February 12, 1985

Docket Nos. 50-317
and 50-318

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Mr. A. E. Lundvall, Jr.
Vice President - Supply
Baltimore Gas & Electric Company
P. O. Box 1475
Baltimore, Maryland 21203

Dear Mr. Lundvall:

We have completed our evaluation of your submittals dated November 30, 1982 and May 14, October 30 and December 31, 1984 concerning the Calvert Cliffs postaccident sampling system (PASS). As indicated in the enclosed safety evaluation, the Calvert Cliffs PASS meets the eleven criteria associated with TMI Item II.B.3, "Postaccident sampling." Accordingly, TMI Item II.B.3 is resolved for Calvert Cliffs Units 1 and 2.

Sincerely,

Original signed by:

James R. Miller, Chief
Operating Reactors Branch #3
Division of Licensing

Enclosure:
As stated

cc w/enclosure
See next page

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

SAFETY EVALUATION BY

THE OFFICE OF NUCLEAR REACTOR REGULATION

POST ACCIDENT SAMPLING SYSTEM

BALTIMORE GAS AND ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT

UNIT NOS. 1 AND 2

DOCKET NOS. 50-317 AND 50-318

Introduction

The postaccident sampling system (PASS) is evaluated for compliance with the criteria in NUREG-0737, Item II.B.3. The licensee should provide information on 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 in accordance with the requirements of NUREG-0737, II.B.3.

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

Evaluation

By letters dated November 30, 1982 and May 14, October 30 and December 31, 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 PASS has 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. Power from standby station diesels can be manually switched on to energize the PASS in the eve: of off-site power failure during postaccident conditions. We determined that these provisions meet Criterion (1) of Item II.B.3 in NUREG-0737 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 , 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 for pH, boron, radionuclides, dissolved oxygen and hydrogen. 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, boron, dissolved oxygen, chloride, and radionuclide analyses. The licensee provided a procedure for estimating the extent of reactor core damage which was based on radionuclide concentrations and taking into consideration other physical parameters, such as local core exit thermocouple temperatures, hydrogen concentrations, and containment area radiation levels. We find that these provisions meet Criterion (2) and are, therefore, acceptable.

Criterion: (3)

> Reactor coolant and containment atmosphere sampling during postaccident 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 postaccident 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 existing sample points on the reactor coolant recirculation loop, containment sump, and containment atmosphere without using an isolated auxiliary system.

The PASS valves which are not accessible after an accident are environmentally qualified for the conditions in which they need to operate. We find that 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.

Pressurized reactor coolant samples are cooled and degassed to obtain representative dissolved gas samples. If chlorides exceed 0.15 ppm, verification that dissolved oxygen is less than 0.1 ppm is possible. Verification that dissolved oxygen is less than 0.1 ppm by measurement of a dissolved hydrogen residual of greater than 10 cc/kg is achievable for up to 30 days after the accident. Within 30 days, consistent with ALARA, direct monitoring for dissolved oxygen is provided. We 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 on an appropriately diluted grab sample within four days. The amount of dilution will be minimized in order to obtain the best analysis accuracy while maintaining ALARA radiation conditions. The dilution is variable up to a maximum of about 2500:1. The analysis will be accomplished in the laboratory on-site. We find 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 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 the sample panel, positioning the grab sample in the shielded transfer cart, and performing manual sample dilutions, if required, for isotopic analysis. 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).

Boron measurement is performed in-line using a specific gravity analysis in a range of 0-5000 ppm with an accuracy of ± 2% of full scale. We find that these provisions meet 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 offsite facilities is acceptable. Equipment provided for backup sampling shall be capable of providing at least one sample per day for 7 days following onset of the accident and at least one sample per week until the accident condition no longer exists.

An in-line chemical analysis panel is provided for reactor coolant pH, boron, oxygen and hydrogen concentrations, as well as radionuclide concentrations. Also, a backup (diluted) reactor coolant grab sample can be obtained for these analyses. We find 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 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 1 μCi/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 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 and 1.7. Radiation background levels will be restricted by shielding and ventilation in the radiological and chemical analysis facilities such that analytical results can be obtained within an acceptably small error (approximately a factor of 2). We find 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 radiological 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, Postaccident 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 postaccident sampling environment. Equipment used in postaccident sampling and analyses will be tested approximately every six months. Retraining of operators for postaccident sampling is scheduled at a frequency of once every six months. We find that these provisions meet Criterion (10) and are, therefore, acceptable.

Criterion: (11)

In the design of the postaccident 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 sampling 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 postaccident 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 charcoal adsorbers and HEPA filters. To limit iodine plateout, the containment air sample line is heat traced. We determined that these provisions meet Criterion (11) of Item II.B.3 of NUREG-0737, and are, therefore, acceptable.

Conclusion

Based on the above evaluation, we now conclude that the postaccident sampling system meets all eleven criteria of Item II.B.3 of NUREG-0737 and is, therefore, acceptable.

Principal Contributor:

J. Wing
D. Jaffe