Docket Nos. 50-317
and 50-318

May 6, 1986

Mr. J. A. Tiernan
Vice President - Nuclear Energy
Baltimore Gas & Electric Company
P. O. Box 1475
Baltimore, Maryland 21203

Dear Mr. Tiernan:

We have completed our review of your letters dated October 31, 1985 and April 1, 1986 concerning conformance to the criteria of Item II.B.3, "Post-Accident Sampling Capability" of NUREG-0737, "Clarification of TMI Action Plan Requirements" for Calvert Cliffs Units 1 and 2. As indicated in the enclosed Safety Evaluation, we conclude that the modified post-accident sampling system (PASS) for Calvert Cliffs meets the 11 criteria of Item II.B.3 of NUREG-0737 and thus provides a viable method for determining post-accident chemistry and environments in the plant. We, therefore, find the Calvert Cliffs PASS acceptable.

Sincerely,

/S/

David H. Jaffe, Project Manager
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Division of PWR Licensing-B

Enclosure:
Safety Evaluation

cc w/enclosure:
See next page

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Calvert Cliffs Nuclear Power Plant

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UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
BALTIMORE GAS & ELECTRIC COMPANY
CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-317 AND 50-318
POST ACCIDENT SAMPLING SYSTEM, NUREG-0737, ITEM II.B.3

Introduction

By letter dated October 25, 1985, Baltimore Gas and Electric Company informed the NRC of their intention to modify the existing post-accident sampling system (PASS) at the Calvert Cliffs Nuclear Power Plant, Units 1 and 2. The original PASS, provided to meet the criteria of Item II.B.3 of NUREG-0737, relied on in-line instrumentation as a primary method for analyzing the reactor coolant and containment atmosphere. It proved, however, to be maintenance intensive and unreliable. Also, inline instrumentation inaccuracies often caused the results to be outside of the recommended tolerances, identified in Item II.B.3 of NUREG-0737. The proposed modified PASS relies, with only one exception, on grab sample analyses for both the reactor coolant and containment atmosphere. No backup method is considered since the criteria of Item II.B.3 specify the need for backup sampling provisions only for sampling systems relying on inline instrumentation. It should be noted that the modified PASS will utilize the same sampling lines as those previously reviewed and approved by the staff in the original inline system. Thus, as indicated above, the major difference in the new PASS approach consists of grab versus inline sampling methods.

Evaluation

By letters dated October 31, 1985 and April 1, 1986, the licensee provided information on the capabilities of the modified PASS and described how it complies with the 11 criteria in Section II.B.3 of NUREG-0737. The following is our evaluation.

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 3 hours or less from the time a decision is made to take a sample.

The modified PASS has sampling and analysis capability to promptly obtain and analyze reactor coolant samples and containment atmosphere samples within 3 hours from the time a decision is made to take a sample. During a loss of offsite power, emergency power is available to operate all non-manually operated control valves needed for taking samples. Sample analyses are performed in a mobile onsite laboratory. This laboratory draws its power from either of two gasoline powered electric generators. The PASS can therefore function following a loss of offsite power. We conclude that these provisions meet the guidelines of Criterion (1) and are, therefore, acceptable.

Criterion (2)

The licensee shall establish an onsite radiological and chemical analysis capability to provide, within the 3-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 inline monitoring capabilities to perform all or part of the above analyses.

The modified PASS has the capability to collect undiluted grab samples which are transported to the radio-chemical laboratory where they are diluted 5:1. An aliquot of the diluted sample could be further diluted, if necessary, and radionuclides determined by the laboratory gamma analysis equipment. The radionuclides in the containment atmosphere are obtained in a similar manner from the sample taken by a syringe. Hydrogen level in the containment is determined by means of an in-line hydrogen analyzer. There is a provision to analyze dissolved gases in the liquid sample as well as chloride and boron. The sensitivity of the analytical methods is sufficient to provide the required accuracy. We find that these features comply with the guidelines of Criterion 2 for sampling 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.

Sampling of the reactor coolant, the low pressure safety injection or the containment atmosphere during post-accident conditions does not require any isolated auxiliary system to be put in operation. Remotely-operated control valves in the PASS itself which must be used during sampling receive their power and compressed air needed for their operation from safety-related sources and are operable in the post-accident environment including loss of offsite power conditions. We find that these provisions meet the guidelines of 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.

The modified PASS has provisions for stripping dissolved gases from the reactor coolant sample. A sample of these gases is then injected into the gas partitioner for hydrogen analysis. When needed, the concentration of dissolved oxygen can be estimated from its concentration in the refueling water tank and/or from its partial pressure in the containment atmosphere. We conclude that the above meets the guidelines of Criterion 4 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 has the capability to perform chloride analysis within 140 minutes using the modified PASS. This capability meets the guidelines of Criterion 5 and is, 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 identified in GDC 19. In making this analysis, it was assumed that an undiluted sample was taken and that it was diluted 5:1 before performing sample analysis. The analysis indicated that the radiation exposure from reactor coolant and containment atmosphere sampling for the personnel operating the PASS was below the limits specified in Criterion 6 above. The modified PASS thus provides acceptable protection for its operators and, therefore, meets the guidelines of Criterion 6.

Criterion (7)

The analysis of primary coolant samples for boron is required for PWRs. (Note that Revision 2 of Regulatory Guide 1.97, when issued, will likely specify the need for primary coolant boron analysis capability at BWR plants).

Boron measurement is performed on grab samples using a slightly modified version of the mannitol potentiometric method described in standard ASTM-D3082. We find this procedure acceptable, and in conformance with the guidelines of Criterion 7.

Criterion (8)

If inline 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.

Inline monitoring will only be used for the analysis of hydrogen in the containment atmosphere. This system is redundant, environmentally qualified and as such does not require backup. The remaining chemical analyses will be performed on grab samples only. This meets the guidelines of Criterion 8 and is, 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 Guide 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 the use of ventilation system design which will control the presence of airborne radioactivity.

The licensee will be able to identify the radionuclides and combustibles gases specified in Regulatory Guides 1.4 and 1.7, respectively, and determine their concentration in both the primary coolant and the containment atmosphere. This will be achieved by taking grab samples, suitably diluting them to minimize personnel exposure, and performing radioisotope and chemical analyses. These analyses will be performed within the above indicated accuracy. Corrections for background radiation will be applied if the levels of this radiation are sufficiently low. However, when these levels become excessively high, the samples will be analyzed in the mobile laboratory which has complete gamma counting facilities. We conclude that these provisions meet the guidelines of Criterion 9 and are 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 shown that the range, sensitivity and accuracy of the modified PASS instrumentation and analytical procedures conform to the recommendations of Regulatory Guide 1.97, Revision 3, and the clarifications to Section II.B.3 of NUREG-0737, transmitted to the licensee in the letter of June 30, 1982. The only departure from these recommendations was the licensee's decision not to measure pH. However, the licensee justified this deviation by demonstrating that the buffering action of sodium triphosphate in the containment spray would prevent the sump water from becoming highly acidic and causing corrosion of metals exposed to it. We concur with this justification. The licensee also indicated that all personnel responsible for operating the PASS will be adequately trained and will undergo retraining approximately once every 6 months. We find the provisions specified to be in accordance with the guidelines of Criterion 10 and, 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 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 modified PASS will utilize the same sampling lines as the originally approved PASS system. Thus, the guidelines of Criterion 11 were previously evaluated and accepted by the staff. In addition, the licensee has provided further assurance that the modified PASS has provisions for taking representative samples. A relatively high velocity will be maintained in the sample lines in order to prevent plateout of materials. Reactor coolant samples will be drawn from the normal reactor coolant sample line using the reactor coolant system pressure as a driving head. In the event of a large LOCA, the liquid sample will be taken from the discharge header of the LPSI pump, thus assuring representative samples which will include the containment sump water. The containment atmosphere will be sampled via the hydrogen sampling line which is not heat traced. However, the expected iodine concentration in the

containment atmosphere is extremely low and consequently the containment atmosphere samples will be analyzed for hydrogen and noble gases only. Plating effects will thus not be of concern in the containment atmosphere line. The degassing station in the chemistry laboratory will be equipped with charcoal filters and the gases from the laboratory ventilation system will be processed through HEPA filters in the auxiliary building and waste processing ventilation system. We conclude that the provisions for sample taking provided in the modified PASS meet the guidelines of Criterion (11) and are, therefore, acceptable.

Conclusion

Based on the above evaluation, we conclude that the modified PASS for Calvert Cliffs meets the 11 criteria of Item II.B.3 of NUREG-0737 and thus provides a viable method for determining post-accident chemistry and environments in the plant. We, therefore, find it acceptable.

Principal Contributor:
K. Parczewski

Date: May 6, 1986