NUREG-75/087

U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 15.7.5 SPENT FUEL CASK DROP ACCIDENTS

REVIEW RESPONSIBILITIES

Primary - Accident Analysis Branch (AAB)

Secondary - Auxiliary and Power Conversion Systems Branch (APCSB)
Site Analysis Branch (SAB)
Effluent Treatment Systems Branch (ETSB)

I. AREAS OF REVIEW

The AAB reviews accidents involving a drop of a spent fuel cask, as described in the applicant's safety analysis report (SAR), Section 15.7.5. The points covered in the review are as follows:

1. APCSB is consulted for verification of the potential drop height during handling of a loaded cask and the procedures for handling the cask with respect to the impact limiter. If the handling procedures meet all applicable criteria, then the radiological consequences of a spent fuel cask drop accident need not be estimated.

2. A design basis radiological analysis is performed if a cask drop exceeding 30 feet can be postulated or the impact limiter is removed from the cask during handling within the plant. If the radiological consequences of a cask drop accident are to be computed, then information on whether building integrity can be expected after a cask drop is obtained from APCSB (e.g., whether the technical specifications require large doors to be closed during fuel handling and whether the building integrity would be violated by the cask drop). Verification that loss of coolable fuel geometry would not be expected to occur is also obtained from APCSB to justify the assumption that only gap activity is released.

3. The SAR and technical specifications are reviewed and the relevant plant parameters are evaluated for incorporation into the dose computation model. The model incorporates conservative transport mechanisms and rates from the fuel release to the atmosphere, suitable breathing rates, dose conversion factors, and other physical and biological data that may affect the dose. The X/Q data are obtained from SAB. It may be found appropriate to utilize analyses from previous cases to determine the consequences on a generic basis.

4. The calculated doses are compared with exposure guidelines to determine the acceptability of the exclusion and low population zone (LPZ) distances and to confirm the

adequacy of engineered safety features (ESF) provided for the purpose of mitigating potential doses from spent fuel cask drop accidents.

II. ACCEPTANCE CRITERIA

1. The plant design with regard to spent fuel cask drop accidents is acceptable without calculation of radiological consequences if potential cask drop distances are less than 30 feet and appropriate impact limiting devices are employed during cask movements.

2. If the radiological consequences of a spent fuel cask drop accident are to be considered, the plant design is acceptable in this regard if the doses to an individual at the nearest exclusion area boundary and LPZ outer boundary distances are calculated to be well within 10 CFR Part 100 exposure guidelines. At the construction permit (CP) review stage, the doses calculated should allow adequate margin for uncertainties to assure that the doses will be well within 10 CFR Part 100 guidelines at the operating license (OL) review stage.

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 first step in the review procedure is to determine, with the assistance of the APCSB as described in Section I of this plan, whether radiological consequences of a spent fuel cask drop accident need be evaluated. If a radiological consequence calculation is found to be necessary, the procedure is as follows:

1. The fuel element gap inventory is determined in a manner similar to that for a fuel handling accident (see Ref. 2). The differences are that a longer decay time is allowed (earliest time after reactor fueling that cask loading operations commence) and the number of fuel elements involved is based on the largest capacity cask available or projected to be available.

2. If the drop is assumed to occur inside the refueling facility at a time when the facility is closed, at a minimum negative pressure of 0.25-inch water gauge, and ESF-grade charcoal filtration is available, credit may be allowed for iodine filtration. For the filters themselves, verification of acceptability and efficiencies is provided by the ETSB. In a dual containment design where the fuel building may be exhausted through the standby gas-treatment system (SGTS), AAB determines the relationship of the operational modes of the SGTS to the time sequence of the accident in order to give proper credit.

3. If the spent fuel cask drop is assumed to occur at a time when the facility is open to the outside atmosphere, an untreated puff release is assumed.

4. Sections 2.1.2 and 2.1.3 of the applicant's SAR are examined to determine the minimum distances to the exclusion area boundary and to the LPZ outer boundary. Following the procedures given for Standard Review Plan (SRP) 2.1.2 and SRP 2.1.3, the reviewer confirms the validity of the applicant's values. From these SRP's the reviewer also obtains relevant information (locations and time durations) concerning any significant activities within the exclusion area boundary which are unrelated to facility operation.

5. The SAB is requested to furnish suitable X/Q values to analyze the consequences of the accident. X/Q values are obtained not only at the nearest exclusion area boundary and the outer boundary of the LPZ, but also at those locations inside the exclusion area boundary where there may be significant activities unrelated to plant operation.

6. The relevant plant parameters and the X/Q values obtained from the SAB are used as input to a digital computer code (Ref. 3). The doses due to a postulated spent fuel cask drop accident are calculated at the nearest exclusion area boundary, the outer boundary of the LPZ, and at those locations within the exclusion area boundary where there may be significant activities unrelated to plant operation.

7. The calculated doses are compared with the acceptance criteria in Section II. Where results of the dose calculations indicate the guidelines may be exceeded, alternatives which would reduce the dose to acceptable levels are explored (e.g., increased distance, better filters); the feasibility of the alternatives is also examined. The AAB Branch Chief is to be consulted as to appropriate action.

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:

"We have evaluated the applicant's analysis of postulated spent fuel cask drop accidents and find the assumptions and calculational techniques acceptable. After performing an independent analysis of the radiological consequences to any individual located at the nearest exclusion area boundary, at the outer boundary of the low population zone (LPZ), or at any point within the exclusion area boundary where there may be significant activities unrelated to plant operation, we conclude that the doses are well within the guideline values of 10 CFR Part 100. The doses are listed in Table ____. "

V. REFERENCES

1. 10 CFR Part 100, "Reactor Site Criteria."

2. Regulatory Guide 1.25, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors," and Standard Review Plan 15.7.4, "Radiological Consequences of Fuel Handling Accidents."

3. Computer codes are currently under development. Documentation will be published as a NUREG report at a later date.

SRP 17.1