Maine Yankee
RELIABLE ELECTRICITY FOR MAINE SINCE 1972

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November 8, 1988 Proposed Change #144
MN-88-109

UNITED STATES NUCLEAR REGULATORY COMMISSION
Attention: Document Control Desk
Washington DC 20555

References:
(a) License No. DPR-36 (Docket No. 50-309)
(b) USNRC Letter to MYAPCo dated December 30, 1983, "Control of Heavy Loads"
(c) NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants", July, 1980
(d) MYAPCo Letter to USNRC dated September 18, 1979 WMY-79-97, Proposed Change #70
(e) USNRC Letter to MYAPCo dated June 16, 1982, "Safety Evaluation and Environmental Impact Appraisal Regarding Maine Yankee Spent Fuel Storage
(f) MYAPCo Letter to USNRC dated July 21, 1982, MN-82-140
(g) USNRC Letter to MYAPCo dated October 22, 1982, Resolution of Open Items - Safety Evaluation of Maine Yankee Spent Fuel Storage
(h) USNRC Letter to MYAPCo dated April 2, 1984, Spent Fuel Storage, Amendment #75 to Operating License No. DPR-36
(i) USNRC Letter to MYAPCo dated March 26, 1975, Cask Drop Accident
(j) SWEC Calculation 12366.02, "Cask Drop Analysis - Maine Yankee", dated July 16, 1974

Subject: Proposed Technical Specification Change Concerning Spent Fuel Shipping Casks

Gentlemen:

The proposed amendment would modify Technical Specification 1.1, "Storage". Technical Specification 1.1 describes and defines those aspects of fuel storage which relate to the prevention of criticality in the fuel storage facility. The proposed amendment changes specification D from "Spent fuel shipping casks shall not be lifted over the spent fuel storage pool", to "Spent fuel shipping casks shall not be lifted over the spent fuel storage pool until all irradiated fuel within 10 rows of the cask laydown area has cooled a minimum of 60 days.

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In a 1979 letter to the Nuclear regulatory Commission, Reference (d), Maine Yankee submitted Proposed Change #70, Spent Fuel Storage Modification. A cask drop analysis was not included in the Maine Yankee Safety Evaluation since there were no plans to use a spent fuel shipping cask in the Maine Yankee spent fuel pool at that time. As a result, Technical Specification 1.1.D was added to the Maine Yankee license to prevent the lifting of a Spent Fuel Cask over the spent fuel pool (see References [e - h]). This proposed change will increase flexibility in future planning and operation.

Analyses have been performed to address the consequences of dropping a spent fuel shipping cask in or near the spent fuel pool. The results of these consequence analyses and evaluations are provided in detail in Attachment 1 and summarized as follows:

1. Any lift of a spent fuel shipping cask at Maine Yankee will be performed in accordance with the heavy load handling guidelines specified in NUREG-0612, Section 5.1.1, thus assuring an extremely low drop probability.

2. If a drop were to occur, and the shipping cask were to fall into the spent fuel pool, a maximum pool leak rate of 5 gpm has been conservatively calculated. The Chemical Volume Control System (CVCS) has borated water make-up capabilities much greater than the postulated leak rate (i.e., 150 to 200 gpm).

3. Radiological analyses have been performed which demonstrate that doses would be well within 10 CFR, Part 100 limits (i.e., less than 25% of the Part 100 limits). The analyses determined that the anticipated release from 100 fuel assemblies (i.e., the shadow area of the largest available shipping cask) would not exceed the prescribed limits providing the spent fuel had decayed for 60 days. If 120 days were allowed, damage to every assembly in the SFP would not exceed 25% of the Part 100 limits.

4. A bounding criticality analysis assuming 4.1 weight percent (w/o) U-235, pool temperature of 68°F and a 2-D infinite array has demonstrated that K_{eff} is less than .95 even under conditions of a collapsed flux trap and optimum lattice pitch, provided credit is taken for the 1,720 ppm soluble boron. This analysis bounds consolidated fuel assemblies.

5. The travel path for the spent fuel shipping cask will not pass over any safety-related equipment.

With regard to the matter of significant hazards considerations, we have evaluated this proposed change as required by 10 CFR 50.92. We concluded that no significant hazards consideration exists. Our analysis is attached to this letter as Attachment 2.

This proposed change has been reviewed and approved by the Plant Operation and Review Committee. The Nuclear Safety Audit and Review Committee has also reviewed this submittal. A representative of the State of Maine is being informed of this request by a copy of this letter.

We request that this proposed change be made effective immediately upon issuance.

An application fee of $150.00 is enclosed.

Very truly yours,

MAINE YANKEE

John B. Randazza
President

RHA/bjp

Attachment

c: Mr. Richard H. Wessman
Mr. William T. Russell
Mr. Cornelius F. Holden
Mr. Patrick M. Sears
Mr. Clough Toppan
State of Maine Attorney General

STATE OF MAINE

Then personally appeared before me, John B. Randazza, who being duly sworn did state that he is President of Maine Yankee Atomic Power Company, that he is duly authorized to execute and file the foregoing request in the name and on behalf of Maine Yankee Atomic Power Company, and that the statements therein are true to the best of his knowledge and belief.

Notary Public

G.D. WHITTIER
NOTARY PUBLIC, MAINE
MY COMMISSION EXPIRES OCTOBER 19, 1991

ATTACHMENT 1

Spent Fuel Cask Drop Accident Analysis

Summary of Assumptions and Results

SPENT FUEL CASK DROP ACCIDENT ANALYSIS

SUMMARY

Analyses have been performed to address the consequences of dropping a spent fuel shipping cask in or near the spent fuel pool.

The results of these analyses are summarized below:

1. Any lift of a spent fuel shipping cask at Maine Yankee will be performed in accordance with the heavy load handling guidelines specified in NUREG-0612, Section 5.1.1, thus assuring an extremely low drop probability.

2. If a drop were to occur, and the shipping cask were to fall into the spent fuel pool, a maximum pool leak rate of 5 gpm has been conservatively calculated. The Chemical Volume Control System (CVCS) has borated water make-up capabilities much greater than the postulated leak rate (i.e., 150 gpm to 200 gpm).

3. Radiological analyses have been performed which demonstrate that doses would be well within 10 CFR, Part 100 limits (i.e., less than 25% of the Part 100 limits). The analyses determined that the anticipated release from 100 fuel assemblies (i.e., the shadow area of the largest available shipping cask) would not exceed the prescribed limits providing the spent fuel had decayed for 60 days. If 120 days were allowed, damage to every assembly in the SFP would not exceed 25% of the Part 100 limits. (See Section I. for the definition of the cask shadow area).

4. A bounding criticality analysis assuming 4.1 w/o U-235, pool water at 68°F and a 2-D infinite array has demonstrated that K_{eff} is less than .95 even under conditions of a collapsed flux trap and optimum lattice pitch, provided credit is taken for the 1,720 ppm soluble boron. This analysis bounds consolidated fuel assemblies.

5. The travel path for the spent fuel shipping cask will not pass over any safety-related equipment.

Based upon these analyses and evaluations, the heavy load guidelines and the required drop consequences have been reviewed in accordance with NUREG-0512 and SRP 15.7.5, and lifting a 100-ton spent fuel shipping cask into the SFP cask laydown area is concluded not to represent an unreviewed safety question.

DISCUSSION

NUREG-0612, Section 5.1.2, Part 4, states that the effects resulting from heavy load drops should be analyzed and shown to satisfy the prescribed evaluation criteria (Section 5.1 of Reference [c]). In addition, the general guidelines of Section 5.1.1 should also be satisfied.

A discussion of the Section 5.1.1 general guidelines will be addressed first, to be followed by a summary of the results of the Section 5.1 analyses.

General Guidelines

NUREG-0612, Reference (c), Section 5.1.1, states that plants should satisfy each of the following for handling heavy loads that could be brought in proximity to irradiated fuel in the Spent Fuel Pool (SFP).

1. Safe Load Paths
2. Load Handling Procedures
3. Crane Operator Training
4. Special Lifting Devices
5. Lifting Devices (not specially designed)
6. Crane (inspection, testing, and maintenance)
7. Crane Design

The yard crane (CR-3) will be used to handle spent fuel shipping casks at Maine Yankee. This crane design includes travel limit switches, overspeed sensing, a second upper limit switch, and overload sensing of the main hook. The travel limit switches prevent yard crane travel over any spent fuel in the pool. Per previous submittals, Maine Yankee has shown that a cask drop/tipping accident due to failure of the yard crane is of a very low probability.

Reference (b) contains the SER which documents the concurrence of the staff and its consultant (Franklin Research Center) that the guidelines in NUREG-0612, Section 5.1.1, for the handling of heavy loads have been satisfied at Maine Yankee. (Note: The use of Crane CR-3 is specifically addressed in Reference [b]).

Even though satisfying the above Section 5.1.1 guidelines assures an extremely low drop probability, Reference (c) still requires consequence analyses be performed for the four areas of concern discussed below.

Analyses were performed in the radiological release and criticality areas to address these Reference (c) requirements.

I. Radiological Releases

Reference (c), Section 5.1, Part 1, states that the release of radioactive material that may result from damage to spent fuel based on calculations involving accidental dropping of a postulated heavy load should produce doses that are well within 10 CFR, Part 100, limits of 300 rem thyroid, 25 rem whole body (analyses should show that doses are equal to or less than 1/4 of the Part 100 limits).

Analysis Results

Since the postulated cask drop height could exceed 30 feet, the maximum number of spent fuel assemblies within the spent fuel cask must be included with spent fuel assemblies damaged as a result of the hypothetical cask drop (SRP 15.7.5). The current largest commercially available shipping cask is 17.5 feet high, 7.33 feet in diameter and has a capacity for seven PWR spent fuel assemblies. As a result, if up to 93 PWR assemblies are anticipated to be damaged due to a dropped/tipped cask (based on shadow area of cask), then 100 assemblies should be used to determine the required decay time prior to cask handling.

The Maine Yankee cask laydown area is a 10 foot square area on the west side of the spent fuel pool. The cask shadow area was determined by assuming the cask hits the spent fuel crane rail and tips towards the east in a path perpendicular to the west wall. Assuming that 9 feet of the cask lands in the cask laydown area, about 8.5 feet impacts on fuel assemblies.

It should be noted that commercially available, but not yet licensed, dry casks (Castor X33) are capable of holding up to 33 assemblies; however, this type of cask is not loaded with fuel assemblies unless they have decayed a minimum of ten years. Releases from assemblies stored in dry casks need not be included with assemblies damaged as a result of the cask drop.

Maine Yankee specific analyses were performed in accordance with the guidelines of Standard Review Plan 15.7.5 for an anticipated release from 100 fuel assemblies. In order to prevent exceeding 25% of the Part 100 limits; 60 days of decay time are required for a nonfiltered release and 25 days of decay time for a filtered release.

The radiological consequences of spent fuel damage (i.e., fuel assembly gap fission product inventory releases) have been analyzed on a generic bases for a reference plant in Reference (c). The results, parameters, and assumptions used in Reference (c) have been evaluated and have been found to be bounding for the Maine Yankee Station. The results of Reference (c) could, therefore, be used to bound a potential fuel cask drop at Maine Yankee. Two cases were considered; releases to the atmosphere processed by a safety-related filter and nonfiltered releases. Nonfiltered releases are applicable since it is a common practice to conduct fuel cask movement with fuel building cargo doors and hatches open to the environment.

The generic analyses from Reference (c) (Section 2.1) gives required decay times of 64 days and 32 days for unfiltered and filtered release, respectively. After a decay time of 120 days, the whole body dose is limiting, and further decay time will not result in any benefit; over 7,000 assemblies could be damaged without exceeding 25% of the Part 100 limits.

II. Criticality Evaluation

Reference (c), Section 5.1, Part II, states that damage to fuel and fuel storage racks based on calculations involving accidental dropping of a postulated heavy load should not result in a configuration of the fuel such that K_{eff} is larger than 0.95.

Analysis Results

Criticality analysis of the Maine Yankee spent fuel racks has been performed for the cask drop accident. The analysis was performed assuming fresh fuel enriched to 4.1 w/o U-235, pool water at 68°F and 2-D infinite array models. Since the cask drop accident involves unpredictable distortions in geometry, conservative assumptions about the final geometry are made in order to bound the reactivity effects. These assumptions include: collapsed flux trap and optimum lattice pin pitch. If credit is taken for the presence of 1,720 ppm soluble boron in the SFP water (addressed in Reference (c) Section 5.1, Part III), the K_{eff} of the spent fuel racks will be below .95 even under conditions of collapsed flux trap and optimum lattice pin pitch. This analysis also bounds consolidated fuel assemblies which are much less reactive than 14 by 14 fuel assemblies at an optimum pin pitch, as well as the older less enriched assemblies.

III. Cask Drop

Reference (c), Section 5.1 Part III states that damage to the SFP based on calculations of damage following accidental dropping of a postulated heavy load should be limited so as not to result in water leakage that could uncover the fuel (make-up water provided to overcome leakage should be from a borated source of adequate concentration if the water being lost is borated).

Analysis Results

In 1975 the Commission reviewed Maine Yankee's analysis of a spent fuel cask drop accident in the SFP. Per Reference (i), the Commission concurred that no safety-related equipment was beneath the path for cask travel and that provisions to prevent a postulated spent fuel shipping cask accident were acceptable. There have been no changes which would adversely affect the Commission's evaluation; thus, their conclusion remains valid. The cask drop analysis, assumed that the cask was dropped in an orientation which results in the most severe consequences to the SFP, Reference (j). A maximum gross weight of 100 tons for a fully loaded cask was used in the analysis. The cask was assumed to be dropped through 4 feet of air and 38 feet of water. Drag force effects of the water medium were taken into account. The results of the analysis showed there would be minimal leakage of the SFP (approximately 2 gpm to 5 gpm).

Estimates of leakage from the SFP are well below the borated water make-up capabilities of Chemical Volume Control System (CVCS). The primary make-up flow paths are:

1. Concentrated boric acid solution blended with demineralized water at the blend tee or a batch makeup of concentrated boric acid with a batch makeup of demineralized water. This source uses the boric acid and primary water transfer pumps and can provide greater than 150 gpm flow to the SFP via the SFP purification header.

2. Batch makeup of refueling concentration borated water from the Refueling Water Storage Tank (RWST). This source uses the refueling purification pump (P-8) and can provide greater than 200 gpm flow to the SFP via the SFP purification header.

IV. Safe Shutdown Equipment

Reference (c), NUREG-0612, Section 5.1, Part IV, states that damage to equipment in redundant or dual safe shutdown paths, based on calculations assuming the accidental dropping of a postulated heavy load, should be limited so as not to result in loss of required safe shutdown functions.

Response

As stated previously (Reference [i]) in 1975, the Commission reviewed Maine Yankee's analysis of a postulated spent fuel cask drop accident and agreed that no safety-related equipment was beneath the cask travel path.

CONCLUSION

The analyses and evaluations required by Reference (c) to permit a spent fuel shipping cask into the SFP cask laydown area have been performed and the results demonstrate that bringing the shipping cask into the laydown area does not represent an unreviewed safety question.

ATTACHMENT 2

Determination of Significant Hazards Considerations

Determination of Significant Hazards Considerations

Removal of Spent Fuel Cask Handling Restriction

This change is requested to move a spent fuel shipping cask into the cask laydown area of the spent fuel pool. The proposed change to the Operating License has been evaluated to determine whether it constitutes a significant hazards consideration as required by 10 CFR 50, Section 50.91 using standards provided in Section 50.92. This analysis is provided below:

1. The proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated.

   The large safety factors associated with the yard crane (CR-3), and the fact that it meets the general guidelines of NUREG 0612 (control of heavy loads), ensures that the probability of an accident will not be significantly increased. The results of the hypothetical cask drop analysis indicate minimal leakage to the SFP which can easily be made up by the Chemical Volume and Control System.

   Fuel assembly decay times of 60 days from shutdown to the start of cask handling result in radiological doses due to cask drop which are well within (25% of 10CFR, Part 100) the acceptance criteria of SRP 15.7.5. Thus, the radiological consequences of an accident will not be significantly increased.

   Criticality analysis using conservative assumptions regarding spent fuel rack distortion geometry has demonstrated that Keff will always be less than the NRC's acceptance criteria, provided credit is taken for the 1,720 ppm soluble boron. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. The proposed amendment will not create the possibility of a new or different kind of accident from any accident previously analyzed.

   Per Reference (i), the Commission in 1975 concurred that no safety-related equipment was beneath the path for cask travel and that provisions to prevent a postulated spent fuel shipping cask accident were acceptable. There have not been any changes which would adversely affect the Commission's evaluation; thus their conclusion remains valid. Also, the use of specific lift procedures (which will be created upon selection of a cask vendor) in conjunction with plant procedures and the safe load path ensures that this change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. The proposed amendment will not involve a significant reduction in the margin of safety.

NUREG-0612, Section 5.1.1, states that plants should satisfy each of the following for handling heavy loads that could be brought in proximity to irradiated fuel in the SFP.

a. Safe load paths.
b. Load handling procedures.
c. Crane operator training.
d. Special lifting devices.
e. Lifting devices (not specifically designed).
f. Crane (inspection, testing and maintenance).
g. Crane design.

By satisfying the above seven criteria, and through the use of procedures governing crane inspection, operation, load testing and crane operator training, we ensure that this change does not involve a significant reduction in the margin of safety.

Based on this guidance, and the reasons discussed above, we have concluded that the proposed change does not involve a significant hazards consideration.

ATTACHMENT 3

Page Change List

Remove existing page 1.1-1 and replace with the enclosed page 1.1-1.

Remove existing page 1.1-2 and replace with the enclosed page 1.1-2.