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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Subject: **Docket No. 50-206**
TMI Item III.D.3.4 Control Room Habitability
San Onofre Nuclear Generating Station, Unit 1

This letter provides SCE's responses to open items identified during an NRC site visit on September 26 and 27, 1989 regarding Control Room Habitability. In your October 17, 1989 meeting minutes you identified specific Action Items which required resolution. Our responses to these Action Items are provided as Enclosure A. In addition, the NRC reviewers raised other items during the site visit that were not included in your meeting minutes. The response to these additional items is provided in Enclosure B. Enclosure C discusses changes to our proposed upgrades and the toxic gas calculations that have occurred since the NRC site visit.

During the site visit the NRC indicated to us that it is necessary to eliminate the use of potassium iodide (KI) pills in our operator thyroid dose calculation. The NRC reviewers made recommendations that have been incorporated into our dose calculation. As a result the operator thyroid dose was reduced below the regulatory limit without the need for KI pills. This calculation is based on our proposed upgrades to the control room emergency HVAC system.

Since the NRC site visit in September 1989, we have initiated engineering for the upgrade of the control room HVAC. In order that we may begin procuring

A046

equipment for the upgrade, we would like your approval of our resolution of TMI Item III.D.3.4 as soon as possible.

If you have any questions regarding this information, please let me know.

Very truly yours,

R M Rosenblum

Enclosure

cc: George Kalman, NRC Project Manager, San Onofre Unit 1
J. B. Martin, Regional Administrator, NRC Region V
C. Caldwell, NRC Senior Resident Inspector, San Onofre Units 1, 2 & 3
C. D. Townsend, NRC Resident Inspector, San Onofre Unit 1

Action Item 1

SCE will provide new Control Room operator doses based on new Control Room atmospheric dispersion factors.

Response

During the site visit, the NRC staff reviewers indicated it would be necessary to eliminate the use of KI pills for reducing control room operator thyroid doses to meet GDC 19 requirements. The NRC staff reviewers recommended using NUREG/CR-5055, "Atmospheric Diffusion for Control Room Habitability Assessments," and Revision 2 to Standard Review Plan (SRP) 6.5.2, "Containment Spray as a Fission Product Cleanup System." The NUREG provides a new methodology for developing the atmospheric dispersion factors (χ/Q) for the Control Room Operator thyroid dose calculation. The NUREG-5055 methodology for calculating χ/Q values is discussed below and the results are provided in Table 3. The SRP provides guidance on determining the containment spray iodine removal time constants. The use of the SRP is discussed in the response to Action Item 2 and the results are provided in Table 3. Also in a telephone discussion with the NRC staff reviewer on August 8, 1990, the use of ICRP 30 was recommended. The ICRP provides guidance on the iodine dose conversion factors. The dose conversion factors obtained from ICRP 30 are provided in Table 3.

The results of the thyroid dose calculation are provided in Table 1. The thyroid dose to the operator with the emergency HVAC (A-33) operating at time zero would be 23.0 rem due to the SONGS 1 LOCA and 4.7 rem due to the SONGS 2 LOCA (the SONGS 2 LOCA case bounds the SONGS 3 LOCA) over 30 days. These values are less than the previously calculated standard review plan dose of 52.3 rem for the upgraded system in our October 10, 1986 submittal. The change is attributed to use of NUREG/CR-5055 SRP 6.5.2 Rev. 2, and ICRP 30 as recommended by the NRC.

In conclusion, the use of KI pills to maintain the control room operator thyroid dose below 30 rem over a 30 day period is eliminated during operation of the control room HVAC without a single failure. The final inputs and assumptions of the dose calculations are identified in Tables 2, 3, and 4. Differences from our previous calculations are identified and explained.

χ/Q Development

A review of NUREG/CR-5055 concluded that for ground releases, as in the case of SONGS 1 and SONGS 2 containments and recirculation system leakage sources, the new building wake diffusion model is most appropriate for the calculation of the χ/Q values. Equation (7) on page 28 of NUREG/CR-5055 was used.

$$\chi/Q = K\, X^a\, A^b\, U^c\, S^d$$

Where X = distance from the release point (m)
A = projected building area (m^2)
U = wind speed at 10 m in the undisturbed flow upwind of the building complex (m/s)

S = atmospheric stability class; 1 = A, 2 = B, ...

The constants are based on the following values as suggested by NUREG/CR-5055 on page 37.

K = 100
a = - 1.2
b = - 1.2
c = 0.68
d = 0.5

A χ/Q value for dispersion from containment to the HVAC intake was calculated for all wind speed/stability class pairs occurring which could potentially impact the control room. The number of sectors is based on the ratio of the distance from the building surface (containment sphere) to the receptor (control room intake) divided by the diameter or width of the building normal to the direction of the wind. This is the s/d ratio as presented in the Murphy-Campe paper[1], on pages 412 and 422. This methodology was used in the modeling of dispersion from the Unit 1 recirculation system and from the SONGS 2 LOCA source.

These calculated χ/Q values were then sorted in descending order and an annual recurrence frequency developed for each χ/Q value. In this way the 5th, 10th, 20th and 40th percentile χ/Q values could be determined for the 0 - 8 hr, 8 - 24 hr, 1 - 4 day and 4 - 30 day time intervals, respectively, consistent with Table 2 of the Murphy-Campe paper.

The resultant χ/Q values were adjusted for wind directional considerations using the equations from the Murphy-Campe paper, on page 414, by considering the frequency of wind in the five SONGS 1 sectors and the three SONGS 2 sectors as a percentage of all 16 sectors. The resultant χ/Q's for SONGS 1 and SONGS 2 are presented in Tables 3 and 4, respectively.

The χ/Q values provided in Tables 3 and 4 have not been adjusted for the Murphy-Campe occupancy values. If these values are to be input into a dose calculation that requires such an adjustment, the 1-4 day and 4-30 day values above should be multiplied by 0.6 and 0.4, respectively, to effect this final adjustment.

Action Item 2

The revised SRP value for containment spray iodine removal time constant will be used for the dose calculation.

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[1] Murphy, K. G., and Campe, K. M., "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Design Criteria 19," 13th AEC Air Cleaning Conference, August 1974.

Response

During the site visit, the NRC staff reviewers indicated that Revision 2 to Standard Review Plan (SRP) Section 6.5.2," Containment Spray as a Fission Product Cleanup System," was issued in January, 1989. It was felt that the guidance provided by the revised SRP would be helpful in reducing the control room operator thyroid dose. We used the methodology provided in the SRP to determine the containment spray iodine removal time constants, the mixing flow rate and the iodine decontamination factor used in our calculation of the Control Room operator thyroid. The results are provided in Table 3.

Action Item 3

SCE will explore the possibility of increasing filter efficiency.

Response

Considering the reduction in calculated operator thyroid doses and resultant elimination of the need for KI pills, additional consideration of an increase in the charcoal filter efficiency was not necessary. As shown in Table 2, the filter efficiency used in the dose calculation is 99%.

Action Item 4

SCE will recalculate the whole body dose to the operator.

Response

SCE's October 10, 1986 submittal regarding offsite hazards and control room habitability indicated the control room operator whole body dose is 6.6 rem. This exceeds the 10 CFR 50 GDC 19 requirement of 5 rem. The submittal further states that about 95% of the whole body dose, 6.2 rem, is due to sources outside the control room.

During the site visit the location where the whole body dose was calculated (northwest corner behind the control panels) was pointed out. At that time the NRC reviewers asked if the whole body dose could be recalculated with the operator occupying areas at the control panels. The possible result being a calculated dose that meets GDC 19.

SCE has reviewed the calculation for the operator whole body dose in the control room and determined it necessary to develop a new calculational model. We have initiated efforts to develop a new model and recalculate the operator whole body dose. This effort is currently scheduled to be completed and provided to you by November 1, 1991.

Action Item 5

SCE will provide additional data on HVAC reliability.

Response

During the site visit the NRC requested information regarding our experience with the Control Room HVAC system. Information regarding the maintenance history was provided during the meeting. The NRC staff reviewers asked that the information be included in the submittal.

The operating history of the Control Room HVAC was reviewed for reliability. In the following, a failure occurs when the system fails to perform its design function. Repairs and maintenance such as replacing door seals, recharging with freon, and adjusting dampers are not included.

There are no documented failures of the emergency HVAC unit, A-33, dampers 1740A & B or any other components associated with the Control Room Emergency Air Treatment System.

Recirculation fan A-31, and heat pumps A-31-1 and A-31-2 have a total number of 9 documented failures since 1984.[2]

- 1 failure in 1985 due to thermostat failure
- 1 failure in 1986 due to A-31-1 reversing valve failure
- 2 failures in 1987 due to A-31-1 compressor failure and control relay failure
- 4 failures occurred in August and September 1988 due to:
    - grounded A-31-1 compressor due to plugged filter drier
    - A-31-1 expansion valve failure
    - A-31-2 loss of freon due to leaky low side pressure relief valve
    - A-31-2 compressor failure

  Both compressors, A-31-1 and A-31-2, were replaced in 1988
- No failures of A-31, A-31-1 or A-31-2 in 1989
- 1 failure in 1990 due to a timer failure on A-31-2.

Excluding the summer of 1988 the Control Room HVAC system has been reliable. Since both compressors are new there should be good reliability for the future. There have been no failures of this system for over a year.

Action Item 6

SCE will explore the possibility of using the TSC HVAC as a backup for the Control Room HVAC to provide a positive pressure in the Control Room.

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[2] History was obtained from the San Onofre Maintenance Management System (SOMMS) which began operation in 1983. Maintenance records prior to 1983 are not readily available.

Response

During the NRC site visit a commitment was made to determine if the TSC HVAC System could be used as a backup system for the Control Room Emergency Air Treatment (CREAT) System. The CREAT System provides filtered outside air to the Control Room during potential high airborne radioactivity conditions. The filtered outside air maintains the Control Room at least 1/8 inch water pressure (0.125 ") above all adjacent areas to minimize air inleakage and Control Room Operator dose. The CREAT System is a single train. The TSC HVAC system is similar to the CREAT System. The TSC HVAC System is nonsafety related and Seismic Category B. It is designed to provide filtered outside air to the TSC area to maintain the TSC at a pressure of at least 1/8 inch water less than the Control Room and at least 1/8 inch water greater than all other areas. Based on the testing performed, the TSC HVAC has the capacity to maintain the Control Room/TSC area pressure greater than all adjacent areas.

A Special Engineering Test was performed on October 30, 1989 to determine the capacity of the TSC HVAC System. During this test the Control Room HVAC and CREAT Systems were secured, the Control Room access door was propped open and the TSC HVAC System was operated in the emergency outside air makeup mode. The differential pressure between the combined Control Room/TSC area and all adjacent areas was measured. The results of this test are listed below. The TSC HVAC System maintained the Control Room/TSC area at least 0.125 inches water pressure above all adjacent areas except the 4kV Room.

Adjacent Area	Control Room/TSC Pressure with respect to Adjacent Area
Atmosphere	+ 0.32 inches water
TSC Corridor	+ 0.37 inches water
Power Block Corridor	+ 0.37 inches water
Chem Lab Corridor	+ 0.23 inches water
Chemistry Lab	+ 0.31 inches water
Communications Room	+ 0.29 inches water
HVAC Equipment Room	+ 0.38 inches water
4kV Room	- 0.13 inches water

During the Control Room/TSC pressure test on October 30, 1989, the 4kV Room pressure was measured to be + 0.45 inches water gauge above atmosphere. Inspection of the 4kV Room HVAC system revealed corroded pressure relief dampers on the return ducting and leakage through the locked closed outside air dampers. Repair of the corroded pressure relief dampers and permanently blocking the outside air dampers has reduced the 4kV Room pressure to + 0.20 inches water with respect to atmosphere. Therefore during pressurization of the Control Room/TSC area with the TSC HVAC System the pressure of the Control Room/TSC area should be approximately + 0.12 inches water gauge above the 4kV Room.

Subsequent to the Special Engineering Test, additional testing and corrective maintenance was performed on the 4kV Room HVAC System. From January 29, 1990 to February 7, 1990 testing was performed to monitor the pressure in the Control Room and TSC while the 4kV Room pressure was varied from atmospheric pressure to +0.40 inches water gauge. No changes in pressures could be detected in either the Control Room or TSC. Therefore there is insignificant leakage between the 4kV Room and the Control Room/TSC area. This determination validated the data taken during the Control Room/TSC pressure test on October 30, 1989 since it has been shown that Control Room and TSC pressure are not affected by the 4kV Room pressure.

The TSC HVAC system provides an adequate back-up system for filtration and pressurization however it does not have sufficient capacity to maintain the control room/TSC area below its maximum design base temperature of 85°F. The TSC HVAC system has approximately 20% of the cooling capacity of the control room system. In addition, the TSC system is nonsafety related and will not be available during loss of power conditions. Therefore the TSC system only provides partial redundancy.

Action Item 7

SCE will provide its basis for using the IDLH toxic gas dose limits.

Response

Control Room Habitability assessments are generally based on the guidelines presented in SRP 6.4, "Control Room Habitability System." This defines three toxic gas incapacitation levels depending on the exposure time. The incapacitation limit of interest is the Protective Action Limit (2 min. or less) since it is generally assumed that the operators can don protective breathing apparatus within two minutes of detection. The SRP states that the limit will ensure chronic effects are not experienced and acute effects are reversible within several minutes after donning a protective breathing apparatus.

The accepted Protective Action Limits for chemicals typically used in nuclear power plants are listed in Regulatory Guide 1.78. Based on SCE's review of alternatives to these limits, it is judged that these limits may be overly conservative and that more reasonable limits can be justified. Such use of alternative limits, with justification, is specifically allowed by Regulatory Guide 1.78.

NUREG/CR-1741, "Models for the Estimation of Incapacitation Times Following Exposure to Toxic Gasses or Vapors," can be used to determine the incapacitation time or to determine the incapacitation limit based on the allowable exposure time. Using the two-minute exposure time criteria, the incapacitation limit was determined for chlorine and ammonia. The NUREG/CR-1741 predicted concentration was 4 times greater than the Regulatory Guide 1.78 value for chlorine and 20 times greater for ammonia. Although the NUREG is merely a guideline for determining incapacitation times, it demonstrates the Regulatory Guide 1.78 values are conservative.

An additional alternative standard is available which closely fits the Protective Action Limit criteria. The Federal Department of Health, Education and Welfare's National Institute for Occupational Safety and Health (NIOSH) has developed the Immediately Dangerous to Life and Health (IDLH) toxic gas limits. These values are concentrations at which an exposed individual could escape in 30 minutes without any impairing symptoms or irreversible health effects. These values are conservative, when applied to SONGS 1, since the operators would only be exposed to the gas for a maximum of two minutes. Also, the IDLH limit assumes that the concentration is at the limit from time zero, whereas the normal assumption per SRP 6.4 is stated as follows:

> "In determining this limit (protective action limit), it should be assumed that the concentration increases linearly with time from zero to two minute and that the limit is attained at two minutes."

The model established by NUREG/CR-1741 was used to check the validity of the IDLH limits. It predicted an incapacitation time of 4.5 minutes for chlorine and 7.1 minutes for ammonia. Although these times are well below the 30 minute expected value (per the definition of IDLH) they are still sufficiently above the two-minute limit required to don respirators.

The current Regulatory Guide limits for ammonia and chlorine are overly conservative when compared to the alternate methods of NUREG CR-1741. The NIOSH IDLH values have been determined to be more realistic, yet sufficiently conservative to protect the operators during a toxic gas event and allow enough time to don protective breathing apparatus. For these reasons SONGS 1 has used the NIOSH IDLH values for ammonia and chlorine as a basis for determining the Control Room Habitability design.

<u>Action Item 8</u>

SCE will examine the possibility of performing the Control Room ventilation modifications during operation such that they could be done more promptly.

<u>Response</u>

A preliminary evaluation of the Control Room HVAC modifications indicates it may take on the order of one month to complete. Major modifications will be required including equipment relocation and partial assembly of the new A-33 filter unit. During the entire period the Control Room boundary would be compromised due to the HVAC ducting being open and the temporary cooling routed through open Control Room Emergency Air Treatment System (CREATS) doors.

In addition the emergency filter unit (A-33), which is being replaced, has a lead time of approximately one year. It is not scheduled to be ordered until mid-1991, following the completion of conceptual engineering.

Therefore, due to the extensive modifications and long lead time for procuring the emergency filter unit, this modification is not feasible prior to the 1992 Cycle 12 refueling outage.

Action Item 9

SCE will re-examine the proposed technical specifications to ensure that they are still appropriate when the above additional information is developed.

Response

SCE determined after reexamination of the proposed Control Room HVAC Technical Specification, that changes will need to be made to reflect changes in procedures and design to the proposed HVAC system. These changes include revising the basis to Section 3.12 to properly describe the filter layout for the emergency filtration unit (A-33) and revising technical specification 4.11 to reflect the upgraded design. A revised Technical Specification will be submitted for NRC review six months prior to the start of the Cycle 12 refueling outage which is presently scheduled for September 1992. Therefore, NRC review and approval of the proposed technical specifications submitted on October 10, 1986 is not required.

Table 1

Dose Calculation Results Summary

Source/CRHVAC Status	Doses
SONGS 1 (A-33 operating)	23.0 Rem thyroid
SONGS 2 (A-33 operating)	4.7 Rem thyroid
SONGS 1 (A-33 not operating)	Less than 30 Rem thyroid *
SONGS 2 (A-33 not operating)	Less than 30 Rem thyroid *

* Use of Self-Contained Breathing Apparatus (SCBAs) and operator shifts consistent with our Emergency Operating Instructions will limit the individual Control Room operator dose to less than 30 Rem to the thyroid, without A-33 operating. Without taking these measures, the thyroid dose would be 617 Rem and 125 Rem from SONGS 1 and SONGS 2 sources respectively.

Table 2

Dose Calculation Input and Assumptions
SONGS 1 Control Room Parameters

Parameter	Value*
Control room volume	18,800 ft^3
Intake flow rate (A-33 for emergency operation)	900 cfm(1)
Unfiltered Inleakage (A-33 Operating)	
- Intake damper	12 cfm
- Door use	10 cfm
- Margin	3 cfm
- Total	25 cfm(2)
Intake filter (A-33 performance; there is no filtered recirculation)	
- elemental	99%
- particulate	99%
- organic	99%
Breathing rate	
0 - 8 hrs	3.47 E-4 m^3/s
8 - 24 hrs	1.75 E-4 m^3/s
1 - 30 days	2.32 E-4 m^3/s
Occupancy factor (No Single Failure)	
0 - 24 hrs	1.0
1 - 4 days	0.6
4 - 30 days	0.4

* The superscripts denote a change from the previous calculations submitted October 10, 1986 and April 17, 1989. An explanation of the changes is provided on page 16.

Table 3

Dose Calculation Input
SONGS 1 LOCA Parameters

Parameter	Value
RCS Volume	50,500 gal
RWST Volume (Useable)	157,116 gal
RCS Drain Tank	748 gal
Recirculation Volume	206,868 gal[3]
Containment Horizontal Projected Area	1473 m^2
Distance from Control Room Intake to SONGS 1 Containment Surface	45 m[4]
Distance from Control Room to the Nearest Recirculation line	78.1 m[4]
Power Level	1,347 MWT
Containment Free Volume	1.21 E6 ft^3
Sprayed Containment Volume During Injection	86%
Sprayed Containment Volume After Injection	71%
Mixing Flow Between the Sprayed and Unsprayed Volumes During Injection	5650 cfm[5]
Mixing Flow Between the Sprayed and Unsprayed Volumes After Injection	11,700 cfm[5]
Containment leak rate	0.12 wt%, 0 - 690,000 sec [6] 0.06 wt%, 690,000 sec - 30 days
Spray Removal Coefficients (Iodine)[7]	
Elemental	
- during Injection	10/hr (2 - 8 min)
- during Transition	2.19/hr (8 - 11 min)
- during Recirculation	2.43/hr (11 - 157 min)
Particulate	
- during Injection	1.9/hr (2 - 8 min)
- during Transition	0.55/hr (8 - 11 min)
- during Recirculation	0.57/hr (11 - 592 min) 0.057/hr (592 min - 30 days)
Organic	0.0/hr (0 - 30 days)

Table 3 (continued)

Dose Calculation Input
SONGS 1 LOCA Parameters

Parameter	Value
Maximum Elemental Iodine Decontamination Factor	59 [8]
Maximum Particulate Iodine Decontamination Factor	[8]
Iodine distribution	
- elemental	91%
- particulate	5%
- organic	4%
Core Inventory (Ci)	
I^{131}	3.37 E7 [9]
I^{132}	5.03 E7
I^{133}	7.79 E7
I^{134}	9.17 E7
I^{135}	7.62 E7
Dose Conversion Factors (rem thyroid/Ci inhaled)	
I^{131}	1.07 E6 [10]
I^{132}	6.29 E3
I^{133}	1.81 E5
I^{134}	1.07 E3
I^{135}	3.15 E4
Fractions of isotopes released to sump and available for release	
- Iodine	50%

Table 3 (continued)

Dose Calculation Input
SONGS 1 LOCA Parameters

Parameter	Value
Fractions of Isotopes Released to Containment and Available for Release	
- Iodine	25%*
Recirculation System Leakage[11]	0 cc/hr (0 - 11 min) 1250 cc/hr (11 min - 30 days)
SONGS 1 χ/Q values (sec/m^3)[12] **	
Containment to HVAC Intake	
0 - 8 hrs	1.06 E-3
8 - 24 hrs	7.38 E-4
1 - 4 days	4.43 E-4
4 - 30 days	1.76 E-4
Recirculation Piping to HVAC Intake	
0 - 8 hrs	6.19 E-4
8 - 24 hrs	3.93 E-4
1 - 4 days	2.47 E-4
4 - 30 days	8.88 E-5

* Includes 50% Plateout Assumption
** Does not include occupancy factor

Table 4

Dose Calculation Input
SONGS 2 LOCA Parameters

Parameter	Value
Recirculation Volume	1.67 E9 cm^3
Containment horizontal projected area	2127 m^2
Distance from SONGS 1 control room intake to SONGS 2 containment	228 m
Power Level	3560 MWt
Free Containment Volume	2.366 E6 ft^3
Sprayed containment volume	80.6%
Containment leak rate	0.1 wt%/day 0 - 24 hrs 0.05 wt%/day 1 - 30 days
Mixing flow between the sprayed and unsprayed volumes	136,000 cfm
Iodine Removal Constant (hr^{-1})	
- Elemental Iodine	
Spray	0.00
Deposition (sprayed region)	6.65*
Deposition (unsprayed region)	11.3*
- Organic Iodine	0.0
- Particulate	2.75**

* Value is reduced by 95% after DF of 100 is reached.
** Value is reduced by 90% after DF is reached.

Table 4 (continued)

Dose Calculation Input
SONGS 2 LOCA Parameters

Parameter	Value
Core Inventory (Ci)	
I^{131}	8.96 E7
I^{132}	1.33 E8
I^{133}	2.06 E8
I^{134}	2.40 E8
I^{135}	1.89 E8
Fractions released to sump and available for release	
Iodine	50%
Fractions of isotopes released to containment and available for release	
Iodine	50%
Outside leakage sources	
- ESF recirculation	11,900 cm^3/hr
Partition Factor	0.1
- PASS leakage	700 cm^3/hr
Partition Factor	0.1
- ESF pump failure	500 cm^3/min
Partition Factors	82.5% 0.01 17.5% 0.1
SONGS 2 χ/Q values(12) (sec/m^3)	
0 - 8 hrs	1.2 E-4
8 - 24 hrs	7.8 E-5
1 - 4 days	4.54 E-5
4 - 30 days	5.95 E-6

EXPLANATION OF CHANGES

The purpose of this section is to explain the changes in calculation assumptions and inputs from our previous dose calculations provided in our October 10, 1986 and April 17, 1989 submittals.

(1) Our October 10, 1986 submittal used a 2,000 cfm flowrate for the upgraded HVAC. We are going to install a 1,000 cfm ± 10% Emergency Filtration Unit (A-33). In our dose calculation we used a conservative value of 900 cfm. This value is conservative because of the step change lowering of χ/Qs at various times post-LOCA (which will bring less iodines and more air into the control room but because of the slower intake and therefore slower outleakage the iodines built up in the control room will be forced out more slowly).

(2) Our October 10, 1986 submittal used an unfiltered inleakage of 11 cfm. The current calculation, which uses 25 cfm unfiltered inleakage, assumes 10 cfm for door opening, 12 cfm for leaktight dampers, and 3 cfm for additional margin.

(3) Our previous submittal used a recirculation volume of 240,000 gallons. The current calculation uses the retrievable sump volume of 206,868 gallons, assuming a 748 gallon holdup in the RCS Drain Tank. The retrievable sump volume is calculated based on:

RWST Vol Injected	157,116 gal	
RCS Vol	+50,500 gal	
	207,616 gal	- 748 gal = 206,868 gal

(4) For the dose calculation χ/Q values were determined for the containment leakage and the recirculation system leakage. The closest distance from the control room HVAC intake to the containment surface and a recirculation line was determined to be 45 meters and 78.1 meters respectively.

(5) The mixing flow rate is assumed to be two turnovers of the unsprayed region per hour, from SRP 6.5.2. III.1.C Revision 2.

(6) Our previous calculation used a leakrate of 0.12 wt%/day from 0 - 4 days and 0.06 wt%/day from 4 - 30 days. This was changed due to a recalculation of the SONGS 1 containment pressure profile due to the installation of new spray restriction orifices CRS-RO-525 & 526.

Regulatory Guide 1.4 Section C.1.e states that the containment should be assumed to leak at the Technical Specification value for the first 24 hours, then at 50% of this value for the duration of the accident. But, SONGS 1 does not comply with SRP 6.2.1.1.A, Revision 2, which states that the pressure inside containment should be reduced to 50% of the peak calculated pressure within 24 hours. Therefore, in keeping with the intent of Regulatory Guide 1.4, the containment will be assumed to leak at the Technical Specification value for the first 690,000 seconds (approximately 8 days).

(7) The containment spray iodine removal coefficients were determined using the guidance provided in SRP 6.5.2, Revision 2. Our use of the SRP to determine the appropriate spray removal coefficients is discussed in the response to Action Item 2.

(8) In our October 10, 1986 calculation a decontamination factor of 100 was used for both types of iodines. In this calculation the elemental and particulate iodine decontamination factors are based on the guidance provided in SRP 6.5.2.III.4.c.(4).d, Revision 2. This section states that there is no need to limit the DF for particulate iodines and references ANSI/ANS 56.5-1979 for elemental iodines. The DF for elemental iodines was calculated using Equation 8.3.7-2 in ANSI/ANS 56.5-1979. SONGS 1 assumes 50% instantaneous plateout of airborne iodines; therefore, the elemental iodine decontamination factor calculated in Equation 8.3.7-2 was reduced by a factor of 2 to account for this, in accordance with the definition presented in Equation 8.3.7-1 of ANSI/ANS 56.5-1979.

(9) The core inventory is based on Technical Information Document (TID-14844) Equation 2, with fission yields from the 14th edition of "Nuclides and Isotopes" published by G.E. in 1989.

(10) The dose conversion factors were taken from ICRP 30. Use of ICRP 30 to determine the dose conversion factors is discussed in the response to Action Item 1. Previously ICRP 2 was used.

(11) Previously, recirculation was assumed to start at 25 minutes post-LOCA. This number came from a Bechtel letter to SCE. However, a new calculation was performed which demonstrated that we could start recirculation at 11 minutes post-LOCA. Thus, 11 minutes was used.

(12) The χ/Q values were calculated from guidance provided by NUREG/CR-5055. Previously the guidance presented in "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criterion 19" by Murphy and Campe was used. The use of NUREG 5055 is discussed in the response to Action Item 1.

The items listed below provide responses to questions which were discussed at the September 26 and 27, 1989 site visit and not included in the NRC's action item list.

Item 1

With the upgrades to the Control Room HVAC, provide a description on how the procedures for operations and emergency planning will be changed. Certain procedural action was discussed during the meeting and the particular action identified.

a) With a radiological accident occurring at Unit 2 or 3, the Unit 1 Control Room operator should be instructed to actuate the emergency HVAC system (A-33).

b) With a toxic gas release identified in the Unit 2 or 3 Control Room or in the event that the operator smells a foreign gas, Unit 1 operators should be instructed to place the Unit 1 Control Room HVAC system into the recirculation mode.

c) The loss of Control Room HVAC procedure should include instructions for operator action during a radiological event if the Control Room is in an alternate cooling mode.

Response

During the Cycle 12 refueling outage, when the control room HVAC will be upgraded, all procedures relating to operations and emergency planning affected by the upgrade will be identified. These procedures will be revised to be consistent with the upgraded HVAC system prior to return to service from the Cycle 12 refueling outage. Listed below are the three procedural changes that pertain to the items listed above.

a) SO123-VIII-30, Operations Leader Duties. This Emergency Plan Implementing procedure has been revised to include direction for the SONGS 1 operator to actuate the Control Room emergency HVAC unit upon notification from SONGS 2 or 3 of a radiological accident or event.

b) SO1-2.2-3, Toxic Gas. This Abnormal Operating procedure has been revised to include guidance to secure the SONGS 1 normal Control Room HVAC (A-31) unit upon a toxic gas event.

c) SO1-2.4-6, Loss of Control Room HVAC. This procedure has been revised to include guidance to ensure appropriate operator action is taken during a radiological or toxic event if the Control Room is in an alternate cooling mode. This action is to ensure that the control room boundary is re-established.

Item 2

Consideration should be given to providing automatic initiation of the Emergency Filter System (A-33) as part of Control Room upgrades.

Response

Automatic Initiation will be provided for the Control Room HVAC system. The current system automatically closes the normal outside air damper (recirculation mode) upon receipt of a Containment Isolation Signal. The new system will automatically start A-33 in addition to changing the damper position.

Item 3

Determine the effect on the dose to the operators with automatic initiation of the Emergency Filter System (A-33).

Response

At the time that this question was posed SCE intended on providing remote manual actuation to the emergency filtration unit (A-33). However, as noted in response to Item 2 above, SCE has formally committed to automatic initiation. Therefore, the calculation results outlined in Table 1 of Enclosure A to this letter are based on automatic initiation of A-33.

Item 4

For the upgraded system the test frequency for the leaktight dampers should be adequate to demonstrate the dampers are maintained leaktight.

Response

The test frequency for the leaktight dampers of the upgraded system will be every refueling outage. This testing will ensure that a specified leakage rate will not be exceeded. The leakage criteria will be consistent with the dose calculation which assumes a damper leakage of 12 cfm.

Technically a leaktight damper is designed to have zero leakage. However, experience has shown that dampers that are normally open have a tendency to build up dirt on the blades which could affect the seal. Consequently a leakage value was chosen that would allow a reasonable testing frequency. Periodic preventative maintenance will be performed on the outside air isolation dampers approximately every 3 months for inspection and cleaning as required.

Item 5

Need to address a method for inputting the toxic gas highway survey into the toxic analysis for SONGS 1.

Response

The method for updating the Unit 1 toxic gas hazards analysis will be similar to the procedure for the Unit 2/3 analysis. Every three years a survey is conducted of the truck traffic that passes the plant. From this information the hazard due to each chemical is determined. The Unit 2/3 hazards analysis is prepared in conjunction with the highway survey every three years. The survey information is generic in nature and applies to the plant in general. However, the hazard due to each chemical is not the same since Unit 1 uses different assumptions. Therefore, a separate analysis is required.

In order to comply with the NRC requirement, the existing Unit 1 toxic gas hazards analysis will be reviewed in conjunction with the truck survey and updated as required. This activity will be performed every three years on the same cycle as the Unit 2/3 analysis. The results of this evaluation will be included in the update of the FSAR.

The survey was recently completed in 1990. The results of the survey and the affect on Units 2 and 3 were provided to the NRC on February 15, 1991. The affect of the survey on Unit 1 will be provided to the NRC.

The SONGS 1 Technical Specifications will be revised to require that SCE review, and update the analysis, as required, every three years using the results of the current traffic survey.

Item 6

Evaluate the containment leak rate data to determine the possibility of reducing the leak rate assumptions in the dose calculations.

Response

The containment leak rate assumption used in the dose calculations was evaluated and it has been determined that the available margin cannot be reduced.

Item 7

An NRC information notice was issued in the past four years on KI pills and use. Evaluate the notice for impact.

Response

NRC Information Notice No. 88-15, Availability of U.S. Food and Drug Administration (FDA) - Approved Potassium for Use in Emergencies Involving Radioactive Iodine was reviewed. The notice was reviewed by SCE to determine if additional action was necessary.

Guidelines for the use of KI pills are addressed in the following:

- Emergency Plan Implementing Procedure SO123-VIII-40
- Emergency Support Organization Procedures Manual Table 12, Use of Potassium Iodine (KI) for Thyroid Protection

Revisions to these procedures as a result of the information notice were not necessary.

Item 8

The dose calculation contained dose reduction factors for KI pills and respirator from industry sources.

Response

SCE has performed further reviews of available data and cites NUREG/CR4191, Survey of License Control Room Habitability Practices, which states that if KI pills are employed, the thyroid gland can be effectively blocked 24 hours after oral administration, with an efficiency of 99%. This source cites the National Council on Radiation Protection and Measurement, Protection of the Thyroid Gland in the Event of Releases of Radioiodine, NCRP Report No. 55 (1979), as its source. Accordingly, the DRF of 20 used previously by SCE in its dose calculations is conservative.

In the case the SCBA DRF of 10,000, equipment vendors were consulted as to their effectiveness, and the result was a DRF of 10,000. This value agrees with SCE's respiratory protection program and 10CFR20 Appendix A.

Additional Topics not Discussed at the September Meeting:

This enclosure includes information that was not requested during the September 1989 meeting but is related to Control Room Habitability and the proposed Cycle 12 modification.

Item 1

Booster Fan Location

The recirculation unit, emergency filter unit, and a large portion of the supply and return ducting are located outside of the control room envelope. Consequently, any low pressure areas in the system are subject to infiltration. The two main areas of concern are the return duct and the return side of the recirculation air handling unit.

To prevent infiltration into the system, SCE proposed installing a booster fan to pressurize the return duct. When this original proposal was made the design appeared to be feasible. After further review, it appears that locating the fan within the control room envelope may not be possible due to the lack of space compared with the size of the fan required. In the event that the fan needs to be located outside of the control room boundary, the design will limit the infiltration. Also, any infiltration will be accounted for in the dose calculation.

Item 2

Intake Flow Rate During Emergency Operation:

The intake flow rate during emergency operation for the proposed upgraded system is being reduced from 2000 SCFM to 1000 SCFM.

When the original proposal for the upgraded system was made in 1986, maintaining the required +1/8" w.g. above all surrounding areas with the existing system (900 cfm) was difficult. Consequently a 2000 SCFM unit was proposed. Since that time an effort was made to improve the integrity of the control room boundary by sealing penetrations and ducting and improving the seals around the doors. This has resulted in consistently high control room pressures (approximately +1/2" w.g.).

Therefore, the upgraded system will include installation of a 1000 SCFM filter unit instead of the proposed 2000 SCFM unit. This system will be adequate to maintain the required +1/8" w.g. above all surrounding areas.

Item 3

Changes to the On-site Toxic Gas Evaluation:

During the NRC visit in September of 1989, the On-site toxic gas evaluation was reviewed and discussed. Subsequent to this time SCE decided to change the evaluation into an Edison approved calculation (Ref. DC-3309). As a result of this process several changes were made and it is the intent of this section to update the NRC on these changes.

-Intake Flow Rate: For reasons discussed in item #2 above, the intake flow rate has been decreased to 1000 CFM, which is the proposed design flow rate for the upgraded control room HVAC system.

-Control Room Volume: The control room volume used in the evaluation was 18,000 ft^3. It was later determined that a more accurate value is 18,800 ft^3.

-Chemicals Analyzed: The 1988 evaluation analyzed the toxic hazard of the Unit 2/3 Ammonia tank. Aqueous Ammonia and Hydrazine stored in the Unit 1 Chemical feed area were evaluated previously and consequently were excluded in this evaluation. Calculation DC 3309, "Reanalysis of Onsite Toxic Gasses," includes all chemicals which may pose a threat to the Unit 1 Control Room.

-Unit 2/3 Ammonia tank size: The ammonia tank volume used in the previous evaluation is 7500 gallons. This value corresponds to the volume that the tank is normally filled to. However it was discovered that the tank capacity is 9000 gallons and there is no physical means of preventing the tank from being filled to this limit. Calculation DC-3309 accounts for the increased volume.

-Surface Area of the Spill; Random Case: In the original evaluation it was assumed that for a random failure of the Ammonia tank at SONGS 2/3 the contents of the tank would drain into the intake pit through a U-drain adjacent the tank. However this assumption was not able to be substantiated. Therefore, the calculation conservatively assumes that the tank contents spill to a uniform depth of 2 cm.

Summary of Input Changes:

Input	Evaluation dated April 17, 1989	Calculation DC-3309 dated 04-11-90
General		
Intake Flow Rate	1370 CFM	1000 CFM
Control Room Volume	18,000 ft^3	18,800 ft^3
SONGS 2/3 Ammonia Tank		
Ammonia Tank Volume	7,500 gallons	9,000 gallons
Spill Surface Area (Random Tank Failure)	3,441 ft^2	18,335 ft^2
Spill Thickness (Random Tank Failure)	8.88 cm.	2 cm.
SONGS 1 Hydrazine		
Hydrazine Tank Size	not included *	350 gallons
Distance From Control Room Intake	not included *	100 ft
Incapacitation Level	not included *	50 ppm
Pool Thickness	not included *	1 cm
Human Sensory Level	not included *	4 ppm
SONGS 1 Ammonia		
Volume	not included *	110 gallons
Distance From Control Room Intake	not included *	100 ft
Incapacitation Level	not included *	500 ppm
Human Sensory Level	not included *	21.45
Pool Thickness	not included *	1 cm

* Hydrazine and Ammonia were not included in this evaluation but were covered in a separate evaluation.

Summary of Results, Calculation DC-3309:

Chemical	Volume	Toxic Limit (IDLH)	Maximum Concentration (Control Room)	Time to Reach Toxic Gas Limit (IDLH)
	(gallon)	(ppm)	(ppm)	(min)
Aqueous Ammonia				
SONGS 1	110	500	24	N/A
SONGS 2/3 (Random)	9,000	500	1,205	9.5
SONGS 2/3 (Tornado)	9,000	500	233	N/A
Hydrazine				
SONGS 1	350	50(1)	2.5	N/A

Item 4

Changes to the Off-Site Toxic Gas Evaluation:

During the NRC visit in September of 1989, the Off-Site toxic gas evaluation was reviewed and discussed. Subsequent to this time SCE decided to change the evaluation into an Edison approved calculation (Ref. DC-3308). As a result of this process several changes were made and it is the intent of this section to update the NRC on these changes.

-Intake Flow Rate: For reasons discussed in item #2 above, the intake flow rate has been decreased to 1000 CFM, which is the proposed design flow rate for the upgraded control room HVAC system.

-Control Room Volume: The control room volume used in the evaluation was 18,000 ft^3. It was later determined that a more accurate value is 18,800 ft^3.

-Location of the Control Room Intake: The distance between the Interstate 5 and the control room intake has been changed from 775 ft to 780 ft to be consistent with other SONGS 1 documents.

1. A toxic gas limit for hydrazine is not available for IDLH. This value was taken from the "Handbook of Environmental Data on Organic Chemicals", by Karl Vershueren, Van Nostrand Reinhold Company Press, 1977.

Summary of Input Changes:

General Input	Evaluation dated April 17, 1989	Calculation DC-3308
Intake Flow Rate	1370 CFM	1000 CFM
Control Room Volume	18,000 ft^3	18,800 ft^3
Distance from I-5 to the Control Room	775 ft	780 ft

Summary of Results

Deterministic Analysis:

	Evaluation Dated April 17, 1989		Calculation DC-3308	
Chemical	**Max. Distance at which hazard is posed**	**Hazard posed**	**Max. Distance at which hazard is posed**	**Hazard posed**
Propane	<700	No	<700	No
Butane	<700	No	<700	No
Chlorine	5850	Yes	4400 ft	Yes
Anhydrous Ammonia	2000	Yes	2300 ft	Yes

Probabilistic Analysis:

	Frequency of Loss of Control Room Habitability	
Chemical	**Evaluation Dated April 17, 1989**	**Calculation DC-3308**
Chlorine	1.1×10^{-7}/yr	1.17×10^{-7}/yr
Anhydrous Ammonia	7.3×10^{-9}/yr	3.4×10^{-9}/yr