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TRM1 - TECHNICAL REQUIREMENTS MANUAL UNIT 1

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Manual Title: TECHNICAL REQUIREMENTS MANUAL UNIT 1

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Title: LOADS CONTROL PROGRAM BASES LIGHT LOADS REQUIREMENTS

3.11 RADIOACTIVE EFFLUENTS

3.11.4 Radiological Environmental Monitoring

3.11.4.1 Monitoring Program

TRO 3.11.4.1 The Radiological Environmental Monitoring Program shall be conducted as specified in Table 3.11.4.1-1.

APPLICABILITY: At all times

ACTIONS

---------- NOTE ----------
The provisions of TRO 3.0.4 are not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Radiological Environmental Monitoring Program not being conducted as specified in Table 3.11.4.1-1.	A.1 Initiate a condition report.	In accordance with the Corrective Action Program
B. The average level of radioactivity over any calendar quarter as the result of an individual radionuclide in plant effluents in a particular environmental exposure pathway in a particular environmental sampling medium, at a specified location exceeds the applicable reporting level of Table 3.11.4.1-2.	B.1 Initiate a condition report.	In accordance with the Corrective Action Program

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. More than one of the radionuclides in Table 3.11.4.1-2 are detected in a particular environmental exposure pathway at a specified monitoring location and are the result of plant effluents. AND The sum of the ratios of the quarterly average activity levels to their corresponding reporting levels of each detected radionuclide, from Table 3.11.4.1-2, is ≥ 1.0.	C.1 Initiate a condition report.	In accordance with the Corrective Action Program
D. One or more Radionuclide(s) other than those in Table 3.11.4.1-2 are detected in a particular environmental exposure pathway at a specified location and are the result of plant effluents. AND The potential annual dose to a MEMBER OF THE PUBLIC from all detected radionuclides that are the result of plant effluents is greater than or equal to the calendar year limits of TROs 3.11.1.2, 3.11.2.2 and 3.11.2.3.	D.1 Initiate a condition report.	In accordance with the Corrective Action Program

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. All requirements for either Condition B, C, or D are met except that the radionuclides detected are not the result of plant effluents.	E.1 Initiate a condition report.	In accordance with the Corrective Action Program
F. Milk or fresh leafy vegetable samples are unavailable from one or more of the sample locations required by Table 3.11.4.1-1.	---------- NOTE ---------- The specific locations from which samples were unavailable may then be deleted from the monitoring program. ---------- F.1 Initiate a condition report.	In accordance with the Corrective Action Program

TECHNICAL REQUIREMENT SURVEILLANCE

---------- NOTE ----------
The provisions of TRS 3.0.3 are not applicable to the below surveillances.

SURVEILLANCE		FREQUENCY
TRS 3.11.4.1.1	Collect the radiological environmental monitoring samples pursuant to Table 3.11.4.1-1.	As required by Table 3.11.4.1-1
TRS 3.11.4.1.2	Analyze samples pursuant to the requirements of Table 3.11.4.1-1 with equipment meeting the detection capabilities required by Table 3.11.4.1-3.	As required by Table 3.11.4.1-1
TRS 3.11.4.1.3	Determine annual cumulative potential dose contributions from radionuclides detected in environmental samples in accordance with the methodology and parameters in the ODCM.	Annually

TABLE 3.11.4.1-1 (Page 1 of 3)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. DIRECT RADIATION	40 routine monitoring stations with two or more dosimeters or with one instrument for measuring and recording dose rate continuously placed as follows: 1. An inner ring of stations, one in each meteorological sector, in the general area of the SITE BOUNDARY 2 An outer ring of stations, one in each meteorological sector, in the 3 to 9 mile range from the site 3. The balance of the stations placed in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control stations	Quarterly	Gamma dose quarterly
2. AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations a. 1 sample from close to each of the 3 SITE BOUNDARY locations (in different sectors) with the highest calculated annual average ground level D/Q b. 1 sample from the vicinity of the community having one of the highest calculated annual ground level D/Q c. 1 sample from a control location, between 15 and 30 km distant and in the least prevalent wind direction of wind blowing from the plant	Continual sampler operation with sample collection weekly, or more frequently if required by dust loading	Radioiodine Canister: I-131 Analysis weekly Particulate Sampler: Gross Beta radio activity analysis following filter change[a] Gamma isotopic analysis of composite (by location) quarterly

[a] Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thorn daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

TABLE 3.11.4.1-1 (Page 2 of 3)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
3. WATERBORNE			
a. Surface	1 sample upstream 1 sample downstream	Upstream Sample: Composite sample over one-month period Downstream Sample: weekly grab sample, composited monthly	Gamma isotopic analysis monthly. Composite for tritium analyses quarterly
b. Ground	Samples from 1 or 2 sources only if likely to be affected	Quarterly	Gamma isotopic and tritium analyses quarterly
c. Drinking	1 sample from each of 1 to 3 of the nearest water supplies that could be affected by its discharge 1 sample from upstream drinking water supply. If none available, Surface water upstream sample serves as a control location for Drinking water	Composite sample over 2-week period when I-131 analysis is performed, monthly composite otherwise	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year. Composite for gross beta and gamma isotopic analyses monthly. Composite for tritium analyses quarterly
d. Sediment from shoreline	1 sample from downstream area with existing or potential recreational value	Semiannually	Gamma isotopic analyses semiannually

TABLE 3.11.4.1-1 (Page 3 of 3)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
4. INGESTION			
a. Milk	a. Samples from milking animals in 3 locations within 5km from the plant having the highest dose potential. If there are none, then, 1 sample from milking animals in each of 3 areas between 5 and 8km distant where doses are calculated to be greater than 1 mrem per year.	Semimonthly when animals are on pasture, monthly at other times.	Gamma isotopic and I-131 analysis semimonthly when animals are on pasture; monthly at other times.
	1 sample from milking animals at a control location (between 15 and 30km from the plant preferably in the least prevalent direction for wind blowing from the plant).		
b. Fish and/or Invertebrates	b. 1 sample of each of two recreationally important species in vicinity of plant discharge area.	Sample in season, or semiannually if they are not seasonal.	Gamma isotopic analysis on edible portions.
	1 sample of same species in areas not influenced by plant discharge.		
c. Food Products	c. 1 sample of each principal class of food products from any area, which is irrigated by water in which liquid plant wastes have been discharged.	At time of harvest	Gamma isotopic analysis on edible portions.
	Samples of 3 different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground level D/Q if milk sampling is not performed.	Monthly when available	Gamma isotopic and I-131 analysis.
	1 sample of each of the similar broad leaf vegetation grown between 15 to 30km from the plant, preferably, in the least prevalent direction for wind blowing from the plant if milk sampling is not performed.	Monthly when available	Gamma isotopic and I-131 analysis.

TABLE 3.11.4.1-2
REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS
IN ENVIRONMENTAL SAMPLES
REPORTING LEVELS

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/kg, wet)
H-3	20,000[a]				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400[b]				
I-131	2	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200[b]			300	

[a] For drinking water samples. This is 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/l may be used.

[b] Total for parent and daughter.

TABLE 3.11.4.1-3
DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS
LOWER LIMIT OF DETECTION (LLD)

Analysis	Water (pCi/l)	Airborne Particulate Or Gases (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/kg, wet)	Sediments (pCi/kg,dry)
Gross Beta	4	0.01				
H-3	2000					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	1[(a)]	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-140	60			60		
La-140	15			15		

(a) LLD for drinking water samples.

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B 3.11.4.1 Monitoring Program

BASES

TRO

The radiological environmental monitoring program required by this Requirement provides representative measurements of radiation and of radioactive materials in those environmental exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the station operation. This monitoring program thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. Changes to the radiological environmental monitoring program specified in Table 3.11.4.1-1 may be made based on expected SSES operation and the results of radiological environmental monitoring during SSES operation.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by Table 3.11.4.1-3 are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an *a priori* (before the fact) limit representing the capability of a measurement system and not as an *a posteriori* (after the fact) limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually); Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry" Anal. Chem. 40, 586-93 (1968); and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975) (Reference 1).

This section of the TRM is also part of the ODCM (Reference 2).

ACTIONS

The Required Action for each Condition is to generate a condition report. Each condition report shall be initiated and processed in accordance with station reporting and Corrective Action Program procedures (References 5, 6 and 7).

TRS

The TRSs are defined to be performed at the specified frequency to ensure that the requirements are implemented. Monitoring samples collected per TRS 3.11.4.1.1 shall be from the specific locations given in the table and figure in the ODCM (Reference 2).

TRS (continued)

The TRSs are modified by a Note to take exception to TRS 3.0.3.

Table 3.11.4.1-1

Sample Locations Specific parameters of distance and direction sector from the centerline of one reactor, and additional description where pertinent, shall be provided for each and every sample location in this Table and in a table and figure(s) in the ODCM. Refer to NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979. (Reference 3) and NUREG-1302, Offsite Dose Calculation Manual Guidance: "Standard Radiological Effluent Controls for Boiling Water Reactors," April 1991 (Reference 5). Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time.

In these instances, suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. Identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples in the next Radioactive Effluent Release Report and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

Direct Radiation One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation.

Radioiodine and Particulates - Sampling and Collection Frequency The charcoal cartridges used in the airborne radioiodine sampling conducted as part of the radiological environmental monitoring program are designed and tested by the manufacturer to assure a high efficiency in the capture of radioiodine. Certificates from the manufacturer of the cartridges are provided with each batch of cartridges certifying the percent retention of the radioiodine for stated air flows.

TRS (continued)

Radioiodine and Particulates - Particulate Sample; Waterborne - Surface, Ground, Sediment; Food Products Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

Waterborne - Composite Sampling A composite sample is one in which the quantity (aliquot) of liquid sampled is proportional to the quantity of flowing liquid and in which the method of sampling employed results in a specimen that is representative of the liquid flow. In this program, composite samples shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure obtaining a representative sample.

Waterborne - Surface The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken just downstream of the discharge line near the mixing zone.

Waterborne - Drinking One sample from each of 1 to 3 of the nearest downstream water supplies that could be affected by liquid effluent releases from the station. Control sample to be taken from the nearest upstream drinking water supply facility. If no upstream drinking water supply facility is available that would be appropriate to serve as a control location, then upstream surface water control sample location to serve as the drinking water control sample location.

Waterborne - Ground - Samples and Sample Locations Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

Drinking Water - I-131 Analyses Calculation of the dose projected from I-131 in drinking water to determine if I-131 analyses of the water are required shall be performed for the maximum organ and age group using the methodology and parameters of the ODCM.

Food Products - Sampling and Collection Frequency If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be monthly. Attention shall be paid to including samples of tuberous and root food products.

TRS (continued)

Table 3.11.4.1-3

This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable at 95% confidence level together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating report.

Required detection capabilities for dosimeters used for environmental measurements are given in Regulatory Guide 4.13 (Reference 4).

The LLD is defined, for purpose of these Requirements, as the smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 s_b}{E \bullet V \bullet 2.22 \bullet Y \bullet \exp(-\lambda \Delta t)}$$

Where:

LLD is the *a priori* lower limit of detection as defined above (as picocuries per unit mass or volume),

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute),

E is the counting efficiency, as counts per disintegration,

V is the sample size, in units of mass or volume,

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide, and

Δt for environmental samples is the elapsed time between sample collection (or end of the sample collection period) and time of counting.

Typical values of E, V, Y, and Δt should be used in the calculation.

BASES

TRS (continued)

It should be recognized that the LLD is defined as *a priori* (before the fact) limit representing the capability of a measurement system and not as an *a posteriori* (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDS unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report.

REFERENCES

1. HASL Procedures Manual, HASL-300 (revised annually); Curie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry" Anal. Chem. 40, 586-93 (1968); and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975) Offsite Dose Calculation Manual.

2. Technical Specification 5.5.1 - Offsite Dose Calculation Manual.

3. NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979.

4. Regulatory Guide 4.13, "Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications."

5. NUREG-1302, Offsite Dose Calculation Manual Guidance: "Standard Radiological Effluent Controls for Boiling Water Reactors," April 1991.

6. Technical Specification 5.6.2 - Annual Radiological Environmental Operating Report.

7. Technical Specification 5.6.3 - Radioactive Effluent Release Report.

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