = present value of APE costs ($)
AOC (averted offsite property damage costs) = present value of AOC costs ($)
AOE (averted occupational exposure) = present value of AOE costs ($)
AOSC (averted onsite costs) = present value of AOSC ($)
COE = cost of enhancement ($)

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA, and it is not considered to be cost beneficial. PG&E's derivation of each of the associated costs is summarized next.

NEI 05-01A states that two sets of estimates should be developed for discount rates of 7 percent and 3 percent (NEI 2005-TN1978). PG&E provided a base set of results using a discount rate of 3 percent and a 20-year license renewal period.

F.6.1.1 Averted Public Exposure (APE) Costs

PG&E defined annual offsite exposure risk, or APE, as the monetary value of accident risk avoided from population doses after discounting (PG&E 2023-TN9822). The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δ person-rem per year)

× monetary equivalent of unit dose ($7,900 per person-rem)
× present value conversion (NRC 1997-TN676)

The monetary equivalent of dose of $7,900 per person-rem was determined using the methodology in NUREG-1530, Revision 1 (NRC 2022-TN7859). The annual reduction in public exposure was calculated according to the following formula:

Annual reduction in public exposure = (Accident frequency without modification × accident population dose without modification) – (Accident frequency with modification × accident population dose with modification)

As stated in NUREG/BR–0184 (NRC 1997-TN676), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the 20-year renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For a discount rate of 3 percent and a 20-year analysis period with a CDF of 8.68×10^{-5} per year and a monetary equivalent of unit dose of $7,900 per person-rem, the applicant calculated an APE cost of approximately $4,377,100 (PG&E 2023-TN9822).

F.6.1.2 Averted Offsite Property Damage Costs (AOC)

PG&E defined annual offsite economic cost risk, or AOC, as the monetary value of risk avoided from offsite property damage after discounting (PG&E 2023-TN9822). The AOC values were calculated using the following formula:

AOC = Annual reduction in offsite property damage × present value conversion

The annual reduction in offsite property damage was calculated according to the following formula:

Annual reduction in offsite property damage = (Accident frequency without modification × accident property damage without modification) – (Accident frequency with modification × accident property damage with modification)

For a discount rate of 3 percent and a 20-year analysis period with a CDF of 8.68×10^{-5} per year, the applicant calculated an AOC of approximately $7,447,000 (PG&E 2023-TN9822).

F.6.1.3 Averted Occupational Exposure (AOE) Costs

PG&E defined annual on-site or occupational exposure risk, or AOE, as the avoided onsite exposure (PG&E 2023-TN9822). Similar to the APE calculations, the applicant calculated costs for immediate onsite exposure. Long-term onsite exposure costs were calculated consistent with guidance in NUREG/BR–0184 (NRC 1997-TN676).

PG&E derived the values for averted occupational exposure from information provided in Section 5.7.3 of NUREG/BR–0184 (NRC 1997-TN676). Best estimate values provided for immediate occupational dose (3,300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year clean-up period) were used. The present value of these doses was calculated using the equations provided in NUREG/BR–0184 with a monetary equivalent of unit dose of $7,900 per person-rem, a real discount rate of 3 percent, and an analysis period of 20 years to represent the remaining life of the plant. Immediate and long-term onsite exposure costs were summed to determine AOE cost. For a CDF of 8.68×10^{-5} per year, the applicant calculated an AOE cost of approximately $212,200 (PG&E 2023-TN9822).

F.6.1.4 Averted Onsite Costs (AOSC)

AOSC includes averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. The applicant derived the values for AOSC based on information provided in Section 5.7.6 of NUREG/BR–0184 (NRC 1997-TN676). This cost element was divided into two parts: the onsite cleanup and decontamination cost, also commonly referred to as averted cleanup and decontamination costs, and the replacement power cost (RPC).

Averted cleanup and decontamination costs (ACC) were calculated using the following formula:

ACC = Annual CDF reduction

× present value of clean-up costs per core damage event

× present value conversion factor

The total cost of clean-up and decontamination subsequent to a severe accident is estimated in NUREG/BR–0184 to be $\$1.5 \times 10^9$ (undiscounted). This value was converted to present costs spread over a 10-year clean-up period and integrated over the term of the proposed license extension. For a discount rate of 3 percent and an analysis period of 20 years with a CDF of 8.68×10^{-5} per year, PG&E calculated an ACC of approximately $1,691,700 (PG&E 2023-TN9822).

Long-term RPCs were calculated using the following formula:

RPC = Annual CDF reduction

× present value of replacement power for a single event

× factor to account for remaining service years for which replacement power is required

× reactor power scaling factor

The applicant based its calculations on a net electric output of 1180 megawatts electric (MWe) and scaled up from the 910 MWe reference plant in NUREG/BR-0184 (NRC 1997-TN676). Therefore, the applicant applied a power-scaling factor of 1.30 (1180/910) to determine the RPC. For a discount rate of 3 percent and a 20-year analysis period with a CDF of 8.68×10^{-5} per year, PG&E calculated an RPC of $621,900 (PG&E 2023-TN9822). AOSC, the summation of ACC and RPC, is therefore approximately $2,313,600 for the 20-year analysis period and a discount rate of 3 percent.

Using the above equations, PG&E estimated the total present dollar value equivalent associated with completely eliminating severe accidents due to internal events as well as internal flooding, fire, and seismic events at Diablo Canyon to be about approximately $14,350,000 (PG&E 2023-TN9822).

PG&E multiplied the estimated benefit for internal events, internal flooding, fire, and seismic contributors by a factor of 1.018 to account for the risk contributions from external (excluding seismic) events to yield the internal and external benefit or maximum attainable risk benefit (PG&E 2023-TN9822). Additionally, the internal and external benefits were multiplied by a factor of 2.6 to account for uncertainties in the CDF calculation (PG&E 2023-TN9822).

F.6.1.5 PG&E's Results

If the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA was determined not cost beneficial. If the benefit exceeded the estimated cost, the SAMA candidate was considered cost beneficial. In the baseline analysis, without consideration of uncertainty, one SAMA candidate (i.e., SAMA 11) was found to be potentially cost beneficial (PG&E 2023-TN9822). Based on consideration of uncertainty analysis, PG&E identified one additional SAMA candidate (i.e., SAMA 8) as potentially cost beneficial. The results of the cost-benefit evaluation are presented in Table F-7.

The potentially cost-beneficial SAMAs are:

- SAMA 8—Protect cables and components required for operation of auxiliary feedwater motor driven pump 1-2 in Fire Area 14A
- SAMA 11—Change procedures to explicitly address vulnerability of automatic safety injection

PG&E stated in ER Section G.8 that neither SAMA identified as potentially cost beneficial is aging related and that PG&E will formally evaluate these SAMA candidates for potential implementation at the plant (PG&E 2023-TN9822).

F.6.2 Review of PG&E's Cost-Benefit Evaluation

Based primarily on NUREG/BR–0184 (NRC 1997-TN676) and NUREG-1530 guidelines on discount rates (NRC 2022-TN7859), the NRC staff determined that the cost-benefit analysis performed by PG&E was consistent with the guidance. Two SAMA candidates were found to be potentially cost beneficial based on the benefit from internal and external events, assuming an external events multiplier of 1.018 (PG&E 2024-TN10619).

The applicant considered possible increases in benefits from analysis uncertainties on the results of the SAMA assessment. PG&E stated that the 95th percentile value of the Diablo Canyon Level 1 CDF was a factor of 2.6 greater than the mean CDF. Thus, a multiplication factor of 2.6 was selected by the applicant to account for uncertainty in internal events, including internal flooding, as well as fire and seismic events. As indicated in Section F.6.1.5, one additional SAMA candidate (i.e., SAMA 8) was determined to be potentially cost beneficial as a result of the uncertainty analysis (PG&E 2023-TN9822).

The NRC staff considers that the multiplier of 2.6 used to account for uncertainty in internal events, including internal flooding, as well as fire and seismic events provides adequate margin and is acceptable for the SAMA analysis.

As discussed in Section F.2.2.4, PG&E performed additional sensitivity analyses on MACCS input parameters for atmospheric mixing height, the delay time for the population to evacuate, evacuation speed, the rate of release of sensible heat in each plume segment, plume release height, and the length of the intermediate phase. No additional cost-beneficial SAMAs were identified as a result of these sensitivity analyses (NRC 2024-TN10161, PG&E 2024-TN10619).

Additionally, the NRC staff observed in an RAI that some other information requests had the potential to impact the results of the baseline SAMA analysis. These include requests to assess the impact of crediting FLEX strategies consistent with NRC guidance (NRC 2022-TN10641, NRC 2022-TN7859), as discussed in Section F.2.2.1; new seismic hazard information, as discussed in Section F.2.2.2; and revised modeling assumptions related to SAMAs 12 and 13, as discussed in Section F.4. In response (PG&E 2024-TN10619), PG&E assessed the individual impact of each issue on the SAMA evaluation. In a separate response (PG&E 2024-TN10619), the applicant further examined the cumulative impact of these modeling changes and determined that incorporating all of them into the baseline PRA model used to support the SAMA analysis would not alter the conclusions of the SAMA analysis. Consequently, no additional cost-beneficial SAMAs were identified as a result of this examination.

The NRC staff concludes that the cost-benefit results provided by PG&E are sufficient for use in the SAMA evaluation because the process and methodology for estimating the maximum attainable risk benefit, and for performing uncertainty and sensitivity analyses, meet the guidance in NEI 05-01A (NEI 2005-TN1978), NUREG/BR–0184 (NRC 1997-TN676), and NUREG-1530 (NRC 2022-TN7859).

F.7 Conclusions

Based on NRC and industry documentation of potential plant improvements, its review of SAMA analyses for other PWR plants, Diablo Canyon IPE and IPEEE assessments, and risk significant contributors at Diablo Canyon from plant-specific probabilistic safety assessment models, PG&E identified 21 candidate SAMAs after eliminating those candidates that were not applicable to Diablo Canyon, had already been implemented at Diablo Canyon, were combined with another SAMA candidate, or were expected to have a very low benefit. Phase I screening reduced the list to 13 unique SAMA candidates by eliminating SAMAs that have an excessive implementation cost.

For the 13 remaining SAMA candidates, PG&E performed a cost-benefit analysis. Five additional SAMAs also underwent a cost-benefit analysis as a means to address possible increases in benefits from analysis uncertainties on the results of the SAMA assessment. Results from the cost-benefit analysis of these 18 SAMA candidates are shown in Table F-7.

The cost-benefit analysis identified two potentially cost-beneficial SAMAs (i.e., SAMAs 8 and 11). Sensitivity cases were analyzed for the MACCS input parameters as well as PRA modeling changes that could impact the baseline SAMA analysis, but no additional potentially cost-beneficial SAMAs were identified.

The NRC staff reviewed the PG&E SAMA analysis, including the PG&E responses to an NRC staff RAI, and concludes that, as discussed in this appendix, the methods used and the implementation of those methods were sound. Based on the applicant's treatment of SAMA benefits and costs, the NRC staff finds that the SAMA evaluations performed by PG&E are reasonable and sufficient for the license renewal submittal.

The NRC staff agrees with PG&E's conclusion that the two candidate SAMAs discussed in this section are potentially cost beneficial, which was based on generally conservative treatment of costs, benefits, and uncertainties. This conclusion of a small number of potentially cost-beneficial SAMAs is consistent with the low residual level of risk indicated in the Diablo Canyon PRA and the fact that PG&E has already implemented the plant improvements identified from the IPE and IPEEE. Because the potentially cost-beneficial SAMAs do not relate to aging management during the period of extended operation, they do not need to be implemented as part of license renewal in accordance with 10 CFR Part 54 (TN4878). Nevertheless, PG&E will formally evaluate these SAMA candidates for potential implementation at Diablo Canyon (PG&E 2023-TN9822).

F.8 References

10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." TN4878.

ANSI/ANS (American National Standards Institute/American Nuclear Society). 2007. *American National Standard, External-Events PRA Methodology*. ANSI/ANS-58.21-2007, American Nuclear Society, La Grange Park, Illinois. TN10663.

ASME/ANS (American Society of Mechanical Engineers/American Nuclear Society). 2009. *Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications.* ASME/ANS RA-Sa-2009, Washington, D.C. TN6220.

ASME/ANS (American Society of Mechanical Engineers/American Nuclear Society). 2013. *Case for to ASME/ANS RA-S-2013, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications*. ASME/ANS RA-S CASE 1, Washington, D.C. TN10372.

NEI (Nuclear Energy Institute). 2005. *Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document*. NEI-05-01, Revision A, Washington, D.C. ADAMS Accession No. ML060530203. TN1978.

NEI (Nuclear Energy Institute). 2008. Letter from B. Bradley, Director, Risk Assessment, Nuclear Generation Division, to M. Drouin, Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, dated December 1, 2008, regarding "Submittal of NEI 05-04, Rev. 2, "Process for Performing Internal Events PRA Peer Reviews Using the ASME/ANS PRA Standard," and NEI 07-12, Rev. 0, Draft H, "Fire Probabilistic Risk Assessment (FPRA) Peer Review Process Guidelines." Washington, D.C. ADAMS Accession Package No. ML083430450. TN10638.

NEI (Nuclear Energy Institute). 2010. *Fire Probabilistic Risk Assessment (FPRA) Peer Review Process Guidelines*. NEI 07-12, Revision 1, Washington, D.C. ADAMS Accession No. ML102230070. TN10652.

NEI (Nuclear Energy Institute). 2012. *External Hazards PRA Peer Review Process Guidelines*. NEI 12-13, Washington, D.C. ADAMS Accession No. ML12240A027. TN10643.

NEI (Nuclear Energy Institute). 2016. *Diverse and Flexible Coping Strategies (Flex) Implementation Guide*. NEI 12-06, Revision 4, Washington, D.C. ADAMS Accession No. ML16354B421. TN10640.

NEI (Nuclear Energy Institute). 2017. Letter from V.K. Anderson, Senior Project Manager, to S. Rosenberg, NRC, dated February 21, 2017, regarding "Final Revision of Appendix X to NEI 05-04/07-12/12-16, Close-Out of Facts and Observations (F&Os)." Washington, D.C. ADAMS Accession No. ML17086A431. TN10358.

NEI (Nuclear Energy Institute). 2019. *Performance of PRA Peer Reviews Using the ASME/ANS PRA Standard*. NEI 17-07, Revision 2, Washington, D.C. ADAMS Accession No. ML19241A615. TN10639.

NRC (U.S. Nuclear Regulatory Commission). 1975. *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*. NUREG–75/087, Washington, DC. ADAMS Accession No. ML081510814. TN10359.

NRC (U.S. Nuclear Regulatory Commission). 1990. *Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants*. NUREG–1150, Washington, D.C. ADAMS Accession No. ML040140729. TN525.

NRC (U.S. Nuclear Regulatory Commission). 1991. *Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities - 10 CFR 50.54(f) (Generic Letter 88–20, Supplement 4)*. Washington, DC. ADAMS Accession No. ML031150485. TN10360.

NRC (U.S. Nuclear Regulatory Commission). 1991. *Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities, Final Report*. NUREG-1407, Washington, DC. ADAMS Accession No. ML063550238. TN10361.

NRC (U.S. Nuclear Regulatory Commission). 1991. *Safety Evaluation Report related to the operation of Diablo Canyon Nuclear Power Plant, Units 1 and 2, Docket Nos. 50-275 and 50-323, Pacific Gas and Electric Company*. NUREG-0675, Supplement No. 34, Washington, D.C. ADAMS Accession Package No. ML14279A124. TN10635.

NRC (U.S. Nuclear Regulatory Commission). 1993. Letter from S.R. Peterson, Project Manager, Project Directorate V, Division of Reactor Projects III/IV, to G.M. Rueger, Nuclear Power Generation, Pacific Gas & Electric Company, dated June 30, 1993, regarding "Staff Evaluation of the Diablo Canyon Power Plant (DCPP), Units 1 and 2, Individual Plant Examination (IPE) - Internal Events Submittal (TAC NOS. M74403 and M74404)." ADAMS Accession Package No. ML16342A163. TN10637.

NRC (U.S. Nuclear Regulatory Commission). 1994. *Review of the Diablo Canyon Probabilistic Risk Assessment*. NUREG/CR-5726, BNL-NUREG-52288, Washington, D.C. ADAMS Accession No. ML16342C677. TN10636.

NRC (U.S. Nuclear Regulatory Commission). 1997. *Individual Plant Examination Program: Perspectives on Reactor Safety and Plater Performance*. Volume 1, Part 1 Final Summary Report and Volume 2, Parts 2-5, Final Report, NUREG-1560, Washington D.C. TN7812. Nonpublic.

NRC (U.S. Nuclear Regulatory Commission). 1997. *Regulatory Analysis Technical Evaluation Handbook.* NUREG/BR–0184, Washington, D.C. ADAMS Accession No. ML050190193. TN676.

NRC (U.S. Nuclear Regulatory Commission). 1997. Letter from S.D. Bloom, Program Manager, Project Directorate IV-2, to G.M. Rueger, Senior Vice President and General Manager, Pacific Gas and Electric Company, dated December 4, 1997, regarding "Review of Diablo Canyon Individual Plant Examination of External Events (IPEEE) Submittal (TACS NOS. M83614 and M83615)." ADAMS Accession Package No. ML16342D905. TN10642.

NRC (U.S. Nuclear Regulatory Commission). 2009. *An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities*. Regulatory Guide 1.200, Revision 2, Washington, D.C. ADAMS Accession No. ML090410014. TN6211.

NRC (Nuclear Regulatory Commission). 2003. *Power Reactor Operating Licenses and Technical Specifications*. Washington, D.C. ADAMS Accession No. ML101940006. TN8607.

NRC (U.S. Nuclear Regulatory Commission). 2011. *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis.* Regulatory Guide 1.174, Revision 2, Washington, D.C. ADAMS Accession No. ML100910006. TN10651.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from E. Leeds and M. Johnson to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, dated March 12, 2012, regarding "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events." Washington, D.C. ADAMS Accession No. ML12054A735. TN3237.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from E. Leeds to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, dated March 12, 2012, regarding "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident." Washington, D.C. ADAMS Accession No. ML12053A340. TN2198.

NRC (U.S. Nuclear Regulatory Commission). 2013. *Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications*. Regulatory Guide 4.2, Supplement 1, Revision 1, Washington, D.C. ADAMS Accession No. ML13067A354. TN4791.

NRC (U.S. Nuclear Regulatory Commission). 2014. Letter from P.J. Bamford, Project Manager, Plant Licensing Branch IV-1, Division of Operating Reactor Licensing, to E.D. Halpin, dated June 23, 2024, regarding "Diablo Canyon Power Plant - Staff Assessment of the Flooding Walkdown Report Supporting Implementation of Near-Term Task Force Recommendation 2.3 Related to the Fukushima Dai-ichi Nuclear Power Plant Accident (TAC NOS. MF0221 and MF0222)." Washington, D.C. ADAMS Accession No. ML14136A194. TN10653.

NRC (U.S. Nuclear Regulatory Commission). 2014. Letter from J. Kim, Project Manager, Plant Licensing Branch IV-1, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, to E.D. Halpin, Senior Vice President and Chief Nuclear Officer, Pacific Gas and Electric Company, dated March 14, 2014, regarding "Diablo Canyon Power Plant, Units 1 and 2 - Staff Assessment of the Seismic Walkdown Reports Supporting Implementation of Near-Term Task Force Recommendation 2.3 Related to the Fukushima Dai-ichi Nuclear Power Plant Accident (TAC NOS. MF0117 and MF0118)." Washington, D.C. ADAMS Accession No. ML14070A050. TN10644.

NRC (U.S. Nuclear Regulatory Commission). 2016. Letter from S.P. Lingam, Project Manager, Plant Licensing Branch IV-1, Division of Operating Reactor Licensing, to E.D. Halpin, Senior Vice President and Chief Nuclear Officer, Pacific Gas and Electric Company, dated April 14, 2016, regarding "Diablo Canyon Power Plant, Unit Nos. 1 and 2 - Issuance of Amendments Regarding Transition to a Risk-Informed, Performance-Based Fire Protection Program in Accordance with 10 CFR 50.48(c) (CAC NOS. MF2333 and MF2334)." Washington, D.C. ADAMS Accession Package No. ML16096A302. TN10650.

NRC (U.S. Nuclear Regulatory Commission). 2016. Letter from F. Vega, Project Manager, Hazards Management Branch, Japan Lessons-Learned Division, Office of Nuclear Reactor Regulation, to E.D. Halpin, Senior Vice President and Chief Nuclear Officer, dated December 21, 2016, regarding "Diablo Canyon Power Plant, Unit Nos. 1 and 2 - Staff Assessment of Information Provided Under Title 10 of the Code of Federal Regulations Part 50, Section 50.54(f), Seismic Hazard Reevaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident (CAC NOS. MF5275 and MF5276)." Washington, D.C. ADAMS Accession No. ML16341C057. TN10645.

NRC (U.S. Nuclear Regulatory Commission). 2016. "Memorandum and Order in the Matter of Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3)." CLI-16-07, Rockville, Maryland. ADAMS Accession No. ML16125A150. TN4631.

NRC (U.S. Nuclear Regulatory Commission). 2017. Letter from J.M. Sebrosky, Senior Project Manager, Beyond-Design-Basis Management Branch, Division of Licensing Projects, to E.D. Halpin, Senior Vice President, Generation and Chief Nuclear Officer, Pacific Gas and Electric Company, dated December 18, 2017, regarding "Diablo Canyon Power Plant Unit Nos. 1 and 2 - Flood Hazard Mitigation Strategies Assessment (CAC NOS. MF7919 and MF7920; EPID L-2016-JLD-0007)." Washington, D.C. ADAMS Accession No. ML17321B040. TN10657.

NRC (U.S. Nuclear Regulatory Commission). 2017. Letter from J.M. Sebrosky, Senior Project Manager, Beyond-Design-Basis Management Branch, Division of Licensing Projects, to E.D. Halpin, Senior Vice President, Generation and Chief Nuclear Officer, Pacific Gas and Electric Company, dated December 18, 2017, regarding "Diablo Canyon Power Plant Unit Nos. 1 and 2 - Staff Assessment of Response to 10 CFR 50.54(f) Information Request - Flood-Causing Mechanism Reevaluation (CAC Nos. MF6039 and MF6040L: EPID L-2015-JLD-005)." ADAMS Accession No. ML17024A207. TN10659.

NRC (U.S. Nuclear Regulatory Commission). 2017. Letter from J. Giitter, Director, Division of Risk Assessment, and M.J. Ross-Lee, Director, Division of Operating Reactor Licensing, to G. Krueger, Director, Risk Regulation, Nuclear Energy Institute, dated May 3, 2017, regarding "U.S. Nuclear Regulatory Commission Acceptance on Nuclear Energy Institute Appendix X to Guidance 05-04, 07-12, and 12-13, Close-out of Facts and Observations (F&Os)." Washington, D.C. ADAMS Accession No. ML17079A427. TN10369.

NRC (U.S. Nuclear Regulatory Commission). 2017. Memorandum from Risk Informed Steering Committee, NRC, to S.L. Rosenberg, Branch Chief, dated May 1, 2017, regarding "U.S. Nuclear Regulatory Commission Staff Expectations for an Industry Facts and Observations Independent Assessment Process." Washington, D.C. ADAMS Accession No. ML17121A271. TN10368.

NRC (U.S. Nuclear Regulatory Commission). 2018. Letter from F. Vega, Project Manager, Beyond-Design-Basis Management Branch, Division of Licensing Projects, to J.M. Welsch, Vice President, Nuclear Generation and Chief Nuclear Officer, dated August 8, 2018, regarding "Diablo Canyon Power Plant, Unit Nos. 1 and 2 - Staff Review of Spent Fuel Pool Evaluation Associated with Reevaluated Seismic Hazard Implementing Near-Term Task Force Recommendation 2.1: Seismic (EPID L-2017-JLD-0058)." Washington, D.C. ADAMS Accession No. ML18211A322. TN10646.

NRC (U.S. Nuclear Regulatory Commission). 2019. Letter from L. Lund, Director, Division of Licensing Projects, to J.M. Welsch, dated January 22, 2019, regarding "Diablo Canyon Power Plant, Unit Nos. 1 and 2 - Staff Review of Seismic Probabilistic Risk Assessment Associated with Reevaluated Seismic Hazard Implementation of the Near-Term Task Force Recommendation 2.1: Seismic (EPID No. L-2018-JLD-0006)." Washington, D.C. ADAMS Accession No. ML18254A040. TN10647.

NRC (U.S. Nuclear Regulatory Commission). 2020. Letter from NRC to J.M. Welsch at Pacific Gas and Electric Company, dated May 8, 2020, regarding "Diablo Canyon Power Plant, Unit Nos. 1 and 2 – Documentation of the Completion of Required Actions Taken in Response to the Lessons Learned from the Fukushima Dai-Ichi Accident." Washington, D.C. ADAMS Accession No. ML20093B934. TN7284.

NRC (U.S. Nuclear Regulatory Commission). 2022. *Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy, Final Report*. NUREG-1530, Washington, D.C. ADAMS Accession No. ML22053A025. TN7859.

NRC (U.S. Nuclear Regulatory Commission). 2022. Memorandum from L.C. Fields, Senior Project Manager, Licensing Processes Branch, to R. Chang, Chief, Licensing Processes Branch, dated August 18, 2022, regarding "Summary of the June 21, 2022, U.S. Nuclear Regulatory Commission Public Meeting with Industry to Discuss Items Pertaining to Diverse and Flexible Coping Strategies (Flex) Data Analysis." Washington, D.C. ADAMS Accession Package No. ML22222A203. TN10641.

NRC (U.S. Nuclear Regulatory Commission). 2022. *Technical Bases for Consequence Analyses Using MACCS (MELCOR Accident Consequence Code System)*. NUREG/CR-7270, SAND2022-12166 R, Washington, D.C. ADAMS Accession No. ML22294A091. TN10655.

NRC (U.S. Nuclear Regulatory Commission). 2024. Letter from K. Conway, Environmental Project Manager, to P. Gerfen, PG&E Senior Vice President, dated July 16, 2024, regarding "Diablo Canyon Nuclear Power Plant, Units 1 and 2 - Summary of the June 2024 Audit Related to the License Renewal Application Severe Accident Mitigation Alternatives Review (EPID Number: L-2023-LNE-0004)." Washington, D.C. ADAMS Accession Package No. ML24187A131. TN10308.

NRC (U.S. Nuclear Regulatory Commission). 2024. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Volume 1-3, Revision 2, Washington, D.C. ADAMS Accession No. ML24087A133. TN10161.

Pacific Gas & Electric Company (PG&E). 1988. Letter from D.A. Brand, Senior Vice President and General Manager, Engineering and Construction Services, Business Unit, to NRC Document Control Desk, dated July 31, 1988, regarding "Diablo Canyon Units 1 and 2, Long Term Seismic Program Completion." San Francisco, California. ADAMS Accession Package No. ML16342C204. TN10634.

PG&E (Pacific Gas and Electric Company). 1992. *Diablo Canyon Power Plant Units 1 and 2 Individual Plant Examination*. Avila Beach, California. ADAMS Accession No. ML073600368. TN10662. Nonpublic.

PG&E (Pacific Gas & Electric Company). 1994. Letter from G.M. Rueger, Senior Vice President and General Manager, Nuclear Power Generation, to NRC Document Control Desk, dated June 27, 1994, regarding "Diablo Canyon Units 1 and 2, Response to Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities." PG&E Letter DCL-94-133, San Francisco, California. ADAMS Accession No. ML073600371. TN10620.

PG&E (Pacific Gas & Electric Company). 2013. Letter from B.S. Allen, Site Vice President, to NRC Document Control Desk, dated June 26, 2013, regarding "Diablo Canyon Units 1 and 2, License Amendment Request 13-03, License Amendment Request to Adopt NFPA 805 Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants (2001 Edition)." PG&E Letter DCL-13-065, Avila Beach, California. ADAMS Accession Package No. ML131960159. TN10649.

PG&E (Pacific Gas & Electric Company). 2016. Letter from L.J. Strickland, P.E., Director, Technical Services, to NRC Document Control Desk, dated February 8, 2016, regarding "Diablo Canyon Power Plant Units 1 and 2, Updated Response to Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 Flooding." ADAMS Accession Package No. ML16040A009. TN10660.

PG&E (Pacific Gas & Electric Company). 2017. Letter from J.A. Franke, Vice President, Generation Technical Services, to NRC Document Control Desk, dated July 19, 2017, regarding "Diablo Canyon Power Plant Focused Evaluation Report for External Flooding." PG&E Letter DCL-17-064, Avila Beach, California. ADAMS Accession No. ML17200D161. TN10656.

PG&E (Pacific Gas & Electric Company). 2017. Letter from J.A. Franke, Vice President, Generation Technical Services, to NRC Document Control Desk, dated April 6, 2017, regarding "Submittal of the Diablo Canyon Power Plant Mitigating Strategies Assessment for Flooding Report." PG&E Letter DCL-17-024, Avila Beach, California. ADAMS Accession No. ML17096A766. TN10658.

PG&E (Pacific Gas & Electric Company). 2018. Letter from J.M. Welsch, Vice President, Nuclear Generation and Chief Nuclear Officer, to NRC Document Control Desk, dated April 24, 2018, regarding "Diablo Canyon Power Plant Units 1 and 2, NEI 12-06, Appendix H, Revision 4, H.4.5 Path 5: GMRS > 2 X SSE, Mitigating Strategies Assessment (MSA) report for the New Seismic Hazard Information." PG&E Letter DCL-18-026, Avila Beach, California. ADAMS Accession No. ML18120A119. TN10648.

PG&E (Pacific Gas & Electric). 2023. Letter from P. Gerfen, Senior Vice President and Chief Nuclear Officer, to NRC Document Control Desk, dated November 7, 2023, regarding "Diablo Canyon Units 1 and 2, Docket No. 50-275, OL-DPR-80, Docket No. 50-323, OL-DPR-82, License Renewal Application." Avila Beach, California. ADAMS Accession No. ML23311A154. TN9822.

PG&E (Pacific Gas & Electric Company). 2024. Letter from M.R. Zawalick, Vice President, Business and Technical Services, to NRC Document Control Desk, dated August 15, 2024, regarding "Responses to NRC Requests for Additional Information on the Diablo Canyon Power Plant License Renewal Application Severe Accident Mitigation Alternatives Analysis." PG&E Letter DCL-24-077, Avila Beach, California. ADAMS Accession No. ML24229A120. TN10619.

APPENDIX G

DIABLO CANYON AQUATIC ECOLOGY STUDIES

This appendix describes the methodology and major findings of aquatic ecological studies at the Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon) site. These studies are impingement studies (1985–1986), entrainment studies (1996–1999 and 2008–2009), an alternative cooling technologies assessment (2012 and 2014), Intake Cove bathymetry surveys (2019, 2021, and 2023), and a marine biological resources assessment (2020). Additionally, Pacific Gas and Electric Company (PG&E) has several ongoing monitoring efforts that include a thermal effects monitoring program and a Receiving Water Monitoring Program (RWMP).

G.1 Impingement Studies

G.1.1 1985–1986 Impingement Study

From April 1985 to March 1986, Tenera Environmental Services (Tenera) (PG&E 2010-TN10119) conducted an impingement study at Diablo Canyon in connection with CWA Section 316(b) requirements. The purpose of the study was to investigate the species composition of impinged organisms, determine any seasonal and diel patterns of impingement, examine impingement rates of susceptible fish and invertebrates, and assess the relationship between impingement rates and cooling water system operational parameters, such as frequency of traveling debris screen rotation and washing cycles.

Tenera (PG&E 2010-TN10119) collected impingement samples during 24-hour sampling periods, once a week from Diablo Canyon Unit 1 and/or Unit 2 intake screens when at least one circulating water pump was operational for the unit(s) being sampled. Researchers collected discrete impingement samples during distinct 4-hour periods to characterize diel patterns in impingement. During each sampling period, the screens remained stationary for approximately 3.75 hours and were then rotated and washed for 15 minutes. Researchers sorted fish, invertebrates, and detritus. For all fish and selected macroinvertebrates, researchers identified organisms by species and counted, measured, and weighed them.

During the study, Tenera (PG&E 2010-TN10119) identified 79 cartilaginous skates and rays (Chondrichthyes) and 323 bony fishes (Osteichthyes) in impingement samples. The three most impinged fish species included yellow/olive rockfish (*Sebastes serranoides*, 20 percent of fish collected), thornback rays (*Raja clavata*, 14 percent of fish collected), and plainfin midshipmen (*Porichthys notatus*, 5 percent of fish collected). Surfperch (Embiotocidae) and sculpins (Cottidae) were also susceptible to impingement. Most impinged fish were juveniles, which suggests that older fish can swim away from the intake structure to avoid or escape impingement. Among the impinged shellfish, Tenera (PG&E 2010-TN10119) collected impinged rock crabs (*Romaleon antennarius*), and sharpnose crabs (*Scyra acutifrons*) most often, for a total of 1,294 and 1,143 individuals, respectively. PG&E (2009-TN10113) determined that spider crabs (*Pugettia richii*) and kelp crabs (*Pugettia producta*) were most susceptible to impingement during the beginning of significant West Coast Pacific storm activity (October through December), when large quantities of algal debris can be transported into the intake structure. Table G-1 summarizes total individuals collected in impingement samples and estimated annual impingement losses by taxa.

Table G-1 Total Impingement and Estimated Annual Impingement by Taxa at Diablo Canyon Nuclear Power Plant Site, 1985–1986

Group	Taxa	Common Name	Habitat[(a)]	Number in Impingement Samples[(b)]	Estimated Annual Impingement[(c)(d)]
Finfish	*Sebastes* spp.	rockfish	B, M	117	1,141
Finfish	*Citharichthys* spp.	sanddab	B	49	373
Finfish	Embiotocidae	surfperch	B, M	44	370
Finfish	*Artedius* spp.	sculpin	I	35	323
Finfish	*Porichthys notatus*	plainfin midshipman	B, M	19	200
Finfish	*Gibbonsia* spp.	kelpfish	S, I	17	161
Finfish	*Syngnathus leptorhyncus*	pipefish	M, B	16	296
Finfish	*Eopsetta jordani*	sole	B	11	78
Finfish	*Seriphus politus*	queenfish	B, M	9	121
Finfish	Multiple species	gunnel	B	3	29
Finfish	*Oxylebius pictus* and *Hexagrammos* spp.	greenlings	B, I	2	14
Sharks and rays	Chondrichthyes	sharks and rays[(e)]	B, M	79	Not reported
Macro-invertebrates	Decapods	crabs[(e)]	B	3,566	Not reported

(a) B = benthic; M = midwater; S = subtidal; I = intertidal.
(b) PG&E 2010-TN10119; Tenera 2000-TN10211.
(c) TER 2005-TN10214.
(d) Number represents estimated total individuals impinged per year. Value calculated as total impingement divided by the average collection efficiency (0.73). The NRC staff calculated the average collection efficiency based on the average total percent recovery from the impingement direct release studies described in Table 4–2 in PG&E 2010-TN10119.
(e) Assumes 170 to 365 days of impingement and 9.69×10^6 m^3 (3.42×10^8 ft^3) daily flow.

Tenera (PG&E 2010-TN10119) also assessed the efficiency of impingement collections by releasing dead anchovies between the bar racks and the traveling screens before a 24-hour impingement collection. Tenera then calculated the efficiency as the percentage of the marked fish recovered in the subsequent impingement samples. The collection efficiency ranged from 49 percent to 93 percent and averaged 73 percent (n=10). Thus, on average, 27 percent of impinged fish fall off the screens or are otherwise lost from the sample. Tenera (PG&E 2010-TN10119) used the collection efficiency in the impingement estimates summarized in Table G-1.

Impingement losses during the 1985–1986 impingement study averaged approximately 2 fish per 1 m^3 (3.53×10^7 cubic feet [ft^3]) of water withdrawn (PG&E 2009-TN10113). PG&E (PG&E 2009-TN10113) stated that impingement losses during full flow intake operations (4 main circulating water pumps and two auxiliary water pumps in operation) amount to 19 fish per day or approximately 2.5 pounds (lb) (1.13 kg) of fish and commercially important shellfish biomass daily. PG&E (PG&E 2009-TN10113) estimated approximately 7,000 individual organisms are impinged annually, or a maximum of between 900 and 1,200 lb (408 and 544 kg) of biomass assuming continuous full power operations.

PG&E (PG&E 2009-TN10113) found that most of the impinged fish were small, primarily young-of-year juveniles, such as rockfish that were 2.4 to 3.1 in. (60 to 80 mm) in length. Further, PG&E (2009-TN10113) stated that the cooling water intake system rarely impinged adult fish. PG&E asserted that because juveniles of most species have low percentage survivorship to adult stages in the marine environment, the loss of juvenile fish is generally considered less impactful to the ecological system than the loss of mature reproductive adults.

PG&E (2009-TN10113) attributed the low impingement rate to the design and placement of the intake structure. The orientation of the breakwaters of Intake Cove and the size and shape of the cove creates a confined area that restricts the movement of large numbers of fish in the immediate vicinity of the intake structure. PG&E (2009-TN10113) suggested that this effectively reduces the occurrence of schooling fish common in the open ocean and reduces susceptibility to impingement. Further, Tenera (2000-TN10211) concluded that the water flow in all areas of the intake structure between the bar racks and traveling screens is below the burst swimming speed of most species and appears to be slow enough to allow healthy fish to swim freely away from the traveling screens. PG&E (2009-TN10113) stated that the design criteria to limit loss of marine organisms due to impingement trapping and subsequent mortality has been successful. PG&E (2009-TN10113) further stated that the low total biomass lost, low impingement rate and associated low absolute number of organisms impacted, and the fact that losses for fish are primarily non-reproductive juveniles, supports a determination that impingement impacts are insignificant for the power plant.

Steinbeck (2008-TN10210) compared impingement rates at multiple California coastal power plants by using the results of impingement studies, including the Diablo Canyon 1985–1986 impingement study (PG&E 2010-TN10119), and the average annual flow rates at each plant for the period 2000 through 2005. Steinbeck (2008-TN10210) determined that Diablo Canyon has the lowest impingement rate of any power plant in California that uses the Pacific Ocean for cooling water. The results of the 1985–1986 impingement study have also been analyzed in several other technical and regulatory assessments (e.g., PG&E 2010-TN10119; Tenera 2000-TN10211; CRWQCB 2003-TN10212; AEG 2005-TN10213; CEC 2005-TN7444; TER 2005-TN10214; Steinbeck 2008-TN10210). In addition, several independent scientific and advocacy groups have analyzed the study's results (California Coastkeeper Alliance 2010-TN10215; SLOMFP 2010-TN10216; SLCSC 2010-TN10217).

G.2 Entrainment Studies

G.2.1 1996–1999 Entrainment Study

Tenera (2000-TN10211) conducted an entrainment study on behalf of PG&E from October 1996 through June 1999 in connection with CWA Section 316(b) requirements. The purpose of the study was to evaluate the entrainment effects of Diablo Canyon's cooling water intake system and assess the available options to reduce entrainment. The Central Coast Regional Water Quality Control Board (CCRWQCB) formed an entrainment technical workgroup to review the study design and to help develop criteria to assess the entrainment effects. The technical workgroup included representatives from PG&E, CCRWQCB, EPA, California Department of Fish and Game (CDFG), National Marine Fisheries Service (NMFS), League for Coastal Protection, California Earth Corps, Romberg Tiburon Research Center, Moss Landing Marine Laboratories, and Data Analysis Group.

The technical workgroup selected 2 crab species and 14 target fish taxa to estimate entrainment impacts (Table G-2). The fish taxa chosen comprised approximately 70 percent of the total number of fish larvae collected in entrainment sampling at Diablo Canyon (ASA 2003-TN10218). The taxa chosen for analysis tended to have demersal/adhesive or internally fertilized eggs and were not likely to be entrained. The workgroup did not estimate entrainment effects on other invertebrates because of insufficient knowledge on the taxonomy of early larval stages. The workgroup also did not estimate entrainment losses on fish eggs because they were difficult to identify (Tenera 2000-TN10211).

Table G-2 Target Taxa for Entrainment Samples at Diablo Canyon Nuclear Power Plant Site, 1996–1999

Common Name[a]	Taxa
Brown rock crab	*Cancer antennarius*
slender crab	*Cancer gracilis*
Pacific sardine	*Sardinops sagax*
northern anchovy	*Engraulis mordax*
blue rockfish complex	*Sebastes* spp. V *and S. mystinus*[b]
KGB rockfish complex	*Sebastes* spp. V_De *and* V_D_[b]
painted greenling	*Oxylebius pictus*
smoothhead sculpin	*Artedius lateralis*
snubnose sculpin	*Orthonopias triacis*
cabezon	*Scorpaenichthys marmoratus*
white croaker	*Genyonemus lineatus*
monkeyface prickleback	*Cebidichthys violaceus*
clinid kelpfishes	*Gibbonsia* spp.
blackeye goby	*Coryphopterus nicholsi*
sanddab	*Citharichthys* spp.
California halibut	*Paralichthys californicus*

(a) KGB = Kelp/gopher/black-and-yellow (rockfish).
(b) V, V_De, and V_D_ refer to pigmentation groups within the larval rockfish complex that were used as a taxonomic group.
Source: Tenera 2000-TN10211.

During the study, Tenera (2000-TN10211) collected water samples containing eggs and larvae from four permanently moored sampling stations located directly in front of the intake structure. Researchers collected samples eight times over a 24-hour period (once every 3 hours). For a given sample, a 335 microns (0.013 in.) mesh net was pulled vertically through the water column from the surface to within 5 to 14 in. (13 to 35 cm) of the bottom and back eight times (twice at each station). Samples were collected once per week for a total of 32 samples or 64 subsamples. Researchers sorted all larval fish and megalopal stages of *Cancer* species from either all or half of the subsamples. Researchers sorted all zoeal stages of *Cancer* species and juvenile urchins from one randomly selected entrainment sample from each of the 3-hour cycles, equaling 8 samples per sampling day. Tenera did not analyze the data for sea urchins.

To estimate the daily number of eggs and larvae in the area surrounding Diablo Canyon, Tenera (2000-TN10211) also collected eggs and larvae along the shoreline for a distance of 8.7 km (5.4 mi) to the north and south of Diablo Canyon and an average distance of 3.0 km (1.9 mi) offshore. In addition, Tenera used data from surface plankton tows in the area surrounding Diablo Canyon from 1996 through 1999 and at the mouth of the Diablo Canyon Intake Cove from 1990 through 1999. Figure G-1 depicts the sampling locations.

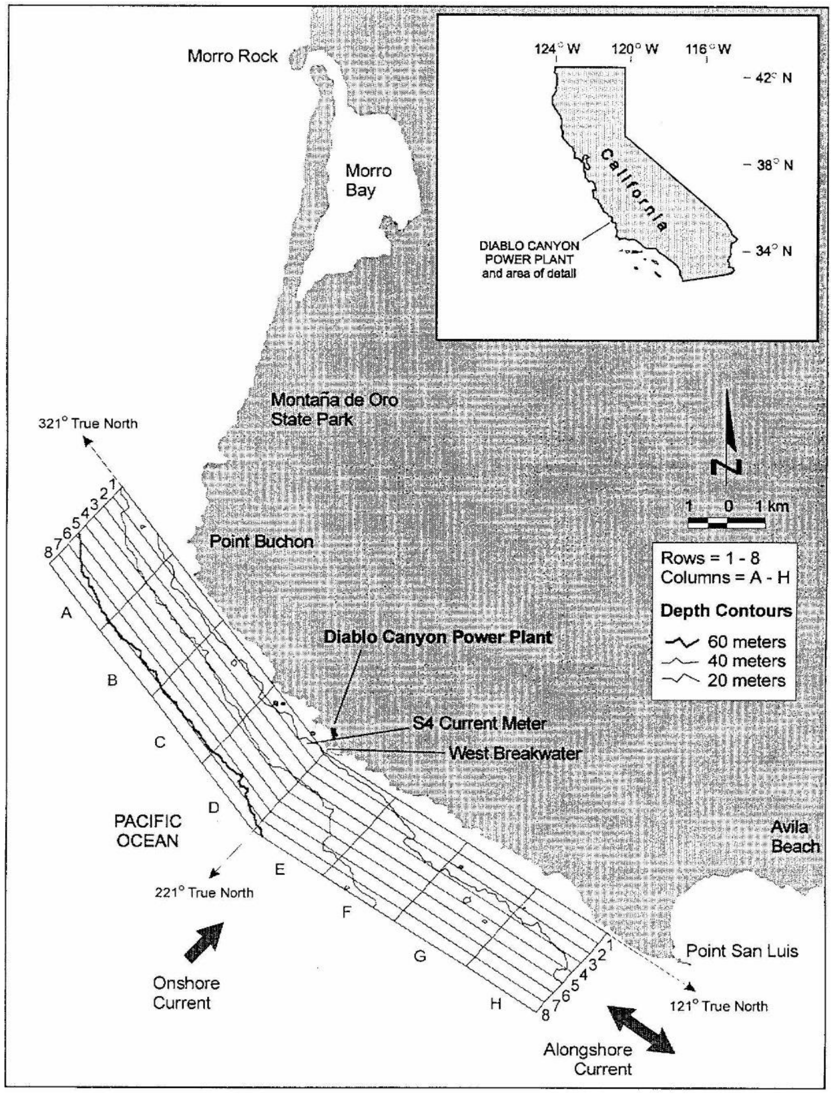

Figure G-1 Study Grid and Depth Contours for Population Density Assessments of Cancer Species, Megalops, and Larval Fish in the Vicinity of Diablo Canyon. Source: Tenera 2000-TN10211.

Tenera (2000-TN10211) used three population assessment approaches to evaluate the potential population-level impacts from entrainment at Diablo Canyon as follows.

- *Adult Equivalent Loss.* This method estimates the number of entrained individuals that would have survived to adulthood if they had not been entrained as eggs or larvae using species-specific mortality rates for each life stage from sources other than entrainment by the power plant. The resulting number is a lower number than the number of entrained individuals because it represents the proportion of those individuals that would have survived to adulthood in the absence of the power plant.
- *Fecundity Hindcasting*. This method estimates the number of eggs that would be required to produce the number of larvae entrained using the number of entrained larvae and species-specific egg-to-larvae mortality rates. This number is then used to calculate the number of female adults that would have been necessary to produce the estimated number of eggs using species-specific fecundity rates.

- *Empirical Transport Model.* This method estimates the proportion of larvae lost to entrainment relative to the total number of larvae present in the source water body. The size of the source water body can have a large influence on the proportional entrainment loss (CRWQCB 2003-TN10219). For example, the proportional loss of 100 larvae to entrainment would be higher in a small source water body as compared to a large source water body.

For Diablo Canyon, Tenera (2000-TN10211) expanded its proportional entrainment loss estimates to predict losses within species-specific areas of larval origin (i.e., areas where adult reproductive activity is known to occur for a given species). Under this method, proportional entrainment loss is calculated from the estimated number of larvae entrained per day divided by the estimated number of larvae in the study grid area during the same day. The daily probability of a given larva being entrained is the product of proportional entrainment loss and the proportion of that species' population that occur within the study grid, as well as the number of days larvae are susceptible to entrainment.

Overall, PG&E (2009-TN10113) estimated the annual average entrainment of larval fish to be 11 percent of the larval population in the source water body near Diablo Canyon or between 1.48 and 1.77 billion larval fish annually. Table G-3 summarizes the proportional loss for each species and the size of the source water body. The magnitude of entrainment impacts were generally correlated with habitat use, whereby nearshore fish and larvae that inhabit intertidal habitat were generally more likely to be entrained and offshore fish and larvae were less likely to be entrained. This correlation likely occurs because the intake withdraws nearshore water located adjacent to intertidal habitat.

Proportional entrainment loss was relatively high (greater than 10 percent) for nearshore species, such as smoothhead sculpin (*Artedius lateralis*), monkeyface prickleback (*Cebidichthys violaceus),* clinid kelpfishes (*Gibbonsia* species), blackeyed goby (*Rhinogobiops nicholsii*), and snubnose sculpin (*Orthonopias triacis*). The greatest annual proportional loss was for clinid kelpfishes, which ranged from 29 to 41 percent. Some nearshore species experienced 1 percent or less proportional losses, such as painted greenling (*Oxylebius pictus*) and cabezon (*Scorpaenichthys marmoratus*). For some of these nearshore species where entrainment was greater than 10 percent of the local population, Tenera (2000-TN10211) did not find any long-term decline in local adult populations or larval production. However, for kelpfish and snubnose sculpin, Tenera (Tenera 1997-TN10220, 2000-TN10211) determined that adult populations appear to be decreasing near Diablo Canyon.

Tenera (2000-TN10211) estimated low proportional entrainment loss for offshore deeper-water species, including species with widespread pelagic larvae, such as Pacific sardine (*Sardinops sagax*) and northern anchovy (*Engraulis mordax*), and commercial and sport fishes, such as sanddabs (*Citharichthys* species), white croaker (*Genyonemus lineatus*), kelp/gopher/black-and-yellow (KGB) rockfish (*Sebastes* species), and blue rockfish (*S. mystinus*). For blue rockfish and the KGB rockfish complex, Tenera (2000-TN10211) estimated that entrainment results in the loss of approximately 2 percent or less of the rockfish population surrounding Diablo Canyon. Stephens et al. (2006-TN10221) determined that rockfish populations have likely remained stable in central California given the little change in fishing success from 1980 to 2005 despite the high number of entrained larvae. Stock assessments and other reviews have also concluded that the rockfish population in central California is not declining (see review in Tenera 2000-TN10211; Dotson and Charter 2003-TN10222; Key et al. 2005-TN10223; PG&E 2008-TN10104, PG&E 2014-TN9843, PG&E 2015-TN9836).

Table G-3 Annual Proportional Entrainment Losses at Diablo Canyon Nuclear Power Plant by Taxa, 1996–1999

Source Population[(a)]	Taxa	Fecundity Hindcasting (adult females per year)[(b)]	Adult Equivalent Loss (adults per year)[(b)]	Estimated Annual Proportion of Larvae Entrained Based on Mean Larval Duration (%)	Estimated Annual Proportion of Larvae Entrained Based on Maximum Larval Duration (%)	Source Water Body Size Based on Mean Larvae Duration (km)[(c)]	Source Water Body Size Based on Maximum Larvae Duration (km)[(c)]
NS	painted greenling	NC	NC	≤1	≤1	180–360	830–1,112
NS	smoothhead sculpin	NC	NC	10–15	15–20	49–52	127–143
NS	snubnose sculpin	NC	NC	4–12	2	45–122	684–971
NS	cabezon	NC	NC	<1	<1	42–158	77–379
NS	monkeyface prickleback	NC	NC	11–16	11–23	42–52	120–139
NS	clinid kelpfishes	NC	NC	29–32	39–41	47–54	108–127
NS	blackeye goby	NC	NC	17–19	22–23	23–35	43–150
OS	Pacific sardine	3,170–8,460	2,600–7,000	<1	<1	24,692	562,722
OS	northern anchovy	16,000–45,000	43,000–120,000	<1	<1	397–8,612	23,700–356,522
OS	blue rockfish	20–43	164–353	1–2	<1	240–4,852	2,198–31,322
OS	KGB rockfish	487–617	905–1,120	1.5–2	≤1	230–3,762	1,540–28,132
OS	sanddab	92–426	511–1,450	1–5	≤1	141–6,102	966–11,702
OS	California halibut	NC	NC	1–12	1–5	182–4,652	1,874–517,122

(a) NS = nearshore; OS = offshore.
(b) NC = no calculation. Tenera (2000-TN10211) was unable to calculate the adult equivalent loss or the fecundity hindcasting values for species with insufficient life history data.
(c) Source water body is expressed as length of coast for nearshore fish and area of marine habitat for offshore fish.
Source: CRWQCB 2003-TN10219, based on information from Tenera (2000-TN10211).

Tenera (2000-TN10211) also examined entrainment for two species of crabs: rock crab and slender crab (*Cancer gracilis*). For rock crabs, Tenera found that 91,000 to 117,000 adult crabs are lost per year based on the fecundity hindcasting estimate and 182,000 to 234,000 adults per year based on the adult equivalent loss. Proportional entrainment loss estimates were low (less than 0.1 percent). For slender crab, Tenera (2000-TN10211) found that 8,950 to 27,300 adult crabs are lost per year based on the fecundity hindcasting estimate and 17,900 to 54,600 adults per year based on the adult equivalent loss. Proportional entrainment loss estimates were also low for slender crab (1 percent or less).

Depending on the species recruitment and successful development from larvae stages to juvenile and adult stages, the removal of eggs and larvae may or may not have noticeable or destabilizing impacts on the local fish and crab populations. For example, fish and crab populations may be able to offset low levels of anthropogenic sources of mortality, such as entrainment, if the population has a rapid growth rate; high fecundity; high reproduction rates; and low levels of disease, predation, competition, and other sources of natural or anthropogenic mortality. As described above, Tenera (2000-TN10211) did not find decreasing trends in populations of the target fish species, except for clinid kelpfish and snubnose sculpin, which appear to be decreasing.

PG&E (2009-TN9842: Appendix E) asserted that observable population or ecological level effects are the appropriate indicator of whether entrainment losses result in adverse environmental impacts. PG&E stated that it has monitored adult fish populations in the area around Diablo Canyon for 30 years and that the data demonstrate that there have been no significant impacts to fish populations from entrainment. In submitted comments and attachments to the State Water Resources Control Board (SWRCB) on California's Once-Through Cooling (OTC) Policy (PG&E 2009-TN10225), PG&E hypothesized that those fish entrained at the greatest rates (cabezon, rockfishes, sculpins, and greenlings) should show a long-term decline resulting from larval losses from entrainment if entrainment was causing a population-level effect. However, based on fisheries catch data, PG&E asserted that the number of rockfish caught per fisher hour near Diablo Canyon has remained stable and has even increased substantially in several recent seasons (PG&E 2009-TN9842: Appendix E). PG&E (2009-TN10225) concluded that El Niño conditions, fish trapping, and closures could better explain the variability in the populations over time. PG&E (2009-TN10225) concluded that continuous declines were not observed in the abundance data from species that would be expected to be affected; therefore, entrainment is not causing depletion in fish populations.

The results of PG&E's entrainment study have been analyzed in several other technical and regulatory assessments (e.g., CRWQCB 2003-TN10219; PG&E 2010-TN10119, 1998; AEG 2005-TN10213; TER 2005-TN10214; CEC 2005-TN7444; Steinbeck et al. 2007-TN10654; Steinbeck 2008-TN10210). In addition, several independent scientific and advocacy groups have analyzed the study's results (California Coastkeeper Alliance 2010-TN10215; SLOMFP 2010-TN10216; SLCSC 2010-TN10217).

G.2.2 2008–2009 Entrainment Study

From July 2008 through June 2009, Tenera (2016 [PG&E 2024-TN10032]) conducted an additional entrainment study in preparation for a National Pollutant Discharge Elimination System (NPDES) permit renewal application. The study design was largely consistent with the methodology used in the 1996–1999 study, although this study was not as extensive as the previous study. The main differences included sampling a significantly reduced source water area, sampling at only two of the four original entrainment stations, and sampling using a six-hour interval per 24-hour period instead of the three-hour interval used previously. The study was also conducted over a shorter period (one year versus two and a half years). In total, researchers collected 383 samples over 24 sampling days.

Researchers collected a total of 16,961 fish larvae from 80 separate taxonomic groups (including unidentified larval fish). Eighteen taxa comprised the top 90 percent of specimens collected. The most abundant taxa were sculpins (Cottidae, *Artedius* species, and *Orthonopias triacis*), rockfishes (*Sebastes* species of the pigmentation pattern groups V_ and V), monkeyface eel (*Cebidichthys violaceus*), kelp blennies (*Gibbonsia* species), blennies/zoarcoids (Blennioidei/Zoarcoidei; largely comprising unidentified pricklebacks), and blackeye goby (*Rhinogobiops nicholsi*). Most of the commonly entrained larvae were of species in which the adults occupy shallow nearshore waters, although larvae from some deepwater species (e.g., northern lampfish (*Stenobrachius leucopsarus*) appeared in entrainment collections in smaller numbers as well.

Researchers estimated the total annual entrainment based on actual cooling water flow during the study to be 2.86 billion fish larvae, 1.82 billion *Cancer* crab megalops, and 360,000 squid paralarvae. Researchers calculated total ichthyoplankton concentrations in the source water to calculate the fractional mortality due to entrainment using the Empirical Transport Model approach. Researchers found that total entrainment estimates from the 2008–2009 sampling effort were approximately twice those of the previous comparable 1996–1999 study described above. Table G-4 lists estimated annual entrainment of larval fish taxa during the 2008–2009 sampling period, as well as during the two 1-year periods of the previous study (1998–1999 and 1997–1998).

The most notable differences among taxa between the two studies were that sculpins and blennies/zoarcoids appeared in numbers an order of magnitude greater in 2008–2009 than in either of the previous study periods, and northern anchovies and sardines, which were very abundant in 1997–1998 (over 106 million anchovy and 103 million sardine larvae entrained), were in low abundance in both 1998–1999 and 2008–2009. The KGB rockfish group abundance was somewhat lower in the 1998–1999 period than in the other two periods, but the blue rockfish group was significantly lower (7 million compared to 123 million). California halibut was lower in 2008–2009, but species such as California halibut that occurred in generally low numbers throughout the year could not be confidently compared among periods because of the large amount of variation in the estimates.

The Empirical Transport Model calculations indicated that the populations least affected by entrainment at Diablo Canyon were those taxa that had a wide range of depth and onshore–offshore distributions such as white croaker, rock crabs, and blue rockfish complex. The fish taxon with the highest estimated annual larval entrainment was the combined group Blennioidei/Zoarcoidei/Stichaeidae. Some commercially important fish with pelagic eggs and widespread populations that were not abundant in the entrainment samples in 2008–2009 study (e.g., northern anchovy, Pacific sardine, sanddabs, and California halibut) were more abundant in the previous study. Tenera (2016 [PG&E 2024-TN10032]) concluded that these species had low estimated larval mortalities or small numbers of adult losses to their populations based on results in the previous entrainment study. Tenera (2016 [PG&E 2024-TN10032]) also concluded that entrainment effects appear to be limited to localized effects on nearshore species and that the potential for damage due to entrainment on the biological value of the larger source water body is low.

Table G-4 Estimated Annual Larval Fish Entrainment at Diablo Canyon Nuclear Power Plant by Taxa During 2008–2009, 1998–1999, and 1997–1998.

Taxon	Common Name	Jul '08–Jun '09	Jul '98–Jun '99	Jul '97–Jun '98
Cottidae	sculpins	398,997,613	29,486,564	43,038,418
Blennioidei/Zoarcoidei/ Stichaeidae	blennies/zoarcoids/ pricklebacks	340,986,238	35,359,048	34,618,904
Sebastes spp. V_	KGB rockfish complex	289,113,661	294,214,870	208,013,064
Cebidichthys violaceus	monkeyface prickleback	246,235,382	132,041,503	118,013,273
Gibbonsia spp.	kelpfishes	222,069,865	94,418,006	121,584,994
Artedius spp.	sculpins	210,254,738	110,769,886	109,446,173
larval/post-larval fish	larval fishes	191,868,513	9,057,466	5,642,001
Orthonopias triacis	snubnose sculpin	154,474,150	55,185,666	75,253,148
Rhinogobiops nicholsi	blackeye goby	134,331,694	130,469,817	156,299,633
CIQ goby complex	gobies	126,496,301	22,464,407	76,290,848
Sebastes spp. V	blue rockfish complex	123,147,095	99,736,511	7,016,351
Stenobrachius leucopsarus	northern lampfish	67,431,908	36,850,992	32,273,776
Genyonemus lineatus	white croaker	66,630,820	20,935,413	65,660,099
Oligocottus/Clinocottus spp.	sculpins	54,726,305	68,322,304	38,786,809
Platichthys stellatus	starry flounder	49,490,717	2,951,452	363,651
Cyclopteridae	snailfishes	49,365,874	15,845,867	7,917,269
Bathymasteridae	ronquils	43,662,117	31,817,216	32,405,185
Oxylebius pictus	painted greenling	31,761,018	20,524,941	11,234,578
Scorpaenichthys marmoratus	cabezon	22,521,855	9,782,966	15,028,255
Blennioidei	blennies	19,438,626	2,152,777	467,833
Leptocottus armatus	Pacific staghorn sculpin	15,007,993	1,286,156	1,533,552
Sebastes spp.	other rockfishes	14,068,454	3,131,568	4,062,504
Brosmophycis marginata	red brotula	12,346,006	1,470,788	5,373,624
Pleuronectoidei	flatfishes	10,515,444	1,550,593	4,816,484
Radulinus spp.	sculpins	9,262,747	0	2,124,449
Gobiesocidae	clingfishes	8,703,341	479,965	961,728
Ruscarius creaseri	roughcheek sculpin	7,987,014	23,187,512	7,600,530
Lepidopsetta bilineata	rock sole	7,838,725	0	68,016
Osmeridae	smelts	7,442,639	2,567,789	182,306
Citharichthys spp.	sanddabs	6,669,908	2,585,270	6,233,295
Gobiesox spp.	clingfishes	6,349,896	4,824,812	6,736,611
Pleuronectidae	righteye flounders	6,060,652	707,716	5,771,052
Agonidae	poachers	5,424,722	711,507	87,802
Lepidogobius lepidus	bay goby	5,316,238	4,535,785	14,377,886
Aulorhynchus flavidus	tubesnout	5,184,751	264,780	123,516
Parophrys vetulus	English sole	4,315,304	1,065,718	11,316,611
Sardinops sagax	sardine	1,100,324	146,637	103,563,065
Hypsoblennius spp.	combtooth blennies	1,012,230	10,850,340	7,255,072
Engraulis mordax	Northern anchovy	353,214	3,229,835	106,443,470
Paralichthys californicus	California halibut	308,642	11,594,892	13,696,238
-	Other taxa	39,422,521	56,979,513	60,225,665
-	**Total**	**3,017,695,253**	**1,353,558,846**	**1,521,907,737**

Source: PG&E 2024-TN10032.

G.2.3 Alternative Cooling Technologies Assessment

In 2012 and 2014, Bechtel Power Corporation assessed alternative cooling technologies or modifications to Diablo Canyon's existing once-through cooling system to support PG&E's compliance with California's OTC Policy (CSWRCB 2023-TN10114). In Phase 1 of this study, Bechtel (2012-TN10115) evaluated the feasibility of a wide variety of cooling technologies without regard for cost. In Phase 2 of the study, Bechtel (2014-TN10116) considered in depth three cooling technologies that it found to be feasible in Phase 1. These were closed-cycle cooling, onshore mechanical intake fine mesh screening systems, and offshore modular wedge wire screens. Multiple variants or configurations of each of these technologies were assessed for their effectiveness in reducing impingement and entrainment, permitting requirements, seismic and tsunami issues, structure and construction, maintenance, and implementation timelines, among other factors. Phase 2 also evaluated nuclear-specific licensing considerations, such as safety concerns and permitting requirements. Ultimately, Bechtel found that none of the evaluated alternatives were feasible at Diablo Canyon. The SWRCB has adopted a policy to phase out once-through cooling for power plants and in accordance with California Senate Bill 846 (State of California 2022-TN10038) and SWRCB Resolution No. 2023-0025 (CSWRCB 2023-TN10117), PG&E has a final compliance date to cease using once-through cooling for Diablo Canyon Units 1 and 2 of October 31, 2030.

G.3 Thermal Studies

G.3.1 Pre-Operational and 1998 Thermal Effects Studies

PG&E has conducted local water temperature and biological monitoring studies since 1976, referred to as the thermal effluent monitoring program reports and later as the RWMP reports (PG&E 2015-TN9836). The RWMP reports provided annual monitoring data within the intertidal and subtidal for seawater temperature and abundance estimates for algae, invertebrates, and fish. In addition, the RWMP reports focus on the elevated temperatures that occur in the receiving water and identify seven temperature elevations, extent, variation with time and plant operation, and effects on the biological communities. These studies include predictive studies, baseline pre-operational studies, laboratory thermal tolerance studies, plume modeling, and environmental assessments. Sampling includes intertidal and subtidal locations in Diablo Cove, Field's Cove, and a north and south control area. These monitoring efforts are required by PG&E's NPDES permit. PG&E has submitted annual RWMP reports to the CCRWQCB since 1983.

Before operations, PG&E submitted two reports in 1982 to the CCRWQCB to satisfy CWA Section 316(a) demonstration requirements. PG&E (2008-TN10104: see citation for PG&E 1982a) evaluated alternatives to reduce the heat and volume of the cooling water discharge. TERA (PG&E 2008-TN10104: see citation for PG&E 1982) estimated the magnitude and extent of ecological changes predicted to occur from the increase in water temperature in Diablo Cove (PG&E 2008-TN10104). TERA (PG&E 2008-TN10104: see citation for PG&E 1982) included information from laboratory studies that began in 1976 on the thermal tolerance of 21 representative important species selected by the CCRWQCB and CDFG (Table G-5).

Table G-5 Representative Important Species from Diablo Canyon Nuclear Power Plant Site Selected for the Thermal Tolerance Studies

Habitat	Group	Species	Common Name
Intertidal	Fishes	*Xiphister mucosus*	rock prickleback
Intertidal	Shellfish and invertebrates	*Anthopleura elegantissima*	aggregating sea anemone
Intertidal	Shellfish and invertebrates	*Cancer antennarius*	rock crab
Intertidal	Shellfish and invertebrates	*Haliotis cracherodii*	black abalone
Intertidal	Shellfish and invertebrates	*Pisaster ochraceus*	ochre starfish
Intertidal	Shellfish and invertebrates	*Pugettia producta*	kelp crab
Intertidal	Shellfish and invertebrates	*Pycnopodia helianthoides*	sunflower sun stars
Intertidal	Shellfish and invertebrates	*Strongylocentrotus purpuratus*	purple sea urchin
Intertidal	Habitat formers	*Chondracanthus canaliculatus*, formerly *Gigartina canaliculata*	unnamed red seaweed
Intertidal	Habitat formers	*Egregia menziesii*	feather-boa kelp
Intertidal	Habitat formers	*Gastroclonium subarticulatum*, formerly *G. coulteri*	hollow-branched seaweed
Intertidal	Habitat formers	*Mazzaella flaccida*, formerly *Iridaea flaccida*	iridescent seaweed
Subtidal	Fishes	*Scorpaenichthys marmoratus*	cabezon
Subtidal	Fishes	*Sebastes carnatus*	gopher rockfish
Subtidal	Fishes	*Sebastes mystinus*	blue rockfish
Subtidal	Shellfish and invertebrates	*Chlorostoma brunnea*, formerly *Tegula brunnea*	brown turban snail
Subtidal	Shellfish and invertebrates	*Haliotis rufescens*	red abalone
Subtidal	Shellfish and invertebrates	*Strongylocentrotus franciscanus*	red sea urchin
Subtidal	Habitat formers	*Laminaria dentigera*	oar-blade kelp
Subtidal	Habitat formers	*Nereocystis luetkeana*	bull kelp
Subtidal	Habitat formers	*Pterygophora californica*	tree kelp

Source: PG&E 2008-TN10104.

In its Thermal Discharge Assessment Report, PG&E (2008-TN10104: see citation for PG&E 1982b) predicted an increase in the abundance and distribution of warmer water species in areas of Diablo Cove where the temperature remained at greater than or equal to 64°F (17.8°C). TERA (PG&E 2008-TN10104: see citation for PG&E 1982) predicted that this area would encompass the entire surface area of Diablo Cove and approximately half of the sea floor area in Diablo Cove. Areas dominated by bull kelp (*Nereocystis luetkeana*) and tree kelps (*Pterygophora californica* and *Laminaria setchellii*) after exposures to the thermal plume were expected to become dominated by giant kelp (*Macrocystis pyrifera*). PG&E (2008-TN10104: see citation for PG&E 1982b) predicted that thermally tolerant filter feeders, such as sea anemones, barnacles, hydroids, and mussels, would dominate the benthic community with most changes occurring in the subtidal habitat. TERA (PG&E 2008-TN10104: see citation for PG&E 1982) predicted that fewer changes would occur in the intertidal habitat and most changes would occur in the southern portion of the cove.

Following a review by TERA (PG&E 2008-TN10104: see citation for PG&E 1982b) that included data showing increased temperatures in the northern portion of Diablo Cove, PG&E created a physical model to refine the thermal plume map, and PG&E constructed an onsite thermal effects laboratory to expand the thermal tolerance information on the 21 representative important species (Tenera 1988-TN10247). PG&E conducted field studies of the thermal plume in 1984 and 1985 during initial startup of Diablo Canyon, during thermal verification studies in June 1986, and during NPDES plume surveys from 1986 to 1990 (PG&E 2008-TN10104). Most thermal plume studies focused on the surface plume in the open ocean (PG&E 2008-TN10104). PG&E (PG&E 2008-TN10104) describes the results from these early studies, which concluded the following.

- The direction of Diablo Canyon's thermal effluent plume in Diablo Cove varies with tidal height and wind direction.
- The estimated surface area of the thermal plume's offshore 2 to 4°F (1 to 2°C) isotherm (seaward of Diablo Rock) is largest (1,500 to 2,000 ac [607 to 809 ha]) when the tide level is ebbing and is smallest during low tide.
- During high tide conditions, the thermal plume covers an estimated area of 700 to 1,200 ac (283 to 486 ha).
- The thermal plume was detected between 0.5 and 1 mi (0.8 and 1.6 km) offshore during 41 to 60 percent of the surveys with a maximum extent of 2 mi (3.2 km) either north or south of Diablo Cove.
- Within the cove, the average increase in temperature for intertidal stations was approximately 6°F (3.3°C) along the northern shoreline and slightly less than that along the southern shoreline. The average temperature increase in Field's Cove to the north was less than 2°F (1.1°C).

In 1988, PG&E submitted to the CCRWQCB a report (Tenera 1988-TN10247) that summarized thermal effluent monitoring data from 9 years of pre-operational and approximately 30 months of operating data (18 months of 2-unit operation). The report concluded that communities in the cove were still changing and that the protection of the beneficial uses of the cove was demonstrated by the continued presence of marine algal, invertebrate, and fish species whose composition, abundance, and distribution, though different than those previously found at the site, were representative of natural marine habitat.

Changes in the 65 species analyzed in the report were evenly divided between increases and decreases with 43 percent of species exhibiting increasing population trends, 31 percent exhibiting decreasing population trends, and 26 percent exhibiting no distinct changes. The primary effect on algae was the early senescence of bull kelp (*Nereocystis luetkeana*). This was the only effect observed outside Diablo Cove. Within the cove, researchers documented a decline in abundance and distribution in three species of underwater kelp and several species of intertidal red and brown algae, as well as an increase in subtidal red algal species in the nearshore discharge area. Invertebrate abundances remained generally unchanged or increased significantly (acorn barnacle and aggregating anemone (*Anthopleura elegantissima*). Rock crabs appeared to avoid the warmest areas of the cove (PG&E 2023-TN9822).

Researchers specifically considered whether black abalone may have been affected by elevated temperatures in areas adjacent to and within the discharge plume. One area that showed a large relative decline in black abalone abundance, from 80 total individuals in the 1981–1982 survey to 26 total in 1985–1986 surveys, was transect I-N, adjacent to the discharge structure. Since this area was not sampled in 1983, Tenera found it to be uncertain if the reduction in black abalone in this area was due to some aspect of power plant operation. However, transect I-S, immediately south of the discharge structure, also showed a decrease in black abalone between 1982 and 1983, which persisted through the 1985–1986 survey. These declines may have resulted from a reduction of preferred habitats for black abalone near the discharge structure or may have been just a natural decline. Researchers postulated that following Diablo Canyon start-up, recruitment of young animals or migration of older animals into these areas may have been inhibited because of elevated water temperatures and increased water velocity from the discharge. Black abalone in most other areas of Diablo Cove were not affected by thermal discharges, and total numbers of abalone within subareas either increased or remained the same after Diablo Canyon operations began. (Tenera 2021-TN10249).

However, during the 1985–1986 survey, the numbers of small (less than 2-in. (5-cm) shell length) black abalone nearly tripled over the previous survey in 1983. This was especially noticeable in areas near Diablo Point in south Diablo Cove (transect TV-S) and transects II-N and III-N in north Diablo Cove, areas of deep crevices and rocky overhangs. Abalone also showed slight increases in mean number per station per year from 1985 to 1988 at north and central Diablo Cove stations. These data suggest that a recruitment of black abalone occurred sometime after summer 1983. One station in south Diablo Cove exhibited a major decline in black abalone from 1980 to 1987. Tenera found that this decline may have been due to the burying of the intertidal with cobble and sand during the storms of 1982–1983 (Tenera 2021-TN10249).

In its thermal impact assessment, Tenera (1988-TN10247) found that—with the possible exception of the area adjacent to the discharge structure—the abundance of black abalone inside Diablo Cove does not appear to have been affected by power plant operation. The results paralleled experiments performed in laboratory thermal effects studies on black abalone indicating that no mortalities were expected at water temperatures below 78.8°F (26°C) and perhaps higher for intertidal black abalone and that black abalone can withstand temperatures of 86 to 89.6°F (30 to 32°C) for at least one hour. Although black abalone apparently do not have a temperature preference, they avoid temperatures above 69.8 to 75.2°F (21 to 24°C). Because temperatures near the discharge structure may exceed this range, especially during heat treatments, Tenera found it possible that the reduction in black abalone from the areas adjacent to the discharge structure between 1983 and 1985–1986 was the result of migration out of an area where temperatures exceeded this range. Tenera (1988-TN10247) concluded that except near the discharge structure, elevated temperatures do not appear to have affected survival of abalone and that the recruitment observed at certain sampling stations following Diablo Canyon start-up indicated that black abalone had shifted their distribution to reside within areas of preferred temperatures.

Tenera (1988-TN10247) found that bull kelp sporophytes do not grow well at temperatures above 60.8°F (16°C). For 6 and 8 months out of the year, subtidal water temperatures at sampling stations SDC–1 and NDC–3, respectively, were above this threshold. From March through June, subtidal water temperatures at NDC–3 averaged 59.6°F (15.3°C). The dark-green-shaded area on the low tide surface infrared aerial image taken on June 12, 1986 (Figure G-2) (PG&E 2008-TN10104), is associated with surface water temperatures of approximately 65°F to 69°F (18°C to 21°C). A map depicting the areas of plume-related changes in bull kelp (Figure G-3) (Tenera 1988-TN10247) mirrors the greater than 7°F (3.9°C) increase from ambient within the northern channel of the thermal plume. Figure G-4 (Tenera 1997-TN10220) suggests that the minimum area associated with bull kelp impacts experiences 4°F (2.2°C) increases in surface water temperature 21 percent to 40 percent of the time over a year.

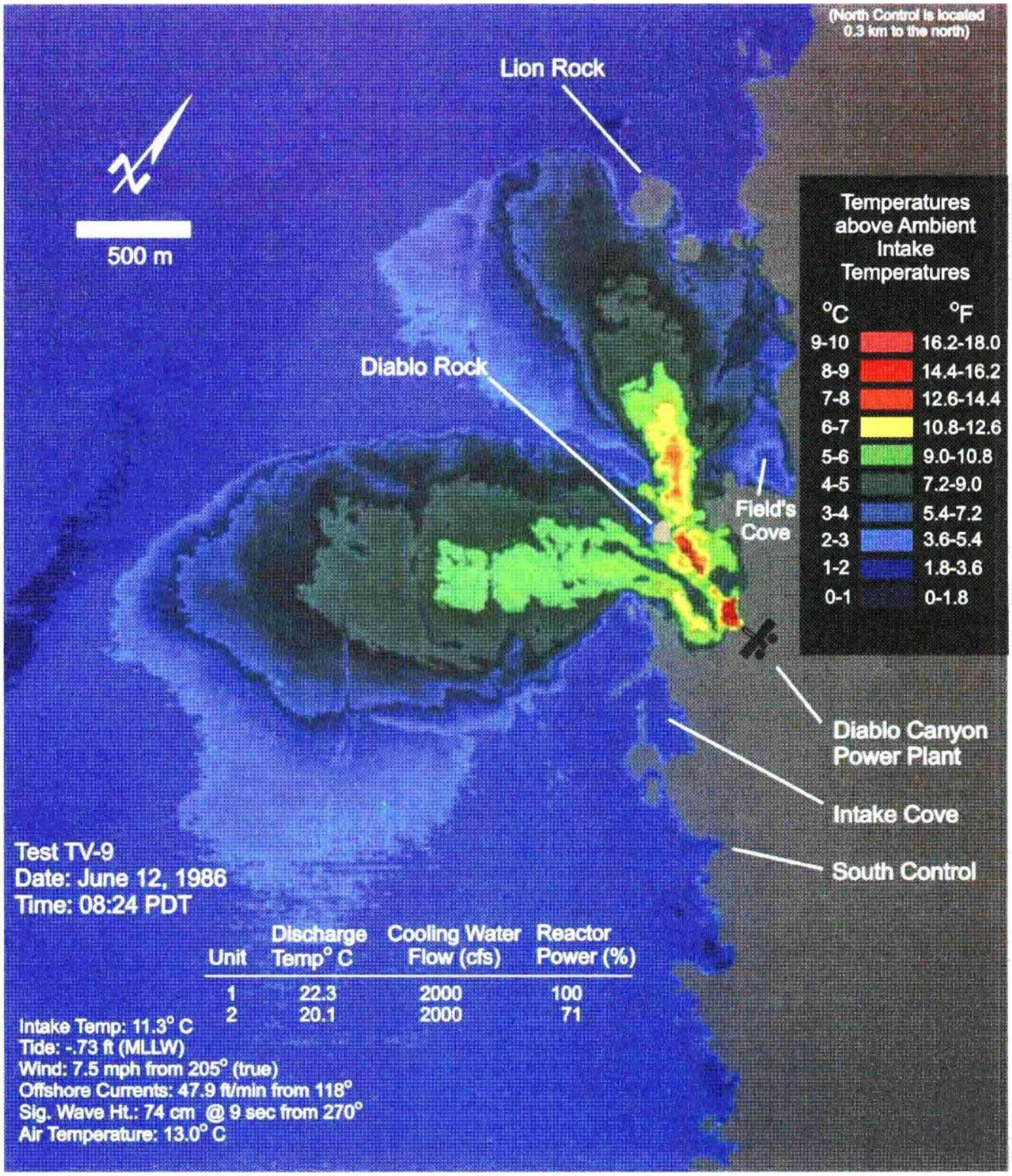

Figure G-2 Surface Infrared Aerial Survey of Diablo Canyon Nuclear Power Plant Thermal Plume on June 12, 1986, During Low Tide Conditions. Source: PG&E 2008-TN10104.

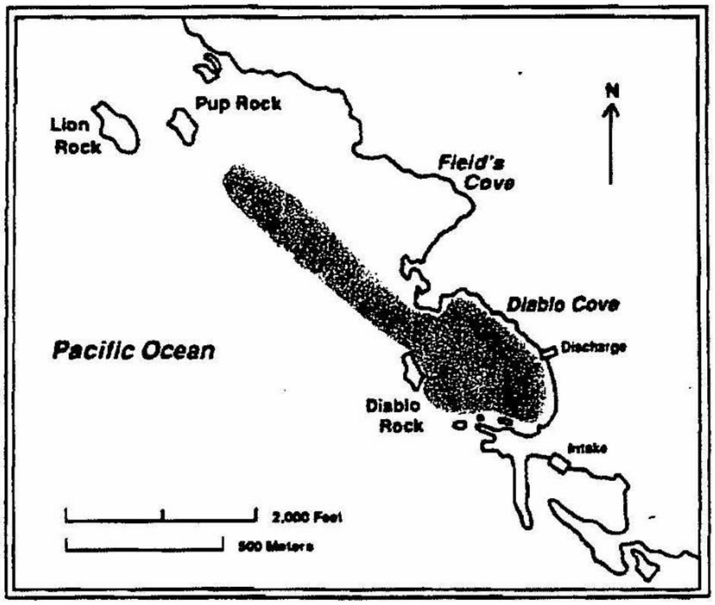

Figure G-3 Areas of Thermal Plume-Related Changes in Bull Kelp Abundance Near Diablo Canyon Nuclear Power Plant Site. Source: Tenera 1988-TN10247.

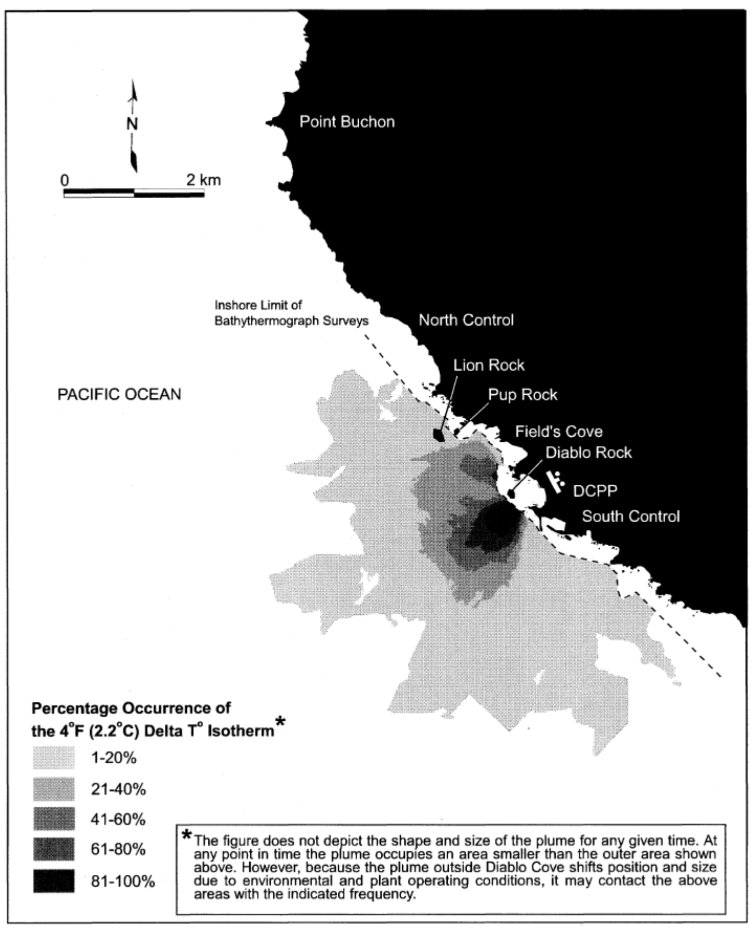

Figure G-4 Areas of Thermal Plume-Related Changes in Bull Kelp Abundance near Diablo Canyon Nuclear Power Plant Site. Source: Tenera 1997-TN10220.

The geographical extent of the decrease in bull kelp cover and increase in prematurely senescent plants includes Diablo Cove and 700 to 3,200 ft (213 to 975 m) northward along the coast beyond Field's Cove (Figure G-3) (Tenera 1988-TN10247). Kelp in Field's Cove was unaffected throughout 1987. The channel south of Diablo Rock has fewer bull kelp because of the increased depth and sandier substrate. The areas immediately inshore of Diablo Rock and near the headland of north Diablo Cove traditionally have been areas of dense bull kelp, but it has not been observed there since Diablo Canyon began to operate (Tenera 1988-TN10247).

G.3.2 2002 Thermal Effects Monitoring Program Report

As a requirement of its NPDES permit, PG&E continued thermal monitoring to determine changes in the biological communities resulting from the Diablo Canyon cooling water discharge. PG&E submitted to the CCRWQCB a follow-up report to Tenera (Tenera 1988-TN10247) that summarizes changes in the marine environment through the middle of 2002 (PG&E 2002-TN10248). This report considered over 20 years of monitoring data on the Diablo Canyon nearshore marine environment. This report addressed the effects of the discharge on intertidal and nearshore subtidal plants, invertebrates, and fishes. Several different survey methods were used to sample a particular habitat or group of organisms, and the data collected were primarily measures of the abundance (percent cover or numbers per area) of species.

Researchers focused on documenting patterns of change in biological communities and not the underlying processes or causes. The effort focused on macroalgae, macroinvertebrates, and fishes in nearshore rocky intertidal and subtidal habitats because these organisms and habitats were conspicuous, accessible, and likely to be affected by Diablo Canyon's thermal effluent discharge. These also provided the most reliable numerical results for statistically detecting change. For example, phytoplankton and zooplankton may have been locally affected by contact with the discharge, but they were not studied due to the low probability of potential impacts at the population level and the difficulty of detecting changes in these transient and rapidly reproducing organisms (PG&E 2023-TN9822).

PG&E's thermal effluent monitoring data indicated that populations of marine algae, invertebrates, and fish underwent significant changes following plant startup when compared to local populations beyond Diablo Canyon's influence. Effects of the discharge on invertebrate taxa can be generally characterized as increases in abundance of intertidal taxa and decreases in subtidal taxa, although many species either increased or decreased in both the intertidal and subtidal. Effects probably resulted from a combination of responses to increased temperatures and responses to changes in other components of the community, such as algal cover in the intertidal, and algal cover and fish abundance in the subtidal. Changes in invertebrates also extended beyond areas directly warmed by the thermal plume due to the mobility of many invertebrate taxa (PG&E 2023-TN9822).

During the study period, researchers observed mortality of black (*Haliotis cracherodii*) and red (*H. rufescens*) abalone due to withering syndrome. This condition was first observed in California in the southern California Channel Islands in 1986 and first observed in black abalone in Diablo Cove in spring 1988. Mortalities from the disease eventually resulted in an approximately 90 percent population decline in black abalone in Diablo Cove. Although recruitment contributed to increases in the Diablo Cove population in 1991 and 1992, abundances outside Diablo Cove also began decreasing during this same period. By 1994, black abalone populations along a shoreline distance of 7.9 mi (12.7 km) had significantly declined from withering syndrome (PG&E 2023-TN9822).

Because most fish are mobile and able to avoid areas outside their preferred temperature range, the most obvious changes in fish composition during Diablo Canyon operation have occurred near the thermal effluent discharge plume in Diablo Cove. Certain taxa are attracted to the plume's turbulence or its warm water. These species, considered rare in the area before plant startup, include leopard shark (*Triakis semifasciata*), bat ray (*Myliobatis californica*), round ray (*Urobatis halleri*), white seabass (*Atractoscion nobilis*), opaleye (*Girella nigricans*), halfmoon (*Medialuna californiensis*), sheephead (*Semicossyphus* spp.), and señorita (*Oxyjulis californica*). A similar assemblage occurs on the in-shore side of Diablo Rock to depths of about 20 ft (6 m). These same species are also seen sporadically throughout Diablo Cove at depths shallower than 32 ft (10 m). The temperature transition zone, or thermocline, often attracts various surfperch (family Embiotocidae) when it is situated close to benthic habitat. Below this depth, cool ambient temperatures are the norm, and the fish fauna is like that of control areas outside Diablo Cove (PG&E 2023-TN9822).

Concurrent with the increases in warm-tolerant species in Diablo Cove, researchers observed decreases in the occurrence of cool water species, such as greenlings (family Hexagrammidae) and some rockfishes (family Sebastidae). Ancillary observations in Field's Cove and Lion Rock Cove (north of Diablo Cove), and the breakwater/seal haulout area (south of Diablo Cove), indicate that the fish fauna at these locations has been unaffected by Diablo Canyon's discharge (PG&E 2023-TN9822).

The daily average change in water temperatures resulting from Diablo Canyon operations has remained below 22°F (12.2°C), based on data collected during the period of 1985 through 2008 (PG&E 2008-TN10104) (see Figure G-5). However, the intertidal water temperatures at the north and south Diablo Cove stations are, on average, 6.0°F and 6.6°F (3.3°C and 3.7°C) (maximum 7.5°F and 7.9°F [4.2°C and 4.4°C]) greater than those at the north control intertidal station (Figure G-6) (PG&E 2002-TN10248). Between May and October, intertidal water temperatures are similar or greater than those observed in Santa Barbara. The subtidal (3 m or 10 ft MLLW) water temperatures in the originally designated control station in Field's Cove were, on average, 1°F (0.56°C) greater than the subtidal water temperature at one of the north Diablo Cove stations (NDC–1) but less than the intertidal water temperatures recorded at Avila Beach (Figure G-7) (PG&E 2002-TN10248). The subtidal water temperatures at the north (NDC–3) and south Diablo Cove stations are, on average, 5.5°F (3°C) and 3.4°F (1.9°C) greater than those at the Field's Cove station. The average subtidal water temperature at the NDC–3 station is 2.2°F (1.2°C) (maximum 6.8°F [3.8°C]) greater than the average intertidal water temperature observed in Santa Barbara (PG&E 2002-TN10248).

Of the original 21 representative important species chosen for thermal effects assessment, 15 taxa showed a decrease in abundance in areas ranging from 2.3 mi (3.7 km) of coastline to 170 ac (69 ha), and two intertidal algal species are now nearly absent from Diablo Cove. In both intertidal and subtidal habitats, the changes in abundances of fish and invertebrates were probably a secondary effect from decreases in the algal cover in the intertidal and from increases in algal cover in the subtidal. Ultimately, however, Tenera (1997-TN10220) concluded that many of these changes were a response to increased water temperatures from Diablo Canyon's thermal effluent discharge. Table G-6 summarizes these results.

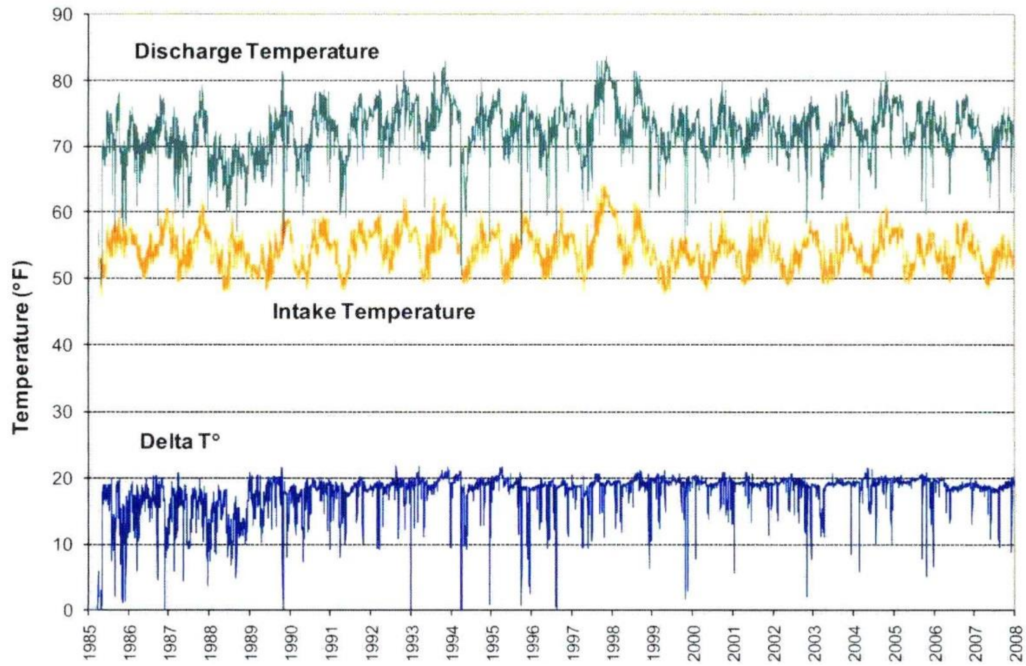

Figure G-5 Daily Average Discharge and Intake Temperature and Temperature Increase (Delta T°) at Diablo Canyon Nuclear Power Plant, 1985–2008. Source: PG&E 2008-TN10104.

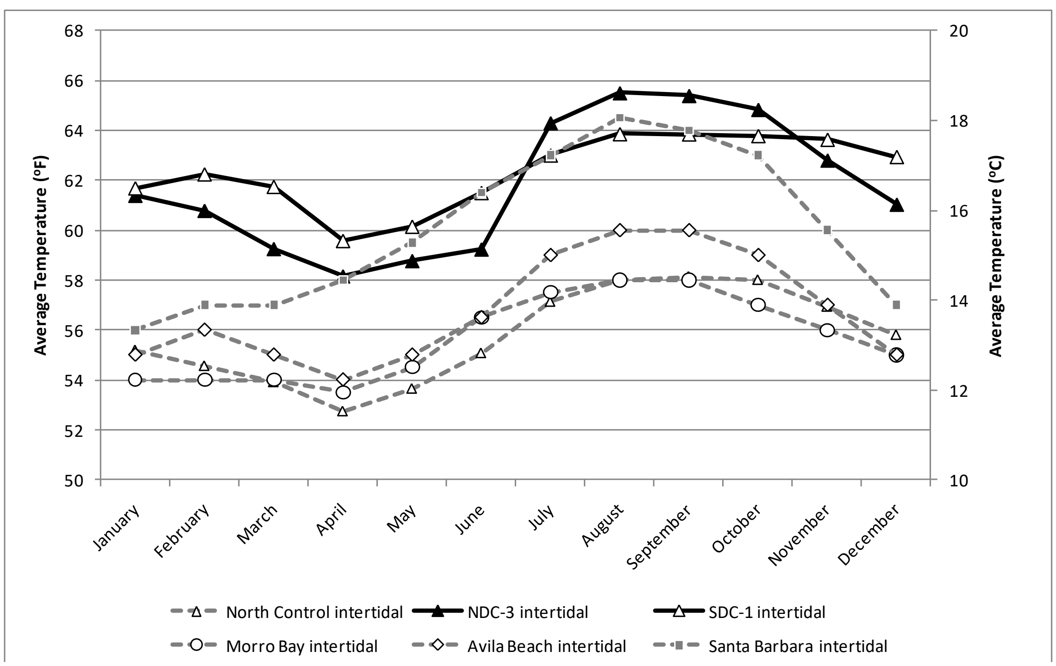

Figure G-6 Average Monthly Water Temperature (°F and °C) for Selected Intertidal Stations in California, 1988–2002. Source: PG&E 2002-TN10248.

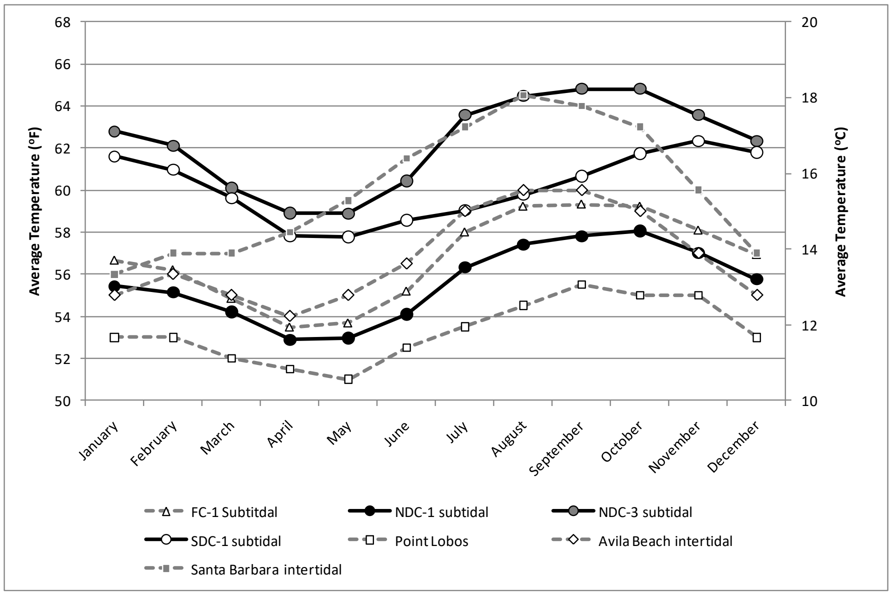

Figure G-7 Average Monthly Water Temperature (°F and °C) for Selected Intertidal Stations in California, 1988–2002. Source: PG&E 2002-TN10248.

Table G-6 Results of Thermal Effects Assessment on Representative Important Species from Diablo Canyon Nuclear Power Plant Site

Species	Common Name	Abundance Trend	Area Affected
Xiphister mucosus	rock prickleback	Decrease	2.3 mi of coastline
Anthopleura elegantissima	aggregating sea anemone	Decrease	2.3 mi of coastline
Cancer antennarius	rock crab	Inconclusive	40.6 ac
Haliotis cracherodii	black abalone	Decrease	7.9 mi of coastline
Pisaster ochraceus	ochre starfish	Increase	2.3 mi of coastline
Pugettia producta	kelp crab	Decrease	40.6 ac
Pycnopodia helianthoides	sunflower sun stars	Decrease	40.6 ac
Strongylocentrotus purpuratus	purple sea urchin	Increase until 1995; decrease thereafter	40.6 ac
Chondracanthus canaliculatus, formerly *Gigartina canaliculata*	unnamed red seaweed	Decrease	2.3 mi of coastline
Egregia menziesii	feather-boa kelp	Decrease	2.3 mi of coastline
Gastroclonium subarticulatum, formerly *G. coulteri*	hollow-branched seaweed	Decrease	2.3 mi of coastline
Mazzaella flaccida, formerly *Iridaea flaccida*	iridescent seaweed	Decrease	2.3 mi of coastline
Scorpaenichthys marmoratus	cabezon	Decrease	>40.6 ac
Sebastes carnatus	gopher rockfish	Unchanged	>40.6 ac
Sebastes mystinus	blue rockfish	Decrease	>40.6 ac
Chlorostoma brunnea, formerly *Tegula brunnea*	brown turban snail	Decrease	40.6 ac
Haliotis rufescens	red abalone	Decrease	40.6 ac
Strongylocentrotus franciscanus	red sea urchin	Increase	40.6 ac
Laminaria dentigera	oar-blade kelp	Inconclusive	19.9 ac
Nereocystis luetkeana	bull kelp	Decrease	169.7 ac
Pterygophora californica	tree kelp	Decrease	19.9 ac

Sources: PG&E 2008-TN10104: see citation for PG&E 1982; Tenera 1997-TN10220, PG&E 2002-TN10248.

G.4 1995–2014 Receiving Water Monitoring Program

As part of a long-term RWMP, PG&E completed an assessment of data from May 1995 through December 2014. The associated report described the conditions and changes in nearshore marine communities in the vicinity of Diablo Canyon during the study period, and it assessed whether the effects of the discharge had changed significantly from the previous 10-year period of operation. To analyze the long-term effects of thermal discharges, researchers used statistical comparisons of data obtained from fixed stations over the following three time periods: pre-operation (January 1, 1978, through December 31, 1984), operational period 1 (an 8-year period of operation from January 1, 1987, through April 30, 1995, following startup) and operational period 2 (a 20-year period of operation from May 1, 1995, through December 31, 2014, following operational period 1) (PG&E 2023-TN9822).

The three principal findings were that (1) over the long term, more species of intertidal algae decreased than increased, while invertebrate taxa largely exhibited the opposite response; (2) a comparison of recent results to previous findings shows that the discharge effects on many species have largely stabilized; and (3) changes in subtidal algae, invertebrate, and fish abundances in Diablo Cove continued to occur during operational period 2, although fewer new effects of the discharge were detected than in previous analyses. Several intertidal taxa at Diablo Point exhibited a delayed response to the thermal discharge (i.e., changes during operational period 2 that did not occur in operational period 1). Section 3.7.7.7 of the environmental report (PG&E 2023-TN9822) describes the results of these studies in detail.

G.5 Intake Cove Bathymetry Surveys

In 2019, 2021, and 2023, PG&E conducted bathymetry surveys of Intake Cove to determine the extent of shoaling within the exclusion zone in support of the potential need for dredging during the current operating license term. Shoaling was most evident in the southwest corner of the survey area. Small, scattered areas, mostly directly offshore from the intake structure and in the southeast corner of the exclusion zone, had become deeper between the two surveys. Between 2019 and 2021, shoaling was evident through most of the study area, and the greatest areas of shoaling were in small pockets directly in front of the intake structure. The 2023 bathymetric study documented hydrographic elevations adjacent to the intake structure within Intake Cove. As in 2021, the southeast corner of the survey area was generally the deepest, while areas just offshore from the intake wall in the northeast corner and an area approximately 66 ft (20 m) from the intake on the northwestern boundary line were generally the shallowest. The largest visible difference from the previous survey was that the area in the center of the study area has further shoaled since the 2021 survey (PG&E 2023-TN9822).

G.6 Marine Biological Resources Assessment

In 2020 and 2021, Tenera (2021-TN10249) prepared a Marine Biological Resources Assessment in support of decommissioning-related permit applications that PG&E requires from the County of San Luis Obispo and the U.S. Army Corps of Engineers. The assessment documents the marine biological resources on the Diablo Canyon site and identifies potential impacts that could occur from decommissioning activities.

Tenera identified several gaps in information related to the marine environment. In particular, PG&E's RWMP studies do not regularly incorporate surveys of the areas immediately adjacent to the discharge structure, which is the area that would be most affected by in-water decommissioning activities. Additionally, no formal studies had been completed within Intake

Cove. Subsequently, Tenera researchers conducted field surveys in the following areas: intertidal zone on either side of the discharge structure; intertidal zone along the shoreline in Intake Cove; intertidal zone along the Intake Cove breakwaters; subtidal (seabed) area inside Intake Cove; and subtidal sections of the Intake Cove breakwaters. Detailed methods and results for these surveys are included in Appendix 1 through 5 of the Marine Biological Resources Assessment (Tenera 2021-TN10249).

The purpose of these field surveys was to supplement information from the multidecadal characterization of the Diablo Canyon site's marine flora and fauna available in other studies within areas that would be most directly affected by decommissioning activities. Tenera (2021-TN10249) adapted subtidal survey methods for the breakwaters from methods used in the monitoring of California's network of protected marine reserves. The methods were selected to collect data at the same sampling depths sampled by the RWMP. Field surveys also targeted special status species in the area, including seagrasses and abalone, as well as the invasive algal taxa *Caulerpa* species and *Sargassum horneri*.

The survey of the subtidal areas inside Intake Cove included a specific task focused on identifying the location and estimating the approximate areal coverage of eelgrass beds. The survey was not conducted in accordance with California Eelgrass Mitigation Policy implementation guidelines because any work on the project is not anticipated to occur until after Diablo Canyon stops operating. Surveys in accordance with California Eelgrass Mitigation Policy guidelines need to be conducted during the active growth period for eelgrass (typically April through October for central California) and should be considered valid for a period of 60 days to ensure substantial changes in eelgrass distribution and density do not occur between survey date and the project start date. Therefore, Tenera (2021-TN10249) anticipated that further eelgrass surveys would likely to be required 60 days or less before demolition or active in-water work activities would begin.

Tenera (2021-TN10249) also focused its supplemental surveys on black abalone because it is federally listed as endangered. Black abalone are a cryptic species typically found in deep cracks, and the shell is typically similar in shape and color to surrounding rock habitat and covered with encrusting invertebrates and algae that are also found on the adjacent rocky benthos. Therefore, there is potential that individual black abalone may be missed during a survey even when the survey methods specifically focus on black abalone. Therefore, even though the surveys included a focus on black abalone, there is still a potential that individual black abalone may not have been observed. The potential for missing black abalone was greatest in the surveys of the intertidal and shallow subtidal areas of the breakwaters where the shape of the interlocking concrete tribars creates deep cracks and small cave-like areas that field biologists could not access. However, the surveys did provide sufficient information to identify habitat for this species throughout the Diablo Canyon site, including along the breakwaters. Tenera (2021-TN10249) assumed the presence of black abalone in areas of suitable black abalone habitat based on the occurrence of suitable habitat for black abalone and the identification of black abalone in areas adjacent to suitable habitat where black abalone were not found.

Scientific divers certified by the California Department of Fish and Wildlife (CDFW) surveyed for the invasive green alga *Caulerpa taxifolia* in the area in front of the cooling water intake structure in accordance with the National Oceanic and Atmospheric Administration (NOAA) and CDFW *Caulerpa* control protocols. These protocols require that NOAA and CDFW be immediately notified if *Caulerpa* is found during a survey. However, researchers identified no *Caulerpa* (Tenera 2021-TN10249).

Tenera (2021-TN10249) also surveyed for the invasive algae *S. horneri*, which has proliferated in several areas of southern California and was recently observed as occurring along the coast in San Luis Obispo County. This species has not been observed in any of the RWMP monitoring that encompasses the wider site-area around Diablo Canyon and was not observed by Tenera researchers.

Diablo Cove contains strong and turbulent currents that hinder a direct inspection of the subtidal areas immediately in front of the discharge structure. Tenera did not complete a formal survey of marine biological resources in this area due to these constraints and the obvious safety concerns. However, Tenera divers had made observations as close-up as approximately 66 ft (20 m) from the discharge structure on previous occasions, and the divers provided anecdotal descriptions of the marine resources in these areas. Tenera (2021-TN10249) included these anecdotal accounts in its Marine Biological Resources Assessment, although these do not constitute a comprehensive description of this subtidal area. Tenera recommended that PG&E complete further surveys of the discharge area once the Diablo Canyon operations cease and the area is safe to survey.

Results of Tenera's 2020 and 2021 survey efforts are incorporated into the description of aquatic resources in Section 3.8 of this supplemental environmental impact statement, as appropriate.

G.7 References

AEG (Aspen Environmental Group). 2005. *Final Environmental Impact Report, Diablo Canyon Power Plant, Steam Generator Replacement Project*. SCH #2004101001, San Francisco, California. TN10213.

ASA (ASA Analysis & Communication, Inc.). 2003. *Estimation of Potential Economic Benefits of Cooling Tower Installation at the Diablo Canyon Power Plant*, *Final Draft*. New Hampton, New York. TN10218.

Bechtel (Bechtel Power Corporation). 2012. *Independent Third-Party Interim Technical Assessment for the Alternative Cooling Technologies or Modifications to the Existing Once-Through Cooling System for Diablo Canyon Power Plant*. Report No. 25762-000-30R-G01G-00009, Revision 2, Reston, Virginia. TN10115.

Bechtel (Bechtel Power Corporation). 2014. *Independent Third-Party Final Technologies Assessment for the Alternative Cooling Technologies or Modifications to the Existing Once-Through Cooling System for Diablo Canyon Power Plant*. Report No. 25762-000-30H-G01G-00001, Reston, Virginia. TN10116.

California Coastkeeper Alliance. 2010. Letter from A.H. Kelley, Program Director, California Coastkeeper Alliance, and Coalition, to C. Hoppin, Chair and Board Member, State Water Resources Control Board, dated April 13, 2010, regarding "Comments on Draft Final Substitute Environmental Document and Sitewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (March 22, 2010)." Sacramento, California. TN10215.

CEC (California Energy Commission). 2005. *Issues and Environmental Impacts Associated with Once-Through Cooling at California's Coastal Power Plants: In Support of the 2005 Environmental Performance Report and 2005 Integrated Energy Policy Report (Docket 04-Iep-1)*. CEC-700-2005-013, Sacramento, California. Available at http://large.stanford.edu/courses/2018/ph241/macfarlane1/docs/cec-700-2005-013.pdf. TN7444.

CRWQCB (California Regional Water Quality Control Board). 2003. *Fact Sheet for Regular Meeting of July 10, 2003, Pacific Gas and Electric Company Diablo Canyon Nuclear Power Plant, Renewal of NPDES Permit*. Sacramento, California. TN10219.

CRWQCB (California Regional Water Quality Control Board). 2003. *Staff Testimony for Regular Meeting of July 10, 2003 Pacific Gas and Electric Company's (PG&E's) Diablo Canyon Power Plant Renewal of NPDES Permit*. Sacramento, California. TN10212.

CSWRCB (California State Water Resources Control Board). 2023. *Resolution No. 2023-0025, Amendment to the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling to Revise Compliance Schedules for Alamitos, Huntington Beach, Ormond Beach, and Scattergood Generating Stations, and Diablo Canyon Nuclear Power Plant*. Sacramento, California. TN10117.

CSWRCB (California State Water Resources Control Board). 2023. *Once-Through Cooling Policy, Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling*. Sacramento, California. TN10114.

Dotson, R.C. and R.L. Charter. 2003. "Trends in the Southern California Sport Fishery." *California Cooperative Oceanic Fisheries Investigations*, 44: 94-106, La Jolla, California. TN10222.

Key, M., A.D. MacCall, T. Bishop, and B. Leos. 2005. *Stock Assessment of the Gopher Rockfish* (Sebastes carnatus). California Department of Fish and Game, Monterey, California. TN10223.

PG&E (Pacific Gas & Electric Company). 2002. Letter from J.R. Becker, Vice President, to R. Briggs, Executive Officer, Central Coast Regional Water Quality Control Board, dated November 8, 2022, regarding "Pacific Gas and Electric (PG&E) Diablo Canyon Power Plant (DCPP) Submittal - Receiving Water Monitoring Program 1995-2002 Analysis." PG&E Letter DCL-2002-584, Avila Beach, California. ADAMS Accession Package No. ML023250439. TN10248.

PG&E (Pacific Gas & Electric Company). 2008. *Diablo Canyon License Renewal Feasibility Study Environmental Report, Technical Data Report, Heat Shock*. Revision 0, Avila Beach, California. ADAMS Accession No. ML11166A151. TN10104.

PG&E (Pacific Gas & Electric Company). 2009. Letter from M. Krausse, Director, State Agency Relations, to California State Water Resources Control Board, dated September 30, 2009, regarding "Comment Letter - OTC Policy." Sacramento, California. TN10225.

PG&E (Pacific Gas & Electric Company). 2009. *Diablo Canyon License Renewal Feasibility Study Environmental Report, Technical Data Report, Impingement of Fish and Shellfish*. Revision 0, Avila Beach, California. ADAMS Accession No. ML11166A153. TN10113.

PG&E (Pacific Gas & Electric Company). 2009. Letter from J.R. Becker, Site Vice President, to NRC Document Control Desk, dated November 23, 2009, regarding “Diablo Canyon Units 1 and 2 License Renewal Application.” PG&E Letter DCL-09-079, Diablo Canyon Power Plant, Avila Beach, California. ADAMS Accession Package No. ML093340125. TN9842.

PG&E (Pacific Gas & Electric Company). 2010. Letter from J.R. Becker, Site Vice President, to NRC Document Control Desk, dated October 27, 2010, regarding “Diablo Canyon Units 1 and 2, Information to Support NRC Review of DCPP License Renewal Application (LRA) Environmental Report - Operating License Renewal Stage.” PG&E Letter DCL-10-124, Avila Beach, California. ADAMS Accession No. ML103070305. TN10119.

PG&E (Pacific Gas & Electric Company). 2014. Letter from E.D. Halpin, Senior Vice President, to NRC Document Control Desk, dated December 22, 2014, regarding “Diablo Canyon Units 1 and 2, 10 CFR 54.21(b) Annual Update to the Diablo Canyon Power Plant License Renewal Application (LRA), Amendment 48 and LRA Appendix E, Applicant’s Environmental Report - Operating License Renewal Stage, Amendment 1.” PG&E Letter DCL-14-103, Diablo Canyon Power Plant, Avila Beach, California. ADAMS Accession Package No. ML14364A259. TN9843.

PG&E (Pacific Gas and Electric Company). 2015. Letter from E.D. Halpin, Senior Vice President, to NRC Document Control Desk, dated December 4, 2015, regarding “Response to NRC Letter dated November 5, 2015, “Request for Additional Information Related to the Environmental Review of the Diablo Canyon Power Plant, Units 1 and 2, License Renewal Application (CAC Nos. MF4019 and MF40200.” PG&E Letter DCL-15-142, Diablo Canyon Power Plant, Avila Beach, California. ADAMS Accession Package No. ML16048A230. TN9836.

PG&E (Pacific Gas & Electric). 2023. Letter from P. Gerfen, Senior Vice President and Chief Nuclear Officer, to NRC Document Control Desk, dated November 7, 2023, regarding “Diablo Canyon Units 1 and 2, Docket No. 50-275, OL-DPR-80, Docket No. 50-323, OL-DPR-82, License Renewal Application.” Avila Beach, California. ADAMS Accession No. ML23311A154. TN9822.

PG&E (Pacific Gas and Electric Company). 2024. Letter from M.R. Zawalick, Vice President, Business and Technical Services, to NRC Document Control Desk, dated May 16, 2024, regarding “Responses to NRC Requests for Additional Information on the Diablo Canyon Power Plant License Renewal Application Environmental Report.” PG&E Letter DCL-24-052, Avila Beach, California. ADAMS Accession No. ML24137A314. TN10032.

SLCSC (Santa Lucia Chapter of the Sierra Club). 2010. Letter from M. DeMeritt, Chapter Chair, to NRC Chief, Rulemaking and Directives Branch, dated March 31, 2010, regarding “Comments on the NRC’s Scoping of the Environmental Impact Statement for the renewal of the Diablo Canyon Nuclear Power Plant’s Operating Licenses.” San Luis Obispo, California. ADAMS Accession No. ML101040674. TN10217.

SLOMFP (San Luis Obispo Mothers for Peace). 2010. Letter from J. ZamEk, San Luis Obispo Mothers for Peace, to J. Townsend, State Water Resources Control Board, dated April 13, 2010, regarding “Comment Letter on OTC Policy.” San Luis Obispo, California. TN10216.

State of California. 2022. *Senate Bill No. 846, Diablo Canyon powerplant: extension of operations*. Sacramento, California. TN10038.

Steinbeck, J. 2008. *Compilation of California Coastal Power Plant Entrainment and Impingement Estimates for California State Water Resources Control Board Staff Draft Issue Paper on Once-through Cooling*. Pismo Beach, California. TN10210.

Steinbeck, J., J. Hedgepeth, P. Raimondi, G. Cailliet, and D. Mayer. 2007. *Assessing Power Plant Cooling Water Intake System Entrainment Impacts*. CEC-700-2007-010, San Luis Obispo, California. TN10654.

Stephens, J., D. Wendt, D. Wilson-Vandenberg, J. Carroll, R. Nakamura, E. Nakada, S. Rienecke, and J. Wilson. 2006. "Rockfish Resources of the South Central California Coast: Analysis of the Resource from Partyboat Data, 1980-2005." *California Cooperative Oceanic Fisheries Investigations*, 47: 140-155, La Jolla, California. TN10221.

Tenera (Tenera Environmental Services). 1988. *Pacific Gas and Electric Company*, *Diablo Canyon Power Plant, Final Report, Thermal Effects Monitoring Program, Volume 1*. Berkely, California. ADAMS Accession No. ML1166A219. TN10247.

Tenera (Tenera Environmental Services). 1997. *Diablo Canyon Power Plant, Thermal Effects Monitoring Program Analysis Report, Chapter 1 - Changes in the Marine Environment Resulting from the Diablo Canyon Power Plant Discharge*. E7-204.7, San Francisco, California. ADAMS Accession No. ML11166A179. TN10220.

Tenera (Tenera Environmental Services). 2000. *Diablo Canyon Power Plant 316(b) Demonstration Report*. San Francisco, California. ADAMS Accession No. ML003689887. TN10211.

Tenera (Tenera Environmental Services). 2021. *Diablo Canyon Decommissioning, Marine Biological Resources Assessment, Revision 1*. San Luis Obispo, California. TN10249.

TER (Triangle Economic Research). 2005. *Benefits Valuation Study for Diablo Canyon Power Plant, Final Report*. Project No. 23205, Durham, North Carolina. TN10214.

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11. ABSTRACT (200 words or less)

The U.S. Nuclear Regulatory Commission (NRC) prepared this supplemental environmental impact statement (SEIS) in response to Pacific Gas and Electric Company’s application to renew the operating licenses for Diablo Canyon Nuclear Power Plant, Units 1 and 2 (Diablo Canyon) for an additional 20 years. This SEIS evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include: (1) purchased power, (2) renewables combination, and (3) not renewing the operating licenses (the no-action alternative). The NRC staff’s recommendation is that Diablo Canyon license renewal is a reasonable option for energy-planning decision-makers.

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