

June 22, 2006

Mr. David Hinds, Manager, ESBWR  
General Electric Company  
P.O. Box 780, M/C L60  
Wilmington, NC 28402-0780

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 39 RELATED TO  
ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Hinds:

By letter dated August 24, 2005, General Electric Company (GE) submitted an application for final design approval and standard design certification of the economic simplified boiling water reactor (ESBWR) standard plant design pursuant to 10 CFR Part 52. The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed design.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter. This RAI concerns the "Engineered Safety Features," Chapter 6, and "Conduct of Operations," Chapter 13, of Tier 2 of the ESBWR design control document. The RAI regarding Chapter 6, was sent to you via electronic mail on May 19, 2006. The RAIs were discussed with you during a telecon on June 12, 2006. You agreed to respond to this RAI by July 17, 2006. The RAI regarding Chapter 13, was sent to you via electronic mail on May 31, 2006. You did not request a telecon to discuss this RAI. You agreed to respond to this RAI by July 14, 2006.

If you have any questions or comments concerning this matter, you may contact me at (301) 415-207 or [lnq@nrc.gov](mailto:lnq@nrc.gov), Amy Cubbage at (301) 415-42875 or [aec@nrc.gov](mailto:aec@nrc.gov), Lawrence Rossbach at (301) 415-2863 or [lwr@nrc.gov](mailto:lwr@nrc.gov), or Martha Barillas at (301) 415-4115 or [mcb@nrc.gov](mailto:mcb@nrc.gov).

Sincerely,

*/RA/*

Lauren Quiñones, Project Manager  
ESBWR/ABWR Projects Branch  
Division of New Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 52-0010

Enclosure: As stated

cc: See next page

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ACCESSION NO. ML061720094

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|--------|------------|------------|
| OFFICE | NRBA/PM    | NRBA/BC    |
| NAME   | LQuinones  | ACubbage   |
| DATE   | 06/22/2006 | 06/22/2006 |

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Distribution for DCD RAI Letter No. 39 dated June 22, 2006

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**REQUESTS FOR ADDITIONAL INFORMATION (RAIs)  
ESBWR DESIGN CONTROL DOCUMENT (DCD) CHAPTER 6**

| RAI Number | Reviewer    | Question Summary  | Full Text   |
|------------|-------------|---|---|
| 6.2-75     | Pulsipher J | Explain why Appendix J exemption is required for MSIV leakage rate testing. | <p>DCD Tier 2, Section 6.2.6.1.1 mentions, without explanation or justification, that, for containment integrated leakage rate tests (ILRTs or Type A tests), main steam isolation valve (MSIV) leakage rates will be excluded from <math>L_a</math>, the maximum allowable containment leakage rate. Further, in DCD Tier 2 Chapter 16, Technical Specifications, there are several mentions of special treatment of MSIV leakage rates (SR 3.6.1.3.8, SR 3.6.1.3.10). However, 10 CFR Part 50, Appendix J, Option A or Option B, requires MSIV leakage rates to be included in <math>L_a</math>. An exemption from Appendix J would be required to exclude MSIV leakage rates from <math>L_a</math>.</p> <p>In addition to this exemption, many operating BWRs have obtained exemptions from including MSIV rates in the sum of local leakage rates (Type B and Type C tests). Many operating BWRs have also obtained exemptions from the requirement to perform Type C tests of MSIVs with a test pressure of <math>P_a</math>, the calculated peak containment internal pressure related to the design basis loss-of-coolant accident (LOCA). Standard Review Plan (SRP) 6.2.6, Rev. 2, July 1981, states that, for MSIV Type C tests, a test pressure of less than <math>P_a</math> and the test acceptance criteria should be justified and included in the plant TS.</p> <p>In the DCD Tier 2, provide and justify the proposed test pressure and acceptance criteria for the MSIVs, and discuss the proposed treatment of the measured leakage rates, in relation to their inclusion in the Type A measured leakage rate and the sum of the Type B and Type C leakage rates. Further, provide and justify any needed exemption requests from Appendix J requirements.</p> |

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| 6.2-76 | Pulsipher J | Correct statements in DCD Tier 2, Section 6.2.6 regarding reporting requirements.        | <p>DCD Tier 2, Section 6.2.6 contains numerous references to Appendix J reporting requirements. However, all requirements to make reports to the NRC were eliminated from Appendix J (in what is now known as Option A) in 1995, and Option B, promulgated in 1995, also contains no reporting requirements, other than referring to the requirements contained in 10 CFR 50.72 and 10 CFR 50.73.</p> <p>Correct these statements in Section 6.2.6 of the DCD.</p>  |
| 6.2-77 | Pulsipher J | Replace " $P_{ac}$ " with " $P_a$ " in DCD Tier 2, Section 6.2.6.                        | <p>DCD Tier 2, Section 6.2.6 uses the term <math>P_{ac}</math> instead of <math>P_a</math> for the calculated peak containment internal pressure related to the design basis loss-of-coolant accident. Although there is a historical basis for the use of <math>P_{ac}</math>, <math>P_a</math> is used today in most documents, including Options A and B of Appendix J, in standard technical specifications, and in the proposed technical specifications in DCD Tier 2 Chapter 16.</p> <p>In the interests of clarity and consistency, replace <math>P_{ac}</math> with <math>P_a</math> in the DCD.</p> |
| 6.2-78 | Pulsipher J | Correct a typographical error in DCD Tier 2, Section 6.2.6: "Below" should be "bellows." | <p>In DCD Tier 2, Section 6.2.6, second paragraph, second bullet (General Design Criterion 53), the word "below" should be "bellows." Correct this error in the DCD.</p>  |
| 6.2-79 | Pulsipher J | Add ILRT pressure stabilization criteria for Option B in DCD Tier 2, Section 6.2.6.1.1.  | <p>In DCD Tier 2, Section 6.2.6.1.1, second paragraph, second bullet, "[ILRT] Pressure Stabilization Phase," the discussion is appropriate for Option A of Appendix J. However, the requirements associated with Option B of Appendix J, through ESBWR's commitment to conform to Regulatory Guide (RG) 1.163 through proposed Technical Specification 5.5.9, are more elaborate.</p> <p>Expand the discussion in the DCD to address the Option B requirements.</p>   |

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| 6.2-80 | Pulsipher J | Justify Pre-operational ILRT duration of less than 24 hours. | <p>In DCD Tier 2 Section 6.2.6.1.1, second paragraph, third bullet, “[Pre-operational] Integrated Leakage Rate Test Phase,” states that a test duration of less than 24 hours may be acceptable if it can be demonstrated that the leakage rate can be accurately determined during the shorter test period. For a pre-operational ILRT, this is generally prohibited. Under Option B of Appendix J, a 24-hour minimum duration is required by ESBWR’s commitment to conform to RG 1.163 through Technical Specification 5.5.9. RG 1.163 endorses ANSI/ANS-56.8-1994, which states, in section 5.8.1(3), “The Type A duration shall be at least 24 hours for a preoperational test...” In a similar way, Appendix J, Option A, section III.A.3.(a) states that, for the Mass Point Method, the test duration of any Type A test must be at least 24 hours. For the rarely-used Total Time and Point-to-Point methods, one is required to conform to N45.4-1972, which states, in section 7.6, “If it can be demonstrated to the satisfaction of those responsible for the acceptance of the containment structure that the leakage rate can be accurately determined during a shorter test period, the agreed-upon shorter period may be used.”</p> <p>The only short-duration methodology which the NRC has accepted is Bechtel Topical Report BN-TOP-1, Revision 1, “Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants,” dated November 1, 1972. However, this methodology is rarely used today.</p> <p>The staff suggests that GE delete the last sentence in the third bullet. Alternately, add to the DCD a full explanation of the restrictions on the use of test durations of less than 24 hours.</p> |
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| 6.2-81 | Pulsipher J | Correct an inconsistency for the ILRT verification test, $\pm 0.25\%$ should be $\pm 0.25 L_a$ . | <p>In DCD Tier 2, Section 6.2.6.1.1, under the heading “Acceptance Criteria,” second bullet, there is the following statement concerning the ILRT verification test: “The measurements are acceptable if the correlation between the verification test data and ILRT data demonstrates an agreement within <math>\pm 25\%</math>.” The correct figure is <math>\pm 0.25 L_a</math>, in accordance with section III.A.3.(b) of Option A of Appendix J and section 5.9.3 of ANSI/ANS-56.8-1994 for Option B of Appendix J.</p> <p>Correct this error in the DCD.</p>  |
| 6.2-82 | Pulsipher J | Add Option B ILRT acceptance criteria to the DCD.  | <p>In DCD Tier 2, Section 6.2.6.1.1, under the heading “Acceptance Criteria,” the third bullet discusses actions to take during an ILRT if excessive leakage occurs through locally testable penetrations or isolation valves to the extent that it would interfere with satisfactory completion of the test. The third sentence states: “The sum of the local leakage rates and the UCL shall be less than 75% of the maximum allowable leakage, <math>L_a</math>.” This is consistent with Option A requirements, but more conservative than Option B requirements. Option B guidelines define a “performance leakage rate” for determining the success of an ILRT for the purpose of determining the future ILRT schedule (see NEI 94-01, Revision 0, section 8.0). The performance leakage rate is generally less than the Option A as-found leakage rate, meaning that a test which would have failed under Option A usually passes under Option B, and Option B test frequencies usually are not increased as they would be under Option A.</p> <p>If the ESBWR intent is to use the Option B approach described above, provide an appropriate revision to this section of the DCD.</p> |

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| 6.2-83 | Pulsipher J | Define the Option A ILRT frequency; must be 3 tests in 10 years. | <p>The response to NRC RAI 6.2-3 provides a revision to the first two paragraphs of DCD Tier 2, Section 6.2.6.1.2, to be made as part of DCD Revision 02. The second sentence of the second paragraph states, "In case Option A is selected, the ILRTs will be performed approximately at equal intervals during each 10-year service period." One can see that this statement does not define the test frequency; it does not say how many tests are performed during each 10-year service period. Option A requires 3 tests in each 10-year service period (Appendix J, Option A, section III.D.1.(a)).</p> <p>Correct this sentence in the DCD.</p> |
| 6.2-84 | Pulsipher J | Add Option B required actions for ILRT failure.                  | <p>DCD Tier 2, Section 6.2.6.1.2, third paragraph, discusses required actions if any ILRTs fail to meet their acceptance criteria. These actions apply to Option A, but are more conservative than Option B (see NEI 94-01, Revision 0, section 9.2.6).</p> <p>Label the existing discussion as applicable to Option A in the DCD and the staff suggests that GE add a discussion for Option B to the DCD.</p>   |



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| 6.2-85 | Pulsipher J | Make the ILRT venting and draining criteria consistent with Option A and Option B. | <p>DCD Tier 2, Section 6.2.6.1.2, under the heading “Additional Criteria for Integrated Leakage Rate Tests,” discusses venting and draining of systems for the test. However, the criteria are not completely consistent with either Option A or Option B of Appendix J, or the associated guidance documents. Specifically:</p> <p>(a) In the second sub-bullet of the first bullet, the DCD says that portions of closed systems inside containment that penetrate containment and that <i>are not relied upon for containment isolation purposes following a LOCA</i> are kept open or vented to the containment atmosphere during the ILRT. By contrast, Option A, section III.A.1.(d) replaces the highlighted portion above with “rupture as a result of a loss of coolant accident.” For Option B, NEI 94-01, Revision 0, is applicable. It states, in section 8.0:</p> <p>“All Appendix J pathways must be properly drained and vented during the performance of the ILRT, with the following exceptions:</p> <ul style="list-style-type: none"> <li>• Pathways in systems which are required for proper conduct of the Type A test or to maintain the plant in a safe shutdown condition during the Type A test;</li> <li>• Pathways in systems that are normally filled with fluid and operable under post–accident conditions;</li> <li>• Portions of the pathways outside primary containment that are designed to Seismic Category I and at least Safety Class 2; or,</li> <li>• For planning and scheduling purpose, or ALARA considerations, pathways which are Type B or C tested</li> </ul> |
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|  |  |  | <p>within the previous 24 calendar months need not be vented or drained during the Type A test.”</p> <p>The second bullet is applicable.</p> <p>(b) The third bullet in the DCD states:</p> <p>“Those portions of fluid systems penetrating containment that are external to the containment and that <i>are not designed to provide a containment isolation barrier</i> are vented to the outside atmosphere, as applicable, to ensure that full post-accident differential pressure is maintained across the containment isolation barrier.” [emphasis added]</p> <p>For Option B, the third bullet of the quotation from NEI 94-01, Revision 0, section 8.0, above, differs from the highlighted phrase from the DCD. For Option A, there is no specifically-applicable guidance.</p> <p>These differences between the DCD and the requirements are significant. Revise the DCD to provide justifications for these variances from the requirements, or revise the DCD to be consistent with the requirements for both Option A and Option B.</p> |
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| 6.2-86 | Pulsipher J | Correct inconsistency:<br>Water cannot be a Type B test medium.                   | <p>DCD Tier 2 Section 6.2.6.2, "Containment Penetration Leakage Rate Test (Type B)," states that, for the flowmeter method, water may be used as a test medium for Type B tests, "if applicable."</p> <p>Option A, section III.B.1, requires the Type B test medium to be air, nitrogen, or pneumatic fluid specified in the technical specifications or associated bases. As water is not a pneumatic fluid, it is prohibited.</p> <p>Option B, section III.B., begins: "Type B pneumatic tests...."<br/>Applicable guidance is in ANSI/ANS-56.8-1994, section 3.3.5, "Test Medium," which states, in part, "Type B and Type C tests shall be conducted with air or nitrogen."</p> <p>Delete the option for water as a Type B test medium from the DCD.</p> |
| 6.2-87 | Pulsipher J | Correct contradictory statements about inflatable seals in air locks in the DCD.  | <p>In DCD Tier 2, Section 6.2.6.2, the last sentence states, "Because the restraining force on the door is not critical for the performance of the overall [air] lock pressure test on a lock with inflatable seals, no mechanism for monitoring the force is provided." However, this contradicts the last sentence of the previous paragraph, which states, "These air-locks contain no inflatable seals."</p> <p>Correct this discrepancy in the DCD.</p>   |
| 6.2-88 | Pulsipher J | Are air lock Type B test methods to be limited to the pressure decay method only. | <p>DCD Tier 2, Section 6.2.6.2, second paragraph, allows Type B tests to be performed using either the pressure-decay method or the flowmeter method. The fifth paragraph seems to require the pressure decay method only to be used for air lock tests. Because the pressure-decay method can be problematic for air lock door seals, verify that this is the intent, or modify the DCD to allow the flowmeter method for air lock tests.</p>   |
| 6.2-89 | Pulsipher J | Typographical error<br>DCD Tier 2, Section 6.2.6.3: Correct "know" to "known."    | <p>DCD Tier 2, Section 6.2.6.3, second paragraph, fourth sentence, states: "The rate of decay of pressure of the know test volume is monitored to calculate the leakage rate." Correct the word "know" to "known."</p>   |

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| 6.2-90 | Pulsipher J | <p>Correct inconsistency:<br/>Water cannot be a Type C test medium.</p> | <p>DCD Tier 2, Section 6.2.6.3, "Containment Isolation Valve Leakage Rate Test (Type C)," states that, for the flowmeter method, water may be used as a test medium for Type C tests, "if applicable."</p> <p>Option A, section III.C.2.(a), "Test Pressure," states: "Valves, unless pressurized with fluid (e.g., water, nitrogen) from a seal system, shall be pressurized with air or nitrogen at a pressure of Pa."</p> <p>Option B, section III.B., begins: "Type B pneumatic tests... and Type C pneumatic tests..." Applicable guidance is in ANSI/ANS-56.8-1994, section 3.3.5, "Test Medium," which states, in part, "Type B and Type C tests shall be conducted with air or nitrogen."</p> <p>The leakage rate tests for containment isolation valves (CIVs) served by seal systems are not Type C tests per se and are addressed in RAI 6.2-91.</p> <p>Delete the option for water as a Type C test medium from the DCD.</p> |
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| 6.2-91 | Pulsipher J | Revise DCD such that the seal system provisions comply with Appendix J requirements. | <p>DCD Tier 2, Section 6.2.6.3, fourth paragraph, first sentence, states: “Valves that are in lines designed to be, or remain, filled with a liquid for at least 30 days subsequent to a LOCA are leakage rate tested with that liquid at a pressure not less than 1.1 P<sub>ac</sub>.” This is not consistent with, and is less conservative than, the requirements of Option A or the requirements associated with Option B of Appendix J, through ESBWR’s commitment to conform to Regulatory Guide 1.163 through proposed Technical Specification 5.5.9.</p> <p>Option A, section III.C.2.(b), “Test Pressure,” states: “Valves, which are sealed with fluid from a seal system shall be pressurized with that fluid to a pressure not less than 1.10 Pa.” Section III.C.3., “Acceptance Criterion,” states:</p> <p>“The combined leakage rate for all penetrations and valves subject to Type B and C tests shall be less than 0.60 La. Leakage from containment isolation valves that are sealed with fluid from a seal system may be excluded when determining the combined leakage rate: <i>Provided, That;</i></p> <p>(a) Such valves have been demonstrated to have fluid leakage rates that do not exceed those specified in the technical specifications or associated bases, and</p> <p>(b) The installed isolation valve seal-water system fluid inventory is sufficient to assure the sealing function for at least 30 days at a pressure of 1.10 Pa.”</p> <p>For Option B, NEI 94-01, Revision 0, section 6.0, states, in part:</p> |
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|  |  |  | <p>“Primary containment barriers sealed with a qualified seal system shall be periodically tested to demonstrate their functionality in accordance with the plant Technical Specifications. Specific details of the testing methodology and requirements are contained in ANSI/ANS 56.8-1994 and should be adopted by licensees with applicable systems.... Leakage from containment isolation valves that are sealed with a qualified seal system may be excluded when determining the combined leakage rate provided that:</p> <ul style="list-style-type: none"> <li>• Such valves have been demonstrated to have fluid leakage rates that do not exceed those specified in the technical specifications or associated bases, and</li> <li>• The installed isolation valve seal-water system fluid inventory is sufficient to assume the sealing function for at least 30 days at a pressure of 1.10 Pa.”</li> </ul> <p>ANSI/ANS-56.8-1994 contains the following definition and criteria:</p> <p>“<b>qualified seal system.</b> A system that is capable of sealing the leakage with a liquid at a pressure no less than 1.1 P<sub>ac</sub> for at least 30 days following the DBA [design basis accident].”</p> <p>“<b>3.4 Qualified seal system testing requirements.</b> Primary containment barriers sealed with a qualified seal system are not required to be local leakage rate tested. If a seal system is used as a primary containment barrier, it shall be periodically tested to prove its functionality. This functional test shall demonstrate that the seal system is capable of sealing the primary containment barrier(s) with the sealing liquid at a differential pressure of not less than 1.1 P<sub>ac</sub> for at least 30 days following a DBA. Qualified seal system testing is as specified in the plant’s licensing basis.”</p> <p>Revise the DCD to conform to these requirements.</p> |
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| 6.2-92 | Pulsipher J | Add additional condition that test connections, vent lines, and drain lines must be 1 inch or less in size to be excepted from Type C testing. | <p>DCD Tier 2, Section 6.2.6.3, fifth paragraph, describes conditions under which test connections, vent lines, and drain lines do not require Type C testing. These conditions are consistent with the requirements, except that the valves must be 1 inch or less in size (see NEI 94-01, Revision 0, section 6.0, or section 3.3.1(3) of ANSI/ANS-56.8-1994).</p> <p>Add this additional condition to the DCD or justify the deviation.</p>   |
| 6.2-93 | Pulsipher J | Indicate directly which CIVs are Type C tested and justify those which are not.  | <p>DCD Tier 2, Tables 6.2-16 through 6.2-38 provide various information about the ESBWR's CIVs. One line item in each table is "Type C Leakage Test." As stated in Regulatory Guide 1.70, Revision 3, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)," each entry is to be "yes" or "no." However, in every case in these tables the entry is "See Table 3.9-8." Unfortunately, Table 3.9-8, "In-Service Testing," is not useful for this purpose. It lists non-CIVs as well as CIVs, it has information about various inservice tests (like valve exercising tests) in addition to Type C tests, it references the ASME code instead of Appendix J, and it uses non-Appendix J terminology like "Category A tests." The staff has attempted to glean the required information from the table, but finds that it is difficult, if not impossible, to positively determine which CIVs are or are not Type C tested.</p> <p>Provide a simple "yes" or "no" for each line item entry in Tables 6.2-16 through 6.2-38. Further, for each "no," provide a justification for not Type C testing the CIV.</p> |

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| 6.2-94 | Pulsipher J | Is exemption from Appendix J, Option A, for air lock testing needed. | <p>Many operating plants that uses Option A of Appendix J for Type B testing has obtained an exemption from section III.D.2.(b)(ii) of the regulation. The DCD does not discuss this issue.</p> <p>Section III.D.2.(b)(ii) states, “Air locks opened during periods when containment integrity is not required by the plant’s Technical Specifications shall be tested at the end of such periods at not less than <math>P_a</math>.” This seemingly reasonable requirement has an unintended effect: if a plant goes to cold shutdown for even a few hours, it must test its air locks at pressure <math>P_a</math> before restart. Most air lock door seals can’t take <math>P_a</math> test pressure without unseating, so this requires a full air lock test, which takes hours to perform. Operating plants have obtained exemptions which instead allow door seal leakage rate tests, at reduced pressure, which take a few minutes to perform. Option B of Appendix J does not have this problem.</p> <p>Provide ESBWR’s position on this issue. If the intent is to have future applicants request exemptions, discuss it in the DCD, especially in DCD Tier 2, Section 6.2.8.3, which currently requires COL Holders to perform Type B tests in conformance with Appendix J.</p> |
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**REQUESTS FOR ADDITIONAL INFORMATION (RAIs)  
ESBWR DESIGN CONTROL DOCUMENT (DCD) CHAPTER 13**

| RAI Number | Reviewer   | Question Summary   | Full Text   |
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| 13.6-1     | Tardiff AI | Provide a drawing that depicts all vital areas of the ESBWR.             | Provide a drawing that depicts all vital areas of the ESBWR. Include a listing of the vital areas and the vital components in them that may be cross-referenced against the drawing. Include in the diagram the locations of the central alarm station, secondary alarm station, control room and security related emergency power supplies.  |
| 13.6-2     | Tardiff AI | Provide ITAAC that addresses five design commitments regarding security. | Provide inspection, test, analyses and acceptance criteria (ITAAC) that address the following five design commitments: 1) locations to be bullet resisting and the corresponding level of minimum bullet resistance, 2) designation of the central alarm station, secondary alarm station, and the control room as being located within vital areas, 3) designation of the backup power for alarm annunciator and non-portable communications as being located in a vital area, 4) vital areas are locked and alarmed with active intrusion detection systems that annunciate in the central and secondary alarm stations upon unauthorized intrusion into a vital area, and 5) locks utilized for the protection of vital areas and special nuclear material are manipulative resistant. |

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