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VICE PRESIDENT
SUPPLY

November 30, 1982

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Mr. Robert A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing

Subject: Calvert Cliffs Nuclear Power Plant
Units Nos. 1 & 2; Dockets Nos. 50-317 and 50-318
TMI Action Plan Item II.B.3

References: (a) Letter from Robert A. Clark to A. E. Lundvall, Jr., dated June 30, 1982

(b) NUREG-0578: TMI-2 Lessons Learned Task Force Status Report and Short Term Recommendations; July 18, 1979

(c) NUREG-0737: Clarification of TMI Action Plan Requirements; October 31, 1980

Gentlemen:

Reference (a) requests a submittal which documents how BG&E has satisfied each criterion of NUREG-0737, Item II.B.3.

The original Post-Accident Sampling requirements were issued (reference (b)) with an initial required in-service date of January 1, 1980. Amplification of these requirements was provided in letters from the NRC dated September 13 and October 30, 1979. Reference (c) clarified all previous NRC Staff positions and postponed the required in-service date to January 1, 1982.

Originally, we had embarked on an ambitious program to have a satisfactory Post Accident Sampling System (PASS) in service by the originally scheduled January 1, 1981, completion date. No such systems existed at that time and a significant effort was launched within the industry to design a system to satisfy the new requirements. At Calvert Cliffs, the final system tests were completed and the system declared operational on June 1, 1982. The attachments to this letter document how the installed PASS meets the criteria (clarifications of Item II.B.3 in NUREG-0737). Each criterion from NUREG-0737 is listed, followed by a discussion of how it is satisfied.

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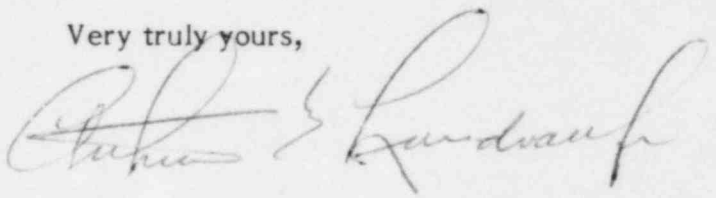
If you have any questions about our response, please do not hesitate to contact us.

Very truly yours,



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Attachments: (1) NUREG-0737 criteria and discussions
(2) BG&E Drawing 60-249 Sheet 2 of 2 Rev. 0G

cc: J. A. Biddison, Jr., Esq. (w/o attach.)
G. F. Trowbridge, Esq. "
Mr. D. H. Jaffe - NRC (10)
Mr. R. E. Architzel - NRC

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.

Discussion: The Post Accident Sampling System (PASS), installed to meet the requirements of NUREG-0737, is a system designed and manufactured by Combustion Engineering (CE) and installed at Calvert Cliffs Nuclear Power Plant (CCNPP). A copy of drawing number 60-249 sheet 2 of 2 Rev. 0G is attached and labeled as Attachment 2. It is a piping and instrument diagram (P&ID) of the PASS as installed. The PASS is installed on the 45' level of the auxiliary building and serves both Unit 1 and Unit 2. It provides for a liquid sample to be retrieved from either the RCS via the normal sample line penetration or from the containment sump via the low pressure safety injection (LPSI) header. The containment atmosphere is sampled separately via a syringe and sample bomb attached to a hydrogen sample line from Unit 1 and Unit 2. The sample bombs for Unit 1 and Unit 2 are located in the respective normal sa ple rooms on the 45' level. The system is designed to obtain and analyze both reactor coolant and containment atmosphere samples within three hours of the time a decision is made to obtain a sample. The limiting item is the startup of the high-purity germanium (HPGe) detector. The PASS has power available from motor control centers MCC204R (ZB facility) and MCC214R (ZA facility).

Criterion: (2) The licensee shall establish an onsite radiological and chemical analysis capability to provide, within 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.,H2), 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.

Discussion: (a) A High Purity Germanium (HPGe) detector is utilized for the detection of radionuclides in the reactor coolant. Coupled with an ND-66 multichannel analyzer, various isotopes can be detected which may be indicators of the degree of

core damage. These isotopes include Xe-131, Xe-133, I-131, and I-133 for cladding failure, Rb-88, Te-129, Te-132, and Cs-134 for fuel overheating, and Ba-140, La-140, La-147, and Pr-144 for fuel melting. A HPGe detector is incorporated as part of the newly installed PASS. For the containment atmosphere, a grab sample is taken via a syringe and analyzed in the laboratory on a multichannel analyzer.

(b) The hydrogen levels in the containment atmosphere are not measured via the PASS but via a hydrogen sampling system being modified to meet the requirements of II.F.1.6 of NUREG-0737.

(c) The CE PASS as installed at CCNPP also has the capability to measure the volume of total dissolved gases and the percentage of total dissolved gases which are hydrogen and oxygen.The total dissolved gases are determined by depressurizing a known volume of pressurized coolant and measuring the amount of gases which come out of solution. These gases are then passed through an in-line hydrogen and oxygen analyzer which measures the percent of each gas in the gaseous volume. Boron concentrations are measured in-line via a specific gravity analysis using a Dynatrol Density Cell by Automation Products, Inc. Chlorides will be measured using an appropriately diluted liquid grab sample taken by syringe and analyzed in the laboratory.

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.

Discussion: The sampling of the reactor coolant or the containment atmosphere does not require any isolated auxiliary system to be put in operation. No remote manual operation of any equipment is required. Those valves and equipment which are remotely operated are environmentally qualified for the conditions in which they must 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.

Discussion: As discussed for Criterion (2) (c), the installed PASS has the ability to measure total dissolved gases by depressurizing and stripping the dissolved gases from a known volume of pressurized coolant. The gases which are stripped from the coolant are then analyzed in-line to measure percent hydrogen and percent oxygen.

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.

Discussion: Calvert Cliffs Nuclear Power Plant is a PWR cooled by the Chesapeake Bay. Under the conditions stated in the criterion, BG&E will obtain and analyze 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.

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).

Discussion: The calculated man rem exposures for obtaining and analyzing post accident samples based on person-motion data follow:

Sampling: 4.45R maximum
Transport: 10-100mR
Analysis: 10-20mR

(Data above is dependent on which analyses are required and assumes a Unit 2 accident with 100% failed fuel (worst case)).

Criterion: (7) The analysis of primary coolant samples for boron is required for PWR's. (Note that Rev. 2 of Regulatory Guide 1.97 specifies the need for primary coolant boron analysis capability at BWR plants).

Discussion: Boron measurement is performed in-line using a specific gravity analysis. A Dynatrol Density Cell, by Automation Products, Inc., is used to determine ppm Boron in a range of 0-5000 ppm with an accuracy of ±2% of full scale.

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 an accident, and at least one sample per week until accident condition no longer exists should be provided.

Discussion: Grab samples are the primary method of obtaining a containment atmosphere sample. In-line monitoring is the primary method of obtaining all but the chloride analysis for the reactor coolant sample. Diluted, depressurized reactor coolant samples and diluted reactor coolant off-gas samples can be taken via the installed PASS. The primary chemistry lab (69' of the Auxiliary Building) would be used for monitoring and analyzing the grab samples. If the chemistry lab had to be evacuated, the on-site mobile lab would be activated. The mobile lab has the capability to analyze and monitor grab samples for boron, ph, hydrogen, oxygen, and chloride concentrations. The Ge(Li) and Na(I) detectors are located in the mobile lab for spectrometer analysis. Additionally, off-site analysis could also be utilized if necessary.

Criterion: (9) The licensee's radiological and chemical 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 1uCi/g to 10C/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.

Discussion: The HPGe detector identifies and quantifies the isotopes of the reactor coolant inline. The detector is designed to detect reactor coolant activity in the range of 1uC/ml to 10C/ml with an accuracy of +100% and -50%. Shielding has been provided in the area to reduce the area radiation to a maximum of 4.26R/Hr at Time 0 for a Reg. Guide 1.4 source term. The detector is designed to operate at 100R/Hr background radiation. Where backup analysis is desired, the primary chemistry lab in the Auxiliary Building or the on-site mobile lab will be utilized.

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.

Discussion: The following data is supplied to the operator from the PASS while performing the in-line analysis:

Analysis	Range	Accuracy
Isotopic	N/A	+100%,-50%
Boron	0-5000ppm	±100ppm
Chloride (off-line)	.5-200 ppm	±1% of value
	<.5 ppm	±.02 ppm
Total gas *		
hydrogen	0-10 Vol%	±2% of full
	0-100 Vol%	scale
oxygen	0-5 Vol%	±2% of full
	0-25 Vol%	scale
pH	3-12 pH units	±.5 pH units

* Total gas is calculated from the change in volume in a burette due to a known volume of depressurized and degassed sample fluid. The calculation is dependent upon initial sample pressure, sample temperature, burette pressure, and initial and final burette level. The range has an upper limit of approximately 900

cc/kg due to the volume of the isolated sample.

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 absorbers and high-efficiency particulate air (HEPA) filters.

Discussion: (a) As noted on drawing 60-249 sheet 2 of 2 Rev. OG, the PASS has been installed with provisions to purge all reactor coolant sample lines with demineralized water. In addition, a strainer has been installed in the sample line to prevent blockage of the system by loose material in the RCS. This strainer can be flushed to the installed return line and from there to the affected unit containment. The sample lines are 1/2" tubing which allows for a relatively high sample velocity to assist in reducing plateout as well as limit the volume of reactor coolant loss from a rupture of the sample line. The reactor coolant sample is drawn from the normal reactor coolant sample line using the RCS pressure as a driving head. In the event of insufficient pressure in the RCS, the sample will be drawn from the discharge header of the LPSI pump. The former assures a representative sample in the case of a small LOCA and the latter assures a representative sample via the containment sump in the event of a large LOCA. The reactor coolant samples are returned to the affected containment. The containment atmosphere sample originates from the containment via the normal hydrogen sample line

at the 135' elevation. Except for that which is removed for analysis by syringe, the sample is returned to containment via the normal hydrogen sample line.

(b) The PASS is ventilated via a charcoal filter into the normal plant ventilation system. The normal plant ventilation system contains HEPA filters.