WBN2Public Resource

From: Stockton, Rickey A [rastockton@tva.gov]
Sent: Friday, February 25, 2011 3:50 PM
To: Poole, Justin
Cc: Crouch, William D; Fickey, Donald G; Woods, Steven E; Clark, Mark Steven; Boyd, Desiree L
Subject: Chapter 11 and 12 RAI Responses
Attachments: 02-25-11 - Chapter 11 and 12 RAI Responses.pdf

Justin,

Attached is the submittal containing the Chapter 11 and 12 RAI Responses. Please call me if you should have any questions.

Rickey Stockton
Unit 2 Licensing
(423) 365-7741

Hearing Identifier: Watts_Bar_2_Operating_LA_Public
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February 25, 2011

10 CFR 50.4(b)(6)
10 CFR 50.34(b)

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 2
NRC Docket No. 50-391

Subject: WATTS BAR NUCLEAR PLANT (WBN) UNIT 2 - FINAL SAFETY ANALYSIS REPORT (FSAR) - RESPONSE TO CHAPTERS 11 AND 12 REQUEST FOR ADDITIONAL INFORMATION

References: 1. TVA letter to NRC dated December 17, 2010, "Watts Bar Nuclear Plant (WBN) - Unit 2 - Final Safety Analysis Report (FSAR), Amendment 102"

2. TVA letter to NRC dated February 15, 2008, "Watts Bar Nuclear Plant (WBN) - Unit 2 - Final Supplemental Environmental Impact Statement for the Completion and Operation of Unit 2"

The purpose of this letter is to respond to a number of requests for additional information (RAIs) regarding the Unit 2 FSAR Chapters 11 and 12.

Enclosure 1 provides the responses to RAIs received via email on February 9, 2011. The NRC questions and associated numbering is retained herein.

Enclosure 2 provides the responses for the outstanding Chapter 11 RAIs previously received.

Enclosure 3 provides proposed markups to FSAR Chapter 11 (Reference 1) and the Final Supplemental Environmental Impact Statement (Reference 2). These markups correct identified errors found during the preparation of the Chapter 11 RAI responses. TVA has evaluated these errors and determined that NRC notification is not required under 10 CFR 50.9(b) since the errors do not represent a significant implication for public health and safety or common defense and security.

Enclosure 4 provides the list of commitments made in this letter.

Attachment 1 provides TVA calculation WBN EEB EDQ1090-99005, "Extending Channel Operational Test Frequency for Radiation Monitors," which is referenced as part of RAI response of Question 24 provided in Enclosure 1.

If you have any questions, please contact Bill Crouch at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 25th day of February, 2011.

Respectfully,

David Stinson
Watts Bar Unit 2 Vice President

Enclosures:

1. Response to Chapters 11 and 12 RAIs
2. Outstanding Chapter 11 RAIs
3. Proposed FSAR Chapter 11 Markups and Final Supplemental Environmental Impact Statement Markups
4. List of Commitments

Attachment
1. Calculation WBN EEB EDQ1090-99005, "Extending Channel Operational Test Frequency for Radiation Monitors"

cc (Enclosures):

U. S. Nuclear Regulatory Commission
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NRC Resident Inspector Unit 2
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Spring City, Tennessee 37381

Enclosure 1

Watts Bar Nuclear Plant
Response to Chapters 11 and 12
Requests for Additional Information

Liquid Waste Management System

1. NRC QUESTION:

Columns 4 through 8 of Table 11.2-5 present five different liquid effluent isotopic spectrums, and the total annual radioactivity, released in liquid effluents with, or without, processing of the different waste streams. These total annual releases are compared to the 5 Ci release limit for each reactor in RM 50-2, as annexed to 10 CFR 50, Appendix I. Amendment 95 made minor adjustments to the activities listed in columns 4 and 5 of Table 11.2-5, and added columns 6, 7, and 8 to include releases from unprocessed steam generator blowdown effluent. Amendment 101 revised Section 11.2.6.5 to describe the radwaste process configurations represented by each column of Table 11.2-5. Amendment 102 added column headers and a footnote to Table 11.2-5 explaining each column. All five of the activity columns (columns 4 through 8) of Table 11.2-5 contain liquid waste contributions from the Tritiated Drain Collector Tank, processed by the CVCS Demineralizer and the Mobil Demineralizer; the Reactor Coolant Drain tank, processed by the Mobil Demineralizer; the unprocessed Laundry and Hot Shower Drain Tank; and the unprocessed Turbine Building drains. In addition to these, Column 4 includes Condensate Demineralizer regeneration backwash and steam generator blowdown effluents that have had Condensate Demineralizer decontamination factors [RAI 11-13 & 14, RAI 11-1 is OPEN] applied. Column 5 also applies the decontamination factors for the Mobile Demineralizer to the Condensate Demineralizer backwash and steam generator blowdown process streams. Column 6 represents no processing of, nor release restrictions on, the Condensate Demineralizer and blowdown effluent streams. Columns 7 and 8 present the annual activity release if the steam generator untreated effluent concentrations are maintained below 5 E-7 uCi/cc and 3.65E-5 uCi/cc, respectively. However, column 7 and column 8 do not include Condensate Demineralizer backwash wastes.

It is unclear how TVA intends to operate WBN Unit 2 without performing this routine maintenance of the Condensate Demineralizer System [RAI 11-10].

TVA RESPONSE:

Column 7 and 8 in Table 11.2-5 are providing information that the 10 CFR 50, Appendix I yearly regulatory limits can be met without use of the Condensate Demineralizers with the specified activity limitations on the Steam Generator Blowdown. Unit 1 currently operates without use of the Condensate Demineralizers. The Condensate Demineralizers will not be used unless significant primary to secondary leakage occurs. Since the demineralizers are not used, the Steam Generator Blowdown is not treated and there is no demineralizer blowdown or backwash waste stream. This method of operation is acceptable so long as the 10 CFR 50, Appendix I and 10 CFR 20 limits are met. TVA plans to operate Unit 2 in the same manner as Unit 1. Note actual plant releases are accomplished and controlled in

accordance with the Offsite Dose Calculation Manual (ODCM) and releases are not allowed to exceed either the 10 CFR 50, Appendix I or the 10 CFR 20 limits.

2. NRC QUESTION:

Amendment 98 made minor revisions to the values in Tables 11.2-5a and 11.2-5b. These revisions did not affect the final results presented in Tables 11.2-5a and 11.2-5b, e.g., that extended effluent releases without processing the Condensate Demineralizer regeneration waste through the Mobile Demineralizer will not meet the limits of 10 CFR 20 and is not acceptable. To insure that the limits of Part 20 are met, Amendment 98 also revised Section 11.2.6.5 of the FSAR to include the statement that "no untreated wastes are released unless they are below the Lower Limit of Detection (LLD=5E-7 uCi/cc gross gamma [sic])." [This closes RAI 11-2]

However, it is unclear how this statement is consistent with the calculational basis for Table 11.2-5, column 8, which assumes the release of untreated Steam Generator Blowdown effluents at concentrations up to 3.65E-5 uCi/cc. [RAI 11-16].

TVA RESPONSE:

Section 11.2.6.5 of the FSAR (see Amendment 102) no longer includes the statement that "no untreated wastes are released unless they are below the Lower Limit of Detection (LLD=5E-7 uCi/cc gross gamma." Section 11.2.6.5 now addresses releases when the Steam Generator Blowdown effluents are at concentrations up to 3.65E-5 uCi/cc.

3. NRC QUESTION:

The staff concurs with TVA's conclusion that operating for an extended period of time without processing the Condensate Demineralizer backwash or steam generator blowdown, as represented by column 6 of Table 11.2-5, is not acceptable. However, the staff cannot agree that the total activities represented by columns 7 and 8 of Table 11.2-5, meet the activity limit of RM 50-2, since neither includes the effluent (backwash) from the routine regeneration of the Condensate Demineralizers. [RAI 11-15] Similarly, the staff cannot conclude that Tables 11.2-5c and 11.2-5d demonstrate that 10 CFR 20 can be met with untreated steam generator blowdown effluents, since they do not include Condensate Demineralizer regeneration backwash effluents. [RAI 11-11 &12; Follow-up RAI 11-1 and 11-2 are OPEN pending resolution]

TVA RESPONSE:

Column 7 and 8 of Table 11.2-5 and Tables 11.2-5c and 11.2-5d show that the RM 50-2 and 10 CFR 20 limits are met without use of the Condensate Demineralizers so long as restrictions are placed on the Steam Generator Blowdown activity. As stated in the RAI response for item 1 above, Unit 1 is currently operated without use of the Condensate

Demineralizers, since primary to secondary leakage is not significant. It is expected that Unit 2 will operate in the same manner. Since the demineralizers are not used, the Steam Generator Blowdown is not treated and there is no demineralizer blowdown or backwash waste stream. This method of operation is acceptable so long as the 10 CFR 50, Appendix I and 10 CFR 20 limits are met. Note actual plant releases are accomplished and controlled in accordance with the ODCM and releases are not allowed to exceed either the 10 CFR 50, Appendix I or the 10 CFR 20 limits.

4. NRC QUESTION:

Amendment 95 updated population on usage data listed in Table 11.2-6. Amendments 95 and 100 update the whole body and organ doses for the maximum exposed individual in each critical age group listed in Table 11.2-7. These updates resulted in minor changes to the calculated doses, which still meet the design criteria for liquid effluents in 10 CFR 50 Appendix I. As discussed below, the staff performed independent dose calculations to verify the acceptability of the applicant's dose assessment. The staff determined that there is sufficient agreement between the TVA's and the staff's results to conclude that the WBN Unit 2 design meets the design criteria of 10 CFR 50 Appendix I and is therefore acceptable.

However, it is not clear which source term was used as the basis for these calculations. [RAI 11-9; RAI 11-3 OPEN pending resolution of the source term assumption]

TVA RESPONSE:

See response to question 11.3.c in Enclosure 2 for the source term.

5. NRC QUESTION (9):

Verify that the changes made to Table 11.2-7 are to conform this table with TVA's re-evaluation of the offsite doses, as presented in the February 15, 2008, Environmental Impact Assessment. If not, describe the liquid isotopic release values used to calculate these doses.

TVA RESPONSE:

The values in Table 11.2-7 have been verified to be consistent with those found in the Final Supplemental Environmental Impact Statement (FSEIS). The liquid isotopic release values found in Table 11.2-5 column 8 were used to determine the doses in Table 11.2-7.

Enclosure 1

Watts Bar Nuclear Plant
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6. **NRC QUESTION (10):**

Amendment 101 revised Section 11.2.6.5 and Amendment 102 added a footnote, explaining the radwaste process configurations represented by each column of Table 11.2-5. Columns 7 and 8 do not include effluents from the Condensate Demineralizer regeneration (backwash) operations. Since Table 11.2-5 represents total annual curies released, how does TVA intend to operate WBN Unit 2 for an entire year without backwashing the Condensate Demineralizers? If not then justify the position that annual releases consistent with Column 8 will meet the 5 Ci limit of RM 50-2 Paragraph A.2 or demonstrate WBN meets the alternate criteria in RM 50-2, Paragraph A.3.

TVA RESPONSE:

Column 7 and 8 in Table 11.2-5 are providing information that the 10 CFR 50, Appendix I yearly regulatory limits can be met without use of the Condensate Demineralizers with the specified activity limitations on the Steam Generator Blowdown. Unit 1 currently operates without use of the Condensate Demineralizers. The Condensate Demineralizers will not be used unless significant primary to secondary leakage occurs. Since the demineralizers are not used, the Steam Generator Blowdown is not treated and there is no demineralizer blowdown or backwash waste stream. This method of operation is acceptable so long as the 10 CFR 50, Appendix I and 10 CFR 20 limits are met. TVA plans to operate Unit 2 in the same manner as Unit 1. Note actual plant releases are accomplished and controlled in accordance with the ODCM and releases are not allowed to exceed either the 10 CFR 50, Appendix I or the 10 CFR 20 limits.

7. **NRC QUESTION (11):**

Similarly, justify the position that Tables 11.2-5b, 11.2-5c, and 11.2-5d demonstrate compliance with 10 CFR 20 when Table 11.2-5b does not include steam generator blowdown effluents, and Tables 11.2-5c and11.2-5d, do not include condensate demineralizer backwash effluents.

TVA RESPONSE:

Tables 11.2-5c and 11.2-5d show that the 10 CFR 20 limits are met without use of the Condensate Demineralizers as long restrictions are placed on the Steam Generator Blowdown activity. As stated in the RAI response to Item 1 above, Unit 1 is currently operated without use of the Condensate Demineralizers since primary to secondary leakage is not significant. It is expected that Unit 2 will operate in the same manner. Since the demineralizers are not used, the Steam Generator Blowdown is not treated and there is no demineralizer blowdown or backwash waste stream. This method of operation is acceptable so long as the 10 CFR 50, Appendix I and 10 CFR 20 limits are met. TVA plans to operate Unit 2 in the same manner as Unit 1. Note actual plant releases are accomplished and

controlled in accordance with the ODCM and releases are not allowed to exceed either the 10 CFR 50, Appendix I or the 10 CFR 20 limits.

8. NRC QUESTION (12):

In addition, Tables 11.2-5b, 11.2-5c, and 11.2-5d, only represent one unit operation. Provide an analysis that demonstrates that the effluents from WBN will not result in a member of the public exceeding the dose limits in Part 20 with both WBN units in operation.

TVA RESPONSE:

The values in the last column of Tables 11.2-5b, 11.2-5c and 11.2-5d for two unit operation will be the sum of the total tritium production core (TPC) value for Unit 1 and the total (non-TPC) value for Unit 2; e.g., for Table 11.2-5b, 3.201E-01 + 2.680E-01= 5.881E-01 curies per year. All these sums are less than unity and thus meet the dose limits of 10 CFR 20.

9. NRC QUESTION (13):

The footnote added to Table 11.2-5 by Amendment 102 appears to have some typographical errors. Verify that the term "F/H1D" in the formulation of Column 5 and "Mobi"le" in the definition of "D" should be, "F/H/D" and "Mobile" respectively.

TVA RESPONSE:

In the footnote added to Table 11.2-5 by Amendment 102, the term "F/H1D" in the formulation of Column 5 and "Mobi"le" in the definition of "D" should be, "F/H/D" and "Mobile", respectively. These items will be corrected in FSAR Amendment 103.

10. NRC QUESTION (14):

I*n addition the definitions of the terms "F" and "H" used in columns 4, 5, and 6 are somewhat confusing. A plain reading of the footnote would indicate that the entire condensate flow that is processed by the Condensate Demineralizer is released from WBN as liquid effluent. Reading this in the context paragraph 11.2.6.5, as revised by Amendment 101, would indicate that the term "F" represents the total annual activity in the effluent waste from Condensate Demineralizer regeneration operations, not the Condensate Demineralizer flow. Verify that this is the case. If it is, identify the demineralizer (whose decontamination factors are represented by "H" in the terms "F/H" and "F/H/D") that the regeneration waste is processed through prior to*

processing with the Mobile Demineralizer. If it is not the case, provide additional clarification of the terms "F/H" and "F/H/D" in the footnote.

TVA RESPONSE:

The term "F" in columns 4, 5, and 6 represents the total annual activity in the effluent waste from Condensate Demineralizer regeneration operations. The demineralizer whose decontamination factors are represented by "H" in the terms "F/H" and "F/H/D" that the regeneration waste is processed through prior to processing with the Mobile Demineralizer is the Condensate Polishing Demineralizer.

11. NRC QUESTION (15):

Provide information that demonstrates that operating WBN Units 1 and 2 will meet the liquid effluent criteria in RM 50-2, Paragraph A.1 (e.g., 5 mrem to the total body or to any organ per site).

TVA RESPONSE:

From the Unit 1 UFSAR, Table 11.2-6, the highest Total Body value is 0.72 mrem for an Adult; the highest organ (Liver) value is 1.0 mrem for a Teen. These values are the same for the corresponding Unit 2 FSAR Table 11.2-7. When added together, Units 1 and 2 will meet the liquid effluent criteria in RM 50-2, Paragraph A.1.

12. NRC QUESTION (16):

Resolve the apparent conflict between the statement in Section 11.2.6.5 that no untreated wastes are released unless they are below the Lower Limit of Detection of 5E-7 uCi/cc, and the calculational basis for Table 11.2-5, Column 8 (and Table 11.2-5d) that concludes that untreated releases up to 3.65E-5 uCi/cc are acceptable.

TVA RESPONSE:

Section 11.2.6.5 contained in Amendment 102 does not indicate that no untreated wastes are released unless they are below the Lower Limit of Detection of 5E-7 uCi/cc. Section 11.2.6.5 now addresses releases when the Steam Generator Blowdown effluents are at concentrations up to 3.65E-5 uCi/cc.

Enclosure 1

Watts Bar Nuclear Plant
Response to Chapters 11 and 12
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Gaseous Waste Management System

13. NRC QUESTION:

Amendments 95 and 98 also made several revisions to the gaseous effluent release analysis parameters presented in Table 11.3-6 with resulting minor changes to the resulting radioactive releases in Table 11.3-7. The radioactive releases listed in Tables 11.3-7 are based on the radioactive source term assumptions in NUREG-0017, adjusted for WBN specific parameters. Table 11.3-7 represent operations with containment purge, while Table 11.3-7c assumes that containment is continuously vented through a filtered release. [RAI 11-18] Section 11.3.7.5 of the FSAR indicates that the estimated releases in Table 11.3-7c were used by TVA in calculating the site boundary doses presented in Table 11.3-10 to demonstrate compliance with 10 CFR 50 Appendix I.

a) However it is unclear if the source term used for Table 11.3-7c (i.e., 1/8% failed fuel) is comparable to the NUREG-0017 source term [RAI 11-19].

b) Also, as discussed below, it is unclear if the basis for the doses presented in Table 11.3-10 is the isotopic releases listed in Table 11.3-7c or Table 11.3-7. [RAI 11-17; RAI 11-7 OPEN]

TVA RESPONSE:

a) The source terms used as a basis for Table 11.3-7c are based on ANSI 18.1-1984. The Nominal values in ANSI 18.1-1984 are the same values used in NUREG-0017. To develop the WBN source terms, the ANSI 18.1-1984 nominal values were adjusted based on WBN specific plant conditions. Therefore, the source term values used as a basis for Table 11.3-7c are comparable to those in NUREG-0017.

b) The individual doses listed in Table 11.3-10 were determined using each nuclides total curies/year listed in Table 11.3-7c, "Total Releases (1/8% failed fuel in Ci/yr), with Continuous Filtered Containment Vent."

14. NRC QUESTION:

Amendments 95, 98, and 99 revised Table 11.3-11 significantly lowing the calculated doses and presenting them in the table on a per-unit basis instead of on a per-site (2 units operating) basis. [RAI 11-24] It appears that these changes were made to conform Chapter 11 of the WBN Unit 2 FSAR with the re-evaluation of public doses presented in TVA's "Watts Bar Nuclear Plant (WBN) – Unit 2-Final Supplemental Environmental Impact Statement," (FSEIS - submitted to the NRC by letter dated February 15, 2008). [RAI 11-16] The revised doses contained in the doses in FSAR Table 11.3-10 (Amendment 98), exactly match the doses presented in Table 3-21 of the

FSEIS. In response to the staff's questions (RAI 11-7 and Follow-up question 11-3), TVA stated that the revised (lower) doses were the result of several changes TVA made to the calculation input parameters, and presenting the doses on a single-unit, versus a duel-unit, basis. TVA stated they updated the X/Q, D/Q and joint frequency tables used in their calculations to reflect updated meteorology (e.g., data from January 1986 to December 2005, versus previous based on January 1974 to December 1993 data). In addition, the feeding factors used to adjust the fraction of the time cows are grazing on exposed pasture, was significantly lowered for all sectors with a milk cow. Amendment 100 revised the Table 11.3-8 to reflect the revised input parameters. Several compass sectors, distances, and terrain adjustment factors in Table 11.3-8 were also changed to reflect an updated land-use census.

The staff reviewed the changes in Amendments 95, 98, 99, and 100, against the information in the FSEIS and Appendix I of NUREG-0498, Supplement 2, and identified several discrepancies. The FSEIS states that the doses in FSEIS Table 3-21 are based on the FSEIS Table 3-20, which is consistent with Table 11.3-7 of the FSAR. This seems inconsistent with the statement noted above, that the doses in FSAR Table 11.3-10 (identical to FSEIS Table 3-21) are based on the significantly different radioactive quantity values in FSAR Table 11.3-7c. [RAI 11-17 & 18] In addition, although the doses listed in FSEIS Table 3-21 are identical to those in FSAR Table 11.3-10, the former indicates that the maximum thyroid dose was based on a cow feeding factor of 0.65, while the later indicates that the dose was based on a cow feeding factor of 0.33 (also listed as 0.33 in Amendment 100 to FSAR Table 11.3-8). Neither of these values agrees with the 0.70 feeding factor given in FSAR Section 11.3.10.1. [RAI 11-20] Several of the distances and directions for the locations of the calculated doses given in FSAR Table 11.3-8 (Amendment 100) do not agree with the information in the FSEIS. [RAI 11-23; RAI 11-4, 11-7, and Follow-up question 11-3 OPEN]

The staff performed independent dose calculations to verify TVA's dose results. The details of the staff's calculations and input parameters assumptions can be found in Appendix I of NUREG-0498, Supplement 2. With the exception of the iodine/thyroid doses, the staff's results generally agree with the TVA's calculations. Bases on its conservative assumptions, the staff's calculations determined that the maximum exposed organ expected from radioactive iodine and particulates in gaseous effluents, is 10.78 mrem. Although both TVA's and the staff's calculations indicate that the design criteria in 10 CFR 50 Appendix I are met (15 mrem per year per unit), they are not sufficient to determine if the criteria in RM 50-2 are met (15 mrem per year "from all light-water-cooled nuclear power reactors at a site").

Therefore, the staff cannot confirm that the WBN Unit 2 can be operated within the dose restrictions of RM 50-2. [RAI 11-3 OPEN]

Verify that the basis for the Amendment 98 changes to Table 11.3-10 is the revised TVA analysis of the offsite radiation doses as presented in the Final Supplemental Environmental Impact Statement (FSEIS), submitted by letter dated February 15, 2008. If this is not the case, describe the basis for the revised values in Table 11.3-10.

TVA RESPONSE:

TVA has reviewed the FSEIS and found the land use data presented in Table 3-19 to be in error. Table 11.3-10 of the FSAR will be corrected to reflect the 2007 feeding factors and the offsite radiation doses calculated without terrain adjustment factors. These changes to Table 11.3-10 will be reflected in Amendment 103. A mark-up of the FSEIS, Table 3-19 is provided in Enclosure 3 for NRC information to facilitate review.

15. NRC QUESTION (18):

FSAR Section 11.3.7.5 indicates that the site boundary doses presented in Table 11.3-10 are based on the annual radioactive gaseous releases listed in Table 11.3.7c. However, the FSEIS indicates that these dose values are based on a source term consistent with FSAR Table 11.3.7. Verify the gaseous release values used to calculate the site boundary doses, and/or explain how two significantly different source terms arrive at the exact same calculated doses.

TVA RESPONSE:

TVA has reviewed the FSEIS and found Table 3-20 to be in error. This was caused by the use of values contained in FSAR Table 11.3.7 instead of values contained in FSAR Table 11.3.7c. The correct source term used for calculating the site boundary doses is FSAR Table 11.3.7c. This accounts for the dose values being same between the FSEIS and the FSAR Table 11.3-10. A mark-up of the FSEIS, Table 3-20 is provided in Enclosure 3 for NRC information to facilitate review.

16. NRC QUESTION (19):

The Continuous Filtered Containment Vent case (Table 11.3-7c) has significantly lower activities for all of the Krypton, Xenon, and Iodine isotopes, than those estimated for the "containment purge" case listed in Tables 11.3-7, while the other particulate activities released from the Containment Building remain the same. Describe the filter that selectively removes noble gases and iodine species but not other particulates from the Containment Building Vent gaseous effluents. Provide a basis for assuming normal operations with the containment vent continuously open. Provide, and justify, the Decontamination Factors (by each isotope class) assumed for continuous containment vent filter.

TVA RESPONSE:

Particulate releases are taken directly from NUREG-0017 with the 99% HEPA filtration efficiency applied. Therefore these values are independent of the case.

The Noble Gas and Iodine values are calculated separately from the particulates. There is a difference between the two cases because of the differences in the amount of air vented/purged. The first case is continuous venting assumed at 100 cfm for an entire year equates to 7.15E11 cc, where the second case is the purge case assumes 26 cfm (12 hr purges from upper and lower containment and the instrument room) for a total volume of 1.22E13 cc purged. Therefore, since the volumes and source terms are the same, less activity is released for the continuous vent case.

The basis for operating with the containment vent continuously open is that it has been shown the 10 CFR 50 Appendix I limits can be met with this path open. This flow path is automatically closed by a containment vent isolation signal in the event of an accident. The only decontamination factors used are for the HEPA and charcoal filters which use 70% for halogens and 99% for particulates, as given in NUREG-0017 Table 1-5 and Section 1.5.2.16.2.

17. **NRC QUESTION (20):**

Verify that the 1/8% failed fuel source term used as the basis for Table 11.3-7c is comparable to the source term specified in NUREG-0017. If not justify the use of this source term for determining nominal effluent release values.

TVA RESPONSE:

The source terms used as a basis for Table 11.3-7c are based on ANSI 18.1-1984. The Nominal values in ANSI 18.1-1984 are the same values used in NUREG-0017. To develop the WBN source terms, the ANSI 18.1-1984 nominal values were adjusted based on WBN specific plant conditions. Therefore, the source term values used as a basis for Table 11.3-7c are comparable to those in NUREG-0017.

18. **NRC QUESTION (21):**

The response to RAI 11-4, and the revisions to Table 11.3-8 (Amendment 100) are inconsistent with the text in the FSAR and the FSEIS. Section 11.3.10.1 indicates that the doses are based on the 1994 land-use survey and that a cow feeding factor of 70% was used. In addition, FSEIS Table 3-21 indicates that a cow feeding factor of 0.65 was used to evaluate the iodine/particulate maximum organ dose value. Resolve these conflicts.

TVA RESPONSE:

TVA has reviewed FSAR Section 11.3.10.1, "Assumptions and Calculation Methods," and found that it incorrectly states the dose to the critical organ from radioiodines, tritium, and particulates is calculated for real pathways existing at the site during a land use survey conducted in 1994. The feeding factor of 70% is the feeding factor associated with the 1994 land use survey. The feeding factors should be from the 2007 Land Use Survey, which is 0.33%. The feeding factor of 65% listed in Table 3-21 of the FSEIS is in error. These changes to FSAR Section 11.3.10.1 will be reflected in Amendment 103. A mark-up of the FSEIS, Table 3-21 is provided in Enclosure 3 for NRC information to facilitate review.

19. NRC QUESTION (22):

Provide a justification for each of the cow feeding factors listed in Table 11.3-8.

TVA RESPONSE:

The feeding factors (fraction of time on pasture) are based upon three farms near the WBN site area. The 2007 data for these three farms are provided below:

Percent Substitutional Feeding for Dairy and Goat Herds 2007

Farm Distance (meters)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	Total / 1200	FF
6706	**ESE**	100	100	100	95	95	95	95	95	95	100	100	100	1170	0.975	0.025
2286	**SSW**	100	100	100	90	90	90	90	90	90	100	100	100	1140	0.95	0.05
3353	**SSW**	WILL NOT PARTICIPATE IN LAND USE SURVEY														0.33*

* This conservative feeding factor assumes a consumption of the milk by an adult.

20. NRC QUESTION (23):

Describe how the revised (Amendment 100) terrain factors in Table 11.3-8 were determined.

TVA RESPONSE:

TVA uses GELC (Gaseous Effluent Licensing Code) to perform routine dose assessments required by NRC Guide 1.111. For WBN, the NRC stated that adjustments to the GELC results were necessary to account for recirculation effects of spatial and temporal variations in airflow in the vicinity of pronounced river valleys.

TVA developed site-specific adjustment factors for WBN by comparing results from the GELC model with results from the MESOPUFF II model. These adjustment factors are revised each year to reflect changes based on annual surveys.

Studies performed during 2010 for development of an American Nuclear Society (ANS) standard (specifically by the ANS-2.15 recirculation sub-group) determined that the adjustment factor approach is not acceptable for addressing recirculation issues.

Further, comparisons with other models determined that MESOPUFF II is not suitable for calculating χ/Q values at WBN receptors, and that GELC adequately estimates χ/Q for WBN receptors, without any need for adjustments. Therefore, WBN can eliminate the use adjustment factors and use GELC results directly.

These changes will be reflected in Table 11.3-8 in FSAR, Amendment 103. A mark-up of the FSEIS, Table 3-19 is provided in Enclosure 3 for NRC information to facilitate review.

21. NRC QUESTION (24):

Footnote 4 to Table 11.3-10 (Amendment 98) indicates that the maximum thyroid dose is for an infant at 3353 meters in the SSW sector. However, the revised (Amendment 100) Table 11.3-8 data indicates that the 0.33 feeding factor is applied to the location at 3353 meters in the SW direction. In addition, Table I-9 of the FSEIS indicates that the max thyroid/iodine dose is for an individual at 1.42 miles (2285 meters) in the SSW direction. a) Resolve these conflicts. b) Provide information describing how two unit operations at WBN will be within all of the dose criteria in RM 50-2 for gaseous releases.

TVA RESPONSE:

a) TVA has reviewed the FSEIS and found the land use data presented in Table 3-19 to be in error. The land use survey used to develop FSAR Table 11.3-10 was from 2007. Table 11.3-10 of the FSAR will be revised to include 2007 feeding factors and the offsite radiation doses being calculated without terrain adjustment factors. These changes to Table 11.3-10 will be reflected in Amendment 103. A mark-up of the FSEIS, Table 3-19 is provided in Enclosure 3 for NRC information to facilitate review.

b) The corresponding Unit 1 FSAR table is being revised in the same manner as described in response to question 11.3a in Enclosure 2. When the Unit 1 and Unit 2 tables are combined, the results will be evaluated against the criteria of RM 50-2. The Unit 1 values are similar in magnitude to the Unit 2 values and thus the sum of the two units will meet the RM 50-2 criteria.

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22. NRC QUESTION:

In WBN Unit 2 FSAR Amendment 95, TVA revised Section 12.2.1.3, "Sources During Refueling," to include a discussion of the incore instrumentation thimble assemblies (IITAs) as important radioactive sources during refueling operations. The discussion replaced the previous discussion of the incore detector bottom-mounted instrumentation (BMI) thimble tubes in FSAR Section 12.2.1.3 and Table 12.2-3, "Chemical and Volume Control System Seal Water Return Filter." In its letter dated June 3, 2010, responding to NRC staff questions (RAI 12-1), TVA stated that the IITAs and BMI thimble tubes would be exposed to the same neutron flux during power operations and therefore would exhibit radiation dose rates of similar magnitude. The radiological hazards posed by this source term change should be no greater than previously described. Therefore, these changes are acceptable to the staff. TVA should provide an update to the FSAR replacing Table 12.2-3 with the expected source strength values of the freshly irradiated IITAs.

TVA RESPONSE:

TVA will provide an update in a future FSAR amendment.

23. NRC QUESTION:

12.4 Radiation Protection Design Features

In FSAR Amendment 97, TVA deleted FSAR Figures 12.3-18 and 19. These figures contained the drawings of WBN radiation protection design features, including controlled access areas, decontamination areas, and onsite laboratories and counting rooms. In lieu of providing drawings depicting these radiation protection design features, TVA provided a description of each. In response to a staff question (RAI 12-7) regarding the FSAR changes, TVA provided clarifying information in its letters dated June 3 and October 4, 2010. In its October 4, 2010, letter, TVA stated that the WBN Unit 2 access controls to radiological areas (including contaminated areas), personnel and equipment decontamination facilities, onsite laboratories and counting rooms, and Health Physics facilities (including dosimetry issue, respiratory protection bioassay, and Radiation Protection Management and technical staff) are all common to Unit 1. Furthermore, TVA stated that these facilities are sized and situated properly to support two operating units. Based on TVA's response, the staff concluded that the FSAR changes did not impact the staff's previous safety conclusion, as documented in SSER 18, dated October 1995. Therefore, the changes are acceptable. TVA should provide an update to the FSAR reflecting the information provided in its letter dated October 4, 2010.

TVA RESPONSE:

TVA will provide an update in a future FSAR amendment.

24. NRC QUESTION:

In FSAR Amendment 97, TVA revised the frequency of the radiation monitor channel operability tests from quarterly to "periodically." In its letter dated June 3, 2010, TVA responded to a staff question (RAI 12-8) about what frequency was meant by "periodically." In its response, TVA provided a WBN Unit 1 FSAR change package as justification for relaxing the interval between monitor channel operability tests from quarterly to 9 months (a "calculated" 18 months with a margin factor of two). The staff reviewed TVA's response and the change package, but could not conclude that TVA has provided adequate technical justification to relax the quarterly operability tests.

TVA RESPONSE:

TVA reviewed the subject calculation and determined that it was inadequate to support extending the quarterly operability tests. The evaluation determined that the issue was with the calculation methodology and not the data. The evaluation also determined that it was probable that if the calculation was re-performed correctly it would support extending the quarterly operability test interval.

As a result, the calculation was re-performed and the results supported extending the quarterly operability test interval. Attachment 1 to this letter contains TVA calculation WBN-EEB- EDQ1090-99005, Revision 1, "Extending Channel Operational Test Frequency for Radiation Monitors."

25. NRC QUESTION:

In FSAR Amendment 97, TVA also revised the description of the airborne monitoring channels in Section 12.3.4.2.4, "Component Descriptions," to reflect the replacement of the seven (7) channels of airborne monitors previously indicated for the Auxiliary Building with four (4) portable airborne monitors. TVA stated in the FSAR that the portable airborne monitors will have a sufficient sensitivity to detect a 10 derived air concentration (DAC)-hour change in airborne radioactivity. In response to a staff question (RAI 12-10), TVA provided additional information in its letter to the NRC dated June 3, 2010, regarding the replacement of the airborne monitors. The use of portable airborne monitors reflects the current operational configuration of Unit 1, and is acceptable to the staff. However, the revised FSAR Section 12.3 contains no discussion of the calibration and operability testing of the portable airborne radiation monitors that replace the seven channels of fixed airborne monitors. The staff lacks sufficient information to determine that these monitors meet the acceptance criteria

in the SRP and thus will provide adequate airborne monitoring at WBN Unit 2, consistent with the requirements of Subpart F, "Surveys and Monitoring," of 10 CFR Part 20, § 20.1501.

TVA RESPONSE:

The four portable monitors listed in FSAR Table 12.3-5 are calibrated every 6 months in accordance with site Radiological Control Instructions. This meets the requirements of Subpart F, "Surveys and Monitoring," of 10 CFR Part 20, § 20.1501, which requires periodic calibration of the monitors. Weekly source checks are performed in accordance with site Radiological Control Instructions. This meets the requirements of Reg. Guide 8.25 Revision 1.

26. NRC QUESTION:

In FSAR Amendment 101, TVA further revised the description in Section 12.3.4.1.3, "Area Monitor Calibration and Maintenance," addressing the calibration and operability testing of area radiation monitors. Rather than specifying appropriate testing frequencies, the revision refers to "licensing or TVA program requirements." The staff lacks sufficient information to determine that these licensing or TVA program requirements are sufficient to meet the regulatory requirements of Subpart F of 10 CFR Part 20, § 20.1501.

TVA RESPONSE:

Subpart F of 10 CFR Part 20, § 20.1501 states:

(b) The licensee shall ensure that instruments and equipment used for quantitative radiation measurements (e.g., dose rate and effluent monitoring) are calibrated periodically for the radiation measured.

The statement "licensing or TVA program requirements" is made to document the source of testing requirement. The first sentence of the paragraph states: "With the exception of the Reactor Building upper and lower compartment post accident monitors, periodic testing of each area monitor includes a channel calibration performed at least once per 22.5 months (18 months plus 25%)." This statement provides the information required by Subpart F of 10 CFR Part 20, § 20.1501 for all except the upper and lower containment post accident monitors which the final sentence states are calibrated in accordance with technical specifications. Surveillance requirement SR 3.3.3.2 requires that the upper and lower containment post accident monitors are calibrated at 18 month intervals.

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27. NRC QUESTION:

In FSAR Amendment 97, TVA added a description of two area radiation monitors for the Spent Fuel Pit (0-RE 90-102 and 103) to the list of monitors in Table 12.3-4, "Location of Plant Area Radiation Monitors." In response to a question from the staff (RAI 12-9), TVA responded in its letter dated June 3, 2010, that it would provide information to demonstrate compliance with the requirements of 10 CFR 70.24 and 10 CFR 50.68. At this time, the staff lacks sufficient information to determine that these monitors meet the criteria in 10 CFR 70.24, "Criticality accident requirements," and 10 CFR 50.68, "Criticality accident requirements," for radiation monitoring in areas where fuel is handled or stored.

TVA RESPONSE:

The referenced CFR requirements relate to criticality monitors for areas where reactor fuel is handled or stored. NRC issued an exemption from the requirements of 10 CFR 70.24 as part of the Unit 1 operating licensing. See the following excerpt from section 2.D.(2) of the Unit 1 operating license, which has been incorporated into the Unit 1 Technical Specifications:

"2.D.(2) The facility was previously granted an exemption from the criticality monitoring requirements of 10 CFR 70.24 (see Special Nuclear Material License No. SNM-1861 dated September 5, 1979). The technical justification is contained in Section 9.1 of Supplement 5 to the Safety Evaluation Report, and the staff's environmental assessment was published on April 18, 1985 (50 FR 15516). The facility is hereby exempted from the criticality alarm system provisions of 10 CFR 70.24 so far as this section applies to the storage of fuel assemblies held under this license."

Since the new fuel and spent fuel storage areas are common to both units, TVA concluded that criticality monitors are not required for WBN in areas where the fuel is handled or stored. This is also consistent with TVA's application for Special Nuclear Material License dated November 12, 2009.

Compliance with 10 CFR 50.68(b) is documented in FSAR Section 4.3.2.7, "Criticality of Fuel Assemblies."

28. NRC QUESTION:

12.5 Dose Assessment

Based on the information provided by TVA in its letter to the NRC dated June 3, 2010, and because historical experience has demonstrated that the average annual collective dose to operate WBN Unit 1 was less that 100 person-rem, the staff

concludes that there is reasonable assurance that WBN Unit 2 can be operated at or below 100 person-rem average annual collective dose. Therefore, FSAR Section 12.4 is acceptable. TVA should update the FSAR to reflect the information provided in its letter the NRC dated June 3, 2010.

TVA RESPONSE:

TVA will provide an update in a future FSAR amendment.

29. NRC QUESTION:

12.6 Health Physics Program

In FSAR Amendment 95, TVA made several editorial changes to FSAR Section 12.5 resulting from organizational changes at WBN. With the exception of the following two issues, these did not impact the staff's previous safety conclusion, as documented in SSER 14, dated December 1994, and are therefore acceptable. The remaining two issues are related to the Radiation Protection Manager (RPM) qualifications. FSAR Section 12.5.1 states that, "The minimum qualification requirements for the Radiation Protection Manager are stated in Section 13.1.3." FSAR Section 13.1.3 states that, "Nuclear Power (NP) personnel at the Watts Bar plant will meet the qualification and training requirements of NRC Regulatory Guide 1.8 with the alternatives as outlined in the Nuclear Quality Assurance Plan, TVA-NQA-PLN89-A." Specifically, TVA modified its commitment to the personnel qualification standards in Regulatory Guide (RG) 1.8, "Qualification and Training of Personnel for Nuclear Power Plants," by adding the caveat, "with the alternatives as outlined in the Nuclear Quality Assurance Plan." It was unclear to the staff whether or not TVA was committed to (1) the requirement that the RPM have five years of "professional experience," and 2) the three month time limit on "temporarily" assigning an RPM who doesn't meet the RPM qualifications (ANSI/ANS 3.1-1981, as referenced in RG 1.8). In response to staff questions (RAIs 12-13 and 12-14), TVA clarified in its letter to the NRC dated October 4, 2010, that it will meet the requirements of RG 1.8, Revision 2, and ANSI/ANS 3.1-1981, for all new personnel qualifying on positions identified in RG 1.8, Regulatory Position C.1, after January 1, 1990. These changes are consistent with the staff's acceptance criteria 12.5.A of Section 12.5 of the SRP as they pertain to staff qualifications and are, therefore, acceptable. TVA should update the FSAR to reflect the qualification standards of the RPM as provided in its letter to the NRC dated October 4, 2010.

TVA RESPONSE:

TVA will provide an update in a future FSAR amendment.

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30. NRC QUESTION:

12.7 NUREG-0737 Items

In FSAR Amendment 97, TVA revised the list in FSAR Section 12.3.2.2, "Design Description," of post accident activities that need to be accomplished, adding three and deleting the activities at the post accident sampling facility. The staff requested information (RAI 12-6) regarding the dose consequences of these vital missions, including plant layout drawings depicting radiation zones during accident conditions and access/egress routes. By letters dated June 3, 2010, and December 10, 2010, TVA provided dose calculations and plant layout drawings depicting the WBN vital area access/egress routes. The staff noted a number of inconsistencies and deficiencies in the information provided by TVA. These include, but are not limited to:

1) ***There is not a good correlation between the list of vital areas in FSAR Section 12.3.3, the calculations provided, and the layout drawings, e.g.,***

   a. ***Not all vital areas listed in Section 12.3.3 have corresponding calculations or maps (i.e., TSC, control room access/egress).***

      TVA RESPONSE:

      Continuous occupancy of the TSC and Main Control Room (MCR) is required during accident conditions (the TSC is within the MCR habitability zone and has the same dose as the MCR). The accident doses for the MCR/TSC include ingress and egress and are reported in FSAR Chapter 15.5. Consequently, dose maps of the MCR/TSR are not necessary.

   b. ***Not all vital areas indicated in the calculations and maps are listed in the FSAR (e.g., OSC, WBNTSR-114, WBNTSR-084).***

      TVA RESPONSE:

      The OSC is an area from which accident missions are dispatched, dose permitting. If the accident dose in the OSC is prohibitive, missions can be dispatched from the TSC. The mission dose calculations are done from both the OSC and TSC. Consequently, the OSC is not considered a vital area relative to dispatch of accident missions. FSAR section 12.3.2.2 will be revised to list any applicable additional areas addressed by the mission dose calculations.

   c. ***Not all calculations (i.e., WBNTSR -086) have corresponding maps.***

TVA RESPONSE:

Calculation WBNTSR-086 is for general surveys of four elevations of the auxiliary building during accident conditions to identify piping and component leaks. Since this is a general area, survey specific locations requiring survey within the building areas are not identified. Consequently, survey maps of the areas are not applicable. The calculation establishes the general area dose rates and estimated time required to complete the surveys.

2) ***Several calculations and maps included in the response clearly demonstrate that GDC 19 dose criteria will not be met during the proposed vital area missions.***

TVA RESPONSE:

Calculation WBNTSR-087 evaluated refill of the Refueling Water Storage Tank from several different sources. All sources except refill from the spent fuel pit could not be accomplished within the GDC 19 dose limitations. However, the mission can be accomplished from the spent fuel pit source. Several other missions exceed the GDC dose limitations for thyroid dose if self contained breathing apparatus (SCBA) are not utilized. However, in this case, use of SCBA is a special requirement of the calculations. In summary, all missions can be accomplished within the GDC 19 dose limitations utilizing the special requirements of the calculations.

3) ***The source term used in the evaluation of a steam generator tube rupture (WBNTSR-084) is not consistent with the source term required in the Design Basis Accident analysis in Chapter 15 of the FSAR (e.g., does not consider an iodine spike in the primary coolant).***

TVA RESPONSE:

The liquid source term used for the sample in WBNTSR-084 is the normal RCS source term, which is based on ANSI/ANS 18.1, 1984. The airborne activity used for the mission is that of a LOCA. It is expected that use of the LOCA source terms will bound use of the RCS source term with an Iodine spike. However, TVA will perform the calculation using the steam generator tube rupture source term.

4) ***Several calculations do not address whether the GDC 19 dose criteria are met, but instead calculate a maximum staytime before exceeding a pre-determined limit, with no indication if the identified access/egress vital action can be performed within the calculated results or whether the pre-determined criteria ensures that GDC 19 will be met.***

TVA RESPONSE:

Calculations WBNTSR-081 and WBNTSR-082 calculated a maximum stay time before exceeding the GDC 19 dose limits. Both these calculations also calculated the mission dose for a 1/2 hour mission. These calculations will be revised to clarify times required to perform the missions.

5) ***Several calculations identify an alternate, more limiting accident scenario (labeled EGTS PCO Control Loop Single Failure) without identifying what this scenario is, or why it is the limiting case. In at least two of the calculations (WBNAPSR 87 and 94) this limiting case is only calculated for Unit 1, with a note that the Unit 2 impact will have to be evaluated at a later date.***

TVA RESPONSE:

The mission dose calculations originally considered a single failure of one train of Emergency Gas Treatment System (EGTS) concurrent with a LOCA. An EGTS Pressure Control Operator (PCO) Control Loop Single Failure was also considered in the calculations due to a corrective actions program requirement. This new failure (scenario) is also described in the calculation revision log. The two different single failures resulted in different exhaust flows out of the Annulus to the outside environment. The mission dose was separately calculated for each of these single failures and was shown to be either bounded by the original single failure or resulted in doses less than the GDC 19 dose limits. Mission dose calculations that are currently only applicable to Unit 1 are being updated to make them applicable to Unit 2. The conclusions of the calculations are not expected to change with these revisions.

6) ***Several of the calculations have lists of operational restrictions (i.e., WBNAPS3 - 124 and 125) with no indication of whether the vital action can be completed within these restrictions, nor is there any indication of how TVA will insure these restrictions will be met.***

TVA RESPONSE:

Calculations WBNAPS3-124 and WBNAPS3-125 were issued for design change package EDC 56203. The normal design change control process, as described in procedure NPG-SPP-09.3, requires coordination of changes and special requirements with plant organizations. As part of this process the plant organizations are required to identify procedures that must be revised to incorporate the design output, including special requirements. The procedures must be revised prior to closing the design change. Ability to perform the special requirements is confirmed as part of the procedure revision process.

7) ***Several of the dose calculation conclusions state, "Therefore, the mission can be performed as long as the sum of occupancy, ingress/egress, and mission doses, for the entire duration of the accident, does not exceed the stated limit." It is unclear to the staff whether or not these mission doses comply with GDC 19. If this statement is intended to indicate that each of the mission dose calculations assumes that the operator has no prior accident-related dose, there should be an assurance that sufficient operators are available to complete all of the necessary missions to mitigate the consequences of the accident.***

Based on the above, the NRC staff has insufficient information to conclude that TVA has taken appropriate actions to reduce radiation levels and increase the capability of operators to control and mitigate the consequences of an accident at WBN Unit 2, in accordance with the guidance of NUREG-0737, Item II.B.2, or can maintain occupational doses to plant operators within the requirements of GDC 19. Therefore, the staff cannot conclude that the plant shielding for WBN Unit 2 is acceptable.

TVA RESPONSE:

The intent of the mission dose calculations is to show that critical missions can be accomplished during accident conditions and the dose will remain within the GDC 19 dose limitations. In actual practice, overall doses to plant personnel during accident conditions will be monitored and controlled by Site Radcon during accident conditions under the Radiological Emergency Plan. Individuals performing high dose missions can be released from the site prior to exceeding overall dose limits. Similarly, individuals who have accrued a significant dose prior to performing missions will not be tasked with performing the mission if exceeding the dose limitations is possible. This plan ensures that overall doses to plant personnel remain within regulatory limits during accident conditions. In addition to Operations personnel, many of the mission dose actions are performed by plant support personnel such as Chemistry and Radcon.

Consequently, the plant is adequately staffed to perform the necessary missions and perform other necessary functions during accident conditions and remain within the applicable regulatory dose limitations.

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Preliminary RAIs for FSAR 11 (taken from e-mail from NRC dated 03/23/2010)

Section 11

NRC Question:

3.c Table 11.2-7-Identify the specific source term, models, parameters, and assumptions used in calculating these values.

TVA RESPONSE:

Source Term

The source term used in calculating Table 11.2-7 was taken from the following design output documents.

The Liquid Radwaste is addressed by Calculation No. TVAN WBNTSR-093 (*Liquid Radioactive Waste Release*), which is based on NUREG-0017.

The Steam Generator Blowdown is addressed by Calculation No. WBNTSR-100 (Design Releases to Show Compliance with 10 CFR 20).

Nuclide	Single Unit Liquid Radwaste Ci/yr	Single Unit Steam Generator Blowdown Ci/yr	Single Unit Totals Ci/yr
Br-84	1.65E-04	5.23E-04	6.88E-04
I-131	2.63E-02	1.14E+00	1.16E+00
I-132	1.32E-02	1.08E-01	1.21E-01
I-133	5.29E-02	8.57E-01	9.10E-01
I-134	6.26E-03	2.65E-02	3.28E-02
I-135	4.75E-02	4.22E-01	4.70E-01
Rb-88	6.89E-03	7.84E-04	7.68E-03
Cs-134	2.93E-02	1.68E-01	1.98E-01
Cs-136	2.55E-03	1.72E-02	1.98E-02
Cs-137	4.03E-02	2.21E-01	2.61E-01
Na-24	1.86E-02	0.0E+00	1.86E-02
Cr-51	7.03E-03	9.27E-02	9.98E-02
Mn-54	4.99E-03	5.10E-02	5.59E-02
Fe-55	8.09E-03	0.0E+00	8.09E-03
Fe-59	2.42E-03	9.05E-03	1.15E-02
Co-58	2.20E-02	1.44E-01	1.66E-01
Co-60	1.44E-02	1.72E-02	3.16E-02

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Nuclide	Single Unit Liquid Radwaste Ci/yr	Single Unit Steam Generator Blowdown Ci/yr	Single Unit Totals Ci/yr
Zn-65	3.82E-04	0.0E+00	3.82E-04
Sr-89	1.92E-04	4.33E-03	4.52E-03
Sr-90	2.20E-05	3.88E-04	4.10E-04
Sr-91	2.84E-04	2.18E-03	2.47E-03
Y-91m	1.68E-04	0.0E+00	1.68E-04
Y-91	9.00E-05	3.00E-04	3.90E-04
Y-93	1.27E-03	0.0E+00	1.27E-03
Zr-95	1.39E-03	1.20E-02	1.34E-02
Nb-95	2.10E-03	8.98E-03	1.11E-02
Mo-99	4.20E-03	9.95E-02	1.04E-01
Tc-99m	3.35E-03	0.0E+00	3.35E-03
Ru-103	5.88E-03	0.0E+00	5.88E-03
Ru-106	7.63E-02	0.0E+00	7.63E-02
Te-129m	1.41E-04	0.0E+00	1.41E-04
Te-129	7.30E-04	0.0E+00	7.30E-04
Te-131m	8.05E-04	0.0E+00	8.05E-04
Te-131	2.03E-04	0.0E+00	2.03E-04
Te-132	1.11E-03	2.93E-02	3.05E-02
Ba-140	1.02E-02	3.48E-01	3.58E-01
La-140	1.62E-02	4.98E-01	5.14E-01
Ce-141	3.41E-04	0.0E+00	3.41E-04
Ce-143	1.53E-03	0.0E+00	1.53E-03
Ce-144	6.84E-03	1.26E-01	1.33E-01
Np-239	1.37E-03	0.0E+00	1.37E-03
H-3	1.25E+03	0.0E+00	1.25E+03
Totals w/o H-3	**4.38E-01**	**4.40E+00**	**4.84E+00**
Totals w/ H-3	**1.25E+03**	**4.40E+00**	**1.26E+03**

In order to ensure that the meaning of the column headings is clear, it is noted that the above numbers are for a single unit rather than for Unit 1. Unit 1 utilizes a tritium producing core (TPC) and thus has different values for the corresponding table.

Assumptions

1. Only the mobile demineralizers will be used for processing of liquid radwaste.

2. All sources, except the Laundry and Hot Shower Tank (LHST) and condensate resin regeneration waste, are collected for 24 hours (resulting in about 12 hour average holdup) prior to release, then discharged instantaneously to the mobile demineralizers for decontamination prior to release to the environment. The condensate resin regeneration

waste collects for 6 days, and the LHST is discharged directly to the environment. An exception to this is the case when there is no processing of the condensate by the Condensate Polishing Demineralizers, and the Steam Generator Blowdown is released directly to the river without processing (this will be a continuous release).

3. This calculation assumes a 365 day/yr/unit operation (i.e., 100% capacity factor) since the plant runs with 18 month fuel cycles; therefore, it is conceivable for the plant to run for the entire year.

4. Only one unit operation is addressed.

5. The unplanned release, which is added to the total, is assumed to be 0.16 Curies/yr based on NUREG-0017, section 2.2.23.1 (1).

6. Liquid Tritium release is 90% of 0.4 Ci/yr/MWt = 0.9 * 0.4 * 3480 = 1262.80 Ci/yr based on NUREG-0017, section 2.2.17.1. The MWt is based on 102% of a nominal power of 3411 MWt.

Model

The computer code STP (as described in FSAR Section 15.5.3) is used to determine the annual discharge due to the combination of the Auxiliary Building tanks (Reactor Coolant Drain Tank (RCDT), Turbine Drain Collector Tank (TDCT), Floor Drain Collector Tank (FDCT)), Chemical Volume Control System (CVCS) Letdown, the Turbine Building (TB), and the condensate regeneration waste (consisting of 6 day collection of Steam Generator Blowdown [SGB] and condensate flow). The model consists of a continuous source (all isotopes except noble gasses and N-16) of either Reactor Coolant (RC) and/or Secondary Side Coolant (SSC) and/or Secondary Side Steam (SSS) into an arbitrary volume of “1 tank” for 24 hours or 6 days, as appropriate. The noble gas daughter products are removed from the volume. The RC, SSC and SSS concentrations consist of ANSI/ANS-18.1-1984 expected reactor coolant, secondary side coolant, and secondary side steam adjusted to WBN operating parameters at 105% power. The ANSI/ANS-18.1-1984 source is essentially the same as NUREG-0017. The continuous source flow is based on NUREG-0017 values. All sources are summed with an appropriate weighting fraction (from NURGEG-0017) to take dilution into account. The weighting fraction is expressed in terms of fraction of Primary Coolant Activity (PCA).

Parameters

Below is a compilation of all leaks/effluents. Unless otherwise specified, the values are from NUREG-0017 Table 1-3. The leakage values are for 1 unit. The isotopes used in the analysis are only those listed in NUREG-0017. For the case of no condensate demineralizer processing of condensate, the regeneration waste is deleted from the total release. Also for this alternate case, the SGB component is modified by multiplying the appropriate Condensate Polishing

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Demineralizer decontamination factor of each isotope (essentially "undoing" the credited processing) to the inventory of each isotope in order to establish the release without processing.

a) Reactor Coolant Pump Seal leakage, 20 gal/day @ 0.1 PCA
b) Reactor Containment Cooling System, 500 gal/day @ 0.001 PCA
c) Other leaks and drains, 10 gal/day @ 1.67 PCA
d) Primary Coolant equipment drains, 80 gal/day @ 1.0 PCA
e) Reactor Coolant sampling, 200 gal/day @ 0.05 PCA
f) Spent Fuel Pit Liner drains, 700 gal/day @ 0.001 PCA
g) Auxiliary Building Floor Drains, 200 gal/day @ 0.1 PCA
h) Secondary System Sampling, 1400 gal/day @ 1 PCA (of SSC) (note: NUREG-0017 uses 1E-4 PCA [RC], this calculation uses actual SSC activities, therefore PCA=1 SSC)
i) CVCS letdown (via Holdup Tanks), 845 lb/hr (2431.654 gal/day) @ 1 PCA
j) Condensate Resin Regeneration Waste consisting of:
    1) SGB blowdown = 3E4 lb/hr (86330.93 gal/day) @ 1 PCA (of SSC)
    2) Condensate flow = 1.5E7 lb/hr (steam flow) *0.55 (flow split) = 8.25E6 lb/hr @ 1PCA (of SSS)
k) Turbine Building floor drains, 7200 gal/ day @ 1 PCA (of SSC) (note: no RC in Turbine Building).
l) LHST release taken directly from NUREG-0017 Table 2-27.

For the condensate regeneration waste, the continuous source varies according to element class, as the Condensate Polishing Demineralizers have variable Decontamination Factors (DFs). The DFs are 0.5 for Cs, Rb; 0 for H3; and 0.9 for I, Br, all others.

The decontamination factors are based on NUREG-0017 and/or vendor data. The various decontamination factors for each demineralizer are:

	H-3	Cs, Rb	Co-58	All Others	
CVCS*	1	2	50	50	
Mobile Demin	1	1000	100	1000	vendor (ref. 29)
Condensate Demins	1	2	10	10	

*The cation bed gives a minimum decontamination factor of 10 for ionic isotopes (including Cesium). The mixed bed also gives an additional factor of 10 (except for Cesium). The effective decontamination factor is then 10 for Cesium, and 100 for others. The use of the above values is therefore conservative.

The total release is determined by the following formula:

$$R_{TOT} = [R_{TANKS} + (R_{CVCS}/DF_{CVCS})]/DF_{MOBDEM} + R_{LHST} + R_{CONDEMINWASTE} + R_{TB}$$

where R_{TOT} = total release
R = release

DF = decontamination factor (see table above)
subscripts refer to source

In the event that the releases from the condensate regeneration are excessive, some of the waste can be treated with the mobile demineralizers. Not all of the condensate regenerative waste can be treated by the mobile demineralizers (the Non-Reclaimable and Neutralization Tank fluids cannot be processed); however, this calculation provides a bounding case which assumes none of the condensate regeneration waste is processed. The equation for the condensate regeneration treatment is:

$R_{TOT} = [R_{TANKS} + (R_{CVCS}/DF_{CVCS})]/DF_{MOBDEM} + R_{LHST} + R_{CONDEMINWASTE}/DF_{MOBDEM} + R_{TB}$

The formula for the case of direct SGB release and no condenser demineralizer processing is:

$R_{TOT} = [R_{TANKS} + (R_{CVCS}/DF_{CVCS})]/DF_{MOBDEM} + R_{LHST} + R_{SGB} + R_{TB}$

where $R_{SGB} = R_{CONDEMINWASTE} * DF_{CONDEMIN}$

Results

Examination of the above indicates that the total release will exceed 5 Ci/unit (10 CFR 50 Appendix I criteria of 5 Ci/unit), therefore another variant is determined. The variant is where the R_{SGB} is maximized so as to reach the total limit of 5 Ci/yr. The gross gamma concentration can then be back calculated to be 4.402 Ci/yr.

The maximum gross gamma concentration in the SGB release to the river without processing and not exceeding 5 Ci/unit is:

$$\frac{(4.402\text{Ci/yr}*1\text{E6uCi/Ci})}{(24hr/day*3E4lb/hr*453.59g/lb*1cc/g*365day/hr)} = 3.6528\text{E-5 uCi/cc}$$

Table 11.2-7 Values

For determining values found in Table 11.2-7, the model used was that specified in Regulatory Guide 1.109 Equations 1, 2, and 3 for potable water, aquatic foods, and shoreline deposits. FSAR Section 11.2.9.1 contains the Assumptions and Calculational Methods used to generate Table 11.2-7. Receptor and public water supplies data were taken from Tables 3-14 and 3-15 of the WBN FSEIS. For conservatism, a transit time of zero was assumed for releases to reach aquatic recreation areas and public water supplies.

Calculations were performed using TVA code “Quarterly Water Dose Computer Code” using equations from Sections 6.3 through 6.7 of WBN ODCM.

Enclosure 2

Watts Bar Nuclear Plant
Remaining Chapter 11 Request for Additional Information

NRC Question 11.3.a:

Table 11.3-10 (formerly 11.3-11) provided in Amendment 98 indicates that only change made is the table number. However, it appears that the entire table has been revised. Provide the basis for the revised dose number in Table 11.3-10.

TVA Response:

TVA has re-verified Table 11.3-10 due to an issue involving terrain adjustment factors identified in 2010, as described below:

In the past, the TVA used Gaseous Effluent Licensing Code (GELC) to perform routine dose assessments required by NRC Regulatory Guide 1.111. For WBN, adjustments to the GELC results were necessary to account for recirculation effects of spatial and temporal variations in airflow in the vicinity of pronounced river valleys. TVA had developed site-specific adjustment factors for WBN by comparing results from the GELC model with results from the MESOPUFF II model. These adjustment factors were revised each year to reflect changes based on annual surveys.

However, studies performed during 2010 for development of an American Nuclear Society (ANS) standard (specifically by the ANS-2.15 recirculation sub-group) determined that the adjustment factor approach is not acceptable for addressing recirculation issues. Further, comparisons with other models determined that MESOPUFF II is not suitable for calculating χ/Q values at WBN receptors, and that GELC adequately estimates χ/Q for WBN receptors, without any need for adjustments.

As a result of the above, the FSAR will be revised to eliminate the adjustment factors and use GELC results directly. Specifically, Table 11.3-10 (Unit 2 only) dose values for Noble Gases and Iodines/Particulates will be revised. In addition, due to elimination of the terrain adjustment factors, the highest dose pathway becomes vegetable ingestion instead of the cow milk with feeding factor. Doses reflected in this table will be of one unit (Unit 2) without a Tritium Producing Core. These changes will be submitted as part of Unit 2 FSAR, Amendment 103. Once Unit 2 is licensed, the plans are to combine this table with the Unit 1 UFSAR table when the Unit 2 FSAR and the Unit 1 UFSAR are merged.

NRC Question 11.3.b:

Table 11.3-10 (formerly 11.3-11) provided in Amendment 98 indicates the only change made is the table number. However, it appears that the entire table has been revised.

It is unclear if this table is demonstrating releases within the design criteria of 10 CFR Part 50 Appendix I (e.g., per unit) or RM 50-2 (e.g., per site), as committed to in response

to Question 8 of Section 11 in letter dated June 3, 2010 (ADAMS Accession Number ML101600477). Please clarification.

TVA Response:

The corresponding Unit 1 table is being revised in the same manner as described in question 11.3a above. When the Unit 1 and Unit 2 tables are combined, the results will be evaluated against the criteria of RM 50-2. The Unit 1 values are similar in magnitude to the Unit 2 values and thus the sum of the two units will meet the RM 50-2 criteria.

NRC Question 11.3.c:

Table 11.3-10 (formerly 11.3-11) provided in Amendment 98 indicates the only change made is the table number. However, it appears that the entire table has been revised.

The revised title indicates that the doses are for "Unit 1 without TPC (Tritium Production Core)." If that is accurate:

i) provide the estimated doses with Unit 2 operating, and

ii) provide the basis for not including Unit 1 tritium production.

TVA Response:

The table provides dose for Unit 2 as explained in the response to NRC question 11.3a. Note that the actual title of Table 11.3-10 is "(For 1 Unit without TPC)" rather than "(For Unit 1 without TPC)" verbiage used in the RAI question.

Enclosure 3

Watts Bar Nuclear Plant

Proposed FSAR Chapter 11 Markups
Proposed Final Supplemental Environmental Impact Statement Markups

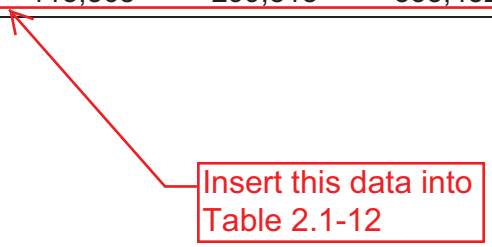
Table 2.1-12 Watts Bar
2040 Population Distribution
Within 50 Miles Of The Site
(Sheet 1 of 1)

Direction	0-10	10-20	20-30	30-40	40-50	Total
N	2,541	2,218	2,281	4,460	6,373	17,873
NNE	1,687	11,747	18,599	12,607	2,549	47,189
NE	1,524	3,597	16,808	26,935	80,896	129,760
ENE	1,174	4,918	31,814	72,849	244,656	355,411
E	4,811	9,773	17,518	24,692	46,384	103,178
ESE	890	6,151	19,601	4,909	3,336	34,887
SE	961	19,601	17,155	4,359	3,985	46,021
SSE	2,051	8,838	13,196	3,083	38,513	65,681
S	6,157	4,070	42,757	56,934	16,750	126,668
SSW	599	3,215	39,231	42,901	106,346	192,292
SW	1,056	13,605	14,537	60,959	127,447	217,604
WSW	943	12,996	2,714	2,667	3,603	22,923
W	941	3,150	4,984	2,771	5,249	17,095
WNW	721	1,981	3,729	5,400	19,945	31,776
NW	4,018	3,302	13,705	8,129	14,875	44,029
NNW	3,430	1,586	33,560	11,512	6,092	56,180
TOTAL	33,504	110,748	292,149	345,167	726,999	1,508,567

No. 1 - Replace with data from following page

Table 2.1-12 Watts Bar
2040 Population Distribution
Within 50 Miles of the Site
(Sheet 1 of 1)

Direction	0-10	10-20	20-30	30-40	40-50	Total
N	2,619	1,885	2,778	4,768	6,172	18,222
NNE	2,150	11,762	18,766	14,502	2,547	49,727
NE	1,441	3,783	16,734	29,838	78,334	130,130
ENE	1,110	3,553	29,539	63,798	253,831	351,832
E	1,915	11,352	18,647	30,063	44,013	105,990
ESE	135	6,230	20,120	5,068	3,280	34,833
SE	203	19,852	15,185	3,950	4,822	44,012
SSE	782	8,951	12,907	2,918	48,593	74,151
S	5,823	4,586	42,883	56,430	17,985	127,707
SSW	567	5,725	42,517	46,281	106,392	201,482
SW	1,051	12,978	14,499	62,307	111,795	202,630
WSW	938	12,791	2,837	2,840	3,372	22,778
W	937	3,406	5,555	2,944	5,474	18,316
WNW	717	2,091	4,372	5,654	20,511	33,345
NW	3,998	2,889	18,634	10,462	15,956	51,940
NNW	3,413	1,536	33,843	11,609	5,890	56,290
TOTAL	27,799	113,368	299,818	353,432	728,968	1,523,385



11.3.7.3 Expected Gaseous Waste Processing System Releases

Gaseous wastes consist of nitrogen and hydrogen gases purged from the Chemical Volume and Control System volume control tank when degassing the reactor coolant, and from the closed gas blanketing system. The gas decay tank capacity permits at least 60 days decay for waste gases before discharge during normal operation.

The quantities and isotopic concentration of gases discharged from the GWPS have been estimated. The analysis is based on input sources to the GWPS per NUREG–0017, modified to reflect WBN plant-specific parameters.

The expected gaseous releases in curies per year per reactor unit are given in Table 11.3-5.

11.3.7.4 Releases from Ventilation Systems

A detailed review of the entire plant has been made to ascertain those items that could possibly contribute to airborne radioactive releases.

During normal plant operations, airborne noble gases and/or iodines can originate from reactor coolant leakage, equipment drains, venting and sampling, secondary side leakage, condenser air ejector and gland seal condenser exhausts, and GWPS leakage.

The assumptions used to estimate the annual quantity of radioactive gaseous effluents are given in Table 11.3-6. These assumptions are in accordance with NUREG-0017. The noble gases and iodines discharged from the various sources are entered in Table 11.3-10.

No. 2 - Replace with "11.3-7"

11.3.7.5 Estimated Total Releases

The estimated releases listed in Table 11.3-7c have been used in calculating the site boundary doses as shown in Table 11.3-10. Table 11.3-7a is the expected gases released for 1% failed fuel with containment purge. Table 11.3-7 is the annual releases with purge air filters. Table 11.3-7b is the expected gases released for 1% failed fuel with continuous filtered containment vent, and Table 11.3-7c for approximately 1/8% failed fuel with continuous filtered containment vent.

The dose calculations, based on the estimated total plant releases, show that the releases are in accordance with the design objectives in Section 11.3.1 and meet the regulations as outlined in Section 11.3.7.1. Further, the total plant releases are within the ODCM limits.

11.3.8 Release Points

Gaseous radioactive wastes are released to the atmosphere through vents located on the Shield Building, Auxiliary Building, Turbine Building, and Service Building. A brief description, including function and location of each type vent, is presented below.

No. 3 - Replace with:

Turbine Building Vents

Gaseous wastes from the condenser are discharged through the condenser vacuum exhaust vent. The vent, which is a 12-inch diameter pipe, discharges at approximately the 760-foot level. Under normal operating conditions the discharge flow rate will typically be less than 45 cfm.

Non-radioactive ventilation air is exhausted from the Turbine Building through the Turbine Building vents. There are eighteen vents at the 755-foot level and twenty vents at the 824-foot level (roof level). The effluent flow rates vary for each type of vent. Generally, the normal flow rates through a typical vent at the 755-foot level is 22,888 cfm and the flow rates through typical vent at the 824-foot level is 28,500 cfm. The general arrangement of vents on the Turbine Building is shown on Figure 1.2-1. The turbine building is shown on the main plant general plan, Figure 2.1-5.

decay tanks is shown in Figure 11.3-1.

Auxiliary Building Vent

Waste gases in the Auxiliary Building are discharged through the Auxiliary Building exhaust vent. In addition, containment atmosphere is continuously vented, during normal operation for pressure control, into the annulus after it is filtered through HEPA and charcoal filters, and subsequently, discharged into the Auxiliary Building exhaust vent. The vent is of the chimney type having a rectangular cross section of 10 by 30 feet. The top of the vent is located atop the Auxiliary Building and discharges approximately 106 feet above grade. Under normal operating conditions, gases are continuously discharged through the vent. Effluent flow rates can be near 224,000 cfm when two Auxiliary Building general exhaust fans and one fuel-handling area exhaust fan are operating at full capacity. Under accident conditions, the Auxiliary Building is isolated, and the Auxiliary Building gas treatment system (ABGTS) is used to treat gaseous effluents. When in service, the ABGTS discharges to the Shield Building exhaust vent. The location of the Auxiliary Building exhaust vent is shown in the equipment layout diagram, Figure 1.2-1. The Auxiliary Building is shown on the main plant general plan, Figure 2.1-5.

Turbine Building Vents

Ventilation air is exhausted from the Turbine Building through the Turbine Building vents. There are eighteen vents at the 755-foot level and twenty vents at the 824-foot level (roof level). The effluent flow rates vary for each type of vent. Generally, the normal flow rates through a typical vent at the 755-foot level is 22,888 cfm and the flow rates through typical vent at the 824-foot level is 28,500 cfm. The general arrangement of vents on the Turbine Building is shown on Figure 1.2-1. The turbine building is shown on the main plant general plan, Figure 2.1-5.

Condenser Vacuum Exhaust Vent

Gaseous wastes from the condenser are discharged through the condenser vacuum exhaust vent. The vent, which is a 12-inch diameter pipe, discharges at approximately the 760-foot level. Under normal operating conditions the discharge flow rate will typically be less than 45 cfm.

Service Building Vent

Radiologically monitored potentially radioactive waste gases from the radiochemical laboratory and the titration room are exhausted through HEPA filters via a common duct which discharges to the common Service Building roof exhaust plenum. Exhaust air from the general area discharges to the common Service Building roof exhaust plenum. Separate vents from the common roof exhaust plenum discharge to atmosphere approximately 24 feet above grade. The Service Building is shown on the site plot plan, Figure 2.1-5.

11.3.9 Atmospheric Dilution

Calculations of atmospheric transport, dispersion, and ground deposition are based on the straight-line airflow model discussed in NRC Regulatory Guide 1.111 (Revision 1, July 1977). Releases are assumed to be continuous. Releases known to be periodic, e.g., those during containment purging and waste gas decay tank venting, are treated as continuous releases.

No. 4 - Replace with "batch."

Releases from the Shield Building, Turbine Building (TB), and Auxiliary Building (AB) vents are treated as ground level. The ground level joint frequency distribution (JFD) is given in Section 2.3. Air concentrations and deposition rates were calculated considering radioactive decay and buildup during transit. Plume depletion was calculated using the figures provided in Regulatory Guide 1.111.

No. 5 - Replace with "the ODCM."

Estimates of normalized concentrations (X/Q) and normalized depos for gaseous releases at points where potential dose pathways exist are listed in Table 11.3-8.

11.3.10 Estimated Doses from Radionuclides in Gaseous Effluents

Individuals are exposed to gaseous effluents via the following pathways: (1) external radiation from radioactivity in the air and on the ground; (2) inhalation; and (3) ingestion of beef, vegetables, and milk. No other additional exposure pathway has been identified which would contribute 10% or more to either individual or population doses.

11.3.10.1 Assumptions and Calculational Methods

No. 6 - Replace with "2007"

External air exposures are evaluated at points of potential maximum exposure (i.e., points at the unrestricted area boundary). External skin and total body exposures are evaluated at nearby residences. The dose to the critical organ from radioiodines, tritium (Unit 1 only) and particulates is calculated for real pathways existing at the site during a land use survey conducted in 1994.

No. 6 - Delete

No. 6 - Replace with "2007"

To evaluate the potential critical organ dose, milk animals and nearest gardens were identified by a detailed survey within five miles of the plant (Table 11.3-8). Information on grazing seasons and feeding regimes are reflected in the feeding factor. The feeding factor is the fraction of the year an animal grazes on pasture. During the 1994 land use survey, there was one milk cow location identified in which information regarding the feeding regime for the animals, and the ages of onsite consumers of the milk could not be established. Because no specific information is known, it is conservatively assumed that the feeding factor for that location is equal to the worst-

No. 6 Delete

No. 7 - Delete

No. 7 - Replace with "0.33"

No. 7 - Replace with "past"

case feeding factor identified during the 1994 land use census for any real cow location (i.e., 70% pasture feeding) and that all four age groups are present. Since specific data on beef animals were not available, the nearest beef animal was assumed to be at the point of maximum offsite exposure. Milk ingestion is the critical pathway.

TVA assumes that enough fresh vegetables are produced at each residence to supply annual consumption by all members of that household. TVA assumes that enough meat is produced in each sector annulus to supply the needs of that region. Watts Bar projected population distribution for the year 2040 is given in Table 11.3-9.

Doses are calculated using the dose factors and methodology contained in NRC Regulatory Guide 1.109 with certain exceptions as follows:

(1) Inhalation doses are based on the average individuals inhalation rates found in ICRP Publication 23 of 1,400; 5,500; 8,000; and 8,100 m^3/year for infant, child, teen, and adult, respectively.

(2) The milk ingestion pathway has been modeled to include specific information on grazing periods for milk animals obtained from a detailed farm survey. A feeding factor (FF) has been defined as that fraction of total feed intake a dairy animal consumes that is from fresh forage. The remaining portion of feed (1-FF) is assumed to be from stored feed. Doses calculated from milk produced by animals consuming fresh forage are multiplied by these factors. Concentrations of radioactivity in stored feed are adjusted to reflect radioactive decay during the maximum assumed storage period of 180 days by the factor:

$$\frac{1}{180}\int_{0}^{180}\exp(-\lambda_i t)dt = \frac{1-\exp(-\lambda_i 180)}{180\lambda_i}$$

This factor replaces the factor exp ($-\lambda_i t_h$) in equation C-10 of Regulatory Guide 1.109.

(3) The stored vegetable and beef ingestion pathways have been modeled to reflect more accurately the actual dietary characteristics of individuals. For stored vegetables the assumption is made that home grown stored vegetables are consumed when fresh vegetables are not available, i.e., during the 9 months of fall, winter, and spring. Rather than use a constant

Category	Ages (A)*	Fraction
Teen	13<A<19	0.153
Adult	19≤A	0.665

* e.g., someone who is 1 year, 11 months is an infant, while someone who is exactly two years old is a child.

Tables 11.3-10 and 11.3-11 provide the doses estimated for individuals and the population within 50 miles of the plant site.

11.3.10.2 Summary of Annual Population Doses

TVA has estimated the radiological impact to regional population groups in the year 2040 from the normal operation of the Watts Bar Nuclear Plant. Table 11.3-11 summarizes these population doses. The total body dose from background to individuals within the United States ranges from approximately 100 mrem to 250 mrem per year. The annual total body dose due to background for a population of about 1,100,000 persons expected to live within a 50 mile radius of the Watts Bar Nuclear Plant in the year 2040 is calculated to be approximately 154,000 man-rem assuming 140 mrem/year/individual. By comparison, the same population (excluding onsite radiation workers) will receive a total body dose of approximately 3.85 man-rem from effluents. Based on these results, TVA concludes that the normal operation of the Watts Bar Nuclear Plant will present minimal risk to the health and safety of the public.

REFERENCES

None

No. 8 - Replace with "210,000"

No. 8 - Replace with "6.66"

No. 8 - Replace with "1,500,000"

Table 11.3-7 Annual Radioactive Releases With Purge Air Filters (Curies/Year/Reactor)

Table based on operation of one unit.

Nuclide	Contain.(1) Building	Aux. Building	Turbine Building	Total
Kr-85m	2.00E+01	4.53E+00	1.23E+00	2.58E+01
Kr-85	6.90E+02	7.05E+00	1.86E+00	6.99E+02
Kr-87	1.09E+01	4.27E+00	1.09E+00	1.62E+01
Kr-88	2.84E+01	7.95E+00	2.13E+00	3.85E+01
Xe-131m	1.17E+03	1.73E+01	4.53E+00	1.19E+03
Xe-133m	4.63E+01	1.90E+00	5.21E-01	4.88E+01
Xe-133	3.12E+03	6.70E+01	1.77E+01	3.20E+03
Xe-135m	3.86E+00	3.68E+00	9.80E-01	8.52E+00
Xe-135	1.55E+02	2.40E+01	6.46E+00	1.85E+02
Xe-137	3.18E-01	9.67E-01	2.58E-01	1.54E+00
Xe-138	3.33E+00	3.42E+00	9.06E-01	7.66E+00
Ar-41	3.40E+01	0.00E+00	0.00E+00	3.40E+01
Br-84	6.00E-05	5.02E-02	4.81E-04	5.07E-02
I-131	7.29E-03	1.39E-01	7.08E-03	1.53E-01
I-132	1.61E-03	6.56E-01	1.70E-02	6.75E-01
I-133	3.55E-03	4.35E-01	2.03E-02	4.58E-01
I-134	1.66E-03	1.06E+00	1.47E-02	1.08E+00
I-135	3.16E-03	8.10E-01	3.13E-02	8.45E-01
H-3	1.39E+02	0.00E+00	0.00E+00	1.39E+02
H-3 (TPC)(3) Unit 1 Only	3.70E+02	0.00E+00	0.00E+00	3.70E+02
Cr-51	9.21E-05	5.00E-04	0.00E+00	5.92E-04
Mn-54	5.30E-05	3.78E-04	0.00E+00	4.31E-04
Co-57	8.20E-06	0.00E+00	0.00E+00	8.20E-06
Co-58	2.50E-04	2.29E-02	0.00E+00	2.32E-02
Co-60	2.61E-05	8.71E-03	0.00E+00	8.74E-03
Fe-59	2.70E-05	5.00E-05	0.00E+00	7.70E-05
Sr-89	1.30E-04	2.85E-03	0.00E+00	2.98E-03
Sr-90	5.22E-05	1.09E-03	0.00E+00	1.14E-03
Zr-95	4.80E-08	1.00E-03	0.00E+00	1.00E-03
Nb-95	1.80E-05	2.43E-03	0.00E+00	2.45E-03
Ru-103	1.60E-05	6.10E-05	0.00E+00	7.70E-05
Ru-106	2.70E-08	7.50E-05	0.00E+00	7.50E-05
Sb-125	0.00E+00	6.09E-05	0.00E+00	6.09E-05
Cs-134	2.53E-05	2.24E-03	0.00E+00	2.27E-03
Cs-136	3.21E-05	4.80E-05	0.00E+00	8.01E-05
Cs-137	5.58E-05	3.42E-03	0.00E+00	3.48E-03
Ba-140	2.30E-07	4.00E-04	0.00E+00	4.00E-04
Ce-141	1.30E-05	2.64E-05	0.00E+00	3.95E-05
C-14	2.80E+00	4.50E+00	0.00E+00	7.30E+00

(1) Includes release from GWPS
(2) 4.28E+02 = 4.28 X 10^2
(3) Tritium values for a Tritim Production Core

No. 9 - Delete

Table 11.3-7a Design (For 1% Failed Fuel) Expected Gas Release Concentration/(Effluent Concentration Limit) With Containment Purge (Sheet 1 of 2)

	Exp. Rel. (Ci/yr)	Des/Exp	Design (Ci/yr)	Design (μCi/cc)	10CFR20 (ECL)	**Single Unit Operation** C/ECL	**Dual Unit Operation** C/ECL
Kr-85m	2.58E+01	12.28	3.17E+02	1.10E-10	1.0E-07	0.0010951	0.0021902
Kr-85	6.99E+02	33.08	2.31E+04	7.99E-09	7.0E-07	0.0114124	0.0228248
Kr-87	1.62E+01	7.45	1.21E+02	4.18E-11	2.0E-08	0.0020906	0.0041812
Kr-88	3.85E+01	12.33	4.75E+02	1.64E-10	9.0E-09	0.0182306	0.0364612
Xe-131m	1.19E+03	2.91	3.45E+03	1.19E-09	2.0E-06	0.0005971	0.0011942
Xe-133m	4.88E+01	43.24	2.11E+03	7.29E-10	6.0E-07	0.0012142	0.0024284
Xe-133	3.20E+03	111.07	3.55E+05	1.23E-07	5.0E-07	0.2456675	0.4913350
Xe-135m	8.52E+00	5.04	4.29E+01	1.48E-11	4.0E-08	0.0003710	0.0007420
Xe-135	1.85E+02	6.97	1.29E+03	4.46E-10	7.0E-08	0.006375	0.012750
Xe-138	7.66E+00	5.43	4.16E+01	1.44E-11	2.0E-08	0.0007188	0.0014376
Br-84	5.07E-02	2.50	1.27E-01	4.38E-14	8.0E-08	5.478E-07	1.096E-06
I-131	1.53E-01	52.41	8.03E+00	2.77E-12	2.0E-10	0.013875	0.027750
I-132	6.75E-01	4.00	2.70E+00	9.33E-13	2.0E-08	4.67E-05	0.0000934
I-133	4.58E-01	26.85	1.23E+01	4.25E-12	1.0E-09	0.0042535	0.0085070
I-134	1.08E+00	1.65	1.78E+00	6.14E-13	6.0E-08	1.023E-05	2.046E-05
I-135	8.45E-01	7.91	6.69E+00	2.31E-12	6.0E-09	0.0003851	0.0007702
Cs-134	2.27E-03	40.60	9.20E-02	3.18E-14	2.0E-10	0.0001589	0.0003178
Cs-136	8.01E-05	165.20	1.32E-02	4.57E-15	9.0E-10	5.079E-06	1.016E-05
Cs-137	3.48E-03	153.22	5.33E-01	1.84E-13	2.0E-10	0.0009203	0.0018406
Cr-51	5.92E-04	0.29	1.73E-04	5.96E-17	3.0E-08	1.988E-09	3.976E-09
Mn-54	4.31E-04	0.47	2.03E-04	7.01E-17	1.0E-09	7.005E-08	1.401E-07
Fe-59	7.70E-05	3.48	2.68E-04	9.27E-17	5.0E-10	1.853E-07	3.706E-07
Co-58	2.32E-02	5.37	1.24E-01	4.30E-14	1.0E-09	4.298E-05	8.596E-05
Co-60	8.74E-03	1.38	1.21E-02	4.17E-15	5.0E-11	8.333E-05	1.667E-04
Sr-89	2.98E-03	22.45	6.69E-02	2.31E-14	1.0E-09	2.313E-05	4.626E-05
Sr-90	1.14E-03	13.49	1.54E-02	5.33E-15	6.0E-12	0.0008877	0.0017754
Zr-95	1.00E-03	1.71	1.71E-03	5.92E-16	4.0E-10	1.481E-06	2.962E-06
Nb-95	2.45E-03	2.34	5.73E-03	1.98E-15	2.0E-09	9.895E-07	1.979E-06
Ba-140	4.00E-04	0.31	1.26E-04	4.34E-17	2.0E-09	2.171E-08	4.342E-08
H-3	1.39E+02	1	1.39E+02	4.80E-11	1.0E-07	0.0004811	0.0009622
H-3 (TPC)	3.70E+02	1	3.70E+02	1.28E-10	1.0E-07	0.0012775	0.0012775
1 rod	1.53E+03	1	1.53E+03	5.29E-10	1.0E-07	0.0052869	0.0052869
2 rod	2.69E+03	1	2.69E+03	9.30E-10	1.0E-07	0.0092962	0.0092962
C-14	7.30E+00	1	7.30E+00	2.52E-12	3.0E-09	0.000841	0.001682
Ar-41	3.40E+01	1	3.40E+01	1.18E-11	1.0E-08	0.0011752	0.0023504
Total						0.3109694	0.6219388
Total (TPC)						0.3117657	0.6227352
1 rod						0.3157751	0.6267446
2 rod						0.3197845	0.6307539

No. 10 - Delete

Table 11.3-7a Design (For 1% Failed Fuel) Expected Gas Release Concentration/(Effluent Concentration Limit) With Containment Purge (Sheet 2 of 2)

Note: The “Dual Unit Operation” column in the above calculation considers dual unit operation. Based on the evaluation done for Revision 7, the per unit concentrations are the same for both units. Therefore, the last column is twice the preceeding column except in the case of TPC.

Note: Dual unit operation considers only Unit 1 with TPC.

Table 11.3-7b Design (For 1% Failed Fuel) Expected Gas Release Concentration/(Effluent Concentration Limit) With Continuous Filtered Containment Vent (Sheet 1 of 2)

	Exp. Rel. (Ci/yr)	Des/Exp	Design (Ci/yr)	Design (μCi/cc)	10CFR20 (ECL)	**Single Unit Operation** C/ECL	**Dual Unit Operation** C/ECL
Kr-85m	9.48E+00	12.28	1.16E+02	4.02E-11	1.0E-07	0.0004024	0.0008048
Kr-85	6.78E+02	33.08	2.24E+04	7.75E-09	7.0E-07	0.0110743	0.0221486
Kr-87	5.81E+00	7.45	4.33E+01	1.50E-11	2.0E-08	0.0007480	0.0014960
Kr-88	1.32E+01	12.33	1.63E+02	5.63E-11	9.0E-09	0.0062505	0.0125010
Xe-131m	1.09E+03	2.91	3.18E+03	1.10E-09	2.0E-06	0.0005489	0.0010978
Xe-133m	4.31E+01	43.24	1.86E+03	6.44E-10	6.0E-07	0.0010735	0.0021470
Xe-133	2.90E+03	111.07	3.22E+05	1.11E-07	5.0E-07	0.2227110	0.4454220
Xe-135m	4.68E+00	5.04	2.36E+01	8.15E-12	4.0E-08	0.0002038	0.0004076
Xe-135	8.88E+01	6.97	6.19E+02	2.14E-10	7.0E-08	0.0030561	0.0061122
Xe-138	4.34E+00	5.43	2.36E+01	8.15E-12	2.0E-08	0.0004073	0.0008146
Br-84	5.07E-02	2.50	1.27E-01	4.38E-14	8.0E-08	0.0000005	0.0000010
I-131	1.53E-01	52.41	8.00E+00	2.77E-12	2.0E-10	0.0138277	0.0276554
I-132	6.73E-01	4.00	2.69E+00	9.30E-13	2.0E-08	0.0000465	0.0000930
I-133	4.57E-01	26.85	1.23E+01	4.24E-12	1.0E-09	0.0042433	0.0084866
I-134	1.07E+00	1.65	1.77E+00	6.10E-13	6.0E-08	0.0000102	0.0000204
I-135	8.42E-01	7.91	6.66E+00	2.30E-12	6.0E-09	0.0003837	0.0007674
Cs-134	2.27E-03	40.60	9.20E-02	3.18E-14	2.0E-10	0.0001589	0.0003178
Cs-136	8.01E-05	165.20	1.32E-02	4.57E-15	9.0E-10	0.0000051	0.0000102
Cs-137	3.48E-03	153.22	5.33E-01	1.84E-13	2.0E-10	0.0009203	0.0018406
Cr-51	5.92E-04	0.29	1.73E-04	5.96E-17	3.0E-08	0.0000000	0.0000000
Mn-54	4.31E-04	0.47	2.03E-04	7.01E-17	1.0E-09	0.0000001	0.0000002
Fe-59	7.70E-05	3.48	2.68E-04	9.27E-17	5.0E-10	0.0000002	0.0000004
Co-58	2.32E-02	5.37	1.24E-01	4.30E-14	1.0E-09	0.0000430	0.0000860
Co-60	8.74E-03	1.38	1.21E-02	4.17E-15	5.0E-11	0.0000833	0.0001666
Sr-89	2.98E-03	22.45	6.69E-02	2.31E-14	1.0E-09	0.0000231	0.0000462
Sr-90	1.14E-03	13.49	1.54E-02	5.33E-15	6.0E-12	0.0008877	0.0017754
Zr-95	1.00E-03	1.71	1.71E-03	5.92E-16	4.0E-10	0.0000015	0.0000030
Nb-95	2.45E-03	2.34	5.73E-03	1.98E-15	2.0E-09	0.0000010	0.0000020
Ba-140	4.00E-04	0.31	1.26E-04	4.34E-17	2.0E-09	0.0000000	0.0000000
H-3	1.39E+02	1	1.39E+02	4.80E-11	1.0E-07	0.0004811	0.0009622
H-3 (TPC)	3.70E+02	1	3.70E+02	1.28E-10	1.0E-07	0.0012775	0.0012775
1 rod	1.53E+03	1	1.53E+03	5.29E-10	1.0E-07	0.0052869	0.0052869
2 rod	2.69E+03	1	2.69E+03	9.30E-10	1.0E-07	0.0092962	0.0092962
C-14	7.30E+00	1	7.30E+00	2.52E-12	3.0E-09	0.0008410	0.0016820
Ar-41	3.40E+01	1	3.40E+01	1.18E-11	1.0E-08	0.0011752	0.0023504
Total						0.2696131	0.5392262
Total (TPC)						0.2704095	0.5400226
1 rod						0.2744189	0.5440320
2 rod						0.2784283	0.5480413

No. 12 - Delete

Table 11.3-7b Design (For 1% Failed Fuel) Expected Gas Release Concentration/(Effluent Concentration Limit) With Continuous Filtered Containment Vent (Sheet 2 of 2)

Note: The “Dual Unit Operation” column in the above calculation considers dual unit operation. Based on the evaluation done for Revision 7, the per unit concentrations are the same for both units. Therefore, the last column is twice the preceeding column except in the case of TPC.

Note: Dual unit operation considers only Unit 1 with TPC.

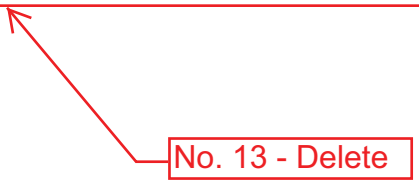


Table 11.3-7c Total Releases (≈ 1/8 failed fuel in Ci/yr), with Continuous Filtered Containment Vent (Sheet 1 of 1)

Table based on operation of one unit

Nuclide	Contain.(1) Building	Aux. Building	Turbine Building	Total
Kr-85m	3.72E+00	4.53E+00	1.23E+00	9.48E+00
Kr-85	6.69E+02	7.05E+00	1.86E+00	6.78E+02
Kr-87	4.48E-01	4.27E+00	1.09E+00	5.81E+00
Kr-88	3.10E+00	7.95E+00	2.13E+00	1.32E+01
Xe-131m	1.07E+03	1.73E+01	4.53E+00	1.09E+03
Xe-133m	4.07E+01	1.90E+00	5.21E-01	4.31E+01
Xe-133	2.82E+03	6.70E+01	1.77E+01	2.90E+03
Xe-135m	2.26E-02	3.68E+00	9.80E-01	4.68E+00
Xe-135	5.83E+01	2.40E+01	6.46E+01	8.88E+01
Xe-137	3.76E-04	9.67E-01	2.58E-01	1.23E+00
Xe-138	1.69E-02	3.42E+00	9.06E-01	4.34E+00
Ar-41	3.40E+01	0.00E+00	0.00E+00	3.40E+01
Br-84	8.16E-07	5.02E-02	4.81E-04	5.07E-02
I-131	6.74E-03	1.39E-01	7.08E-03	1.53E-01
I-132	1.36E-04	6.56E-01	1.70E-02	6.73E-01
I-133	2.36E-03	4.35E-01	2.03E-02	4.57E-01
I-134	4.26E-05	1.06E+00	1.47E-02	1.07E+00
I-135	8.80E-04	8.10E-01	3.13E-02	8.42E-01
H-3	1.39E+02	0.00E+00	0.00E+00	1.39E+02
H-3 (TPC)	3.70E+02	0.00E+00	0.00E+00	3.70E+02
Cr-51	9.21E-05	5.00E-04	0.00E+00	5.92E-04
Mn-54	5.30E-05	3.78E-04	0.00E+00	4.31E-04
Co-57	8.20E-06	0.00E+00	0.00E+00	8.20E-06
Co-58	2.50E-04	2.29E-02	0.00E+00	2.32E-02
Co-60	2.61E-05	8.71E-03	0.00E+00	8.74E-03
Fe-59	2.70E-05	5.00E-05	0.00E+00	7.70E-05
Sr-89	1.30E-04	2.85E-03	0.00E+00	2.98E-03
Sr-90	5.22E-05	1.09E-03	0.00E+00	1.14E-03
Zr-95	4.80E-08	1.00E-03	0.00E+00	1.00E-03
Nb-95	1.80E-05	2.43E-03	0.00E+00	2.45E-03
Ru-103	1.60E-05	6.10E-05	0.00E+00	7.70E-05
Ru-106	2.70E-08	7.50E-05	0.00E+00	7.50E-05
Sb-125	0.00E+00	6.09E-05	0.00E+00	6.09E-05
Cs-134	2.53E-05	2.24E-03	0.00E+00	2.27E-03
Cs-136	3.21E-05	4.80E-05	0.00E+00	8.01E-05
Cs-137	5.58E-05	3.42E-03	0.00E+00	3.48E-03
Ba-140	2.30E-07	4.00E-04	0.00E+00	4.00E-04
Ce-141	1.30E-05	2.64E-05	0.00E+00	3.95E-05
C-14	2.80E+00	4.50E+00	0.00E+00	7.30E+00

(TPC) Tritium values for a Tritium Production Core (Unit 1 only)

No. 14 - Delete

Table 11.3-8 Data On Points Of Interest Near Watts Bar Nuclear Plant (Page 1 of 2)

	Sector	Distance (Meters)	Chi-over-Q (s/m^3)	D-over-Q (1/m^2)	Terrain Adjustment Factor	Milk Feeding Factor
Unrestricted Area Boundary	N	1550	5.12e-06	8.13e-09	1.70	
Unrestricted Area Boundary	NNE	1980	6.35e-06	1.23e-08	1.80	
Unrestricted Area Boundary	NE	1580	1.05e-05	1.10e-08	2.10	
Unrestricted Area Boundary	ENE	1370	1.23e-05	8.77e-09	1.70	
Unrestricted Area Boundary	E	1280	1.37e-05	9.66e-09	1.60	
Unrestricted Area Boundary	ESE	1250	1.43e-05	1.16e-08	1.80	
Unrestricted Area Boundary	SE	1250	1.11e-05	9.49e-09	1.50	
Unrestricted Area Boundary	SSE	1250	6.04e-06	8.21e-09	1.50	
Unrestricted Area Boundary	S	1340	5.33e-06	1.17e-08	1.90	
Unrestricted Area Boundary	SSW	1550	4.14e-06	1.05e-08	2.00	
Unrestricted Area Boundary	SW	1670	4.46e-06	7.34e-09	2.10	
Unrestricted Area Boundary	WSW	1430	5.47e-06	6.37e-09	1.80	
Unrestricted Area Boundary	W	1460	2.11e-06	2.07e-09	1.20	
Unrestricted Area Boundary	WNW	1400	2.49e-06	2.38e-09	2.50	
Unrestricted Area Boundary	NW	1400	2.05e-06	2.13e-09	1.70	
Unrestricted Area Boundary	NNW	1460	2.68e-06	3.08e-09	1.60	
Resident	N	2134	2.84e-06	4.21e-09	1.50	
Resident	NNE	3600	2.69e-06	4.41e-09	1.80	
Resident	NE	3353	3.84e-06	3.22e-09	2.20	
Resident	ENE	2414	6.26e-06	3.83e-09	1.90	
Resident	E	3268	3.97e-06	2.14e-09	1.70	
Resident	ESE	4416	2.64e-06	1.46e-09	1.90	
Resident	SE	1372	9.66e-06	8.16e-09	1.50	
Resident	SSE	1524	4.18e-06	5.56e-09	1.40	
Resident	S	1585	3.91e-06	8.42e-09	1.80	
Resident	SSW	1979	2.76e-06	6.64e-09	1.90	
Resident	SW	4230	1.15e-06	1.43e-09	2.00	
Resident	WSW	1829	3.61e-06	4.03e-09	1.70	
Resident	W	2896	7.30e-07	6.01e-10	1.10	
Resident	WNW	1646	2.26e-06	2.12e-09	2.90	
Resident	NW	2061	1.03e-06	9.95e-10	1.50	
Resident	NNW	4389	3.50e-07	2.97e-10	1.00	
Garden	N	7664	3.13e-07	3.00e-10	1.00	
Garden	NNE	6173	1.06e-06	1.42e-09	1.50	
Garden	NE	3829	3.06e-06	2.44e-09	2.10	
Garden	ENE	4927	2.01e-06	9.39e-10	1.60	
Garden	E	4991	1.99e-06	9.02e-10	1.50	
Garden	ESE	6096	1.63e-06	7.77e-10	1.80	
Garden	SE	4633	1.58e-06	8.97e-10	1.30	
Garden	SSE	7454	4.74e-07	3.57e-10	1.40	
Garden	S	2254	2.50e-06	4.94e-09	1.90	

No. 15 - Replace with attached revised table

Table 11.3-8 Data On Points Of Interest Near Watts Bar Nuclear Plant (Page 2 of 2)

	Sector	Distance (Meters)	Chi-over-Q (s/m^3)	D-over-Q (1/m^2)	Terrain Adjustment Factor	Milk Feeding Factor
Garden	SSW	8100	2.79e-07	4.16e-10	1.40	
Garden	SW	8100	4.28e-07	4.03e-10	1.80	
Garden	WSW	4667	9.86e-07	8.06e-10	1.70	
Garden	W	5120	3.33e-07	2.23e-10	1.10	
Garden	WNW	5909	1.85e-07	1.13e-10	1.40	
Garden	NW	3170	5.63e-07	4.78e-10	1.50	
Garden	NNW	4698	3.18e-07	2.64e-10	1.00	
Milk Cow	ESE	6096	1.63e-06	7.77e-10	1.80	0.25
Milk Cow	ESE	6706	1.35e-06	6.18e-10	1.70	0.03
Milk Cow	SSW	2286	2.24e-06	5.20e-09	1.90	0.05
Milk Cow	SSW	3353	1.36e-06	2.84e-09	2.00	0.33

No. 15 - Replace with attached revised table

No. 15 - New Data for Table 11.3.8

Table 11.3-8 Data On Points of Interest Near Watts Bar Nuclear Plant (Page 1 of 2)

	Sector	Distance (Meters)	Chi-over-Q (s/m^3)	D-over-Q (1/m^3)	Milk Feeding Factor
Unrestricted Area Boundary	N	1550	3.01e06	4.78e-09	1.00
Unrestricted Area Boundary	NNE	1980	3.53e-06	6.82e-09	1.00
Unrestricted Area Boundary	NE	1580	4.99e-06	5.23e-09	1.00
Unrestricted Area Boundary	ENE	1370	7.24e-06	5.16e-09	1.00
Unrestricted Area Boundary	E	1280	8.57e-06	6.04e-09	1.00
Unrestricted Area Boundary	ESE	1250	7.94e-06	6.46e-09	1.00
Unrestricted Area Boundary	SE	1250	7.40e-06	6.32e-09	1.00
Unrestricted Area Boundary	SSE	1250	4.03e-06	5.48e-09	1.00
Unrestricted Area Boundary	S	1340	2.81e-06	6.14-e09	1.00
Unrestricted Area Boundary	SSW	1550	2.07e-06	5.23e-09	1.00
Unrestricted Area Boundary	SW	1670	2.13e-06	3.50e-09	1.00
Unrestricted Area Boundary	WSW	1430	3.04e-06	3.54e-09	1.00
Unrestricted Area Boundary	W	1460	1.76e-06	1.72e-09	1.00
Unrestricted Area Boundary	WNW	1400	9.95e-07	9.50e-10	1.00
Unrestricted Area Boundary	NW	1400	1.20e-06	1.25e-09	1.00
Unrestricted Area Boundary	NNW	1460	1.67e-06	1.93e-09	1.00
Nearest Resident	N	2134	1.90e-06	2.81e-09	1.00
Nearest Resident	NNE	3600	1.49e-06	2.45e-09	1.00
Nearest Resident	NE	3353	1.75e-06	1.46e-09	1.00
Nearest Resident	ENE	2414	3.29e-06	2.01e-09	1.00
Nearest Resident	E	3268	2.34e-06	1.26e-09	1.00
Nearest Resident	ESE	4416	1.39e-06	7.66e-10	1.00
Nearest Resident	SE	1372	6.44e-06	5.44e-09	1.00
Nearest Resident	SSE	1524	2.99e-06	3.97e-09	1.00
Nearest Resident	S	1585	2.17e-06	4.68e-09	1.00
Nearest Resident	SSW	1979	1.45e-06	3.50e-09	1.00
Nearest Resident	SW	4230	5.76e-07	7.14e-10	1.00
Nearest Resident	WSW	1829	2.13e-06	2.37e-09	1.00
Nearest Resident	W	2896	6.64e-07	5.47e-10	1.00
Nearest Resident	WNW	1646	7.81e-07	7.31e-10	1.00
Nearest Resident	NW	2061	6.88e-07	6.64e-10	1.00
Nearest Resident	NNW	4389	3.50e-07	2.97e-10	1.00
Nearest Garden	N	7664	3.13e-07	3.00e-10	1.00
Nearest Garden	NNE	6173	7.04e-07	9.46e-10	1.00
Nearest Garden	NE	3353	1.75e-06	1.46e-09	1.00
Nearest Garden	ENE	4927	1.26e-06	5.87e-10	1.00
Nearest Garden	E	6372	9.63e-07	3.87e-10	1.00
Nearest Garden	ESE	4758	1.25e-06	6.73e-10	1.00
Nearest Garden	SE	4633	1.21e-06	6.90e-10	1.00
Nearest Garden	SSE	7454	3.39e-07	2.55e-10	1.00
Nearest Garden	S	2254	1.31e-06	2.60e-09	1.00

No. 15 - New Data for Table 11.3.8

Table 11.3-8 Data On Points of Interest Near Watts Bar Nuclear Plant (Page 2 of 2)

	Sector	Distance (Meters)	Chi-over-Q (s/m^3)	D-over-Q (1/m^3)	Milk Feeding Factor
Nearest Garden	SSW	1979	1.45e-06	3.50e-09	1.00
Nearest Garden	SW	8100	2.38e-07	2.24e-10	1.00
Nearest Garden	WSW	4667	5.80e-07	4.74e-10	1.00
Nearest Garden	W	5120	3.03e-07	2.03e-10	1.00
Nearest Garden	WNW	5909	1.32e-07	8.07e-11	1.00
Nearest Garden	NW	3170	3.75e-07	3.18e-10	1.00
Nearest Garden	NNW	4602	3.28e-07	2.74e-10	1.00
Milk Cow	ESE	6706	7.97e-07	3.64e-10	0.03
Milk Cow	SSW	2286	1.18e-06	2.74e-09	0.05
Milk Cow	SSW	3353	6.80e-07	1.42e-09	0.33

Table 11.3-9 Projected 2040 Population Distribution Within 50 Miles Of Watts Bar Nuclear Plant Population Within Each Sector Element Distance From Site (Miles)

	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	0	111	32	47	135	893	2071	2166	3453	4040
NNE	0	25	25	76	43	796	8591	19187	9342	1194
NE	0	0	130	208	130	861	3381	19210	30623	54111
ENE	0	2	55	53	78	252	2445	9497	38457	136395
E	0	2	7	53	38	482	9716	8837	10649	17404
ESE	0	2	4	47	58	591	4514	12085	3420	300
SE	0	0	16	35	29	505	17835	10818	3969	3756
SSE	0	23	3	27	24	714	4018	8056	3899	6362
S	12	54	14	24	257	1368	1141	34699	40812	11522
SSW	0	34	7	19	32	739	5653	17523	25829	117868
SW	0	0	5	2	0	519	6490	9411	68565	125338
WSW	0	10	40	38	30	1281	10369	2091	7134	6571
W	2	5	19	59	65	837	965	5337	2839	2035
WNW	5	30	10	140	121	244	1461	2925	3440	17598
NW	0	10	111	113	387	2279	314	7266	7004	9802
NNW	0	0	62	87	98	2081	874	18279	4784	2983
Total	19	308	540	1028	1525	14442	79838	187387	264219	517279

No. 16 - Replace with attached revised table

Table 11.3-9
Projected 2040 Population Distribution
Within 50 Miles of Watts Bar Nuclear Plant Population
Within Each Sector Element Distance from Site (Miles)

Direction	0-10	10-20	20-30	30-40	40-50	Total
N	2,619	1,885	2,778	4,768	6,172	18,222
NNE	2,150	11,762	18,766	14,502	2,547	49,727
NE	1,441	3,783	16,734	29,838	78,334	130,130
ENE	1,110	3,553	29,539	63,798	253,831	351,832
E	1,915	11,352	18,647	30,063	44,013	105,990
ESE	135	6,230	20,120	5,068	3,280	34,833
SE	203	19,852	15,185	3,950	4,822	44,012
SSE	782	8,951	12,907	2,918	48,593	74,151
S	5,823	4,586	42,883	56,430	17,985	127,707
SSW	567	5,725	42,517	46,281	106,392	201,482
SW	1,051	12,978	14,499	62,307	111,795	202,630
WSW	938	12,791	2,837	2,840	3,372	22,778
W	937	3,406	5,555	2,944	5,474	18,316
WNW	717	2,091	4,372	5,654	20,511	33,345
NW	3,998	2,889	18,634	10,462	15,956	51,940
NNW	3,413	1,536	33,843	11,609	5,890	56,290
TOTAL	27,799	113,368	299,818	353,432	728,968	1,523,385

No. 16 - New Data for Table 11.3.9

No. 17 - Replace with

0.479

1.62

0.38

1.02

1.70

Table 11.3-10 Watts Bar Nuclear Plant- Individual Doses From Gaseous Effluents (For 1 Unit without TPC)

Effluent	Pathway	Guideline*	Location	Dose	
Noble Gases	γ Air dose	10 mrad	Maximum Exposed Individual[1]	0.801	mrad/yr
	β Air dose	20 mrad	Maximum Exposed Individual[1]	2.710	mrad/yr
	Total body	5 mrem	Maximum Residence[2,3]	0.571	mrem/yr
	Skin	15 mrem	Maximum Residence[2,3]	1.540	mrem/yr
Iodines/ Particulates	Thyroid (critical organ)	15 mrem	Maximum Real Pathway[4]	2.715	mrem/yr

No. 17 - Replace with: Total Vegetable Ingestion 0.97

Breakdown of Iodine/Particulate Doses (mrem/yr)

No. 17 - Replace with

0.322

0.0499

0.0685

0.285

1.6954

Cow Milk with Feeding Factor of 0.33	2.44
Inhalation	0.174
Ground Contamination	0.0405
Submersion	0.0603
Beef Ingestion	0.0
Total	2.7148

No. 17 -Replace with "5"

*Guidelines are defined in Appendix I to 10 CFR Part 50.

No. 17 - Replace with "1280"

[1]Maximum exposure point is at 1250 meters in the SE sector.

No. 17 - Replace with "E"

[2]Dose from air submersion.

[3]Maximum exposed residence is at 1372 meters in the SE sector.

No. 17 - Replace with "1979"

No. 17 - Replace with "child"

[4]Maximum exposed individual is an infant at 3353 meters in the SSW sector.

No. 17 -Insert "5 Maximum dose location for all receptors is 1280 meters in the E Sector."

Table 11.3-11 Summary Of Population Doses

THYROID

	Infant	Child	Teen	Adult	Total
Submersion	8.28E-02	1.59E-01	1.44E-01	6.28E-01	9.45E-01
Ground	3.11E-03	3.49E-02	3.17E-02	1.38E-01	2.08E-01
Inhalation	7.45E-02	1.39E-00	7.44E-01	2.64E+00	4.85E+00
Cow Milk Ingestion	4.09E-01	1.98E-00	8.42E-01	1.60E-00	4.83E+00
Beef Ingestion	0.00E+00	3.52E-01	1.77E-01	8.93E-01	1.42E-00
Vegetable Ingestion	0.00E+00	1.18E-00	4.76E-01	1.26E-01	2.92E+00
Total man-rem	5.01E-01	5.10E+00	2.42E+00	7.15E+00	1.52E+01

TOTAL BODY

	Infant	Child	Teen	Adult	Total
Submersion	1.42E-02	1.59E-01	1.44E-01	6.28E-01	9.45E-01
Ground	3.11E-03	3.49E-02	3.17E-02	1.38E-01	2.08E-01
Inhalation	4.28E-03	1.14E-01	7.23E-02	2.99E-01	4.90E-01
Cow Milk Ingestion	1.14E-01	6.30E-01	2.39E-01	4.25E-01	1.41E-00
Beef Ingestion	0.00E+00	3.36E-01	1.69E-01	8.52E-01	1.36E-00
Vegetable Ingestion	0.00E+00	1.20E-00	5.08E-01	1.42E-00	3.12E+00
Total man-rem	1.36E-01	2.47E+00	1.16E-00	3.76E+00	7.53E+00

No. 18 - Replace with attached revised table

Table 11.3-11 Summary of Population Doses

THYROID

	Infant	Child	Teen	Adult	Total
Submersion	1.26e-02	1.41e-01	1.28e-01	5.57e-01	8.38e-01
Ground	2.31e-03	2.59e-02	2.36e-02	1.03e-01	1.54e-01
Inhalation	6.62e-02	1.24e+00	6.64e-01	2.36e+00	4.33e-00
Cow Milk Ingestion	3.22e-01	1.57e+00	6.63e-01	1.25e+00	3.81e+00
Beef Ingestion	0.00e+00	3.17e-01	1.59e-01	8.04e-01	1.28e+00
Vegetable Ingestion	0.00e+00	1.04e+00	4.16e-01	1.09e+00	2.55e+00
Total man-rem	4.04e-01	4.34e+00	2.05e+00	6.17e+00	1.30e+01

TOTAL BODY

	Infant	Child	Teen	Adult	Total
Submersion	1.26e-02	1.41e-01	1.28e-01	5.57e-01	8.38e-01
Ground	2.31e-03	2.59e-02	2.36e-02	1.03e-01	1.54e-01
Inhalation	3.93e-03	1.05e-01	6.65e-02	2.76e-01	4.52e-01
Cow Milk Ingestion	1.04e-01	5.73e-01	2.17e-01	3.85e-01	1.28e+00
Beef Ingestion	0.00e+00	3.06e-01	1.53e-01	7.74e-01	1.23e+00
Vegetable Ingestion	0.00e+00	1.05e+00	4.40e-01	1.21e+00	2.70e+00
Total man-rem	1.23e-01	2.20e+00	1.03e+00	3.31e+00	6.66e+00

No. 18 - New Data for Table 11.3.11

Table 3-19. Receptors from Actual Land Use Survey Results Used for Potential Gaseous Releases From WBN Unit 2

Receptor Number	Receptor Type	Sector	Distance (meters)
1	Nearest Residence	N	2134
2	Nearest Residence	NNE	3600
3	Nearest Residence	NE	3353
4	Nearest Residence	ENE	2414
5	Nearest Residence	E	3139
6	Nearest Residence	ESE	4416
7	Nearest Residence	SE	1372
8	Nearest Residence	SSE	1524
9	Nearest Residence	S	1585
10	Nearest Residence	SSW	1979
11	Nearest Residence	SW	4230
12	Nearest Residence	WSW	1829
13	Nearest Residence	W	2896
14	Nearest Residence	WNW	1646
15	Nearest Residence	NW	3048
16	Nearest Residence	NNW	4389
17	Nearest Garden	N	7644
18	Nearest Garden	NNE	6173
19	Nearest Garden	NE	3829
20	Nearest Garden	ENE	4831
21	Nearest Garden	E	8005
22	Nearest Garden	ESE	4758
23	Nearest Garden	SE	4633
24	Nearest Garden	SSE	2043
25	Nearest Garden	S	4973
26	Nearest Garden	SSW	2286
27	Nearest Garden	SW	8100
28	Nearest Garden	WSW	4667
29	Nearest Garden	W	5150
30	Nearest Garden	WNW	5793
31	Nearest Garden	NW	3170
32	Nearest Garden	NNW	4698
33	Milk Cow	ESE	6096
34	Milk Cow	ESE	6706
35	Milk Cow	SSW	2286
36	Milk Cow	SSW	3353
37	Milk Cow	NW	8100

Replace this data using updated data in the following table

Use this updated data in place of the data in the prior table

Table 3-19 Receptors from 2007 Actual Land Use Survey Results Used for Potential Gaseous Releases From WBN Unit 2

Receptor Number	Receptor Type	Sector	Distance (meters)
1.	Nearest Resident	N	2134
2.	Nearest Resident	NNE	3600
3.	Nearest Resident	NE	3353
4.	Nearest Resident	ENE	2414
5.	Nearest Resident	E	3268
6.	Nearest Resident	ESE	4416
7.	Nearest Resident	SE	1372
8.	Nearest Resident	SSE	1524
9.	Nearest Resident	S	1585
10.	Nearest Resident	SSW	1979
11.	Nearest Resident	SW	4230
12.	Nearest Resident	WSW	1829
13.	Nearest Resident	W	2896
14.	Nearest Resident	WNW	1646
15.	Nearest Resident	NW	2061
16.	Nearest Resident	NNW	4389
17.	Nearest Garden	N	7664
18.	Nearest Garden	NNE	6173
19.	Nearest Garden	NE	3353
20.	Nearest Garden	ENE	4927
21.	Nearest Garden	E	6372
22.	Nearest Garden	ESE	4758
23.	Nearest Garden	SE	4633
24.	Nearest Garden	SSE	7454
25.	Nearest Garden	S	2254
26.	Nearest Garden	SSW	1979
27.	Nearest Garden	SW	8100
28.	Nearest Garden	WSW	4667
29.	Nearest Garden	W	5120
30.	Nearest Garden	WNW	5909
31.	Nearest Garden	NW	3170
32.	Nearest Garden	NNW	4602
33.	Milk Cow	ESE	6706
34.	Milk Cow	SSW	2286
35.	Milk Cow	SSW	3353

Replace this data using updated data in the following table

Table 3-20. WBN Total Annual Gaseous Discharge Per Operating Unit (curies/year/reactor)

Nuclide	Containment Building	Auxiliary Building	Turbine Building	Total per Unit
Kr-85m	1.99E+01	4.53E+00	1.23E+00	2.57E+01
Kr-85	6.90E+02	7.05E+00	1.86E+00	6.99E+02
Kr-87	1.09E+01	4.27E+00	1.09E+00	1.63E+01
Kr-88	2.83E+01	7.95E+00	2.13E+00	3.84E+01
Xe-131m	1.17E+03	1.73E+01	4.53E+00	1.19E+03
Xe-133m	4.63E+01	1.90E+00	5.21E-01	4.87E+01
Xe-133	3.12E+03	6.70E+01	1.77E+01	3.20E+03
Xe-135m	3.85E+00	3.68E+00	9.80E-01	8.51E+00
xXe-135	1.55E+02	2.40E+01	6.46E+00	1.85E+02
Xe-137	3.18E-01	9.67E-01	2.58E-01	1.54E+00
Xe-138	3.32E+00	3.42E+00	9.06E-01	7.65E+00
Ar-41	3.40E+01	0.00E+00	0.00E+00	3.40E+01
Br-84	6.00E-05	5.01E-02	4.81E-04	5.06E-02
I-131	7.29E-03	1.39E-01	7.08E-03	1.53E-01
I-132	1.60E-03	6.56E-01	1.70E-02	6.75E-01
I-133	3.55E-03	4.35E-01	2.03E-02	4.59E-01
I-134	1.66E-03	1.06E+00	1.47E-02	1.08E+00
I-135	3.16E-03	8.10E-01	3.13E-02	8.44E-01
H-3	1.37E+02	0.00E+00	0.00E+00	1.37E+02
H-3 (TPC)	3.70E+02	0.00E+00	0.00E+00	3.70E+02
Cr-51	9.21E-05	5.00E-04	0.00E+00	5.92E-04
Mn-54	5.30E-05	3.78E-04	0.00E+00	4.31E-04
Co-57	8.20E-06	0.00E+00	0.00E+00	8.20E-06
Co-58	2.50E-04	2.29E-02	0.00E+00	2.32E-02
Co-60	2.61E-05	8.71E-03	0.00E+00	8.74E-03
Fe-59	2.70E-05	5.00E-05	0.00E+00	7.70E-05
Sr-89	1.30E-04	2.85E-03	0.00E+00	2.98E-03
Sr-90	5.22E-05	1.09E-03	0.00E+00	1.14E-03
Zr-95	4.80E-08	1.00E-03	0.00E+00	1.00E-03
Nb-95	1.80E-05	2.43E-03	0.00E+00	2.45E-03
Ru103	1.60E-05	6.10E-05	0.00E+00	7.70E-05
Ru-106	2.70E-08	7.50E-05	0.00E+00	7.50E-05
Sb-125	0.00E+00	6.09E-05	0.00E+00	6.09E-05
Cs-134	2.53E-05	2.24E-03	0.00E+00	2.27E-03
Cs-136	3.21E-05	4.80E-05	0.00E+00	8.01E-05
Cs-137	5.58E-05	3.42E-03	0.00E+00	3.48E-03
Ba-140	2.30E-07	4.00E-04	0.00E+00	4.00E-04
Ce-141	1.30E-05	2.64E-05	0.00E+00	3.94E-05
C-14	2.80E+00	4.50E+00	0.00E+00	7.30E+00

A companion figure, illustrating the release points for radioactive gaseous effluents from WBN is presented in Figure 3-9.

Use this updated data in place of the data in the prior table

Table 3-20 WBN Total annual Gaseous discharge Per Operating Unit (curies/year/reactor)

Nuclide	Containment Building	Auxiliary Building	Turbine Building	Total
Kr-85m	3.72E+00	4.53E+00	1.23E+00	9.48E+00
Kr-85	6.69E+02	7.05E+00	1.86E+00	6.78E+02
Kr-87	4.48E-01	4.27E+00	1.09E+00	5.81E+00
Kr-88	3.10E+00	7.95E+00	2.13E+00	1.32E+01
Xe-131m	1.07E+03	1.73E+01	4.53E+00	1.09E+03
Xe-133m	4.07E+01	1.90E+00	5.21E-01	4.31E+01
Xe-133	2.82E+03	6.70E+01	1.77E+01	2.90E+03
Xe-135m	2.26E-02	3.68E+00	9.80E-01	4.68E+00
Xe-135	5.83E+01	2.40E+01	6.46E+01	8.88E+01
Xe-137	3.76E-04	9.67E-01	2.58E-01	1.23E+00
Xe-138	1.69E-02	3.42E+00	9.06E-01	4.34E+00
Ar-41	3.40E+01	0.00E+00	0.00E+00	3.40E+01
Br-84	8.16E-07	5.02E-02	4.81E-04	5.07E-02
I-131	6.74E-03	1.39E-01	7.08E-03	1.53E-01
I-132	1.36E-04	6.56E-01	1.70E-02	6.73E-01
I-133	2.36E-03	4.35E-01	2.03E-02	4.57E-01
I-134	4.26E-05	1.06E+00	1.47E-02	1.07E+00
I-135	8.80E-04	8.10E-01	3.13E-02	8.42E-01
H-3	1.39E+02	0.00E+00	0.00E+00	1.39E+02
H-3 (TPC)	3.70E+02	0.00E+00	0.00E+00	3.70E+02
Cr-51	9.21E-05	5.00E-04	0.00E+00	5.92E-04
Mn-54	5.30E-05	3.78E-04	0.00E+00	4.31E-04
Co-57	8.20E-06	0.00E+00	0.00E+00	8.20E-06
Co-58	2.50E-04	2.29E-02	0.00E+00	2.32E-02
Co-60	2.61E-05	8.71E-03	0.00E+00	8.74E-03
Fe-59	2.70E-05	5.00E-05	0.00E+00	7.70E-05
Sr-89	1.30E-04	2.85E-03	0.00E+00	2.98E-03
Sr-90	5.22E-05	1.09E-03	0.00E+00	1.14E-03
Zr-95	4.80E-08	1.00E-03	0.00E+00	1.00E-03
Nb-95	1.80E-05	2.43E-03	0.00E+00	2.45E-03
Ru-103	1.60E-05	6.10E-05	0.00E+00	7.70E-05
Ru-106	2.70E-08	7.50E-05	0.00E+00	7.50E-05
Sb-125	0.00E+00	6.09E-05	0.00E+00	6.09E-05
Cs-134	2.53E-05	2.24E-03	0.00E+00	2.27E-03
Cs-136	3.21E-05	4.80E-05	0.00E+00	8.01E-05
Cs-137	5.58E-05	3.42E-03	0.00E+00	3.48E-03
Ba-140	2.30E-07	4.00E-04	0.00E+00	4.00E-04
Ce-141	1.30E-05	2.64E-05	0.00E+00	3.95E-05
C-14	2.80E+00	4.50E+00	0.00E+00	7.30E+00

A companion figure illustrating the release points for radioactive gaseous effluents from WBN is presented in Figure 3-9.

A tabulation of the resulting calculated gaseous doses to individuals per operational unit is given in Table 3-21.

Replace this data using updated data in the following table

Table 3-21. WBN Doses From Gaseous Effluent For Unit 2 Without Tritium Production for Year 2040

Effluent	Pathway	Guideline[1]	Location	Dose
Noble Gases	γ Air dose	10 mrad	Maximum Exposed Individual[2]	0.801 mrad/year
	β Air dose	20 mrad	Maximum Exposed Individual[2]	2.710 mrad/year
	Total body	5 mrem	Maximum Residence[3,4]	0.571 mrem/year
Iodines/ Particulate	Skin	10 mrem	Maximum Residence[3,4]	1.540 mrem/year
	Thyroid (critical organ)	15 mrem	Maximum Real Pathway[5]	2.715 mrem/year

Breakdown of Iodine/Particulate Doses (mrem/yr)

Cow Milk with Feeding Factor of 0.65	2.44
Inhalation	0.174
Ground Contamination	0.0405
Submersion	0.0603
Beef Ingestion[2]	0.00
Total	2.7148

[1]Guidelines are defined in Appendix I to 10 CFR Part 50.
[2]Maximum exposure point is at 1250 meters in the ESE sector.
[3]Dose from air submersion.
[4]Maximum exposed residence is at 1372 meters in the SE sector.
[5]Maximum exposed individual is an infant at 3353 meters in the SSW sector.

The estimated annual airborne releases and resulting doses as presented by the 1972 FES, the WBN Unit 1 FSAR, Unit 2, Unit 1 and 2 totals, and recent historical data from WBN Unit 1 (as submitted in the Annual Radioactive Effluent Reports to the NRC) with NRC guidelines given in 10 CFR 50 Appendix I are compared in Table 3-22. These guidelines are designed to assure that releases of radioactive material from nuclear power reactors to unrestricted areas during normal conditions, including expected occurrences, are kept as low as practicable.

A tabulation of the resulting calculated gaseous doses to individuals per operational unit is given in Table 3-21.

Use this updated data in place of the data in the prior table

Table 3-21 WBN Doses From Gaseous Effluent for Unit 2 Without Tritium Production for Year 2040

Effluent	Pathway	Guideline*	Location	Dose
Noble Gases	γ Air dose	10 mrad	Maximum Exposed Individual[1]	0.479 mrad/year
	β Air dose	20 mrad	Maximum Exposed Individual[1]	1.62 mrad/year
	Total body	5 mrem	Maximum Residence[2,3]	0.38 mrem/year
Iodines/ Particulate	Skin	10 mrem	Maximum Residence[2,3]	1.02 mrem/year
	Thyroid (critical organ)	15 mrem	Maximum Real Pathway[4]	1.70 mrem/year

Breakdown of Iodine/Particulate Doses (mrem/yr)

Total Vegetable Ingestion	0.97
Inhalation	0.322
Ground Contamination	0.0499
Submersion	0.0685
Beef Ingestion[5]	0.285
Total	1.6954

*Guidelines are defined in Appendix I to 10 CFR Part 50.
[1]Maximum exposure point is at 1280 meters in the E sector.
[2]Dose from air submersion.
[3]Maximum exposed residence is at 1372 meters in the SE sector.
[4]Maximum exposed individual is a child at 1979 meters in the SSW sector.
[5]Maximum dose location for all receptors is 1280 meters in the E Sector.

The estimated annual airborne releases and resulting doses as presented by the 1972 FES, the WBN Unit 1 FSAR, Unit 2, Unit 1 and 2 totals, and recent historical data from WBN Unit 1 (as submitted in the Annual Radioactive Effluent Reports to the NRC) with NRC guidelines given in 10 CFR 50 Appendix I are compared in Table 3-22. These guidelines are designed to assure that releases of radioactive material from nuclear power reactors to unrestricted areas during normal conditions, including expected occurrences, are kept as low as practicable.

Enclosure 4

Watts Bar Nuclear Plant

List of Commitments

1. In the footnote added to Table 11.2-5 by Amendment 102, the term “F/H1D” in the formulation of Column 5 and “Mobi”le” in the definition of “D” should be, “F/H/D” and “Mobile”, respectively. These items will be corrected in FSAR Amendment 103. (Question 9)

2. Table 11.3-10 of the FSAR will be corrected to reflect the 2007 feeding factors and the offsite radiation doses calculated without terrain adjustment factors. These changes to Table 11.3-10 will be reflected in Amendment 103. (Question 14)

3. TVA has reviewed the FSEIS and found Table 3-20 to be in error. This was caused by the use of values contained in FSAR Table 11.3.7 instead of values contained in FSAR Table 11.3.7c. The correct source term used for calculating the site boundary doses is FSAR Table 11.3.7c. As a result, this accounts for the dose values being same between the FSEIS and the FSAR Table 11.3-10. (Question 15)

4. FSAR Section 11.3.10.1, “Assumptions and Calculation Methods” incorrectly states the dose to the critical organ from radioiodines, tritium, and particulates is calculated for real pathways existing at the site during a land use survey conducted in 1994. The feeding factor of 70% is the feeding factor associated with the 1994 land use survey. The feeding factor of 65% listed in Table 3-21 of the FSEIS is in error and should be 0.33%. These changes to FSAR Section 11.3.10.1 will be reflected in Amendment 103. (Question 18)

5. Further, comparisons with other models determined that MESOPUFF II is not suitable for calculating χ/Q values at WBN receptors, and that GELC adequately estimates χ/Q for WBN receptors, without any need for adjustments. Therefore, WBN can eliminate the use adjustment factors and use GELC results directly. These changes will be reflected in Table 11.3-8 in FSAR, Amendment 103. (Question 20)

6. TVA has reviewed the FSEIS and found the land use data presented in Table 3-19 to be in error. The land use survey used to develop Table 11.3-10 was from 2007. Table 11.3-10 of the FSAR will be revised to include 2007 feeding factors and the offsite radiation doses being calculated without terrain adjustment factors. These changes to Table 11.3-10 will be reflected in Amendment 103. (Question 21)

7. TVA will provide an update in a future FSAR amendment. (Question 22, 23, 28, and 29)

8. FSAR section 12.3.2.2 will be revised to list any applicable additional areas addressed by the mission dose calculations. (Question 30.1.b)

9. The liquid source term used for the sample in WBNTSR-084 is the normal RCS source term, which is based on ANSI/ANS 18.1, 1984. The airborne activity used for the mission is that of a LOCA. It is expected that use of the LOCA source terms will bound use of the RCS source term with an Iodine spike. However, TVA will perform the calculation using the steam generator tube rupture source term. (Question 30.3)

Enclosure 4

Watts Bar Nuclear Plant

List of Commitments

10. TVA will revise calculations WBNTSR-081 and WBNTSR-092 to specify mission times. (Question 30.4)

11. Mission dose calculations that are currently only applicable to Unit 1 are being updated to make them applicable to Unit 2. (Question 30.5)

12. The FSAR will be revised to eliminate the adjustment factors and use GELC results directly. Specifically, Table 11.3-10 (Unit 2 only) dose values for Noble Gases and Iodines/Particulates will be revised. In addition, due to elimination of the terrain adjustment factors, the highest dose pathway becomes vegetable ingestion instead of the cow milk with feeding factor. Doses reflected in this table will be of one unit (Unit 2) without a Tritium Producing Core. These changes will be submitted as part of Unit 2 FSAR, Amendment 103. (Enclosure 2 - Question 11.3.a)

Attachment 1

Watts Bar Nuclear Plant

Calculation WBN EEB EDQ1090-99005
Extending Channel Operational Test Frequency for Radiation Monitors

A.

NPG CALCULATION COVERSHEET/CCRIS UPDATE

REV 0 EDMS/RIMS NO.	EDMS TYPE:	EDMS ACCESSION NO (N/A for REV. 0)
B26000215402	calculations (nuclear)	

Calc Title: Extending Channel Operational Test Frequency for Radiation Monitors

CALC ID	TYPE	ORG	PLANT	BRANCH	NUMBER	CUR REV	NEW REV	REVISION APPLICABILITY
CURRENT	CN	NUC	WBN	EEB	EDQ1090-99005	000	001	Entire calc ☒ Selected pages ☐
NEW	CN	NUC						

ACTION	NEW ☐ REVISION ☒	DELETE ☐ RENAME ☐	SUPERSEDE ☐ DUPLICATE ☐	CCRIS UPDATE ONLY ☐ (Verifier Approval Signatures Not Required)	No CCRIS Changes ☐ (For calc revision, CCRIS been reviewed and no CCRIS changes required)

UNITS 001	SYSTEMS 090	UNIDS: N/A

DCN, EDC, N/A	APPLICABLE DESIGN DOCUMENT(S)	CLASSIFICATION
PER 292999	FSAR 12.3.4, 11.4	D

QUALITY RELATED?	SAFETY RELATED? (If yes, QR = yes)	UNVERIFIED ASSUMPTION	SPECIAL REQUIREMENTS AND/OR LIMITING CONDITIONS?	DESIGN OUTPUT ATTACHMENT?	SAR/TS and/or ISFSI SAR/CoC AFFECTED
Yes ☒ No ☐	Yes ☒ No ☐	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒

PREPARER ID	PREPARER PHONE NO	PREPARING ORG (BRANCH)	VERIFICATION METHOD	NEW METHOD OF ANALYSIS
acwhaley	423-452-4446	EEB	Design Review	☐ Yes ☒ No

PREPARER SIGNATURE	DATE	CHECKER SIGNATURE	DATE
Aaron C. Whaley	2/10/11	Jeremy A. Thompson	2-10-11
VERIFIER SIGNATURE	DATE	APPROVAL SIGNATURE	DATE
Jeremy A. Thompson	2-10-11	Thomas R. Raley	2/14/11

STATEMENT OF PROBLEM/ABSTRACT

The Channel Operational Tests (COT) have been performed at a quarterly frequency for many monitors. History has shown that frequency is overly conservative. This calculation analyzes the historical data and recommends changes in the COT frequency.

It was determined that the COT frequency can be extended. For monitors that are required by Tech Spec or ODCM, a COT frequency of once every 3 quarters was recommended and once per fuel cycle for all others.

MICROFICHE/EFICHE Yes ☐ No ☒ FICHE NUMBER(S)

☐ LOAD INTO EDMS AND DESTROY
☒ LOAD INTO EDMS AND RETURN CALCULATION TO CALCULATION LIBRARY. ADDRESS: EQB-1M-WBN
☐ LOAD INTO EDMS AND RETURN CALCULATION TO:

LEGIBILITY EVALUATED AND ACCEPTED FOR ISSUE. 2/10/11
SIGNATURE DATE

(ALL PAGES REV 001)

NPG CALCULATION COVERSHEET/CCRIS UPDATE

Page 1a

CALC ID	TYPE	ORG	PLANT	BRANCH	NUMBER	REV
	CN	NUC	WBN	EEB	EDQ1090-99005	001

ALTERNATE CALCULATION IDENTIFICATION

BLDG	ROOM	ELEV	COORD/AZIM	FIRM	Print Report Yes ☒
N/A	N/A	N/A	N/A	Bechtel	

CATEGORIES: NA

KEY NOUNS (A-add, D-delete)

ACTION (A/D)	KEY NOUN	A/D	KEY NOUN

CROSS-REFERENCES (A-add, C-change, D-delete)

ACTION (A/C/D)	XREF CODE	XREF TYPE	XREF PLANT	XREF BRANCH	XREF NUMBER	XREF REV
A	P	IN	WBN	EEB	EEB-TI-28	
A	P	PE	WBN	EEB	PER 292999	
A	P	PE	WBN	EEB	PER 00-001766-000	
A	P	DN	WBN	EEB	DCN 51426	
A	P	DN	WBN	EEB	DCN 50483	
A	P	DN	WBN	EEB	EDC 50574	
A	P	DW	WBN	EEB	1-47W610-90-1	
A	P	DW	WBN	EEB	1-47W610-90-2	
A	P	DW	WBN	EEB	1-47W610-90-3	
A	P	DW	WBN	EEB	1-47W610-90-4	
A	P	DW	WBN	EEB	1-47W610-90-5	
A	P	GN	WBN	EEB	P.S.4.M.4.1	

CCRIS ONLY UPDATES:
Following are required only when making keyword/cross reference CCRIS updates and page 1 of form NEDP-2-1 is not included:

PREPARER SIGNATURE	DATE	CHECKER SIGNATURE	DATE
PREPARER PHONE NO.	EDMS ACCESSION NO.		

This sheet added by R1.

B. **NPG CALCULATION RECORD OF REVISION**

CALCULATION IDENTIFIER : WBN-EEB-EDQ1090-99005

Title: Extending Channel Operational Test Frequency for Radiation Monitors

Revision No.	DESCRIPTION OF REVISION
000	Initial issue. FSAR Review: Referenced sections of the FSAR & Technical Requirements Manual, and Tech Specs were reviewed for impact. There is no present impact. This calculation gives a basis for change. This calculation contains 24 pages with 2 attachments for a total of 47 pages.
001	This revision resolves PER 292999. Revision 0 contained a condition that did not meet the acceptance criteria specified in the calculation. Zero failures were allowed among the 41 samples selected in order to meet 95/95 criteria. One failure was recorded among the samples. Inadequate justification was given for this one failure. This revision revises the acceptance criteria by expanding the number of samples taken to the 77 (all monitors presented in this calculation were sampled). By expanding the number of samples to 77, the 95/95 criteria can be met with a maximum of 3 failures within the sample set. The 95/95 criteria was met under these circumstances, therefore the conclusion of this calculation to change the COT frequency is supported. This revision does not change the conclusion of Revision 0. Only the justification supporting the conclusion has been modified in this revision. In addition to these changes, the word "of" was inserted into a sentence on page 6 in order to make the sentence grammatically correct. Revision levels of the references were updated where appropriate. There are no computations in this calculation. Pages Added: 1a, Attachment 3 pages 1-3 Pages Changed: 1-13, 21 Pages Deleted: None Total Pages in this Calculation: 51 Including Appendixes (pages) 0 and Attachments (pages) 26 WBN SAR Section(s) 12.3.4 & 11.4 were Reviewed By Aaron C. Whaley and are not impacted by the results of this calculation. WBN Technical Specifications/Bases and Technical Requirements Manual/Bases Sections(s) 3.3.3, 3.3.6, 3.3.7, 3.3.8, 3.4.15, Drawings N/A, and Table(s) 3.3.3-1, 3.3.6-1, 3.3.7-1, 3.3.8-1 have been Reviewed By Aaron C. Whaley and are not impacted by the results of this calculation. Aaron Whaley 2/10/11

This sheet replaced by R1.

NPG CALCULATION TABLE OF CONTENTS

Calculation Identifier: WBN-EEB-EDQ1090-99005	Revision:	001

TABLE OF CONTENTS

This sheet replaced by R1.

C. NPG CALCULATION VERIFICATION FORM

Calculation Identifier	WBN-EEB-EDQ1090-99005	Revision 001
Method of verification used:		
1. Design Review	☒	
2. Alternate Calculation	☐	Verifier Jeremy Thompson Date 2-10-11
3. Qualification Test	☐	

Comments: See Reference 10 (Attachment 3) Design Verification Report, Design Verification Checklist, 25402-3DP-G04G-00027, R3 WBN, Instrumentation and Control, Calculation ID: WBN-EEB-EDQ1090-99005

This sheet replaced by R1.

Purpose

The purpose of this calculation is to determine whether the present Channel Operational Test (COT) frequency for radiation monitors can be reduced. Decreasing the frequency reduces the maintenance induced wear and reduces the manpower costs to the site. The present frequency is once per quarter. The present engineering calculations for radiation monitors with NE SSD's predict acceptable operation of the radiation monitors for a fuel cycle (18 months). All other radiation monitors' performance characteristics are based on NE SSD's.

References

1. G29 P.S.4.M.4.1 (R9) External Surface Cleanness of Austenitic Stainless Steel Piping and Components
2. EEB-TI-28 Setpoint Calibrations (R7)
3. FSAR 12.3.4 (Amendment 0), 11.4 (Amendment 0), Living FSAR (1557 S00 PKG)
4. Tech Spec 1.1, SR 3.3.3.3, Table 3.3.3-1, SR 3.3.6.4, Table 3.3.6.1, SR 3.3.7.2, Table 3.3.7-1, SR 3.3.8-2, Table 3.3.8-1, SR 3.4.15.2 (Amendment 83)
5. Technical Requirements Manual 1.1 (Rev. 45)
6. ODCM Table 2.1-1, Table 2.1-2, Table 3.1 Rev. 23
7. System Engineer Review of additional data (T69 000125 497)
8. Control Diagrams 1-47W610-90-1 R37, -2 R51, -3 R35, -4 R59, -5 R40
9. Procedures: NPG-SPP-6.7, NPG-SPP-3.6, NPG-SPP-6.6 and NEDP 12
10. Design Verification Report, Design Verification Checklist, 25402-3DP-G04G-00027, Revision 3, WBN, Instrumentation and Control, Calculation ID: WBN-EEB-EDQ1090-99005
11. PER 292999
12. PER 00-001766-000
13. DCN 51426-A & DCN 50483-A
14. EDC 50574-A

Design Input Data

1. COT Definitions:
   - FSAR 12.3.4.1.3 & 12.3.4.2.6: The channel operational test (COT) is the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify the operability of required alarm, interlock, display and trip functions. The COT includes adjustments, as necessary, of the required alarm, interlock, and trip setpoints so that the setpoints are within the required range and accuracy.
   - Tech Spec 1.1: A COT shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify the OPERABILITY of required alarm, interlock, display, and trip functions. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints so that the setpoints are within the required range and accuracy.
   - Technical Requirements Manual 1.1: A COT shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify the OPERABILITY of required alarm, interlock, display, and trip functions. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints so that the setpoints are within the required range and accuracy.
   - ODCM Table 2.1-1 note (1) (typical example - each monitor may have unique functions that are required to be checked): The CHANNEL OPERATIONAL TEST shall demonstrate that automatic isolation of this pathway occurs if the instrument indicates measured levels above the alarm/trip setpoint. The CHANNEL OPERATIONAL TEST also demonstrates control room annunciation occurs if any of the following conditions exist:

     1. Instrument indicates measured levels above the alarm setpoint, or

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2. Circuit failure, or
3. Indication of downscale failure, or
4. Instrumentation controls not set in operate mode, or
5. Loss of sample flow.

2. Calculation Basis: Radiation monitors with NE-SSD's (Safety related, Tech Spec, and compliance that accuracy is a factor) have a calculational time basis of 1 fuel cycle (18 months + 25%). This was verified by a review of all the radiation monitor NE-SSDs. All other radiation monitors have a plant SSD and are based upon those with NE-SSDs. Therefore, all monitors have an engineering basis (directly via an NE-SSD or indirectly via similarity) of acceptable operation for 1 fuel cycle.

3. COT / Calibration / Maintenance History: EMPAC is a database that records the maintenance history on plant equipment. This database was reviewed for the maintenance history on the COT performances. The list of radiation monitors in Table 3 was used as the basis. This table represents the radiation monitors that had data that could be retrieved from EMPAC at the time of the data study. EMPAC is a living database and changes are made with time. Until recently there was no set method of recording the work performed. Therefore, a set of the actual work performed sheets were retrieved in hardcopy to verify and interpret the information in EMPAC when the data recorded was ambiguous. Only the latest available COT at the time of the study was used because this best represents the present instrument performance.

4. G29 - P.S.4.M.4.1 (R9) specifies a sampling methodology that produces a 95/95 probability/confidence for an attribute in a population. This method was utilized to determine radiation monitor performance during COTs.

Assumptions

None

Special Requirements/Limiting Conditions

None

Computations and Analyses

This calculation extends the COT frequency for the maintained monitors. The population size of monitors was determined to be 77 (See Table 3). Data was taken on the radiation monitors from EMPAC. The maintenance history recorded in EMPAC includes work orders when the radiation monitors were first brought into service. Therefore, there are work orders that show mis-wiring, missing components, etc. These work orders are not indicative of the operation of the present system. Therefore, the methodology chosen for this analysis used the latest available COT that data can be accurately understood. This means that if the work performed field in EMPAC is unambiguous that it was used directly. Hardcopy data was retrieved from RIMS when the EMPAC data was insufficient.

According to G29, 40 monitors must be sampled for a population of 77 monitors with zero allowed failures, 57 monitors must be sampled with 1 allowed failure, 70 monitors must be sampled with 2 allowed failures, and all 77 monitors must be sampled with 3 allowed failures in order to state with a 95/95 probability and confidence that the attribute of interest is indicative of the population. The attribute of interest for this statistical test is the "as-left" band. If the monitors are operating within this band for the COT test, then recalibration is not

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required. Since the engineering calculations prove that as long as a device is left within the "as-left" band, then they can operate for 18 months.

The criteria for using the "as-left" band as a successful performance is conservative for a COT since by definition the instrument would be correctly operating if it were found within the "as-found" band. EEB TI-28 defines the "as-found" band as the region where the instrument is performing as predicted. During a calibration and not a COT, if the instrument were found within the "as-found" band, then it would be recalibrated to within the "as-left" band. However, based upon a review of the EMPAC data it has been WBN's practice to recalibrate as part of a COT when the instrument is outside the "as-left" but within the "as-found".

The monitors were numbered 1 to 78. All monitors were sampled. The first COT for each of these sampled monitors that the performance could be determined either directly from the EMPAC "work performed" field or from the hardcopy RIMS data was chosen as the sample for each monitor. This data is the best example of how the monitors are presently maintained and operating.

The attribute evaluated is the accuracy or performance of each module checked. This includes as appropriate for each monitor

- Ratemeter Indications
- Recorder
- Flow Switches
- Alarm Setpoints
- Ratemeter Analog Outputs
- Flow Controllers

Not all functions above are appropriate for all monitors. However, the COT tests each monitor for all calibratable features.

Table 2 tabulates the results of the above sample test. Out of the 77 samples, there were 3 failures recorded. Per Reference 1, the 95/95 criteria is supported even with 3 failures. With a 95/95 probability and confidence, the radiation monitors are operating within the setting tolerance assumed in the accuracy calculations. Therefore, the full 18 month uncertainty is still available.

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Supporting Graphics

Since this revision utilized all 77 monitors for observation, the monitors did not need to be randomly selected. Table 1 shows the monitors used in this calculation. Radiation monitor 2-RM-90-402 was listed originally in Revision 0, but has been replaced by 1-RM-90-112B (#48). This was done because no work order information could be found for 2-RM-90-402.

Table 1

Number	Monitor	Number	Monitor	Number	Monitor
1	0-RM-90-12	27	0-RM-90-3	53	0-RM-90-125-A
2	0-RM-90-13	28	0-RM-90-4	54	Intentionally Blank
3	1-RM-90-14	29	0-RM-90-5	55	0-RM-90-126-B
4	0-RM-90-15	30	1-RM-90-6	56	0-RM-90-132
5	0-RM-90-16	31	2-RM-90-6	57	2-RM-90-400
6	0-RM-90-17	32	1-RM-90-7	58	0-RM-90-135
7	1-RM-90-59	33	2-RM-90-7	59	0-RM-90-138
8	1-RM-90-60	34	1-RM-90-8	60	0-RM-90-133-A
9	1-RM-90-61	35	2-RM-90-8	61	0-RM-90-134-B
10	1-RM-90-62	36	0-RM-90-9	62	0-RM-90-140-A
11	0-RM-90-101A	37	1-RM-90-10	63	0-RM-90-141-B
12	1-RM-90-272	38	2-RM-90-10	64	0-RM-90-205-A
13	1-RM-90-273-A	39	0-RM-90-11	65	0-RM-90-206-B
14	1-RM-90-274-B	40	1-RM-90-119	66	0-RM-90-212
15	1-RM-90-275	41	1-RM-90-120	67	0-RM-90-225
16	1-RM-90-276	42	1-RM-90-121	68	0-RM-90-230
17	1-RM-90-277	43	0-RM-90-122	69	0-RM-90-231
18	1-RM-90-278	44	0-RM-90-123	70	1-RM-90-271-A
19	1-RM-90-280	45	0-RM-90-103-B	71	1-RM-90-404
20	1-RM-90-290	46	1-RM-90-106	72	1-RM-90-421
21	1-RM-90-291	47	0-RM-90-102A	73	1-RM-90-422
22	1-RM-90-292	48	1-RM-90-112B	74	1-RM-90-423
23	1-RM-90-293	49	1-RM-90-112C	75	1-RM-90-424
24	1-RM-90-1	50	0-RM-90-118	76	1-RM-90-130-A
25	2-RM-90-1	51	1-RM-90-123	77	1-RM-90-131-A
26	1-RM-90-2	52	2-RM-90-123	78	1-RM-90-400

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The following table lists the data obtained from EMPAC or RIMS hardcopy for the sampled monitors.

Table 2: Work Performed

Number	Monitor	Date	WO#	Work Performed	Pass/Fail	Reel/Frame
1	0-RM-90-12	03/29/1999	99-000322-000	All devices Left As Found (PM As Found condition 100)	Pass	
2	0-RM-90-13	11/30/1998	98-012479-000	All devices Left As Found	Pass	
3	1-RM-90-14	12/07/1998	98-012935-000	Low flow switch and flow controller outside As-Left. All other devices Left As Found.	Fail	E05791/1744
4	0-RM-90-15	11/05/1998	98-012004-000	All devices Left As Found	Pass	
8	1-RM-90-60	02/05/1999	98-014050-000	All devices Left As Found	Pass	
14	1-RM-90-274-B	01/22/1999	98-014058-000	All devices Left As Found	Pass	
16	1-RM-90-276	01/11/1999	98-014078-000	All devices Left As Found	Pass	
18	1-RM-90-278	01/19/1999	98-014067-000	All devices Left As Found	Pass	
20	1-RM-90-290	12/07/1998	98-012952-000	All devices Left As Found	Pass	
22	1-RM-90-292	02/16/1999	98-014045-000	All devices Left As Found	Pass	
24	1-RM-90-1	02/28/1999	98-015025-000	All devices Left As Found	Pass	
25	2-RM-90-1	02/28/1999	98-015026-000	All devices Left As Found	Pass	
26	1-RM-90-2	12/18/1998	98-012918-000	All devices Left As Found	Pass	
27	0-RM-90-3	12/23/1998	98-012949-000	All devices Left As Found	Pass	E05793/1024
29	0-RM-90-5	02/03/1999	98-016679-000	All devices Left As Found	Pass	
30	1-RM-90-6	01/11/1999	98-015028-000	All devices Left As Found	Pass	
31	2-RM-90-6	01/28/1999	98-016278-000	All devices Left As Found	Pass	
32	1-RM-90-7	02/10/1999	98-014065-000	All devices Left As Found	Pass	
33	2-RM-90-7	01/29/1999	98-014072-000	All devices Left As Found	Pass	
34	1-RM-90-8	02/11/1999	98-014018-000	All devices Left As Found	Pass	
35	2-RM-90-8	02/02/1999	98-014073-000	All devices Left As Found	Pass	
36	0-RM-90-9	02/05/1999	98-014064-000	All devices Left As Found	Pass	
37	1-RM-90-10	12/09/1998	98-013013-000	All devices Left As Found	Pass	
38	2-RM-90-10	04/06/1999	99-000208-000	All devices Left As Found (PM As Found condition 100)	Pass	
39	0-RM-90-11	12/04/1998	98-012925-000	All devices Left As Found	Pass	
44	0-RM-90-123	02/01/1999	98-014079-000	All devices Left As Found	Pass	
46	1-RM-90-106A-A	01/11/1999	98-015535-000	All devices Left As Found	Pass	
49	1-RM-90-112C-B	01/29/1999	98-016539-000	All devices Left As Found	Pass	
51	1-RM-90-123	02/08/1999	98-015090-000	All devices Left As Found	Pass	
53	0-RM-90-125-A	03/06/1999	99-000338-000	All devices Left As Found	Pass	
59	0-RM-90-138	12/04/1998	98-012481-000	All devices Left As Found	Pass	
61	0-RM-90-134-B	02/16/1999	98-016593-000	All devices Left As Found	Pass	
62	0-RM-90-140-A	12/09/1998	98-013050-000	All devices Left As Found	Pass	
63	0-RM-90-141-B	02/18/1999	98-016898-000	All devices Left As Found	Pass	
64	0-RM-90-205-A	12/04/1998	98-013256-000	All devices Left As Found	Pass	
65	0-RM-90-206-B	02/11/1999	98-016654-000	All devices Left As Found	Pass	
68	0-RM-90-230	02/01/1999	98-014046-000	All devices Left As Found	Pass	
69	0-RM-90-231	02/08/1999	98-014049-000	All devices Left As Found	Pass	
72	1-RM-90-421	12/09/1998	98-012924-000	All devices Left As Found. Recorder 1-RR-090-0268 has WO 98-015690-000 against it for repair.	Pass	
73	1-RM-90-422	02/08/1999	98-014066-000	All devices Left As Found	Pass	
74	1-RM-90-423	12/23/1998	98-012948-000	All devices Left As Found	Pass	E05793/0024

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Table 2: Work Performed (continued)

Number	Monitor	Date	WO#	Work Performed	Pass/Fail	Reel/Frame
5	0-RM-90-16	08/02/1999	99-008145-000	All devices Left As Found	Pass	
6	0-RM-90-17	02/04/1999	98-014054-000	H/L Flow Switches & L Flow Controller outside As-Left. All other devices Left As Found.	Fail	E05797/2843
7	1-RM-90-59	12/17/1998	98-012959-000	All devices Left As Found	Pass	E05793/3851
9	1-RM-90-61	06/29/1999	99-006348-000	All devices Left As Found	Pass	E05863/1402
10	1-RM-90-62	06/02/1999	99-004564-000	Lower Discriminator outside of As-Found limit. All other devices Left As Found.	Fail	E05860/1843
11	0-RM-90-101A	06/28/1999	99-006364-000	All devices Left As Found	Pass	E05863/2513
12	1-RM-90-272	06/08/1999	99-004566-000	All devices Left As Found	Pass	E05855/0271
13	1-RM-90-273-A	01/07/1999	98-014183-000	All devices Left As Found	Pass	E05796/2898
15	1-RM-90-275	06/21/1999	99-004537-000	All devices Left As Found	Pass	E05860/2843
17	1-RM-90-277	06/08/1999	99-005053-000	All devices Left As Found	Pass	E05863/1713
19	1-RM-90-280	02/11/1999	98-014923-000	All devices Left As Found	Pass	E05822/3198
21	1-RM-90-291	02/08/1999	98-014059-000	All devices Left As Found	Pass	E05797/2458
23	1-RM-90-293	02/09/1999	98-014055-000	All devices Left As Found	Pass	E05797/2443
28	0-RM-90-4	01/28/1999	98-014186-000	All devices Left As Found	Pass	E05796/2327
40	1-RM-90-119	05/03/1999	99-003256-000	All devices Left As Found	Pass	
41	1-RM-90-120	03/03/1999	99-000075-000	All devices Left As Found	Pass	
42	1-RM-90-121	05/06/1999	99-003298-000	All devices Left As Found	Pass	
43	0-RM-90-122	05/22/1999	99-004106-000	All devices Left As Found	Pass	
45	0-RM-90-103-B	06/10/1999	99-008316-000	All devices Left As Found	Pass	
47	0-RM-90-102A	06/18/1999	99-008317-000	All devices Left As Found	Pass	
48	1-RM-90-112B	06/08/2000	99-017717-000	All devices Left As Found	Pass	
50	0-RM-90-118	05/18/1999	99-004098-000	All devices Left As Found	Pass	
52	2-RM-90-123	05/22/1999	99-003571-000	All devices Left As Found	Pass	E05860/3620
55	0-RM-90-126-B	05/12/1999	99-004037-000	All devices Left As Found	Pass	
56	0-RM-90-132	01/25/1999	98-014068-000	All devices Left As Found	Pass	E05797/1054
57	2-RM-90-400	03/04/1999	99-000686-000	All devices Left As Found	Pass	
58	0-RM-90-135	05/05/1999	98-012902-000	All devices Left As Found	Pass	E05859/2252
60	0-RM-90-133-A	05/22/1999	99-004102-000	All devices Left As Found	Pass	
66	0-RM-90-212	08/05/1999	99-007998-000	All devices Left As Found	Pass	
67	0-RM-90-225	05/03/1999	99-003240-000	All devices Left As Found	Pass	
70	1-RM-90-271-A	06/10/1999	99-004555-000	All devices Left As Found	Pass	E05863/1259
71	1-RM-90-404	04/14/2005	03-012634-000	All devices Left As Found	Pass	
75	1-RM-90-424	06/14/1999	99-005315-000	All devices Left As Found	Pass	E05858/0001
76	1-RM-90-130-A	03/25/1999	99-001014-000	All devices Left As Found	Pass	
77	1-RM-90-131-A	03/10/1999	99-000718-000	All devices Left As Found	Pass	
78	1-RM-90-400	06/22/1999	99-006131-000	All devices Left As Found	Pass	

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This sheet replaced by R1.

Number	Monitor	Date	WO#	Work Performed	Pass/Fail	Reel/Frame
41	41				41	

Table 3 Disposition

Listing from EMPAC and Compilation of Programs							
Unid	FSAR Required	FSAR not Required for Unit 1	Other	Tech Spec	ODCM	Sampled	Maintained
WBN-0-LPR -090-0003	Y					Y	Y
WBN-0-LPR -090-0004	Y						Y
WBN-0-LPR -090-0005	Y					Y	Y
WBN-0-LPR -090-0009	Y					Y	Y
WBN-0-LPR -090-0011	Y					Y	Y
WBN-0-LPR -090-0012	Y					Y	Y
WBN-0-LPR -090-0013	Y					Y	Y
WBN-0-LPR -090-0015	Y					Y	Y
WBN-0-LPR -090-0016	Y						Y
WBN-0-LPR -090-0017	Y						Y
WBN-0-LPR -090-0101A	Y						Y
WBN-0-LPR -090-0101B			counted with 101A		Y		Y
WBN-0-LPR -090-0101C			counted with 101A		Y(COT NA)		Y
WBN-0-LPR -090-0102-A	Y			Y			Y
WBN-0-LPR -090-0103-B	Y			Y			Y
WBN-0-LPR -090-0105			No SSD				

Listing from EMPAC and Compilation of Programs							
Unid	**FSAR Required**	**FSAR not Required for Unit 1**	**Other**	**Tech Spec**	**ODCM**	**Sampled**	**Maintained**
WBN-0-LPR -090-0118	Y				Y		Y
WBN-0-LPR -090-0122	Y				Y		Y
WBN-0-LPR -090-0123	Y					Y	Y
WBN-0-LPR -090-0125-A	Y			Y		Y	Y
WBN-0-LPR -090-0126-B	Y			Y			Y
WBN-0-LPR -090-0132A	Y						
WBN-0-LPR -090-0132B			Counted with 132 A		Y		
WBN-0-LPR -090-0132C			Counted with 132 A				
WBN-0-LPR -090-0133-A	Y				Y		Y
WBN-0-LPR -090-0134-B	Y				Y	Y	Y
WBN-0-LPR -090-0135	Y						Y
WBN-0-LPR -090-0138	Y					Y	Y
WBN-0-LPR -090-0140-A	Y				Y	Y	Y
WBN-0-LPR -090-0141-B	Y				Y	Y	Y
WBN-0-LPR -090-0205-A	Y					Y	Y
WBN-0-LPR -090-0206-B	Y					Y	Y
WBN-0-LPR -090-0211			No SSD				
WBN-0-LPR -090-0212	Y				Y		Y
WBN-0-LPR -090-0217A			Portable - No SSD				
WBN-0-LPR -090-0217B			Portable - No SSD				
WBN-0-LPR -090-0217E			Portable - No SSD				
WBN-0-LPR -090-0218A			Portable - No SSD				
WBN-0-LPR -090-0218B			Portable - No SSD				
WBN-0-LPR -090-0218D			Portable - No SSD				
WBN-0-LPR -090-0218E			Portable - No SSD				

Listing from EMPAC and Compilation of Programs							
Unid	**FSAR Required**	**FSAR not Required for Unit 1**	**Other**	**Tech Spec**	**ODCM**	**Sampled**	**Maintained**
WBN-0-LPR -090-0219A			Portable - No SSD				
WBN-0-LPR -090-0219B			Portable - No SSD				
WBN-0-LPR -090-0219D			Portable - No SSD				
WBN-0-LPR -090-0219E			Portable - No SSD				
WBN-0-LPR -090-0225	Y				Y		Y
WBN-0-LPR -090-0230	Y					Y	Y
WBN-0-LPR -090-0231	Y					Y	Y
WBN-0-LPR -090-0235			No SSD				
WBN-0-LPR -090-0236			No SSD				
WBN-0-LPR -999-0063			TLD - No SSD				
WBN-1-LPR -090-0001	Y					Y	Y
WBN-1-LPR -090-0002	Y					Y	Y
WBN-1-LPR -090-0006	Y					Y	Y
WBN-1-LPR -090-0007	Y					Y	Y
WBN-1-LPR -090-0008	Y					Y	Y
WBN-1-LPR -090-0010	Y					Y	Y
WBN-1-LPR -090-0014	Y					Y	Y
WBN-1-LPR -090-0059	Y						Y
WBN-1-LPR -090-0060	Y					Y	Y
WBN-1-LPR -090-0061	Y						Y
WBN-1-LPR -090-0062	Y						Y
WBN-1-LPR -090-0106A-A	Y			Y	Notes Only	Y	Y
WBN-1-LPR -090-0106B-A			Counted with 106A	Y	Notes Only		Y
WBN-1-LPR -090-0106C-A			Counted with 106A		Notes Only		Y
WBN-1-LPR -090-0112A-B	Y			Y	Notes Only		Y

Listing from EMPAC and Compilation of Programs							
Unid	**FSAR Required**	**FSAR not Required for Unit 1**	**Other**	**Tech Spec**	**ODCM**	**Sampled**	**Maintained**
WBN-1-LPR -090-0112B-B			Counted with 112A	Y	Notes Only		Y
WBN-1-LPR -090-0112C-B			Counted with 112A		Notes Only	Y	Y
WBN-1-LPR -090-0119	Y				Y		Y
WBN-1-LFR -090-0120	Y				Y		Y
WBN-1-LPR -090-0121	Y				Y		Y
WBN-1-LPR -090-0123	Y					Y	Y
WBN-1-LPR -090-0124			No SSD				
WBN-1-LPR -090-0130-A	Y			Y	Y		Y
WBN-1-LPR -090-0131-B	Y			Y	Y		Y
WBN-1-LPR -090-0170		NOT	No SSD				
WBN-1-LPR -090-0210			No SSD				
WBN 1-LPR -090-0262			No SSD				
WBN-1-LPR -090-0271-A	Y			Y			Y
WBN-1-LPR -090-0272-B	Y			Y			Y
WBN-1-LPR -090-0273-A	Y			Y			Y
WBN-1-LPR -090-0274-B	Y			Y		Y	Y
WBN-1-LPR -090-0275	Y						Y
WBN-1-LPR -090-0276	Y					Y	Y
WBN-1-LPR -090-0277	Y						Y
WBN-1-LPR -090-0278	Y					Y	Y
WBN-1-LPR -090-0280	Y						Y
WBN 1-LPR -090-0290	Y					Y	Y
WBN 1-LPR -090-0291	Y						Y
WBN 1-LPR -090-0292	Y					Y	Y
WBN-1-LPR -090-0293	Y						Y

Listing from EMPAC and Compilation of Programs							
Unid	**FSAR Required**	**FSAR not Required for Unit 1**	**Other**	**Tech Spec**	**ODCM**	**Sampled**	**Maintained**
WBN-1-LPR -090-0400	Y				Y		Y
WBN-1-LPR -090-0404	Y						Y
WBN-1-LPR -090-0405			Same as 404				
WBN-1-LPR -090-0421	Y					Y	Y
WBN-1-LPR -090-0422	Y					Y	Y
WBN-1-LPR -090-0423	Y					Y	Y
WBN-1-LPR -090-0424	Y						Y
WBN-1-LPR -090-0450			Same as 404				
WBN-1-LPR -090-123 /A			Same as 123				
WBN-1-LPR -999-0099			TLD - No SSD				
WBN-1-LPR -999-0100A			TLD - No SSD				
WBN-1-LPR -999-0100B			TLD - No SSD				
WBN-1-LPR -999-0100C			TLD - No SSD				
WBN-1-LPR -999-0104			TLD - No SSD				
WBN-1-LPR -999-0403			TLD - No SSD				
WBN-2-LPR -090-0001	Y					Y	Y
WBN-2-LPR -090-0002		NOT	No SSD				
WBN-2-LPR -090-0006	Y					Y	Y
WBN-2-LPR -090-0007	Y					Y	Y
WBN-2-LPR -090-0008	Y					Y	Y
WBN-2-LPR -090-0010	Y					Y	Y
WBN-2-LPR -090-0014			No SSD				
WBN-2-LPR -090-0059		NOT	No SSD				
WBN-2-LPR -090-0060		NOT	No SSD				
WBN-2-LPR -090-0061		NOT	No SSD				

Listing from EMPAC and Compilation of Programs							
Unid	**FSAR Required**	**FSAR not Required for Unit 1**	**Other**	**Tech Spec**	**ODCM**	**Sampled**	**Maintained**
WBN-2-LPR -090-0062		NOT	No SSD				
WBN-2-LPR -090-0099		NOT	No SSD				
WBN-2-LPR -090-0100A			No SSD				
WBN-2-LPR -090-0100B			No SSD				
WBN-2-LPR -090-0100C			No SSD				
WBN-2-LPR -090-0104			No SSD				
WBN-2-LPR -090-0106A-A		NOT	No SSD		Notes Only		
WBN-2-LPR -090-0106B-A			No SSD		Notes Only		
WBN-2-LPR -090-0106C-A			No SSD		Notes Only		
WBN-2-LPR -090-0112A-B		NOT	No SSD		Notes Only		
WBN-2-LPR -090-0112B-B			No SSD		Notes Only		
WBN-2-LPR -090-0112C-B			No SSD		Notes Only		
WBN-2-LPR -090-0119		NOT	No SSD		Y		
WBN-2-LPR -090-0120		NOT	No SSD		Y		
WBN-2-LPR -090-0121		NOT	No SSD		Y		
WBN-2-LPR -090-0123	Y						Y
WBN-2-LPR -090-0124		NOT	No SSD				
WBN-2-LPR -090-0130-A		NOT	No SSD		Y		
WBN-2-LPR -090-0131-B		NOT	No SSD		Y		
WBN-2-LPR -090-0170		NOT	No SSD				
WBN-2-LPR -090-0210			No SSD				
WBN-2-LPR -090-0260-A			No SSD				
WBN-2-LPR -090-0261-B			No SSD				
WBN-2-LPR -090-0262			No SSD				
WBN-2-LPR -090-0271-A		NOT	No SSD				

Listing from EMPAC and Compilation of Programs							
Unid	**FSAR Required**	**FSAR not Required for Unit 1**	**Other**	**Tech Spec**	**ODCM**	**Sampled**	**Maintained**
WBN-2-LPR -090-0272-B		NOT	No SSD				
WBN-2-LPR -090-0273-A		NOT	No SSD				
WBN-2-LPR -090-0274-B		NOT	No SSD				
WBN-2-LPR -090-0275		NOT	No SSD				
WBN-2-LPR -090-0276		NOT	No SSD				
WBN-2-LPR -090-0277		NOT	No SSD				
WBN-2-LPR -090-0278		NOT	No SSD				
WBN-2-LPR -090-0280		NOT	No SSD				
WBN-2-LPR -090-0290		NOT	No SSD				
WBN-2-LPR -090-0291		NOT	No SSD				
WBN-2-LPR -090-0292		NOT	No SSD				
WBN-2-LPR -090-0293		NOT	No SSD				
WBN-2-LPR -090-0400	Y		No SSD		Y		Y
WBN-2-LPR -090-0402	Y		No SSD		Y		Y
WBN-2-LPR -090-0405			No SSD				
WBN-2-LPR -090-0421		NOT	No SSD				
WBN-2-LPR -090-0422		NOT	No SSD				
WBN-2-LPR -090-0423		NOT	No SSD				
WBN-2-LPR -090-0424		NOT	No SSD				
WBN-2-LPR -090-0450			No SSD				
WBN-2-LPR -090-123 /A			Same as 123				
WBN-2-LPR -999-0403			TLD- No SSD				
							77

Summary of Results

The COT data was statistically sampled to determine the performance of the radiation monitors. The analysis has shown that the 95/95 level of probability and confidence has been met. Out of the 77 monitors observed, 3 failures were reported. The number of failures allowed to meet the 95/95 criteria for a sample size of 77 is three, therefore the criteria is met. The three monitors that had failures were 1-RM-90-14, 0-RM-90-17, and 1-RM-90-62. These were Continuous Air Monitors (CAMs), and per DCN 51426 and DCN 50483, all three of these monitors were later removed from service for the following reasons:

-the monitors are not safety related
-they do not perform a primary safety function
-they are not required to mitigate a design basis accident
-they have not performed reliably (particularly the moving filter assembly)

These monitors were used for personnel protection and have been replaced by portable CAMs. Therefore, any calibration problems experienced by these monitors are no longer a concern.

Conclusions

The analysis of the COT data has shown that the radiation monitors at WBN are operating within the "as-left" band at the current test frequency. The three observed failures out of the 77 samples is acceptable to meet 95/95 probability and confidence. In addition, the three monitors that experienced the failures have since been deleted from service. The calculational basis of 18 months is still completely valid starting at this time interval. Therefore, it is reasonable to extend the COT testing.

The monitors required by Tech Spec and ODCM can conservatively move the COT to 9 months. Keep in mind that this is 1/2 the calculational basis.

All other monitors should move the COT to the calculational basis of 18 months with the exception of flow switches on raw water systems and non VX-252 local indicators. PER 00-001766-000 initiated corrective actions for these devices. The calibration tolerances for the local indicators were relaxed per EDC 50574, and the calibration frequency of the ERCW flow switches was changed to 6 months. This PER has been closed.

Alternate Review (Ref. 7)

TVA's calibration program has feedback mechanisms built into the procedures to find instruments outside the norm and to fine tune engineering basis data (SPP 6.7 section 3.2.c.2, SPP 3.6, SPP 6.6 and NEDP 12). As part of this process the Radiation Monitor system engineer evaluated data on a device specific basis over the last 2+ years.

The review of reference 7 is summarized below.

The system engineer determined whether the instrument was found outside the "as-left" (OAL), outside the "as-found" (OAF), inoperative (INOP), or within the "as-left" (no entry). Remember that the instrument is working as predicted if it is found within the "as-found" tolerance. Similar devices/features were combined, e.g. the analog ratemeters.

This calculation's review further categorized the data by instrument type and sub group. For instance, recorders were broken down by Manufacturer and Model and the liquid flow switches were grouped by calibration interval. These groupings are attached.

Ratemeter Modules:

There are two basic types of Ratemeter modules. One that measures pulses and one that measures current. There are similarities between these two types such as the indicator on the front and the bistable circuits.

This sheet replaced by R1.

Common Items

1. Indicator: Twenty-four (24) monitors were sampled. Two-hundred-forty (240) COTs were evaluated. There were no indicators found outside the "as-found" criteria. There were eight (8) instances where an indicator point was found outside the "as-left". This is a 100% success rate.
2. Alert Bistable: Twenty-four (24) monitors were sampled. Two-hundred-forty (240) COTs were evaluated. There were no bistables found outside the "as-found" criteria. There was one (1) instance where a bistable was found outside the "as-left". This is a 100% success rate.
3. Hi Rad Bistable: Twenty-four (24) monitors were sampled. Two-hundred-forty (240) COTs were evaluated. There were no bistables found outside either the "as-found" or the "as-left"criteria. This is a 100% success rate.

Unique Items:

1. High Voltage: Eleven (11) monitor were sampled. One hundred ten, (110), COTs were evaluated. There were no instances where the High Voltage was outside either the "as-found" or the "as-left". This is a 100% success rate.
2. Low Discriminator: Eleven (11) monitors were sampled. One hundred ten (110) COTs were evaluated. There were four (4) instances where the discriminator was outside the "as-found" and two (2) instances outside the "as-left". The entire out of tolerance instances was on two (2) monitors. There is no engineering basis for this value. The system engineer has determined the setting. The discriminator sets the signal to noise ratio for the monitor. The pulse height of the radiation received at the ratemeter is a function of the gain of the detector tube, the gain of the preamp, and the attenuation of the cable run. The value has been taken as a rule of thumb and failures are not indicative of unacceptable operation of the monitor for this study Proper operation can only be determined by using a source on the detector. The system engineer determined that the 101C monitor is not performing as expected and has initiated a work order to replace this module. Other than the iodine monitors there were no failures of the discriminator settings.
3. Upper Discriminator: All four (4) monitors that use this feature were evaluated. Forty-three (43) COTs were evaluated. There were seven (7) instances where the discriminator was outside "as-found" and one (1) instance outside "as-left". Six (6) of the OAF values were on one instrument. This function is not an engineered value. The value has been taken as a rule of thumb and failures are not indicative of unacceptable operation of the monitor for this study. Electronically, there is no difference in the upper and lower setpoints. As stated previously, proper operation can only be determined by using a source on the detector. The system engineer determined that the 101C monitor is not performing as expected and has initiated a work request (WR C340313) to replace this module. Other than the iodine monitors there were no failures of the discriminator settings.

LOCAL INDICATOR:

Fifty-eight (58) COTs, eight (8) instruments, one (1) COT inop, three (3) COT OAF, five (5) instruments with no failures. There is nothing significantly different in these instruments from the MCR or the VX 252 indicators. PER 00-001766-00 was written to resolve this problem.

DIGITAL RADIATION MONITOR:

1. Monitor 52 COTs, 6 instruments. A database value was found incorrect. This is not a calibration error.
2. Flow Switch 19 COTs, 2 Instruments, 1 COT found outside the "as-found", all others were within the "as-left". This is a small data set but still shows a 95% success rate.

COMPUTER:

Eighteen (18) computer points were sampled. One-hundred-eighty-one (181) COTs were evaluated. One (1) point was found outside the "as-found" during a COT and the next point in the same COT was outside the "as-left". All others COTs were within the "as-left". This is a 99.4% success rate. The one failure is insignificant.

RECORDERS:

1. Speedomax-M: Eleven (11) recorders were sampled. One-hundred-ten (110) COTs were evaluated. There were three instances where the recorder was outside "as-found", one (1) outside "as-left", and two (2) inop. All failures were on 3 recorders. All but one failure was corrected by "cleaning". The pen was seen to be stuck. This failure mode is best found by the source check and not a COT (Source checks are done at the discretion of the operations staff and procedurally at intervals less than COTs - Ref 4, 5, and 6). A review of maintenance history shows that indeed the operations staff has found these recorders inoperative by this method and cleaning was the fix. Additionally, these are obsolete and are slated to be replaced (WBN MIL 519 – Plant Recorder System Replacement).
2. Speedomax-250: Two (2) recorders were sampled. Eighty-two (82) COTs were evaluated. There was one (1) instance where the recorder was found outside the "as-found". All other COTs were within the "as-left". This is a 98.8% success rate. The failure is statistically insignificant.
3. Yokogawa-UR1800: One (1) recorders were sampled. Forty eight (48) COTs were evaluated. There were no instances where the recorder was found outside either the "as-found" or the "as-left". This is a 100% success rate.

Universal Flow Switch:

1. 92 day data : One (1) instrument, eleven (11) COTs, zero (0) OAF, four (4) OAL. This is a 100% success rate.
2. 18 month data: Seven (7) instruments, nineteen (19) COTs, four (4) OAF, three (3) OAL, four (4) instruments with no failures. The failures are on switches measuring ERCW system water. This is raw water and is a possible problem. Three (3) switches on Condenser Demineralizer or CCS system water showed no failures. The failures occurred on flow switches that are already on an 18 month calibration cycle. PER 00-001770-000 has been written to address this problem.

VX-252:

20 COTs, 2 Instruments, No Failures, All within "as-left".

CONCLUSION:

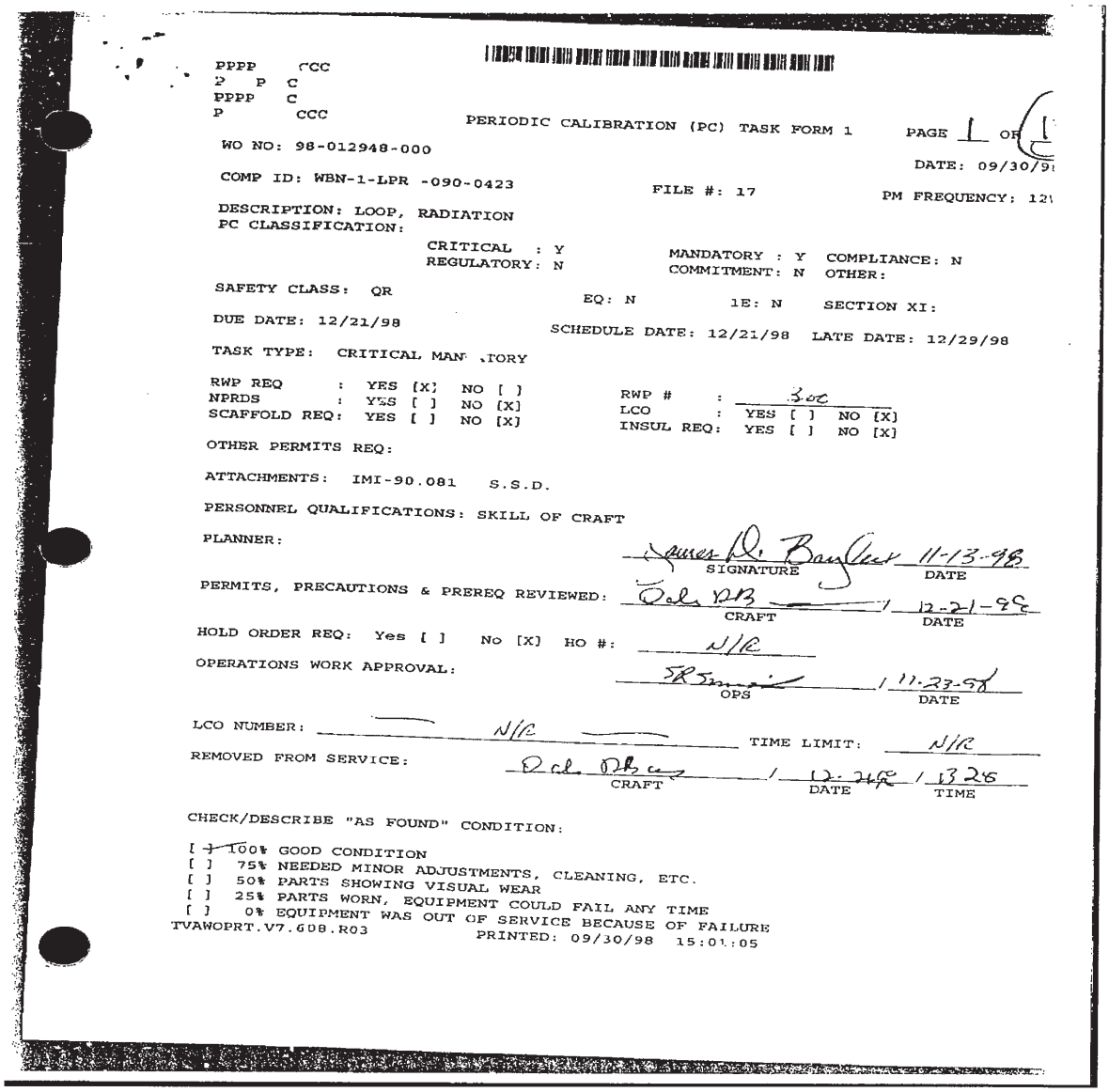
The system engineer data helps confirm that the radiation system as a whole is working well. The feedback mechanism is in place (SPP 6.7 and NEDP 12) to evaluate and correct anomalous or mis-operating equipment.

The analog ratemeters are working exceptionally well. There were no failures in the engineered features. One ratemeter was identified as being anomalous (but not inoperative) and is being replaced (WR C340313).

Yokogawa and the Speedomax 250 recorders are working well. Three of the eleven Speedomax M recorders sampled showed problems. However, the problems found are best determined by source checks and not COTs. The failure mode was a stuck pen and the resolution was to clean the slidewire or contacts. A source check that is already performed on a more frequent basis than COTs is the preferred method for finding these failures. Additionally, these recorders have been identified by the obsolete equipment project to be replaced.

Flow switches on raw water that are presently on 18 month intervals do show a problem. PER 00-001766-000 was written to address this problem.

Local indicators have shown failures when the MCR and VX-252 indicators have shown no problems. There is no fundamental difference in movements of these devices. PER 00-001766-000 was written to address this problem.



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PERIODIC CALIBRATION (PC) TASK FORM 1 PAGE 1 OF 1

WO NO: 98-012948-000 DATE: 09/30/9

COMP ID: WBN-1-LPR -090-0423 FILE #: 17 PM FREQUENCY: 12

DESCRIPTION: LOOP, RADIATION
PC CLASSIFICATION:

CRITICAL : Y MANDATORY : Y COMPLIANCE: N
REGULATORY: N COMMITMENT: N OTHER:

SAFETY CLASS: QR EQ: N 1E: N SECTION XI:

DUE DATE: 12/21/98 SCHEDULE DATE: 12/21/98 LATE DATE: 12/29/98

TASK TYPE: CRITICAL MAN ,TORY

RWP REQ : YES [X] NO [ ] RWP # : 30c
NPRDS : YES [ ] NO [X] LCO : YES [ ] NO [X]
SCAFFOLD REQ: YES [ ] NO [X] INSUL REQ: YES [ ] NO [X]

OTHER PERMITS REQ:

ATTACHMENTS: IMI-90.081 S.S.D.

PERSONNEL QUALIFICATIONS: SKILL OF CRAFT

PLANNER: James R. Bayless / 11-13-98
SIGNATURE DATE

PERMITS, PRECAUTIONS & PREREQ REVIEWED: Dale DB / 12-21-98
CRAFT DATE

HOLD ORDER REQ: Yes [ ] No [X] HO #: N/R

OPERATIONS WORK APPROVAL: SR Smith / 11-23-98
OPS DATE

LCO NUMBER: N/R TIME LIMIT: N/R

REMOVED FROM SERVICE: Dale DB / 12-24-98 / 1326
CRAFT DATE TIME

CHECK/DESCRIBE "AS FOUND" CONDITION:

[ ] 100% GOOD CONDITION
[ ] 75% NEEDED MINOR ADJUSTMENTS, CLEANING, ETC.
[ ] 50% PARTS SHOWING VISUAL WEAR
[ ] 25% PARTS WORN, EQUIPMENT COULD FAIL ANY TIME
[ ] 0% EQUIPMENT WAS OUT OF SERVICE BECAUSE OF FAILURE

TVAWOPRT.V7.608.R03 PRINTED: 09/30/98 15:01:05

PERIODIC CALIBRATION (PC) TASK FORM 2 PAGE 2 OF _

WO NO: 98-012948-000

WO 98-012948-0

VERIFICATION AND COMPLETIONS

AS LEFT DATA IS WITHIN TOLERANCE: Dale Baker / 12-21-98
CRAFT DATE

HOUSEKEEPING COMPLETE: Dale Baker / 12-21-98
CRAFT DATE

RETURNED TO SERVICE: Dale Baker / 12-21-98 / 1354
CRAFT DATE TIME

OPERATIONS NOTIFIED WORK COMPLETE: Dale Baker / 12-21-98
CRAFT DATE

WORKED AS: PC [Y] CM [ ]

IF WORKED AS A CM, GIVE BRIEF STATEMENT OF WHAT YOU THINK THE FAILURE WAS AND THE CORRECTIVE ACTION TAKEN:

NONE

WORK PERFORMED BY:

CRAFTSMEN NAME	HRSW	CRAFTSMEN NAME	HRSW
Dale Baker	4 MIG		
Howard Steel	4 MIG		
N/R		N/R	

NOTES/COMMENTS: TOTAL HRS: 8

* Unable to perform due to WR C425726 ID 12-21-98

N/R

RESPONSIBLE SECTION REVIEW:

WAS PER REQUIRED: YES [ ] NO [Y] IF YES, PER #: N/R

Phillip E. Wake / 12/22/98
FOREMAN DATE

SUPERVISOR/GF / 12/23/98
DATE

PERIODIC CALIBRATION ASSOCIATED EQUIPMENT PAGE 3 OF ___

EQUIP ID: WBN-1-LPR -090-0423 FILE #: 17 REV #: WO NO: 98-012948-000

PLANNER							FOREMAN/CRAFT	
ITEM NUM	EQUIPMENT ID NUMBER	SEC XI	SAFETY CLASS	1E	10 CFR 50 .49	MAINT. PERF. (NOTE 1) YES	NO	LOCATION
1	WBN-1-PX -090-0423	N	QR	N	N	[ ]	[✓]	755
2	WBN-1-RE -090-0423A	N		N	N	[ ]	[✓]	
3	WBN-1-RE -090-0423B	N		N	N	[ ]	[✓]	729A2X
4	WBN-1-RI -090-0423	N		N	N	[ ]	[✓]	755
5	WBN-1-RM -090-0423A	N		N	N	[ ]	[✓]	755

NOTE 1: Check Yes if a deficiency was corrected or part(s) was replaced and document in work performed section

PERIODIC CALIBRATION ASSOCIATED EQUIPMENT PAGE 4 OF ___

EQUIP ID: WBN-1-LPR -090-0423 FILE #: 17 REV #: WO NO: 98-012948-00

PLANNER | FOREMAN/CRAFT

ITEM NUM	EQUIPMENT ID NUMBER	SEC XI	SAFETY CLASS	1E	10 CFR 50 .49	MAINT. PERF. (NOTE 1) YES	NO	LOCATION
6	WBN-1-RR -090-0268P003	N	QR-1LB	N	N	[ ]	[✓]	755
	WBN-_-____-___-________-_							
	WBN-_-____-___-________							
	WBN-_-____-___-________							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________-_							
	WBN-_-____-___-________							

NOTE 1: Check Yes if a deficiency was corrected or part(s) was replaced and document in work performed section

WBN 1	92 DAY CHANNEL OPERATIONAL TEST OF THE STEAM LINE RADIATION MONITORS	IMI-90.081 Revision 1 Page 14 of 21

Data Package: Page 13 of _____ Date 12-21-5

APPENDIX A
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WO 00-155048-

DATA BASE VERIFICATION
(MONITOR ITEMS)

Loop Number 1-LPR-90-423

MONITOR ITEM	DESIRED INDICATION	AS-FOUND	AS-LEFT
005	2400	2400	2400
020	001	001	001
036	003	003	003
039	000	000	000
048	000	000	000
049	061	061	061
052	255	255	255
053	254	254	254
054	009	009	009

Performed By: DM

Performed By: N/R

90.081 _____

WBN 1	92 DAY CHANNEL OPERATIONAL TEST OF THE STEAM LINE RADIATION MONITORS	IMI-90.081 Revision 1 Page 15 of 21

Data Package: Page 14 of ____ Date 12.21.95

WO 98-120048

APPENDIX B
Page 1 of 1

DATA BASE VERIFICATION
(CHANNEL ITEMS)

Loop Number 1-LPR-90-423

DATA TABLE B-1

CHANNEL ITEM	DESIRED INDICATION	AS-FOUND	AS-LEFT
001	003	003	003
009	3.50+02	3.50+02	3.50+02
010	1.75+02	1.75+02	1.75+02
011	8.07+00	8.07+00	8.07+00
013	000	000	000
014	1.00+01	1.00+01	1.00+01

CHANNEL 2 (mR/hr HIGH)

CHANNEL ITEM	DESIRED INDICATION	AS-FOUND	AS-LEFT
015	5.00+04	5.00+04	5.00+04
016	001	001	001
017	000	000	000
020	000	000	000
022	0.00+00	0.00+00	0.00+00
024	0.00+00	0.00+00	0.00+00

DATA TABLE B-2

CHANNEL ITEM	DESIRED INDICATION	AS-FOUND	AS-LEFT
001	003	003	003
009	3.50+02	3.50+02	3.50+02
010	1.75+02	1.75+02	1.75+02
014	1.00+01	1.00+01	1.00+01

CHANNEL 3 (mR/hr AUTO)

CHANNEL ITEM	DESIRED INDICATION	AS-FOUND	AS-LEFT
016	001	001	001
017	000	000	000

Performed By DM

Performed By JJR

90.081

PPPP CCC
P P C
PPPP C
P CCC

PERIODIC CALIBRATION (PC) TASK FORM 1 PAGE 1 OF 2

WO NO: 98-012949-000 DATE: 09/30/9

COMP ID: WBN-0-LPR -090-0003 FILE #: 17 PM FREQUENCY: 12

DESCRIPTION: WASTE PKG AREA MONITOR LOOP
PC CLASSIFICATION:
CRITICAL : Y MANDATORY : Y COMPLIANCE: N
REGULATORY: N COMMITMENT: N OTHER:

SAFETY CLASS: QR EQ: N 1E: SECTION XI:

DUE DATE: 12/21/98 SCHEDULE DATE: 12/21/98 LATE DATE: 12/29/98

TASK TYPE: CRITICAL M .DATORY

RWP REQ : YES [X] NO [ ] RWP # : 300
NPRDS : YES [ ] NO [X] LCO : YES [ ] NO [X]
SCAFFOLD REQ: YES [ ] NO [X] INSUL REQ: YES [ ] NO [X]

OTHER PERMITS REQ:

ATTACHMENTS: IMI-90.015 S.S.D.

PERSONNEL QUALIFICATIONS: SKILL OF CRAFT

PLANNER: James D. Bayless / 11-13-98
SIGNATURE DATE

PERMITS, PRECAUTIONS & PREREQ REVIEWED: Dwight L Bowlin / 12-21-98
CRAFT DATE

HOLD ORDER REQ: Yes [ ] No [X] HO #: NR

OPERATIONS WORK APPROVAL: SR Smith / 11-23-98
OPS DATE

LCO NUMBER: NR TIME LIMIT: NR

REMOVED FROM SERVICE: Dwight L Bowlin / 12-21-98 / 0829
CRAFT DATE TIME

CHECK/DESCRIBE "AS FOUND" CONDITION:

[X] 100% GOOD CONDITION
[ ] 75% NEEDED MINOR ADJUSTMENTS, CLEANING, ETC.
[ ] 50% PARTS SHOWING VISUAL WEAR
[ ] 25% PARTS WORN, EQUIPMENT COULD FAIL ANY TIME
[ ] 0% EQUIPMENT WAS OUT OF SERVICE BECAUSE OF FAILURE

TVAWOPRT.V7.608.R03 PRINTED: 09/30/98 15:01:06

PERIODIC CALIBRATION ASSOCIATED EQUIPMENT PAGE 2 OF __

EQUIP ID: WBN-0-LPR -090-0003 FILE #: 17 REV #: WO NO: 98-012949

PLANNER | FOREMAN/CRAFT

ITEM NUM	EQUIPMENT ID NUMBER	SEC XI	SAFETY CLASS	1E	10 CFR 50 .49	MAINT. PERF. (NOTE 1) YES	MAINT. PERF. (NOTE 1) NO	LOCATION
1	WBN-0-PX -090-0003	N	QR sub	N	N	[ ]	[✓]	
2	WBN-0-RE -090-0003	N	↓	N	N	[ ]	[✓]	
3	WBN-0-RI -090-0003B	N	↓	N	N	[ ]	[✓] 729	
4	WBN-0-RM -090-0003	N	↓	N	N	[ ]	[✓] 755	
5	WBN-1-RR -090-0001P010	N	↓	N	N	[ ]	[✓] 755	
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_		N	R				
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							
___	WBN-_-____-___-________-_							

NOTE 1: Check Yes if a deficiency was corrected or part(s) was replaced and document in work performed section

WBN 0, 1, 2	92 DAY CHANNEL OPERATIONAL TEST OF THE LOW RANGE AREA RADIATION MONITORS	IMI-90.015 Revision 3 Page 30 of 42

Data Package: Page 17 of ____ Date 12-21-98

APPENDIX A
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WO 98-100423-0

RM ALARM DATA SHEET

Loop Number 0-LPR-90-3

	ALARM SETPOINTS				
	DESIRED (Vdc)	AS-FOUND (Vdc)	AS-FOUND TOLERANCE	AS-LEFT (Vdc)	AS-LEFT TOLERANCE
Yellow ALERT Alarm	4.92	4.95	± 0.166	LEFT AS	± 0.100
Red HIGH Alarm	5.31	5.32	± 0.166	FOUND	± 0.100

M&TE	TVA ID NO.	CAL DUE DATE	RANGE	NOTES
Keithley	537744	12-7-99	0-20vdc	

DEVICE	UNID	OOT
Ratemeter	0-RM-90-3	Yes ____ No ✓

Performed By [signature]

Performed By NR

2245R

WBN 0, 1, 2	92 DAY CHANNEL OPERATIONAL TEST OF THE LOW RANGE AREA RADIATION MONITORS	IMI-90.015 Revision 3 Page 31 of 42

Data Package: Page 18 of _____ Date 12-21-98

APPENDIX B
Page 1 of 1

WO 98-[illegible]-00

RM INDICATOR DATA SHEET

Loop Number 0-LPR-90-3

DISPLAY (mR/hr)	DESIRED (Vdc)	LO LIMIT	(Located on RM) AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
1.00E-1	0.000	-0.224	-0.060	0.224	-0.100	LEFT	0.100
1.00E0	2.000	1.776	2.003	2.224	1.900	AS	2.100
1.00E1	4.000	3.776	4.054	4.224	3.900	FOUND	4.100
1.00E2	6.000	5.776	6.042	6.224	5.900		6.100
1.00E3	8.000	7.776	8.032	8.224	7.900		8.100
1.00E4	10.000	9.776	10.030	10.224	9.900		10.100
1.00E3	8.000	7.776	7.998	8.224	7.900		8.100
1.00E2	6.000	5.776	6.005	6.224	5.900		6.100
1.00E1	4.000	3.776	4.002	4.224	3.900		4.100
1.00E0	2.000	1.776	1.980	2.224	1.900		2.100
1.00E-1	0.000	-0.224	-0.052	0.224	-0.100		0.100

M&TE	TVA ID NO.	CAL DUE DATE	RANGE	NOTES
Keithley	537744	12-7-99	0-20Vdc	
		N		
		R		

DEVICE: RM Indicator

UNID: 0-RI-90-3A

OOT: Yes ____ No ✓

Performed By [illegible]

Performed By [illegible]

2245R

WBN 0, 1, 2	92 DAY CHANNEL OPERATIONAL TEST OF THE LOW RANGE AREA RADIATION MONITORS	IMI-90.015 Revision 3 Page 32 of 42

Data Package: Page 19 of ____ Date 12-21-98

APPENDIX C
Page 1 of 1

REMOTE INDICATOR DATA SHEET WO [illegible]

Loop Number 0-LPR-90-3

DISPLAY (mR/hr)	DESIRED (Vdc)	LO LIMIT	(Located in Field) AS FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
1.00E-1	0.000	-0.224	-0.025	0.224	-0.100	LEFT	0.100
1.00E0	2.000	1.776	2.003	2.224	1.900	AS	2.100
1.00E1	4.000	3.776	3.978	4.224	3.900	FOUND	4.100
1.00E2	6.000	5.776	5.950	6.224	5.900		6.100
1.00E3	8.000	7.776	7.931	8.224	7.900		8.100
1.00E4	10.000	9.776	10.000	10.224	9.900		10.100
1.00E3	8.000	7.776	7.930	8.224	7.900		8.100
1.00E2	6.000	5.776	5.932	6.224	5.900		6.100
1.00E1	4.000	3.776	3.948	4.224	3.900		4.100
1.00E0	2.000	1.776	1.980	2.224	1.900		2.100
1.00E-1	0.000	-0.224	-0.052	0.224	-0.100		0.100

M&TE	TVA ID NO.	CAL DUE DATE	RANGE	NOTES
Keithley	537744	12-7-99	0-20VDC	
		N		
		R		

DEVICE: Remote Indicator
UNID: 0-RI-90-38
OOT: Yes ___ No ✓

Performed By [illegible]
Performed By NR

2245R

WBN 0, 1, 2	92 DAY CHANNEL OPERATIONAL TEST OF THE LOW RANGE AREA RADIATION MONITORS	IMI-90.015 Revision 3 Page 35 of 42

Data Package: Page 20 of ____ Date 12-21-98

APPENDIX F
Page 1 of 1

WO 00-110000-0

RECORDER DATA SHEET
(YOKOGAWA DISPLAY)

Loop Number 0-LPR-90-3 CN-2

RECORDER DISPLAY

DESIRED (Vdc)	DISPLAY (mR/hr)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
0.000	1.00E-1	1.00E-1	1.01E-1	1.22E-1	1.00E-1	LEFT	1.12E-1
2.000	1.00E0	7.76E-1	9.99E-1	1.22E0	8.71E-1	AS	1.12E0
4.000	1.00E1	7.76E0	9.95E+0	1.22E1	8.71E0	FOUND	1.12E1
6.000	1.00E2	7.76E1	9.82E+1	1.22E2	8.71E1		1.12E2
8.000	1.00E3	7.76E2	9.75E+2	1.22E3	8.71E2		1.12E3
10.000	1.00E4	7.76E3	9.64E+3	1.22E4	8.71E3		1.12E4

CN-3

M&TE	TVA ID NO.	CAL DUE DATE	RANGE	NOTES
Keithley	537744	12-7-99	0-20VDC	
		N		
			2	

DEVICE

Recorder 1-RR-90-1P010

UNID OOT

Yes ____ No ✓

Performed By L

Performed By NR

2245R

PPPP CCC
P P C
PPPP C
P CCC

PERIODIC CALIBRATION (PC) TASK FORM 1 PAGE 1 OF 44

WO NO: 98-012935-000 DATE: 09/30/98

COMP ID: WBN-1-LPR -090-0014 FILE #: 17 PM FREQUENCY: 12W

DESCRIPTION: SAMPLE ROOM PART MON LOOP
PC CLASSIFICATION:

CRITICAL : Y MANDATORY : Y COMPLIANCE: N
REGULATORY: N COMMITMENT: N OTHER:

SAFETY CLASS: QR EQ: N 1E: N SECTION XI:

DUE DATE: 11/30/98 SCHEDULE DATE: 11/30/98 LATE DATE: 12/08/98

TASK TYPE: CRITICAL MANDATORY

RWP REQ : YES [X] NO [ ] RWP # : 320
NPRDS : YES [ ] NO [X] LCO : YES [ ] NO [X]
SCAFFOLD REQ: YES [ ] NO [X] INSUL REQ: YES [ ] NO [X]

OTHER PERMITS REQ:

ATTACHMENTS: IMI-90.027 IMI-90.002 SSD

PERSONNEL QUALIFICATIONS: SKILL OF CRAFT

PLANNER: James W. Bowden / 11-5-98
SIGNATURE DATE

PERMITS, PRECAUTIONS & PREREQ REVIEWED: Chas L Bowden / 12-2-98
CRAFT DATE

HOLD ORDER REQ: Yes [ ] No [X] HO #: NR

OPERATIONS WORK APPROVAL: [signature] / 11/22/98
OPS DATE

LCO NUMBER: NR

REMOVED FROM SERVICE: TIME LIMIT: NR
Chas L Bowden / 12-2-98 / 0845
CRAFT DATE TIME

CHECK/DESCRIBE "AS FOUND" CONDITION:

[ ] 100% GOOD CONDITION
[X] 75% NEEDED MINOR ADJUSTMENTS, CLEANING, ETC.
[ ] 50% PARTS SHOWING VISUAL WEAR
[ ] 25% PARTS WORN, EQUIPMENT COULD FAIL ANY TIME
[ ] 0% EQUIPMENT WAS OUT OF SERVICE BECAUSE OF FAILURE

TVAWOPRT.V7.608.R03 PRINTED: 09/30/98 15:00:43

PERIODIC CALIBRATION ASSOCIATED EQUIPMENT PAGE 3 OF ___

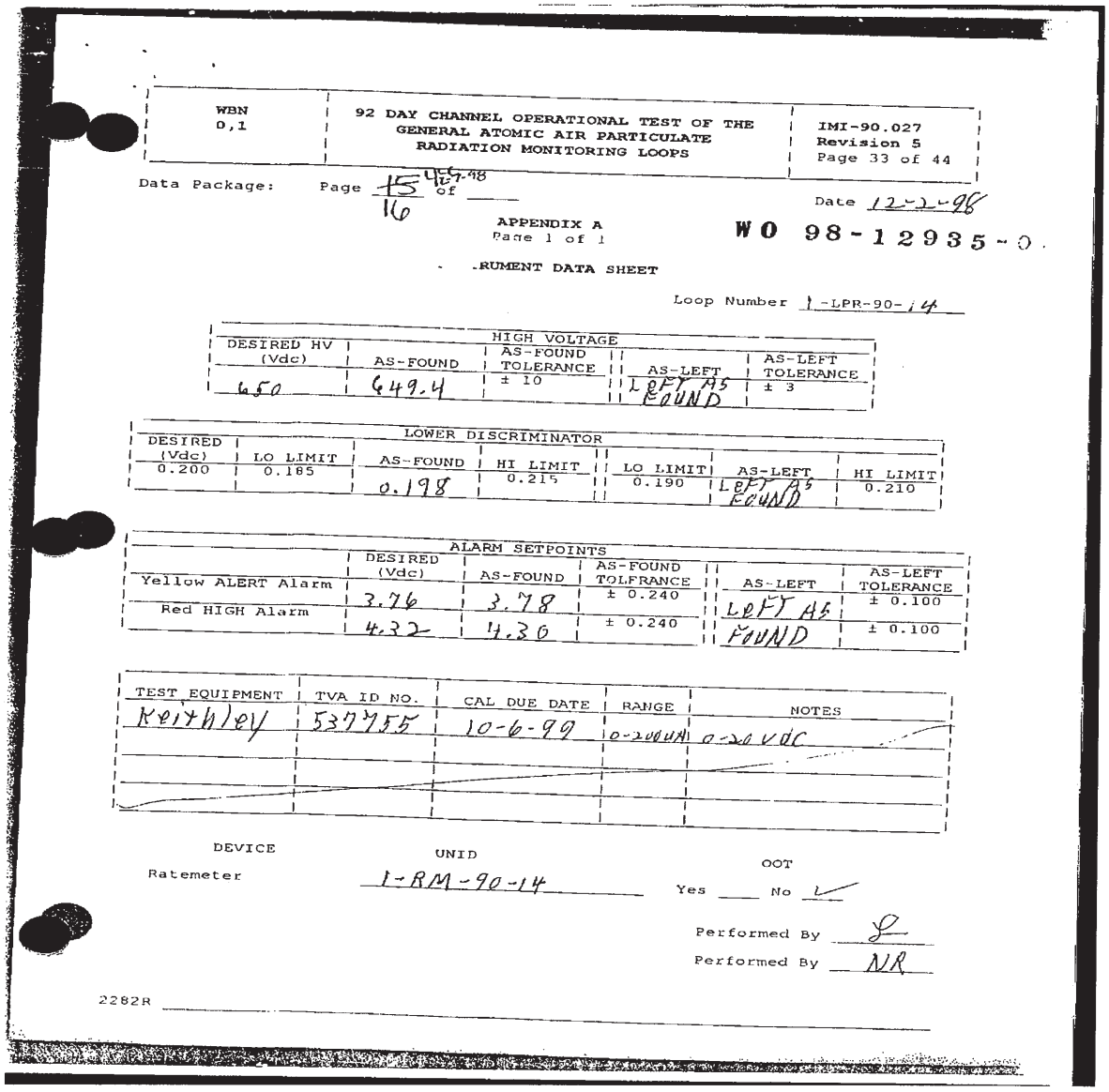
EQUIP ID: WBN-1-LPR -090-0014 FILE #: 17 REV #: WO NO: 98-012935-0

PLANNER | FOREMAN/CRAFT

W-0-98-12935-00

ITEM NUM	EQUIPMENT ID NUMBER	SEC XI	SAFETY CLASS	1E	10 CFR 50 .49	MAINT. PERF. (NOTE 1) YES	NO	LOCATION
1	WBN-0-RR -090-0013[illegible]	N	QR-ILB	N	N	[ ]	[✓]	755
2	WBN-1-FC -090-00[illegible]	N		N	N	[✓]	[ ]	
3	WBN-1-FI -090-0014	N		N	N	[ ]	[✓]	
4	WBN-1-FS -090-0014	N		N	N	[✓]	[ ]	
5	WBN-1-PI -090-0014	N		N	N	[ ]	[✓]	
6	WBN-1-PX -090-0014	N		N	N	[ ]	[✓]	
7	WBN-1-RE -090-0014	N		N	N	[ ]	[✓]	
8	WBN-1-RM -090-0014	N		N	N	[ ]	[✓]	
9	WBN-1-RR -090-0014B	N		N	N	[ ]	[✓]	
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							
	WBN-_-___-___-___-_							

NOTE 1: Check Yes if a deficiency was corrected or part(s) was replaced and document in work performed section



WBN 0,1	92 DAY CHANNEL OPERATIONAL TEST OF THE GENERAL ATOMIC AIR PARTICULATE RADIATION MONITORING LOOPS	IMI-90.027 Revision 5 Page 33 of 44

Data Package: Page 15 of 16 (12-7-98)

Date 12-2-98

APPENDIX A
Page 1 of 1

WO 98-12935-0

-RUMENT DATA SHEET

Loop Number 1-LPR-90-14

HIGH VOLTAGE

DESIRED HV (Vdc)	AS-FOUND	AS-FOUND TOLERANCE	AS-LEFT	AS-LEFT TOLERANCE
650	649.4	± 10	LEFT AS FOUND	± 3

LOWER DISCRIMINATOR

DESIRED (Vdc)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
0.200	0.185	0.198	0.215	0.190	LEFT AS FOUND	0.210

ALARM SETPOINTS

	DESIRED (Vdc)	AS-FOUND	AS-FOUND TOLFRANCE	AS-LEFT	AS-LEFT TOLERANCE
Yellow ALERT Alarm	3.76	3.78	± 0.240	LEFT AS FOUND	± 0.100
Red HIGH Alarm	4.32	4.30	± 0.240		± 0.100

TEST EQUIPMENT	TVA ID NO.	CAL DUE DATE	RANGE	NOTES
Keithley	537755	10-6-99	0-200uA	0-20 VDC

DEVICE: Ratemeter

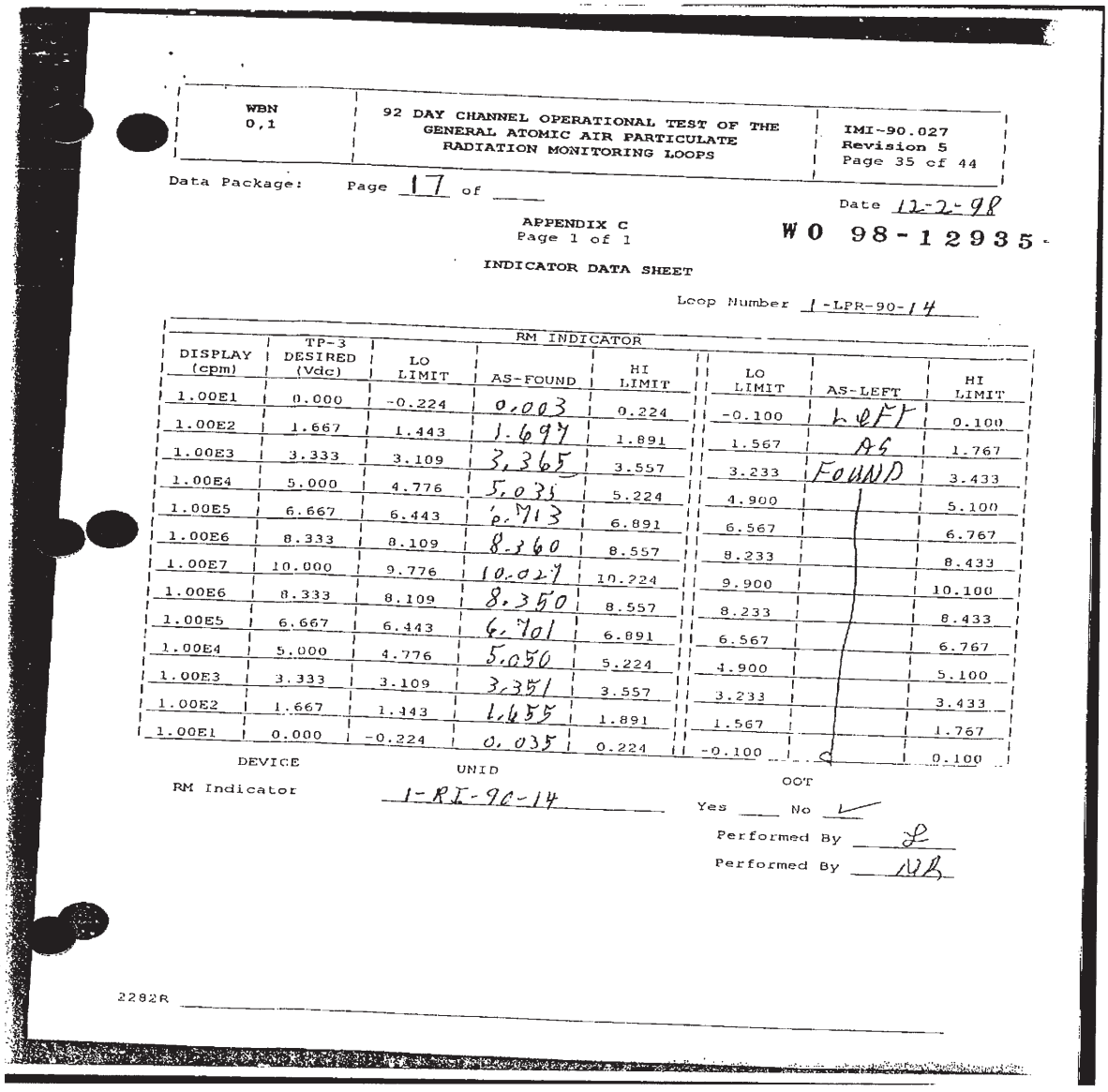
UNID: 1-RM-90-14

OOT: Yes ___ No ✓

Performed By [signature]

Performed By NR

2282R



WBN 0,1	92 DAY CHANNEL OPERATIONAL TEST OF THE GENERAL ATOMIC AIR PARTICULATE RADIATION MONITORING LOOPS	IMI-90.027 Revision 5 Page 35 of 44

Data Package: Page 17 of ____ Date 12-2-98

APPENDIX C
Page 1 of 1

WO 98-12935-

INDICATOR DATA SHEET

Loop Number 1-LPR-90-14

RM INDICATOR							
DISPLAY (cpm)	TP-3 DESIRED (Vdc)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
1.00E1	0.000	-0.224	0.003	0.224	-0.100	LEFT	0.100
1.00E2	1.667	1.443	1.697	1.891	1.567	AS	1.767
1.00E3	3.333	3.109	3.365	3.557	3.233	FOUND	3.433
1.00E4	5.000	4.776	5.035	5.224	4.900		5.100
1.00E5	6.667	6.443	6.713	6.891	6.567		6.767
1.00E6	8.333	8.109	8.360	8.557	8.233		8.433
1.00E7	10.000	9.776	10.027	10.224	9.900		10.100
1.00E6	8.333	8.109	8.350	8.557	8.233		8.433
1.00E5	6.667	6.443	6.701	6.891	6.567		6.767
1.00E4	5.000	4.776	5.050	5.224	4.900		5.100
1.00E3	3.333	3.109	3.351	3.557	3.233		3.433
1.00E2	1.667	1.443	1.655	1.891	1.567		1.767
1.00E1	0.000	-0.224	0.035	0.224	-0.100		0.100

DEVICE: RM Indicator

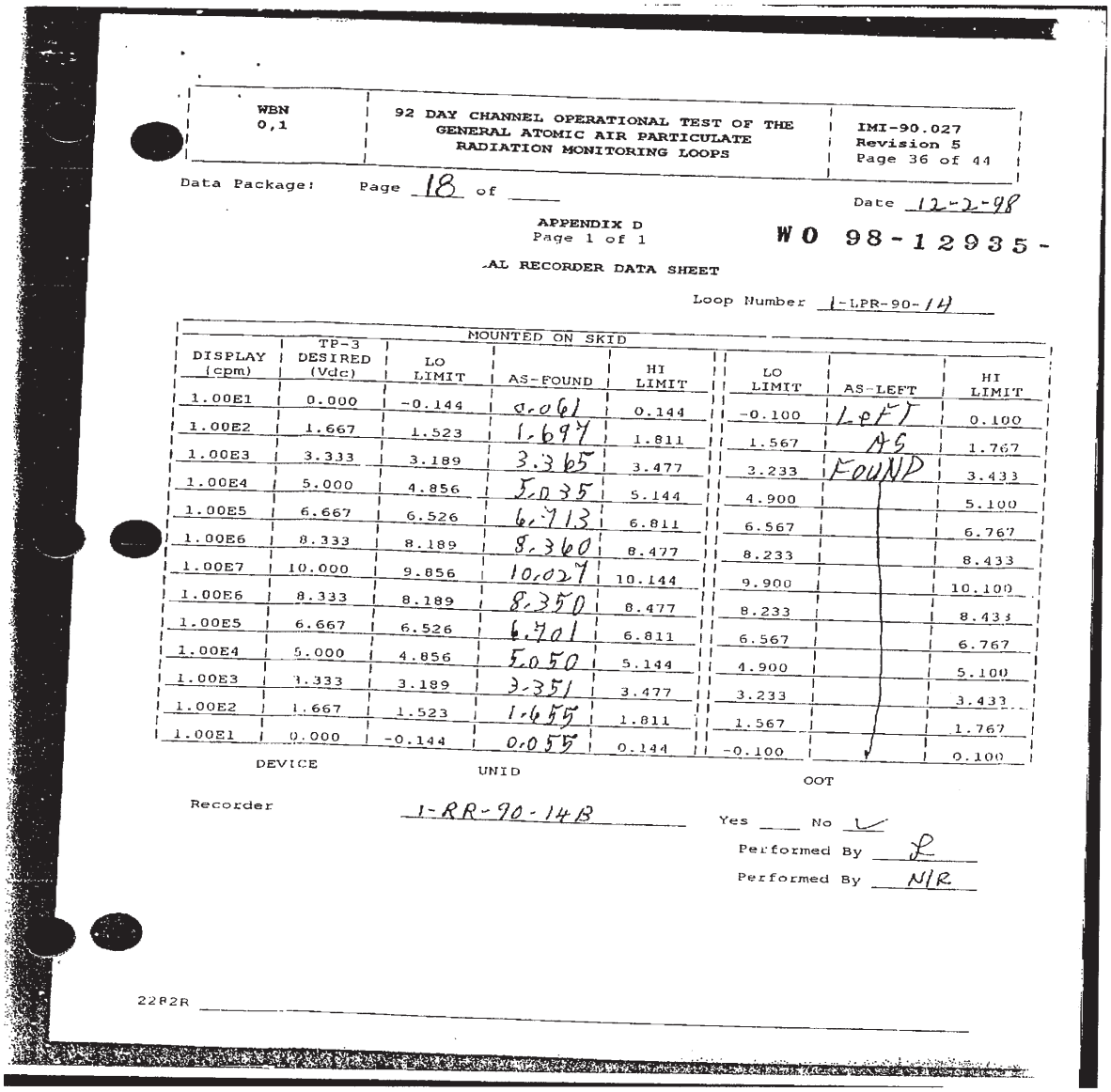
UNID: 1-RE-90-14

OOT: Yes ____ No ✓

Performed By ____

Performed By ____

2282R



WBN 0,1	92 DAY CHANNEL OPERATIONAL TEST OF THE GENERAL ATOMIC AIR PARTICULATE RADIATION MONITORING LOOPS	IMI-90.027 Revision 5 Page 36 of 44

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APPENDIX D
Page 1 of 1

WO 98-12935-

AL RECORDER DATA SHEET

Loop Number 1-LPR-90-14

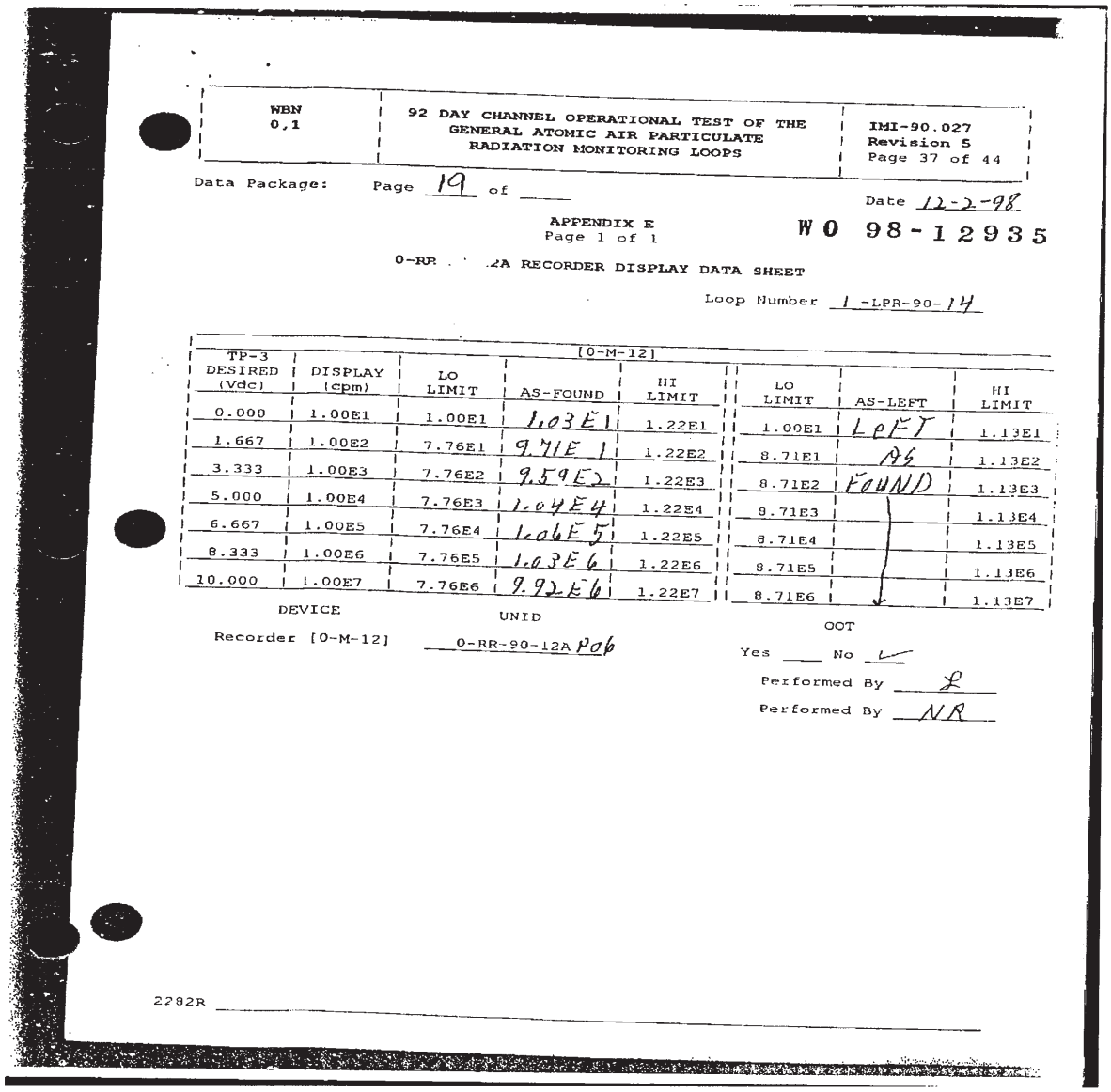
MOUNTED ON SKID							
DISPLAY (cpm)	TP-3 DESIRED (Vdc)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
1.00E1	0.000	-0.144	0.061	0.144	-0.100	LEFT	0.100
1.00E2	1.667	1.523	1.697	1.811	1.567	AS	1.767
1.00E3	3.333	3.189	3.365	3.477	3.233	FOUND	3.433
1.00E4	5.000	4.856	5.035	5.144	4.900		5.100
1.00E5	6.667	6.526	6.713	6.811	6.567		6.767
1.00E6	8.333	8.189	8.360	8.477	8.233		8.433
1.00E7	10.000	9.856	10.027	10.144	9.900		10.100
1.00E6	8.333	8.189	8.350	8.477	8.233		8.433
1.00E5	6.667	6.526	6.701	6.811	6.567		6.767
1.00E4	5.000	4.856	5.050	5.144	4.900		5.100
1.00E3	3.333	3.189	3.351	3.477	3.233		3.433
1.00E2	1.667	1.523	1.655	1.811	1.567		1.767
1.00E1	0.000	-0.144	0.055	0.144	-0.100		0.100
DEVICE			UNID		OOT		

Recorder 1-RR-90-14B Yes ___ No ✓

Performed By R

Performed By N/R

2282R



WBN 0,1	92 DAY CHANNEL OPERATIONAL TEST OF THE GENERAL ATOMIC AIR PARTICULATE RADIATION MONITORING LOOPS	IMI-90.027 Revision 5 Page 37 of 44

Data Package: Page 19 of ____ Date 12-2-98

APPENDIX E
Page 1 of 1

WO 98-12935

0-RR . . 2A RECORDER DISPLAY DATA SHEET

Loop Number 1-LPR-90-14

[0-M-12]							
TP-3 DESIRED (Vdc)	DISPLAY (cpm)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
0.000	1.00E1	1.00E1	1.03E1	1.22E1	1.00E1	LEFT	1.13E1
1.667	1.00E2	7.76E1	9.71E1	1.22E2	8.71E1	AS	1.13E2
3.333	1.00E3	7.76E2	9.59E2	1.22E3	8.71E2	FOUND	1.13E3
5.000	1.00E4	7.76E3	1.04E4	1.22E4	8.71E3		1.13E4
6.667	1.00E5	7.76E4	1.06E5	1.22E5	8.71E4		1.13E5
8.333	1.00E6	7.76E5	1.03E6	1.22E6	8.71E5		1.13E6
10.000	1.00E7	7.76E6	9.92E6	1.22E7	8.71E6		1.13E7

DEVICE: Recorder [0-M-12]

UNID: 0-RR-90-12A P06

OOT: Yes ___ No ✓

Performed By ___

Performed By NR

2282R

WBN 0, 1	92 DAY GENERAL ATOMIC PARTICULATE MONITOR FLOW INSTRUMENT CALIBRATION	IMI-90.002 Revision 9 Page 30 of 36

Data Package: Page 42 ~~of~~ 12/7/98
43

Date 12-2-98

APPENDIX A
Page 1 of 1

WO 98-12935-00

FLOW SWITCH DATA SHEET

Sample Flow: 11.94 & 11.96 scfm

Loop Number 1-LPR-90-14 | CN-1

Maximum Flow: 15.44 scfm

HIGH FLOW SWITCH

DESIRED (in. Hg vac)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
8.0	6.0	8.20	10.0	7.0	8.5	9.0

LOW FLOW SWITCH

DESIRED (scfm)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
5.6	3.6	3.91	7.6	4.4	4.84	6.8

TEST EQUIPMENT	TVA ID NO.	CAL DUE DATE	RANGE	NOTES
HP15P	891288	3-4-99	0-30"	
		NA		

Out of Tolerance

High Flow Switch Yes___ No ✓

Low Flow Switch Yes ✗ No ✓

Performed By [signature]

Performed By [signature]

[signature] 12-2-98

7591R

WBN 0, 1	92 DAY GENERAL ATOMIC PARTICULATE MONITOR FLOW INSTRUMENT CALIBRATION	IMI-90.002 Revision 9 Page 31 of 36

Data Package: Page 43 of 43 4/27/98
44 44

Date 12-2-98

APPENDIX B
Page 1 of 1

WO 98-12935

PARTICULATE FLOW CONTROLLER DATA SHEET

Loop Number 1-LPR-90-14

CONTROLLER HIGH FLOW

DESIRED (scfm)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
11.0	9.0	11.82	13.0	9.8	11.77	12.2

CONTROLLER LOW FLOW

DESIRED (scfm)	LO LIMIT	AS-FOUND	HI LIMIT	LO LIMIT	AS-LEFT	HI LIMIT
9.0	7.0	10.29	11.0	7.8	9.34	10.2

Out of Tolerance

Controller High Flow Yes___ No ✓

Controller Low Flow Yes___ No ✓

Performed By [signature]

Performed By [signature]

7591R

PPPP CCC
P P C
PPPP C
P CCC

PERIODIC CALIBRATION (PC) TASK FORM 1 PAGE 1 OF 1

WO NO: 98-012948-000 DATE: 09/30/9

COMP ID: WBN-1-LPR -090-0423 FILE #: 17 PM FREQUENCY: 12

DESCRIPTION: LOOP, RADIATION
PC CLASSIFICATION:

CRITICAL : Y MANDATORY : Y COMPLIANCE: N
REGULATORY: N COMMITMENT: N OTHER:

SAFETY CLASS: QR EQ: N 1E: N SECTION XI:

DUE DATE: 12/21/98 SCHEDULE DATE: 12/21/98 LATE DATE: 12/29/98

TASK TYPE: CRITICAL MANDATORY

RWP REQ : YES [X] NO [ ] RWP # : 300
NPRDS : YES [ ] NO [X] LCO : YES [ ] NO [X]
SCAFFOLD REQ: YES [ ] NO [X] INSUL REQ: YES [ ] NO [X]

OTHER PERMITS REQ:

ATTACHMENTS: IMI-90.081 S.S.D.

PERSONNEL QUALIFICATIONS: SKILL OF CRAFT

PLANNER: James A. Bayless / 11-13-98
SIGNATURE DATE

PERMITS, PRECAUTIONS & PREREQ REVIEWED: Rob DB / 12-21-98
CRAFT DATE

HOLD ORDER REQ: Yes [ ] No [X] HO #: N/R

OPERATIONS WORK APPROVAL: SR Smith / 11-23-98
OPS DATE

LCO NUMBER: N/R TIME LIMIT: N/R

REMOVED FROM SERVICE: Rob DB / 12-24-98 / 1328
CRAFT DATE TIME

CHECK/DESCRIBE "AS FOUND" CONDITION:

[ ] 100% GOOD CONDITION
[ ] 75% NEEDED MINOR ADJUSTMENTS, CLEANING, ETC.
[ ] 50% PARTS SHOWING VISUAL WEAR
[ ] 25% PARTS WORN, EQUIPMENT COULD FAIL ANY TIME
[ ] 0% EQUIPMENT WAS OUT OF SERVICE BECAUSE OF FAILURE

TVAWOPRT.V7.608.R03 PRINTED: 09/30/98 15:01:05

LOOP	MODEL	DISC	# of COTs	[redacted]	MCR IND OAL	LOCAL IND OAL **ONLY**	LOCAL IND OAF	[redacted]	RECORDER SpeedoMax M OAL **ONLY**	RECORDER SpeedoMax M OAF	RECORDER SpeedoMax M INOP
0R122	RP-30AM	INT	10		0	NA	NA		0	0	0
0R133	RP-30AM	INT	9		1	NA	NA		0	1	0
0R225	RP-30AM	INT	9		0	NA	NA		0	0	0
2R123	RP-30AM	INT	9		0	NA	NA		0	0	0
0R126	RP-30AM	INT	10		2	NA	NA		0	1	2
0R205	RP-30AM	INT	10		1	NA	NA		0	1	0
1R106B	RP-30AM	INT	10		0	1	0		0	0	0
			67								

LOOP	MODEL	DISCTYPE	# of COTs	[redacted]	UP DISC OAL ONLY	UP DISC OAF	[redacted]	MCR IND	[redacted]	SpeedoMax M RECORDER OAL
0R101C	RP-30AM	DIFF	9		0	6		0		0
0R132C	RP-30AM	DIFF	13		0	1		0		0
1R106C	RP-30AM	DIFF	10		0	0		0		0
1R112C	RP-30AM	DIFF	11		1	0		0		1
			43							

LOOP	MODEL	# OF COTS	[redacted]	MCR IND OAL	LOCAL IND OAL **ONLY**	LOCAL IND OAF	LOCAL IND INOP	LOCAL IND NO DATA	[redacted]	[redacted]	[redacted]
0R004	RP-1AM	10		0	1	2	0	3	NA	NA	
0R011	RP-1AM	9		0	0	0	0	0	NA	NA	
1R059	RP-1AM	9		1	0	1	1	1		NA	
2R010	RP-1AM	10		0	0	0	0	0	NA	NA	
1R275	RP-1AM	9		0	0	0	0	5	NA	NA	
1R278	RP-1AM	11		0	0	0	0	1	NA	NA	
		58									

LOOP	MODEL	# of COTs	[redacted]	MCR IND OAL	[redacted]
1R271	RP 2C	10		1	
1R272	RP 2C	10		0	
1R273	RP 2C	11		1	
1R274	RP 2C	11		0	
1R291	RP 2C	11		0	
1R293	RP 2C	9		0	
		62			

LOOP	MODEL	# of COTs	[redacted]	MCR IND OAL	LOCAL IND	[redacted]
1R002	RP 2AM	10		1	0	

ATTACHMENT 2 PG 1 of 2

WBN-EEB-EDR/090-99005 REV 0

SpeedoMax M # of Instruments	SpeedoMax M # of Instrumentswith NO Failures	SpeedoMax M # of COTs	RECORDER SpeedoMax M OAL ONLY	RECORDER SpeedoMax M OAF	RECORDER SpeedoMax M INOP
11	7	110	1	3	2

MCR Indicator # of Instruments	MCR Indicator # of Instrumentswith NO Failures	MCR Indicator # of COTs	MCR Indicator COT OAL	MCR Indicator OAF
24	24	240	8	0

Local Indicator # of Instruments	Local Indicator # of Instruments with NO Failures	Local Indicator # of COTs	Local Indicator COT OAL ONLY	Local Indicator COT OAF	Local Indicator COT INOP
8	5	58	2	3	1

High Discriminator # of Instruments	High Discriminator # of Instruments with NO Failures	High Discriminator # of COTs	High Discriminator COT OAL ONLY	High Discriminator COT OAF
4	2	43	1	7

ATTACHMENT 2 PG 2 S/O ENNR W8N-EEB-EDQ1090-99005 REV 0

Design Verification Report
Extending Channel Operational Test Frequency for Radiation Monitors
EDQ1090-99005 Revision 001

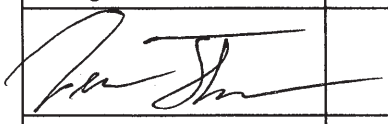
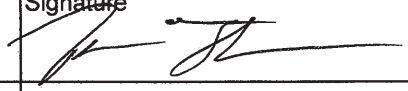
Design Verified (System, Structure, Component):	Method(s)	
EDQ1090-99005 Revision 001		Interdisciplinary Review
		Off-Project Design Review
	X	Individual Critical Review
		Alternate Calculation
		Qualification Testing

Document(s) Reviewed:
Calculation: EDQ1090-99005

Summary of Review (attach additional sheets if needed):
This calculation was reviewed for compliance with applicable procedures and technical instructions, appropriate references, completeness of documentation, and reasonableness of results.

This calculation is prepared in accordance with TVA Procedure NEDP-2, Bechtel Calculation Procedure 25402-3DP-G04G-00037, and TVA Branch Technical Instruction EEB-TI-28, Setpoint Calculations, Revision 7. The calculation is verified in accordance with TVA Procedure NEDP-5, and Bechtel Procedure 25402-3DP-G04G-0027.

Conclusions (attach additional sheets if needed)
Design Input Sources used in the uncertainty were documented and appropriate. The methods used to determine uncertainty were consistent with procedural requirements defined above and the results obtained reasonable to demonstrate that the accuracy is adequate for the intended purpose.

Signature of Verifier	Organization	Position	Report Prepared by
	Bechtel	Control Systems Engineer	Name Jeremy A. Thompson
			Signature 
			Date February 10, 2011

Attachment No. 3: Page 1 of 3
Calculation ID: EDQ1090-99005

Design Verification Checklist
(excerpted from ANSI N.45.2.11 [1974 Edition]
Extending Channel Operational Test Frequency for Radiation Monitors
EDQ1090-99005 Revision 001

Yes	No	N/A	Design Verification Element Note: Any items checked "No" automatically imply the design is not verified.	Remarks *
X			Is the person performing the design verification qualified to originate the document?	
X			Is the design verification being performed by someone other than the supervisor of the originator? If the supervisor of the originator is performing design verification, mark the answer "N/A" and provide justification in the document (see section 2.3.7 for requirements).	
X			Do the collective results of the design input/output substantiate the concept and approach chosen to ensure the design activity provides an adequate, accurate, and workable solution to the problem/question being resolved?	
X			Were the design inputs correctly selected and incorporated into design?	**The design inputs are consistent with the requirements for this type calculation.**
		X	Are assumptions necessary to perform the design activity adequately described and reasonable? Where necessary, are assumptions identified for subsequent re-verifications when the detailed design activities are completed?	**There are no assumptions.**
X			Are the appropriate quality and quality assurance requirements specified?	
		X	Are the applicable codes, standards and regulatory requirements including issue and addenda properly identified, and their requirements for design met?	
		X	Have applicable construction and operating experiences been considered?	
		X	Have the design interface requirements been satisfied?	
X			Were appropriate design methods and computer programs used?	
X			Is the design output reasonable compared to design inputs?	
		X	Are the specified parts, equipment, and processes suitable for the required application? Are all applicable construction specifications referenced on the drawing(s)?	
		X	Are the specified materials compatible with each other and the design environmental conditions to which the material will be exposed?	
		X	Have adequate maintenance features and requirements been specified?	
		X	Are accessibility and other design provisions adequate for initial installation and for performing needed maintenance and repair?	
		X	Have adequate accessibility been provided to perform the in-service inspection expected to be required during the plant life?	
		X	Has the design properly considered radiation exposure to the public and plant personnel (e.g., ALARA)?	

Design Verification Checklist (excerpted from ANSI N.45.2.11 [1974 Edition] Extending Channel Operational Test Frequency for Radiation Monitors EDQ1090-99005 Revision 001				
Yes	**No**	**N/A**	**Design Verification Element** Note: Any items checked "No" automatically imply the design is not verified.	**Remarks ***
X			Are the acceptance criteria incorporated in the design documents sufficient to allow verification that design requirements have been satisfactorily accomplished?	
		X	Have adequate pre-operational and subsequent periodic test requirements been appropriately specified?	
		X	Have adequate handling, storage, cleaning, and shipping requirements been specified?	
		X	Are adequate identification requirements specified?	
		X	Are requirements for record preparation review, acceptance, retention, etc., adequately specified?	
		X	Has constructability been adequately considered?	

* It is encouraged that the verifier provide a brief explanation of the considerations utilized in performing the design verification activity in the "Remarks" column