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Q A related

June 14, 1993

Mr. David Fauver
Division of Low-Level Waste Management-NMSS
U.S. Nuclear Regulatory Commission
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SUBJECT: RESULTS OF FIELD SURVEY INSTRUMENTATION CROSS-COMPARISONS AND ISSUE RESOLUTION, SHOREHAM NUCLEAR POWER STATION, BROOKHAVEN, NEW YORK—DOCKET FILE NO. 50-322

Dear Mr. Fauver:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) made a site visit to the Shoreham Nuclear Power Station (SNPS) on May 25 and 26, 1993. The purpose of the site visit was to conduct field radiation detection instrumentation cross-comparisons and to resolve questions related to the SNPS termination survey procedures as described in the May 19, 1993 correspondence from ESSAP to the NRC. The procedures and results of the instrument cross-comparisons and the SNPS response to issues are enclosed.

Please do not hesitate to contact either Michele Landis at (615) 576-2908 or myself at (615) 576-5073 should you have any questions or we may provide additional information.

Sincerely,

James E. Kroger for

Timothy J. Vitkus
Environmental Project Leader
Environmental Survey and
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TJV:rde

Enclosed

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FIELD RADIATION DETECTION INSTRUMENTATION CROSS-COMPARISON SHOREHAM NUCLEAR POWER STATION BROOKHAVEN, NEW YORK

PROCEDURES

Each type of detector that SNPS personnel would potentially use for collecting total surface activity measurement data was provided for this exercise. Those detectors included the following:

- Eberline HP-260 thin-window GM detector
  Active area of detector = 15.5 cm^2
- APTEC Large Area GM detector
  Active area of detector = 126 cm^2
- APTEC Large Area GM detector
  Active area of detector = 252 cm^2
- Eberline AC-3-7 ZnS scintillation detector
  Active area of detector = 59 cm^2

Each of the above detectors was coupled to an Eberline ESP-2 ratemeter-scaler. The ESSAP instrumentation used included an HP-260 thin-window GM detector and AC-3-7 ZnS scintillation detector, each coupled to an Eberline PRS-1 ratemeter-scaler. Backgrounds for each detector type were determined.

Small area (≤ 15 cm^2) alpha and beta check and/or calibration sources, were used for the instrument response checks. The sources used included Am-241 and Th-230 for alpha, and Sr-90, Co-60, and Tc-99 for beta.

Each source was placed into one of the SNPS calibration source holders, which maintain a distance of approximately 1 cm between the source and probe face, and/or was placed at contact with the center of the detector face.

The gross counts were then accumulated for a period of 1 minute, the result recorded, the gross count rates compared, and results converted to dpm/100 cm^2, where appropriate.

RESULTS

The results of the comparison are summarized in Table 1. In general, the instrument responses were as expected. Initially, a SR-90 source was used as a check for instrument response; only gross counts were accumulated for the HP-260's and the results were 22,567 cpm and 25,600 cpm for ORISE and SNPS respectively. An efficiency factor for Sr-90 had not been developed and the information was therefore not included in the Table. For the remaining radionuclides and based on the efficiencies provided in the LIPA Termination Survey Plan, total activity calculations are on the conservative side. The one noted exception was the APTEC 252 cm^2 detector. As shown on Table 1, when averaged over the area of the detector (geometry correction factor of 252/100), the small source activity would be reported as 6200 dpm/100 cm^2 versus the conservative 20,200 dpm/100 cm^2 calculated for the APTEC 126 cm^2 detector. In order to prevent underestimating the activity which would be exhibited by a similar small area of contamination during termination surveys, LIPA has proposed an alarm level be set on the ESP-2, when coupled to the 252 cm^2, that equates to 5000 dpm/100 cm^2. If the gross field count exceed this threshold, additional investigations would be performed using smaller detectors to determine compliance with the average and maximum guidelines. A suggested second, and perhaps more conservative, approach to avoid underestimating the activity, would be to eliminate the use of a geometry correction factor during data conversions, where the large-area detectors had been used.

The final issue, relative to instrumentation, that was addressed is the correlation of the direct measurement data collected by ESSAP and LIPA. LIPA's procedures require that calibration [illegible] be placed in a jig, which raises the active area of the detector 1 cm above the source. The [illegible] result of this is a lower reported efficiency for the instrument/detector combination. This was demonstrated by placing a Co-60 source at contact with LIPA's HP-260 detector and accumulating counts for 1 minute. The same Co-60 source was then placed in LIPA's calibration jig and the same detector used to accumulate counts for 1 minute with the source 1 cm away. The results were 36,900 cpm versus 27,300 cpm or a difference in efficiency of approximately 26% for a measurement made at contact, as compared to 1 cm above the surface.

If LIPA performs direct measurements at contact, rather than at 1 cm using similar detectors the surface activity level LIPA reported would be higher than ESSAP would report. The more conservative approach used by LIPA results in data that is not directly comparable to ESSAP's data without an "adjustment" factor. ESSAP recommends that such "adjustment" factors be developed, if point-to-point and population-mean activity level comparisons are desirable for this project.

TABLE 1

DIRECT MEASUREMENT COMPARISON
SHOREHAM NUCLEAR POWER STATION
BROOKHAVEN, NEW YORK

Radionuclide	Radiation Type	Measured By	Instrument	Detector	Background (cpm)	4π Eff. (%)	Gross cpm	dpm	Detector Area (cm^2)	dpm/100 cm^2
Th-230	Alpha	ORISE	PRS-1 #14	AC-3-7 #14	0	18[a]	2,840	15,800	59	26,700
	Alpha	SNPS	ESP-2 #1466	AC-3-7 #0507	5	16[b]	2,630	16,400	59	27,800
Am-241	Alpha	ORISE	PRS-1 #14	AC-3-7 #14	0	18[a]	4,325	24,000	59	40,700
	Alpha	SNPS	ESP-2 #1466	AC-3-7 #0507	5	16[b]	4,310	26,900	59	45,600
Co-60	Beta	ORISE	PRS-1 #10	HP-260 #10	34	16[c]	33,734	210,600	15.5	1,400,000
	Beta	SNPS	ESP-2 #1649	HP-260 #1009	82	10.9[d]	36,900	337,800	15.5	2,200,000
Tc-99	Beta	ORISE	PRS-1 #10	HP-260 #10	34	16[c]	1,977	12,100	15.5	78,300
	Beta	SNPS	ESP-2 #1647	HP-260 #1009	82	10.9[d]	2,020	17,800	15.5	114,700
	Beta	SNPS	ESP-2 #1647	APTEC 126	129	3.9[d]	918	20,200[d]	126	15,100[d]
						5.8[e]		13,600[e]		
	Beta	SNPS	ESP-2 #1647	APTEC 252	215	6.4[d]	1,210	15,500[d]	252	6,200[d]
						8.0[e]		12,400[e]		4,900[e]

[a]Based on calibration with Pu-239; calibration source at contact with detector
[b]Based on calibration with Am-241;
[c]Based on calibration with Tc-99; calibration source at contact with detector
[d]Based on calibration with Co-60; calibration source matches detector area and is spaced 1 cm from detector
[e]Based on calibration with Co-60 button (small) source; calibration source spaced 1 cm from detector

ISSUE RESPONSE
SHOREHAM NUCLEAR POWER STATION
BROOKHAVEN, NEW YORK

Issue No. 1: Has the direct measurement conversion factor been established to account for residual Fe-55? How will the factor affect the reclassification action level?

Response: The April 1993 Revision 1 of the SNPS Termination Survey Plan provides a conversion factor of 1.2 for any fixed-point or removable activity measurement which exceeds the critical level (exceeds the normal background distribution). An action level is then calculated for each direct measurement which exceeds the critical level to determine the need for additional investigation and possible reclassification.

Status: Closed

Issue No. 2: Will the large area probes (specifically the 252 cm^2 GM detectors) be used for fixed-point direct measurements? If so, how will the probe geometry be accounted for in data conversions?

Response: The 252 cm^2 probes are not currently being used for performing direct measurements. However, the licensee would like to use these probes for measurements and is currently developing a scenario that would allow the use of the detectors that would prevent misrepresentation of the activity in a small (less than 100 cm^2) "hot spot". Currently, data conversion calculations include accounting for probe geometry.

Status: Closed

Issue No. 3: Can the licensee identify locations where smears are collected and where direct measurements and smears are collected?

AND...

Issue No. 4: The field drawings generated by the licensee are not consistently labeled as to which of the measurement locations indicated area smears only and/or which locations indicate both direct measurements and smears were taken.

Response: The licensee is developing a uniform designation that will indicate locations where direct measurements were made and where direct measurements and smears were made.

Status: Open, pending the finalization and implementation of a uniform designation system.

Issue No. 5: ESSAP requests a list of those systems where special access requirements and procedures must be met.

Response: The licensee will provide this information on an informal basis as ESSAP identifies systems to be surveyed. For planning purposes, assume all open, functional systems will require some from of special access procedures.

Status: Closed

Issue No. 6: How does the licensee plan to evaluate direct measurements where the surface activity is between the average and maximum guideline levels?

Response: SNPS intends to investigate these measurements per the flow chart found in the Termination Survey Data Processing Procedure 67×001.11.

Status: Closed

Issue No. 7: Has the licensee finalized the procedure that will be used for the computer generated tabular data summaries? Are all the input parameters readily available for manual data validations?

Response: See SNPS Termination Survey Data Processing Procedure 67×001.11. Input parameters will be available on the tabulated data summary sheets found in Termination Survey Reports.

Status: Closed

Issue No. 8: Will the licensee visibly mark each direct measurement location to enable ESSAP to relocate a specific measurement location?

Response: Direct measurement locations on the floor and lower walls (up to 2 m) will not be marked, but will be referenced to the grid. Measurement locations on upper surfaces will be plainly marked and identifiable.

Status: Closed