

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report Nos. 50-206/87-13, 50-361/86-12, 50-362/87-14

Docket Nos. 50-206, 50-361, 50-362

License Nos. DPR-13, NPF-10, NPF-15

Licensee: Southern California Edison Company
P. O. Box 800
2244 Walnut Grove Avenue
Rosemead, California 91770

Facility Name: San Onofre Nuclear Generating Station, Units 1, 2 and 3

Inspection at: San Clemente, California

Inspection Conducted: June 1-4, 1987

Inspected by:

W. K. TenBrook
W. K. TenBrook, Radiation Specialist

6-30-87
Date Signed

J. E. Russell
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6-30-87
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Approved by:

G. Yuhas
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6/30/87
Date Signed

Summary:

Areas Inspected: Routine announced inspection of licensee capability to adequately perform required chemical and radiochemical measurements. The inspectors also reviewed changes to laboratory facilities and equipment, the status of the Unit 2/3 condensate polishing system, and licensee audits of the effluent quality assurance program. Inspection procedures 84725 and 79701 were used.

Results: No violations or deviations were identified.

DETAILS

1. Persons Contacted

a) Licensee Staff

- *E. Bennett, Quality Assurance Engineer
- *S. Chick, Chemical Engineer
- C. Couser, Compliance Engineer
- *G. Gibson, Compliance Lead Engineer
- J. Heflin, Effluent Foreman
- J. Madigan, Unit 2/3 Health Physics Supervisor
- D. Madson, Health Physics Engineer
- *J. Mortensen, Acting Chemistry Supervisor
- *J. Winter, Engineer
- V. Woodall, Unit 1 Chemistry Foreman
- *J. Young, Unit 1 Chemistry Supervisor
- *M. Zenker, Compliance Engineer

b) U. S. Nuclear Regulatory Commission

- A. Hon, Resident Inspector
- J. Tatum, Resident Inspector

*Indicates licensee personnel present at the exit interview.

2. Confirmatory Radiochemical Measurements

Four samples were collected by the licensee for intercomparison of gamma spectroscopy measurements between chemistry, health physics, and the NRC mobile laboratory. The licensee chemistry department measured samples of reactor coolant, suspended solids from reactor coolant, and waste gas. The licensee health physics department measured the activities present in an effluent stack charcoal cartridge provided by the chemistry department. All licensee analyses were performed according to standard procedures.

A one milliliter sample of Unit 3 reactor coolant was analyzed for gamma isotopic activity using the NRC mobile laboratory germanium (HPGE) detector system, one detector system belonging to Unit 1 Chemistry, and two detector systems belonging to Unit 2/3 Chemistry. An intercomparison of the measurements is given in table 1.

Table 1

Reactor Coolant

| <u>Nuclide</u> | <u>NRC uCi/ml</u> | <u>Agreement Range*</u> | <u>Licensee Measurement/NRC Measurement</u> | | |
|----------------|-----------------------|-----------------------------|---|---------------------|---------------------|
| | | | <u>Unit 1</u> | <u>Unit 2/3 "a"</u> | <u>Unit 2/3 "b"</u> |
| Na-24 | 5.70 E-3 | 0.75-1.33 | 0.82 | 0.75 | 0.77 |
| I-131 | 6.24 E-2 | 0.85-1.18 | 0.95 | 1.00 | 0.96 |
| I-132 | 7.09 E-2 | 0.80-1.25 | 0.99 | 1.08 | 1.11 |
| I-133 | 1.40 E-1 | 0.80-1.25 | 0.91 | 0.91 | 0.82 |
| I-134 | 1.09 E-1 | 0.75-1.33 | 0.91 | 1.03 | 0.97 |
| I-135 | 9.40 E-2 | 0.80-1.25 | 1.00 | 0.97 | 0.97 |
| Cs-134 | 1.69 E-3 | 0.75-1.33 | 0.94 | 1.06 | - |
| Cs-137 | 1.63 E-3 | 0.75-1.33 | 1.09 | 1.05 | - |
| Ba-139 | 1.41 E-2 | 0.40-2.50 | 0.67 | 0.99 | 0.48 |

The agreement between the licensee and NRC measurements is generally adequate. However, one Unit 2/3 Chemistry gamma analysis failed to identify Cs-134 and Cs-137. An examination of the peak search software output for this particular analysis revealed that neither the 661.64 keV gamma ray from Cs-137 or the 795.8 keV gamma ray from Cs-134 were resolved from the Compton background continuum. The Unit 2/3 Chemistry detector system "a" was able to quantify these radionuclides without accumulating significantly higher total counts in the energy range of interest. The most significantly differing parameter that could account for the discrepancy is differing detector resolution. The full-width at half-maximum (FWHM) at 667.7 keV for detector "b" was 2.07 keV. The FWHM at 667.7 keV for detector "a" was 1.53 keV. The FWHM values at 1333 keV are also significantly different, 1.998 and 2.447, for "a" and "b" respectively. A smaller FWHM for a given gamma ray energy would yield a better defined peak shape for a given number of net counts, thus increasing the probability that the peak search software will identify and accurately quantify the peak. Evidently, the low resolution of detector "b" yielded vague peak shapes for the low activity gamma rays from Cs-134 and Cs-137. Subsequently, the peak search software was not able to resolve the peaks from fluctuations in the background continuum.

The licensee passed 100 ml of Unit 3 reactor coolant through a 47 mm membrane filter to collect suspended solids. The filter sample was analyzed using one detector system belonging to Unit 1 Chemistry, three detector systems belonging to Unit 2/3 Chemistry, and the NRC mobile laboratory detector system. The results of the measurement intercomparison are given in table 2.

*See enclosure for explanation.

Table 2

Suspended Solids from Reactor Coolant

| Nuclide | NRC uCi/ml | Agreement Range | Licensee Measurement/NRC Measurement | | | |
|---------|---------------|--------------------|--------------------------------------|--------------|--------------|--------------|
| | | | Unit 1 | Unit 2/3 "a" | Unit 2/3 "b" | Unit 2/3 "c" |
| Cr-51 | 5.34 E-5 | 0.50-2.00 | 0.94 | 1.00 | 0.71 | 0.77 |
| Mn-56 | 2.88 E-5 | 0.40-2.50 | 0.75 | 1.13 | 0.13 | 1.21 |
| Co-58 | 5.91 E-5 | 0.85-1.18 | 0.90 | 0.87 | 0.90 | 0.93 |
| Zr-95 | 1.35 E-5 | 0.60-1.66 | 0.86 | 1.00 | 1.47 | 0.90 |
| Zr-97 | 2.57 E-5 | 0.80-1.25 | 0.92 | 0.98 | 0.85 | 0.90 |
| Nb-95 | 9.69 E-6 | 0.60-1.66 | 0.23 (0.80) | 1.04 | 0.95 | 0.44 |
| Nb-97 | 2.91 E-5 | 0.80-1.25 | - (0.95) | 0.86 | 0.86 | - |
| Tc-99m | 3.82 E-6 | 0.50-2.00 | 0.76 | 0.66 | 0.70 | 1.01 |
| I-131 | 1.51 E-4 | 0.85-1.18 | 0.95 | 0.92 | 0.91 | 0.96 |
| I-132 | 2.73 E-4 | 0.80-1.25 | 0.59 | 0.57 | 0.59 | 0.66 |
| I-133 | 3.21 E-4 | 0.85-1.18 | 0.93 | 0.89 | 0.88 | 0.96 |
| I-135 | 2.27 E-4 | 0.80-1.25 | 0.94 | 0.92 | 0.91 | 1.00 |
| Te-132 | 2.09 E-6 | 0.40-2.50 | 0.44 | 1.64 | 1.25 | 0.89 |
| Np-239 | 1.33 E-5 | 0.60-1.66 | 0.95 | 0.64 | 0.72 | 0.95 |

Overall agreement between the licensee measurements and NRC measurements appears adequate. However, several anomalies deserve comment. The detector "b" Mn-56 measurement and the NRC measurement did not agree. To determine the cause of the disagreement, the inspector examined the licensee peak search data for the 1810.7 keV gamma ray used to quantify Mn-56. The measurement in question consisted of 19 net counts for the 1810.7 keV peak with an error of 88%. The FWHM for the 1810.7 keV peak was 0.58 keV. The other three measurements possessed 139 to 155 net counts at 1810.7 keV, with FWHM values ranging from 2.44 to 2.55 keV. In addition, the standard FWHM at 1333 keV for detector "b" was 2.48 keV, which is significantly higher than the other three detectors. It appears that the low resolution detector system yielded an aberrant peak shape for the low activity 1810.7 keV peak from Mn-56. The poorly defined peak shape prevented the peak search algorithm from correctly quantifying the peak. This appears to be a second instance of a measurement error that could be largely attributed to the low resolution of Unit 2/3 Chemistry detector system "b". As a result, the licensee intends to remove detector "b" from service and send it to the manufacturer for repair and reconditioning. The licensee will replace detector "b" with a detector presently undergoing reconditioning.

The inability of the licensee's detector system "b" to properly identify and quantify Cs-134, Cs-137 and Mn-56 at the levels present in reactor coolant is an NRC concern and will be tracked as an "open" item (50-361/87-12-01) pending evaluation of the licensee's corrective action.

Measurements for Nb-95 and Nb-97 by Unit 1 Chemistry and one Unit 2/3 detector system do not agree with the NRC measurements. These discrepancies were caused by an improper software interference correction used in the two licensee analyses. The two analyses in question identified Ag-110m as present in the sample, despite the absence of several gamma rays of significant abundance. The interference correction software then subtracted a calculated contribution due to Ag-110m from the key gamma ray peaks of Nb-95 and Nb-97, thus reducing the reported activity for Nb-95 and deleting the activity of Nb-97. The inspector calculated the activities for the Unit 1 Nb-95 and Nb-97 measurements without the interference correction. The agreement ratios for these calculations are shown in parentheses under the reported values. Without the improper interference correction, the measurements show adequate agreement. The inspector also noted that the interference correction for Ag-110m was not performed in the other two licensee analyses, and the measurements were in substantial agreement. The licensee intends to review the nuclide library data for Ag-110m and the nuclide identification software parameters to determine what changes could be made to prevent spurious identification of Ag-110m.

The NRC measurement for I-132 did not agree with the licensee measurements. The disagreement requires further evaluation to ascertain whether it is an acceptable item, deviation, or a violation and is therefore considered an unresolved item at this time (50-361/87-12-02).

A charcoal cartridge sample was analyzed using one Unit 1 Health Physics detector system, two Unit 2/3 Health Physics detector systems, and the NRC mobile laboratory detector system. The licensee Chemistry department obtained a standard charcoal cartridge which had been used for routine weekly effluent stack sampling. The cartridge was provided to the Health Physics department for the measurement intercomparison. The results of the intercomparison are presented in table 3.

Table 3

Charcoal Cartridge

| <u>Nuclide</u> | <u>NRC uCi/ml</u> | <u>Agreement Range</u> | <u>Licensee Measurement/NRC Measurement</u> | | |
|----------------|-----------------------|----------------------------|---|-----------------|-----------------|
| | | | <u>Unit 1</u> | <u>Unit 2/3</u> | <u>Unit 2/3</u> |
| Br-82 | 3.14 E-11 | 0.75-1.33 | 1.26 | 0.93 | 0.96 |
| I-131 | 2.04 E-9 | 0.85-1.18 | 1.22 | 1.03 | 1.06 |
| I-133 | 8.89 E-11 | 0.75-1.33 | 1.25 | 1.10 | 1.12 |
| Xe-133 | 2.41 E-10 | 0.85-1.18 | 1.11 | 0.91 | 0.93 |

The agreement between the licensee and NRC measurements is generally adequate for this measurement geometry.

The licensee obtained a gaseous sample by purging several liters of gas from a waste gas decay storage tank through a 1.26 liter Marinelli beaker. The gas sample was analyzed using one detector system belonging to Unit 1 Chemistry, two detector systems belonging to Unit 2/3 Chemistry, and the NRC mobile laboratory detector system. The results of the measurement intercomparison for the waste gas are given in table 4.

Table 4

Waste Gas

| Nuclide | NRC uCi/ml | Agreement Range | Licensee Measurement/NRC Measurement | | |
|---------|---------------|--------------------|--------------------------------------|----------|----------|
| | | | Unit 1 | Unit 2/3 | Unit 2/3 |
| Kr-85 | 1.13 E-4 | 0.75-1.33 | 1.05 | 0.97 | 1.18 |
| Xe-131m | 9.16 E-6 | 0.75-1.33 | 1.16 | 1.07 | 1.22 |
| Xe-133 | 1.82 E-5 | 0.80-1.25 | 1.28 | 1.26 | 1.06 |
| Xe-135 | 3.11 E-7 | 0.60-1.66 | 0.98 | 0.66 | 0.98 |

The preliminary NRC measurements for the waste gas intercomparison were consistently lower than the licensee measurements. However, the NRC gas Marinelli beaker calibration is based upon a 1000 ml sample volume, while the licensee calibration is based upon a 1260 ml sample volume. The inspector estimated the NRC detector system efficiency for the licensee's 1260 ml geometry and determined that the difference between the licensee and NRC geometries was sufficient to account for the disagreement. The NRC measurements presented in table 4 have been corrected to correspond to the licensee's calibration geometry. The overall agreement is adequate, considering the uncertainties in the NRC measurements.

No violations or deviations were identified during this part of the inspection.

2. Changes in Laboratory Facilities

The inspector toured the licensee's chemistry and radiochemistry laboratories to review changes in laboratory facilities over the past year. The only significant changes were the addition of several new instruments for chemical and radiochemical measurements in the Unit 1 laboratories. The licensee has purchased a high capacity, automated liquid scintillation counter (LSC) for beta measurements. The new LSC is primarily intended for routine tritium analyses. Also, an additional ion chromatograph has been purchased for the Unit 1 laboratory to relieve the analysis load on the previously available instruments. The new ion chromatograph is specifically intended for cation analysis. New in-line instrumentation has been added to quantify parts-per-billion levels of dissolved oxygen and hydrazine in Unit 1 feedwater. The dissolved oxygen in-line monitor is of the permeable membrane type, and the hydrazine analyzer uses a platinum electrode system. EPRI guidance expresses a preference for in-line instrumentation for dissolved oxygen analysis over grab sampling since sample contamination can be avoided.

No violations or deviations were identified during this part of the inspection.

3. Status of the Unit 2/3 Condensate Polishing System

The licensee employs a state-of-the-art full-flow condensate polisher (FFCP) system to reduce secondary water impurities to the parts-per-trillion level. After installation of the FFCP, the licensee observed unexpected intrusion of sulfate into the secondary system. The licensee traced the source of the contamination to breakdown of the cation resin originally incorporated in the FFCP. The licensee has corrected the problem by replacing the original cation resin with a more stable and proven resin from the same vendor. In addition, the licensee has performed a 10% ammonium sulfate solution wash through the anion resin beds over a period of 30 minutes to remove residual sulfate contamination. Finally, the licensee's Chemistry department is recommending a 2% ammonium sulfate wash each time the resins are regenerated to remove any remaining sulfate contamination that may resurface. The 2% ammonium sulfate wash procedure is to be performed at the discretion of the Operations department.

Presently, the Unit 2 FFCP system is bypassed due to a primary-to-secondary leak below technical specification limits. This provided an opportunity to compare secondary water chemistry parameters between twin plants with and without the FFCP. Cation conductivity measurements were generally 50% higher in the bypassed Unit 2 secondary system with respect to Unit 3. Sulfate measurements with the FFCP in operation were less than a third of the levels observed with the system bypassed. Chloride levels were reduced by 50% at some points in the secondary system with the FFCP in operation. A secondary water chemistry report prepared for June 4, 1987, and a secondary water chemistry trend report covering May 29, 1987, through June 4, 1987, indicated that the licensee was meeting secondary water chemistry values recommended in industry guidelines.

The licensee is currently performing radiological and radiochemical assessments to determine if the Unit 2 FFCP system could be returned to operation despite the primary-to-secondary leak. The licensee Chemistry department is recommending restoring the FFCP to operation based on preliminary assessments.

No violations or deviations were identified during this part of the inspection.

4. Licensee Audit of the Effluent Quality Assurance Program

From February 25, 1986, to April 20, 1986, the licensee Quality Assurance department performed a formal audit to evaluate compliance with radiological effluent technical specifications and environmental monitoring technical specifications. Audit plan item 15 concerned verification that the replicate sampling program specified in Chemistry Procedure S0123-III-5.40, "Effluent Quality Assurance Program," was being properly implemented. The auditor reported that intralaboratory comparisons of split samples, analyses of sequential samples from the same effluent stream, and independent laboratory comparisons were all performed and documented in a timely and proper manner. The audit item was closed.

The inspector reviewed Chemistry Procedure S0123-III-5.40, "Effluent Quality Assurance Program," and the results of the independent laboratory comparison program. The procedure provides numerical criteria for acceptability of replicate sample comparisons and intralaboratory split sample comparisons. The criteria are related to the one-sigma standard deviation of the measurement as determined by counting statistics. The licensee criteria are similar to those used by the NRC mobile laboratory program for radiochemical confirmatory measurements. The procedure provides administrative means to resolve inconsistencies discovered during intercomparisons.

The licensee also participates in an independent laboratory comparison program administered by Analytics, Inc. The inspector reviewed the independent verification program results for the three calendar quarters preceding the inspection. Gamma isotopic measurements were compared for liquid and charcoal cartridge samples. The vendor employs the NRC confirmatory measurements acceptability criteria for gamma measurements. Gross beta activity, gross alpha activity and tritium activity were compared for liquid samples. The vendor results indicate adequate agreement for each of the three quarters reviewed.

No violations or deviations were identified during this part of the inspection.

5. Exit Interview

The inspectors held an exit interview with licensee personnel on June 4, 1987, to discuss the preliminary inspection findings. The licensee was informed of the overall measurement agreement for three of the four radioactive samples analyzed. Possible causes of the measurement disagreements for specific radionuclides were briefly discussed. The inspectors stated that the measurement intercomparison for the waste gas sample was not in agreement. The inspectors stated that there would be a period of review of the analysis data to determine the cause of the remaining measurement disagreements, particularly the disagreement involving the waste gas measurement. The inspectors also discussed the review of the licensee's radiochemical measurements audit, the changes to laboratory facilities, and the status of the condensate polishing system.

Enclosure

Criteria for Accepting the Licensee's Measurements

| <u>Resolution</u> | <u>Ratio</u> |
|-------------------|--------------|
| <4 | 0.4 - 2.5 |
| 4 - 7 | 0.5 - 2.0 |
| 8 - 15 | 0.6 - 1.66 |
| 16 - 50 | 0.75 - 1.33 |
| 51 - 200 | 0.80 - 1.25 |
| 200 | 0.85 - 1.18 |

Comparison

1. Divide each NRC result by its associated uncertainty to obtain the resolution. (Note: For purposes of this procedure, the uncertainty is defined as the relative standard deviation, one sigma, of the NRC result as calculated from counting statistics.)
2. Divide each licensee result by the corresponding NRC result to obtain the ratio (licensee result/NRC).
3. The licensee's measurement is in agreement if the value of the ratio falls within the limits shown in the preceding table for the corresponding resolution.