FROM:
Pacific Gas & Electric Company
San Francisco, California ( )106
F. T. Searls

TO:
DRL

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POST OFFICE

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DATE OF DOCUMENT: 4-10-72

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CONCURRENCE ☐
COMMENT ☐
DATE ANSWERED:
BY:

FILE CODE: 50-275 50-323 (ENVIRO FILE)

DESCRIPTION: (Must Be Unclassified)

Ltr re our 3-24-72 ltr.....furnishing info regarding Basic Data for Source term Calculation, Trans the following:
3 ORIG + 42 CYS OF ENCL REC'D

ENCLOSURES:

Responses to AEC Question for Basic Data for Source Term Calculation, notarized 4-10-72. W/ Attachment I Detailed Ans to PWR Ques concerning Review of Enviro Rpt
CERTIFICATE OF SERVICE, showing svc of responses to AEC Ques submitted in 3-

REMARKS:

24-72 ltr, upon John Freeman, Chairman San Luis Obispo County Board of Supervs, Calif. (Holding (16) cys for ACRS
5- ORNL (T. E. Rowe)
1 cy Local PDR (San Luis Obispo, Cal)

REFERRED TO	DATE	RECEIVED BY	DATE
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U.S. ATOMIC ENERGY COMMISSION

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ACKNOWLEDGED

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PACIFIC GAS AND ELECTRIC COMPANY

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DOCKETED USAEC APR 12 1972 REGULATORY MAIL SECTION DOCKET CLERK

April 10, 1972

RECEIVED APR 12 1972 U.S. ATOMIC ENERGY COMMISSION Regulatory Mail Section

U. S. Atomic Energy Commission
Washington, D. C. 20545

Attention: Director, Division of Reactor Licensing

Re: Dockets Nos. 50-275, 50-323
Diablo Canyon Units 1 and 2

Gentlemen:

Enclosed are 3 signed and 42 conformed copies of responses to the questions submitted with Mr. R. C. DeYoung's letter dated March 24, 1972.

By and large, the answers to these questions can be found in either the Application or Environmental Report. In addition, in most cases a proper interpretation of the individual answer requires that consideration be given to its original source. Therefore, references to the parent documents are given as part of each answer. Copies of the referenced pages have been included with a copy of this supplement to our applications and transmitted under separate cover directly to Mr. Tom Row. Please note that question No. 30 has not been covered. We plan to repond to this question during the meeting scheduled with Mr. Row.

In accordance with 10 CFR 2.101(b), a copy of the responses is being served upon Mr. John Freeman, Chairman of the San Luis Obispo County Board of Supervisors. A copy of the certificate of service is enclosed. Copies of the responses are also being sent to the parties of record indicated below.

Kindly acknowledge receipt of this material on the enclosed copy of this letter and return it to me in the enclosed addressed envelope.

Very truly yours,

F. T. Searls

Enclosures
CC: Mr. John Freeman
Luige Marre Land and Cattle Company and
San Luis Obispo Bay Properties, Inc.
Mr. Ian I. McMillan
Scenic Shoreline Preservation Conference, Inc.

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UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of	)	
	)	Docket No. 50-275
PACIFIC GAS AND ELECTRIC COMPANY	)	
	)	Docket No. 50-323
(Diablo Canyon Site - Units 1 and 2)	)	
	)	

CERTIFICATE OF SERVICE

A copy of the responses to questions submitted by the Atomic Energy Commission's letter dated March 24, 1972 has been served today on the following by deposit in the United States mail, properly stamped and addressed:

Mr. John Freeman
Chairman
San Luis Obispo County
Board of Supervisors
County Courthouse
San Luis Obispo, California 93401

Philip A. Crane, Jr.
Philip A. Crane, Jr.
Attorney for
Pacific Gas and Electric Company

Dated: April 10, 1972.

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UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the Matter of PACIFIC GAS AND ELECTRIC COMPANY (Diablo Canyon Site - Units 1 and 2)	Docket No. 50-275 Docket No. 50-323

Pacific Gas and Electric Company hereby supplements its above-numbered applications by submitting herewith responses to the questions forwarded by the Commission with its letter dated March 24, 1972.

Subscribed in San Francisco, California, this 10th day of April, 1972.

Respectfully submitted,

PACIFIC GAS AND ELECTRIC COMPANY

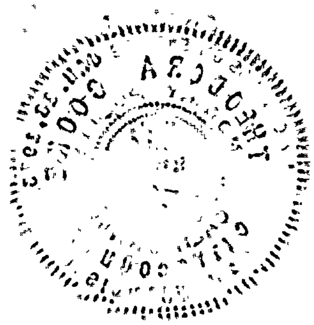
By John F. Bonner
John F. Bonner
Executive Vice President

FREDERICK T. SEARLS
JOHN C. MORRISSEY
PHILIP A. CRANE, JR.

By Philip A. Crane, Jr.
Philip A. Crane, Jr.

Subscribed and sworn to before me this 10th day of April, 1972
Theodora Cooke
Theodora Cooke, Notary Public in and for the City and County of San Francisco, State of California

My Commission expires January 28, 1973.



ATTACHMENT I

DETAILED ANSWERS TO PWR QUESTIONS

CONCERNING REVIEW OF ENVIRONMENTAL REPORT

FOR DIABLO CANYON UNITS 1 & 2

DOCKET NO. 50-275
DOCKET NO. 50-323

1. Operating power (MWt) at which impact is to be analyzed?

The construction permit reactor thermal power rating for Unit No. 2 is 3250 MWt. The Containment System and Engineered Safety Features for both are designed and evaluated for 3568 MWt, and all postulated accidents are analyzed at 3568 MWt. It is suggested that the Commission's Environmental Environmental Analysis be based on the 3568 MWt rating.

2. Weight of U loaded (first loading and equilibrium cycle).

Fuel weight (as UO_2) 218,530 lbs. for both Units 1 and 2 are for both initial and equilibrium cycles. (Unit No. 2 PSAR, page 3-37).

3. Isotopic ratio in fresh fuel (first loading and equilibrium cycle).

Enrichment:	2.20% Region 1
(first core)	2.70% Region 2
	3.20% Region 3

For reloads, enrichment is 3.20%
(Unit No. 2 PSAR, page 3-37)

4. Expected percentage of leaking fuel?

The actual levels of coolant activity, and thus the existing levels of defective or "failed" fuel, are variables which are controllable by plant operators through procedures involving the radwaste systems and removal of imperfect fuel. In the analyses presented in Supplement I to the Environmental Report, page 21, the value of 0.2 percent "fuel defects" was assumed for several cases, on the following bases:

"The Liquid and gaseous radioactive releases from normal operation of the Diablo Canyon plant were discussed in detail in the Environmental Report under "Radioactive Discharges". In that section, however, the quantities tabulated were based on essentially continuous operation of both units at the design level of fuel cladding defects, that is, 1 percent. Past commercial operating experience on pressurized water plants has demonstrated, however, that actual releases of noble and halogen gases has generally not approached the level associated with operation with 1 percent fuel defects. In fact, in consideration of this experience and data from current pressurized water plants, the average level of fuel defects has been less than 0.2 percent."

In the use of a calculated coolant activity based on assumed escape rate coefficients, several factors should be considered. First, the variations between calculated and measured coolant activities have been large. The "percent defect" model is useful and valid for contractural definitions concerning mechanical manufacturing defects and for design basis calculations for defining sizes and duties of radwaste systems. The direct application of this model to calculated estimates of plant releases, however, should be done with care.

Pre-operational calculated estimates, made for the purposes of comparison with plant release limits, should be made only with proper considera- tion of these limitations. In addition, the use of fixed percentages of "leaking" fuel over a long term, in conjunction with fixed values of other plant parameters, (such as steam generator leakage or primary loop leakage) does not yield a realistic picture of the capabilities of a particular plant design or operational scheme. Parameters such as leakages of steam generators, valve leakages, radwaste system decontamination factors, etc., are also under control of plant operators in the long term, through repairs and other procedural actions. For these reasons, pre- operational judgements regarding the ability of a plant to comply with limits on radioactivity releases must take these plant operational features into consideration.

5. Escape rate coefficients used (or reference).

The values used for the purpose of design basis calculations are tabulated on page 9-19 of the Unit No. 2 PSAR. They are as follows:

Fission product escape rate coefficients:

Noble gas isotopes, sec^{-1}	6.5×10^{-8}
Br, I and Cs isotopes, sec^{-1}	1.3×10^{-8}
Te isotopes, sec^{-1}	1.0×10^{-9}
Mo isotopes, sec^{-1}	2.0×10^{-9}
Sr and Ba isotopes, sec^{-1}	1.0×10^{-11}
Y, La, Ce Pr isotopes, sec^{-1}	1.6×10^{-12}

6. Plant factor.

For purposes of calculating the buildup of long-lived isotopes such as Kr-85 and tritium, we have used 85%. (Supplement I to the Environmental Report, page 21).

7. Number of steam generators.

We have four steam generators, one for each coolant loop. (Unit No. 2 PSAR, page 4-17).

8. Type of steam generators (recirculating, straight through).

All four are of the recirculating type. (Unit No. 2 PSAR, page 4-17).

9. Mass of primary coolant in system total (lb) and mass of primary coolant in reactor (lb).

Mass of primary coolant is approximately 530,000 lbs. Mass of primary coolant in reactor vessel is approximately 190,000 lbs. Mass of primary coolant in active core region is approximately 27,000 lbs. (Unit No. 2 PSAR, page 4-15).

10. Primary coolant flow rate (lb/hr).

Primary coolant flow rate = 135×10^6 lbs/hr. (Unit No. 2 PSAR, page 3-52).

11. Mass of steam and mass of liquid in each generator (lb).

Approximately 320,000 lbs. of water in four steam generators during normal operation. Weight of steam in four steam generators is approximately 27,000 lbs. (Unit No. 2 PSAR, page 4-17).

12. Total mass of secondary coolant (lb).

Including four steam generators, the condenser water volume, and estimated volumes of the feedwater lines and heaters, the approximate total mass is 500,000 lbs.

13. Turbine operating conditions (temperature °F, pressure psi, flow rate (lb/hr)).

The steam conditions at steam generator outlet, which are approximately the turbine inlet conditions are as follows:

3.53×10^6	lbs/hr
519	°F
805	psia

(Reference Unit No. 2 PSAR, page 4-17).

14. Total flow rate in the condensate demineralizer (lb/hr).

The Diablo Canyon plants do not have a condensate demineralizer.

15. What is the containment volume (ft^3)?

Containment free volume: 2.6×10^6 ft^3
(Unit No. 2 PSAR, page 12-108).

16. What is the expected leak rate of primary coolant to the containment? (lb/hr)?

17. How often is the containment purged? Is it filtered prior to release? Are iodine absorbers provided? What decontamination factor is expected?

18. Is there a continuous air cleanup for iodine in the containment? If so, what volume per unit time is circulated through it? What decontamination factor is expected? At what concentration will purging be initiated?

The "expected" leak rate during the long term is essentially zero. On the basis of past operating experience, however, occasional leaks can be expected to occur, and the operational procedures pertinent to these conditions will be detailed in the technical specifications. For the purposes of estimating the maximum radiological consequences of the long term existence of such a leak, an analysis of this case was made and reported in the Environmental Report (Supplement I to the Environmental Report, page 22). With the exception of the specific concentration at which recirculation will begin, all the parameters requested in questions 16, 17 and 18 are contained in that analysis, which is as follows:

> "Case II: In the analysis of the second case, it has been assumed that one unit of the plant operated at full power for a full year, with 0.2 percent defective fuel cladding and a continuous primary coolant system leakage of 20 gallons per day. Most of the iodine activity released with the water would be expected to be collected in the containment sump and processed through the radioactive waste treatment system. For this calculation, however, it has been assumed that all the iodines are released to the containment atmosphere. It is also assumed that normal plant operation would require one entry into the containment per week, and that a full containment purge would be carried out before entry. The iodines and noble gases would thus be subject to three days decay, on the average, before release to the atmosphere via the plant vent. It is also assumed that 99 percent of the iodines would be removed before the purge by recirculation of the containment air through the containment filters. On this basis, the additional radiological exposures resulting from the operation of one unit of the plant for a full year with a 20-gallon per day primary leak rate are as follows:

Whole body dose at site boundary	0.022 millirem
Thyroid dose at site boundary	0.019 millirem
Population dose	0.043 man-rem"

In this analysis, as stated above, a 99% iodine reduction factor was used. On the basis of the extensive research in this field, however, the one-pass filter efficiency appropriate for these conditions would be close to 99.99%, and using a recirculating removal model would result in an essentially zero air concentration in a short time.

19. Give the total expected continuous letdown rate (lb/hr).

a. What fraction is returned through the demineralizer to the primary system. What is the expected demineralizer efficiency for removal of principal isotopes?

b. What fraction of this goes to boron control system? How is this treated, demineralization, evaporation, filtration?

c. Is there a separate cation demineralizer to control Li and Cs?

The normal letdown rate is 75 gpm (Unit 2 PSAR, page 9-16).

All letdown flow is passed through a mixed bed demineralizer and, if desired, through a separate cation demineralizer. Of this, 80 to 100 percent returns to the primary system depending on system demand. The remainder is passed through the boron control system where it is again demineralized in a second mixed bed cation bed system, filtered and evaporated. The distillate is passed through an additional cation bed, filtered and recycled to the makeup water storage tank (Unit 2 PSAR, page 9-16 and pages 9-10 to 9-14). The demineralizer efficiencies are given below (Unit 2 PSAR, page 9-19). There is a separate cation demineralizer for control of Li and Cs (Unit 2 PSAR, page 9-13).

Mixed bed demineralizers decontamination factors:

a. Noble gases and Cs-134, 136, 137, Y-90 and Mo-99	1.0
b. All other isotopes	10.0

Cation bed demineralizer decontamination factor for Cs-134, 136, 137, Y-90 and Mo-99	10.0

20. What fraction of the noble gases and iodines are stripped from that portion of the letdown stream which is demineralized to the primary return system? How are these gases collected? What decay do they receive prior to release?

The stripping fractions are given below and on page 9-19 of the Unit 2 PSAR. The waste gas collection system is described on pages 11-6 through 11-8. The decay time available depends upon the quantities being processed, and the modes of system operation. On the basis of operating with 1% defects, system components and procedures have been designed to allow a 45-day decay time.

Volume control tank noble gas stripping fraction (closed system):

Isotope	Stripping Fraction
Kr-85	2.3×10^{-5}
Kr-85m	2.7×10^{-1}
Kr-87	6.0×10^{-1}
Kr-88	4.3×10^{-1}
Xe-133	1.6×10^{-2}
Xe-133m	3.7×10^{-2}
Xe-135	1.8×10^{-1}
Xe-135m	8.0×10^{-1}
Xe-138	1.0

21. What fraction of the noble gases and iodines are stripped from the portion of the letdown stream which is sent to the boron control system? How are these gases collected? What decay do they receive prior to release?

The design reduction factor is 10^5 (Unit 2 PSAR, page 9-39). The manner of collection is described on pages 9-39 through 9-40b. Since these gases are vented via the gas decay tanks, the decay time is the same as discussed in the answer to question 20.

22. Are releases from the decay tanks passed through a charcoal absorber? What decontamination factor is expected?

Gases from the gas decay tanks are passed through a HEPA filter, but not charcoal absorbers. In environmental analyses (PSAR and Environmental Report), no decontamination factor was claimed for filters. (Environmental Report, plate 4, and Supplement I to the Environment Report, page 22 and 25). The HEPA filters are used to pick up particulate daughters of the gases.

23. How frequently is the system shut down and degassed? How many volumes of the primary coolant system are degassed in this way each year? What fraction of the gases present are removed? What fraction of other principal nuclides are removed, and by what means? What decay time is provided?

The system is normally shut down and degassed annually (PSAR). One volume of the primary coolant system is thus degassed this way each year. The amount of gases expected to be removed is 200,000 SCF (Unit 2 PSAR, page 11-4). The quantities of nuclides removed are based on the coolant nuclide concentrations (given on the attached sheet and page 9-21 of Unit 2 PSAR for the design basis fuel defect level of 1%). Total design basis curie numbers are determined by multiplying these values by the coolant volume. Total curie numbers for the 0.2% level of fuel defects (caution should be used in relating this to the "expected" long-term release limits, as discussed in the answer to question 4) can be estimated by dividing by five. Since the gases pass through the vent header and gas decay tanks, the 45-day decay time is applicable.

TABLE 9-5 - Unit 2 F[illegible]R

REACTOR COOLANT MAXIMUM ACTIVITIES
DOWNSTREAM OF REGENERATIVE HEAT EXCHANGER

Activation Products	μc/cc (120°F)
Mn-54	5.6×10^{-4}
Mn-56	2.1×10^{-2}
Co-58	1.8×10^{-2}
Fe-59	7.5×10^{-4}
Co-60	5.4×10^{-4}

Non-Volatile Fission Products (Continuous Full Power Operation)

	μc/cc (120°F)		μc/cc (120°F)	
Br-84	$4.00\ 10^{-2}$	I-133	3.69	
Rb-88	3.81	Te-134	2.85×10^{-2}	2
Rb-89	8.85×10^{-2}	I-134	5.24×10^{-1}	
Sr-89	4.12×10^{-3}	Cs-134	2.66×10^{-1}	
Sr-90	1.23×10^{-3}	I-135	1.97	
Y-90	1.56×10^{-4}	Cs-136	3.92×10^{-2}	
Sr-91	1.77×10^{-3}	Cs-137	1.44	
Y-91	7.30×10^{-4}	Cs-138	6.80×10^{-2}	
Mo-99	3.28	Ba-140	2.10×10^{-4}	
I-131	2.31	La-140	8.56×10^{-4}	
Te-132	2.55×10^{-1}	Ce-144	2.95×10^{-3}	
I-132	8.55×10^{-1}	Pr-144	3.17×10^{-3}	

Gaseous Fission Products	μc/cc (120°F)
Kr-85	6.47
Kr-85m	1.56
Kr-87	1.06
Kr-88	3.83
Xe-133	2.60×10^{2}
Xe-135	6.94
Xe-138	4.89×10^{-1}

24. Are there any other methods of degassing (i.e., through pressurizer, etc.)? If so, describe.

25. If gas is removed through the pressurizer or by other means, how is it treated?

Provisions are made to allow degassing of the pressurizer, although this is not the normal mode. Treatment and decay times are the same as would be available by the normal paths discussed in question 20 (described in the Unit 2 PSAR).

26. What is the expected leak rate of primary coolant to the secondary system (lb/hr)?

The "expected" average long-term primary to secondary leak rate is essentially zero. In the past, steam generator leakage has occurred in several plants and has occasionally occurred at times when significant coolant activities existed. This leakage is one of the parameters which is under the long-term control of plant operators, and pre-operational estimates of long-term releases based on assumed rates of leakage must take into consideration the operational actions available. In the Diablo Environmental Report, pages 23 and 28, assessments were made of the general range of environmental releases possible as a result of steam generator leakage. One of the cases analyzed was based on an assumption of 20 gallons per day long-term leakage and one case was based on a temporary leakage of one gallon per minute.

27. What is the normal rate of steam generator blowdown? Where are the gases from the blowdown vent discharged? Are there charcoal absorbers on the blowdown tank vent? If so, what decontamination factor is expected?

The normal rate of blowdown is 2300 lbs/hr per steam generator. The gases from the blowdown vent are vented from the top of the auxiliary building. There are no charcoal absorbers on this vent. The iodine decontamination factor due to partitioning in the blowdown tank is given on pages 23 and 28 of the Supplement I to the Environmental Report.

28. What is the expected leak rate of steam to the turbine building? What is the ventilation air flow through the turbine building (CFM)? Where is it discharged? Is the air filtered or treated before discharge? If so, provide expected performance.

The design basis for the makeup water was 5 gpm; the leak rate is thus not expected to exceed this value. We expect the major part of any leakage flow to be in the liquid phase from the condensate system, thus allowing only a small fraction of any contained iodine to be released to the building atmosphere. The air is not treated before venting.

29. What is the flow rate of gaseous effluent from the main condenser ejector? What treatment is provided? Where is it released?

The air flow rate at the ejector exit is approximately 10 SCFM. The turnover rate of gas in the condenser vapor space must be determined from the pressure-corrected volume flow rate from the space, approximately 275 CFM. The condenser vapor volume is approximately 100,000 ft. This basis can be used, if decay is accounted for, to determine the noble gas release. For iodines, in the Diablo Canyon Environmental Report Supplement, page 23, the iodine release from the air ejector was determined by assuming the ejector exhause (10 SCFM) was air at 100% relative humidity, and that the moisture was at the same specific activity level (curies per lb H_2O) as the main steam. This model amounts to assuming that the dominant source of iodine in the ejector exhaust comes from un-condensed driving steam. No treatment is provided for the air ejector exhaust, and release is via the plant vent (Unit 2 PSAR).

30. What is the origin of the steam used in the gland seals (i.e., is it primary steam, condensate, or demineralized water from a separate source, etc.)? How is the effluent steam from the gland seals treated and disposed of?

(Data is being collected on flow rates for this question, and will be discussed in the meeting on April 13, 1972).

31. What is the expected leak rate of primary coolant to the auxiliary building? What is the ventilation air flow through the auxiliary building (CFM)? Where is it discharged? Is the air filtered or otherwise treated before discharged? If so, provide expected performance.

The leak rate from all sources to the auxiliary building is not expected to exceed 580,000 gallons per year (see page 11-4 of Unit 2 PSAR) This is not,. of course, reactor coolant water. The exhaust flow rate (normal mode) from the ventilation system is 73,500 CFM. The air is passed through roughing and absolute filters normally, and can be passed through charcoal filters (standby) if required. Based on current research on charcoal filter efficiency, the one pass value expected would be 99.99 percent. Only a small fraction of any iodine contained in the leakage water would be present in the air, because of the partition factor.

[illegible]

32. Provide average gallons/day and uCi/cc for following categories of liquid effluents. Use currently observed data in the industry where different from the SAR or Environmental Report (indicate which is used).

a. High-level wastes (for example, primary coolant let down, "clean" or low conductivity waste, equipment drains and deaerated wastes)

b. "Dirty" wastes (for example, floor drain wastes, high-conductivity wastes, aerated wastes, and laboratory wastes).

c. Laundry, decontamination, and wash-down wastes.

d. Steam generator blowdown - give average flow rate and maximum short-term flows and their duration.

e. Drains from turbine building.

For these wastes (a-e) provide:

1. Number of capacity of collector tanks.
2. Fraction of water to be recycled or factors controlling decision.
3. Treatment steps - include number, capacity, and process D.F. for each principal nuclide for each step. If step is optional, state factors controlling decision.
4. Cooling time from primary loop to discharge.
5. How is waste concentrate (filter cake, demineralizer resin, evaporator bottoms) handled? Give total volume or weight and curies per day or year.

a. Approximately 2,000 gpd of high level waste, mainly from pump seals and the Boron recovery system, at an activity level of about 14 uCi/cc, is collected in two 15,000 gallon tanks (Unit 2 PSAR, pages 11-4 and 11-18). Normally, this water is not recycled; however, water will be used in flushing demineralizers thereby minimizing waste generation. Waste will normally be evaporated and filtered before discharge. The minimum hold time in the waste system will be approximately 10 days. Waste concentrates and filter cartridge are drummed - see PSAR Table 11-4 for estimated quantities.

b. Approximately 3,000 gpd of low level waste containing essentially zero activity collected in two 15,000 tanks. Normally, this waste will be passed through two stages of filtration and discharged. The minimum hold time for the waste system will be 7 days. Spent filters are also drummed.

c. Approximately 300 gpd of laundry waste collected in two 1,000 tanks. Normally, laundry waste will be passed through three stages of filtration and discharged. The minimum hold time in the waste system will be 5 days. Filters are also drummed.

d. The data for this item is given in the answer to question 27.

e. The data for this item is given in the answer to question 28.

33. Dilution flow rate for liquid effluents, normal gpm and total gallons per year.

The circulating water system provides 867,000 gpm of screened seawater for cooling purposes (Unit 2 PSAR - page 10-17). This is approximately 4.6×10^{11} gallons per year per unit.