August 29, 1984

Docket No. 50-219
LS05-84-08-045

Mr. P. B. Fiedler
Vice President and Director
Oyster Creek Nuclear Generating Station
Post Office Box 388
Forked River, New Jersey 08731

Dear Mr. Fiedler:

SUBJECT: SAFETY EVALUATION OF POST-ACCIDENT SAMPLING SYSTEM

Re: Oyster Creek Nuclear Generating Station

The staff has reviewed your submittals dated March 6 and July 19, 1984 relating to NUREG-0737, Item II.B.3, Post-Accident Sampling System (PASS). The staff's Safety Evaluation is enclosed. The evaluation was based on acceptance Criterion 5 in Section 9.3.2 of the Standard Review Plan (NUREG-0800, July 1981), and the guidelines of Item II.B.3 in NUREG-0737. The staff concludes that your post-accident sampling system meets the requirements of Item II.B.3 and is therefore acceptable. No further action is anticipated and the staff considers the subject to be complete.

Original signed by

Walter A. Paulson, Acting Chief
Operating Reactors Branch #5
Division of Licensing

Enclosure:
Safety Evaluation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

OYSTER CREEK NUCLEAR GENERATING STATION

GPU NUCLEAR CORPORATION

DOCKET NO. 50-219

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

1.0 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.

2.0 EVALUATION

By letters dated March 6 and July 19, 1984, 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 has the capability to recover from loss of offsite power within 15 minutes, so that sampling may be performed in the three-hour limit. The staff finds 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 nonvolatile 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 the capability to collect diluted or undiluted liquid and gaseous reactor coolant and containment atmosphere grab samples that can be transported to the onsite radiological and chemical laboratory for hydrogen, oxygen, pH, chloride, boron, and radionuclide analyses. The licensee adopted the procedure of the General Electric BWR Owners Group for estimating the extent of core damage which was based on radionuclide concentrations and taking into consideration other physical parameters, such as local core temperatures, core coolant conditions, hydrogen concentrations, and area radiation levels. The staff finds that these provisions meet Criterion (2) of NUREG-0737, Item II.B.3, and are, therefore, acceptable.

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 (RWCUS)] 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 reactor coolant samples from the recirculation loop and the liquid poison system, and gaseous samples from the containment atmosphere. The staff finds the licensee's proposal to meet Criterion (3) 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 cooled and degassed to obtain representative total dissolved gas samples at the PASS sampling station. The hydrogen concentration is measured by gas chromatography. The licensee is committed to the General Electric Company's modification to the dissolved gas equipment to correct operational problems (letter from W. V. Johnston, NRC, to G. G. Sherwood, GE, July 17, 1984). The accuracy of the total dissolved gas measurement is adequate to provide pertinent data to the operator in order to describe the chemical status of the reactor coolant system. The dissolved oxygen content in the coolant is measured indirectly by verifying that dissolved oxygen is less than 0.1 ppm by measurement of a dissolved hydrogen residual of greater than 10 cc/kg. The staff has 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 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.

Chloride analysis can be performed within 24 hours onsite by turbidimetric method which has a sensitivity of 0.1 ppm in an undiluted sample. An undiluted sample can also be collected in a shielded cask and retained for chloride analysis for 30 days. The staff has determined that 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 licensee has performed a preliminary 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 will be kept 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.)

A diluted grab sample of the reactor coolant will be analyzed for boron by the carminic acid colorimetric method, which is capable of measuring boron concentrations in coolant down to 50 ppm. This provision meets the recommendations of Regulatory Guide 1.97, Rev. 3 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 day for seven days following the onset of the accident and at least one sample per week until the accident condition no longer exists.

Diluted and undiluted reactor coolant grab samples and undiluted containment atmosphere grab samples will be obtained for analyses of boron, dissolved gases, pH, chloride and radioisotopes in the reactor coolant and hydrogen, oxygen and radioisotopes in the containment atmosphere. The staff finds that these provisions meet 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 terms 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 1μCi/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 terms given in Regulatory Guides 1.3, Rev. 2 and 1.7. These analyses are expected to be accurate within a factor of 2. The staff finds that 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 the raiological and chemical status of the reactor coolant systems.

The accuracy, range, and sensitivity of the PASS instruments and analytical procedures are consistent with the recommendations of Regulatory Guide 1.97, Rev. 3, and the clarifications of NUREG-0737, Item II.B.3, Post-Accident Sampling Capability, transmitted to the licensee on June 30, 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. Equipment used in post-accident sampling and analyses will be calibrated or tested approximately every 6 months. Retraining of operators for post-accident sampling is scheduled at a frequency of once every 12 months. The staff finds that these provisions meet Criterion (10) 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 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 lines. 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 to 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 (1) provisions for purging to ensure samples are representative, (2) size of the sample lines, (3) flow restrictions and/or isolation valves to limit reactor coolant loss from a failure of the sample line, and (4) ventilation exhaust from the PASS station (which is ducted to the Reactor Building) filtered through charcoal adsorbers and HEPA filters. To limit iodine plateout, the containment air sample line is heat traced. The post-accident reactor coolant and containment atmosphere samples will be representative of the reactor coolant in the core area and the containment atmosphere. The staff has determined that these provisions meet Criterion (11) of Item II.B.3 of NUREG-0737, and are, therefore, acceptable.

3.0 CONCLUSION

Based on this evaluation, the staff concludes that the post-accident sampling system meets all the eleven criteria of Item II.B.3 of NUREG-0737, and is, therefore, acceptable.

4.0 ACKNOWLEDGEMENT

This Safety Evaluation was prepared by J. Wing.

Date: