U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-312/82-45

Docket No. 50-312 License No. DPR-54 Safeguards Group

Licensee: Sacramento Municipal Utility District

1708 59th Street, Box 15830

Sacramento, California 95813

Facility Name: Rancho Seco

Inspection at: Clay Station, California

Inspection conducted: November 15-19, 1982

Inspectors: G. H. Hamada — Jan. 31, 1983
G. H. Hamada, Radiation Laboratory Specialist — Date Signed

G. M. Temple — 1-31-83
G. M. Temple, Radiation Technician (Instrumentation) — Date Signed

Approved by: GP Yuhas for — 2/1/83
F. Wenslawski, Chief, Reactor Radiation Protection Section — Date Signed

Approved by: H. E. Book — 2/1/83
H. E. Book, Chief, Radiological Safety Branch — Date Signed

Date Signed

Summary:

Inspection of November 15-19, 1982 (Report No. 50-312/82-45)

Areas Inspected: Routine announced inspection of laboratory quality control program including independent confirmatory measurements involving the Region V Mobile Laboratory. The inspection consisted of a total of 65 hours onsite by one inspector and one radiation technician.

Results: No items of noncompliance were identified in the areas inspected.

RV Form 219 (2)

DETAILS

1. Persons Contacted

*R. Colombo, Technical Assistant
*S. Crunk, Secretary, Plant Review Committee
*P. Howard, Chemistry and Radiation Assistant
*F. Kellie, Chemistry and Radiation Protection Assistant Superintendent
S. Manofsky, Chemistry and Radiation Assistant
*R. Miller, Chemistry and Radiation Protection Superintendent
*J. Newey, Senior Chemistry and Radiation Assistant
S. Nicolls, Senior Chemistry and Radiation Assistant
*P. Oubre', Plant Superintendent

*Those present at exit interview.

2. Discussion

Inspections involving the Mobile Laboratory are intended to provide a basis for assessing the adequacy of the licensee's radioactivity measurement capabilities. Independent verifications are performed by analyzing split samples, as appropriate, with the licensee. For samples that are not amenable to splitting; e.g., iodine cartridges and air particulates, representative samples (as representative as possible under the circumstances) are separately obtained for comparative analysis. The results of these comparisons are presented below.

Table 1

Silver Zeolite Cartridge (Reactor Building Air)

Nuclide	Licensee uCi/ml	NRC uCi/ml	Ratio Licensee/NRC	Agreement Range
I-131	2.03 E-9	1.75 E-9	1.16	0.80-1.25
I-133	1.73 E-9	1.71 E-9	1.01	0.80-1.25
I-135	4.73 E-10	5.80 E-10	0.82	0.80-1.25

The above table shows agreement between the licensee and NRC for the silver zeolite cartridge geometry even though the NRC calibration for this geometry was obtained with charcoal rather than silver zeolite. It appears that cartridge dimensions and activity loading characteristics of the sample were close enough to that of the standards used by the licensee and NRC that reasonably good agreement was acheived.

The particulate filter sample assoc ated with the cartridge was also measured by both NRC and the licensee. The activity level in the filter was too low to permit a meaningful comparison. The licensee detected only background activities while the NRC measurement only showed a trace of Cs-137 activity (7×10^{-13} uCi/ml).

Table 2A

STRIP GAS A - REACTOR COOLANT

(Sampled at 11:20 a.m. on November 17, 1982)

Nuclide	Licensee Serum Vial uCi/ml	NRC Serum Vial uCi/ml	Ratio Licensee/NRC	Agreement** Range
Kr-85M	3.07 E-2	2.40 E-2	1.28	0.6-1.66
Kr-87	4.83 E-2	3.13 E-2	1.54	0.6-1.66
Kr-88	4.78 E-2	5.75 E-2	0.83	0.6-1.66
Xe-133	6.60 E-1	4.70 E-1	1.40	0.6-1.66
Xe-133M	6.51 E-3	1.08 E-2	0.60	0.6-1.66
Xe-135	1.81 E-1	1.73 E-1	1.05	0.6-1.66

Table 2B

STRIP GAS B - REACTOR COOLANT

(Sampled at 11:20 a.m. on November 17, 1982)

Nuclide	Licensee Serum Vial uCi/ml	NRC 33 ml Bulb uCi/ml	Ratio Licensee/NRC	Agreement** Range
Kr-85M	2.72 E-2	2.01 E-2	1.35	0.75-1.33
Kr-87	3.18 E-2	2.84 E-2	1.12	0.75-1.33
Kr-88	4.11 E-2	4.83 E-2	0.85	0.75-1.33
Xe-133	4.90 E-1	3.63 E-1	1.35	0.75-1.33
Xe-135	1.51 E-1	1.48 E-1	1.02	0.75-1.33

Table 2C

STRIP GAS - REACTOR COOLANT

(Sampled at 11:20 a.m. on November 17, 1982)

Nuclide	Serum Vial uCi/ml	NRC 33 ml Bulb uCi/ml	Ratio Serum Vial/33 ml Bulb
Kr-85M	2.40 E-2	2.01 E-2	1.19
Kr-87	3.13 E-2	2.84 E-2	1.10
Kr-88	5.75 E-2	4.83 E-2	1.19
Xe-133	4.70 E-1	3.63 E-1	1.29
Xe-135	1.73 E-1	1.48 E-1	1.17

Table 2D

STRIP LIQUID - REACTOR COOLANT

(Sampled at 11:20 a.m. on November 17, 1982)

(10 ml Liquid Scintillation Vial)

Nuclide	Licensee uCi/ml	NRC uCi/ml	Ratio Licensee/NRC	Agreement** Range
Na-24	1.42 E-2	1.51 E-2	0.94	0.80-1.25
Cr-51	-	1.14 E-3	-	0.80-1.25
Mn-54	7.93 E-4*	7.17 E-4	1.11	0.80-1.25
Mn-56	3.90 E-3*	2.09 E-3	1.87	0.80-1.25
Co-58	5.65 E-3	5.99 E-3	0.94	0.80-1.25
Co-60	5.03 E-4	4.56 E-4	1.10	0.60-1.66
Tc-99M	1.70 E-3	1.44 E-3	1.18	0.75-1.33
I-131	9.62 E-4	9.09 E-4	1.06	0.75-1.33
I-132	5.88 E-3	6.84 E-3	0.86	0.75-1.33
I-133	5.04 E-3	5.34 E-3	0.94	0.75-1.33
I-134	1.63 E-2*	1.22 E-2	1.34	0.75-1.33
I-135	5.98 E-3	8.44 E-3	0.71	0.75-1.33
Cs-134	2.35 E-3	2.24 E-3	1.05	0.75-1.33
Cs-137	3.48 E-3	3.42 E-3	1.02	0.80-1.25
Cs-138	6.19 E-2	1.40 E-1	0.44	0.80-1.25

*Results are biased high because of contribution from other nuclides with similar energy lines.

Table 3A

STRIP GAS A - REACTOR COOLANT

(Sampled at 14:07 p.m. on November 18, 1982)

Nuclide	Licensee Serum Vial uCi/ml	NRC Serum Vial uCi/ml	Ratio Licensee/NRC	Agreement** Range
Ar-41	2.41 E-3	3.13 E-3	0.77	0.6-1.66
Kr-85M	3.30 E-2	2.40 E-2	1.38	0.6-1.66
Kr-87	4.82 E-2	3.23 E-2	1.49	0.6-1.66
Kr-88	4.60 E-2	5.76 E-2	0.80	0.6-1.66
Xe-133	5.97 E-1	3.70 E-1	1.61	0.6-1.66
Xe-133M	-	8.93 E-3	-	0.6-1.66
Xe-135	1.70 E-1	1.64 E-1	1.04	0.6-1.66
Xe-135M	1.43 E-1	9.31 E-2	1.54	0.6-1.66
Xe-138	7.73 E-2	7.25 E-2	1.07	0.6-1.66

Table 3B

STRIP GAS B - REACTOR COOLANT

(Sampled at 14:07 p.m. on November 18, 1982)

Nuclide	Licensee Serum Vial uCi/ml	NRC 33 ml Bulb uCi/ml	Ratio Licensee/NRC	Agreement** Range
Ar-41	3.04 E-3	2.18 E-3	1.39	0.75-1.33
Kr-85M	1.93 E-2	1.54 E-2	1.25	0.75-1.33
Kr-87	2.11 E-2	2.18 E-2	0.97	0.75-1.33
Kr-88	2.81 E-2	3.71 E-2	0.76	0.75-1.33
Xe-133	2.97 E-1	2.21 E-1	1.34	0.75-1.33
Xe-133M	-	5.93 E-3	-	0.75-1.33
Xe-135	1.02 E-1	1.08 E-1	0.94	0.75-1.33
Xe-135M	7.37 E-2	6.16 E-2	1.20	0.75-1.33
Xe-138	3.24 E-2	4.79 E-2	0.68	0.75-1.33

Table 3C

STRIP GAS - REACTOR COOLANT

Nuclide	7 ml Serum Vial uCi/ml	NRC 33 ml Bulb uCi/ml	Ratio Serum Vial/ 33 ml Bulb
Ar-41	3.13 E-3	2.18 E-3	1.44
Kr-85M	2.40 E-2	1.54 E-2	1.56
Kr-87	3.23 E-2	2.18 E-2	1.48
Kr-88	5.76 E-2	3.71 E-2	1.55
Xe-133	3.70 E-1	2.21 E-1	1.67
Xe-133M	8.93 E-3	5.93 E-3	1.51
Xe-135	1.64 E-1	1.09 E-1	1.52
Xe-135M	9.31 E-2	6.16 E-2	1.51
Xe-138	7.25 E-2	4.79 E-2	1.51

Table 3D

STRIP LIQUID - REACTOR COOLANT

(Sampled at 14:07 p.m. on November 18, 1982)

Nuclide	Licensee uCi/ml	NRC uCi/ml	Ratio Licensee/NRC	Agreement** Range
Na-24	1.22 E-2	1.41 E-2	0.87	0.75-1.33
Mn-54	1.16 E-3*	8.87 E-4	1.31	0.6 -1.66
Co-58	8.31 E-3	9.87 E-3	0.84	0.75-1.33
Co-60	-	6.05 E-4	-	-
Tc-99M	1.90 E-3	1.83 E-3	1.04	0.75-1.33
I-131	1.49 E-3	1.70 E-3	0.88	0.75-1.33
I-132	7.75 E-3	8.15 E-3	0.95	0.75-1.33
I-133	5.58 E-3	6.91 E-3	0.81	0.75-1.33
I-134	2.18 E-2*	9.77 E-3	2.23	0.6 -1.66
I-135	7.59 E-3	9.27 E-3	0.82	0.75-1.33
Cs-134	1.04 E-3	2.08 E-3	0.50	0.75-1.33
Cs-137	1.55 E-3	3.18 E-3	0.49	0.75-1.33
Cs-138	1.37 E-1	1.44 E-1	0.95	0.75-1.33

*Results are biased high because of contribution from other nuclides with similar energy lines.

Table 4A

REACTOR COOLANT - UNSTRIPPED LIQUID

(Sampled at 9:58 a.m. on November 17, 1982)

(10 ml Liquid Scintillation Vial)

Nuclide	Licensee uCi/ml	NRC uCi/ml	Ratio Licensee/NRC	Agreement** Range
Na-24	1.74 E-2	1.55 E-2	1.12	0.80-1.25
Cr-51	-	2.97 E-3	-	0.80-1.25
Mn-54	7.08 E-3*	2.71 E-3	2.61	0.80-1.25
Mn-56	5.24 E-2*	8.44 E-3	6.21	0.80-1.25
Co-58	1.59 E-2	1.69 E-2	0.94	0.80-1.25
Co-60	-	6.22 E-4	-	0.80-1.25
I-131	9.56 E-3	7.63 E-3	1.25	0.80-1.25
I-132	7.43 E-2	7.01 E-2	1.06	0.80-1.25
I-133	5.75 E-2	4.88 E-2	1.18	0.80-1.25
I-134	1.31 E-1*	1.12 E-1	1.17	0.80-1.25
I-135	6.49 E-2	7.64 E-2	0.85	0.80-1.25
Cs-134	-	2.08 E-3	-	0.80-1.25
Cs-137	-	3.38 E-3	-	0.80-1.25
Cs-138	1.45 E-1	1.41 E-1	1.03	0.80-1.25

*Results are biased high because of contribution from other nuclides with similar energy lines.

Table 4B

REACTOR COOLANT - UNSTRIPPED LIQUID

(Sampled at 9:58 a.m. on November 17, 1982)

(50 ml Polyethylene Bottle)

Nuclide	Licensee uCi/ml	NRC uCi/ml	Ratio Licensee/NRC	Agreement** Range
Na-24	1.90 E-2	1.54 E-2	1.23	0.80-1.25
Cr-51	-	4.11 E-3	-	0.40-2.50
Mn-54	7.09 E-3*	2.68 E-3	2.65	0.80-1.25
Mn-56	8.56 E-2*	7.81 E-3	11.0	0.80-1.25
Co-58	1.63 E-2	1.71 E-2	0.95	0.75-1.33
Co-60	3.58 E-4	9.21 E-4	0.39	0.50-2.00
I-131	8.86 E-3	7.49 E-3	1.18	0.75-1.33
I-132	7.50 E-2	6.68 E-2	1.12	0.75-1.33
I-133	5.78 E-2	4.71 E-2	1.23	0.75-1.33
I-134	1.26 E-1*	1.13 E-1	1.12	0.75-1.33
I-135	6.38 E-2	7.54 E-2	0.85	0.75-1.33
Cs-134	5.96 E-3	2.48 E-3	2.40	0.60-1.66
Cs-137	-	3.00 E-3	-	0.60-1.66
Cs-138	1.44 E-1	1.40 E-1	1.03	0.60-1.66

*Results are biased high because of contribution from other nuclides with similar energy lines.

Table 4C

REACTOR COOLANT - UNSTRIPPED LIQUID

(Sampled at 9:58 a.m. on November 17, 1982)

Nuclide	NRC 10 ml Scintillation Vial uCi/ml	NRC 50 ml Bottle uCi/ml	Ratio 10 ml/50 ml
Na-24	1.55 E-2	1.54 E-2	1.01
Cr-51	2.97 E-3	4.11 E-3	0.72
Mn-54	2.71 E-3	2.68 E-3	1.01
Mn-56	8.44 E-3	7.81 E-3	1.08
Co-58	1.69 E-2	1.71 E-2	0.99
Co-60	6.22 E-4	9.21 E-4	0.68
I-131	7.63 E-3	7.49 E-3	1.02
I-132	7.01 E-2	6.68 E-2	1.05
I-133	4.88 E-2	4.71 E-2	1.04
I-134	1.12 E-1	1.13 E-1	0.99
I-135	7.64 E-2	7.54 E-2	1.01
Cs-134	2.08 E-3	2.48 E-3	0.84
Cs-137	3.38 E-3	3.00 E-3	1.13
Cs-138	1.41 E-1	1.40 E-1	1.01

** Strictly speaking, the agreement range criteria are not applicable to measurements other than for effluents (liquid and gaseous) because lower limit of detection (LLD) values are not specified for measurements other than for effluents. The agreement range limits are, however, a useful guide for deciding whether or not relative agreement has been achieved and should be considered as a goal to be attained if currently not being achieved.

Table 5

Spent Fuel Pool Liquid

Nuclide	Licensee uCi/ml	NRC uCi/ml	Ratio Licensee/NRC	Agreement Range
Na-24	-	4.61 E-6	-	0.60-1.66
Mn-54	-	6.37 E-6	-	0.60-1.66
Co-58	3.53 E-5	3.17 E-5	1.11	0.80-1.25
Co-60	8.35 E-5	8.96 E-5	0.93	0.80-1.25
Ag-110M	7.18 E-5	6.36 E-5	1.13	0.80-1.25
Cs-134	3.84 E-4	3.34 E-4	1.15	0.80-1.25
Cs-137	6.04 E-4	7.00 E-4	0.86	0.80-1.25
Sb-125	-	5.45 E-5	-	0.80-1.25

Tables 2A and 2B show comparative results for replicate samples of reactor coolant strip gas obtained at 11:20 a.m. on November 17, 1982. Table 2C compares the NRC results for the replicates. Tables 3A, 3B and 3C show the results for similar samples obtained on November 18, 1982. While the agreement between licensee and NRC is adequate, there are indications that significant sampling errors may be present when obtaining strip gas samples. Tables 2C and 3C show the internal consistency of the NRC measurements by the relative constancy of the ratios. Allowing for some measurement fluctuation, Table 2C ratios could be considered to be near enough to one to conclude that the sampling error is small. The ratios in Table 3C, however, deviate significantly from one with an indication of a sampling error of about 50 percent.

Tables 2D and 3D are the comparative results of the liquid fractions from which the gases had been stripped, respectively. Residual gaseous activities, however, are still present and can cause interference with the measurement of other nuclides. For example, Kr-88 has a branch with identical energy to that of Mn-54 (834.83 Kev) and thus can cause Mn-54 activity to be too high. Also the licensee uses the 846.75 Kev line as the key line for Mn-56 and the 847.03 Kev line as the key line for I-134 with consequent over estimation of both nuclides when both are present. Similarly, the licensee uses the 884 Kev line as the key line for Ag-110M. Since I-134 also has a 884 Kev line at an abundance of 66 percent, Ag-110M is overestimated when I-134 is present. We have recommended that the 1812.72 Kev line be used for Mn-56 and the 657.74 Kev line be used for Ag-110M as the key lines respectively.

Tables 4A and 4B show the comparative results for unstripped reactor coolant replicates and Table 4C shows the internal consistency of the NRC measurements. The ratios in Table 4C are very nearly one, showing that the sampling error for liquids is negligible as it should be.

Table 5 shows the comparative results for spent fuel pool liquid. This sample was obtained in lieu of a liquid waste sample for split sample analysis by radiochemistry because no activity could be detected in a one liter sample of available liquid waste. It was intended that after gamma spectrometry analysis, a split sample would be sent to NRC's contractor laboratory for Sr-89, Sr-90, H-3 and gross beta analyses. Unfortunately, this effort was invalidated when it was discovered that the licensee's fraction of this sample was inadvertently discarded. This fact became known when the inspector telephoned the licensee to determine the status of this sample.

There were other mishaps during this inspection. On one split gas sample, the licensee failed to perform a measurement. On three other samples, the licensee lost the data. The licensee's data for a stack gas sample was never provided although we were informed that this was available. The licensee was reminded that all measurement results be provided to the inspector on a timely basis. This was not done and most of the licensee results were obtained on the last day of the inspection.

A few early licensee results were made available to the inspector, but these turned out to be the wrong data; i.e., the wrong splits were matched in one case and in at least two other cases the wrong calibration parameters were used. This became evident when the licensee-NRC comparisons differed by a factor of 5-7. As a consequence, considerable in-office time was spent evaluating the results. This evaluation also included telephone calls to the licensee on four separate occasions to discuss the data and to ask for clarification on certain licensee procedures. For example, the licensee results provided were in unevaluated raw data form, and thus included many extraneous nuclides and many significant unidentified energy lines. Virtually all of these extraneous nuclides (such as Nb-95, Rh-106, Br-83, etc.) as well as the major unidentified lines are usually due to the less significant lines of nuclides already indentified and therefore can be discounted. But this cannot be assumed a priori, and thus an evaluation of all of these factors must be performed. Normally, the licensee routinely performs these evaluations. It should be pointed out that this was a relatively hectic period for Chemistry and Radiation personnel. A previously scheduled B&W training program for all Chemistry and Radiation personnel was in progress during the entire week, and three other inspections were also ongoing during this period.

The above factors contributed to making this inspection somewhat inefficient. Information gained from this inspection was insufficient to allow an assessment of the adequacy of the licensee's radioactivity measurement capabilities. As a consequnce, the inspection modules are incomplete and must be completed at a later date. (82-45-01)

3. Outstanding Items:

During the previous inspection (Inspection Report No. 50-312/82-17), an improper procedure for measuring tritium in air was identified. It has been verified that this has been corrected and an appropriate method is now in place. Also, it was indicated that a test solution would be sent to Rancho Seco to test the new gamma spectrometry system expected to be operational by August 1982 (82-17-01). This has not been done and will be further delayed because, as of this date, the new system is not yet operational.

4. Exit Interview

Inspection findings were discussed with licensee personnel indicated in paragraph 1. Licensee management was informed of the relative inefficiency of this inspection and the inspector's perceptions of the reasons for this inefficiency. Management responded by suggesting that inspections such as this be prearranged and a date picked which would allow more efficient interaction between licensee personnel and the inspection effort. The inspector pointed out that in general this was against NRC policy. The inspector indicated that a follow-up inspection could be required.