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Docket No. 50-309

Mr. John H. Garrity, Senior Director
Nuclear Engineering and Licensing
Maine Yankee Atomic Power Company
83 Edison Drive
Augusta, Maine 04336

Dear Mr. Garrity:

SUBJECT: POST ACCIDENT SAMPLING SYSTEM (NUREG-0737, ITEM II.B.3)

We are continuing our review of your submittal dated May 26, 1983 on the post accident sampling system (PASS). A draft of our current evaluation of your submittal is enclosed. We find that eight of the eleven criteria from NUREG-0737 are met.

In order to close the remaining items, we request that you supply the required information or justification for not meeting the criteria to the staff within 45 days of your receipt of this letter. You may request a conference call to exchange information necessary to resolve these open items. Where work is still in progress, you should indicate a proposed schedule for its completion. Please contact the NRC Project Manager, K. Heitner, if you have any questions or to arrange a teleconference.

The information requested in this letter affects fewer than 10 respondents; therefore OMB clearance is not required under P.L. 96-511.

Sincerely,

Original signed by
C M Trammell
for James R. Miller, Chief
Operating Reactors Branch #3
Division of Licensing

Enclosure:
Draft Safety Evaluation

cc: See next page

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DRAFT SAFETY EVALUATION BY
THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO OPERATION OF
MAINE YANKEE ATOMIC POWER PLANT
MAINE YANKEE ATOMIC POWER COMPANY
Docket No. 50-309

Post-Accident Sampling System (NUREG-0737, II.B.3)

Introduction

Subsequent to the TMI-2 incident, the need was recognized for an improved post-accident sampling system (PASS) to determine the extent of core degradation following a severe reactor accident. Criteria for an acceptable sampling and analysis system are specified in NUREG-0737, Item II.B.3. The system should have the capability to obtain and quantitatively analyze reactor coolant and containment atmosphere samples without radiation exposure to any individual exceeding 5 rem to the whole body or 75 rem to the extremities (GDC-19) during and following an accident in which there is core degradation. Materials to be analyzed and quantified include certain radionuclides that are indicators of severity of core damage (e.g. noble gases, isotopes of iodine and cesium, and nonvolatile isotopes), hydrogen in the containment atmosphere and total dissolved gases or hydrogen, boron, and chloride in reactor coolant samples.

To comply with NUREG-0737, Item II.B.3, the licensee should (1) review and modify his sampling, chemical analysis, and radionuclide determination capabilities as necessary and (2) provide the staff with information pertaining to system design, analytical capabilities and procedures in sufficient detail to demonstrate that the criteria are met.

Evaluation

By letter dated May 26, 1983, the licensee provided information on the PASS.

Criterion (1):

> The licensee shall have the capability to promptly obtain reactor coolant samples and containment atmosphere samples. The combined time allotted for sampling and analysis should be three hours or less from the time a decision is made to take a sample.

The licensee has provided sampling and analysis capability to promptly obtain and analyze reactor coolant samples and containment atmosphere samples within three hours from the time a decision is made to take a sample. The PASS electrical power supply is from the control room lighting transformer which is to provide continuous power and to transfer automatically and/or manually to the Class IE power source to ensure continued power to equipment when the main generator is off the line. We find that these provisions meet Criterion (1) and are, therefore, acceptable.

Criterion (2):

The licensee shall establish an onsite radiological and chemical analysis capability to provide, within the three-hour time frame established above, quantification of the following:

a) Certain radionuclides in the reactor coolant and containment atmosphere that may be indicators of the degree of core damage (e.g., noble gases, iodines and cesiums, and non-volatile isotopes);

b) hydrogen levels in the containment atmosphere;

c) dissolved gases (e.g., H_2), chloride (time allotted for analysis subject to discussion below), and boron concentration of liquids;

d) Alternatively, have in-line monitoring capabilities to perform all or part of the above analyses.

The PASS provides in-line monitoring analysis for hydrogen in the containment atmosphere. The PASS also provides the capability to collect diluted or undiluted liquid and gaseous grab samples that can be transported to the radio-chemical laboratory for hydrogen, pH, conductivity, boron, chloride, and radionuclide analyses.

We find that the licensee partially meets Criterion (2) by establishing an on-site radiological and chemical analysis capability. However, the licensee should provide a procedure, consistent with our clarification of NUREG-0737, Item II.B.3, Post-Accident Sampling System, transmitted to the licensee on June 30, 1982, to estimate the extent of core damage based on radionuclide concentrations and taking into consideration other physical parameters such as core temperature data and sample location. Guidance for the procedure to estimate core damage is attached (Attachment 1).

Criterion (3):

> Reactor coolant and containment atmosphere sampling during post-accident conditions shall not require an isolated auxiliary system (e.g., the letdown system, reactor water cleanup system) to be placed in operation in order to use the sampling system.

Reactor coolant and containment atmosphere sampling during post-accident conditions does not require an isolated auxiliary system to be placed in operation in order to perform the sampling function. The PASS provides the ability to obtain samples from the reactor coolant system, the pressurizer, the RHR system, and the containment atmosphere without using an isolated auxiliary system. The licensee's proposal to meet Criterion (3) is acceptable since PASS sampling is performed without requiring operation of an isolated auxiliary system and the PASS valves which are not accessible after an accident are environmentally qualified for the conditions in which they need to operate.

Criterion (4):

> Pressurized reactor coolant samples are not required if the licensee can quantify the amount of dissolved gases with unpressurized reactor coolant samples. The measurement of either total dissolved gases or H_2 gas in reactor coolant samples is considered adequate. Measuring the O_2 concentration is recommended, but is not mandatory.

Pressurized reactor coolant samples are analyzed by gas chromatography to obtain hydrogen concentrations. We have determined that this provision meets Criterion (4) of Item II.B.3 in NUREG-0737 and is, therefore, acceptable.

Criterion (5):

> The time for a chloride analysis to be performed is dependent upon two factors: (a) if the plant's coolant water is seawater or brackish water and (b) if there is only a single barrier between primary containment systems and the cooling water. Under both of the above conditions the licensee shall provide for a chloride analysis within 24 hours of the sample being taken. For all other cases, the licensee shall provide for the analysis to be completed within 4 days. The chloride analysis does not have to be done onsite.

The licensee proposes to perform chloride analysis on a diluted sample. It is our position that diluted samples do not provide the necessary accuracy to meet the guidelines provided in our June 30, 1983 letter. It is acceptable to verify that dissolved oxygen is <0.1 ppm, when chloride content is above 0.15 ppm, by measurement of a dissolved hydrogen residual of >10 cc/Kg for up to 30 days after the accident. The licensee should obtain an undiluted sample and retain it for chloride analysis with the required sensitivity of 0.15 ppm. The undiluted sample can be allowed to decay up to 30 days before performing the chloride analysis consistent with ALARA.

Criterion (6):

> The design basis for plant equipment for reactor coolant and containment atmosphere sampling and analysis must assume that it is possible to obtain and analyze a sample without radiation exposures to any individual exceeding the criteria of GDC-19 (Appendix A, 10 CFR Part 50) (i.e., 5 rem whole body, 75 rem extremities). (Note that the design and operational review criterion was changed from the operational limits of 10 CFR Part 20 (NUREG-0578) to the GDC-19 criterion (October 30, 1979 letter from H. R. Denton to all licensees.)

The licensee has performed a shielding analysis to ensure that operator exposure while obtaining and analyzing a PASS sample is within the acceptable limits. This operator exposure includes entering and exiting the sample panel area, operating sample panel manual valves, positioning the grab sample into the shielded transfer carts, and performing sample dilutions. PASS personnel radiation exposures from reactor coolant and containment atmosphere sampling and analysis are within 5 rem whole body and 75 rem extremities, which meet the requirements of GDC-19 and Criterion (6) and are, therefore, acceptable.

Criterion (7):

> The analysis of primary coolant samples for boron is required for PWRs. (Note that Rev. 2 of Regulatory Guide 1.97 specifies the need for primary coolant boron analysis capability at BWR plants.)

An diluted grab sample of the reactor coolant will be analyzed for boron. The system is capable of measuring boron concentrations in diluted and degased coolant samples. This provision meets the recommendations of Regulatory Guide 1.97, Rev. 2 and Criterion (7) and is, therefore, acceptable.

Criterion (8):

> If in-line monitoring is used for any sampling and analytical capability specified herein, the licensee shall provide backup sampling through grab samples, and shall demonstrate the capability of analyzing the samples. Established planning for analysis at offsite facilities is acceptable. Equipment provided for backup sampling shall be capable of providing at least one sample per week until the accident condition no longer exists.

A diluted reactor coolant grab sample can be obtained for the boron, pH, chloride (reactor coolant only) and the isotopic analyses. An in-line hydrogen monitor is available for containment atmsophere. Also, a backup in-line, hydrogen analyzer is available in the event that the primary unit becomes inoperative. We find that these provisions meets Criterion (8) and are, therefore, acceptable.

Criterion (9):

The licensee's radiological and chemical sample analysis capability shall include provisions to:

a) Identify and quantify the isotopes of the nuclide categories discussed above to levels corresponding to the source term given in Regulatory Guides 1.3 or 1.4 and 1.7. Where necessary and practicable, the ability to dilute samples to provide capability for measurement and reduction of personnel exposure should be provided. Sensitivity of onsite liquid sample analysis capability should be such as to permit measurement of nuclide concentration in the range from approximately 1μ Ci/g to 10 Ci/g.

b) Restrict background levels of radiation in the radiological and chemical analysis facility from sources such that the sample analysis will provide results with an acceptably small error (approximately a factor of 2). This can be accomplished through the use of sufficient shielding around samples and outside sources, and by the use of a ventilation system design which will control the presence of airborne radioactivity.

The radionuclides in both the primary coolant and the containment atmosphere will be identified and quantified. Provisions are available for diluted reactor coolant samples to minimize personnel exposure. The PASS can perform radioisotope analyses at the levels corresponding to the source term given in Regulatory Guides 1.4, Rev. 2 and 1.7. Radiation background levels will be restricted by shielding. Ventilated radiological and chemical analysis facilities are provided to obtain results within an acceptably small error (approximately a factor of 2). We find these provisions meet Criterion (9) and are, therefore, acceptable.

Criterion (10):

Accuracy, range, and sensitivity shall be adequate to provide pertinent data to the operator in order to describe radiological and chemical status of the reactor coolant systems.

The licensee has not provided information regarding Criterion (10) on the accuracy, range, and sensitivity of the PASS instruments and analytical procedures consistent with the recommendations of Regulatory Guide 1.97, Rev. 2, and the clarifications of NUREG-0737, Item II.B.3, Post-Accident Sampling Capability, transmitted to the licensee on June 30, 1982. The analytical methods and instrumentation should be selected for their ability to operate in the post-accident sampling environment. The licensee should train its chemistry personnel in the PASS procedures utilizing a test solution similar to that described in the letter of June 30, 1982.

The licensee should also provide additional information consistent with the guidelines in our letter dated June 30, 1982, on the following: All equipment and procedures which are used for post-accident sampling and analysis should be calibrated or tested at a frequency which will ensure, to a high degree of reliability, that it will be available if required. Operators should receive initial and refresher training in post-accident sampling, analysis and transport. A minimum frequency for the above efforts is considered to be every six months if indicated by testing.

Criterion (11):

In the design of the post-accident sampling and analysis capability, consideration should be given to the following items:

a) Provisions for purging sample lines, for reducing plateout in sample line, for minimizing sample loss or distortion, for preventing blockage of sample lines by loose material in the

RCS or containment, for appropriate disposal of the samples, and for flow restrictions to limit reactor coolant loss from a rupture of the sample line. The post-accident reactor coolant and containment atmosphere samples should be representative of the reactor coolant in the core area and the containment atmosphere following a transient or accident. The sample lines should be as short as possible to minimize the volume of fluid to be taken from containment. The residues of sample collection should be returned to containment or to a closed system.

b) The ventilation exhaust from the sampling station should be filtered with charcoal adsorbers and high-efficiency particulate air (HEPA) filters.

The licensee has addressed provisions for purging to ensure samples are representative, size of sample line to limit reactor coolant loss from a rupture of the sample line, and ventilation exhaust from PASS filtered through HEPA filters. By purging to an enclosed system which has effluent treatment and radiation monitoring provisions during the sampling process, the licensee is minimizing discharges of radioactivity during sampling. To limit iodine plateout, the containment air sample line is heat traced. We determined that these provisions meet Criterion (11) and are, therefore, acceptable.

Conclusion

We conclude that the post-accident sampling system partially meets the criteria of Item II.B.3 of NUREG-0737. The licensee's proposed methods to meet eight of the eleven criteria are acceptable. The three criteria which have not been fully resolved are:

Criterion (2) Provide a core damage estimate procedure to include radionuclide concentrations and other physical parameters as indicators of core damage.

Criterion (5) Meet the requirement of Criterion (5) for monitoring of chloride.

Criterion (10) Meet the requirement of Criterion (10) ↄ accuracy, range and sensitivity of the instrumentation.