U.S. NUCLEAR REGULATORY COMMISSION

# STANDARD REVIEW PLAN

## OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 15.6.2 FAILURE OF SMALL LINES CARRYING PRIMARY COOLANT OUTSIDE CONTAINMENT

REVIEW RESPONSIBILITIES

Primary - Accident Analysis Branch (AAB)

Secondary - Site Analysis Branch (SAB)
Containment Systems Branch (CSB)
Reactor Systems Branch (RSB)

I. AREAS OF REVIEW

This review plan covers the radiological consequences of failures outside the containment of small lines connected to the primary coolant pressure boundary, such as instrument lines and sample lines. For the purpose of this review these lines are classified into two categories:

1. Those lines meeting the isolation requirements of General Design Criterion 55.

2. Lines exempted from General Design Criterion (GDC) 55, i.e., instrument lines.

Specifically, the AAB review covers the following areas for lines exempt from the GDC 55 isolation requirements:

1. The calculation of whole body and thyroid doses at the site boundary resulting from a failure of an instrument line exempt from the GDC 55 isolation criteria.

2. Any limitations on primary coolant radioactivity concentrations, as established in the technical specifications, required as a result of the analysis of instrument line failures.

For lines which meet the GDC 55 isolation requirements the AAB reviews the requirements, if any, on the isolation time and maximum leak rate of the isolation valves, which may be necessary to assure that the radiological consequences of a failure of these lines will not exceed a small fraction of 10 CFR Part 100 dose guidelines.

The RSB reviews the plant response to a failure of an instrument line, and will notify the AAB if this accident is predicted to cause fuel failures. In addition, the RSB may be requested by the AAB to confirm the value assumed for the mass of coolant released in the accident. The SAB provides the reviewer with the X/Q values to be used in the two-hour dose calculations. The CSB may be requested by the reviewer to verify that secondary containment integrity is maintained.

II. ACCEPTANCE CRITERIA

The plant is considered adequately designed against the radiological consequences of a failure of containment-penetrating small line carrying reactor coolant (and the technical specifications for primary coolant activity and isolation time and maximum allowable leak rate of isolation valves in these lines appropriately limited) if calculations show that the resulting doses at the site boundary are small fractions of the 10 CFR Part 100 exposure guidelines.

III. REVIEW PROCEDURES

The reviewer selects and emphasizes aspects of the areas covered by this review plan as may be appropriate for a particular case. The judgment on areas to be given attention and emphasis in the review is based on an inspection of the material presented to see whether it is similar to that recently reviewed on other plants and whether items of special safety significance are involved.

The detailed review of the radiological consequences of a failure of a small line carrying reactor coolant outside of the containment is done at the operating license (OL) stage, when system parameters and accident analyses are fully developed. At the construction permit stage the review is limited to a brief survey of the pertinent portions of the plant design and the applicant's discussion of these accidents to determine that there are no unusual features that would prevent limitation of radiological consequences to acceptable levels by appropriate limits on coolant activity concentrations or isolation valve closing times and leak rates.

The AAB review at the OL stage consists of the following steps:

1. Review of the applicant's descriptions of the accidents, in order to confirm the appropriateness and conservatism of the assumptions used in the analysis.

2. Performance of an independent analysis of the radiological consequences of the failure of the instrument or ~~er line. At present, the following conservative assumptions are used to simplify the analysis:

   a. The mass of reactor coolant released during a two-hour period is estimated with the assumption of choked flow at a fluid enthalpy equal to that of the reactor coolant under normal operating conditions. (Assume this is correct unless otherwise notified by RSB.)

   b. The initial fission product concentrations in the primary coolant are those given as maximum equilibrium values in the technical specifications. The effects of an activity spike resulting from reactor shutdown or depressurization of the primary system is modeled by increasing the rate of activity release from the fuel by a factor of 500.

c. The fission products in the primary coolant are assumed to be released to the environment if the line carrying the primary coolant penetrates the secondary containment (if any). Otherwise, the fission products are assumed to be released to the secondary containment or auxiliary building, as appropriate. The CSB should verify the integrity of the secondary containment during the pressure transient associated with a failure within its boundary. An appropriate mixing volume is determined from the location of the assumed failure and the proximity to secondary containment ventilation systems assumed to be operating (if any).

d. Determination of the values of the meteorological parameters to be used in the dose calculations. The SAB provides the reviewer with the X/Q value for the calculation of the two-hour doses. Depending on the operability of any air treatment system(s), a ground-level or elevated (stack) release is assumed.

e. Review of the results of the dose calculations. The resulting doses from these accidents should be small fractions of the 10 CFR Part 100 limits. If this is not the case, the primary coolant activity concentration limits allowed by the technical specifications should be reduced.

3. A survey of all other lines carrying primary coolant and penetrating the containment to determine the need for any special technical specification limits for the isolation valves in these lines. A failure of the line downstream of the outboard isolation valve, combined with a single active failure of any valve in the line is postulated. If such an accident sequence could result in significant primary coolant release, it may be necessary to specify a maximum allowable valve closure time and maximum allowable leak rate for the isolation valves in the technical specifications to assure that the consequences of this accident sequence do not exceed small fractions of the exposure guidelines of 10 CFR Part 100.

## IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and the review and calculations support conclusions of the following type, to be included in the staff's safety evaluation report at the operating license stage:

> "The applicant's analyses of the failure of small lines carrying primary coolant outside the containment and the proposed technical specifications for limiting the consequences of such failures have been reviewed. Independent evaluations of these accidents have been performed, and we conclude that the technical specifications for the reactor coolant activity and the isolation times and leakage limits for the isolation valves in such lines [if appropriate] assure that the radiological consequences of these accidents are limited to small fractions of the dose guidelines of 10 CFR Part 100."

## V. REFERENCES


1. 10 CFR Part 50, Appendix A, General Design Criterion 55, "Reactor Coolant Pressure Boundary Penetrating Containment."

2. 10 CFR Part 100, "Reactor Site Criteria."

3. Regulatory Guide 1.11, "Instrument Lines Penetrating Primary Containment."

SRP 15.6.3