

PMVogtleCOLPEm Resource

From: Sebrosky, Joseph
Sent: Thursday, November 05, 2009 3:43 PM
To: 'andrea sterdis'; 'erg-xl@cox.net'; 'richard.grumbir@excelservices.com';
'bobhirman@live.com'; 'Spink, Thomas E'; Amy Aughtman; Wes Sparkman
Cc: Joshi, Ravindra; Anderson, Brian; Hughes, Brian; Simms, Tanya; Coffin, Stephanie;
PMBelCOL PEmails; Haggerty, Sharon; Patel, Chandu; Goetz, Sujata; Huang, Jason;
Snyder, Amy; Habib, Donald; Comar, Manny; McGovern, Denise; VogtleCOL Resource
Subject: Bellefonte chapter 15 ser open items
Attachments: bellefonte chapter 15 ser with open items.doc

To all,

As you know, the staff will not issue Chapter 15 of the Bellefonte safety evaluation report (SER) with open items until Chapter 15 for the Westinghouse design certification amendment is issued. However, in order to expedite resolution of the Bellefonte Chapter 15 SER open items, the open items have been extracted and are contained in the attached document. The items will be tracked in the erai database. Temporarily a standard or site-specific classification has been assigned to each rai in the erai system based on the staff's assessment of whether the issue will apply to all COL applications or just to the Bellefonte COL application, respectively. The standard or site-specific classification can be changed based on feedback from the design centered working group.

If you have any questions please let me know.

Sincerely,

Joe Sebrosky
Senior Project Manager
NRO/DNRL/NWE1
301-415-1132

Hearing Identifier: Vogtle_COL_Public
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From: Sebrosky, Joseph

Created By: Joseph.Sebrosky@nrc.gov

Recipients:

"Joshi, Ravindra" <Ravindra.Joshi@nrc.gov>
Tracking Status: None
"Anderson, Brian" <Brian.Anderson@nrc.gov>
Tracking Status: None
"Hughes, Brian" <Brian.Hughes@nrc.gov>
Tracking Status: None
"Simms, Tanya" <Tanya.Simms@nrc.gov>
Tracking Status: None
"Coffin, Stephanie" <Stephanie.Coffin@nrc.gov>
Tracking Status: None
"PMBelCOL PEmails" <PMBelCOL.PEmails@nrc.gov>
Tracking Status: None
"Haggerty, Sharon" <Sharon.Haggerty@nrc.gov>
Tracking Status: None
"Patel, Chandu" <Chandu.Patel@nrc.gov>
Tracking Status: None
"Goetz, Sujata" <Sujata.Goetz@nrc.gov>
Tracking Status: None
"Huang, Jason" <Jason.Huang@nrc.gov>
Tracking Status: None
"Snyder, Amy" <Amy.Snyder@nrc.gov>
Tracking Status: None
"Habib, Donald" <Donald.Habib@nrc.gov>
Tracking Status: None
"Comar, Manny" <Manny.Comar@nrc.gov>
Tracking Status: None
"McGovern, Denise" <Denise.McGovern@nrc.gov>
Tracking Status: None
"VogtleCOL Resource" <VogtleCOL.Resource@nrc.gov>
Tracking Status: None
"andrea sterdis" <alsterdis@tva.gov>
Tracking Status: None
"erg-xl@cox.net" <erg-xl@cox.net>
Tracking Status: None
"richard.grumbir@excelservices.com" <richard.grumbir@excelservices.com>
Tracking Status: None
"bobhirman@live.com" <bobhirman@live.com>
Tracking Status: None
"Spink, Thomas E" <tespink@tva.gov>
Tracking Status: None
"Amy Aughtman" <agaughtm@southernco.com>

Tracking Status: None
"Wes Sparkman" <wasparkm@southernco.com>
Tracking Status: None

Post Office: HQCLSTR02.nrc.gov

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Chapter 15 Safety Evaluation Report Open Items
Bellefonte Units 3 and 4
Tennessee Valley Authority
Docket No. 52-014 and 52-015
SRP Section: 15 - Introduction - Transient and Accident Analyses
Application Section: 15.0-1

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

RAI 15-1

AP1000 COL Information Item- Summary of Application

· COL 15.0-1

This COL information item was provided in a response to a request for additional information (RAI) related to the AP1000 design certification amendment review. Specifically, in its response dated May 6, 2009, (Agencywide Documents Access and Management System (ADAMS) Accession Number ML091310260) to NRC RAI AP1000 DCD RAI-SRP15.0-SRSB-02, Westinghouse proposed COL Information Item 15.0-1 to provide documentation of the plant calorimetric uncertainty methodology. It should be noted that the BLN applicant has not yet proposed this item. RAI-SRP15.0-SRSB-02 noted that the AP1000 DCD assumes a 2 percent power uncertainty for the initial condition for most accidents that are not departure from nucleate boiling limited. However, a 1 percent power uncertainty is assumed for the initial reactor power for the large-break loss-of-coolant accident (LOCA) in DCD Section 15.6.5.4A, as well as the mass and energy release calculation in DCD Sections 6.2.1.3 and 6.2.1.4. In response to this RAI, Westinghouse proposed a new COL information item to be included in the AP1000 DCD Section 15.0.15 (Revision 18). COL Information Item 15.0-1 states that:

Following selection of the actual plant operating instrumentation and calculation of the instrumentation uncertainties of the operating plant parameters prior to fuel load, the Combined License holder will calculate the primary power calorimetric uncertainty. The calculations will be completed using an NRC acceptable method and confirm that the safety analysis primary power calorimetric uncertainty bounds the calculated values.

AP1000 COL Information Item - Technical Evaluation

· COL 15.0-1

Although Westinghouse has proposed COL Information Item 15.0-1, the BLN application does not address this item. Therefore, the staff cannot complete its evaluation until this information is provided. This is **Open Item 15.0-1**.

RAI 15-2

Tier 2 Departure- Summary of Application

The applicant proposed the following Tier 2 departure (DEP) from the AP1000 DCD:

- BLN DEP 2.3-1

In its February 2, 2009, response to RAI 15.00.3-1, Tennessee Valley Authority (TVA) proposed BLN DEP 2.3-1 associated with the exclusion area boundary (EAB) atmospheric dispersion value. In this departure and associated exemption request, TVA notes that Revision 17 of the AP1000 DCD changed the EAB atmospheric dispersion (χ/Q) value to $5.1E-04 \text{ sec/m}^3$. Since the site specific χ/Q site parameter at the EAB of $5.85E-04$ is greater than the AP1000 DCD value, a plant-specific dose consequence analysis is necessary to determine the doses at the EAB. The departure and exemption request included a reduction in some conservatisms associated with the dose consequence analysis. The conservatisms that were removed include:

- a reduction of the calorimetric power uncertainty to 1 percent (from 2 percent previously used in the dose analysis)
- removal of the excess conservatism for fuel cycle variations resulting in an approximate 4 percent reduction in the source term
- the containment leak rate used in the LOCA analysis was reduced from 0.10 wt. percent/day to 0.09 wt. percent/day

The NRC staff evaluation of the reduction of the calorimetric power uncertainty to 1 percent is contained in Section 15.0.4 of this report. The evaluation of the other conservatisms and the departure and exemption associated with the request can be found in Section 15.9 of this report.

Tier 2 Departure - Technical Evaluation

- BLN DEP 2.3-1

The applicant's response to RAI 15.00.3-1 does not describe the instrumentation or methodology to support the 1 percent power uncertainty. To resolve this issue the staff needs the following information:

- a. A description of the mechanism, such as the AP1000 DCD and inspections, tests, analyses, and acceptance criteria (ITAAC) or a COL information item, by which the information will be provided to support the claimed 1 percent power measurement.
- b. The following information should be provided to support the claimed 1 percent power measurement uncertainty:

(1) A description of the instrumentation and methodology used for the main feedwater flow measurement and calorimetric power measurement.

(2) Either of the following:

A. A reference to the NRC approval of the main feedwater and power measurement methodology, instrumentation, and associated uncertainties.

Or

B. A detailed description of the analyses of the main feedwater flow measurement and power measurement uncertainties, respectively. The description should include information such as:

- 1) the parameters measured, e.g., feedwater flow rate, pressure, and inlet and outlet temperatures;
- 2) the instrument string, including applicable sensors or transducers, process rack, analog/digital converter, process computer, and readout devices, etc., for each parameter measured;
- 3) the accuracy of allowance associated with each instrument component, such as sensor reference, calibration, and measurement accuracies, respectively; rack calibration and measurement accuracies; sensor pressure and temperature effects; rack pressure and temperature effects; drift; process measurement accuracy; instrument range, span, and operating limits, etc.;
- 4) the methodology for combining uncertainties, allowances, or errors of the instrument components associated with each parameter to arrive at the overall uncertainty of each measured parameter; and
- 5) the methodology used to arrive at the total uncertainties for the main feedwater flow rate and reactor thermal power, respectively.

This is **Open Item 15.0-2**.

Bellefonte Units 3 and 4
Tennessee Valley Authority
Docket No. 52-014 and 52-015
SRP Section: 15.04.06 - Inadvertent Decrease in Boron Concentration in the Reactor
Coolant (PWR)
Application Section: 15.4

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

RAI 15.04.06-1

Generic Letter 85-05, Inadvertent Boron Dilution - Summary of Application

The applicant provided additional information in Standard (STD) COL 1.9-2 to address Bulletins and Generic Letters (GLs). The Bulletins and GLs provided in this AP1000 COL information item included GL 85-05, "Inadvertent Boron Dilution Events." In Revision 0 of the BLN COL FSAR, Table 1.9-204 stated that additional information regarding GL 85-05 was contained in FSAR Section 5.2.4.9. In Revision 1 of the BLN COL FSAR, the applicant removed the reference to GL 85-05 in FSAR Table 1.9-204. The applicant noted in a January 27, 2009, letter (ADAMS Accession Number ML090290127) that the basis for removal of the information was that the DCD evaluation was sufficient.

Generic Letter 85-05 - Technical Evaluation

GL 85-05, "Inadvertent Boron Dilution Events," informed each PWR licensee of the NRC staff position resulting from the evaluation of Generic Issue 22, "Inadvertent Boron Dilution Events," and urges each licensee to ensure that its plants have adequate protection against boron dilution events. GL 85-05 was evaluated as a part of the AP1000 DCD review, and the evaluation was documented in NUREG-1793, Chapter 20. GL 85-05 was resolved based on the analyses of inadvertent boron dilution events described in AP1000 DCD Section 15.4.6, which show that in all modes of operation the inadvertent boron dilution is prevented or responded to by automatic functions, or sufficient time is available for operator action to terminate the transient. The staff also stated that COL applicants should develop plant-specific emergency operating procedures (EOPs) that address the boron dilution events. The development of EOPs is identified as COL Information Item 13.5-1, Plant Procedures, which is addressed in BLN FSAR Section 13.5. Therefore, based on the above, the applicant needs to reinsert a reference to GL 85-05 in FSAR Table 1.9-204 and provide a cross reference to COL Information Item 13.5-1. This is **Open Item 15.4-1**.

Bellefonte Units 3 and 4
Tennessee Valley Authority
Docket No. 52-014 and 52-015
SRP Section: 02.04.13 - Accidental Releases of Radioactive Liquid Effluents in Ground
and Surface Waters
Application Section: 15.7

QUESTIONS for Health Physics Branch (CHPB)

RAI 02.04.13-8

AP1000 COL Information Item - Summary of Application

· BLN COL 15.7-1

The applicant provided additional information in BLN COL 15.7-1 to address COL Information Item 15.7-1, "Consequences of Tank Failures," described in Section 15.7.6 of the AP1000 DCD. The applicant added the following paragraph at the end of DCD Section 15.7.6:

This COL item is addressed in Section 2.4.13.

AP1000 COL Information Item - Technical Evaluation

· BLN COL 15.7-1

The applicant addresses the consequence of a liquid waste tank failure in BLN COL FSAR Section 2.4.13. The staff's evaluation of liquid waste tank failure is contained in Sections 11.2, "Liquid Waste Management Systems," and 2.4.13, "Accidental Release of Radioactive Liquid Effluents in Ground and Surface Waters," of this report. As noted in Section 2.4 of this report, the staff stopped the hydrology review and will not restart it until after TVA satisfactorily passes an inspection and when reviewer resources are available. The resolution of hydrologic engineering issues is identified as Open Item 2.4-1. The staff cannot come to a conclusion regarding radioactive release from a subsystem or component until Open Item 2.4-1 is resolved. This is **Open Item 15.7-1**.

Bellefonte Units 3 and 4
Tennessee Valley Authority
Docket No. 52-014 and 52-015
SRP Section: 15.00.03 - Design Basis Accidents Radiological Consequence Analyses
for Advanced Light Water Reactors
Application Section: 15

QUESTIONS for Siting and Accident Conseq Branch (RSAC)

RAI 15.00.03-2

Tier 2 Departure and Exemption Request - Summary of Application

The applicant proposed the following Tier 2 departures from the AP1000 DCD:

- BLN DEP 2.3-1

In a supplemental response to an RAI dated February 2, 2009, (ADAMS Accession Number ML090350443), the applicant requested a departure and an exemption from the AP1000 DCD, Revision 17 because the BLN site cannot meet the EAB x/Q values in the AP1000 DCD, Revision 17. To support the departure and exemption request, TVA completed a site specific calculation to demonstrate that the NRC dose requirements were met at the EAB. This site-specific calculation took credit for a reduction in the fission product source term by applying the following two assumptions:

1. Reduction in the containment leak rate used in the LOCA analysis from 0.10 wt. percent/day to 0.09 wt. percent/day (exemption from the AP1000 generic technical specifications)
2. Reduction of the calorimetric power uncertainty to the AP1000 certified value of 1 percent (from 2 percent previously used in the dose analysis) and removal of the excess conservatism for fuel cycle variations resulting in an approximate 4 percent reduction in the core source term.

The exemption request related to the AP1000 DCD EAB X/Q site parameter involves exemptions to the following requirements:

1. Containment leak rate technical specification.

TVA requested an exemption from the requirement of 10 CFR Part 52, Appendix D, Subsection III.B to comply with the requirements of the Generic Technical Specifications (TS). Specifically, TVA requested an exemption from Generic TS 5.5.8.c and proposed a more stringent containment leakage rate TS of 0.09 wt. percent/day as opposed to the Generic TS limit of 0.10 wt. percent/day.

2. AP1000 DCD Tier 1 EAB x/Q site parameter

TVA requested an exemption from the requirement of 10 CFR Part 52, Appendix D, Subsection III.B to comply with the requirements contained in Tier 1 of the AP1000 DCD. Specifically, TVA requested an exemption from AP1000 DCD Tier 1, Table 5.0-1, Site Parameter for the Site (Exclusion Area) Boundary (0- 2 hour) atmospheric dispersion factor. In its exemption request TVA proposed a site-specific dose consequence analysis using a site-specific EAB χ/Q .

Tier 2 Departures and Exemption Request - Technical Evaluation

- BLN DEP 2.3-1, relating to EAB x/Q site parameter

In BLN COL FSAR, Revision 0, the applicant referenced the AP1000 DCD, Revision 16. The AP1000 DCD, Revision 16 used an assumption (i.e., aerosol impaction in the containment leakage pathways) which the NRC staff found was not technically justified and, therefore, rejected in evaluating the radiological consequence analysis for the postulated LOCA. In addition, the site-specific x/Q values for the LOCA shown in BLN

FSAR, Revision 0, Table 2.0-201, exceeded the x/Q values for the EAB referenced in the AP1000 DCD, Revisions 15 and 17 (it met the x/Q values in Revision 16).

Consequently, in RAI 15.00.03-01, the staff requested that the applicant provide the site-specific DBA radiological consequence analysis that does not make use of the rejected assumption for the EAB, LPZ, and control room. In response to RAI 15.00.03-01, the applicant acknowledged in its submittal dated February 2, 2009, that the site-specific x/Q values for the EAB for the LOCA shown in BLN FSAR, Revision 0, Table 2.0-201, exceeded the x/Q values for the EAB referenced in the AP1000 DCD, Revisions 15 and 17 and, therefore, the applicant provided a new radiological consequence analysis for the EAB for the postulated LOCA to demonstrate that it meets the dose evaluation factors set forth in 10 CFR 52.79(a)(1)(vi).

In its new DBA radiological consequence analysis, the applicant proposed the following two reductions in conservatisms from the AP1000 DCD, Revision 17 to reduce the core fission product source term:

1. Containment Leak Rate

The applicant proposed a reduction of the containment leak rate used in the radiological consequence analysis for the postulated LOCA for the EAB in the AP1000 DCD, Revision 17, Chapter 15 from 0.1 weight percent (w/o) per day to 0.09 w/o per day. NUREG-0800 Section 6.2.6, "Containment Leakage Testing," states that the minimum acceptable design containment leakage rate should not be less than 0.1 percent per day. It further stated that nuclear power plant leakage rate testing experience shows that a design leakage rate of 0.1 percent per day provides adequate margin above typically measured containment leakage rates and is compatible with current leakage rate test methods and test acceptance criteria. Therefore, this proposal is an exception to the NUREG-0800 guidance. The staff's evaluation of the reduction in the containment leak rate can be found in Section 6.2 of this report.

2. Reactor Core Fission Product Source Term

In the AP1000 DCD Chapter 15A, Revision 17, Westinghouse used the core source term at shutdown for an assumed three-region equilibrium cycle at end of life after continuous operation at 2 percent above (3468 megawatt thermal [MWt]) the design core power of 3400 MWt, stating that use of 2 percent power uncertainty is conservative and that the main feedwater calorimetric flow measurement supports a 1 percent calorimetric power uncertainty. The applicant proposed use of 1 percent calorimetric power uncertainty for the radiological consequence analysis for the postulated LOCA in the BLN FSAR, Chapter 15, Revision 1. The staff's evaluation of the use of a 1 percent calorimetric power uncertainty can be found in section 15.0.4 of this report.

The applicant stated that a 4 percent conservatism was originally included in the AP1000 core design calculations to provide margin for uncertainties in the predicted core designs. The applicant stated that the core source term calculations have been revised for the first three core loadings and an equilibrium core cycle that will be utilized for BLN Units 3 and 4. The applicant further stated that it

refined the site-specific core source term based on a more detailed evaluation of the first three core loadings and an equilibrium core cycle reduces the uncertainty in the core design, so that the original 4 percent design conservatism is not necessary. The applicant proposed to remove this 4 percent conservatism. The NRC staff has not yet completed its evaluation of the removal of this 4 percent conservatism. **This is Open Item 15.9-1.**

RAI 15.00.03-3

Tier 2 Departure and Exemption Request - Summary of Application

The applicant proposed the following Tier 2 departures from the AP1000 DCD:

- **BLN DEP 2.3-1**

In a supplemental response to an RAI dated February 2, 2009, (ADAMS Accession Number ML090350443), the applicant requested a departure and an exemption from the AP1000 DCD, Revision 17 because the BLN site cannot meet the EAB x/Q values in the AP1000 DCD, Revision 17. To support the departure and exemption request, TVA completed a site specific calculation to demonstrate that the NRC dose requirements were met at the EAB. This site-specific calculation took credit for a reduction in the fission product source term by applying the following two assumptions:

1. Reduction in the containment leak rate used in the LOCA analysis from 0.10 wt. percent/day to 0.09 wt. percent/day (exemption from the AP1000 generic technical specifications)
2. Reduction of the calorimetric power uncertainty to the AP1000 certified value of 1 percent (from 2 percent previously used in the dose analysis) and removal of the excess conservatism for fuel cycle variations resulting in an approximate 4 percent reduction in the core source term.

The exemption request related to the AP1000 DCD EAB x/Q site parameter involves exemptions to the following requirements:

1. Containment leak rate technical specification.

TVA requested an exemption from the requirement of 10 CFR Part 52, Appendix D, Subsection III.B to comply with the requirements of the Generic Technical Specifications (TS). Specifically, TVA requested an exemption from Generic TS 5.5.8.c and proposed a more stringent containment leakage rate TS of 0.09 wt. percent/day as opposed to the Generic TS limit of 0.10 wt. percent/day.

2. AP1000 DCD Tier 1 EAB x/Q site parameter

TVA requested an exemption from the requirement of 10 CFR Part 52, Appendix D, Subsection III.B to comply with the requirements contained in Tier 1 of the AP1000 DCD. Specifically, TVA requested an exemption from AP1000 DCD Tier 1, Table 5.0-1, Site Parameter for the Site (Exclusion Area) Boundary (0- 2 hour) atmospheric dispersion factor. In its exemption request TVA proposed a site-specific dose consequence analysis using a site-specific EAB x/Q.

Tier 2 Departures and Exemption Request - Technical Evaluation

BLN DEP 2.3-1, relating to EAB x/Q site parameter

As stated above the applicant also requested an exemption from: 1) the containment leak rate technical specification contained in the AP1000 Generic TSs; and 2) the AP1000 DCD Tier 1 EAB χ/Q site parameter. The proposed reduction in core fission product source term in TVA's site-specific analysis supports this exemption request. Pursuant to 10 CFR 52.7, "Specific Exemption," the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 52. 10 CFR 52.7 further states that the Commission's consideration will be governed by 10 CFR 50.12, which states that an exemption may be granted when: (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Special circumstances are present as specified in 10 CFR 50.12(a)(2).

In its response to RAI 15.00.03-1 TVA stated that special circumstance 10 CFR 50.12(a)(2)(ii) was present since the x/Q site parameter in Tier 1 of the DCD is not necessary to achieve the underlying purpose of the rules. TVA stated that the site-specific analysis using the assumptions crediting a reduction in the fission product source term demonstrates that the higher site-specific χ/Q does not affect the design. In addition, TVA stated that special circumstance 10 CFR 50.12(a)(2)(iii) was also present since compliance would necessitate expanding the EAB, which would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted. In its response to RAI 6.2.6-2 TVA amended the special circumstances it was citing to only reference 10 CFR 50.12(a)(2)(ii).

The NRC staff is unable to make the findings required to grant the exemption because of the following:

1. Open items associated with the reductions in conservatisms from the AP1000 DCD, Revision 17 to reduce the core fission product source term have not been resolved (e.g., Open Item 15.0-2, and 15.9-1). These issues must be resolved in order for the staff to determine that the exemption will not present an undue risk to public health and safety.
2. The staff has not completed its evaluation as to whether the special circumstances in 10 CFR 50.12(a)(2) exist.

The staff's evaluation of the EAB x/Q exemption request in accordance with the requirements of 10 CFR 50.12 is **Open Item 15.9-2**.

RAI 15.00.03-4

AP1000 COL Information Item

- Site Specific Offsite, Control Room, and TSC Atmospheric Dispersion Factors

The DBA radiological consequences analyses in the AP1000 DCD, Revision 17 used the hypothetical set of atmospheric dispersion factors (x/Q values), in place of site-specific values. The x/Q values are the only input to the DBA radiological consequences analyses that are impacted by the site characteristics. The estimated offsite DBA dose calculated for a particular site is impacted by the site characteristics through the calculated x/Q input to the analysis and the resulting dose would be different from that calculated generically for the AP1000 design. All other inputs and assumptions in the radiological consequence analyses remain the same as in the DCD. Smaller x/Q values are associated with greater dilution capability, resulting in lower radiological doses. When comparing a DCD site parameter x/Q value and a site characteristic x/Q value, the site is acceptable for the design if the site characteristic x/Q value is smaller than the site parameter x/Q value. Such a comparison shows that the site has better dispersion characteristics than those required by the reactor design.

The applicant discussed the BLN site-specific offsite, TSC, and control room x/Q values in the FSAR, Revision 1, Chapter 2, Section 2.3.4, "Short-Term Diffusion Estimates," and provided the BLN site-specific offsite and control room x/Q values in the FSAR, Revision 1, Table 2.3-319, "BLN Offsite Dispersion x/Q Values," and Table 2.3-321, "BLN Control Room x/Q Values." Other than the EAB x/Q value, the applicant demonstrated that the BLN site-specific LPZ x/Q values for each time-averaging period are less than the design reference offsite x/Q values used by the AP1000 DCD, Revision 17, for the radiological consequences analyses for each of the DBAs. Since the result of the radiological consequences analysis for a DBA during any time period of radioactive material release from the plant is directly proportional to the x/Q for that time period, and because the BLN site-specific LPZ x/Q values are less than the comparable AP1000 DCD, Revision 17 design reference LPZ x/Q values for all time periods and all accidents, the BLN site-specific total LPZ dose for each DBA is less than the AP1000 DCD, Revision 17 generic total dose for each DBA.

The staff is currently evaluating the BLN site-specific offsite, TSC, and control room x/Q values proposed by the applicant; the staff's findings and evaluation are provided in Section 2.3.4, "Short-Term Diffusion Estimates," of this SER. As noted in Section 2.3.4 of this report there are several open items associated with the review of short-term diffusion estimates. The staff can not complete its radiological review until these open items are resolved. **This is Open Item 15.9-3.**