October 4, 1985

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Docket No. 50-261

Mr. E. E. Utley, Executive Vice President
Power Supply and Engineering and Construction
Carolina Power and Light Company
Post Office Box 1551
Raleigh, North Carolina 27602

Dear Mr. Utley:

SUBJECT: NUREG-0737, ITEM II.B.3, POST-ACCIDENT SAMPLING SYSTEM, H. B. ROBINSON STEAM ELECTRIC PLANT UNIT NO. 2 (TAC No. 44474)

We have completed our review of your Post-Accident Sampling System information submitted by your letters dated August 12, 1983, December 28, 1984 and June 24, 1985. Your submittals were in response to Item II.B.3 of NUREG-0737.

We conclude that H. B. Robinson Unit 2 meets ten of the eleven criteria of Item II.B.3. The one criterion requiring a procedure for estimating the extent of core damage from fission product measurements is acceptable on an interim basis. Your staff has committed to provide a plant specific procedure which includes other physical parameters in addition to fission product activities to provide a realistic estimate of core damage by October 23, 1985. We will review this report on a plant specific basis.

Based on the above discussion we consider this item closed. A copy of our safety evaluation is enclosed.

Sincerely,

/s/SVarga

Steven A. Varga, Chief
Operating Reactors Branch #1
Division of Licensing

Enclosure:
As Stated

ORB#1:DL CR	ORB#1:DL	~~BC:ORB#1:DL~~
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Safety Evaluation
by the Office of Nuclear Reactor Regulation
Related to Operation of
H. B. Robinson Unit 2 Nuclear Power Plant
Carolina Power & Light Company
Docket No. 50-261

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 letters dated August 12, 1983, December 28, 1984 and June 24, 1985, the licensee provided information on the Post-Accident Sampling System.

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. This has been verified and documented in Region II Inspection Report 50-261/85-15, June 18, 1985. During loss of off-site power, all valves supporting PASS operation, and the PASS itself, are powered from the existing emergency diesels. 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 grab sample capability to obtain pressurized and unpressurized reactor coolant liquid and containment atmosphere samples. Boron, pH, and hydrogen can be measured through in-line instruments. The PASS also provides the capability to collect diluted and undiluted liquid and gaseous grab samples for chloride, pH, boron, hydrogen, oxygen, total dissolved gases, and radionuclide analysis.

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 September 24, 1982, to estimate the extent of core damage based on radionuclide concentrations and taking into consideration other physical parameters such as core temperature data, pressure vessel liquid level and containment radiation levels and hydrogen concentrations. The licensee is a participant in a working group under the Westinghouse Owners Group that had developed a methodology of a generic core damage assessment based on measurements of radionuclide concentrations and other plant indicators. The licensee has committed to provide a plant specific procedure by October 23, 1985.

We find that these provisions meet Criterion (2) of Item II.B.3 in NUREG-0737 and are, therefore, acceptable. The procedure for estimating the degree of core damage is acceptable on an interim bases. By October 23, 1985, the licensee should provide the final procedure for estimating core damage.

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 valves which are not accessible after an accident are environmentally qualified for the conditions in which they need to operate. These provisions meet Criterion (3) and are, therefore, acceptable.

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.

Total dissolved gas concentration is determined by degassing the sample by depressurization and circulation. Hydrogen and oxygen concentrations in the stripped gases are measured by hydrogen and oxygen analyzers. We have determined that these provisions meet Criterion (4) of Item II.B.3 in NUREG-0737 and are, 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 applicant shall provide for a chloride analysis within 24 hours of the sample being taken. For all other cases, the applicant shall provide for the analysis to be completed within 4 days. The chloride analysis does not have to be done on-site.

Chloride analysis of reactor coolant is performed within 96 hours on a diluted sample for an initial scoping chloride concentration. Additional accuracy will be obtained by analyzing an undiluted sample that has been decayed sufficiently to be in conformance with ALARA. These provisions meet Criterion (5), and are, therefore, acceptable.

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 evaluation of the Post-Accident Sample Sink Shield wall was performed with the PATH Gamma Shielding Code. Total exposure at the control panel will be less than 200 mR/hr.

The licensee has performed a time-person-motion study to ensure that operator exposure while obtaining, transporting, 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 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).

The PASS provides the capability to perform in-line boron analysis. In addition, the PASS provides the capability of obtaining diluted and undiluted grab samples for backup boron analysis. We find these provisions met Criterion (7) and are, 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 off-site 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.

In-line sampling and analysis is provided for pH, conductivity, dissolved hydrogen, boron and hydrogen concentrations in the containment atmosphere. A backup grab sample, diluted or undiluted reactor coolant, diluted reactor coolant off gas, and diluted containment air can also be taken. Provisions are provided to flush the in-line probes with demineralized water to facilitate access for repair. We find these provisions meet Criterion (8) and are, therefore, acceptable.

Criterion (9):

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

a) Identify and quantify 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 on-site liquid sample analysis capability should be such as to permit measurement of nuclide concentration in the range from approximately 1μ Ci 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. Reactor coolant samples are diluted to minimize personnel exposure. The PASS can perform radioisotopes 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 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 September 24, 1982. Therefore, they are adequate for describing the radiological and chemical status of the reactor coolant. The analytical methods and instrumentation were selected for their ability to operate in the post-accident sampling environment. The standard test matrix and radiation effect evaluation indicated no interference in the PASS analyses.

The PASS was designed for both normal and post-accident operation. The PASS will be used on a daily basis, if practical, thus providing an up-to-date status of equipment and trained operators. We determined that these provisions meet Criterion (10) of Item II.B.3 in NUREG-0737, and are, therefore, acceptable.

Criterion (11):

> In the design of the post-accident sampling and analysis capability, consideration should be given to the following items:
>
> a) Provisions should be made for purging sample lines, for reducing plateout in sample lines, 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, recirculation back to containment and remote calibration sampling capabilities to ensure samples are representative. In addition to heat tracing, piping, lengths are kept as short as possible, thus limiting plateout in sample lines. To limit iodine plateout, the containment atmosphere sample line is heat traced. The PASS sample panel is exhausted to a HEPA and charcoal filter ventilation system. We determined that these provisions meet Criterion (11) of Item II.B.3 of NUREG-0737, and are, therefore, acceptable.

Conclusion

On the basis of our evaluation, we now conclude that the post-accident sampling system meets ten of the eleven criteria of Item II.B.3 in NUREG-0737. The procedure for estimating the degree of core damage is acceptable on an interim basis. By October 23, 1985, the licensee has committed to provide the final plant specific procedure for estimating core damage, which we will review and report.