



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 27, 2016

Mr. Edward D. Halpin
Senior Vice President, Generation and
Chief Nuclear Officer
Pacific Gas and Electric Company
Diablo Canyon Power Plant
P.O. Box 56, Mail Code 104/6
Avila Beach, CA 93424

SUBJECT: DIABLO CANYON POWER PLANT, UNITS 1 AND 2 - REGULATORY AUDIT
REPORT FOR THE AUGUST 3-4, 2016, AUDIT AT THE WESTINGHOUSE
FACILITY IN ROCKVILLE, MARYLAND, IN SUPPORT OF ALTERNATE
SOURCE TERM LICENSE AMENDMENT REQUEST (CAC NOS. MF6399
AND MF6400)

Dear Mr. Halpin:

By letter dated June 17, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15176A539), as supplemented by letters dated August 31, October 22, November 2, November 6, and December 17, 2015; and February 1, February 10, April 21, and June 9, 2016 (ADAMS Accession Nos. ML15243A363, ML15295A470, ML15321A235, ML15310A522, ML16004A363, ML16032A603, ML16041A533, ML16120A026, and ML16169A264, respectively), Pacific Gas and Electric (PG&E, the licensee), submitted a license amendment request to revise the licensing bases to adopt the alternative source term as allowed by Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.67, "Accident source term," for Diablo Canyon Power Plant, Units 1 and 2.

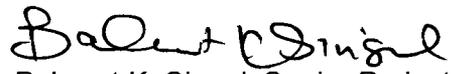
The U.S. Nuclear Regulatory Commission (NRC) staff conducted a regulatory audit at the Westinghouse facility in Rockville, Maryland, on August 3 and 4, 2016, to allow the NRC staff to review technical information related to the atmospheric dispersion modeling analyses submitted by PG&E in support of its LAR submittal. Attached is the audit report, which was completed in accordance with the guidance set forth in NRC Office of Nuclear Reactor Regulation, Office Instruction LIC-111, "Regulatory Audits," dated December 29, 2008 (ADAMS Accession No. ML082900195).

E. Halpin

- 2 -

If you have any questions, please contact me at 301-415-3016 or via e-mail at Balwant.Singal@nrc.gov.

Sincerely,



Balwant K. Singal, Senior Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-275 and 50-323

Enclosure:
Audit Report

cc w/encl: Distribution via Listserv



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

REGULATORY AUDIT REPORT PERFORMED AT
WESTINGHOUSE FACILITY FROM AUGUST 3 AND 4, 2016, IN
SUPPORT OF THE LICENSE AMENDMENT REQUEST TO REVISE THE CURRENT
LICENSING BASES TO ADOPT THE ALTERNATIVE SOURCE TERM
PACIFIC GAS AND ELECTRIC COMPANY
DIABLO CANYON POWER PLANT, UNITS 1 AND 2
DOCKET NOS. 50-275 AND 50-323

1.0 BACKGROUND

By letter dated June 17, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15176A539), as supplemented by letters dated August 31, October 22, November 2, November 6, and December 17, 2015; and February 1, February 10, April 21, and June 9, 2016 (ADAMS Accession Nos. ML15243A363, ML15295A470, ML15321A235, ML15310A522, ML16004A363, ML16032A603, ML16041A533, ML16120A026, and ML16169A264, respectively), Pacific Gas and Electric Company (PG&E, the licensee), submitted a license amendment request (LAR) to revise the licensing bases to adopt the alternative source term (AST) as allowed by Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.67, "Accident source term," for Diablo Canyon Power Plant (DCPP), Units 1 and 2.

The U.S. Nuclear Regulatory Commission (NRC) staff issued an initial set of requests for additional information (RAIs) on October 1, 2015 (ADAMS Accession No. ML15278A049). These RAIs primarily focused on acquiring: (1) meteorological (Met) data; (2) input and output files for the ARCON96 dispersion modeling runs, including Met data formatted for input to that model; (3) input files for the proprietary EN-113 dispersion model and a description of the EN-113 model input file structure; and (4) plant drawings used to determine certain model input parameters. The licensee provided its response to the NRC staff request on November 2, 2015.

The NRC staff reviewed the licensee's RAI responses and identified a discrepancy between the sequential hourly Met data formatted per NRC Regulatory Guide (RG) 1.23, "Meteorological Monitoring Programs for Nuclear Power Plants," Revision 1, March 2007 (ADAMS Accession No. ML070350028), and the Met data formatted for input to the ARCON96 (and presumably EN-113) dispersion model(s), along with other characteristics based on that data. The NRC staff was unable to determine, among other items, whether the appropriate Met data were input to the modeling runs. Priority was given to resolution of these discrepancies over initiating

Enclosure

review of the ARCON96 modeling analysis because of its potential impact on previously submitted relative concentration (X/Q) values and subsequent radiological dose calculations.

The NRC staff's second set of RAIs related to the Met data used to execute the dispersion models was provided to the licensee on February 17, 2016 (ADAMS Accession No. ML16048A232). The licensee evaluated the issues, confirmed the NRC staff-identified discrepancy between the Met data formatted per RG 1.23 and the Met data used as input to the dispersion models, and after correction, determined the effects on the subsequent dose calculations. The licensee provided its responses to those RAIs by letter dated April 21, 2016.

The NRC staff's review of the ARCON96 and EN-113 dispersion modeling analyses continued after receiving the second set of RAI responses. A decision was made to subsequently conduct an audit of the licensee to allow the NRC staff to review calculations performed in support of the analyses during the audit.

The NRC staff conducted the regulatory audit on August 3 and 4, 2016. This audit report is completed in accordance with the guidance set forth in NRC Office of Nuclear Reactor Regulation, Office Instruction LIC-111, and "Regulatory Audits," dated December 29, 2008 (ADAMS Accession No. ML082900195).

2.0 REGULATORY AUDIT BASIS

The focus of this audit was to review the analyses submitted by the licensee referenced in the Background section; in particular the atmospheric dispersion modeling analyses of onsite and offsite impacts due to hypothetical design-basis accident releases which provide direct input to subsequent dose calculations. The following regulations and regulatory guidance served as the basis for this audit.

- 10 CFR 50.67, "Accident source term," paragraph (b)(2).
- 10 CFR Part 50, Appendix A, General Design Criteria for Nuclear Power Plants," Criterion 19, "Control room."
- NUREG-0800, "Standard Review Plan for the Review of Nuclear Power Plants: LWR Edition" (SRP) Section 2.3.4, "Short-Term Atmospheric Dispersion Estimates for Accident Releases," Revision 3, March 2007, Section II, "Acceptance Criteria" (ADAMS Accession No. ML070730398).

Among other items, SRP Section 2.3.4 states that the atmospheric dispersion models used to calculate X/Q values from accident releases at offsite and onsite locations should be documented in detail and substantiated so that the NRC staff can evaluate the appropriateness of their use with regards to release characteristics, plant configuration, plume density, meteorological conditions, and site topography.

- RG 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, November 1982, Reissued February 1983 (ADAMS Accession No. ML003740205).
- NUREG/CR-2858 (PNL-4413), "PAVAN: An Atmospheric-Dispersion Program for Evaluating Design-Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations," November 1982 (ADAMS Accession No. ML12045A149).
- NUREG/CR-2260 (NUS-3854), "Technical Basis for Regulatory Guide 1.145, 'Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants,'" October 1981 (ADAMS Accession No. ML12045A197).
- RG 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," June 2003 (ADAMS Accession No. ML031530505).
- NUREG/CR-6331 (PNNL-10521), "Atmospheric Relative Concentrations in Building Wakes," Revision 1, May 1997.
- RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000 (ADAMS Accession No. ML003716792).
- NUREG-0737, "Clarification of TMI [Three Mile Island] Action Plan Requirements: Requirements for Emergency Response Capability," Supplement No. 1, Reprinted February 1989 (ADAMS Accession No. ML 102560009).
- NUREG-0696, "Functional Criteria for Emergency Response Facilities," February 1981 (ADAMS Accession No. ML051390358).
- RG 1.23, "Meteorological Monitoring Programs for Nuclear Power Plants," Revision 1, March 2007 (ADAMS Accession No. ML070350028).

3.0 REGULATORY AUDIT SCOPE

The scope of the audit was to examine and evaluate technical and process information (e.g., functions, inputs, and assumptions) related to (1) the proprietary EN-113 dispersion model used to estimate offsite X/Q values at the exclusion area boundary (EAB) and the outer low population zone (LPZ) boundary, and (2) the NRC-accepted ARCON96 dispersion model used to estimate onsite X/Q values at the various air intakes and ingress / egress locations to the Control Room (CR) and Technical Support Center (TSC).

- Purpose - The intent of reviewing this information was to (1) evaluate those accident-related atmospheric dispersion analyses for conformance to applicable regulatory requirements and guidance, and (2) determine the reasonability of the

dispersion modeling results presented in the documentation that supports the AST LAR. With respect to the proprietary EN-113 dispersion model, the intent was not to endorse the model but rather to determine its acceptability for the AST submittal.

- **Goals and Objectives** – The information contained in this audit report that is expected to be referenced, as appropriate, by the safety evaluation prepared for the subject LAR submittal. This is especially important for the EN-113 modeling analysis, which uses a proprietary computer code.

The audit was also meant to identify the information needs to be submitted on the docket for completing the review as additional RAIs after completion of the audit. The responses to any such RAIs may require Revision to dispersion model input and output files (in the case of ARCON96 model runs), revised dispersion model input files and summaries of all applicable output results (in the case of EN-113 model runs) and, if necessary, revised Met data formatted for input to the respective models. The Revision or correction of any related figures or drawings, and summary tables of dispersion or dose calculation results will be expected to be provided as part of the RAI response(s).

4.0 AUDIT LOCATION AND DATES

The audit was conducted at the Westinghouse facility in Rockville, Maryland, on August 3 and 4, 2016. A closeout meeting was held at the conclusion of the audit on August 4, 2016.

5.0 AUDIT TEAM

Title / Organization	Team Member
Team Leader, NRO/DSEA/RHM1/RMOT	Brad Harvey
Audit Leader, NRO/DSEA/RHM1/RMOT	Michael Mazaika
Technical Support, NRO/DSEA/RHM1/RMOT	Jason White
Senior Project Manager, NRR/DORL/LPL4-1	Balwant Singal
Branch Chief, NRO/DSEA/RHM1	Christopher Cook

A list of audit participants and their affiliation is presented as Attachment 1 to this report.

6.0 DOCUMENTS AUDITED

The information reviewed during the audit was based on review of the information already submitted, including responses to RAIs.

The purpose of the audit was not to endorse the proprietary EN-113 dispersion model. Hence, no review of the code itself or any related quality assurance documentation was made. Only the input files and information on the input file structure was reviewed during the audit.

Attachment 2 to this report contains a list of documents that were reviewed by the NRC staff during the audit, in part or in whole, to review specific aspects of certain technical aspect (e.g., development of a model input value). These documents were made available to the NRC staff in hard copy form during the audit and may not be submitted on docket.

7.0 AUDIT ACTIVITIES AND TECHNICAL DISCUSSIONS

An audit plan and agenda were transmitted to the license by letter dated July 12, 2016, prior to the audit (ADAMS Accession No. ML16193A332). The audit entrance meeting summarized the background information presented earlier in this report and reiterated the purpose and statement of the audit's goals and objectives.

Tables 1 and 2 present the technical information and supporting analysis reviewed and discussed during the audit and results of the review and are provided in Attachments 3 and 4, respectively, to this audit report. Table 1 identifies technical areas of interest to the NRC staff regarding the EN-113 dispersion modeling analysis of offsite impacts at the EAB and outer LPZ boundary. Table 2 identifies technical areas of interest to the NRC staff regarding the ARCON96 dispersion modeling analysis of onsite impacts at the various air intakes and ingress/egress locations to the CR and TSC. Tables 1 and 2 also show the results of the NRC staff review for each technical area of interest based on the information made available to the NRC staff during the audit. Tables 1 and 2 also indicate the areas requiring the licensee to submit certain information on docket and will be the subject of future RAIs.

8.0 EXIT BRIEFING

On August 4, 2016, the NRC staff closed out the regulatory audit with an exit briefing on the results of the review of technical information made available during the audit. The license was briefed on the potential topics of interest where the NRC staff is likely to request additional information.

Date:

Attachments:

1. Audit Participants
2. Documents Reviewed
3. Table 1 – EN-113 Dispersion Modeling Analysis
4. Table 2 – ARCON96 Dispersion Modeling Analysis

ATTACHMENT 1
AUDIT PARTICIPANTS

NAME	TITLE	ORGANIZATION
Balwant Singal	Senior Project Manager	NRC/NRR/DORL/LPL4-1
Hossein Hamzehee	Manager, Regulatory Services	PG&E
Mike Wright	Manager, LBVP	PG&E
Stephen Vigeant	Senior Scientist	CB&I Federal Services*
Sreela Ferguson	Supervisor – Rad & TH Group	Westinghouse / WECTEC*
Keith Ferguson	Radiological Specialist	Westinghouse / WECTEC*
Christopher Cook	Branch Chief	NRC/NRO/DSEA/RHM1
Brad Harvey	Acting Team Leader	NRC/NRO/DSEA/RHM1/RMOT
Jason White	Physical Scientist-Meteorologist	NRC/NRO/DSEA/RHM1/RMOT
Michael D. Mazaika	Physical Scientist-Meteorologist	NRC/NRO/DSEA/RHM1/RMOT
Kristy Bucholtz	Reactor Engineer	NRC/NRR/DRA/ARCB

*Contract staff representing PG&E

NRC = U.S. Nuclear Regulatory Commission

NRR = Office of Nuclear Reactor Regulation

NRO = Office of New Reactors

DORL/LPL4-1 = Division of Operating Reactor Licensing, Plant Licensing Branch IV-1

DSEA/RHM1/RMOT = Division of Site Safety and Environmental Analysis, Hydrology and Meteorology Branch 1, Meteorology and Oceanography Team

DRA/ARCB = Division of Risk Assessment, Radiation Protection and Consequence Branch

PG&E/DCPP = Pacific Gas and Electric Company

ATTACHMENT 2

LIST OF DOCUMENTS REVIEWED

Diablo Canyon Alternative Source Term Radiological Calculations

- A. Calculation Number (Calc. No.) 14078104-C-M-0001, Revision 1, Atmospheric Dispersion Factors (X/Qs) at Control Room Receptors for Post-Accident LOCA Radiological Releases Using the ARCON96 Program.
- B. Calc. No. 14078104-C-M-0002, Revision 0, Atmospheric Dispersion Factors (X/Qs) at the Exclusion Area Boundary and Low Population Zone for Radiological Releases from Unit 1 and Unit 2 Using Regulatory Guide 1.145 Methodology.
- C. Calc. No. 14078104-C-M-0003, Revision 1, Atmospheric Dispersion Factors (X/Qs) at Control Room Receptors for Fuel Handling Accident Radiological Releases Using the ARCON96 Program.
- D. Calc. No. 14078104-C-M-0004, Revision 1, Atmospheric Dispersion Factors (X/Qs) at Control Room Receptors for Radiological Releases from MSSVs/ADVs Using the ARCON96 Program.
- F. Calc. No. 14078104-C-M-0006, Revision 0, Atmospheric Dispersion Factors (X/Qs) at TSC Receptors for LOCA Radiological Releases Using the ARCON96 Program.
- G. Calc. No. 14078104-C-M-00028, Revision 0, Effect of Using the Stability Classes based on Regulatory Guide 1.23 Methodology on Accident Atmospheric Dispersion Factors (X/Qs) and Associated Dose Consequences at On-Site and Off-Site Receptors.

ATTACHMENT 3

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
1	Issues Related to Input Card 3 of Proprietary EN-113 Model		
1(a)	<p>The period of record (POR) of meteorological (Met) data used for the EN-113 atmospheric dispersion modeling analysis of offsite impacts in support of the LAR 15-03 submittal has been stated to be 2007 thru 2011. However, the variables "ISTART" and "ISTOP" on Card 3 for each of the three EN-113 model input files, provided with the November 2, 2015, RAI response, are shown as "87001" and "91365," respectively.</p> <p>The licensee should confirm whether the three EN-113 model input files represent the offsite dispersion modeling performed for LAR 15-03 and, more importantly, verify whether or not the X/Q values and subsequent dose calculations are based on Met data for the 1987 through 1991 5-year POR <u>or</u> the 2007 thru 2011 POR.</p> <p>If the 1987-1991 POR of Met data was used, the licensee should revise the X/Q estimates for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs, subsequent dose calculations, and other related discussions and summary tables in the Updated Final Safety Analysis Report (UFSAR) and elsewhere in the LAR submittal.</p> <p>If the 2007-2011 POR of Met data was used, the licensee should provide the EN-113 model input files that correspond to the LAR 15-03 dispersion modeling analyses along with the sequential hourly Met data formatted for input to the EN-113 model.</p> <p>If necessary, the licensee should revise the discussions in the UFSAR accordingly.</p>	<p>The licensee confirmed that the input files and file description provided with the November 2, 2015, RAI response represent the EN-113 runs that support LAR 15-03.</p> <p>The licensee reported that the EN-113 model input files represented the 2007-2011 POR. The variables "ISTART" and "ISTOP" on Card 3 for each of the EN-113 input files are designated as "87001" and "91365," respectively, as a work-around for a Y2K year and date time stamping issue. EN-113 was developed in the 1970s and has not been updated to address this dating issue. The NRC staff is familiar with this issue and work-around and determined this approach to be reasonable.</p> <p>The Met data input to the EN-113 model runs (corrected for classification of stability class consistent with RG 1.23) was provided with the April 21, 2016, RAI response.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the technical issue and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
1(b)	<p>The licensee should explain how the variable "DHT," which is set to a value of "100" for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) model input files, relates to the actual vertical distance of separation for the delta-T measurement system, to the Met data input to the EN-113 dispersion model, and to the units of measure specified in Table 1 of Regulatory Position C.2.2 and Appendix A in RG 1.23, Revision 1 for defining Pasquill stability class as a function of delta-T (i.e., degrees Celsius (°C) per 100 meters (m)).</p>	<p>The licensee stated that EN-113 classifies stability using variable "DHT" based on how input delta-T (stability) data are provided. If delta-T values in input Met file represented literal vertical distance between two measurement levels, that would trigger conversion to °C/100 m to classify stability before use in X/Q calculations. In this case, input data already represented °C/100 m so the variable "DHT" was set to "100."</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the technical issue and no further action is warranted.</p>	No
1(c1)	<p>The licensee should explain why different calm threshold wind speed values, and possibly units of measure for wind speed, were specified by the variable "IREDIS" for the U1 (EAB) and U2 (EAB) EN-113 model input files (i.e., set to a value of "2" indicating a calm speed of 1.5 meters per second (m/sec) or 3.3557 miles per hour (mph)) compared to the U1/U2 (LPZ) EN-113 model input file (i.e., the variable "IREDIS" set to a value of "1" indicating a calm speed of 1.5 mph).</p>	<p>Variable "IREDIS" is a calm redistribution function assigning hours with calm wind conditions to non-calm wind directions similar to PAVAN. The licensee indicated that these threshold values are not used to calculate X/Q values. The licensee acknowledged incorrect use of different threshold values and units of measure for U1 (EAB) and U2 (EAB) runs versus U1/U2 (LPZ) run. However, the licensee does not plan to re-run EN-113 model for the LAR 15-03 submittal having looked at the effect of consistent "IREDIS" settings prior to the audit and found no significant difference in controlling X/Qs because of infrequent occurrence of calm winds at DCPD site.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the technical issue and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
1(c2)	<p>The licensee should confirm the starting threshold wind speeds for both the anemometer and wind vane on the primary and back-up Met towers during the modeled 5-year POR. As necessary, the licensee should reconcile, consistent with the definition for "calm" in Regulatory Position C.1 of RG 1.23, any differences between the highest of the starting speeds for the anemometer and wind vane on each tower, against the appropriate threshold value for calm wind conditions presumably specified by the variable "IREDIS."</p>	<p>The licensee was not sure of starting threshold wind speeds for anemometers and wind vanes on primary or back-up Met towers, although it was thought to be 0.5 m/sec for the anemometer. The licensee's wind speeds used for X/Q calculations under calm conditions were assumed to be 0.5 mph (accident releases) and 0.3 mph (annual average calculations) (see variables "CALMAC" and "CALMAN" on Card 8 as opposed to values entered on Card 3 for variable "IREDIS").</p> <p>The NRC staff determined that these values represent acceptably conservative assumptions for calculation purposes and that the licensee's approach was reasonable because the infrequent occurrence of light wind conditions at the DCPD site should not affect the resulting X/Q values. As such, the staff determined that the information provided by the licensee was sufficient to address the technical issue and no further action is warranted.</p>	No
1(c3)	<p>Given that the variable "ISPUNT" on Card 4 is set to "0" for each of the EN-113 input files indicating that the unit of measure for wind speed is mph, the licensee should confirm that there are no discrepancies between the units of measure that appear to be associated with the variable "IREDIS" for the U1 (EAB) and U2 (EAB) model runs and the hourly Met data input to EN-113 or the units of measure that appear to be associated with the variable "IREDIS" for the U1/U2 (LPZ) model run and the hourly Met data input to EN-113.</p>	<p>The licensee indicated that there is no relationship between the variable "ISPUNT" on Card 4 and the variable "IREDIS" on Card 3. See the resolution status for Item 1(c1) regarding the function of the variable "IREDIS." The variable "ISPUNT" designates the units of measure for the wind speed data input to EN-113. The setting of "0" corresponds to "mph." Wind speed values are in units of mph in the EN-113 input Met data file. Spot checks made by staff on conversion of wind speed (as input to EN-113) versus units of measure in RG 1.23 (i.e., m/sec) data file were determined to be acceptable.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the technical issue and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
2	Issues Related to Input Card 4 of Proprietary EN-113 Model		
2(a1)	<p>The EN-113 input file description for Card 4 indicates that the first nine entries on that card specify three-character Met data parameter IDs. Of those, three IDs are given - "Speed" (131), "Dir" (132), and "Delta T" (136). All other IDs are entered as "0." However, the sequential hourly, ASCII-character Met data file input to the EN-113 model includes six parameters (lines of data) per Julian Day (i.e., IDs = 131, 132, 134, 135, 136, and 137). The licensee should identify the Met parameters or data corresponding to parameter IDs 134, 135, and 137 along with the respective units of measure.</p>	<p>The licensee indicated only three of the six 24-hour records for each day of the input Met data file are used by EN-113 and correspond to the non-zero IDs (i.e., 131, 132, and 136) entered on Card 4. Numerical values assigned to the three other 24-hour daily records are "dummy" values produced by a Fortran program used to prepare the Met data file. The Fortran program was originally set up to provide input to other codes that utilize Met data (not applicable to this LAR analysis). The NRC staff made spot checks on conversion of wind speed (input to EN-113 as mph) versus units of measure in RG 1.23 (i.e., m/sec) data file and consistency of time/date stamping between both files. Spot checks OK.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No
2(a2)	<p>The licensee should confirm whether the Met parameters or data corresponding to parameter IDs 134, 135, and 137 were accounted for in the EN-113 modeling runs for the LAR and, if so, how those values are used in the dispersion calculations.</p>	<p>This concern covered the possibility that data associated with Met parameter IDs 134, 135, and 137 were input to the EN-113 modeling analysis. The licensee confirmed that this is not the case. See resolution status for Item 2(a1).</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concern and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
3	Issues Related to Input Card 6 of Proprietary EN-113 Model		
3(a1)	<p>The variable "ISTRNLN" on Card 6 appears to relate to the calculation (interpolation) of X/Q values between (presumably) a 1-hour average value and some endpoint in time. There appears to be two numerical entries associated with this variable (i.e., "0" and "2") for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model input files. The "0" entry suggests that "no calculation" is made. The licensee should explain how each of the two numerical entries for this variable relate to the calculation of the 0- to 2-hour X/Q values reported for the EAB distance relative to U1 and U2 <u>and</u> to the calculation (and/or interpolation) of the 0- to 2-hour, 2- to 8-hour, 8- to 24-hour, 1- to 4-day, and 4- to 30-day X/Q values estimated for the outer LPZ boundary distance.</p>	<p>The licensee indicated that although EN-113 operates using hourly Met data as input (as opposed to PAVAN which uses joint frequency distributions of wind speed, wind direction, and atmospheric stability class as input), EN-113 can calculate X/Q values for intermediate time periods beyond the 0-2 hour interval, such as for the LPZ, by logarithmic interpolation. The variable "ISTRNLN" on Card 6 controls this function. The first of the two entries for this variable instructs the code to use logarithmic interpolation rather than hourly X/Q values to calculate X/Q values for the intermediate time periods. The second of the two entries for "ISTRNLN" sets the shorter-term endpoint for the interpolation. In this case, the value "2" assumes the appropriate 1-hour X/Q value represents a 2-hour average on the interpolation curve. The annual average X/Q value, representing the other end point for the interpolation, is determined elsewhere by EN-113.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concern and no further action is warranted.</p>	No
3(a2)	<p>The licensee should discuss the consistency of this apparent methodology with the guidance in RG 1.145, Revision 1, Re-issued February 1983 and NUREG/CR-2858 (PNL-4413), dated November 1982.</p>	<p>The licensee stated its method is consistent with approach used by PAVAN model which implements RG 1.145.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the technical issue and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
3(b)	<p>In light of the apparent discrepancy between the calm threshold wind speed specified for the U1 (EAB) and U2 (EAB) model input files (i.e., 1.5 m/sec) and that specified for the U1/U2 (LPZ) model run (i.e., 1.5 mph) on Card 3, the licensee should confirm the validity of setting the variable "ICALM" on Card 6 to a value of "0" for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model input files which appears to implement the default re-setting of the wind speed to the (presumably threshold) calm speed value if the (hourly) "wind speed falls below the calm speed."</p>	<p>The licensee indicated that the variable "ICALM" on Card 6 has a different function than the settings for "IREDIS" on Card 3 (i.e., which distributes hours with calm winds to non-calm wind directions). "ICALM" is related to the variables "CALMAC" and "CALMAN" on Card 8; that is, the wind speed value to be used to calculate an hourly X/Q value under conditions when the wind speed for that hour is considered to be calm (i.e., "CALMAC") and the wind speed value to be used to calculate an annual average X/Q value for those hours during the POR that are considered to be calm (i.e., "CALMAN").</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the technical issue and no further action is warranted.</p>	No
3(c)	<p>The variables "UCU" and "UCS" on Card 6 appear to relate to correction factors to be applied, respectively, to the wind speed during unstable / neutral stability conditions and during stable conditions if (presumably) the wind speed measurement height and release height are different. The variables "UCU" and "UCS" are set to "0.00" for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model input files. However, the input file description indicates that the default setting for these variables is "1.0."</p> <p>The regulatory guidance in NUREG/CR-2858 (PNL-4413), dated November 1982, indicates that for a ground-level release, the release height is set to 10 m. This height is the same as the lower wind measurement height on the DCPP, Units 1 and 2, Met tower such that no height adjustment for wind speed appears to be necessary for the dispersion calculations. Given that the variable "MESHT" on Card 7 is set to "0," indicating "[s]peed modification with height not made" and that the setting for the variable "IRETYPE" on Card 5 corresponds to a ground-level release, the licensee should confirm that the <u>non-default</u> settings for variables "UCU" and "UCS" are consistent with the regulatory guidance in NUREG/CR-2858.</p>	<p>The licensee indicated that despite setting the variables "UCU" and "UCS" on Card 6 to "0.00" for the EAB and LPZ EN-113 modeling runs instead of the default value of "1.0," there was no adjustment to the wind speed for any difference between the wind speed measurement height and the release height. For these model runs, accident releases are assumed to be ground-level (default release height of 10 m) which is the same as the wind speed measurement height. Therefore, no adjustment is made to the wind speed used in the X/Q calculations. This is consistent with the relationship between the variables "TOWERH" and "IRETYPE" in the PAVAN user's guide (NUREG/CR-2858).</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the technical issue and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
4	Issues Related to Input Card 7 of Proprietary EN-113 Model		
4(a)	<p>The variable "ISECVG" on Card 7 appears to relate to sector averaging and is set to a value of "1" for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model input files suggesting that sector averaging is performed in calculating the X/Q values at each boundary location. Further, the option selected indicates that sector averaging is made "without correction."</p> <p>The licensee should confirm whether this variable affects only the estimate of annual average X/Q values used to interpolate intermediate, short-term accident-related X/Q values (i.e., 2-8 hours, 8-24 hours, 1-4 days, and 4-30 days) at the outer LPZ boundary or calculations of the 0-2 hour X/Q values at the EAB receptor distances (only) and the 0-2 hour X/Q values at the LPZ. If the latter, the licensee should reconcile and/or clarify the text in the fourth bulleted item under Section 5.1 (Paragraph 8) of the "Diablo Canyon Power Plant Technical Assessment, Revision 2," which states that "[t]he plume centerline from each release is transported directly over the receptor."</p>	<p>The licensee indicated that the variable "ISECVG" (i.e., sector averaging) only applies to the calculation of annual average X/Q values, but <u>not</u> to the calculation of hourly X/Qs. The licensee also stated that the statement in the fourth bulleted item under Section 5.1 (Paragraph 8) of the Technical Assessment (i.e., "[t]he plume centerline from each release is transported directly over the receptor") applies only to the calculation of hourly X/Q values.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No
4(b)	<p>The variable "IBWEFF" on Card 7 is set to a value of "5" for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model input files. This entry indicates that building wake effects on short-term dispersion calculations are accounted for and based on "Rancho Seco ('77) building wake meander." Horizontal plume dispersion (sigma-Y) values, based on the results from the Rancho Seco and Experimental Organic Cooled Reactor field tests to characterize plume meander effects, are shown on Figures II-2 through II-5 for atmospheric stability classes D through G, respectively, as documented in the technical basis for RG 1.145 (i.e., NUREG/CR-2260 (NUS-3854), October 1981).</p> <p>In particular, for a downwind distance of 800 m, similar to many of the EAB distances entered for the variable "DISITE" on Card 11 of the U1 (EAB) and U2 (EAB) EN-113 model input files, the plotted sigma-Y values range from approximately 0.25 to 3.0 times higher, depending on stability class, than the plume meander adjustment factors incorporated into RG 1.145. Consequently:</p>	<p>The licensee stated that the "Rancho Seco ('77) building wake meander" option selected with the variable "IBWEFF" on Card 7 implements the methodology in RG 1.145. The licensee also acknowledged that the terminology used to describe this option is not as clear as it could, reiterating that the code and descriptions were developed many years ago. The NRC staff indicated that these factors and the cited regulatory guidance were the bases for the NRC staff concerns raised in the questions that follow.</p> <p>The audit scope did not include inspection of the EN-113 code itself.</p>	

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
4(b1)	The EN-113 input file description suggests that there is a building wake / meander component associated with the "IBWEFF" variable. If so, the licensee should confirm the wind speed threshold(s) and specify the atmospheric stability conditions that implement the adjustments for plume meander in the dispersion model calculations.	<p>The licensee indicated that EN-113 implements RG 1.145 Regulatory Position C.1.3.1(a) for plume meander when the wind speed is less than 6 m/sec under D, E, F, and G stability conditions based on Figure 3 of RG 1.145. Plume meander is not implemented for other Met conditions consistent with RG 1.145 Regulatory Position C.1.3.1(b).</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No
4(b2)	The licensee should discuss the consistency of the methodology invoked by setting the variable "IBWEFF" on Card 7 to "5" with the guidance in RG 1.145, NUREG/CR-2858, and NUREG/CR-2260, which implements or is the basis for the regulatory positions in RG 1.145.	<p>The licensee stated that the "Rancho Seco ('77) building wake meander" option selected with the variable "IBWEFF" on Card 7 implements the methodology in RG 1.145 without modification.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No
4(b3)	The licensee should confirm whether any adjustment is made to the vertical plume dispersion parameter (i.e., sigma-Z) in estimating X/Q values with the EN-113 model when the "Rancho Seco ('77) building wake meander" methodology is invoked by setting the variable "IBWEFF" on Card 7 to "5." If so, explain and provide technical justification for that approach.	<p>The licensee indicated that EN-113 makes no modification to the sigma-Z (or the sigma-Y) dispersion curves in RG 1.145. Staff noted that no sigma-Z measurements were made during the Rancho Seco field tests or as documented in NUREG/CR-2260 (NUS-3854), the technical basis for RG 1.145.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No
4(b4)	If any other differences exist between the cited regulatory guidance and the "building wake meander" methodology controlled by setting the variable "IBWEFF" to "5" in the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs, the licensee should provide technical justification for those approaches, especially if the X/Q calculation results are less conservative, had the guidance in RG 1.145 been followed.	<p>The licensee stated that no other differences exist between RG 1.145 and the building wake methodology implemented by the EN-113 model for this LAR submittal.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
4(c)	<p>The variable "ITERIN" on Card 7 appears to allow for the model calculations to be adjusted for the effects of nearby terrain on dispersion and is set to a value of "1" for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model input files. The U1 (EAB) and U2 (EAB) input files specify 16 identical terrain adjustment factors (TAFs) set to a value of "4.0" (presumably one for each of the 16 standard direction sectors). However, the U1/U2 (LPZ) input file specifies 16 TAFs with each set to a value of "1.25."</p> <p>The fifth bulleted item under Section 5.1 (Paragraph 8) of the "Diablo Canyon Power Plant Technical Assessment, Revision 2," states that "[a] terrain recirculation factor of 4 is used in the calculation of the annual average X/Q values." Given the distances to the respective EAB and outer LPZ boundaries specified on Card 11 of the EN-113 input files, the TAFs are consistent with the default TAFs from Figure 4.2 in NUREG/CR-2858 for the NRC-approved PAVAN dispersion model. Therefore:</p>	<p>The licensee confirmed that default open terrain adjustment factors (TAFs) were input to the EN-113 model runs for the EAB and LPZ to account for terrain recirculation effects at the DCPD site based on the option selected for the variable "ITERIN" on Card 7 and that these factors were based on Figure 4.2 of NUREG/CR-2858. Factors are as listed for each of the 16 direction sectors which were included as part of the echo of model inputs in the output files for each model run. This model input information was provided to the NRC staff, along with descriptions of the input file structure and available input options, as part of the November 2, 2015, RAI response.</p>	
4(c1)	<p>The licensee need to reconcile and/or clarify the fifth bulleted item under Section 5.1 (Paragraph 8) of the referenced Technical Assessment, as well as the parallel text in Subsection 2.3.5.2.1 of the UFSAR, Revision 21, as proposed to be revised on December 17, 2015 (ADAMS Accession No. ML16004A363), and elsewhere as appropriate, as to the numerical value of the "terrain recirculation factor" actually input to the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs.</p>	<p>The licensee acknowledged that the referenced bulleted item in Section 5.1 of the Technical Assessment and the parallel text in Subsection 2.3.5.2.1 of the UFSAR only represents the TAF applied to the U1 (EAB) and U2 (EAB) model runs.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the technical issue. An RAI will be issued requesting that the licensee update the Technical Assessment and UFSAR to include the TAF applied to the U1/U2 (LPZ) model run.</p>	Yes

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
4(c2)	<p>Given the location of the DCPD site, the licensee should explain the rationale for not setting the variable "ITERIN" to "6" which appears to correspond to TAFs associated with a coastal setting.</p>	<p>The licensee indicated that the "ITERIN" option on Card 7 for TAFs associated with a coastal setting was not selected because the licensee is not familiar with where and how the measurements resulting in those factors were made, or how the TAFs were determined. The licensee was also not sure if earlier field studies conducted at and around the DCPD site (as discussed in UFSAR), to evaluate stability classification approaches based on measurements of horizontal and vertical wind direction fluctuation and delta-T, also included development of site-specific TAFs. Because of these uncertainties, the licensee considered the default open terrain adjustment factors from NUREG/CR-2858 for the NRC-approved PAVAN dispersion model to be conservative.</p> <p>The NRC staff determined that the licensee's approach was reasonable and that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted. The staff notes that the UFSAR discussions of these site-specific field studies and wind conditions at the site suggest that dispersion conditions are generally good and so assumption still considered to be reasonable.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
5	Issues Related to Input Card 8 of Proprietary EN-113 Model		
5(a1)	<p>The variables "CALMAC" and "CALMAN" on Card 8 appear to specify default wind speeds that are assigned to (presumably hourly) calm wind observations in calculating accident and annual average X/Q values and are set to "0.5" and "0.3" mph, respectively. The settings are the same for these variables for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs. The licensee should explain the rationale for assigning different default calm wind speeds to the accident and annual average X/Q calculations.</p>	<p>The licensee pointed out that difference between wind speeds used for X/Q calculations under calm conditions (i.e., "CALMAC" = 0.5 mph for accident releases and "CALMAN" = 0.3 mph for annual average calculations) on Card 8 is based on difference between RG 1.145 and RG 1.111. The NRC staff acknowledges this difference (see Regulatory Position C.1.1 (Paragraph 4) in RG 1.145 which calls for higher of starting speed of anemometer or wind vane and Regulatory Position C.4 (Paragraph 4) in RG 1.111 which calls for one-half of higher of starting speeds for those instruments).</p> <p>Although licensee was not sure of starting threshold wind speeds for anemometers and wind vanes on primary or back-up Met towers, the NRC staff believes that these values represent acceptably conservative assumptions for X/Q calculation purposes and that the licensee's approach was reasonable because the infrequent occurrence of light wind conditions at the DCPD site should not affect the resulting X/Q values. As such, the NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
5(a2)	<p>The licensee should explain the relationship between the default calm wind speeds specified by the variables "CALMAC" and "CALMAN" on Card 8 and the calm threshold wind speed for the U1 (EAB) and U2 (EAB) model input files (i.e., 1.5 m/sec) and for the U1/U2 (LPZ) model run (i.e., 1.5 mph) (refer to Items 1(c1), 1(c2), and 1(c3) pertaining to Card 3 for these latter values). The licensee should also confirm the validity of these settings in light of the apparent discrepancy between the calm threshold wind speeds and, if necessary, reconcile with the settings for the variables "CALMAC" and "CALMAN" on Card 8.</p>	<p>The licensee indicated that the variable "IREDIS" on Card 3 which distributes hours with calm winds to non-calm wind directions has a different function than the settings for the variables "CALMAC" and "CALMAN" on Card 8; that is, the wind speed value to be used to calculate an hourly X/Q value under accident conditions when the wind speed for that hour is considered to be calm (i.e., "CALMAC") and the wind speed value to be used to calculate an annual average X/Q value for those hours during the POR that are considered to be calm (i.e., "CALMAN").</p> <p>The NRC staff determined that the licensee's approach was reasonable because the values for "CALMAC" AND "CALMAN" represent acceptably conservative assumptions for X/Q calculation purposes and because the infrequent occurrence of light wind conditions at the DCPD site should not affect the resulting X/Q values. As such, the staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
5(b)	<p>The variable "BHT" on Card 8 appears to identify a representative building height which is presumably considered in the calculation of annual average X/Q values to account for structural wake effects on dispersion and is set to a value of "66.5" (presumably in meters) for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs. Further, 16 values are entered on Card 10 for the variable "A" in each of the three EN-113 input files representing the "[b]uilding wake effect area"; each is set to a value of "2745" (units of measure are <u>not</u> specified). Based on the drawings referenced in the RAI responses of November 2, 2015, the variables "BHT" and "A" appear to correspond to the containment structure.</p> <p>The licensee should explain how the building cross-sectional area was determined (including the domed-portion of the containment structure, if applicable). See also Items 6(a1) and 6(a2) pertaining to Card 10 regarding a potential discrepancy with the specified building cross-sectional area.</p>	<p>The licensee indicated that the building cross-sectional area was based on the projected height and width of the cylindrical portion of the containment building plus the domed portion on top of the containment. The licensee suggested that the cross-sectional area of the domed portion was estimated based on a triangular representation minus a small portion of the dome on each side.</p> <p>Based on a calculation review during the audit, the NRC staff determined that the area of the domed portion of the containment building was accounted for by treating it as a hemisphere rather than a triangular shape. However, the staff does not consider this to be an issue. Using the cross-sectional area of the containment building to account for wake effects is conservative (i.e., smaller area) compared to the larger cross-sectional area of all the other structures directly adjacent to the containment building.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns. An RAI will be issued requesting that the licensee update the UFSAR and Technical Assessment to explain how the building cross-sectional area was determined (including the domed-portion of the containment structure).</p>	Yes

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
6	Issues Related to Input Card 10 of Proprietary EN-113 Model		
6(a1)	<p>The minimum cross-sectional area of the reactor building identified in Subsection 2.3.4.7 (Paragraph 4) and Subsection 2.3.5.2 (Paragraph 1) of the UFSAR (Revision 22) is 1600 square meters (sq-m) and is designated as the variable "A." However, the 16 values entered on Card 10 for the variable "A" for each of the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) model runs is 2745 (units of measure <u>not</u> specified).</p> <p>Further, Section 5.1 (in Paragraph 3, for the variable "A," and in Paragraph 7) of the "Diablo Canyon Power Plant Technical Report, Revision 1" and the later "Diablo Canyon Power Plant Technical Assessment, Revision 2" does <u>not</u> specify the building cross-sectional area used for the offsite impact modeling analysis. In addition, Subsection 2.3.5.2.1 (Paragraph 3) of the UFSAR, Revision 21, as proposed to be revised on December 17, 2015 (ADAMS Accession No. ML16004A363), no longer specifies the building cross-sectional area used for this offsite impact analysis.</p> <p>Consequently, the licensee should explain the rationale for and impact of the potentially non-conservative change to the licensing basis by assuming a building cross-sectional area of 2745 (presumably in sq-m) compared to the value of 1600 sq-m in the referenced UFSAR subsections.</p>	<p>The licensee confirmed that a value 2745 sq-m was used to account for building wake effects in the EN-113 modeling analysis of offsite X/Q values at the EAB and LPZ receptors. The licensee also indicated that value of 1600 sq-m for the minimum cross-sectional area of the containment buildings is a value entered in the plant meteorological computer for its X/Q calculations (possibly for emergency response purposes, although licensee was unsure of its purpose and history) but was not the value used for design basis X/Q calculations. The licensee also stated that the use of a containment building cross-sectional area of 2745 sq-m is conservative (i.e., smaller area) compared to the actual larger cross-sectional area of all the other structures directly adjacent to each containment building.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address NRC staff concerns. An RAI will be issued requesting that the licensee update the UFSAR and Technical Assessment to identify the cross-sectional area of the containment building used as input to the EN-113 dispersion modeling analysis for the EAB and LPZ receptors, and to the ARCON96 modeling analysis for the CR and TSC receptors. The RAI will request the licensee to confirm whether the value of 2745 sq-m rather than 1600 sq-m represents a change to the current licensing basis for the offsite and onsite dispersion modeling analyses.</p>	Yes
6(a2)	<p>If necessary, the licensee should reconcile any discrepancies with the ARCON96 onsite dispersion modeling analyses which incorporate a similar building cross-sectional area of 2744.5 sq-m.</p>	<p>The licensee stated that both the EN-113 and ARCON96 models accounted for wake effects due to the containment buildings using a building cross-sectional area of approximately 2745 sq-m.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
7	Issues Related to Input Card 11 of Proprietary EN-113 Model		
7(a1)	<p>The variable "DISITE" on Card 11 appears to specify distances to the "site boundary" for each of 16 direction sectors from a given release point beginning with the distance to the receptor to the south (i.e., wind from the north) and continuing in a clockwise direction. The discussion in Section 5.1 (Paragraph 5) of the "Diablo Canyon Power Plant Technical Assessment, Revision 2" indicates that these distances correspond to the EAB. Figure 5.1-1, referenced from Section 5.1, does not appear to specifically identify the EAB when compared to Figure 2.1-2 of the UFSAR.</p> <p>The EAB and Site Boundary appear to be collocated in portions of the northwest clockwise through the northeast direction sectors and to be two distinct boundaries in portions of the northeast clockwise through the southeast direction sectors relative to True North. Further, some of these sectors extend beyond the coastline into the Pacific Ocean adjacent to the DCPP, Units 1 and 2, plant site, including a portion of the southeast clockwise through a portion of the northwest direction sectors. Except for portions of the southeast and northwest sectors, Figure 2.1-2 of the UFSAR gives no clear indication of the actual EAB location within this sector range; only the site boundary is designated.</p> <p>Distances for the variable "DISITE" (or EAB) are specified for each of the 16 direction sectors for the U1 (EAB) and U2 (EAB) EN-113 model input files. The discussion in Subsection 2.3.5.2.1 (Paragraph 5) of the UFSAR, Revision 21, as proposed to be revised on December 17, 2015 (ADAMS Accession No. ML16004A363), indicates that the EAB distances are derived from Figure 2.1-2 in accordance with Regulatory Position C.1.2 of RG 1.145.</p> <p>The licensee should confirm whether the EAB and the Site Boundary are collocated in the southeast clockwise through the northwest direction sectors. If not, the licensee should explain, for both Units 1 and 2, the basis for any modeled EAB receptor distances located offshore.</p>	<p>The licensee indicated that DCPP, Units 1 and 2, Site Boundary and EAB were <u>not</u> collocated in all direction sectors, including those sectors along the shoreline adjacent to the plant (i.e., a portion of the southeast clockwise through a portion of the northwest sector). The licensee recognized that UFSAR Figure 2.1-2 better represented the relationship between those boundaries than Figure 5.1-1 as cited in the Technical Assessment. However, the licensee also understood that UFSAR Figure 2.1-2 and other discussions in the UFSAR and Technical Assessment do not provide sufficient information to either confirm that Site Boundary and EAB are <u>not</u> collocated in the direction sectors along the shoreline, to verify the distances to the EAB assigned to those sectors on Card 11 of the U1 (EAB) and U2 (EAB) EN-113 model runs, or to confirm that the guidance in Regulatory Position C.1.2 of RG 1.145 for selecting those distances is met.</p> <p>The NRC staff determined the information discussed by the licensee during the audit to be sufficient to address the NRC staff concerns. The NRC staff plans to issue an RAI requesting that the licensee update the UFSAR and Technical Assessment with additional information that describes the basis and location of the offshore EAB receptors.</p>	Yes

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
7(a2)	<p>The licensee should update UFSAR Figure 2.1-2 to clearly illustrate the location of the continuous EAB in the southeast clockwise through the northwest direction sectors. In addition, the licensee should provide a tabular list, on that figure or elsewhere, which identifies the modeled distances to the EAB from the nearest edge of the respective containment buildings for both Units 1 and 2 for all direction sectors consistent with the guidance in Regulatory Position C.1.2 of RG 1.145.</p>	<p>As an alternative to revising UFSAR Figure 2.1-2 to show the location of the continuous EAB in the southeast clockwise through the northwest direction sectors, the licensee proposed to update related sections of the UFSAR and Technical Assessment with additional information that describes the basis and location of the offshore EAB receptors. Updates to include a table(s) that lists, by direction sector and unit, the distances to the EAB receptors from the nearest edge of the Unit 1 and Unit 2 containment buildings for all direction sectors. The NRC determined that the proposed approach should resolve NRC staff concerns.</p> <p>The NRC staff plans to issue an RAI requesting that the licensee update the UFSAR and Technical Assessment with a table or tables that list the modeled distances to the EAB from the nearest edge of the respective containment buildings for DCCP, Units 1 and 2, and for all 16 direction sectors consistent with the cited guidance in Regulatory Position C.1.2 of RG 1.145, Revision 1.</p>	Yes

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
7(b)	<p>In verifying the distances to the EAB specified for the variable "DISITE" on Card 11 in the U1 (EAB) and U2 (EAB) EN-113 model input files, the exclusion area boundary, as shown on UFSAR Figure 2.1-2, follows a zig-zag pattern within the east-northeast clockwise through a portion of the southeast direction sectors with that boundary approaching closer and extending farther away from the containment buildings for the two units. For the east-northeast and perhaps the southeast direction sectors for both the U1 (EAB) and U2 (EAB) input files, the "DISITE" values do not appear to agree, within reason, with the location of the EAB as illustrated in UFSAR Figure 2.1-2 and using the guidance in Regulatory Position C.1.2 of RG 1.145 as cited by the licensee.</p> <p>The licensee should confirm the distances to the EAB specified for the variable "DISITE" on Card 11 in the U1 (EAB) and U2 (EAB) EN-113 model input files for the east-northeast and southeast direction sectors. If <u>any</u> of the modeled EAB receptor distances should be located closer to the nearest edge of the respective containment buildings, then the licensee should discuss the basis for assigning the distance(s) to the EAB receptor(s) in question and if changed make the necessary revisions.</p>	<p>The NRC staff reviewed UFSAR Figure 2.1-2 during audit. Based on the review, the NRC staff determined that for the east-northeast sector, the staff misinterpreted the markings of various boundaries included on Figure 2.1-2 and within radial area extending 22.5 degrees either side of the ENE direction radial (in accordance with the cited regulatory position). Based on the review and discussions with the licensee, the NRC staff determined that for the southeast sector, portion of the DCP, Units 1 and 2, site boundary along the shoreline was not collocated with the EAB for receptors located offshore. Subsequently, the staff was able to confirm the distances to the EAB for the east-northeast and southeast direction sectors.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No
8	Other Potential EN-113 Dispersion Modeling Analysis Issues		
8(a1)	<p>The licensee should confirm that the X/Q values for the EAB and outer LPZ boundary summarized in Table 5.1-1 of the "Diablo Canyon Power Plant Technical Assessment, Revision 2," were, in fact, selected from among <u>all</u> 16 direction sectors whether located over land or over water. If not the case, then the licensee should clarify the text in Section 5.1 and Note 2 to Table 5.1-1 of the Technical Assessment as well as the text in Subsection 2.3.5.2.1 (last paragraph) of the UFSAR, Revision 21, as proposed to be revised on December 17, 2015 (ADAMS Accession No. ML16004A363), by explaining the basis for following that approach which is inconsistent with the guidance in RG 1.145.</p>	<p>The licensee stated that the maximum offsite 0.5% sector-dependent X/Q values listed in Table 5.1-1 of the Technical Assessment were selected from among <u>all</u> 16 direction sectors, whether located over land or over water, from the respective U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs.</p> <p>The NRC staff determined that the clarifications provided by the licensee during the audit were sufficient to address the NRC staff concerns.</p>	No

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
8(a2)	<p>Since the N-113 dispersion model is a proprietary code, the NRC staff requested for only the input files and a description of their structure in a previously issued RAI. However, Table 5.1-1 of Revision 2 to the referenced Technical Assessment only lists the highest accident-related X/Q values at the EAB and outer LPZ boundary. Therefore, consistent with Regulatory Position C.4 in RG 1.145, the licensee should provide a summary of all direction-dependent sector X/Q values for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs equivalent to the output of the NRC-accepted PAVAN dispersion model.</p>	<p>The NRC staff plans to issue an RAI requesting that the licensee include the sector-specific 0.5% X/Q values and sector-specific receptor distances for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) model runs in the Technical Assessment table(s).</p>	Yes
8(a3)	<p>The licensee should update UFSAR Figure 2.1-2 to clearly illustrate the location of the defined 2,000-yard radius offshore Security Zone, referenced in the last paragraph of UFSAR Subsection 2.1.2.1.3, and its relationship to the distances entered for the variable "DISITE" on Card 11 in the U1 (EAB) and U2 (EAB) EN-113 model input files for at least the south-southeast clockwise through the west-northwest direction sectors. If the boundary that represents the defined Safety Zone differs from the modeled distances to the EAB, the licensee should explain and/or reconcile the basis for those differences.</p>	<p>As an alternative to revising UFSAR Figure 2.1-2 to show the location of the defined 2,000-yard radius offshore Security Zone, the licensee proposed to update Section 2.1 of UFSAR with additional information that describes the location of the Security Zone in relation to the EAB receptors also located offshore as input to the U1 (EAB) and U2 (EAB) EN-113 model runs. The NRC staff considered the proposed alternative to be a reasonable approach.</p> <p>The NRC staff plans to issue an RAI requesting the licensee to update Section 2.1 of the UFSAR, where appropriate, with additional information that describes the location of the 2000-yard radius offshore Security Zone in relation to the EAB receptors, also located offshore in at least the south-southeast clockwise through the west-northwest direction sectors.</p>	Yes
8(b)	<p>Neither Section 5.1 nor Table 5.1-1 of the "Diablo Canyon Power Plant Technical Assessment, Revision 2," appears to address the estimation of 5-percent overall site X/Q values for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs. The NRC staff is unable to confirm whether the 0-2 hour X/Q values in Table 5.1-1 actually represent the controlling X/Q values for that time period for evaluation as called for by Regulatory Positions C.3 and C.4 in RG 1.145. Consequently:</p>	<p>Refer to the following items.</p>	

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
8(b1)	<p>The licensee should confirm whether 5-percent 0-2 hour overall site X/Q values were estimated as part of the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs.</p> <ul style="list-style-type: none"> • If not, the licensee should provide justification for not doing so. • If so, the licensee should confirm whether the modeling results from all 16 direction sectors were considered in determining the overall cumulative probability distribution on which 5-percent 0-2 hour overall site X/Q values are to be based in accordance with Regulatory Position C.3 in RG 1.145. • If the modeling results from fewer than 16 direction sectors were included in each of those determinations, the licensee should then explain how the overall cumulative probability distributions were constructed and provide justification for their comparison to the 0.5-percent sector-dependent X/Q values in determining the controlling 0-2 hour accident X/Q values at the EAB and outer LPZ boundary. 	<p>The licensee stated that the output generated by the EN-113 dispersion model includes 5-percent overall site 0-2 hour X/Q values as called for by Regulatory Position C.3 in RG 1.145.</p> <p>The licensee also stated that the cumulative probability distributions of 0-2 hour X/Q values from the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) EN-113 model runs were determined using the results from <u>all</u> 16 direction sectors, consistent with Regulatory Position C.3 in RG 1.145, and that the respective 5-percent overall site 0-2 hour X/Q values were based on the corresponding distributions.</p> <p>The NRC staff determined that that the clarifications provided by the licensee during the audit should be sufficient to address the NRC staff concerns.</p>	No
8(b2)	<p>The licensee should confirm whether the results from the U1/U2 (LPZ) modeling run for all 16 direction sectors were considered in determining the intermediate, short-term accident-related X/Q values (i.e., 2-8 hours, 8-24 hours, 1-4 days, and 4-30 days) at the outer LPZ boundary by interpolating between the 5-percent 0-2 hour overall site X/Q and the highest of the 16 sector-dependent annual average X/Q values in accordance with Regulatory Position C.3 in RG 1.145. If fewer than 16 sector-dependent annual average X/Q values were used in that determination, the licensee should provide justification for not doing so and address its potential effects on the interpolated intermediate, short-term accident-related X/Q values.</p>	<p>The licensee stated that intermediate, short-term X/Q values at the LPZ were based on interpolation between the 5-percent 0-2 hour overall site X/Q and the highest of the 16 sector-dependent annual average X/Q values consistent with Regulatory Position C.3 in RG 1.145.</p> <p>The NRC staff determined that that the clarifications provided by the licensee during the audit should be sufficient to address the NRC staff concerns.</p>	No
8(b3)	<p>Consistent with Regulatory Position C.4 in RG 1.145, the licensee should provide a summary of all 5-percent overall site X/Q values for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) analyses equivalent to the output of the NRC-accepted PAVAN dispersion model.</p>	<p>The NRC staff plans to issue an RAI requesting that the licensee include the 5-percent overall site 0-2 hour X/Q values from the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) model runs, the intermediate, short-term X/Q values (i.e., 2-8 hours, 8-24 hours, 1-4 days, and 4-30 days) from the U1/U2 (LPZ) model run, and the 16 sector-dependent annual average X/Q values from the U1/U2 (LPZ) model run in the appropriate table or tables of the Technical Assessment.</p>	Yes

Table 1

Technical Areas of Interest & Resolution Status Regarding EN-113 Dispersion Modeling Analysis of Offsite (EAB and LPZ) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	Need for RAI
8(c)	<p>Note 2 to Table 5.1-1 of the "Diablo Canyon Power Plant Technical Assessment, Revision 2," identifies the highest 0.5-percent sector-dependent X/Q values for the U1 (EAB), U2 (EAB), and U1/U2 (LPZ) model runs and states that "[t]he worst case downwind sector for the 0-2 hour period for all receptors is northwest" and "[f]or Unit 1/2 LPZ the worst case sector for periods 2-8 hours and longer is southeast." The (presumably) maximum sector X/Q value for the 0-2 hour time period is 180 degrees out of phase with the (presumably) maximum sector X/Q values for the intermediate short-term accident time periods. It is not clear to the NRC staff whether this difference in maximum sectors is related to the issues raised in the preceding questions 8(a) and 8(b) regarding whether and how modeling results from over land and/or over-water receptors were considered.</p> <p>Consequently, the licensee should explain how the results presented in Table 5.1-1 of the referenced Technical Assessment and as used elsewhere in the LAR implements the guidance in Regulatory Position 2.2.1 of RG 1.145 and represents the maximum sector X/Q values at the outer LPZ boundary. If not the case, then provide justification for the approach followed.</p>	<p>The licensee stated that although the worst-case downwind sector was different for the 0-2 hour time period than for all time periods from 2-8 hours and longer, the highest X/Q value for any given time interval (i.e., 0-2 hours and the intermediate short-term intervals from 2-8 hours, 8-24 hours, 1-4 days, and 4-30 days) were used in the dose calculations, regardless of the sector in which it occurred.</p> <p>The NRC staff considered the licensee's approach to be reasonable in that it meets the intent of Regulatory Position C.2.2.1 (Last Paragraph) of RG 1.145. As such, the NRC staff determined that that the clarifications provided by the licensee during the audit should be sufficient to address the NRC staff concerns.</p>	No

ATTACHMENT 4

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
1	Issues Related to ARCON96 Dispersion Modeling Analysis		
1(a)	<p>Subsection 6.4.2.3 of the UFSAR, Revision 22, refers to the following regulatory criteria with respect to the safety evaluation for the Technical Support Center (TSC) and its habitability: Supplement 1 to NUREG-0737, which in turn refers to the ventilation, filtration, radiological protection, and radiation monitoring criteria in NUREG-0696.</p> <p>Section 2.6 of NUREG-0696 states that "TSC personnel shall be protected from radiological hazards, including direct radiation and airborne radioactivity....under accident conditions, to the same degree as control room personnel." Section 8.2.1, Item (f), of NUREG-0737 states that the TSC will be "[p]rovided with radiological protection....necessary to assure that radiation exposure to any person working in the TSC would not exceed 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident." In addition, Section 1.3.2 of RG 1.183 states that "[a]ny implementation of an AST [alternative source term].... should be supported by evaluations of all significant radiological and nonradiological impacts of the proposed actions."</p> <p>Section 9.0 of the "Diablo Canyon Power Plant Technical Assessment, Revision 2" states that "[i]n accordance with current licensing basis, the dose to the Technical Support Center has been evaluated for the DBA [design basis accident] that has the worst case radioactivity release, i.e., the LOCA [loss-of-coolant accident]." Section 5.2 of the referenced Technical Assessment also indicates that the dispersion parameter (X/Q) values selected for the dose consequence assessments are intended to support bounding analyses for an accident that occurs at either unit and that they take into consideration the various release points-receptors applicable to each accident to identify the bounding X/Qs.</p> <p>Receptors associated with the Control Room (CR) are located closer to potential accident releases from Main Steam Safety Valves (MSSVs), 10% Atmospheric Dump Valves (ADV), and due to a Main Steam Line Break (MSLB) at Units 1 and 2 than to TSC receptors. However, dispersion modeling results for MSSV, ADV,</p>	<p>The licensee reiterated that the only accident scenario analyzed for LAR 15-03 submittal was the LOCA because it represented the current licensing basis. However, the licensee estimated previously unanalyzed X/Q values at the TSC for accident releases from the MSSVs, 10% ADVs, and an MSLB. The licensee summarized its approach for demonstrating that LOCA was still the worst-case accident scenario for dose consequences. Since the release points for these three accident scenarios are located so close together, the highest of the modeled X/Q values was used to represent all three scenarios. The licensee performed a simplified dose assessment, based on results from RADTRAD analysis of impacts at the LPZ which covered the presumed 30-day duration of an accident, by scaling the resultant LPZ doses using the ratio of the TSC and LPZ X/Q values. Since dispersion model calculations are based, in part, on the distance of the receptor from a release point, this approach assumed that a TSC operator was located on the roof of the TSC at one of the air intakes and did not take into account any reductions due to emergency air filtering.</p> <p>The licensee also indicated that a comparison was made between the results from a MSLB scenario to a Control Rod Ejection Accident (CREA).</p> <p>The NRC staff considered the proposed approach reasonable as long as sufficient descriptive information is submitted documenting the approach. The licensee indicated that it does not plan to provide dose results based on these additional evaluations.</p> <p>The NRC staff plans to issue an RAI requesting that the licensee update the Technical Assessment and UFSAR, as appropriate, with a thorough explanation of the approach used, including X/Q modeling results at the TSC receptors for MSSV, 10% ADV, and MSLB release scenarios, determination of the ratios of these results to the X/Q values estimated at the LPZ, and a relative comparison of the estimated doses based on these ratios to the doses for the assumed controlling LOCA scenario. The RAI will also request for</p>	Yes

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
	<p>and MSLB release scenarios range from a factor of about 2 higher to almost a factor of 10 higher (particularly at the CR Center receptor location), depending on averaging time, compared to LOCA-related release points / scenarios. Section 8.0 of the referenced Technical Assessment estimates the total effective dose equivalent to the TSC operator to be 4.1 rem compared to the 5 rem regulatory limit.</p> <p>Based on this information, it is not clear that the LOCA-related release scenarios represent the highest potential dose to TSC occupants. Therefore, the licensee should either provide additional regulatory and technical justification for retaining only the LOCA-related release scenarios as the licensing and design bases for radiological impacts at the TSC, or perform additional ARCON96 dispersion modeling runs to estimate X/Qs at the TSC receptors due to accident releases from the MSSVs, ADVs, and MSLB scenarios at Units 1 and 2 and update any subsequent dose calculations.</p>	<p>ARCON96 model input and output files for these additional model runs.</p>	
1(b)	<p>If bounding X/Q values for a given release scenario and dose calculation are selected from the corresponding ARCON96 modeling results associated with a given unit (as appears to be the case in Chapter 15 of the UFSAR and Section 7 of the referenced Technical Assessment), then the licensee should annotate the tables to indicate the unit from which the X/Q values were obtained.</p>	<p>The NRC staff plans to issue an RAI requesting that the licensee annotate any tables in the UFSAR and Technical Assessment to indicate the unit from which a bounding X/Q was obtained and used as input to a dose calculation for a given release scenario.</p>	Yes
2	Issues Related to ARCON96 Dispersion Modeling Analysis		
2(a)	<p>Subsection 2.3.5.2.2 of the UFSAR, Revision 21, as proposed to be revised on December 17, 2015 (ADAMS Accession No. ML16004A363), and Section 5.2 of the "Diablo Canyon Power Plant Technical Assessment, Revision 2," under the headings "Energetic Releases" and "Vertically-Oriented Releases," identifies accident releases from the MSSVs and 10% ADVs as "energetic" in terms of exit velocity. The context of those discussions is to justify the application of a deterministic reduction factor to modeled onsite X/Q values based on Regulatory Position C.6 in RG 1.194 to sources with these characteristics.</p> <p>The vertical velocity of MSSV and 10% ADV releases is stated to be at least 95 times larger than the 95th-percentile wind speed of 1</p>	<p>The licensee acknowledged misinterpretation of 95th-percentile wind speed for the purpose of determining the ratio of the expected vertical velocity of releases from MSSVs and 10% ADVs to that 95th-percentile wind speed value in order to justify use of deterministic reduction factor applied to modeled X/Q values for those release scenarios.</p> <p>The licensee indicated that 95th-percentile 10-m wind speed was about 11.0 m/sec for the modeled 5-year POR rather than 1 m/sec as currently stated in Technical Assessment. Ratio of expected vertical velocity of MSSV and 10% ADV releases to 95th-percentile wind speed at 10-m decreases from 95, as currently stated, to about 8.6.</p>	Yes

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
	<p>m/sec and approximately 5 times larger than the highest observed 10-m wind speed (i.e., 18.9 m/sec) within the modeled 5-year Met data base. Plume rise from MSSV and 10% ADV releases is also stated to be enhanced by 11 m at the (presumed) 95th-percentile wind speed of 1 m/sec due to the large vertical velocities.</p> <p>Note 13 at Paragraph 1 (Sentence 3) of Regulatory Position C.6 of RG 1.194 states “[a]s used here, 95th-percentile wind speed is that wind speed that is not exceeded more than 5 percent of the time.” It appears that the licensee interpreted this note incorrectly and that wind speeds greater than 1 m/sec occur more than 5 percent of the time at the DCPD site. Therefore, the licensee should correct the 95th-percentile wind speed value to be consistent with the referenced guidance and as that value appears to have been used in estimating plume rise enhancement from MSSV and 10% ADV releases.</p>	<p>The NRC staff plans to issue an RAI requesting that the licensee update any related discussions in the UFSAR and Technical Assessment to correct:</p> <ul style="list-style-type: none"> (a) the 95th-percentile 10-meter wind speed value to be consistent with the guidance in Note 13 at Paragraph 1 (Sentence 3) of Regulatory Position C.6 of RG 1.194; (b) the ratios of the expected vertical velocity of MSSV and 10% ADV releases to corrected 95th-percentile 10-meter (m) wind speed; and (c) the corrected 95th-percentile 10-m wind speed as it appears to have been used in estimating enhancement to plume rise of the MSSV and 10% ADV releases. 	
2(b)	<p>Given the general tendency of wind speed to increase with height and the stated release heights for the MSSVs and 10% ADVs (i.e., 27.1 and 26.5 m, respectively), confirm the appropriateness of using unadjusted wind speed data from the 10-m level of the onsite Met tower to determine the 95th-percentile wind speed value <u>or</u> provide the technical basis for and propose adjustments to the resulting value or other alternative approach.</p>	<p>To address this concern, the licensee also determined 95th-percentile 76-m wind speed to be 12.1 m/sec for the modeled 5-year POR and ratio of expected vertical velocity of MSSV and 10% ADV releases to 95th-percentile 76-m wind speed to be about 7.8. For both levels, revised ratio is still greater than threshold value of 5 in Regulatory Position C.6 of RG 1.194 below which allows reduction factor to be applied.</p> <p>The NRC staff plans to issue an RAI requesting that the licensee confirm the appropriateness of using unadjusted wind speed data from the 10-m level of the onsite Met tower to determine the 95th-percentile wind speed value or provide the technical basis for and propose adjustments to the resulting value or other alternative approach.</p>	Yes

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
2(c)	<p>It is reasonable to expect that wind speeds at the indicated release heights <u>and</u> in the layer of air above (through which the plume would rise) would be higher than those measured at the 10-m level. If it is determined that the ratio of the MSSV and 10% ADV exit velocities to the appropriate 95th-percentile wind speed value is less than the threshold value of 5 in the cited guidance, that allows for the X/Q reduction factor of 5 to be applied, then revise the applicable ARCON96 modeled X/Q values and subsequent dose calculations accordingly.</p>	<p>The NRC staff concern covered possibility that the deterministic reduction factor of 5 might not apply based on the re-calculated 95th-percentile wind speed and the ratio of the expected vertical velocity of MSSV and 10% ADV releases to the 95th-percentile 10-m wind speed (or a value adjusted for a higher elevation). Based on discussions with the licensee, it was determined that that the ratios based on the 95th-percentile 10- and 76-m wind speeds are both greater than the threshold value of 5.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concern and no further action is warranted.</p>	No
3	Issues Related to ARCON96 Dispersion Modeling Analysis		
3(a)	<p>The minimum cross-sectional area of the reactor building identified in Subsections 2.3.4.7 (Paragraph 5) and 2.3.5.2 (Paragraph 1) of the UFSAR, Revision 22, pertaining to the analysis of offsite impacts at the EAB and outer LPZ boundary, is 1600 sq-m and is designated as the variable "A." However, the 16 sector-specific values entered on Card 10 for the variable "A" for the Unit 1 (EAB), Unit 2 (EAB), and Unit 1 / Unit 2 (LPZ) EN-113 model runs is "2745" (units of measure are <u>not</u> specified).</p> <p>Further, Section 5.1 (Paragraph 3, for the variable "A," and Paragraph 7) in the "Diablo Canyon Power Plant Technical Report, Revision 1" and the later "Diablo Canyon Power Plant Technical Assessment, Revision 2" does <u>not</u> specify the building cross-sectional area used for the offsite impact modeling analysis. In addition, Subsection 2.3.5.2.1 (Paragraph 3) of the UFSAR, Revision 21, as proposed to be revised on December 17, 2015 (ADAMS Accession No. ML16004A363), no longer specifies the building cross-sectional area used for this offsite impact analysis.</p> <p>Similarly, Subsection 2.3.5.2.2 (Paragraph 1) of the UFSAR, Revision 21, as proposed to be revised on December 17, 2015, indicates that input data to the ARCON96 dispersion model consists, in part, of release characteristics that include the "building area affecting the release." Subsection 2.3.5.2.2 (Paragraph 7, third bulleted item) also states that "[t]he applicable structure</p>	<p>The licensee confirmed that a value 2745 (2744.5) sq-m was used to account for building wake effects in the ARCON96 modeling analysis of onsite X/Q values at the CR and TSC receptors. The licensee also indicated that value of 1600 sq-m for the minimum cross-sectional area of the containment buildings is a value entered in the plant meteorological computer for its X/Q calculations (possibly for emergency response purposes, although the licensee was unsure of its purpose or history) but was not the value used for design basis X/Q calculations. The licensee stated that the use of a containment building cross-sectional area of 2745 sq-m is conservative (i.e., a smaller area) compared to the actual larger cross-sectional area of all the other structures directly adjacent to each containment building.</p> <p>The NRC staff determined that the information provided by the licensee during the audit was sufficient to address the NRC staff concerns and no further action is warranted. The concern that modeled cross-sectional area for the Containment Building represents a non-conservative change to this element of the current licensing basis has previously been addressed under EN-113 Item 6(a1).</p>	No

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
	<p>relative to quantifying building wake effects on the dispersion of the releases is based on release / receptor orientation relative to the plant structures." Comparable text also appears in Section 5.2 (Paragraph 2 and the third bulleted item of Paragraph 8) of the referenced Technical Assessment.</p> <p>The licensee should explain the rationale and basis for the potentially non-conservative change to this element of the licensing basis by assuming a building cross-sectional area of 2745 sq-m compared to the value of 1600 sq-m in the referenced revisions of the UFSAR subsections.</p>		
3(b)	<p>None of the three different building cross-sectional areas used in the ARCON96 model input files – that is, 2744.5, 215.5, and 530.4 sq-m representing the Unit 1 and Unit 2 Containment Buildings, Refueling Water Storage Tanks (RWSTs), and Fuel Handling Buildings (FHBs), respectively - appear to be specified in the referenced UFSAR or Technical Assessment (Report) text, nor is the determination of those values explained. The building cross-sectional area input to the EN-113 and selected ARCON96 dispersion model runs (i.e., for the Unit 1 and 2 containment buildings) is essentially the same numerically. The output files for the ARCON96 model runs specify the units of measure for the building (cross-sectional) area as square meters.</p> <p>The licensee should explain the determination of each of the three building cross-sectional areas input to the various ARCON96 dispersion modeling runs including identification of the applicable structures or portions of structures, building dimensions (e.g., width, height, and, if applicable, the method of handling portions of irregularly-shaped structures), and cross-references to the applicable plant drawings on which the preceding information is based.</p>	<p>The licensee agreed to update UFSAR and Technical Assessment.</p> <p>The NRC staff plans to issue an RAI requesting that the licensee update the UFSAR and Technical Assessment by identifying the cross-sectional areas of the Containment Buildings, RWSTs, and FHBs for Units 1 and 2 as input to the ARCON96 dispersion modeling analysis (and for the Containment Buildings in the case of the EN-113 modeling analysis). This information represents part of (or, in the case of the cross-sectional area for the Containment Buildings, a possible change to) the licensing basis associated with the dispersion analyses that support the LAR.</p> <p>The licensee will also be requested to update the Technical Assessment by explaining how the respective cross-sectional areas were determined (e.g., identification of the applicable structures or portions of structures considered, building dimensions (e.g., width, height, and, if applicable, the method of handling portions of irregularly-shaped structures), and cross-references to the applicable plant drawings on which the preceding information is based). The NRC staff notes that some of this information was available in one of the calculations reviewed during the audit.</p>	Yes

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
3(c)	<p>The DCP, Units 1 and 2, containment buildings and RWSTs are cylindrical structures with domed tops. The projected widths of these structures alone, as seen by a given downwind receptor, should be the same except for the different structural widths regardless of the release-receptor orientation. However, the FHBs appear to be rectangular-shaped structures and the orientations between a potential release point, on or affected by the wake of the applicable FHB, and receptor pairing varies along with the projected width of the building wake.</p> <p>The same building cross-sectional area is input for several of the ARCON96 modeling runs used to evaluate accident releases from or affected by the wake of a FHB. The statements in the earlier referenced UFSAR and Technical Assessment (Report) text (i.e., “[t]he applicable structure relative to quantifying building wake effects on the dispersion of the releases is based on release / receptor orientation relative to the plant structures”) appears to be inconsistent with the fact that the projected width of the building wake for the FHB is the same for different release-receptor orientations.</p> <p>The licensee should clarify the text in UFSAR Subsection 2.3.5.2.2 and Section 5.2 of the Technical Assessment (Report) by expanding the discussion to include any limitations on the referenced statements and the rationale for using the same building cross-sectional area for the FHB-related scenarios. If necessary, the licensee should also revise any affected ARCON96 modeling runs, subsequent dose calculations, and any other related discussions and summary tables.</p>	<p>The licensee presented an image of power block area that included the FHB showing it as a continuous structure across both units and with the extent of the entire FHB within the area covered by the larger Auxiliary Building. The licensee indicated that only a portion of the entire FHB structure (i.e., for either Unit 1 or Unit 2) was used to determine the projected width and building cross-sectional area (input to the ARCON96 modeling runs) to account for building wake effects where the dispersion of certain release scenarios were assumed to be affected by the FHB wake. Projected width for a given unit was taken on the diagonal of that portion of the applicable FHB.</p> <p>The NRC staff considers use of cross-sectional area from only that portion of the FHB associated with a given unit (i.e., a relatively smaller area), compared to the larger cross-sectional area of all the other structures directly adjacent to the FHB, to generally be a conservative approach. Further, based on the past experience, the NRC staff believes that ARCON96 is not necessarily sensitive to cross-sectional area at wind speeds associated with higher X/Q values.</p> <p>The NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	No
4	Issues Related to ARCON96 Dispersion Modeling Analysis		
4(a)	<p>Subsection 2.3.5.2.2 (Paragraph 1) of the UFSAR, Revision 21, as proposed to be revised on December 17, 2015 (ADAMS Accession No. ML16004A363), indicates that input data to the ARCON96 dispersion model consists, in part, of “various receptor parameters (e.g., distance and direction from release to control room air intake...)” However, Section 2.3.4 of Revision 1 to NUREG/CR-6331, which implements (with qualification) the guidance in RG 1.194, calls for the direction from the intake to the</p>	<p>The NRC staff plans to issue an RA requesting that the licensee correct the statement in the referenced UFSAR subsection (and Technical Assessment, if applicable) regarding the proper direction orientation between receptor locations and release points to be entered into the ARCON96 dispersion model input files (i.e., from the receptor to the release point).</p>	Yes

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
	<p>source to be entered into the ARCON96 model. The revised ARCON96 model input files, provided with the RAI responses of April 21, 2016, appear to have correctly-entered <u>directions from the various intake locations</u> associated with the Unit 1 and Unit 2 CRs and the TSC <u>to the various release points</u> assumed for the accident scenarios evaluated.</p> <p>Consistent with the referenced regulatory guidance, the licensee should correct the statement in the proposed Revision to UFSAR Subsection 2.3.5.2.2 regarding the proper direction orientation between receptor locations and release points to be entered into the ARCON96 dispersion model input files.</p>		
4(b)	<p>The ARCON96 dispersion model requires receptor-to-source orientations to be specified with respect to True North as Appendix A to the "Diablo Canyon Power Plant Technical Assessment, Revision 2," acknowledges (also indicating that there is a 23-degree clockwise offset between Plant North and True North). Based on a ± 5 degree tolerance limit and using Figure A-1 of the referenced Technical Assessment, the NRC staff identified four receptor-to-source orientations that need to be verified:</p> <ul style="list-style-type: none"> • <u>dccase07</u> – Control Room Center (Point 9) to U1 Plant Vent (Point 1) specifies 354° as the direction to source. The NRC staff's check shows an orientation of about 347°. • <u>dccase17</u> – Control Room Center (Point 9) to U2 Plant Vent (Point 2) specifies 140° as the direction to source. The NRC staff's check shows an orientation of about 147°. • <u>dccase18</u> – U1 Control Room Emergency Intake (Point 5) to U2 Refueling Water Storage Tank Vent (Point 8) specifies 105° as the direction to source. The NRC staff's check shows an orientation of about 120°. • <u>dcfhc11</u> – U1 Control Room Emergency Intake (Point 5) to U2 Fuel Handling Building (Point 15) specifies 112° as the direction to source. The NRC staff's check shows an orientation of about 122°. <p>The licensee should confirm the indicated receptor-to-source orientations and, if necessary, correct and update any affected</p>	<p>Based on discussions during the audit, the receptor-to-source orientations specified in the Technical Assessment were reviewed and found to be within 1-2 degrees azimuth of those determined by the NRC staff rather than as reported. The licensee's re-checked orientations were: dccase07 (was 354°, should be 348°); dccase17 (was 140°, should be 146°); dccase18 (was 105°, should be 118°); dcfhc11 (was 112°, should be 121°).</p> <p>It was also found that the receptor (center of Control Room at roof elevation) associated with the receptor-to-source orientations for the first two cases differs by 6 degrees azimuth from those specified previously in LAR 15-03. This difference reflects the limitations of accuracy of orientation measurements from drawings, and is nearly within the ± 5 degree azimuth tolerance used by NRC staff. The licensee noted that this receptor is meant to be representative of general Control Room in-leakage and therefore not a precise location like an air intake, but is a general location chosen to represent possible multiple points of entry. As such, and taking into context the use made of this receptor in the dose consequence analysis, the licensee does not consider a 6-degree azimuth difference to be critical.</p> <p>In addition, it was determined that the receptor-to-source orientations associated with the 3rd and 4th cases are different by 13 degrees and 9 degrees azimuth, respectively, from those specified previously in LAR 15-03. The licensee indicated that</p>	No

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
	<p>ARCON96 modeling runs, subsequent dose calculations, and/or any other related discussions and summary tables in the UFSAR and elsewhere in the LAR submittal as necessary. In addition, Figure A-1 in the referenced Technical Assessment and UFSAR Figure 2.3-5 should be updated to illustrate and specify the offset between Plant North (already shown) and True North (not provided).</p>	<p>review of Tables 7.2-5 and 7.3-3 of the Technical Assessment indicates that X/Q values associated with the emergency intakes are approximately 1 to 2 orders of magnitude less than the other X/Q values used in the analysis, lending credence to the argument that the dose consequences associated with these pathways are minimal, and that any minor change in the X/Q values due to orientation correction will have no impact on the reported dose consequences in the Control Room following a LOCA or a fuel handling accident in the Fuel Building, respectively.</p> <p>The NRC staff considered licensee's explanation for first two cases and agrees that accuracy for determining orientations from drawings has limitations. More importantly, X/Q values in Table 7.3-3 of Technical Assessment suggest that Plant Vent releases to Control Room Center are not the controlling scenario. With respect to third and fourth cases, NRC staff agreed that although modeled orientations are incorrect, impacts to U1 Control Room Emergency Intake have nearly the lowest X/Qs (as pointed out by staff) among all scenarios. So, correction of modeling runs for these cases not necessary.</p> <p>Finally, licensee pointed out that Figure 5.1-1 shows and text in Chapter 5 of Technical Assessment identifies the offset between Plant and True North.</p> <p>The NRC staff was of the opinion that the implications of orientation discrepancies are minimal and information on Plant North and True North offset is available. Therefore, the NRC staff determined that the information provided by the licensee was sufficient to address the NRC staff concerns and no further action is warranted.</p>	
5	Issues Related to ARCON96 Dispersion Modeling Analysis		
	<p>There appears to be a minor discrepancy between one of the revised ARCON96 dispersion model input files provided with the RAI responses of April 21, 2016, and the scenario tables in Appendix A of the "Diablo Canyon Power Plant Technical Assessment, Revision 2." Specifically, a building area of 2744.5 sq-m is listed for Case 9 of the summary titled "Unit 1 MSSVs / 10% ADVs / MSL Break Releases to CR Receptors." The entry should</p>	<p>The NRC staff plans to issue an RAI requesting that the licensee correct the typographical error in the Technical Assessment for the building area entered for Case 9 by changing it to "0.0" from "2744.5" sq-m.</p>	Yes

Table 2

Technical Areas of Interest and Resolution Status Regarding ARCON96 Dispersion Modeling Analysis of Onsite (CR and TSC) Impacts

ITEM	TECHNICAL ISSUE	RESOLUTION	RAI
	<p>be "0.0" consistent with the entries for Cases 1 and 17 under that summary table and the entries for Cases 6, 14, and 22 under the comparable summary table for Unit 2.</p> <p>No model runs were made for these particular scenarios because of the energetic nature of these releases and the proximity of the release points to the normal CR air intake of the same unit consistent with the guidance in RG 1.194. However, the licensee should confirm this apparent discrepancy and, if necessary and for consistency with these other cases, correct the typographical error for the building area entered for Case 9 by changing it to "0.0" from "2744.5" sq-m.</p>		

NOTE: The RAIs expected to be issued as a result of the audit were issued on September 7, 2016 (ADAMS Accession No. ML16251A091).

E. Halpin

- 2 -

If you have any questions, please contact me at 301-415-3016 or via e-mail at Balwant.Singal@nrc.gov.

Sincerely,

/RA/

Balwant K. Singal, Senior Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-275 and 50-323

Enclosure:
Audit Report

cc w/encl: Distribution via Listserv

DISTRIBUTION:

PUBLIC

LPL4-1 R/F

RidsACRS_MailCTR Resource

RidsNrrDorlLpl4-1 Resource

RidsNrrDraArcb Resource

RidsNroDsea Resource

RidsNrrLAJBurkhardt Resource

RidsNrrPMDiabloCanyon Resource

RidsRgn4MailCenter Resource

BHarvey, NRO/DSEA/RHM1/RMOT

MMazaika, NRO/DSEA/RHM1/RMOT

KBucholtz, NRR/DRA/ARCB

ADAMS Accession No.: ML16279A343

*Audit Summary by memo dated September 26, 2016

OFFICE	NRR/DORL/LPL4-1/PM	NRR/DORL/LPL4-1/LA	NRR/DRA/ARCB/BC
NAME	BSingal	JBurkhardt	UShoop
DATE	10/24/16	10/20/16	10/26/16
OFFICE	NRO/DSEA/RHM1/RMOT/TL	NRR/DORL/LPL4-1/BC	NRR/DORL/LPL4-1/PM
NAME	BHarvey*	RPascarelli	BSingal
DATE	09/26/16	10/27/16	10/27/16

OFFICIAL RECORD COPY