

ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-361/95-22
50-362/95-22

Licenses: NPF-10
NPF-15

Licensee: Southern California Edison Co.
P.O. Box 128
San Clemente, California

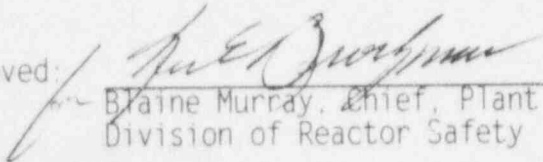
Facility Name: San Onofre Nuclear Generating Station, Units 2 and 3

Inspection At: San Clemente, California

Inspection Conducted: November 6-9, 1995

Inspectors: J. B. Nicholas, Ph.D., Senior Radiation Specialist
Plant Support Branch

Thomas H. Andrews, Jr., Radiation Specialist
Plant Support Branch

Approved: 

Blaine Murray, Chief, Plant Support Branch
Division of Reactor Safety

12-8-95
Date

Inspection Summary

Areas Inspected (Units 2 and 3): Routine, announced inspection of the licensee's calculations of off-site radiological effluent doses resulting from liquid and gaseous radioactive effluents released to the environment.

Results (Units 2 and 3):

Plant Support

- The licensee was calculating offsite doses using methods described in the Offsite Dose Calculation Manual. Initial confirmatory dose calculations were performed during the inspection using the NRC PC-DOSE computer code for offsite dose calculations. The licensee's and the NRC's calculated doses were in agreement for the radioactive liquid effluents and the noble gas effluents. The licensee's dose data from the five test cases performed for radioactive airborne tritium, iodines, and particulates for the critical age group and organ doses were in close agreement and generally slightly greater and more conservative than the NRC's calculated doses. It was concluded that the licensee's

computer calculations of offsite doses resulting from radioactive waste effluents discharged to the environment were accurate and in accordance with the methods, assumptions, dose factors, and equations described and defined in the Offsite Dose Calculation Manual (Section 1).

- The Annual Radiological Effluent Release Reports contained all the required information presented in the format described in NRC Regulatory Guide 1.21. Revisions 26 and 27 to the Offsite Dose Calculation Manual were documented in the respective Annual Radiological Effluent Release Reports (Section 2).

Summary of Inspection Findings:

- Violation 361/9511-01; 362/9511-01 was closed (Section 3).

Attachments:

- Attachment 1 - Persons Contacted and Exit Meeting
- Attachment 2 - Adult Liquid Dose Calculations
- Attachment 3 - Noble Gas Dose Calculations
- Attachment 4 - Airborne Particulate Dose Calculations
- Attachment 5 - Summation of All Liquid Effluent Releases
- Attachment 6 - Summation of All Airborne Effluent Releases
- Attachment 7 - Maximum Annual Doses from Gaseous and Liquid Effluent Releases

DETAILS

1 RADIOACTIVE LIQUID AND GASEOUS EFFLUENT DOSE CALCULATIONS (84750)

The inspectors reviewed the licensee's radioactive effluent dose calculations to determine compliance with the requirements in the Offsite Dose Calculation Manual.

The inspectors conducted initial confirmatory calculations of the offsite doses from the plant's liquid and gaseous radioactive effluents released to the environment. Radioactive effluent dose calculations were performed by the inspectors for liquids, noble gases, and airborne tritium, iodines, and particulates using the NRC computer code, PC-DOSE, which was developed to verify the dose calculations described in the Offsite Dose Calculation Manual.

The chemistry department performed effluent dose calculations using methodologies, assumptions, and equations described in the Offsite Dose Calculation Manual and implemented by a computer code developed by the licensee. The inspectors, in cooperation with the chemistry department, developed realistic test cases based on typical effluent radionuclide concentrations and release rates for radioactive liquid and gaseous effluents. The inspectors and the chemistry department performed dose calculations using the same radionuclide concentrations for two liquid effluent test cases. For all radionuclides tested, the licensee's and NRC's calculated dose results from radwaste liquid effluents for the adult total body and adult critical organs were in agreement. The calculated dose data for the liquid effluents is presented in Attachment 2 to this inspection report.

In addition to the radioactive liquid effluent test cases, two test cases for noble gas dose and five test cases for doses resulting from airborne tritium, iodines, and particulates were performed. The licensee's dose results for the total body gamma-air dose and the total body beta-air dose from exposure to radioactive noble gases were in agreement with the NRC's calculated doses. The calculated dose data for the noble gas effluents is presented in Attachment 3 to this inspection report.

In accordance with Offsite Dose Calculation Manual methodologies, the licensee performed dose calculations using dose factors derived using the NRC code, PARTS. At each of the identified controlling locations, the licensee's dose factors were determined for each identified airborne effluent radionuclide based on the most restrictive age group, ingestion pathway, and critical organ. The dose factors and controlling locations represented the maximum calculated individual dose as determined by the annual land use census. The five test cases performed by the licensee and the inspectors were based on the controlling radionuclides, locations, ingestion pathways, and age groups as tabulated in the Offsite Dose Calculation Manual. The licensee's dose data from the five test cases performed for radioactive airborne tritium, iodines,

and particulates were in close agreement and, generally, slightly greater and more conservative, than the NRC's calculated doses. The calculated dose data for the airborne particulate effluents is presented in Attachment 4 to this inspection report.

The inspectors concluded that the licensee's computer calculations of offsite doses resulting from radioactive waste effluents discharged to the environment were confirmed to be accurate and in accordance with the methods, assumptions, dose factors, and equations described and defined in the Offsite Dose Calculation Manual.

2 REPORTS OF RADIOACTIVE EFFLUENTS (84750)

The inspectors reviewed the licensee's reports concerning radioactive waste systems and effluent releases to determine compliance with the requirements of 10 CFR Part 50.36(a)(2), Technical Specifications 6.9.1.8 and 6.14, and the Offsite Dose Calculation Manual.

The inspectors reviewed the licensee's Annual Radiological Effluent Release Reports for Units 2 and 3 for the periods January 1 through December 31, 1993, and January 1 through December 31, 1994. These reports were written in the format described in NRC Regulatory Guide 1.21 and contained the information required by the Offsite Dose Calculation Manual and Technical Specifications. During 1993, the licensee performed 198 liquid batch releases and 10 gaseous batch releases from gas decay tanks (containment vents and purges were considered continuous releases). During 1994, the licensee performed 108 liquid batch releases and 2 gaseous batch releases from gas decay tanks. A summary of the liquid and gaseous effluent releases and associated doses for 1993 and 1994 are presented in Attachments 5 through 7 to this inspection report.

The licensee reported two unplanned releases during 1993. A slow continuous release from the surge tank connected to the in-service waste gas decay tank occurred from July 31 to August 1, 1993, for about 28 hours, due to a waste gas system isolation valve left inadvertently in the open position. Although this release was unplanned, the release was monitored, sampled, and quantified as part of the plant vent stack flowpath. The total activity released was conservatively estimated at 2.8 curies for a potential gamma dose of $1.54E-04$ millirad. There was no significant dose consequences as a result of this release, and an Operations Division Experience Report (ODER 2-93-22) was written to document the event and to provide for corrective actions. The second unplanned release was from the Unit 2 high conductivity sump. On December 23, 1993, about 9000 gallons of water were released to the outfall without prior sampling and analysis in accordance with the Offsite Dose Calculation Manual. Subsequent sampling and analysis of the remaining water in the high conductivity sump indicated that there was no detectable activity. Therefore, there was no dose consequences as a result of this unplanned release. A Chemistry Division Investigation Report (CDIR 93-009) was written to document the event and to provide for corrective actions.

During 1994, the licensee reported one unplanned release. A slow, intermittent low level release from the nitrogen gas system occurred from January 24 to February 9, 1994, due to leaking isolation check valves between the nitrogen supply header and the radwaste system gas decay tank header. The total activity released to the atmosphere was conservatively estimated at $2.36E-02$ curies for a potential gamma dose of $8.01E-07$ millirad and beta dose of $4.99E-06$ millirad. There were no significant dose consequences as a result of this release, and a Station Division Investigation Report (IDIR-94-003) was written to document the event and to provide for corrective actions.

Revision 26 to the Offsite Dose Calculation Manual was approved on December 20, 1993, and Revision 27 to the Offsite Dose Calculation Manual was approved on December 21, 1994. The inspectors reviewed the changes to the Offsite Dose Calculation Manual incorporated into revisions 26 and 27 and found them to be satisfactory and well documented in the respective Annual Radiological Effluent Release Reports.

No major changes were made to the liquid and gaseous radwaste systems during 1993 and 1994.

3 FOLLOWUP - PLANT SUPPORT (92904)

3.1 (Closed) Violation 361/9511-01; 362/9511-01 - High Radiation Area Access Control Problems

In NRC Inspection Report 50-361/95-11; 50-362/9511, a violation was issued for 14 incidents where radiation workers entered into areas controlled as high radiation areas without being controlled by radiation exposure permits intended for work in high radiation areas, without being knowledgeable of the dose rates within the areas, and without health physics coverage to provide positive controls over their activities. As part of the response to this violation, the licensee stated that they would conduct meetings on a continuing basis with station work groups to emphasize and call attention to these incidents. The licensee also conducted a root cause evaluation and identified a number of corrective actions in addition to those stated in their response to the violation. The inspector reviewed the corrective actions taken by the licensee and noted that the licensee had conducted meetings and had provided bulletins to workers that discussed high radiation area access controls and radiation protection boundaries and barriers, including a discussion of radiography boundaries.

After the issuance of this violation, the licensee experienced 3 additional incidents involving improper access to high radiation areas involving 4 individuals and one incident involving the entry of 1 individual into a radiography zone. There were no regulatory or administrative dose limits exceeded as a result of these incidents. The licensee considered the radiography zone incident as being similar to the high radiation area access control problems because the potential for radiation exposure existed.

The licensee took progressively stronger actions up until August 18, 1995, when the Vice President, Nuclear Generation, stopped all site work and conducted a site-wide briefing via the plant public address system.

On August 23, 1995, there was another incident where an individual entered into a high radiation area without being knowledgeable of the conditions in the area. In this instance, the worker was signed in on a radiological exposure permit that allowed entry into high radiation areas, but he had not verified the conditions in the area prior to entering. Compounding the problem, the high radiation area, which blocked the individual's exit route, was established by health physics technicians who did not perform an adequate search of the area prior to establishing the high radiation area. The individual was counselled and suspended for one day.

Since August 23, 1995, there had not been any further incidents involving improper access into high radiation areas. Because the licensee's actions were effective in correcting access control problems, this violation was closed.

ATTACHMENT 1

1 PERSONS CONTACTED

1.1 Licensee Personnel

- *J. T. Rosenblum, Vice President, Engineering and Technical Services
- *E. J. Bennett, Quality Assurance Engineer
- M. J. Bua, Supervisor, Units 2/3 Chemistry
- *P. K. Chang, Effluent Supervisor, Chemistry
- *J. R. Clark, Manager, Chemistry
- *D. Dick, Effluent Engineer, Chemistry
- *G. T. Gibson, Manager, Compliance
- *R. S. Giroux, Compliance Engineer
- *E. M. Goldin, Supervisor, Health Physics and Environmental
- *M. J. Johnson, Supervisor, Environmental Protection
- R. L. Kaplan, Compliance Engineer
- S. S. Paranandi, Supervisor, Quality Assurance
- G. L. Plumlee, Supervisor, Compliance
- *J. T. Reilly, Manager, Nuclear Engineering and Construction and Fuel Services
- *M. A. Wharton, Manager, Nuclear Engineering Design Organization
- *K. C. Yhip, Engineer, Health Physics and Environmental

1.2 NRC Personnel

- *J. A. Sloan, Senior Resident Inspector
- *D. L. Solorio, Resident Inspector

*Denotes personnel that attended the exit meeting on November 9, 1995. In addition to the personnel listed, the inspectors contacted other personnel during this inspection period.

2 EXIT MEETING

An exit meeting was conducted on November 9, 1995. During this meeting, the inspectors reviewed the scope and findings of the inspection and discussed the results of the offsite dose calculations performed during the inspection. The licensee did not express a position on the inspection findings documented in this report. The licensee did not identify as proprietary, any information provided to, or reviewed by the inspectors.

ATTACHMENT 2

COMPARISON OF PC-DOSE AND SONGS PERMIT PROGRAM								
ADULT TOTAL LIQUID DOSE RECEIVED BY ORGAN								
ISOTOPE	ACTIVITY	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LI
H-3	1.75E-02		2.72E-06	2.72E-06	2.72E-06	2.72E-06	2.72E-06	2.72E-06
Cr-51	1.30E-06			4.06E-09	2.42E-09	8.93E-10	5.38E-09	1.02E-06
Co-58	2.36E-06		7.94E-07	1.78E-06				1.61E-05
Co-60	4.84E-07		4.68E-07	1.03E-06				8.78E-06
Cs-134	1.03E-07	3.91E-07	9.31E-07	7.61E-07		3.01E-07	1.00E-07	1.63E-08
Cs-137	2.20E-07	1.07E-06	1.47E-06	9.62E-07		4.99E-07	1.66E-07	2.84E-08
TOTALS								
PC-DOSE		1.47E-06	6.38E-06	7.26E-06	2.72E-06	3.52E-06	2.99E-06	2.87E-05
SONGS		1.46E-06	6.37E-06	7.24E-06	2.72E-06	3.51E-06	2.99E-06	2.86E-05
ADULT TOTAL LIQUID DOSE RECEIVED BY ORGAN								
ISOTOPE	ACTIVITY	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LI
H-3	1.00E-07		8.47E-08	8.47E-08	8.47E-08	8.47E-08	8.47E-08	8.47E-08
Na-24	2.00E-07	2.75E-07	2.75E-07	2.75E-07	2.75E-07	2.75E-07	2.75E-07	2.75E-07
Fe-55	3.00E-07	4.61E-02	3.18E-02	7.42E-03			1.78E-02	1.83E-02
Fe-59	4.00E-07	9.69E-02	2.28E-01	8.73E-02			6.37E-02	7.59E-01
Co-58	5.00E-07		9.06E-04	2.03E-03				1.84E-02
Co-60	6.00E-07		3.12E-03	6.89E-03				5.87E-02
Zn-65	7.00E-07	3.39E-01	1.08E+00	4.87E-01		7.21E-01		6.79E-01
Zr-95	8.00E-07	3.83E-05	1.23E-05	8.32E-06		1.93E-05		3.90E-02
I-131	9.00E-07	5.90E-04	8.44E-04	4.84E-04	2.77E-01	1.45E-03		2.23E-04
I-133	1.00E-06	2.24E-04	3.89E-04	1.19E-04	5.72E-02	6.79E-04		3.50E-04
I-135	2.00E-06	1.40E-04	3.66E-04	1.35E-04	2.41E-02	5.86E-04		4.13E-04
Cs-134	3.00E-06	6.17E-02	1.47E-01	1.20E-01		4.75E-02	1.58E-02	2.57E-03
Cs-137	4.00E-06	1.05E-01	1.44E-01	9.44E-02		4.89E-02	1.63E-02	2.79E-03
Ba-140	5.00E-06	2.47E-02	3.10E-05	1.62E-03		1.05E-05	1.78E-05	5.08E-02
TOTALS								
PC-DOSE		6.75E-01	1.63E+00	8.08E-01	3.58E-01	8.20E-01	1.13E-01	1.63E+00
SONGS		6.73E-01	1.63E+00	8.07E-01	3.56E-01	8.19E-01	1.13E-01	1.63E+00

ATTACHMENT 3

COMPARISON OF PC-DOSE AND SONGS PERMIT PROGRAM			
NOBLE GAS DOSE CALCULATIONS			
ISOTOPE	ACTIVITY	Beta-Air	Gamma-Air
Ar-41	1.73E-02	5.09E-08	1.44E-07
Kr-85m	1.30E-06	5.09E-09	3.18E-09
Kr-87	2.36E-06	5.33E-08	3.19E-08
Xe-131m	4.84E-07	8.61E-09	1.21E-09
Xe-133	1.03E-07	1.09E-08	3.65E-09
Xe-135	2.20E-07	3.18E-08	2.48E-08
TOTALS			
PC-DOSE		1.61E-07	2.09E-07
SONGS		1.60E-07	2.09E-07
NOBLE GAS DOSE CALCULATIONS			
ISOTOPE	ACTIVITY	Beta-Air	Gamma-Air
Ar-41	1.00E-07	3.39E-07	9.62E-07
Kr-85m	2.00E-07	4.07E-07	2.54E-07
Kr-85	3.00E-07	6.05E-07	5.34E-09
Kr-87	4.00E-07	4.26E-06	2.55E-06
Kr-88	5.00E-07	1.52E-06	7.86E-06
Xe-131m	6.00E-07	6.89E-07	9.68E-08
Xe-133m	7.00E-07	1.07E-06	2.37E-07
Xe-133	8.00E-07	8.69E-07	2.92E-07
Xr-135m	9.00E-07	6.88E-07	3.13E-06
Xe-135	1.00E-06	2.54E-06	1.99E-06
Xe-138	2.00E-06	9.82E-06	1.90E-05
TOTALS			
PC-DOSE		2.28E-05	3.64E-05
SONGS		2.28E-05	3.64E-05

ATTACHMENT 4

COMPARISON OF PC-DOSE AND SONGS PERMIT PROGRAM							
AIRBORNE PARTICULATE DOSE CALCULATIONS							
PATHWAY	AGE	ISOTOPE	ACTIVITY	SONGS	PC-DOSE	ORGAN	
DEER MEAT	ADULT	Ru-103	2.00E-10	4.65E-07	3.75E-07	Gi-Lli	Inhalation & Deer meet
	ADULT	Te-129m	3.00E-10	3.44E-07	2.91E-07	Gi-Lli	
	ADULT	Nb-95	1.00E-10	1.47E-07	1.19E-07	Gi-Lli	
		TOTAL		6.00E-10	9.56E-07	7.86E-07	
SC RANCH	CHILD	Cs-134	3.00E-10	2.17E-06	2.29E-06	Liver	No inhalation Vegetation & Ground plane
	CHILD	Sr-89	1.00E-10	9.35E-07	1.06E-06	Bone	
	CHILD	Sr-90	2.00E-10	7.84E-05	7.60E-05	Bone	
		TOTAL		6.00E-10	8.15E-05	7.94E-05	
SC RANCH	TEEN	Ce-141	2.00E-10	1.24E-08	1.61E-08	Gi-Lli	No inhalation
	TEEN	Ce-144	1.00E-10	7.24E-07	7.66E-07	Gi-Lli	Vegetation &
		TOTAL	3.00E-10	7.36E-07	7.82E-07		Ground plane
SO MOBILE HOMES	TEEN	H-3	1.00E-10	2.07E-11	1.16E-11	T. Body	No ingestion
	TEEN	Cr-51	2.00E-10	1.40E-09	7.27E-10	T. Body	Inhalation &
	TEEN	Mn-54	3.00E-10	4.21E-07	3.23E-07	T. Body	Ground plane
	TEEN	Co-58	4.00E-10	2.01E-07	1.18E-07	T. Body	
	TEEN	Co-60	5.00E-10	9.22E-06	8.35E-06	T. Body	
	TEEN	Zr-95	6.00E-10	3.75E-07	2.57E-07	Lung	
	TEEN	Cs-136	7.00E-10	1.03E-07	9.72E-08	T. Body	
	TEEN	Ba-140	8.00E-10	2.69E-07	2.59E-07	Lung	
		TOTAL		3.60E-09	1.06E-05	9.40E-06	
SO MOBILE HOMES	CHILD	Cs-137	1.00E-10	7.91E-07	8.01E-07	T. Body	No ingestion
	CHILD	I-131	2.00E-10	5.13E-07	5.18E-07	Thyroid	Inhalation &
	CHILD	I-132	3.00E-10	9.37E-09	9.26E-09	Thyroid	Ground plane
	CHILD	I-133	4.00E-10	2.43E-07	2.45E-07	Thyroid	
	CHILD	I-134	5.00E-10	4.24E-09	4.04E-09	Thyroid	
	CHILD	I-135	6.00E-10	7.68E-08	7.57E-08	Thyroid	
		TOTAL		2.10E-09	1.64E-06	1.65E-06	

ATTACHMENT 5

SUMMATION OF ALL LIQUID EFFLUENT RELEASES

	1993				1994			
	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4
1. Number of batch releases	198				108			
2. Fission & Activation Products (Curies)	1.86 E-02	1.84 E-02	5.29 E-02	2.04 E-01	1.41 E-01	1.07 E-01	2.06 E-02	1.19 E-02
3. Tritium (Curies)	3.92 E+02	2.54 E+02	2.44 E+02	8.84 E+01	1.04 E+02	9.26 E+01	9.96 E+01	5.95 E+02
4. Dissolved & Entrained Noble Gases (Curies)	6.01 E-03	3.65 E-01	3.76 E-01	5.18 E-01	6.88 E-04	3.90 E-04	3.44 E-03	2.40 E-02
5. Gross Alpha (Curies)	1.10 E-05	1.00 E-07	1.00 E-07	1.00 E-07	1.00 E-07	1.00 E-07	1.00 E-07	1.00 E-07
6. Waste Volume Released (liters)	8.77 E+06	1.01 E+07	3.01 E+07	2.38 E+07	2.24 E+07	4.67 E+06	2.75 E+06	4.67 E+06

ATTACHMENT 6

SUMMATION OF ALL AIRBORNE EFFLUENT RELEASES

	1993				1994			
	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4
1. Number of batch releases	10				2			
2. Fission & Activation Products (Curies)	3.31 E+02	6.25 E+02	3.96 E+02	1.90 E+02	5.04 E+01	6.50 E+01	1.38 E+02	1.12 E+02
3. Total Iodine-131 (Curies)	1.24 E-03	1.76 E-02	9.77 E-03	1.94 E-02	1.54 E-04	5.85 E-04	7.49 E-04	2.97 E-04
4. Particulates with Half-lives > 8 days (Curies)	5.75 E-05	1.67 E-04	1.02 E-03	6.07 E-04	1.94 E-04	1.70 E-04	1.28 E-04	8.67 E-05
5. Gross Alpha (Curies)	1.00 E-13	1.00 E-13	4.14 E-06	1.16 E-06	1.28 E-06	2.78 E-07	1.00 E-13	1.50 E-06
6. Tritium (Curies)	8.89 E+00	2.62 E+01	7.20 E+00	7.81 E+00	6.70 E+00	5.22 E+00	3.44 E+01	3.41 E+00

ATTACHMENT 7

MAXIMUM ANNUAL DOSES FROM GASEOUS AND LIQUID EFFLUENT RELEASES

	1993 Dose	Annual Limit Per Unit	Percent of Limit
Liquid Effluents			
Whole Body	1.08 E-02 mrem	3 mrem	3.60 E-01%
Organ	4.26 E-02 mrem	10 mrem	4.26 E-01%
Gaseous Effluents			
Noble Gas			
Gamma (Air Dose)	1.43 E-01 mrad	10 mrad	1.43 E+00%
Beta (Air Dose)	1.06 E-01 mrad	20 mrad	5.30 E-01%
Iodine-131, Iodine-133, tritium, and particulates with half-lives > 8 days	5.51 E-02 mrem	15 mrem	3.67 E-01%
	1994 Dose	Annual Limit Per Unit	Percent of Limit
Liquid Effluents			
Whole Body	3.79 E-03 mrem	3 mrem	1.26 E-01%
Organ	6.81 E-02 mrem	10 mrem	6.81 E-01%
Gaseous Effluents			
Noble Gas			
Gamma (Air Dose)	1.34 E-02 mrad	10 mrad	1.34 E-01%
Beta (Air Dose)	2.75 E-02 mrad	20 mrad	1.38 E-01%
Iodine-131, Iodine-133, tritium, and particulates with half-lives > 8 days	1.12 E-02 mrem	15 mrem	7.47 E-02%