



U.S. NUCLEAR REGULATORY COMMISSION
STANDARD REVIEW PLAN
 OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 11.5

PROCESS AND EFFLUENT RADIOLOGICAL MONITORING
AND SAMPLING SYSTEMSREVIEW RESPONSIBILITIES

Primary - Effluent Treatment Systems Branch (ETSB)

Secondary - Electrical, Instrumentation and Control Systems Branch (EICSB)
- Accident Analysis Branch (AAB)I. AREAS OF REVIEW

ETSB reviews the following information in the applicant's safety analysis report (SAR):

1. The design objectives and design criteria for the process and effluent radiological monitoring and sampling system are reviewed. The review includes the identification of the process and effluent streams to be monitored or sampled, the purpose of each monitoring or sampling function provided, and the parameters to be determined through monitoring or sampling (e.g., gross beta-gamma concentrations, radionuclide distribution, or quantities of specific radioisotopes).
2. The system description for the process and effluent radiological monitoring and sampling system is reviewed. The review includes (a)* description of instrumentation provided, including redundancy, range, independence, and diversity of components for normal operations, anticipated operational occurrences, and postulated accidents; (b)* location of monitors and direct readouts; (c)* location of sampling points and sampling stations; (d) calculation of radioactivity concentrations to be monitored or sampled for normal operations, anticipated operational occurrences, and postulated accidents; (e) measurements or determinations to be made (e.g., gross beta-gamma concentration or measurement of specific radionuclides); (f)* types and locations of annunciators and alarms and the actions initiated by each, (g) provisions for purging sample lines, input volumes to waste collection systems, and sampling frequency, (h) expected relationships between monitoring and sampling results and plant operations; (i)* descriptions or procedures for calibration, maintenance, and inspection of monitoring instrumentation; (j) layout drawings, piping and instrumentation diagrams (P&ID's), and process flow diagrams.
3. The technical specifications proposed by the applicant for process and effluent control are reviewed at the operating license (OL) stage (FSAR).

* Final Safety Analysis Report (FSAR) only.

USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to Revision 2 of the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20548.

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EICSB will review the seismic design, redundancy, and emergency power supply for process and effluent radiological monitors required for safe shutdown of the plant under Standard Review Plan (SRP) 7.6.

AAB will review specification and criteria for monitoring instrumentation and postulated accidents.

II. ACCEPTANCE CRITERIA

The applicant's design should meet the following criteria:

1. Provisions should be made to monitor or sample all normal and potential pathways for release of radioactive materials to the environment in conformance with General Design Criterion 64 and Regulatory Guide 1.21.
 - a. For a boiling water reactor (BWR) the following process streams or effluent release points should be monitored or sampled continuously:
 - (1) Main condenser air ejector offgases.
 - (2) Main condenser offgas treatment system effluents.
 - (3) Turbine gland seal condenser effluents.
 - (4) Mechanical vacuum pump effluents.
 - (5) Ventilation air exhausts from all buildings having the potential to contain airborne radioactivity.
 - (6) Liquid waste effluent streams.
 - (7) Service water effluent stream.
 - b. For a pressurized water reactor (PWR) the following process streams or effluent release points should be monitored or sampled continuously:
 - (1) Main condenser air ejector offgases.
 - (2) Waste gas treatment system effluent.
 - (3) Equipment vents routed directly to the environment (e.g., steam generator blowdown flash tank vent, liquid waste tank vents).
 - (4) Ventilation air exhausts from all buildings having the potential to contain airborne radioactivity.
 - (5) Turbine building floor drain effluents.
 - (6) Liquid effluents from the steam generator blowdown system.
 - (7) Boron recovery system effluents.
 - (8) Liquid waste effluent streams.
 - (9) Service water effluent stream.
 - (10) Component cooling water loop.
 - c. For both BWR's and PWR's, liquid wastes should be sampled batchwise prior to release, in accordance with Regulatory Guide 1.21. For liquid discharges which cannot be practicably monitored (e.g., main condenser cooling water), an alternative method such as periodic automatic composite sampling and weekly analyses should be provided. Continuous vent monitors for open structures, such as a PWR turbine building, are not required.

2. Provisions should be made to monitor or sample radioactive waste process systems in conformance with General Design Criterion 63.
 - a. Provisions should be made to assure representative samples from radioactive process streams and tank contents. Recirculation pumps for liquid waste tanks (collection or sample test tanks) should be capable of recirculating two tank volumes in approximately eight hours. For process stream samples, provisions should be made for purging sample lines and for reducing plateout in sample lines. Provisions for sampling from ducts and stacks should be in agreement with ANSI N13.1.
 - b. Provisions should be made to collect samples from process waste streams at central sample stations to reduce leakage, spillage, and radiation exposures to operating personnel.
 - c. Provisions should be made to purge and drain sample streams back to the system of origin or to an appropriate waste treatment system.

3. Instrumentation, sampling and monitoring provisions should conform to the following:
 - a. Sampling frequencies, required analyses, instrument sensitivities, and provisions to composite samples for low-level analyses should be in conformance with Regulatory Guide 1.21. Sampling frequencies and required analyses should be given in the plant technical specifications; these provisions will be reviewed at the OL stage.
 - b. Provisions for the necessary instrumentation and facilities to perform gross beta-gamma and gross alpha measurements, isotopic analyses, and other routine analyses should be in conformance with Regulatory Guide 1.21.
 - c. Provisions should be made to perform routine instrument calibration, maintenance, and inspections. The frequencies of such actions should be given in the plant technical specifications. The provisions will be reviewed at the OL stage. Provisions should also be made to replace or decontaminate monitors without opening the process system or losing the capability to isolate the effluent stream.

4. Continuous monitors on liquid effluent lines and gaseous release points should alarm when radionuclide concentrations exceed a predetermined level in the discharge line. In addition, provisions to automatically terminate the discharge of effluents at a predetermined level should be made for the following streams:
 - a. BWR's: Main condenser air ejector offgas
 Drywell purge
 Containment purge
 Liquid waste discharge
 - b. PWR's: Waste gas treatment system discharge ✓
 Containment purge
 Steam generator blowdown system discharge* ✓
 Turbine building floor drain discharge*
 Boron recovery system discharge*
 Liquid waste discharge ✓

Isolation valves should fail in the closed position. The release rates should be established in the plant technical specifications.

*For release routes other than through the liquid waste system.

5. The process and effluent radiological monitoring and sampling system provisions for postulated accidents will be acceptable if normal gaseous effluent paths are provided with supplemental monitoring equipment capable of monitoring postulated accident releases in accordance with ANSI Draft Standard N13/42 WG6.
6. The PERMSS provisions for monitoring liquid effluents for postulated accidents will be acceptable if both normal and postulated accident liquid effluents are discharged in the batch mode, if administrative procedures are in effect to minimize inadvertent or accidental releases of radioactive fluids, and if the normal liquid effluent monitors provide automatic termination of releases in the event that established effluent control levels are exceeded.

III. REVIEW PROCEDURES

The reviewer will select and emphasize material from this review plan as may be appropriate for a particular case.

1. In the review of the process and effluent radiological monitoring and sampling system, ETSB will compare the listing of process and effluent monitors contained in the SAR with the principal release points identified in SRP 11.2 and SRP 11.3 to assure that all major process streams and release pathways are being monitored during normal operation and anticipated operational occurrences. The review includes the following:
 - a. The location of probes, sample stations, and the bases for the selection of these sample points are compared with the general principles for obtaining valid samples of airborne radioactive materials, the methods and materials for gas and particulate sampling, and guides for sampling from ducts and stacks contained in ANSI N13.1-1969, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities."
 - b. The equipment, piping, and description of sampling methods to assure representative sampling will be compared with the guidelines given in Regulatory Guide 1.21.
 - c. ETSB will independently calculate on an audit basis the radiation levels and concentrations in the process and effluent stream using the models of Draft Regulatory Guides 1.BB and 1.CC to verify the expected levels.
 - d. ETSB will compare the sampling frequencies, types of analyses required, and monitoring instrument sensitivities with those recommended in Regulatory Guide 1.21. At the OL stage, ETSB will compare the applicant's monitoring instrumentation specifications and performance criteria with that contained in ANSI N13.10-1974 (Ref. 7).
 - e. In the review of the P&ID's for the waste treatment system, ETSB will verify that all major release points of radioactive material have provisions for automatic termination of releases in the event they exceed a predetermined level.
 - f. ETSB will review the location of the monitors shown on the P&ID's and the location of readouts, annunciators, and alarms discussed in SAR Chapter 7 to assure that the operator will be advised of system performance and effluent releases consistent with the release limits specified in the plant technical specifications.
 - g. ETSB will compare the calibration methods with the guidelines in Regulatory Guide 1.21 (FSAR)
 - h. ETSB will assure that provisions are included in the design for replacing detectors or decontaminating the monitors without opening the process system or losing the capability to isolate the system or divert the effluent to a standby treatment system.

- i. In the review of the radiation levels and concentrations of radioactive material expected from postulated accidents, ETSB will compare the applicant's values with values contained in ANSI N13/42 WG6 (Ref. 3).
 - j. In the review of the design and operation of the monitoring systems for postulated accidents, ETSB will compare the applicant's design with the guidance contained in ANSI N13/42 WG6.
 - k. ETSB will review special features, applicable topical reports, and data referenced in the SAR on a case-by-case basis.
2. ETSB reviews the technical specifications proposed by the applicant for process and effluent radiological monitoring and sampling at the OL stage. The reviewer determines that the content and intent of the technical specifications prepared by the applicant are in agreement with the requirements developed as a result of the staff's review. The review will include the evaluation or development of appropriate limiting conditions for operation and their bases consistent with the plant design.

IV. EVALUATION FINDINGS

ETSB verifies that sufficient information has been provided and that the review supports conclusions of the following type, to be included in the staff's safety evaluation report:

"The process and effluent radiological monitoring and sampling systems include the instrumentation for monitoring and sampling contaminated liquid, gaseous, and solid waste process and effluent streams. Our review included the provisions proposed to sample and monitor all station effluents in accordance with General Design Criterion 64, the provisions proposed to provide automatic termination of effluent releases and assure control over discharges in accordance with General Design Criterion 60, the provisions proposed for sampling and monitoring plant waste process streams for process control in accordance with General Design Criterion 63, the provisions for conducting sampling and analytical programs in accordance with the guidelines in Regulatory Guide 1.21, and the provisions for monitoring process and effluent streams during postulated accidents. The review included piping and instrument diagrams and process flow diagrams for the liquid, gaseous, and solid radwaste systems, and ventilation systems, and the location of monitoring points relative to effluent release points on the site plot diagram.

"The basis for acceptance in our review has been conformance of the applicant's designs, design criteria, and design bases for the process and effluent radiological monitoring and sampling systems to the applicable regulations and guides, as indicated above, as well as to staff technical positions and industry standards. Based on our evaluation, we find the proposed systems to be acceptable."

V. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 60, "Control of Releases of Radioactive Material to the Environment;" Criterion 63, "Monitoring Fuel and Waste Storage;" and Criterion 64, "Monitoring Radioactivity Releases."

2. ANSI N13.1-1969, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities," American National Standards Institute (1969).
3. ANSI N13.42 WG6, Draft, "Performance Specifications for Reactor Emergency Monitoring Instrumentation," American National Standards Institute (1974).
4. Regulatory Guide 1.21, "Measuring and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1.
5. Regulatory Guide 1.BB, "Calculation of Releases of Radioactive Materials in Liquid and Gaseous Effluents from Pressurized Water Reactors (PWR's)."
6. Regulatory Guide 1.CC, "Calculation of Releases of Radioactive Materials in Liquid and Gaseous Effluents from Boiling Water Reactors (BWR's)."
7. ANSI N13.10-1974, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents" (1974).

SRP 12-1