May 2, 1984

Docket Nos. 50-315
and 50-316

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Mr. John Dolan, Vice President
Indiana and Michigan Electric Company
c/o American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43216

Dear Mr. Dolan:

We have finished our preliminary review of the post accident sampling system for the Donald C. Cook Nuclear Plant, Unit Nos. 1 and 2. This system is in response to NUREG-0737 Action Item II.B.3 requirements. Our preliminary evaluation is enclosed. Please review the open items and provide a schedule for resolution. We are available to discuss these items if you wish. You schedule should be submitted within two weeks of receipt of this letter.

The reporting and/or recordkeeping requirements of this letter affect fewer than ten respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

Original signed by
Steven A. Varga

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

Enclosure:
As stated

cc w/enclosure:
See next page

ORB#1:DL	C-ORB#1:DL
DWigginton;ps	SVarga
5/2/84	5/2/84

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Draft Safety Evaluation by
the Office of Nuclear Reactor Regulation
Related to Operation of
D. C. Cook Nuclear Plant
Indiana & Michigan Electric Company
Docket Nos. 50-315/316

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 November 5, 1982, 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 normal station service power supply. In the event that offsite power is lost, an emergency power supply and the station 250V battery system are available to operate the sampling and analysis panels. 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 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 samples of reactor coolant and to analyze them for pH, boron, chloride, radionuclides and dissolved gases. It also provides the capability to take diluted grab samples of the containment atmosphere for analysis by gas chromatograph for hydrogen. In addition, in-line monitoring of the coolant is provided for dissolved hydrogen by gas chromatography and for dissolved oxygen by polarography. In-line monitoring of hydrogen in the containment atmosphere by gas chromatograph is also provided.

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 the 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, pressure vessel liquid level, containment radiation levels and hydrogen concentrations. The licensee is a participant in the Westinghouse Owners Group that has developed a methodology for a generic core damage assessment based on measurements of radionuclide concentrations and other plant indicators. A plant specific procedure based on this methodology would be 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 or the 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 steam space, the RHR system, the containment sump and the containment atmosphere without using an isolated auxiliary system. However, portions of the existing Nuclear Sampling System need to be placed in service to obtain post-accident samples. Some of the valves in this system fail closed upon loss of instrument air, or are not qualified for post-accident service. Therefore, we find that the licensee partially meets Criterion (3) of Item II.B.3 of NUREG-0737. The licensee should verify that all valves used in the PASS will function in the post-accident environment in which they 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 is cooled and diluted by a factor of 1000 to obtain depressurized dissolved gas samples at the PASS sampling station. The hydrogen and oxygen concentrations in the diluted sample are measured by gas chromatography. The dissolved oxygen content is also measured by an in-line polarographic method to concentrations below 0.1 ppm. An in-line gas chromatographic method is also used to measure the hydrogen concentration in undiluted coolant. 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 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 analyze a diluted sample for chloride within 4 days by the mercuric thiocyanate method. The method is sensitive to 5 ppb of chloride, but since the sample is diluted by a factor of 1000, the lower limit of detectability in the reactor coolant is 5 ppm. A sensitivity of 0.15 ppm in the reactor coolant is desired. Also, the mercuric thiocyanate method is subject to interference by iodide ion. The licensee has made no provision for taking an undiluted grab sample of reactor coolant for confirmatory analysis, consistent with the guidelines in our letter of June 30, 1982.

We find that these provisions partially meet Criterion (5). The licensee should provide a method for chloride analysis which is less susceptible to interference by anticipated contaminants in post-accident coolant. Also, the licensee should provide for collecting an undiluted grab sample of reactor coolant.

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 the operations in the sampling room, hot laboratory and counting room. 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.)

A diluted grab sample of the reactor coolant will be analyzed for boron by the Circumin method, which is capable of measuring boron concentrations in coolant down to 200 ppm. 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.

In-line monitoring is provided for pH, dissolved oxygen and dissolved hydrogen in the coolant and for hydrogen concentration in the containment atmosphere. Only diluted grab samples of coolant and containment atmosphere will be taken for backup analyses. No provision is made for undiluted backup grab samples of coolant. We find that these provisions do not meet Criterion (8). The licensee should provide for the collection of undiluted grab samples of coolant.

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 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 are identified and quantified. Provisions are available for diluted reactor coolant and containment atmosphere 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. 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 the radiological and chemical status of the reactor coolant systems.

The accuracy, range, and sensitivity of the PASS in-line instruments and analytical procedures for chloride and boron are not 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. Also, the licensee does not address the training of chemistry personnel in the PASS procedures using a test solution containing anticipated contaminants, as recommended in the clarification of Criterion (10) of NUREG-0737, Item II.B.3. We find that the licensee partially meets Criterion (10). The license should develop procedures which will yield more accurate results for chloride and boron analysis. The licensee should 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.

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, for limiting reactor coolant loss from a rupture of a sample line, and for ventilation exhaust from PASS filtered through charcoal adsorbers and HEPA filters. The reactor coolant system sampling locations were selected to provide coolant samples that are representative of core conditions.

We determined that these provisions partially meet Criterion (11) of Item II.B.3 of NUREG-0737. The licensee should install heat tracing or incorporate other provisions on the containment air line to limit iodine plateout.

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 five of the eleven criteria are acceptable. The six 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 (3) Replace all non-qualified valves used in PASS with valves which will function in the post-accident environment.

Criterion (5) Provide PASS capability to analyze for chloride by a method with the required sensitivity in the presence of anticipated interfering species.

Criterion (8) Provide for the collection of undiluted samples of reactor coolant.

Criterion (10) Develop more sensitive analytical methods for boron and chloride. Provide information demonstrating applicability of procedures and instrumentation in the post-accident water chemistry and radiation environment, and retraining of operators on a semi-annual basis.

Criterion (11) Provide a means to minimize iodine plateout in the containment air sample line.