

50-317/318



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20655-0001

November 12, 1998

Mr. Charles H. Cruse  
Vice President - Nuclear Energy  
Baltimore Gas and Electric Company  
Calvert Cliffs Nuclear Power Plant  
1650 Calvert Cliffs Parkway  
Lusby, MD 20657

SUBJECT: RESPONSE TO BALTIMORE GAS AND ELECTRIC COMPANY (BGE) COMMENTS  
ON THE SAFETY EVALUATION FOR THE CALVERT CLIFFS REACTOR  
COOLANT SYSTEM LOW FLOW AMENDMENT (TAC NOS. MA2280 AND  
MA2282)

Dear Mr. Cruse:

In Amendments 228 and 202 to the Calvert Cliffs Unit 1 and Unit 2 licenses, the staff approved a reduction in the limit for reactor coolant system flow rate from 370,000 gpm to 340,000 gpm. This reduction in flow rate occurred as a result of a reduction in flow area caused by steam generator tube plugging. In the staff's Safety Evaluation (SE) for these amendments, the NRC staff provided comments on the Calvert Cliffs analyses which supported the amendment requests. These comments identified certain calculations and/or assumptions of the analyses which the staff found unacceptable. None of these issues, either in total or individually, led the staff to conclude that the proposed Technical Specification (TS) change should not be issued because use of the staff's assumptions in lieu of the licensee's still led the staff to conclude that the proposed TS change was acceptable. However, the staff believed that the licensee's continued use of these questionable assumptions and/or calculations was inappropriate. Consequently, the staff indicated in the SE that the licensee should make the changes to their analyses and/or reference documents.

In a July 7, 1998 letter, BGE commented on the staff's SE. The staff has reviewed those comments. This letter is responding to those comments. For each of the numbered items below, a summary of the SE issue is presented in Subsection a), a summary of the BGE comments in Subsection b), and the staff's response to the BGE comments is presented in Subsection c).

1. a) The staff's SE described the manner in which the control room would be isolated and the control room emergency ventilation system (CREVS) would be initiated in the event of an accident. The SE stated that the CREVS automatically start on a safety injection actuation signal (SIAS) for either a main steam line break (MSLB), a steam generator tube rupture (SGTR) or a seized rotor accident.
- b) BGE provided clarifying information stating that a SIAS would only isolate and actuate one train of the CREVS while a signal from the control room radiation monitor will isolate the control room and actuate both trains of the CREVS in the required time frame.
- c) The staff has no comment with respect to the clarifying remarks concerning this comment.

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2. a) The staff's SE had stated that BGE only considered releases from the main steam piping room vent and the condenser as ground level releases and that the other release points were not treated as ground level releases.
- b) In their clarifying comments BGE stated that all of their release points were assumed to be vent releases as defined by NUREG/CR-6331, Revision 1, ARCON96 Manual, instead of ground level releases as stated by the staff in the SE.
- c) The staff's statement in the SE was insufficient. The staff's statement should have recognized the release point as a release from a vent and then described the fact that BGE's modeling of these release points resulted in  $\chi/Q$  values which were representative of a ground level release without plume rise and that the  $\chi/Q$  values associated with the other release points were indicative of those associated with assumed plume rise. The staff should have stated further that, for the above noted SE, the staff determined that none of the release points at Calvert Cliffs qualified as an elevated release point. However, the review of the meteorological data to support consideration of plume rise remains active. Therefore, for the purpose of the amendments issued on May 23, 1998, all releases were considered by the staff as ground level without plume rise, but this determination is not yet final.

NUREG/CR-6331, Revision 1, "Atmospheric Relative Concentrations in Building Wakes," is a technical contractor report and is not an NRC policy document. At this time, reviews by the NRC staff of licensee assessments using the NUREG/CR-6331, Revision 1, methodology are being performed on a case-by-case basis. Although this report describes a methodology that could be used to estimate dispersion within or near building complexes, the NRC may determine that certain capabilities of the methodology should not be used in design basis accident assessments. The examples provided in the report are provided to demonstrate how to run the ARCON96 computer code, but do not necessarily represent inputs and assumptions that the NRC would find acceptable. The staff anticipates completion of its review of the Calvert Cliffs control room  $\chi/Q$  values by November 1998.

3. a) The staff's SE states that because the staff is still reviewing BGE's submittal, the staff has not accepted BGE's  $\chi/Q$  values for the atmospheric dump valve (ADVs) and main steam safety valves (MSSVs). Instead, since the review was not complete, the staff utilized the  $\chi/Q$  values presented in the April 21, 1998, BGE submittal for releases from the main steam piping room vent release (MSPRV) for the MSRB accident ( $5.12E-3 \text{ sec/m}^3$ ). The staff anticipates completion of its review of the Calvert Cliffs control room  $\chi/Q$  values by November 1998.
- b) In their comments, BGE states that use of the MSPRV  $\chi/Q$  value is extremely conservative. Given the high energy of postulated releases from the ADVs and MSSVs, BGE states that the actual calculated value should consider thermal and momentum plume rise and would result in a  $\chi/Q$  value of approximately  $1E-10 \text{ sec/m}^3$ . BGE notes that NUREG/CR-6331, Revision 1, clearly states that, "ARCON96 does not compute plume rise. Therefore, if you wish to include plume rise in your calculation, you must combine plume rise with the actual stack height to get an effective stack height and enter the effective stack height in the text box in place of the actual height."

- c) The staff agrees that the use of the MSPRV value may be conservative. The staff further agrees that the user must calculate plume rise separately and adjust the input to the ARCON96 code if it is determined that consideration of plume rise is appropriate. However, as stated in the response to Item 2 above, NUREG/CR-6331, Revision 1, "Atmospheric Relative Concentrations in Building Wakes," is a technical contractor report and is not an NRC policy document. Reviews by the NRC staff of licensee assessments using the NUREG/CR-6331 methodology are being performed on a case-by-case basis. The staff anticipates completion of its review of the Calvert Cliffs control room  $\chi/Q$  values by November 1998.
4. a) The staff stated in the SE that for the MSLB, BGE had assumed the accident had resulted in 1.35% of the fuel rods in the reactor experiencing clad failure. The SE had also stated that BGE's analysis had included in their assessment an iodine spike which resulted in the release of iodine from the fuel at a rate which was 500 times greater than the release rate necessary to maintain primary coolant at the 100-hour technical specification value of dose equivalent  $^{131}I$ .
- b) BGE indicated that no such spike was considered in the MSLB analysis because the MSLB was assumed to result in fuel failures and, consistent with Standard Review Plan (SRP) 15.1.5, Appendix A, no concurrent iodine spike is required to be considered when fuel failure is assumed to occur.
- c) The staff is in agreement with BGE's comment that it is inappropriate to include in the dose consequences assessment, the impact of a concurrent iodine spike in the calculation of the consequences of a MSLB accident when fuel failures are assumed to occur. It should be noted that the inclusion of this source had little impact upon the resultant doses. Its exclusion had no impact upon the exclusive area boundary (EAB) dose and resulted in an approximate reduction in the low-population zone (LPZ) and control room doses of 10%.

It should be noted that it is appropriate to include the concurrent iodine spike in the calculation of the dose consequences of the MSLB and SGTR in the establishment of the technical specification value for the 100-hour value for dose equivalent iodine in primary coolant. For that application, no fuel failure is assumed, iodine spiking is assumed to occur and the thyroid dose is calculated and a determination is made as to whether the 100-hour value for dose equivalent  $^{131}I$  results in acceptable doses or the technical specification value must be reduced.

5. a) The staff's SE states that in BGE's submittal to support the amendment requests two different masses were utilized for primary coolant. One value was assumed in the calculation of EAB doses and the other value was utilized in the calculation of the LPZ and control room operator doses. The staff's SE concluded that there was no basis for incorporating different values for the mass of primary coolant. First, the mass of water, once added to primary coolant, is fixed unless additional water is added. Changing the temperature affects water density but will not affect the mass of primary coolant. The mass of primary coolant can only be affected by the adding or removing of water. The staff noted that in the April 8, 1998 letter, the calculation of the mass of primary coolant appears to have been based upon a water density which is the average of the density at the operating temperature of 572.5 ° F and at the shutdown temperature of 300 ° F. The staff considers this density averaging calculation to lead

to an erroneous result. At the operating and shutdown temperatures, the mass of primary coolant will not change but the volume will.

- b) BGE indicated that the error which the staff was referring to implied that the licensee would not be allowed to credit the high-pressure safety injection (HPSI) or charging pump flow in their analysis. BGE indicated that following an MSLB, SGTR or a seized rotor event, the primary coolant system cools to 300 °F via steaming through the main steam piping room vent or the ADV. Occurring simultaneously is actuation of the HPSI or the charging pumps in order to maintain inventory in the primary coolant and to keep the core covered. BGE's response then continued with a description of the manner in which they calculated the mass of primary coolant.
- c) The staff has reviewed BGE's comment concerning the staff's SE. The staff believes the statement made in the SE remains accurate. The staff's point was the following. The primary coolant is added to the reactor at room conditions. Upon completion of this action, primary coolant consists of a given mass of liquid which is at room or ambient conditions. From startup until operating conditions are reached, primary coolant continues to have its temperature raised. When operating conditions are reached, the mass of liquid in the primary coolant remains the same as it was when the filling of the primary coolant was completed but the density of the coolant has changed as has the volume. BGE's analyses to support Amendments 228 and 202 and in the July 7, 1998 letter, to the staff BGE has indicated that when the reactor was cooled from operating conditions to 300 °F, this decrease in temperature caused a 25% increase in the mass of the primary coolant. The staff's point is that such a change in temperature cannot induce a change in mass.

Further, there is a given mass of primary coolant when the accident occurs. That value should be the same for all accidents. When the accident occurs, it is assumed that immediately radioactivity is released from the fuel to primary coolant. The activity in primary coolant is released to the environment. The quantity released will be a function of the activity level in primary coolant. The activity level varies with time and will increase or decrease depending upon whether additional water is added to or subtracted from primary coolant and whether additional activity is released from the fuel to primary coolant.

The staff believes that BGE has misinterpreted the SE. Nothing in the staff's SE disallowed the variation of primary coolant mass with time but such variation needed to be accounted for in the calculations. The manner in which the licensee varied the primary coolant for Calvert Cliffs was inappropriate. They assumed that the mass changed as a result of a temperature change which is erroneous. The staff has never stated that the mass of primary coolant could not change over the course of the accident nor has the staff stated that the mass of flow liquid injected by such potential sources as the HPSI or charging pump flow could not be included. In fact, it should be clear from a review of the staff's SE that the incorporation of such mass liquid was not precluded.

- 6. a) In the staff's SE, it was noted that the mass which BGE had utilized for the LPZ and control room calculations had neglected to account for the reduction in volume due to steam generator tube plugging although they accounted for this reduction in volume in

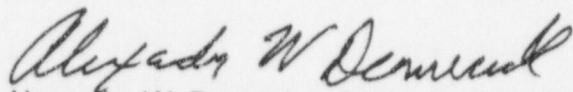
the EAB calculations. Steam generator tube plugging results in a reduction in primary coolant volume of approximately 7%.

- b) BGE indicated that the calculation of primary coolant mass at the operating conditions and at 300 °F had included the reduced volume resulting from tube plugging but BGE had utilized the more conservative value of 457,437 lbs<sub>m</sub>.
  - c) As noted in the response in Item 5 above, the staff is not in agreement with the manner in which the licensee calculated the mass of primary coolant for the MSLB, SGTR and seized rotor accidents. BGE indicated that for the control room and LPZ doses, the mass of primary coolant assumed in the calculation of the consequences of these accidents was 457, 437 lb<sub>m</sub>. This manner in which this value was calculated is shown on page 3 of Attachment 2 of BGE's April 8, 1998 letter. As seen from that calculation, the reduction in steam generator tube plugging volume was not taken into account.
7. a) The staff stated that their assessment included failed fuel and the contribution from a pre-existing spike or an accident-initiated spike.
- b) BGE indicated that SRP 15.3.3 -15.3.4 does not assume a concurrent iodine spike if fuel failures are anticipated to occur.
  - c) The staff is in agreement with BGE's comment that it is inappropriate to include the impact of a concurrent iodine spike in the calculation of the consequences for SGTR (SRP 15.6.3) and a MSLB (SRP 15.1.5) accidents when fuel failures are assumed to occur. However, for the seized rotor accident (SRP 15.3.3 - 15.3.4), it is very clear from Item IV(f) of that SRP that the staff expects an analysis to include the consequences of coincident iodine spike. However, whereas for the MSLB and the SGTR, the coincident iodine spike analysis acceptance criteria is a small fraction of Part 100 (30 rem thyroid); for the seized rotor, which usually entails fuel damage, dose acceptance criteria is the full Part 100 value (300 rem thyroid).

It should be noted that it is appropriate to exclude the fuel failures and to include the concurrent iodine spike in the calculation of the dose consequences of the MSLB and SGTR for the establishment of the limiting technical specification value for dose equivalent iodine in reactor coolant. For this application, no fuel failure is assumed and the thyroid dose is calculated at the EAB, LPZ and control room.

In addition to the above comments, BGE's letter also provided two clarifying items of information. First, BGE indicated that the staff's values for atmospheric dispersion ( $\chi/Q$ ) at the EAB and LPZ locations should have been  $1.3 \times 10^{-4}$  and  $3.3 \times 10^{-5}$  respectively rather than the staff values of  $1.8 \times 10^{-4}$  and  $5.6 \times 10^{-5}$ , respectively. The  $\chi/Q$  values utilized by the staff are the same values which have been utilized by the staff in the original SE for the Calvert Cliffs when the operating license was issued. The licensee's second comment was that the control room recirculation flow should have been  $2,000 \text{ cfm} \pm 10\%$  rather than  $1,800 \text{ cfm} \pm 10\%$  as indicated in the staff table to the SE. The staff is in agreement with this comment. Incorrect information was conveyed. The table should indicate that the control room recirculation flow rate is  $2,000 \text{ cfm} \pm 10\%$  and that  $1,800 \text{ cfm}$  was utilized in the staff's calculations.

Sincerely,



Alexander W. Dromerick, Senior Project Manager  
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Office of Nuclear Reactor Regulation

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