

# NRC INSPECTION MANUAL

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## INSPECTION PROCEDURE 84525

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### QUALITY ASSURANCE AND CONFIRMATORY MEASUREMENTS FOR IN-PLANT RADIOCHEMICAL ANALYSIS (PREOPERATIONAL AND SUPPLEMENTAL)

PROGRAM APPLICABILITY: 2513, 2515, and 2525

#### 84525-01 INSPECTION OBJECTIVE

The objective of this procedure is to determine the licensee's analytical capability to make consistently accurate radioactivity measurements under normal and emergency conditions and chemical measurements under emergency conditions.

#### 84525-02 INSPECTION REQUIREMENTS

02.01 Facilities, Equipment, and Supplies. Determine that the licensee's laboratory facilities, equipment, instrumentation, and supplies are adequate to perform radiochemical analyses under routine and emergency situations and chemical analyses in emergency situations.

02.02 Procedures. Determine that the licensee has developed appropriate operating procedures for normal and emergency operations.

02.03 Confirmatory Measurements. Evaluate the licensee's capability for safely collecting and accurately measuring radioactivity in

- a. liquid radwaste samples
- b. gaseous radwaste samples
- c. charcoal/silver zeolite cartridges
- d. air particulate samples
- e. reactor coolant water

02.04 Postaccident Sample Analysis. Determine whether the licensee's capability for the safe and accurate analysis of highly radioactive postaccident samples meets requirements.

02.05 Quality Assurance (QA) Program. Verify that the licensee has developed and implemented an effective QA program for radiochemical measurements.

02.06 Contractor Activities. Verify the adequacy of the licensee's program for oversight of contractor activities.

#### 84525-03 INSPECTION GUIDANCE

03.01 Facilities, Equipment, and Supplies. Verify the adequacy of the following items by review of plans and blueprints of laboratory areas, direct observation, and discussions with licensee personnel:

- a. laboratory layout--space and configuration and accessibility under accident conditions
- b. storage space
- c. arrangements for processing and analyzing highly radioactive samples under accident conditions (adequate shielding, remote handling and sample dilution capabilities, etc.)
- d. analytical equipment, calibration dates
- e. fresh laboratory supplies readily available and accessible under normal and emergency conditions

03.02 Procedures. Review a representative sampling of the operating procedures for normal and emergency operations for

- a. sampling
- b. handling and transporting highly radioactive samples
- c. sample processing in laboratory
- d. chemical (emergency operations only) and radiochemical analyses
- e. data reporting, including handling anomalous results
- f. calibration of radiochemical instrumentation
- g. contamination control in the laboratory
- h. quality control

03.03 Confirmatory Measurements. Use simulated samples if actual samples are not available to evaluate the licensee's measurements. These samples can be obtained from the Radiological and Environmental Sciences Laboratory (RESL).

Using the Verification Test, evaluate the licensee's measurement by comparing the licensee's measurement with the NRC measurement or RESL's. Ensure that both measurements are made on the same samples or on split samples. If cartridge or filter samples are not available, substitute a simulated cartridge or filter sample prepared by RESL.

The licensee should analyze NRC or split samples in a routine manner. The methodology, procedures, equipment, personnel, sample size, and counting times should be the same as the licensee normally uses.

Verification by calculation: Using the counting efficiencies, counting times, and other parameters, verify that the licensee can meet the lower limit of detection (LLD) specified in the operating license (OL).

Whenever practical, observe the sampling, splitting, and processing of samples. Improper techniques may result in incorrect results regardless of the accuracy of the measurement.

If the licensee uses more than one counting facility, or one of multiple counting systems (i.e., if the radiochemistry laboratory is inaccessible under accident conditions and an offsite laboratory facility is used), all facilities should be inspected. If it is not possible to recount samples on all systems, focus should be placed on the licensee's program to ensure uniformity of measurement.

Analyses should be performed by the NRC inspection staff in the mobile laboratory or at the regional office. If the region does not have the capability, samples should be sent to RESL. The collection, packaging, and shipping methods described in IE Manual Chapter 1232, "Collection, Preparation, and Shipment of Independent Measurement Samples," should be followed.

Verification Test: Using the following procedures for comparing measurements:

a. Liquid and Gas Analyses:

Gamma Emitters --Identify all radionuclides detected in the NRC samples. The licensee should identify and quantify all the nuclides that are detectable with the licensee's system. Compare results as described below.

Other Radionuclides -- For radionuclides that cannot be determined by gamma-ray spectrometry (e.g., H-3, Sr-89, Sr-90, Fe-55) compare the licensee's results with the NRC or RESL values as described below.

b. Air Particulate Filter and Charcoal/Silver Zeolite Cartridge:

Identify all radionuclides detected in the NRC sample. Compare the NRC measurements with the licensee's using the method described below.

c. For each comparison:

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.)

Divide each licensee result by the corresponding NRC result to obtain the Ratio (licensee result/NRC).

d. Criteria for Accepting the Licensee's Measurements. The licensee's measurement is in agreement if the value of the ratio falls within the limits shown in the following table for the corresponding resolution.

<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

e. Action Taken for Measurements Not in Agreement. Perform another Verification Test, if practical, during the inspection. If measurements are still in disagreement, remedial action should be taken. Remedial action to resolve a disagreement may include the following:

1. a review of calibrations and/or recalibration by the licensee
2. consideration of ways in which the licensee's radioanalytical methods and radioactivity measurement algorithms may contribute to the disagreement.
3. licensee analysis of a spiked sample supplied by RESL
4. reanalysis of the sample by RESL
5. consultation with RESL for technical advice and assistance

Note that some discrepancies may result from use of different equipment and techniques. This should be considered in attempting to resolve disagreements.

03.04 Postaccident Sample Analysis. Review procedures and equipment for the analysis of postaccident samples of containment air and primary coolant and sump liquids. Focus on:

- a. identification and quantification of radionuclides in reactor coolant and containment atmospheres; hydrogen levels in containment atmosphere; dissolved gases, chloride and boron (PWR only) concentrations in liquids
- b. shielding of sample preparation and analysis facilities
- c. counting times and geometry
- d. sample preparation
- e. containment control
- f. accessibility of sample preparation and analysis facilities under accident conditions
- g. capability for handling expanded sample load

See NUREG-0737, Item II.B.3 and Regulatory Guide 1.97.

03.05 Quality Assurance Program. For radiochemical analyses, Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment," provides guidance for the content and extent of an acceptable program. Consider especially the results of inter- and intra-laboratory comparisons.

03.06 Contractor Activities. The determination as to whether the licensee adequately monitors contractors can be achieved by reviewing appropriate procedures and audit reports, and by discussions with cognizant individuals.

## 84525-04 REFERENCES

### 04.01 NRC Documents

Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants."

Regulatory Guide 1.101, "Emergency Planning and Preparedness for Nuclear Power Reactors."

Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment "

NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," November 1980.

NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980.

NUREG/CR-1413, "A Radionuclide Decay Data Base Index and Summary Table," May 1980.

IE Manual Chapter 1230, "Quality Assurance Program for Radiological Confirmatory Measurements," 1983.

IE Manual Chapter 1232, "Collection, Preparation and Shipment of Independent Measurement Samples," 1983.

### 04.02 General

ASTM Book of Standards, Volume 11.01, Water (I) and Volume 11.02, Water (II).

Erdtmann, G., and Soyka, W., "The Gamma Rays of the Radionuclides: Tables for Applied Gamma Ray Spectroscopy," Verlag Chemie, New York, 1979.

U.S. Department of Energy, HASL-300, "Environmental Measurements Laboratory Procedures Manual," H. L. Volchok and G. dePlanque, 1982.

U.S. Department of Energy, IDO-12096, "RESL Analytical Chemistry Branch Procedures Manual," L. Z. Bodnar and D. R. Percival, 1982.

U.S. Department of Energy, DOE/TIC 11026, "Radioactive Decay Tables," D. C. Kocher, 1981.

EPRI NP-3513, "Postaccident Liquid Sampling Systems," May 1984.

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