Attachment 8

TVA design criteria document WB-DC-40-24, "Radiation Monitoring (Unit 1/Unit 2)," Revision 24, dated November 30, 2011 (Letter Item 6)

TVA **WBN Design Criteria Document**	**RADIATION MONITORING (UNIT 1 / UNIT 2)**	**WBN-DCD-40-24** **Rev. 0024** **Page 1 of 89** Quality Related ☑ Yes ☐ No Effective Date 11-30-2011

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Concurred by:	J. V. Ware Jr. Mechanical Design Engineer	Date
Approved by:	E. D. Higgins Mechanical / Civil Design Manager	Date

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
0	9-8-72		Initial issue.
1	3-31-89		General revision.
DCN S-11682-A			DCN RIMS No. B26 900730 844 Revised Table 9.0-1, Radiation Monitoring Classification," page 119 to add monitors 0-RE-90-217, 0-RE-90-218, and 0-RE-90-219.
2			Incorporated the following Design Input Memorandums (DIM): A. DIM-WB-DC-40-24-1 - D. W. Wilson to P. R. Mandava, July 15, 1989 (B26 890714 207). B. DIM-WB-DC-40-24-2 - D. W. Wilson to P. R. Mandava, September 15, 1989 (B26 890915 078). C. DIM-WB-DC-40-24-3 - D. W. Wilson to P. R. Mandava and F. A. Koontz, Jr., September 15, 1989 (B26 890915 078). D. DIM-WB-DC-40-24-4 - D. W. Wilson to P. R. Mandava, October 31, 1989 (B26 891031 076). E. DIM-WB-DC-40-24-6 - D. W. Wilson to P. R. Mandava, December 21, 1989 (B26 891221 076). F. DIM-WB-DC-40-24-5 - R. C. Weir to W. S. Raughley, April 23, 1990 (B26 900423 076). Revised Sections 3.1.1, 3.1.1.6, 3.1.1.7, 3.2.1.5, and 3.7.1.2.4 to reflect the design change for the Shield Building vent monitors. Delete Section 3.1.1.5 and renumber Sections 3.1.1.6 through 3.1.1.11. Revised Section 3.1.3 and added Sections 3.1.3.10, 3.2.3.10, and 3.7.3.2.10 to add CDWE Building particulate monitor requirements.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
2 (cont'd)			Revised Section 3.1.6 to add the CDWE Building area monitors and correct the name of 1,2-RE-90-010 from Auxiliary Building access area monitors to CVCS board area monitors. Added Sections 3.1.6.21, 3.2.6.21, and 3.7.6.2.21 to add requirements for the CDWE Building area monitors. Revise Section 3.2.5.1b to correct the safety function from primary to secondary for the waste disposal system gaseous effluent monitor. Revised Sections 3.2.6.1 through 3.2.6.14 and 3.2.6.17 through 3.2.6.20, 3.7.6.2.1 through 3.7.6.2.14 and 3.7.6.2.17 through 3.7.6.2.20 to delete the requirements for a local alert and malfunction alarm for the area monitors. Revised Section 7.2 to add approved exceptions. Added references 8.2.1, 8.4.11, 8.4.12, and 8.6.1 through 8.6.33 (requirements calculations). Revised Tables 9.0-1, 9.0-2, 9.0-3, 9.0-4, and 9.0-5 to reflect design changes, CDWE Building monitor additions, to correct environmental and mechanical data, and to incorporate the results of the requirements (range and accuracy calculations. Revised Sections 3.1.1.11 (now 3.1.1.10), 3.2.1.8, and 3.7.1.2.7 to add the requirements for the portable airborne radioactivity monitors. Revised Sections 3.1.1.2, 3.1.4.1, 3.1.4.10 (now 3.1.4.9), 3.1.6.10, 3.2.1.2, 3.2.1.3, 3.2.1.4, 3.2.1.7, 3.2.2.2, 3.2.4.5, 3.2.4.10 (now 3.2.4.9), 3.7.1.2.8, 3.7.2.2.3, 3.7.3.1, 3.7.3.2.9, 3.7.4.1, 3.7.5.2.1, 3.7.7, 4.1.1.3, 4.1.2.1, and 4.1.3, and deleted 3.9, 4.0, 4.1.1.2, 3.7.6.2.20b and relettered paragraphs. Revised the Table of Contents as necessary. Made editorial changes for consistency in nomenclature and when required for clarity. This revision incorporated applicable commitments/requirements per WBEP-DB.02. Revised Sections 3.1.7.1 and 3.1.7.2 to allow use of a single monitor if one monitor that satisfies the required range and accuracy is obtainable.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
2 (cont'd)			Make clear requirements that containment lower and upper compartment monitors provide real-time detection of radioiodine. Section 3.2.4 - Clarified minimum sample flow requirements for the off-line liquid monitors. Clarified requirements for remote indication of several area monitors. Section 3.7.1.2.2 - Changed sample flow rate requirements for the Service Building vent monitor. Section 3.12 - Changed a requirement for low point taps in sampling systems to a recommendation. In Sections 3.1.3.2, 3.1.3.7, in subsequent sections, and in the tables, the two area monitors previously both identified as "Waste Packaging Area Monitor" are differentiated by renaming one of them the "Second Waste Packaging Area Monitor." Section 3.1.7 - The letdown monitor, RE-90-104, is reclassified from an offline liquid monitor to an online monitor. The changes in the criteria that result from this reclassification are made. Sections 3.2.6.15 and 3.2.6.16 - A requirement to provide indication of exposure rates measured by the Reactor Building post-accident monitors in the MCR is added. Section 3.7.1.2.5 - The requirement to provide output from the condenser vacuum pump normal range monitors to the plant computer data logger is deleted. Section 3.9 - The requirement for sample pumps to have remote on/off controls is deleted. Section 3.8 - Revised to state thermal overload bypass of thermal overload protection devices for safety-related motor-operated valves and torque switches is not required. Clarified Note 1 to Table 9.0-1. Deleted unused notes in the tables

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
2 (cont'd)			Section 3.7.1.2.4 - Deleted requirement that the SBV Noble gas monitor provide means for local display of the latest averaged measured data, and means for local actuation of the check source for channels that have check sources. Deleted requirement that the SBV particulate and iodine monitor include a radiation detector near the particulate/iodine grab sample filters.
DCN M-21861-A			Revise Table of Contents to delete existing Section 3.10.1.1 and re-number Section 3.10.1.2 as new Section 3.10.1.1. Delete the automatic control functions of the Auxiliary Building Vent Monitor as specified in Sections 3.1.1.1, 3.2.1.1, and 3.7.1.2.1. Delete existing Section 3.10.1.1 for the Auxiliary Building Vent Monitor automatic control functions. Re-number Section 3.10.1.2 as new Section 3.10.1.1. Delete Auxiliary Building Ventilation Monitor from table 9.0-4.
DCN S-17772-A	06/18/93		RIMS No. T56 930618 881 Revise Table of Contents to delete Sections 3.1.1.10, 3.1.6.13, 3.2.1.8, 3.2.6.13, 3.7.1.2.7 and 3.7.6.2.13, 3.10.1 and 3.10.1.1 and renumber Sections 3.1.6.14 thru 3.1.6.21 as 3.1.6.13 thru 3.1.6.20, Section 3.2.1.9 as 3.2.1.8, Sections 3.2.6.14 thru 3.2.6.21 as 3.2.6.13 thru 3.7.6.20, Section 3.7.1.2.8 as 3.7.1.2.7, and Sections 3.7.6.2.14 thru 3.7.6.2.21 ad 3.7.6.2.13 thru 3.7.6.2.20. Revise Sections 3.1.1, 3.1.1.5, 3.1.1.6, 3.2.1.5, 3.6 and 3.7.1.2.4 to address changes related to the Shield Building Vent Monitors. Revise Sections 3.1.1.3, 3.1.1.4, 3.2.1.3, 3.2.1.4, 3.7.1.2.3, 3.10.1.1 and Table 9.0-4 to address changes to the Containment Lower and Upper Compartment Monitors. Delete Section 3.1.1.10.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-17772-A (cont'd)			In Section 3.1.6 delete line for Laundry Room Monitor 0-RE-90-063. Delete Section 3.1.6.13 and renumber succeeding Sections 3.1.6.14 through 3.1.6.21 as 3.1.6.13 through 3.1.6.20. Delete Section 3.2.1.8 and renumber paragraph 3.2.1.9 as 3.2.1.8. Delete Section 3.2.6.13 and renumber succeeding Sections 3.2.6.14 through 3.2.6.21 as 3.2.6.13 through 3.2.6.20. Revised Section 3.5 to add pressure and temperature effects. Revised Section 3.2.7.1 to revise the Safety Classification and Safety Function for the Main Steam Line Monitors from primary to secondary safety function. Delete Section 3.7.1.2.7 and renumber Section 3.7.1.2.8 as 3.7.1.2.7. Delete Section 3.7.6.2.13 and renumber succeeding Sections 3.7.6.2.14 through 3.7.6.2.21 as 3.7.6.2.13 through 3.7.6.2.20. Revise reference list to update and add References. Revised Table 9.0-1 to revise the Electrical Safety Class, Seismic Category of Detector Assembly, and WB-DC-30-7 Category/Type for 1, 2-RE-90-421 thru 1, 2-RE-90-424 to reflect non IE, Seismic I(L) and 2/C, E respectively, to delete 0-RE-90-063, to add note 39 for 1, 2-RE-90-400 and 402, to delete Portable Monitors 0-RE-90-217, 218, 219 and to delete Monitor 1-RE-90-104. Revised Table 9.0-2 to revise the source of sample description for 1, 2-RE-90-106 and 112, and to delete Portable Monitors 1, 2-RE-90-217, 218 and 219. Revise Table 9.0-3 to delete Laundry Room Monitor 0-RE-90-063 and Portable Monitors 0-RE-90-217, 218, and 219.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-17772-A (cont'd)			Revised Table 9.0-4 to delete Cnmt Bldg. Lower and Upper Compartment Monitors. Revised Table 9.0-5 to revise the Primary Safety Function, and Secondary Safety Function for 1, 2-RE-90-421 thru 1, 2-RE-90-424 to reflect No and Yes respectively, to delete 0-RE-90-063 and to delete Portable Monitors 0-RE-90-217, 218 and 219. These revisions reflect the changes implemented by DCNs M-09964-A, M-3450-A, M-3451-A, F-24447-A, M-13516, and M-11823. Pages Added: Revision Log (2 pages) Pages Changes: i, ii, iii, iv, vi, 6, 8, 9, 18, 21, 22, 27-32, 49-54, 56, 57, 61-64, 77-80, 86, 87, 106, 108, 109, 111-114, 116, 117, 120, 128-130, 132, 133, 138-140. Pages Replaced: None
3	07-30-93		Revision 3 is performed as part of the Corrective Action to SCAR WBE890178901SCA, Revision 3. This is a general revision based on a review in accordance with the guidelines of Appendix B to EAI-3.08 and included comments from SERT Program, thus revision bars are omitted on editorial comments. This revision incorporates EX-WB-DC-40-24-3 and EX-WB-DC-40-24-4 of Revision 2 of this Design Criteria.
DCN S-29571-A	02/25/94		DCN RIMS NO. T56 940226 909 Revised Section 3.2.4.5 to correct the seismic category of the detection assembly of monitors 0, 1, 2-RE-90-123 from I to I(L). Revised Pages: va and 41

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-30248-A	04/14/94		DCN RIMS NO. T56 940415 844 Revised to update references to new revision of 10CFR20, correct minor documentation discrepancies, provide clarifying statements for functional requirements. Revised Pages: va, 11, 12, 13, 14, 23, 27, 28, 30, 31, 41, 44, 54, 55, 59, 67, 83, 84, 89, 96, 97, 104, 105, 106, 107, 108, 109, 111, 112, 113, 115, 116, 117, 123, 124, 125, 131, 133, 134, and 136 Pages Added: 55a
DCN S-29903-A	05/02/94		DCN RIMS NO. T56 940503 928 Revised to state that SGBD radiation monitor 1-RE-90-124 is not used for Unit 1 operation. Revised Pages: va, 14, 15, 112, 121, and 133
DCN S-30248-B	06/03/94		DCN RIMS NO. T56 940603 850 Revised Table 9.0-1 for clarification of the power requirements for RE-90-133/134/140/141 and to revise the range of RE-90-002 from MR/hr to R/hr. Revised to add revision bar to table 9.0-3. Change was performed by DCN S-30248-A which omitted the revision bar. Revised Pages: va, 112, and 123
DCN S-32560-A	09/10/94		DCN RIMS NO. T56 940910 810 Revised Section 3.1.4.3, Table 9.0-1, 9.0-3, and 9.0-4 to indicate the boric acid evaporator condensate monitor (1-RE-90-170) is not used for Unit 1 operation. Revised Section 3.2.7.2.a, 3.2.7.3.a, and 3.2.7.4.a to delete the requirement for visual alarm locally on channel malfunction. Revised Section 3.7.1.1 (Page 60) to clarify that instruments to measure flow rate and system pressure are required to correct particulate and iodine measurements.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-32560-A (cont'd)			Revised Section 3.7.6.2.21.c to correct mR/m to mR/Hr. Revised Section 4.1.1.2 to refer to Reference 8.6.31 for guidance on probe isokinetic design and to delete "Later" for minimum probe nozzle diameter. Revised References to add Reference 8.6.31. Revised Table 9.0-5 to indicate monitor, 1,2-RE-90-129 has no post accident monitoring function and that monitor 1,2-RE-90-421 does not perform a primary safety function. Pages Revised: 15, 54, 55, 60, 80, 95, 109, 112, 121, 129, 131, 133 Pages Added: vb Total Pages: 154 (Including i - xiv, va, vb, 55a, 104a)
DCN S-31881-A			DCN RIMS Number T56 940926 882 Revised to add Source Notes CATD 22911-WBN-01. Revised Pages vb, xiv Added Pages: 137 Deleted Pages: None
DCN S-32575-A	10/07/94		DCN RIMS NO. T56 941008 900 Revised Index, Page xiv, to reflect renumbered pages. Revised Section 3.1.4 to add "*" to 1-RE-90-170. Revised Section 3.7.1.2.3 to correct typographical error. Revised Section 3.7.4.1, Paragraph 10, to change reference from Section 3.10.4 to Table 9.0-5. Revised Section 4.1.1.1.2, Paragraph 6, to delete "Reference Later." Revised Calculation Section 8.6 to add RIMS number for Reference 8.6.13.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-32575-A (cont'd)			Revised Table 9.0-1 to delete 1E electrical safety class for 1,2-RE-90-404 and to delete 1E from Note 14. Revised Table 9.0-3, Page 121, to delete transmission factor and Page 126 to revised Note 10 and add Note 10.1. Consolidated Pages 127 and 128 and renumbered Pages 129 through 137 to 129 through 136. Revised Table 9.0-5, Page 132, to add "*" to 1-RE-90-170. Pages Added: vc Pages Deleted: 137 Pages Revised: xiv, 14, 61, 69, 94, 108, 111, 115, 121, 126 through 136 Total Pages: 156 (Including cover sheet, i, xiv, va, vb, vc, 55a, 104a)
DCN S-34674-A			DCN RIMS NO. T56 950204 831 Revised Index, Sections 3.1.4, 3.1.4.8, 3.2.4.8, 3.7.4.2.8, Table 9.0-1, Table 9.0-3, and 9.0-5 to delete plant liquid discharge monitor 0-RE-90-211. This monitor is not required since all radioactive liquid sources making up the plant liquid discharge stream are monitored separately. DCN W-34481-A deleted the monitor from the drawings. Pages revised: vc, viii, ix, xi, 14, 17, 42, 43, 112, 121, 132 Total Pages: 156 (Including cover sheet i, xiv, va, vb, vc, 55a, 104a)
4	4/28/95		This is a complete revision of the entire design criteria. This revision is being performed as part of the corrective action to WBPER940423 and WBPER940601. Since this revision constitutes a total rewrite of the design criteria, revision bars have been omitted. Total Pages: 73

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-36274-A	5/19/95		RIMS No. T56 950519 958 Section 3.1.6.1 - Revised Table number reference. Section 3.1.6.5 - Clarify function of monitors 1-RE-90-291 and -293. Table 9.0-2 - Revise this table to delete local visual and audio alarm for monitors 1-RE-90-291 and -293. Pages added: 27a Pages replaced: 2i, 25, 27, 55 and 56 Total pages: 74 (including cover sheet, 2a thru 2i and 27a)
5			Revision 5 is performed to implement user comments subsequent to issue of Revision 4. Section 2.0 - Revised definition of sample line. Section 3.0 - Revised to clarify seismic requirements. Section 3.1.1.2 - Revised Auxiliary Building exhaust flow rate. Section 3.1.4.2, 3.1.4.4, 3.1.4.5 - Revised to clarify 10CFR20 requirements. Section 3.1.6 & 3.1.6.3 - Revised to exclude requirement for local displays for the spent fuel pool monitors. Section 3.6.3.1 - Revised to clarify sample line requirements. Section 7.1 - Clarified that all exceptions have been incorporated or cancelled by revision 4. Section 8 - Updated references. Table 9.0-2 - Deleted requirement for low range detector for main steam line monitors. Pages Added: 32a Pages Replaced: 2i, 8, 9, 13, 21, 22, 25, 27a, 32, 35, 41, 42, 45, 46, 56 and 60. Total Pages: 75

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-37549-A	07/22/95		DCN RIMS NO. T56 950722 948 Revised Table 9.0-1 to allow seismic class I(L) for components within the instrument class boundary for monitors RE-90-16, 101, 400 and 402. Revised Tables 9.0-2 and 9.0-4 to correct typographical errors. Pages Added: 2j, 50a Pages Deleted: None Page Total: 77
DCN S-37195-A	07/23/95		DCN RIMS NO. T56 950723 981 Added 50.55(e) 390/86-49 and 391/86-46 as a Source Note to Source Note Log Page 65. Pages Revised: 2j, 65 Pages Added: None Pages Deleted: None Page Total: 77
DCN S-37610-A	07/27/95		DCN RIMS NO. T56 950727 907 Revised Sections 3.1.4.1 and 3.1.6.1 to make minor clarification. Pages Revised: 2i, 2j, 20, 25 Total Pages: 77
DCN S-37718-A	08/07/95		DCN RIMS NO. T56 950807 861 Revised Section 3.1.3 and tables 9.01, 9.02, and 9.04 to allow the use of portable monitors in lieu of 0-RE-90-105 and 2-RE-90-014. Pages added: 18a Pages deleted: None Pages changed: 2j, 18, 48, 50a, 53, 54, 58, 61, 64 Total of pages: 78

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-37648-A	09/01/95		DCN RIMS NO. T56 950901 942 Revised Section 3.1.5.1 to delete the requirement that areas monitors alarm locally upon malfunction or loss of power. Pages added: 2k Pages deleted: None Pages changed: 2j, 24 Total of pages: 79
DCN S-38098-A			DCN RIMS NO. T56 950909 916 Revised Section 3.1.3 and Tables 9.01, 9.02, and 9.04 to delete the Unit 2 Hot Sample Room continuous Air Monitor (2-RE-90-14) and the Main Control Room Continuous Air Monitor (0-RE-90-105); included a statement that the Unit 2 Hot Sample Room and the Main Control Room will be monitored by portable continuous air monitors supplied and administered by Site Radcon. Pages Added: None Pages Deleted: None Pages Changed: 2k, 18, 48, 50a, 53, 54, 58, 61, 64 Total Pages: 79
6	09/22/95		Revised Section 3.1.6.1 to delete the requirement for a loss of signal malfunction alarm for monitors 1-RE-90-421, 422, 423, and 424. Reprinted all pages. Total Pages: 79
DCN S-38273-A	10/04/95		DCN RIMS NO. T56 951004 800 Revised Table 9.0-2 to document 1-RE-90-002 as an ion chamber. This detector is an RD-2A ion chamber detector. Pages Added: None Pages Deleted: None Pages Changed: 2k, 56 Total Pages: 79

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
DCN S-38339-A	10/13/95		DCN RIMS NO. T56 951013 864 Revised Table 9.0-2 to delete beta detector for 1-RE-90-421, 422, 423, 424. Pages added: None Pages deleted: None Pages changed: 2k, 56 Total Pages: 79
DCN M-38887-A	11/07/96		DCN RIMS NO. T56 961108 817 Revised Section 3.1.1.4, Service Building Vent Monitor (0-RE-90-132), to reflect deletion of isokinetic sample pump and associated instrumentation. Pages added: 2k Pages deleted: None Pages revised: 14, 46 Total Pages: 79
DCN M-39372-A	05/02/97		DCN RIMS NO. T56 970505 803 Deleted background detector for 1-RE-90-404 from Section 3.1.1.7. Pages added: 21 Pages deleted: None Pages changed: 15 Total of pages: 80
DCN S-39417-A	06/25/97		DCN RIMS NO. T56 970626 800 Revised Sections 3.1.6 and 3.1.1.7 to provide a method of detecting and monitoring steam generator tube leak/rupture when condenser vacuum exhaust monitors are not operating prior to achieving a vacuum in the main condenser. Pages added: 15a Pages deleted: None Pages changed: 2(k), 2(l), and 15 Total of pages: 81

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
7	2/18/99		DCN M-39854-B (T56 980714 802) revised Table 9.0-2 to delete listing of Service Building Vent monitor particulate channel 0-RE-90-132A. Incorporates DCNs S-38273-A, S-38339-A, M-38887-A, M-39372-A, S-39417-A, and M-39854-B. Reformatted entire document, which made it necessary to renumber pages. Changed page numbers on the Table of Contents (pages xv through xvi). Pages Revised: All Total Pages: 84 (which includes i through xvi and pages 1-68)
8	5/27/99		Incorporates DCNs as follows: DCN M-39911-A (T56 981215 803) replaces the obsolete Unit 1 Westinghouse P2500 Plant Process Computer with a new Plant Integrated Computer System. This Plant Computer System provides an operator friendly, state of the art, real time process computer system for the WBN plant operators. After this modification, the new Plant Computer will be operational and performing all the functions of the existing Plant Computer (WB-DC-30-29) and Emergency Response Facilities Data System (ERFDS) (WB-DC-30-8). Therefore, Design Criteria's WB-DC-30-8 and WB-DC-30-29 have been combined into one Design Criteria WB-DC-30-29 "Plant Integrated Computer System." Design Criteria WB-DC-40-24 has been revised to incorporate this change by removing references to the Emergency Response Facilities Data System (ERFDS), Technical Support Center (TSC) Computer or P2500 and replacing them with Plant Computer references. DCN D-50122-A (T56 990218 802) revised normal vent monitor flow in Section 3.1.1.2. Deleted Coordination Log which is not required per NEDP-10, which required renumbering of pages i-xv and changed Table of Contents). Pages Revised: All Total Pages: 83 (includes pages i-xv and 1-68)

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
9	4/10/2000		Incorporates DCN as indicated below: DCN D-50502-A (T56 000309 801) revised Section 3.1.4.2 to clarify an additional function for the radiation monitors and revised calculation reference 8.5.9. Reformatted and renumbered pages i-xiii, which changed page numbers on the Table of Contents (pages xii-xiii). Total Pages: 81 (includes pages i-xiii and 1-68)
10	10-23-2000		Screening Review WBPLMN-00-063-0 (T25 000816 906) evaluated this revision to Section 3.1.4.1 to include a reference for minimum flow requirements for 1-RE-90-120, -121, 0-RE-90-122, -225. Added Reference 8.5.33. Revised calculation Reference 8.5.9. Incorporates DCN D-50483-A (T56 000523 801) - Revised Section 3.1.3 and Tables 9.0-1, 9.0-2, and 9.0-4 to delete the Decontamination Room Continuous Air Monitor (0-RE-90-016), Waste Packaging Room Continuous Air Monitor (0-RE-90-138), Unit 1 Sample Room Continuous Air Monitors (1-RE-90-14), and Reactor Building Lower Compartment Instrument Room Continuous Air Monitor (1-RE-90-062); includes a statement that the Waste Packaging Room and Unit 1 Sample Room will be monitored by portable continuous air monitors supplied and administered by Site RADCON. Renumbered pages i-xiv, which changed page numbers on the Table of Contents (pages xiii-xiv). Total Pages: 82 (includes pages i-xiv and 1-68)

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
11	4-16-2001		Incorporates DCN as follows: DCN D-50482-A (T56 000815 800) deleted area monitors 1-RE-90-280, 275-278 and 290-293. Deleted iodine channels 0-RE-90-132C and 1-RE-90-106C. Revised Sections 3.1.1, 3.1.1.3, 3.1.1.6, 3.1.5, 3.1.6, 3.1.6.1; deleted Sections 3.1.6.5, 3.1.6.6, and 3.1.6.7; revised Section 3.6.3.4.1; revised Tables 9.0-1, 9.0-2, 9.0-3, and 9.0-4. Section 3.1.1 was revised to delete the normal range particulate and iodine sampler 1-RE-90-129 for consistency with DCN D-50482-A. Renumbered pages 1-67, which changed page numbers on the Table of Contents (pages xiii-xiv). Total Pages: 81 (includes pages i-xiv and 1-67)
12	3-6-2003		Incorporates EDC as follows: EDC-51385-A revised Section 3.1.1.6 to add a means of maintaining the operability of 1-RE-90-119 after a turbine trip. Total Pages: 81 (includes pages i-xiv and 1-67)

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
13	5-14-2003		Incorporates EDC as follows: EDC E-51278-A revised Sections 3.1.1.6 and 3.1.1.7 to remove the requirement for a portable monitor to be placed at the CVE exhaust once each hour if CVE and steam generator blow down radiation monitors are not in service and corrected EPIP-16 to EPIP-13. Also revised Section 3.1.1.6 to state that sampling in accordance with the ODCM will be used to assess radioactivity in the CVE in the event the CVE is operating and the CVE normal range monitor is inoperable. Section 3.1.1.7 was revised to delete the requirement for a portable monitor to be placed at the CVE exhaust once each hour and use of the steam generator blowdown monitors to identify and assess a steam generator tube leak when the accident range monitor is inoperable since the function of the accident range monitor is to monitor accidents and not normal operations. The accident effluents are monitored and assessed by the main steam monitors and EPIP-13 as stated in Section 3.1.1.7. This EDC partially implements the corrective action plan of PER 01-17357-000. Total Pages: 81 (includes pages i-xiv and 1-67)

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
14	1-28-2004		Incorporates DCN as follows: DCN D51229-A - Installs tritium samplers 0-SMPL-90-800, 1-SMPL-90-801 and 2-SMPL-90-801 in the Auxiliary and Shield Buildings. -Section 3.1.1.2 was revised to add a tritium sampler to monitor the quantity of tritium exiting the Auxiliary Building Stack. -Section 3.1.1.4 was revised to justify the potential release of tritium in the Service Building is negligible and therefore no tritium monitoring is required. -Section 3.1.1.5 was revised to add a tritium sampler to monitor the quantity of tritium exiting the Shield Building Stack. -Section 3.1.1.6 was revised to state WBN will monitor the condenser vacuum pump exhaust for tritium if tritium bars are present in the reactor core, and a SG tube leak is detected. -Section 8.6 was added to add Reference 8.6.1 to document TVA commitment to continuously monitor Tritium. -Revised Table 9.0.1 Radiation Monitoring Classification to add tritium samplers 0-SMPL-90-800, 1-SMPL-90-801, and 2-SMPL-90-801. -Revised Tables 9.0-4 Radiation Monitoring Functions, and 9.0-2 Radiation Monitoring Characteristics to add tritium samplers 0-SMPL-90-800, 1-SMPL-90-801, and 2-SMPL-90-801. Renumbered pages i-xv due to adding a page to the Revision Log, which changed page numbers on page xiv of the Table of Contents. Total Pages: 82 (includes pages i-xv and 1-67)

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
15	5-23-2005		Incorporates DCN as follows: DCN 51426-A revised Sections 3.1.3, 3.6.3.4.1, 3.6.3.5.2, and 8.5.7, Table 9.0-1, Table 9.0-2, and Table 9.0-4 to delete the Spent Fuel Pool Area Continuous Air Monitor (0-RE-90-012), Shipping Bay Area Continuous Air Monitor (0-RE-90-013), Holdup Valve Gallery Area Continuous Air Monitor (0-RE-90-015), and the SI Pump Area Continuous Air Monitor (0-RE-90-017); and to include a statement that the Spent Fuel Pool Area, Shipping Bay Area, Holdup Valve Gallery Area, and SI Pump Area will be monitored by portable continuous air monitors applied and administered by Site Radcon. Renumbered pages 1-66, which changed page numbers on the Table of Contents (pages xiv-xv). Total Pages: 81 (includes i-xv and 1-66)
16	05-04-2007	All	This design criteria was converted from Word 95 to Word 2003 using Rev. 15. Section 3.1.6A, 4th paragraph, changed 3.1.6.7 (Word 95 format) to 3.1.6D. Sections 3.1.6.5 through 3.1.6.7 were deleted by Revision 11. Section 3.6.3E.1, 3rd paragraph, changed "Section 8.6.3.5.3" to "Sections 3.6.3E.3 and 3.6.3E.6. There is not a Section 8.6.3.5.3. Incorporates DCN 51786 which modified the turbine building sump radiation monitor 0-RE-90-212 to eliminate the sample flow line problem. Section 3.1.4F (Section 3.1.4.6 in Word 95 version) was deleted and Section 3.1.6E added. Tables 9.0-1, 9.0-2, and 9.0-4 were revised to reflect the change to 0-RE-90-212 from an off-line monitor to an on-line monitor.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
17	03-13-2008	1, 21, 38, 48, 79, 80	DCN 52220: Revised Sections 3.1.2, 3.1.6, and Table 9.0-3 to reflect the design change to permit initiation of a CVI from a high radiation signal from the spent fuel pool radiation monitors and to permit initiation of that portion of an ABI signal (normally initiated by the spent fuel pool radiation monitors) by a CVI signal during movement of irradiated fuel when the Containment is open to the Auxiliary Building. This change will allow operation of the containment purge system during movement of irradiated fuel in the Auxiliary Building with the containment open to the Auxiliary Building ABSCE spaces.
18	04-21-2008	1, 21, 48, 70	Incorporates DCN 52211-A (PIC 52299-A) as follows: Section 3.1.6C - added notation to section to include mention of the areas being monitored not previously included in the section. Also added reference to the system description section which notes the special ventilation interface requirements associated with the Fuel Handling Exhaust (FHE) System during irradiated fuel movement in the Fuel Transfer Canal to support the proper operation of the radiation monitor function (Ref. 96939). Section 8.5 - added new reference 8.5.34 calculation, WBNTSR-009, which specifies the special requirements associated with the FH exhaust ventilation system.
19	08-26-2008	1, 21, 24	This revision was issued by WB2CCP to address the Radiation Monitoring System applicability to Unit 2 in Section 1.0 of this DCD. An outstanding WITEL Punchlist item applicable to Unit 2 is listed as follows: -- PL-08-1094, see Section 1.0 New and upgraded radiation monitoring detectors are being supplied thru WB2CCP purchase requisitions 25402-011-MRA-HARA-00001 and 25402-011-MRA-HARA-00002.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
20	01-21-2009	1, 22, 84	Administrative change to add Notes to Table 9.0-4, that were lost during issue of Revision 17. Reference PER 158904
21	06-17-2009	1, 22, 44, 45, 50, 71, 72	Incorporates EDC as follows: EDC E-53382: Document the stroke time credited for closure of valves 0-FCV-77-119, 0-RCV-77-43, 0-FCV-14-451. Add associated references in conjunction with change. Revised Section 3.1.4.C to specify the stroke time for 0-RCV-77-43. Revised Section 3.1.4.E to specify the stroke time for 0-FCV-14-451. Revised Section 3.1.6.B to specify the stroke time for 0-FCV-77-119. Added References 7.5.35 and 7.5.36. Updated revision level of References 8.5.10, 8.5.17, and 8.5.21.
22	02-09-2011	1, 22, 33, 34, 67, 70	Incorporates EDC as follows: EDC 53107-A revises Sections 3.1.1, 8.1.8, and 8.5.3 to remove the Technical Specification 3.4.15 requirement for the gas channel to detect a 1 gpm leak within 1 hour and to update the title for R.G.1.45, and revision level for calculation WBNTSR-062.
23	07-11-2011	1, 22, 50, 71, 72	Incorporates EDC as follows: EDC 55701-A: Document the stroke time credited for closure of 0-FCV-77-119. Revised Section 3.1.6.B to address required stroke time. Updated revision level of references 8.5.21 & 8.5.36.

Revision Log

Revision or Change Number	Effective Date	Affected Page Numbers	Description of Revision/Change
24	11/30/11	1, 23-26, 30, 31, 34-38, 40-43, 46-51, 53, 55, 56, 59, 60, 62, 64-85, 87, 88	Revised to make this DCD fully applicable to units 1 and 2, see EDCRs 52338, 52340, 52341, 52342. Incorporated minor changes for clarity.

Table of Contents

Table of Contents (continued)

1.0 SCOPE

This document establishes the design requirements of the Radiation Monitoring System (RMS) for the operation of Watts Bar Units 1 and 2 [Source Note 7]. The RMS provides continuous monitoring of radiation levels, provides the results of the monitoring to the operator and in some instances produces signals to initiate automatic control actions. In addition, the RMS includes equipment for off-line tritium, particulate and iodine sample collection with no real-time detection. The RMS consists of process, airborne, area, and effluent radioactivity monitors. The outdoor radiological monitoring instrumentation, laboratory radiation measurement equipment, criticality monitoring equipment, and portable survey instrumentation is outside the scope of this criteria. If a discrepancy exists between this design criteria and any other Nuclear Engineering (NE) design criteria, the appropriate Engineering Manager should be notified by a memorandum. If a discrepancy exists between this design criteria and any other document where the other document is not a NE design criteria, this design criteria shall govern.

2.0 DEFINITIONS

Accuracy - The degree of agreement with the true value of the quantity being measured.

Accessible Area - An area which is designed to be entered without special radiological controls (i.e., is not a high radiation area or airborne radioactivity area), dismantling of installed equipment or the introduction of support equipment such as staging, ladders, etc.

Anticipated Operational Occurrences - Those conditions of normal operation which are expected to occur one or more times during the life of the nuclear power unit and include but are not limited to the loss of power to all reactor coolant recirculation pumps, a trip of the turbine generator set, isolation of the main condenser and a loss of all off-site power.

Categories 1, 2, and 3 - References to Categories 1, 2, and 3 are as stated in RG 1.97 (Reference 8.1.11).

Channel - A channel includes all of the instrumentation necessary to provide the monitoring function. A channel includes associated sample lines, skid assemblies, and local readout and alarm devices. A channel also includes equipment in the control room for recording, readout, and alarm and includes the electrical cable that connects monitor components.

Check Source - A test source supplied as an integral part of the monitor channel for use in determining if the channel is functional. This may be a radioactive source, or when a check of the channel exclusive of the detector scintillator is appropriate (i.e., where increased background cannot be tolerated), a pulsed light source or other similar device appropriate for the type of detector.

Class 1E - The safety-related classification of the electrical equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment.

Grab Sample - A volume removed from a process or effluent for laboratory analysis.

Gross beta or gamma radioactivity - The combined radioactivity from the mix of nuclides without distinction as to energy levels of the emissions.

2.0 DEFINITIONS (continued)

In-Line Monitor - A monitor with no sample line where the detector or the detector well is immersed in the source fluid to be measured.

Isokinetic - A condition which prevails when the velocity of air entering a sample probe or the collector when held in the airstream is identical to the velocity of the airstream being sampled within a specific accuracy.

May - Denotes permission, neither a requirement nor a recommendation.

Minimum Detectable Level - The smallest amount of a quantity, e.g., radioactivity, which can be consistently detected by an instrument.

Off-line Monitor - A monitor where a representative sample is withdrawn from the source fluid stream and conveyed by a sample line to the detector assembly.

On-Line Monitor - A monitor where the detector is adjacent to or near the pipe, tubing, or tank containing the source fluid. Sometimes referred to as "shine" monitor.

Plate Out - A thermal, electrical, chemical, or mechanical action that results in a loss of sample material by deposition on surfaces between sample intake and sample collector.

Primary Calibration - The determination of the response of a monitor channel when the channel detector is exposed to radiation from multiple sources of known energies and activity levels traceable to the National Institute of Standards and Technology (formerly known as the National Bureau of Standards) and having the same physical state as the medium to be measured.

Primary Safety Function - The function of a structure, system, or component which must remain functional to assure: (1) integrity of the reactor coolant pressure boundary, (2) capability to shut down the reactor and maintain it in a safe shutdown condition, or (3) capability to prevent or mitigate the consequences of accidents which could result in potential off-site exposures comparable to the guideline exposures of 10 CFR Part 100 (Reference 8.1.4) and limit radiation exposure in the control room to the requirements defined in 10 CFR 50, Appendix A, General Design Criteria 19 (Reference 8.1.1).

Radiation Monitor - A device composed of one or more channels that measures radiation or a device composed of one or more channels that share an off-line sample intake to obtain a sample for measurement of its radioactivity.

Radiation Sampler - A radiation monitor which only collects samples for subsequent analysis.

Real-Time - Refers to measurements that are current and from continuously operating instruments that provide detection capability when a sample is presented.

Response Time - The time interval from the appearance of the input concentration corresponding to the high alarm setpoint level at the sample line intake for off-line monitors, or opposite the detector for on-line or in-line monitors, to completion of required control action.

2.0 DEFINITIONS (continued)

Representative Sample - A sample which has a specific activity similar to the entire volume from which the sample is drawn.

Safe Shutdown Earthquake (SSE) - That earthquake which produces the maximum vibratory ground motion for which structures, systems, and components important to safety are designed to remain functional.

Sample Line - A pipe or tube which conveys fluid from and back to a vent, duct, pipe, or an open area for the purpose of providing a sample for assessment of its radioactivity content. For the purposes of this design criteria, the sample line is defined to include the line through which the sample normally flows from and back to the source fluid or process line, to the instrument isolation valves (including the valves) or to the manufacturer's instrument connections if there are no isolation valves. For liquid monitors the sample line originates at the monitor side of the root valve if the process line is equal to or less than 36 inches from the root valve and at the process tap if the process line is greater than 36 inches from the root valve. The root valve and 36 inch line segment not defined as a sample line shall meet code and seismic requirements of the process line. For gas monitors the sample line originates at the probe or the end of the sample line.

Secondary Calibration - The determination of the response of a system with an applicable source whose effect on the system was established at the time of a primary calibration or whose effect on the system is otherwise known.

Secondary Safety Function - The function of a structure, system, or component which must either: (1) retain limited structural integrity because its failure could jeopardize to an unacceptable extent the achievement of a primary safety function or because it forms an interface between Seismic Category I and Non-seismic Category I plant features, or (2) performs a mechanical motion which is not required in the performance of a primary safety function but whose failure to act could jeopardize to an unacceptable extent the achievement of a primary safety function.

Seismic Category I - Those structures, systems, or components which perform primary safety functions are designated as Seismic Category I and are designed and constructed so as to assure achievement of their primary safety functions during and after a safe shutdown earthquake (SSE).

Seismic Category I(L) - Those portions of structures, systems, or components which are designed and constructed so as to assure achievement of their pressure boundary and/or limited structural integrity at all times including a concurrent safe shutdown earthquake (SSE) because their failure could jeopardize to an unacceptable extent the achievement of a primary safety function or because it forms an interface between Seismic Category I and Non-seismic Category I plant features. This may be accomplished without meeting the full extent of the design, construction, quality assurance, and other regulatory requirements normally specified for Seismic Category I structures, systems, or components wherein a primary safety function must be assured. These are designated (by TVA) as Seismic Category I(L) (i.e., limited seismic requirements) and are considered to serve a secondary safety function.

Shall - Denotes a requirement.

2.0 DEFINITIONS (continued)

Should - Denotes a recommendation.

Source Fluid - A liquid or gaseous fluid from which a measure of radioactivity is obtained by real time monitoring or by sampling and analysis. The source fluid may denote a volume, process, effluent, or airborne stream as appropriate.

3.0 DESIGN REQUIREMENTS

The primary function of the RMS is to detect ionizing radiation at selected places or in selected processes and effluents throughout the plant. The RMS may be used in conjunction with analysis of samples collected to determine the quantity of radioactive material released to the environment. The RMS shall have, (a) monitors which provide real-time monitoring of selected source fluids and initiate required automatic control functions, (b) monitors which provide real-time monitoring without an automatic control function and (c) monitors which provide for the collection of samples for analysis. The RMS should also provide, by means of audible and visual alarm devices, warning to the plant operator of (1) potential malfunction of systems which contain radioactive material, (2) excessive radioactive releases to the environment and/or (3) selected plant areas which exceed the radiation zone design limits.

Radiation monitors that perform a function to mitigate the dose consequences off-site or for control room habitability requirements for design basis events as described in WB-DC-40-64 (Reference 8.3.17), shall be considered to perform a primary safety function. Radiation detectors which monitor Category 1 post-accident key variables, as described in WB-DC-30-7 (Reference 8.3.5) shall be considered to perform a primary safety function.

RMS equipment (excluding sample lines) located in Seismic Category I structures that do not perform a primary safety function shall be qualified to Seismic Category I(L) except for that equipment, in these structures, that is located in areas which are designated as not requiring seismic qualification. The qualification to Seismic Category I(L) is required to retain pressure boundary and/or limited structural integrity because the equipment's failure could jeopardize to an unacceptable extent the achievement of a primary safety function or because it forms an interface between Seismic Category I and Non-Seismic Category I plant features. Seismic Qualification of sample lines shall be per Section 3.6.3C.

Purge lines, instrument sensing lines, and instrument air lines connected to sample lines shall have safety class requirements similar to that of the sample lines as described in Table 9.0-1 of this document, or incorporate a class break between the sample and the purge line, instrument sensing line, or instrument air line. Instrument sensing lines shall be designed in accordance with WB-DC-30-16 (Reference 8.3.18). Interfaces with process and effluent piping and ductwork shall be designed in accordance with WB-DC-40-36 (Reference 8.3.10).

This design criteria satisfies the requirements of:

10 CFR 50 Appendix A (Reference 8.1.1)
10 CFR 50 Appendix I (Reference 8.1.2)
10 CFR 20 Appendix B and Numbered Sections (Reference 8.1.3)
10 CFR 100 (Reference 8.1.4)
40 CFR 60 Appendix A (Reference 8.1.5)

3.0 DESIGN REQUIREMENTS (continued)

The requirements of this design criteria meet the intent of the recommendations and guidance provided in the pertinent sections of the following documents:

ANSI N42.18-1974 (Reference 8.2.7)	NRC NUREG-0133 (Reference 8.1.12)
ANSI A59.1 (Reference 8.2.1)	-0737 (Reference 8.1.14)
ANSI/ISA-S67.10 (Reference 8.2.4)	-0800 (Reference 8.1.15)
ANSI N18.2 (Reference 8.2.6)	IE Notice 82-49 (Reference 8.1.16)
ANSI/ANS-HPSSC-6.8.1-1981 (Reference 8.2.3)	ISA 57.3 (Reference 8.2.12)
ANSI B40.1-1980 (Reference 8.2.2)	NRC RG 1.21 (Reference 8.1.7)
ANSI N13.1 (Reference 8.2.5)	1.97 (Reference 8.1.11)
ANSI N320-1979 (Reference 8.2.8)	1.53 (Reference 8.1.9)
IEEE 344-1971 (Reference 8.2.10)	1.76 (Reference 8.1.10)
IEEE 344-1975 (Reference 8.2.11)	1.45 (Reference 8.1.8)
IEEE 279-1971 (Reference 8.2.9)	8.8 (Reference 8.1.6)

3.1 Functional Requirements

In the following subsections, the monitors of the RMS are assigned to the following groups:

Off-line Particulate, Iodine, and Noble Gas Monitoring
Off-Line Gas Monitors
Continuous Air Monitors (Airborne Particulate Monitoring)
Off-Line Liquid Monitors
Area Type Monitor
On/In-Line Monitors

Under the subsection for each of the above groups, general requirements and features are provided and specific features and functions for each monitor of the group are described.

3.1.1 Off-Line Particulate, Iodine and Noble Gas Monitors

The design of the following monitors shall include off-line channels to provide continuous real-time detection of particulate, iodine (except 1,2-RE-90-106), and noble gas (PIG) radioactivity (including collection of particulate and radiohalogens for on-site analysis):

Auxiliary Building Vent Monitor	0-RE-90-101
Containment Lower Compartment Monitor	1,2-RE-90-106
Containment Upper Compartment Monitor	1,2-RE-90-112

The design of the monitors listed below shall include off-line channels to provide for a combination of real-time detection of noble gas radioactivity and for the collection of particulates and iodine without real-time detection:

Service Building Vent Monitor	0-RE-90-132 (Iodine channel deleted)
Shield Building Vent Wide Range Gas Monitor Sample Detection Skid	1,2-RE-90-400

3.1.1 Off-Line Particulate, Iodine and Noble Gas Monitors (continued)

Shield Building Vent Wide Range Gas Monitor Sample Conditioning Skid	1,2-RE-90-402
Condenser Vacuum Pump Exhaust Monitors: Normal Range Noble Gas	1,2-RE-90-119
Accident (Mid- and High-Range) Noble Gas	1-RE-90-404

A. General Requirements

PIG monitors shall withdraw, by means of a pump, a representative gaseous sample with entrained particulates from a source fluid volume. Samples taken from a remote volume, duct, pipe or stack shall be transported to the detector skid assembly via a sample line. For particulate monitoring or collection only, if the source fluid is flowing in a duct, pipe or stack, then measures shall be taken either to ensure the sample is taken under isokinetic conditions, or that the effects of non-isokinetic sampling are analyzed and properly accounted for. The sample that is provided to the monitor particulate filter may be a subsample (see Section 3.6.1) of that taken from the process or effluent source fluid. Other gas sample lines do not require isokinetic conditions.

Various flow path arrangements are acceptable. For channels in series, the sample should sequentially pass through a particulate filter for particle collection, a charcoal adsorption medium for iodine (a radiohalogen) vapor removal and finally through a gas chamber. Alternatively, a system in which the particulate filter and the gas chamber (in series) are installed in parallel with the charcoal absorber (radiohalogen) is acceptable. It is also acceptable for gas monitoring and for particulate and radiohalogen (iodine) collection to have a completely separate sample points and flow paths from the same source fluid. The radiohalogen adsorption medium flow path should be provided with particulate filtering prior to the sample flow passing through the adsorption medium. If the design includes real-time detection of particulates, a moving filter with either automatic step advance or continuous advance should be provided. Filters for collection of particulates for subsequent laboratory analysis should use a fixed filter design.

The channels with real-time monitoring capabilities shall have sufficient range to measure the anticipated quantity or concentration of radioactivity in the sample considering the ambient background radiation conditions at the detector's location. The real-time radiation detectors shall be shielded from background radiation to attain the required minimum detectable activity level during background radiation conditions. It should be assumed that the background radiation level is from a high energy gamma emitting source such as Cobalt 60 or Cesium 137. Where multiple detectors are required to cover the anticipated range, the range of the detectors shall overlap. Overlap should be at least one decade. The monitor's minimum detectable activity level shall be less than or equal to the lower end of the required radioactivity concentration range identified in Table 9.0-2.

A normal range monitors' design shall ensure retaining a full-scale reading for a radiation field of up to two decades above the full-scale radiation field.

3.1.1 Off-Line Particulate, Iodine and Noble Gas Monitors (continued)

Those monitors which include real-time detection shall include the appropriate circuitry to produce audible and visible alarms in the control room and at additional locations as prescribed in the individual monitor's description section when the radiation level exceeds high alarm set points (see Table 9.0-4) or there is a system malfunction (as a minimum, a malfunction alarm condition shall be initiated for loss of detector signal, power or flow). Each type of alarm condition i.e., high radiation or system malfunction shall be readily identifiable on the appropriate radiation monitor panel.

Channels which include real-time detection shall have devices to display measured cpm values for each channel in the control room and allow for retrieval of historical data. Accomplishing these functions by the use of computer terminals or numerical displays common to more than one channel is acceptable as long as the display credited with satisfying the required functions meets the same safety classification requirements as the channel. Care must be exercised to provide proper isolation or analysis performed to demonstrate no impact where primary safety related components of the loop are interfaced with non-essential components of the loop (see Section 3.5). Selected monitors shall transmit measured cpm data to the Plant Computer System for display in the Technical Support Center (TSC) in accordance with Section 2.9 of NUREG-0696 (Reference 8.1.13).

Process monitors which include real-time detection shall have provisions to allow for periodic on-line testing of the channel's response by actuation of an installed check source of sufficient intensity to provide an upscale reading of the ratemeter when the detector is subjected to normally expected background radiation levels. The check source may be radioactive, a photon source such as an LED, or other similar device appropriate for the type of detector. The check source should verify, to the extent possible, operability of the entire channel from the point that radiation is incident on the detector to the output device. The check source may be remotely activated from the control room or locally. Radioactive check sources should be shielded from the detector while in the stored position to preclude misleading radiation contributions while sample measurements are made.

The monitors shall have the capability to either measure or monitor the flow rate of the sample. If necessary to provide more accurate measurements, the sample pressure and/or temperature should also be measured to allow corrections to be made to sample flow rates and noble gas channel cpm or activity measurements. This satisfies the recommendations in IE Information Notice 82-49 (Reference 8.1.16).

The monitors' sampling system shall provide means by which grab samples may be withdrawn for laboratory analysis. Where multiple monitors are used to monitor a single process or source fluid, grab sample capability is not required on every monitor. The sample line shall include inlet and outlet flow taps from which grab samples may be taken. The grab sample inlet and outlet flow taps should be isolated from the normal sampling flow path. The taps should be located to best utilize the components of the installed system, e.g., sample pump, flow meter. Where subsampling is utilized, the grab sample may be taken from either the sample extracted from the source fluid or from the subsample.

3.1.1 Off-Line Particulate, Iodine and Noble Gas Monitors (continued)

Acceptable methods of detection of particulates, iodines and gases are described in this paragraph. For the normal range channels, beta radiation detection shall be used for gross real-time analysis of the radioactivity in the gas collection chamber. A beta radiation detector should be provided for particulate radioactivity. A gamma scintillation detector may be provided for determination of the iodine-131 radioactivity, by utilizing both lower and upper energy discriminators for observing the I-131 energy peak.

For accident conditions, energy compensated GM tubes or Cd-Te detectors may be provided for mid-range and high-range noble gas detection.

The sampling system shall have provisions for purging the gas sample chamber for the purposes of determining background count rate without damaging the particulate and iodine collection media (when applicable). Care should be taken in the design to preclude potential damage to sample line instrumentation from the purging operation.

B. Auxiliary Building Vent Monitor (0-RE-90-101)

The Auxiliary Building Vent Monitor is an effluent monitor which shall continuously monitor the Auxiliary Building effluent discharge to the environment and perform real-time detection of the noble gas radioactivity as required by 10 CFR 50, Appendix A, GDC 60 and 64 (Reference 8.1.1), 10 CFR 50, Appendix I (Reference 8.1.2), and meet the intent of the guidance of RG 1.21 (Reference 8.1.7) and RG 1.97 (Reference 8.1.11) [Source Note 8].

The particulate and iodine real-time monitoring shall be used to support the requirements of 10 CFR 20 Section 20.1101(b) (Reference 8.1.2) and 10 CFR 50 Appendix A, GDC 19 (Reference 8.1.1). These channels shall monitor the normal Auxiliary Building Exhaust path and should detect airborne radioactivity from particulates and iodine in excess of 10 DAC/hr from any area of the Auxiliary Building which normally may be occupied by personnel, taking into account dilution in the ventilation system (see Reference 8.5.23).

The monitor should provide a means for collection of iodines and particulates for on-site analysis.

The monitor shall provide isokinetic sampling of the vent at normal vent flow rates (160,000-229,000 CFM). It shall include sample line flow rate measurements and flow controls necessary to allow manual or automatic adjustments to maintain isokinetic sampling conditions or an analysis shall be performed to justify flow adjustments are not necessary to obtain a representative sample.

The measured volumetric flow rate of the source fluid in the Auxiliary Building vent ductwork should be provided to the TSC and plant computer data logger. Real time activity should be provided to the plant computer data logger.

A tritium sampler shall be installed to assure accurate monitoring of the Auxiliary Building stack. This sampler shall utilize a pump and integrator to ensure accurate data is utilized to determine the quantity of tritium exiting the Auxiliary Building Stack. This is per TVA commitment in Section 2.11.4 (Gaseous Waste Management Systems Evaluation) of Reference 8.6.1.

3.1.1 Off-Line Particulate, Iodine and Noble Gas Monitors (continued)

C. Containment Upper (1,2-RE-90-112 and Lower (1,2-RE-90-106) Compartment Monitors

These monitors shall detect and measure the airborne radioactivity concentration in the respective unit's Containment Building upper and lower compartments and perform real-time detection of the particulate and noble gas radioactivity in compliance with 10 CFR 50 Appendix A, GDC 30 and 64 (Reference 8.1.1) The particulate channel of these monitors are used to satisfy the guidance in RG 1.45 (Reference 8.1.8). The upper containment monitor 1,2-RE-90-112 should also perform real-time detection of radioiodine.

The monitors shall have the capability to take a sample from either or both of two separate locations in containment in order to provide assistance in locating the general area of abnormal leakage.

The upper compartment monitor shall have the backup capability to monitor the radioactivity in the containment lower compartment atmosphere and the lower compartment monitor shall have the backup capability to monitor the radioactivity in the containment upper compartment atmosphere.

The monitors shall be capable of continued operation after loss of off-site power. This satisfies the guidance in Section 12.3-12.4 of NUREG-0800 (Reference 8.1.15).

The monitors shall provide for local display of measured noble gas channel cpm values and local audible and visible alarms for high radioactivity from the noble gas channel which meets the intent of the guidance in Section 2.7 of RG 8.8 (Reference 8.1.6). Local alarms for the Containment Lower and Upper Compartment Monitors should be in proximity to the Containment Lower and Upper Containment access hatch, respectively. This meets the intent of the guidance in Section 2.7 of RG 8.8 (Reference 8.1.6).

The Containment Upper and Lower Compartment Airborne Monitors do not perform a primary safety function but do perform a secondary safety function and they shall be qualified to Seismic Category I. The monitors are being maintained as a 1E, Seismic Category I component (as noted in the Q-List) in order to meet the guidance in RG 1.45 (Reference 8.1.8) which states that the particulate radiation monitoring channels should remain functional for a SSE (See Table 9.0-1). Real-time activity levels for particulate, iodine (Upper Compartment only) and gas channels should be provided to the Plant Computer System for display in the TSC.

D. Service Building Vent Monitor (0-RE-90-132)

The Service Building Vent Monitor shall continuously monitor the radioactivity release from the Service Building vent and perform real-time detection of noble gas radioactivity as required in 10 CFR 50 Appendix A GDC 64 (Reference 8.1.1), 10 CFR 50 Appendix I (Reference 8.1.2), and meet the intent of the guidance in Appendix A of RG 1.21 (Reference 8.1.7) [Source Note 8].

The monitor shall provide a means for collection of iodines and particulates. Real-time iodine and particulate channels may be provided, but are not required.

3.1.1 Off-Line Particulate, Iodine and Noble Gas Monitors (continued)

The monitor shall provide sampling of the vent at a sample flow rate not greater than that necessary for isokinetic sampling at the maximum normal vent flow rate. Isokinetic sampling over the range of normal flow rates is not required since the Service Building vent is not a principle radioactivity discharge path. For non-isokinetic sampling, calculations must be completed (Ref. 8.5.24, 8.5.32) to determine partical loss such that estimates of effluent release can be made based on particulate samples obtained.

The measured volumetric flow rate of the source fluid in the Service Building vent ductwork should be provided to the plant computer data logger. Real-time gaseous activity should be provided to the plant computer data logger.

The only credible path for Tritium into the Service Building is through the Chemistry Lab (from samples). The potential amount of Tritium release from this source is negligible, therefore Tritium monitoring of the Service Building exhaust vent is not required.

E. Shield Building Vent Wide Range Radiation Monitor (1,2-RE-90-400 & -402)

The monitors' Sample Detection Skid shall perform real-time detection of gaseous radioactivity in the Shield Building effluent discharge to the environment during normal operation and subsequent to a design basis accident. This conforms to the requirements in 10 CFR 50 Appendix A, GDC 64 (Reference 8.1.1) and the guidance in Appendix A of RG 1.21 (Reference 8.1.7) and RG 1.97 (Reference 8.1.11) [Source Note 8]. If multiple detectors are required to cover the full range, channels whose ranges overlap shall be used. This complies with the requirements of Section II.F.1 of NUREG-0737 (Reference 8.1.14). The flow paths to the low range radiation detectors shall be automatically isolated whenever the counting rate exceeds their range. Local audible and visible alarms for activity levels which exceed the radiation alarm setpoint and a local visible alarm for channel malfunction should be provided. The capability for real-time background radiation measurements for automatic or manual background subtraction from noble gas channel measurements should be provided.

The monitors' Sample Conditioning Skid shall collect particulates and iodine in the Shield Building effluent discharge to the environment during normal operation and subsequent to a design basis accident. This conforms to the requirements in 10 CFR 50, Appendix A, GDC 64 (Reference 8.1.1) and RG 1.97 (Reference 8.1.11). The monitor sampling system design and location shall allow plant personnel to remove samples, replace sampling media, and transport the sample to the on-site analysis facility without exceeding the dose of 5 rem whole body or 75 rem to the extremities as described in Section II.F.1 of NUREG-0737 (Reference 8.1.14).

The monitors shall have automatic isokinetic sampling capabilities for Shield Building exhaust flows from 7,200 to 14,000 cubic feet per minute (cfm). This meets the requirements of RG 1.97 (Reference 8.1.11). The automatic control requirements apply from sample intake from the shield building vent to the particulate collector. The flow elements are Category 2 components located in a harsh environment and shall be qualified in accordance with the requirements of WB-DC-30-7 and WB-DC-40-54 (References 8.3.5 and 8.3.9, respectively).

3.1.1 Off-Line Particulate, Iodine and Noble Gas Monitors (continued)

The vent flow rate and noble gas activity level shall be transmitted to the Plant Computer System for display in the TSC.

A tritium sampler shall be installed to assure accurate monitoring of the Shield Building stack. This sampler shall utilize a pump and integrator to ensure accurate data is utilized to determine the quantity of tritium exiting the Shield Building Stack. This is per TVA commitment in Section 2.11.4 (Gaseous Waste Management Systems Evaluation) of Reference 8.6.1.

F. Condenser Vacuum Pump Exhaust Normal Range Noble Gas Monitor (1,2-RE-90-119)

The Condenser Vacuum Pump Exhaust Normal Range Monitors are effluent monitors consisting of a low range noble gas channel which shall continuously (except as noted below) make real-time measurements of the condenser vacuum pump exhaust discharge to the environment during normal operations of the respective unit (except as noted below) as required in 10 CFR 50 Appendix A, GDC 64 (Reference 8.1.1), 10 CFR 50 Appendix I (Reference 8.1.2), and meet the intent of the guidance in Appendix A of RG 1.21 (Reference 8.1.7) and RG 1.45 (Reference 8.1.8) [Source Note 8]. Subsequent to a design basis accident, the noble gas monitors shall monitor the low range of radioactivity in the Condenser Vacuum Pump Exhaust effluent discharge to the environment as required in 10 CFR 50 Appendix A, GDC 64 (Reference 8.1.1) and WB-DC-30-7 (Reference 8.3.5). Upon increased noble gas activity, a portable sampler could be put in place to provide means to quantify any particulate or iodine effluent. If there is a steam generator tube rupture, alternate means, such as recent primary and secondary system lab analysis, can be used to conservatively estimate particulate and iodine releases through the Condenser Vacuum Exhaust.

Prior to achieving a vacuum in the Main Condenser (6.5 inches Hg absolute), the high condenser vacuum exhaust (CVE) flow drives water into the CVE Radiation Monitors. Since the CVE Radiation Monitors contain components sensitive to water (i.e., carbon pump vanes), the monitors cannot be operated until a vacuum is achieved in the condenser. As a compensatory measure to identify and assess steam generator tube leaks, Steam Generator Blowdown Monitor 1,2-RE-90-120 or 1,2-RE-90-121 shall be used. If these monitors indicate a steam generator tube leak, the radioactive effluent through the condenser vacuum exhaust shall be assessed under the provisions of the Offsite Dose Calculation Manual (ODCM). In addition, if the normal range CVE radiation monitor is not operable prior to and after a vacuum is established in the main condenser, the radioactive effluent through the condenser vacuum exhaust shall also be assessed under the provisions of the ODCM.

In the unlikely event of a steam generator tube rupture during the time the CVE Monitors are not operating, the tube rupture will be identified by the Main Steam Radiation Monitors 1,2-RE-90-421, 422, 423 & 424, and radioactive effluents through the CVE shall be determined by sampling per the requirements of EPIP-13. In addition, the steam activity, as determined by the Main Steam Radiation Monitors may be used in conjunction with the quantity of steam entering the condenser to determine the amount of radioactivity released through the condenser vacuum exhaust.

3.1.1 Off-Line Particulate, Iodine and Noble Gas Monitors (continued)

When the Condenser Vacuum system is still in service after a turbine trip, condenser in-leakage increases, initiating a spurious flow alarm in the CVE radiation monitor, 1,2-RE-90-119. Manual valves at the radiation monitor can be adjusted to reset the flow switch and enable the monitor to detect a low flow condition. Upon return to full power, the valves are again adjusted to reset the flow switch for the normal flow condition.

The applicable Operations procedures shall be revised to reflect the above operational requirements, which are a result of the corrective actions for PER 01-017357-000.

The measured noble gas activity level shall be transmitted to the Plant Computer System for display in the TSC.

G. Condenser Vacuum Pump Exhaust Accident Range Noble Gas Monitor (1-RE-90-404)

The Condenser Vacuum Pump Exhaust Accident Range Noble Gas Monitor is a dual-channel effluent monitor with mid- and high-range radiation detection capability which shall continuously (except as noted below) make real-time measurements of the activity of the noble gases in the condenser vacuum pump exhaust subsequent to a design basis accident. This conforms to the requirements in 10 CFR 50, Appendix A, GDC 64 (Reference 8.1.1) and WB-DC-30-7 (Reference 8.3.5). Since two channels are required to cover the full range, channels whose ranges overlap shall be used. This complies with the requirements of Section II.F.1 of NUREG-0737 (Reference 8.1.14) [Source Note 8]. This monitor is intended to measure radioactivity in the condenser vacuum pump exhaust effluent after an accident and therefore, has no function during normal operation.

Prior to achieving a vacuum in the Main Condenser (6.5 inches Hg absolute), the high condenser vacuum exhaust (CVE) flow drives water into the CVE Radiation Monitors. Since the CVE Radiation Monitors contain components sensitive to water (i.e., carbon pump vanes), the monitors cannot be operated until a vacuum is achieved in the condenser.

In the unlikely event of a steam generator tube rupture during the time the CVE Monitor is not operating, the tube rupture will be identified by the Main Steam Radiation Monitors 1-RE-90-421,422,423 & 424, and radioactive effluents through the CVE shall be determined by sampling per the requirements of EPIP-13. In addition, the steam activity, as determined by the Main Steam Radiation Monitors may be used in conjunction with the quantity of steam entering the condenser to determine the amount of radioactivity released through the condenser vacuum exhaust.

The applicable Operations procedures shall be revised to reflect the above operational requirements, which are a result of the corrective actions for PER 01-017357-000.

The measured noble gas activity level shall be transmitted to the Plant Computer System for display in the TSC.

When TPBARs (Tritium Producing Burnable Absorber Rods) are present in the reactor core, and a steam generator tube leak is detected, the condensor vacuum pump exhaust will be monitored for Tritium.

3.1.2 Off-Line Gas Monitors

The design of these monitors shall include an off-line sampling channel to provide real-time detection of noble gas radioactivity:

Main Control Room Normal Air Intake Monitors 0-RE-90-125 & -126
Main Control Room Emergency Air Intake Monitors 0-RE-90-205 & -206
Containment Purge Air Exhaust Monitors 1,2-RE-90-130 & -131

A. General Requirements

The gas monitors shall withdraw, by means of a vacuum pump, a gaseous sample from a source fluid volume. Samples taken from a duct, pipe or stack shall be transported to the RMS skid assembly via a sample line.

The channels with real-time monitoring capabilities shall have sufficient range to measure the anticipated quantity of radioactivity in the sample considering the ambient background radiation conditions at the detector's location. The sensing elements shall be shielded from background radiation to attain the required minimum detectable activity level during background radiation conditions. It should be assumed that the background radiation level is from a high energy gamma emitting source such as Cobalt 60 or Cesium 137. Where multiple detectors are required to cover the anticipated range, the range of the detectors shall overlap. Overlap should be at least one decade. The monitor's minimum detectable activity level shall be less than or equal to the lower end of the required radioactivity concentration range identified in Table 9.0-2.

The normal range monitors' design shall ensure retaining a full-scale reading for a radiation field of up to two decades above the full-scale radiation field.

Those monitors which include real-time detection shall include the appropriate circuitry to produce audible and visible alarms in the control room and at additional locations as prescribed in the individual monitor's description section when the radiation level exceeds high alarm set points (see Table 9.0-4) or there is a system malfunction (as a minimum, a malfunction alarm condition shall be initiated for loss of detector signal, power or flow). Each type of alarm conditions i.e., high radiation or system malfunction shall be readily identifiable on the appropriate radiation monitor panel.

Those monitors which include real-time detection shall have devices to display measured cpm values for each channel in the control room and allow for retrieval of historical data, except for the containment purge air exhaust monitoring channels which have local display and no provisions for retrieval of historical data. Accomplishing these functions by the use of computer terminals or numerical displays common to more than one channel is acceptable as long as the output device credited with satisfying the required functions has the same safety classification as the channel. Care shall be exercised to provide proper isolation or analysis performed to demonstrate no impact where primary safety related components of the loop are interfaced with non-essential components of the loop (see Section 3.5). Selected monitors shall transmit measured cpm data to the Plant Computer System for display in the Technical Support Center (TSC) in accordance with Section 2.9 of NUREG-0696 (Reference 8.1.13).

3.1.2 Off-Line Gas Monitors (continued)

Process monitors shall have provisions to allow for periodic on-line testing of the channel's response by actuation of an installed check source of sufficient intensity to provide an upscale reading of the ratemeter when the detector is subjected to normally expected background radiation levels. The check source may be radioactive, a photon source such as an LED, or other similar device appropriate for the type of detector. The check source should verify, to the extent possible, operability of the entire channel from the point that radiation is incident on the detector to the output device. The check source may be remotely activated from the control room or locally. Radioactive check sources should be shielded from the detector while in the stored position to preclude misleading radiation contributions while sample measurements are made. The monitor should be provided with appropriate circuitry to avoid control actuation during check source operation.

The monitors shall have the capability to either measure or monitor the flow rate of the sample. If necessary to provide more accurate measurements, the sample pressure and/or temperature should also be measured to allow corrections to be made to the gas channel cpm or activity measurements. This satisfies the recommendations in IE Information Notice 82-49 (Reference 8.1.16).

The monitors' sampling system shall provide means by which grab samples may be withdrawn for laboratory analysis. The sample line shall include inlet and outlet flow taps from which grab samples may be taken. The grab sample inlet and outlet taps should be isolated from the normal sampling flow path. The taps should be located to best utilize the components of the installed system, e.g., sample pump, flow meter.

For normal range channels, beta radiation detection shall be provided for gross real-time analysis of the radioactivity in the gas collection chamber.

The sampling system shall have provisions for purging the sample chamber for the purposes of determining background count rate. The design should provide for local actuation of the purge system. The clean air used for purging normal range channels may be filtered ambient air.

B. Main Control Room Normal Air Intake Monitors (0-RE-90-125 & -126)

Two redundant, safety-related monitors that perform a primary safety function shall be provided. Their actions permit occupancy of the Control Room during design basis events without personnel exceeding the exposure limits described in 10 CFR 50 Appendix A, GDC 19 (Reference 8.1.1) and Section II.B.2 of NUREG 0737 (Reference 8.1.14). The monitors shall perform real-time detection of the radioactivity in the inlet air to meet the intent of the guidance in Section 2.4 of RG 8.8 (Reference 8.1.6) [Source Note 3].

Upon receipt of a high radiation alarm signal from either of the noble gas monitors, the monitor shall automatically generate a Control Room Isolation Signal which in turn will interface with the Control Room HVAC and Air Cleanup System to a) reduce the intake air flow and divert it through HEPA and charcoal filters, b) pressurize the Control Room, and c) clean up the air recirculated to the Control Room. The specific control actions initiated by these monitors are described in system description No. N3-30CB-4002 (Reference 8.4.2).

3.1.2 Off-Line Gas Monitors (continued)

The measured noble gas activity level shall be transmitted to the Plant Computer System for display in the TSC.

C. Main Control Room Emergency Air Intake Monitor (0-RE-90-205,-206)

Two redundant, safety-related monitors that perform a primary safety function shall be provided. The safety function will limit the exposure of personnel in the Control Room to satisfy the dose limit requirements defined in 10 CFR 50, Appendix A, GDC 19 (Reference 8.1.1).

The monitors shall not perform an automatic function. Upon manual actuation by the control room operator, these channels shall continuously monitor the radioactivity in the ventilation air flow entering the control room habitability zone through the emergency air intake [Source Note 3].

Upon a high alarm, the operator may make an appraisal of the existing conditions for possible manual action to switch control room air intake location. The safety classification of the monitor is described in Table 9.0-1.

The measured noble gas activity level shall be transmitted to the Plant Computer System for display in the TSC.

D. Containment Purge Air Exhaust Monitors (1,2-RE-90-130 & -131)

These are gaseous effluent monitors which shall continuously monitor the radioactivity in the exhaust air from the containment atmosphere as required in 10 CFR 50, Appendix A, GDC 60 and 64 (Reference 8.1.1) and meet the intent of the guidance in Section C.2 of RG 1.21, (Reference 8.1.7) [Source Note 8]. The monitors shall incorporate provisions to display measured data locally. Two redundant, safety-related monitors that perform primary safety functions shall be provided. The primary safety function is the mitigation of the off-site dose consequences for the small loss of coolant accident.

A high radiation alarm signal from either noble gas monitor shall automatically generate a Containment Ventilation Isolation Signal which in turn will interface with the Reactor Building Ventilation System to isolate the containment purge. During movement of irradiated fuel inside containment when the containment and/or the annulus is open to the Auxiliary Building Secondary Containment Enclosure (ABSCE) spaces, the noble gas monitors shall generate that portion of an ABI signal normally initiated by the spent fuel pool accident radiation monitors. This requirement is to ensure radioactive material released from a fuel handling accident in containment will be filtered by the Auxiliary Building Gas Treatment System (ABGTS) if such releases migrate into the Auxiliary Building. The specific control actions initiated by either of these monitors are described in system description N3-30RB-4002 for unit 1 (Reference 8.4.3) and WBN2-30RB-4002 for unit 2 (Reference 8.4.10). The automatic control function of these monitors' is a primary safety function, since it mitigates the potential release of radioactive material to the environment following a postulated design basis event which satisfies the requirements described in 10 CFR 100 (Reference 8.1.4).

The measured noble gas activity level shall be transmitted to the Plant Computer System for display in the TSC.

3.1.3 Continuous Air Monitors (Airborne Particulate Monitors)

The following continuous air (particulate) monitors shall be provided for plant areas where airborne particulate radioactivity may potentially exist and where normal occupancy is required either on a continuous basis or on an infrequent but routine basis:

- * Spent Fuel Pool Monitor
- * Shipping Bay Monitor
- * Holdup Valve Gallery Monitor
- * SI Pump Area Monitor
- * Main Control Room Monitor
- * Waste Packaging Room Monitor
- * Sample Rooms Monitors

* Monitoring of the above listed plant areas are accomplished using portable continuous air monitors supplied and administered by Site Radcon. The requirements of this Design Criteria do not apply to these monitors.

3.1.4 Off-Line Liquid Monitors

The monitors that come under this category are:

Steam Generator Blowdown Liquid Monitor	1,2-RE-90-120 & -121
Waste Disposal System Liquid Monitor	0-RE-90-122
Component Cooling System Monitor	0,1,2-RE-90-123
Condensate Demineralizer Regenerant Waste Discharge Monitor	0-RE-90-225
Essential Raw Cooling Water Effluent Monitors	0-RE-90-133-, 134,-140 & -141

These monitors provide real-time monitoring of the gross gamma radioactivity in liquid samples. Selected off-line liquid monitor channels shall initiate an automatic control function to terminate releases either to the unrestricted area or to the plant environs as described in the following subsections.

A. General Requirements

The monitors shall have pumps or the process connection points shall provide sufficient differential pressure to ensure that an adequate flow rate from the process streams can be predictably delivered to the sample chamber.

The monitors shall have detectors with sufficient range to measure the anticipated quantity of radioactivity in the sample considering the ambient background radiation conditions at the detectors' location. The sensing elements shall be shielded from background radiation to attain the required minimum detectable level during background radiation conditions. Where multiple detectors are required to cover the anticipated range, the range of the detectors shall overlap. Overlap should be at least one decade. The detectors shall be able to detect a minimum activity level equal to or less than the lower end of the radioactivity concentration range identified in Table 9.0-2.

3.1.4 Off-Line Liquid Monitors (continued)

The normal range monitors' design shall ensure retaining a full-scale reading for a radiation field of up to two decades above the full-scale radiation field.

The monitor channels which include real-time detection shall include the appropriate circuitry to produce audible and visible alarms in the control room and at additional locations as prescribed in the individual monitor's description section when the radiation level measured by a detector exceeds high alarm set points (see Table 9.0-4) or there is a system malfunction (as a minimum, a malfunction alarm condition shall be initiated for loss of detector signal, power or flow). Each of the alarm conditions, i.e., high radiation or system malfunction shall be readily identifiable on the appropriate radiation monitor panel. To the extent described in the individual monitor sections, the monitors shall have (1) devices to display measured cpm values for each channel in the control room or locally and allow for retrieval of historical data and (2) transmit measured cpm data to the Plant Computer System for display in the Technical Support Center (TSC) in accordance with Section 2.9 of NUREG-0696 (Reference 8.1.13).

Process monitors shall have provisions to allow for periodic on-line testing of the channel's response by actuation of an installed check source of sufficient intensity to provide an upscale reading of the ratemeter when the detector is subjected to normally expected background radiation levels. The check source may be radioactive, a photon source such as an LED, or other similar device appropriate for the type of detector. The check source should verify, to the extent possible, operability of the entire channel from the point that radiation is incident on the detector to the output device. The check source may be remotely activated from the control room or locally.

Radioactive check sources should be shielded from the detector while in the stored position to preclude misleading radiation contributions while sample measurements are made. The monitor should be provided with appropriate circuitry to avoid control actuation during check source operation.

The monitors shall have the capability to either measure or monitor the flow rate of the sample and the means to initiate alarms for low flow conditions. Minimum flow requirements for 1,2-RE-90-120, -121, 0-RE-90-122, -225 are specified in Reference 8.5.33. A low flow alarm in the main control room is not required for monitors on batch release paths.

The monitors' sampling system shall provide means by which grab samples may be withdrawn for laboratory analysis. Where multiple monitors are used to monitor a process, grab sample capability is not required on every monitor. The sample lines shall include flow taps from which grab samples may be taken and are normally isolated from the sampling flow path. The flush valves may be used to obtain a grab sample. The taps should be located to best utilize the components of the installed system, e.g., sample pump, flow meter.

The sampling system should have provisions to allow flushing of the sample chamber with clean water or decontamination solution for purposes of background determination or removal of surface contamination. The design may provide for local or remote actuation of the purge system. The design should preclude potential damage to sample line instrumentation from the flushing operation.

3.1.4 Off-Line Liquid Monitors (continued)

B. Steam Generator Blowdown Liquid Monitor (1,2-RE-90-120 & -121)

These monitors are liquid effluent monitors which shall continuously make real-time measurements of the gross gamma radioactivity in the blowdown liquid from the steam generators to the cooling tower blowdown and shall be capable of detecting the radioactivity resulting from primary to secondary side leakage in compliance with 10 CFR 50 Appendix A, GDC 30, 60 and 64, (Reference 8.1.1); 10 CFR 50, Appendix I (Reference 8.1.2), RG 1.21 (Reference 8.1.7) and RG 1.45 (Reference 8.1.8).

During periods when there is no indication of a primary to secondary leak, these liquid effluent monitors have an additional function to isolate the Steam Generator Blowdown when activity is > 5 E-7 μCi/cc (Ref. 8.5.9).

Each monitor shall have two channels of detection capability. Each channel shall have the capability to monitor samples taken either downstream of the steam generator blowdown heat exchangers or from the discharge line of the steam generator blowdown flash tank.

Upon receipt of a high radiation alarm signal from either channel (1,2-RE-90-120 or 1,2-RE-90-121) the respective monitor shall generate a signal to terminate steam generator blowdown flow directly to the cooling tower blowdown line and divert the flow through the Condensate Demineralizer System [Source Note 2]. The specific control actions initiated by the monitors are described in the respective system description N3-15-4002 (Unit 1) (Reference 8.4.4) and WBN2-15-4002 (Unit 2) (Reference 8.4.11). The automatic control function of these monitors is not a primary safety function since it is not required for the mitigation of any design basis events. The purpose of the automatic isolation of the effluent release paths to the environment during normal operations is to prevent radioactivity release in excess of limits prescribed in Table 2 of 10 CFR 20, Appendix B (Reference 8.1.3) as determined by ODCM methodology.

The monitors shall provide measured cpm data and historical data to the main control room and shall transmit the data to the Plant Computer System for display in the TSC.

C. Waste Disposal System Liquid Monitor (0-RE-90-122)

This monitor is a single channel liquid effluent monitor which shall continuously make real-time measurements of the gross gamma radioactivity in the liquid waste disposal effluent discharge to the cooling tower blowdown in compliance with 10 CFR 50 Appendix A, GDC 60 and 64 (Reference 8.1.1), 10 CFR 50, Appendix I (Reference 8.1.2). This satisfies the guidance of RG 1.21 (Reference 8.1.7). This monitor is on a batch release path.

3.1.4 Off-Line Liquid Monitors (continued)

Upon receipt of a high radiation alarm signal or a malfunction alarm signal from the monitor channel, the monitor shall generate a signal to terminate flow to the cooling tower blowdown [Source Note 2]. Valve 0-RCV-77-43 performs the isolation function and is credited with a 5 second stroke time in the required response time and demonstrated accuracy calculations (References 8.5.10 and 8.5.35). The specific control actions initiated by the monitor are described in system description No. N3-77C-4001 (Reference 8.4.5). The automatic control function of this monitor is not a primary safety function since its action is not required for the mitigation of any design basis event. The purpose of the automatic isolation of the effluent release path to the environment during normal operations is to prevent radioactivity release in excess of limits prescribed in Table 2 of 10 CFR 20, Appendix B (Reference 8.1.3) as determined by ODCM methodology.

The monitor shall provide measured cpm data and historical data to the main control room and shall transmit the data to the Plant Computer System for display in the TSC. Additionally, this monitor provides local display and high radiation alarm on panel 0-L-2.

D. Component Cooling System Monitors (0,1,2-RE-90-123)

These monitors are single channel liquid process monitors which shall continuously perform real-time measurements of the gross gamma radioactivity in the Component Cooling System water. This conforms to the requirements in 10 CFR 50 Appendix A, GDC 30 (Reference 8.1.1) and satisfies the guidance in RG 1.45 (Reference 8.1.8).

Any of the three component cooling system monitors shall generate, upon receipt of a high radiation alarm, a signal to isolate the component cooling surge tank vent for both Unit 1 and Unit 2. The specific control actions initiated by this monitor are described in system description No. N3-70-4002 (Reference 8.4.6). The automatic control function of these monitors is not a primary safety function since its action is not required to mitigate any design basis event. These monitors assist other methods of RCS intersystem leak detection recommended by R.G. 1.45 (Reference 8.1.8).

The monitor shall provide measured cpm data and historical data to the main control room.

E. Condensate Demineralizer Regenerant Waste Discharge Monitor (0-RE-90-225)

This monitor is a single channel liquid effluent monitor which shall continuously perform real-time measurements of the gross gamma radioactivity in the fluids coming from condensate demineralizer regeneration process (waste fluid from the Nonreclaimable Waste Tank, fluids from the Neutralization Tank and the discharge fluid from the High Crud Filter) for discharge to the environment via the cooling tower blowdown in compliance with 10 CFR 50, Appendix A, GDC 60 and 64 (Reference 8.1.1), 10 CFR 50 Appendix I, (Reference 8.1.2) and meet the intent of the guidance of RG 1.21 (Reference 8.1.7).

3.1.4 Off-Line Liquid Monitors (continued)

Upon receipt of a high radiation alarm signal, the monitor shall generate a signal to terminate flow to the cooling tower blowdown (Condenser Circulating Water System) and the Turbine Building Sump [Source Note 2]. Valve 0-FCV-14-451 performs the isolation function and is credited with a 5 second stroke time in the required response time and demonstrated accuracy calculations (References 8.5.17 and 8.5.35). The specific control actions initiated by the monitor are described in system description No. N3-14-4002 (Reference 8.4.7). The automatic control function of this monitor is not a primary safety function since its action is not required to mitigate any design basis event. The purpose of the automatic isolation of the effluent release path to the environment during normal operations is to prevent radioactivity release in excess of limits prescribed in Table 2 of 10 CFR 20, Appendix B (Reference 8.1.3) as determined by ODCM methodology.

The monitor shall provide measured cpm data and historical data to the main control room and shall transmit the data to the Plant Computer System for display in the TSC.

F. DELETED

G. Essential Raw Cooling Water Effluent Monitors (0-RE-90-133,-134, -140 & -141)

The Essential Raw Cooling Water (ERCW) Effluent Monitors shall continuously perform real-time measurements of the gross gamma radioactivity in the ERCW discharge to the cooling tower basins or to the yard holding pond during normal operations and post-accident as required in 10 CFR 50, Appendix A, GDC 64 (Reference 8.1.1) and WB-DC-30-7 (Reference 8.3.5). An ERCW monitor shall be provided for each ERCW effluent line. Each monitor shall have two channels.

The monitors shall be provided to detect leakage from the containment spray heat exchangers post-accident. In the event of a high radiation signal, the operator may initiate isolation of the leaking heat exchanger.

These monitors shall provide measured cpm data and historical data to the main control room and shall transmit the data to the Plant Computer System for display in the TSC.

The monitors do not perform a primary safety function. These monitors are being maintained as 1E Seismic Category I, safety-related components (as noted in the Q-List) which is acceptable since it exceeds the functional requirements of the monitors. However, the sample pumps included in the monitor assemblies are only required to meet Seismic I(L) pressure boundary retention requirements (Also see Table 9.0-1).

3.1.5 Area Radiation Monitors

The following monitors shall continuously monitor ambient radiation levels in the plant buildings to assure that work areas designed for short-term accessibility or normal occupancy have exposure rates which do not exceed the prescribed radiation zone limits, and to provide early warning of abnormal process system operations.

3.1.5 Area Radiation Monitors (continued)

Spent Fuel Pool Area Monitors	1,2-RE-90-001
Personnel Lock Monitors	1,2-RE-90-002
Waste Packaging Area Monitor	0-RE-90-003
Decontamination Room Monitor	0-RE-90-004
Spent Fuel Pool Pumps Area Monitor	0-RE-90-005
Component Cooling Heat Exchanger Area Monitors	1,2-RE-90-006
Sample Rooms Monitors	1,2-RE-90-007
Auxiliary Feedwater Pump Area Monitors	1,2-RE-90-008
Waste Evaporator Condensate Tank Area Monitor	0-RE-90-009
CVCS Board Area Monitors	1,2-RE-90-010
Containment Spray RHR Pump Area Monitor	0-RE-90-011
RB Upper Compartment Refueling Floor Area Monitors	1,2-RE-90-059
RB Upper Compartment Area Monitors	1,2-RE-90-060
RB Lower Compartment Instrument Room Monitors	1,2-RE-90-061
Main Control Room Monitor	0-RE-90-135
Condensate Demineralizer Area Monitor	0-RE-90-230
Condensate Demineralizer Area Monitor	0-RE-90-231
RB Upper Compartment Post Accident Monitors	1,2-RE-90-271 & -272
RB Lower Compartment Post Accident Monitors	1,2-RE-90-273 & -274

A. General Requirements

The monitors shall provide real-time measurement of gross gamma ambient radiation exposure rates in plant areas. These instruments shall be installed in locations which satisfy the guidelines in RG 8.8 (Reference 8.1.6) and ANSI/ANS-HPSSC-6.8.1-1981 (Reference 8.2.3).

The monitors shall have detectors with sufficient range to encompass the minimum and maximum exposure rate expected during normal and anticipated operational occurrences (considering the ambient background radiation conditions at the detectors' location). The monitors should have a minimum of five decades of range as described in ANSI/ANS-HPSSC-6.8.1-1981 (Reference 8.2.3). Certain locations may require a range in excess of five decades. Where multiple detectors are required to cover the anticipated range, the range of the detectors shall overlap. Overlap should be at least one decade. Extended ranges are discussed in the individual monitor sections below.

The normal range monitors' design shall ensure retaining a full-scale reading for a radiation field of up to two decades above the full-scale radiation field.

3.1.5 Area Radiation Monitors (continued)

The monitors shall include the appropriate circuitry to produce audible and visible alarms in the control room when the radiation level measured by a detector exceeds high alarm set points (see Table 9.0-4) or there is a system malfunction (as a minimum, a malfunction alarm condition shall be initiated for loss of detector signal or power). High radiation shall be visibly and audibly alarmed at the local station (except 0-RE-90-135 and 1,2-RE-90-271, -272, -273 & -274). Each type of alarm conditions i.e., high radiation or system malfunction shall be readily identifiable on the appropriate radiation monitor panel.

The monitors shall have devices to display measured exposure rate of mR/hr or R/hr in the control room and locally (except 0-RE-90-135 and 1,2-RE-90-271, -272, -273 & -274) and allow for retrieval of historical data.

The monitors shall have provisions to allow for periodic on-line testing of the channel's response by actuation of an installed check source of sufficient intensity to provide an upscale reading of the ratemeter when the detector is subjected to normally expected background radiation levels. The check source may be radioactive, a photon source such as an LED, or other similar device appropriate for the type of detector. The check source should verify, to the extent possible, operability of the entire channel from the point that radiation is incident on the detector to the output device. The check source may be remotely activated from the control room or locally. Radioactive check sources should be shielded from the detector while in the stored position to preclude misleading radiation contributions while sample measurements are made.

Only those monitors having specific requirements in addition to the above general requirements are discussed in the following subsections.

B. Personnel Lock Monitor (1,2-RE-90-002)

The monitors shall be located to indirectly measure the airborne radioactivity in the respective primary containment under accident conditions. The monitors shall include devices to transmit measured radiation exposure rate data to the Plant Computer System for display in the Technical Support Center. This satisfies the guidance in Section 2.9 of NUREG-0696 (Reference 8.1.13)

C. Reactor Building Upper Containment & Refueling Floor Area Monitor (1,2-RE-90-59 & -60)

These monitors shall include devices to transmit measured radiation exposure rate data to the Plant Computer System for display in the Technical Support Center. This satisfies the guidance in Section 2.9 of NUREG-0696 (Reference 8.1.13)

D. Reactor Building Upper and Lower Compartment Post-accident Monitors (1,2-RE-90-271, -272, -273 & -274)

These redundant area type monitors shall be used to measure the radiation from airborne radioactivity and shall be installed in locations which satisfy the guidelines in RG 1.97 (Reference 8.1.11) and NUREG-0737 (Reference 8.1.14).

3.1.5 Area Radiation Monitors (continued)

These redundant monitors shall continuously monitor the radiation exposure rate in the respective Reactor Building Upper and Lower Compartments during and after an accident. This conforms to the requirements in WB-DC-30-7 (Reference 8.3.5) [Source Notes 4, 5 & 6]. The measured exposure rates shall be provided in the MCR in accordance with the requirements of reference 8.3.5. Exposure rates shall be transmitted to the Plant Computer System for display in the Technical Support Center. These monitors perform a primary safety function as described in WB-DC-30-7 (Reference 8.3.5).

3.1.6 On/In-Line Monitors

The monitors which shall provide continuous surveillance of the radioactive fluid in the respective system flow paths or volumes are:

Waste Disposal System Gas Effluent Monitor	0-RE-90-118
Spent Fuel Pool Accident Monitors	0-RE-90-102 & -103
Main Steam Line Monitors	1,2-RE-90-421, -422, -423 & -424
Turbine Building Sump Discharge Monitor	0-RE-90-212
Unit 2 Condenser Vacuum Pump Exhaust Mid- and High-Range Accident Monitors	2-RE-90-255 & -256

These monitors shall be capable of providing continuous detection and measurement of the gross gamma radioactivity in selected process and effluent lines. Only the Waste Disposal System Gas Effluent Monitor is an in-line monitor; all the others are on-line monitors. On-line monitors may also be called shine monitors.

A. General Requirements

The monitors shall have detectors with sufficient range to measure the anticipated quantity of radioactivity in the sample considering the ambient background radiation conditions at the detectors' location. The sensing elements shall be shielded from background radiation (unless it is known that the background radiation at the point of measurement is not significant when compared to the process measurement of the unshielded sensing element) to attain the required minimum detectable level during background radiation conditions. Where multiple detectors are required to cover the anticipated range, the range of the detectors shall overlap. Overlap should be at least one decade. The detectors shall be able to detect a minimum activity level equal to or less than lower end of the radioactivity concentration range identified in Table 9.0-2. The monitor design for a required detection range should take into account the background radiation level assuming a high energy gamma emitting source such as Cobalt 60 or Cesium 137.

The normal range monitors' design shall ensure retaining a full-scale reading for a radiation field of up to two decades above the full-scale radiation field.

3.1.6 On/In-Line Monitors (continued)

These monitor channels shall include the appropriate circuitry to produce audible and visible alarm annunciation in the control room and/or locally when the radiation level measured by a detector exceeds high alarm set points (see Table 9.0-2) or there is a system malfunction (as a minimum, a malfunction alarm condition shall be initiated for loss of detector signal with exception of 1,2-RE-90-421, 422, 423, 424, or power). Each type of alarm conditions i.e., high radiation or system malfunction shall be readily identifiable on the appropriate radiation monitor panel.

Those monitor channels which include real-time detection, except as noted in the following subsections, shall have devices to display measured activity levels for each channel locally (as specified in Sections 3.1.6B through 3.1.6D) and in the control room and allow for retrieval of historical data. The monitors shall transmit measured cpm data to the Plant Computer System for display in the Technical Support Center (TSC) in accordance with Section 2.9 of NUREG-0696 (Reference 8.1.13).

The monitors shall have provisions to allow for periodic on-line testing of the channel's response by actuation of an installed check source of sufficient intensity to provide an upscale reading of the ratemeter when the detector is subjected to normally expected background radiation levels. The check source may be radioactive, a photon source such as an LED, or other similar device appropriate for the type of detector. The check source should verify, to the extent possible, operability of the entire channel from the point that radiation is incident on the detector to the output device. The check source may be remotely activated from the control room or locally. Radioactive check sources should be shielded from the detector while in the stored position to preclude misleading radiation contributions while sample measurements are made. The monitor should be provided with appropriate circuitry to avoid control actuation during check source operation.

Shine monitors should incorporate GM detectors or ion chambers for on-line monitoring of radioactive fluids contained in system pipes. For the in-line monitor (0-RE-90-118), beta radiation detection shall be provided for gross real-time analysis of the radioactivity in the gas stream.

With the exception of 0-RE-90-102 & -103, none of these monitors perform a primary safety function.

Some of the monitors perform automatic functions to terminate flow and isolate the flow path of fluid lines transporting fluid with excessive levels of radioactivity. With the exception of 0-RE-90-102 & -103, there are no automatic control actions that are safety related associated with these monitors. Monitor channels that initiate automatic control actions are identified in Table 9.0-3.

B. Waste Disposal System Gas Effluent Monitor (0-RE-90-118)

This monitor shall continuously provide real-time measurements of the noble gas radioactivity of the waste gas releases to the environment. This conforms to the requirements of 10 CFR 50, Appendix A, GDCs 60 and 64 (Reference 8.1.1) and satisfies the guidance in regulatory Guide 1.21 (Reference 8.1.7) [Source Note 8].

3.1.6 On/In-Line Monitors (continued)

The design shall include an in-line, single channel assembly for detection of the gross noble gas radioactivity within the discharge line. The channel shall have recording, alarm, and display instrumentation in the main control room. Local indication and high radiation alarm shall be provided on panel 0-L-2 and measured cpm data shall be transmitted to the plant computer for display in the TSC.

Upon receipt of a high radiation signal or an instrument malfunction signal, this monitor shall initiate the isolation of the gaseous waste disposal system vent to atmosphere via the Shield Building Vent. Valve 0-FCV-77-119 performs the isolation function and is credited with a 7 second stroke time in the required response time and demonstrated accuracy calculations (References 8.5.21 and 8.5.36). The specific control actions initiated by the monitor are described in the Gaseous Waste Disposal System description No. N3-77A-4001 (Reference 8.4.8). The automatic control function performed by this monitor is not required for the mitigation of any design basis event. The purpose of the automatic isolation of the effluent release path to the environment during normal operations is to restrict radioactivity releases and prevent off-site exposures in excess of the limits prescribed in Section 20.1301 of 10 CFR 20 (Reference 8.1.3).

C. Spent Fuel Pool Accident Monitors (0-RE-90-102 & -103)

These redundant monitors shall be installed in proximity to the surface of the water of the spent fuel pool and continuously monitor the radiation exposure rate above the spent fuel pool water surface [Source Note 9], fuel transfer canal, and cask loading area. Refer to system description N3-30AB-4001 (Sections 4.27 and 4.28) for special ventilation requirements during movement of irradiated fuel in either the fuel transfer canal or cask loading areas. A high radiation signal from either of the Spent Fuel Pool Accident Monitors shall generate a signal to initiate the isolation of the Auxiliary Building normal ventilation system, to start the Auxiliary Building Gas Treatment Subsystem as defined in System Description document No. N3-30AB-4001 (Reference 8.4.1). Also, during movement of irradiated fuel in the Auxiliary Building during times when a containment and/or an annulus is open to the Auxiliary Building Secondary Containment Enclosure (ABSCE) spaces, a high radiation signal from either of the Spent Fuel Pool Accident Monitors shall generate a Containment Ventilation Isolation (CVI) signal on the respective unit. This requirement is to ensure the ABSCE can be established in the event of a fuel handling accident in the Auxiliary Building when a containment is open to the Auxiliary Building ABSCE spaces and the associated containment purge system is operating. Local display of activity is not required for these monitors.

These instruments shall transmit measured exposure rate data to the Plant Computer System for display in the TSC. This satisfies the guidance in Section 2.9 of NUREG-0696 (Reference 8.1.13).

These monitors perform a primary safety function as described in WB-DC-40-64 (Reference 8.3.17) and are required to be Seismic Category I and to receive Class 1E power.

3.1.6 On/In-Line Monitors (continued)

D. Main Steam Line Monitors (1,2-RE-90-421, -422, -423 & -424)

These monitors shall continuously provide real-time measurement of the gross gamma radioactivity of the steam in the Main Steam Lines. This conforms to the requirements in 10 CFR 50, Appendix A, GDC 60 and 64 (Reference 8.1.1) and WB-DC-30-7 (Reference 8.3.5). Each Main Steam Line shall be provided with a single channel to cover the full range of expected radioactivity unless two channels are required to satisfy the required range and accuracy.

These monitors shall provide activity level indication, alarm and historical data to the main control room and measured activity level shall be transmitted to the Plant Computer System for display in the TSC.

E. Turbine Building Sump Discharge Monitor (0-RE-90-212)

The Turbine Building Sump Discharge Monitor is a single channel effluent monitor which shall continuously perform real-time detection of the radioactivity in the Turbine Building sump liquid effluent discharge to the environment as required in 10 CFR 50, Appendix A, GDC 60 and 64 (Reference 8.1.1), 10 CFR 50, Appendix I (Reference 8.1.2), and satisfies with the guidance of RG 1.21 (Reference 8.1.7).

This monitor does not perform an automatic function.

The monitor shall provide measured cpm data locally and shall transmit the data to the Plant Computer System for display in the TSC historical data recording.

F. Condenser Vacuum Pump Exhaust Accident Monitors (2-RE-90-255 & -256)

The Condenser Vacuum Pump Exhaust Accident monitors are two monitors with mid and high range radiation detection capability which shall continuously make real-time measurements of the radiation activity in the condenser vacuum pump exhaust subsequent to a design basis accident. This conforms to the requirements in 10 CFR 50, Appendix A, GDC 64 (Reference 8.1.1) and WB-DC-30-7 (Reference 8.3.5). Since two detectors are required to cover the full range, detectors whose ranges overlap shall be used. This complies with the requirements of Section II.F.1 of NUREG-0737 (Reference 8.1.14) [Source Note 8]. These monitors are intended to measure radioactivity in the condenser vacuum pump exhaust after an accident and therefore, have no function during normal operation.

In the unlikely event of a steam generator tube rupture during the times that the CVE monitors are not operating, the tube rupture will be identified by the main Steam Radiation monitors 2-RE-90-421, 422, 423, & 424, and radioactive effluents through the CVE shall be determined by sampling per the requirements of EPIP-13. In addition, the steam activity, as determined by the main Steam Radiation monitors may be used in conjunction with the quantity of steam entering the condenser to determine the amount of radioactivity released through the condenser vacuum exhaust.

The measured radioactivity level shall be transmitted to the Plant Computer System for display in the TSC.

3.2 Design Basis Events

The Radiation Monitoring System shall include monitors which, on high radiation alarm, shall generate signals to actuate responses from safety-related systems as described in Section 3.1 of this document, to mitigate potential radioactivity releases and to reduce the dose to control room operators from postulated design basis accidents in accordance with 10 CFR 50, Appendix A, GDC 19 (Reference 8.1.1).

3.3 Environmental Requirements

The Radiation Monitoring System shall be designed to operate in an environment associated with normal conditions, including anticipated operational occurrences.

Design and procurement of radiation monitoring system equipment that perform primary safety functions shall satisfy the ambient conditions described in WB-DC-40-42 (Reference 8.3.8) for the pressure, temperature, and humidity environment. The radiation dose values for normal operating conditions shall be the maximum 40-year integrated dose for the respective location in the plant. Those components located in a harsh environment shall be environmentally qualified for the applicable design basis events in accordance with WB-DC-40-54 (Reference 8.3.9) to the environmental conditions of pressure, temperature, humidity, and radiation dose at the specific monitor location. Radiation monitor channels provided for RG 1.97 (Reference 8.1.11) post-accident monitoring functions shall be designed to meet the requirements of WB-DC-30-7 (Reference 8.3.5).

Non-safety related monitors should be procured to reasonable industry standards. Qualified life determinations are not required. Procurement specifications should include the design environmental requirements.

3.4 External Events

Radiation monitor channels that perform a primary safety function as identified in Table 9.0-4 and defined in this document shall be designed to withstand or be protected from the phenomena described in Sections 3.4.1 through 3.4.4 for design basis accident conditions without loss of capability to perform their design function.

3.4.1 Loss of Off-site Power

Radiation monitors which perform a primary safety function shall be designed to remain functional following a loss of off-site power, shall be powered from redundant on-site electrical power systems in accordance with the criteria of Section 3.5 of this document and shall be automatically loaded onto the standby bus.

3.4.2 Safe Shutdown Earthquake

Radiation monitors which serve a primary safety function shall be qualified to Seismic Category I requirements. If the primary safety function is attributable only to sample line requirements, the Seismic I requirement is applicable only to the monitor sample lines up to and including a suitable class break. Radiation Monitors which serve a secondary safety function as defined in this document and described in Table 9.0-1, shall be qualified to Seismic Category I(L) as described in Section 3.0 of this document.

3.4.3 Wind and Tornado Loadings

Radiation monitors which serve either a primary or secondary safety function shall be protected from the effects of a design basis wind or design basis tornado in accordance with the requirements of 10 CFR 50 Appendix A, GDC 2, (Reference 8.1.1). This protection may be afforded by locating components within plant structures designed to withstand design basis winds, and design basis tornado winds in accordance with WB-DC-20-1 (Reference 8.3.15).

3.4.4 Flooding

Components of the Radiation Monitoring System (RMS) necessary for operation in the Design Basis Flood (DBF) mode shall be installed in accordance with paragraph 4.6.6 of WB-DC-40-29 (Reference 8.3.16). Components of the RMS necessary for operation during non-DBF conditions shall be installed at elevations higher than the relevant internal flood water level for specific plant areas or be designed to operate submerged.

Monitors that should be operational during design basis flood conditions, with the plant in safe shutdown conditions, are those which provide the Control Room operator information regarding the ambient in-plant airborne radioactivity and radiation exposure rates in areas which are not flooded and may require access, and the Spent Fuel Pool Area Accident Monitors. Monitors which provide surveillance of airborne radioactivity levels and exposure rate levels in areas which are not flooded and where access may be required are:

Portable Continuous Air Monitors	Spent Fuel Pool Monitor
	Main Control Room Monitor
Area Monitors	1,2-RE-90-001
	1,2-RE-90-059
	0-RE-90-135

3.5 Electrical Requirements

All components of Radiation Monitoring System (RMS) requiring electrical power, including electric heat tracing, shall be energized from electrical sources which are commensurate with the component's safety classification and electrical category as described in Table 9.0-1.

Safety and nonsafety-related electrical components of the RMS shall be capable of performing their design function when supplied with the following power as appropriate:

- 117 V ac (±10 percent), single phase, 60 ±1 Hz (safety and nonsafety)
- Vital (uninterruptable power supply) 120 V ac, (±2 percent), single phase, 60 Hz, ±0.6 Hz
- 480V ac (±10 percent), three phase, 60 ±1 Hz (safety and nonsafety)

3.5 Electrical Requirements (continued)

The components of Radiation Monitoring channels classified as Category 1 variables, as defined in Regulatory Position 1.3 of NRC RG 1.97 (Reference 8.1.11), as well as the components of Radiation Monitoring channels performing primary safety functions, shall be supplied from Class 1E electric systems. Redundancy, signal isolation, and control power for Radiation Monitoring channels functioning as Category 1 variables shall be designed in accordance with Section 3.5.1 of WB-DC-30-7 (Reference 8.3.5).

Power systems and associated components for the Class 1E portion of the RMS shall be designed in accordance with WB-DC-30-27 (Reference 8.3.11) and WB-DC-30-28 (Reference 8.3.12). Electric equipment, cable, and raceways for the Class 1E portion of the RMS shall have separation and redundancy in accordance with WB-DC-30-4 (Reference 8.3.6).

Electrical requirements for Radiation Monitoring channels classified as Category 2 variables, as defined in Regulatory Position 1.3 of NRC RG 1.97 (Reference 8.1.11), shall be in accordance with Sections 3.5.2 or 3.5.3 of WB-DC-30-7 (Reference 8.3.5).

Thermal overload bypass protection devices for safety-related motor-operated valves and torque switches are not required (reference 8.5.8).

Care should be taken in the design of the RMS so that low level signal circuits are not adversely affected by electro-magnetic or radio frequency interference (RFI) noise. Circuits should be protected from these interferences by proper attention to equipment design, cable selection, avoidance of multiple grounds (i.e., ground loops) in accordance with Section 2.2.3.3 of WB-DC-30-32 (Reference 8.3.13) and cable routing to provide adequate separation of detector and signal circuits from power circuits and from circuits subject to inductive switching surges. The selection of cables for equipment interconnection (i.e., of coaxial, triaxial, mineral insulated, or shielded construction) should be made to the manufacturer's recommendations. Cable selection shall also be in accordance with WB-DC-30-5 (Reference 8.3.7).

3.6 Mechanical Requirements

3.6.1 General Requirements

For monitors which collect or monitor particulates and iodines, the monitor sample flow paths should either be sized to provide flow rates such that off-line particulate and iodine filter efficiencies and loading capabilities are not impaired (Reference 8.1.14) or a study shall be performed to show these effects are negligible (Reference 8.2.5). In cases where required response times have been determined, the sampling process shall be designed such that required response times for terminating effluent releases can be achieved.

3.6.1 General Requirements (continued)

Sample line connections to systems expected to be contaminated in the course of normal plant operation shall be welded, threaded, or flareless as described in this paragraph, which is based on Section 5.6 of ANSI/ISA S67.10 (reference 8.2.4). Welded lines less than or equal to 1 inch shall be socket welded in accordance with the guidance of Section 5.6.2 of ANSI/ISA S67.10 (Reference 8.2.4). Welded lines greater than 1 inch should be butt welded where socket weld fittings could create radioactive particle (crud) traps. Liquid sample lines of the RMS which transport reactor coolant samples and which are greater than 1 inch nominal diameter, shall be butt welded. Flareless fittings may be used in lieu of welded fittings in those sample lines fabricated using tubing subject to the following restrictions. Flareless fittings shall not be used where sample lines must be protected against inadvertent disassembly. Threaded pipe or tubing fittings should not be used in the normal sample flow path of those monitors connected to systems expected to be contaminated, or in the inlet flow path of gaseous particulate/non-volatile iodine samplers up to the particulate/iodine collection medium, unless an in-line device is manufactured with threaded connections. Threaded pipe or tubing fittings may be used as necessary in conjunction with off-line instruments or components supplied with threaded fittings, or in those monitors connected to systems with a low potential for becoming contaminated.

Components of the sample lines and monitors which are exposed to the sample fluid shall be designed to the pressure and temperature of the process system at the point the sample is drawn unless design features are provided to change the sample fluid characteristics, the monitor is isolated during periods of high pressure or temperature in the source fluid, or an analysis is performed to demonstrate that the sample is within the pressure and temperature capability of the monitor when the sample reaches the monitor.

Pumps used for drawing representative air samples from a process duct shall be sized to take into account the pressure drops due to the intake nozzles/manifold and sample line configuration, as well as the required volumetric flow rate. Where the number of intake nozzles and the required nozzle diameter result in a sample flow which exceeds those allowable for the particulate and iodine channels, the final sample shall be obtained through a secondary air sampling system which uses the sample line from the process duct as its source duct. This technique may be referred to as subsampling.

For gas monitoring applications, positive displacement piston type vacuum pumps should be provided with a bleed line or other design feature to allow the sample pump to operate at design flow rate capacity when sample flow rate requirements are less than the pump design capacity. Radiation Monitor skids which incorporate rotary type vacuum pumps shall provide indication of a degraded flow condition in the Main Control Room to allow the pump to be turned off prior to experiencing damage. Sample monitors may alarm locally since these monitors have no real-time display in the main control room and portable sampling can be substituted in the event of monitor failure.

3.6.2 Seismic Qualification of Instrumentation and Electrical Equipment

For those functional safety related Seismic Category I instrumentation and equipment (as specified by the Q-list in MEL), the seismic qualification shall be in accordance with WB-DC-40-31.2 and WB-DC-40-31.12 (references 8.3.1 and 8.3.22, respectively).

3.6.2 Seismic Qualification of Instrumentation and Electrical Equipment (continued)

For those non-safety related Seismic Category I(L) instrumentation and equipment (as specified by the Q-list in MEL), the seismic qualification shall be in accordance with WB-DC-40-31.13 (reference 8.3.2).

3.6.3 RMS Sample Line Design Criteria

The purpose of this section is to establish the general design criteria for RMS sample lines used with gaseous and liquid off-line monitors listed in Table 9.0-2.

Criteria that apply to both gaseous and liquid sample lines are given in Sections 3.6.3A through 3.6.3D. Criteria specific to gaseous or liquid sample lines are given in Sections 3.6.3E and 3.6.3F, respectively.

A. General Criteria for Sample Lines

Sample tubing runs should normally be as short as practical with the number of fittings and direction changes minimized. Sample lines shall be routed to avoid contact interferences caused by relative motion between the line and adjacent equipment or the configuration shall be evaluated for acceptability (reference 8.3.21). Sources of relative motion that shall be considered are thermal expansion and seismic motion. Sample lines should be routed so as to minimize changes in the sample fluid temperature. Sample lines should also be routed so as not to interfere with doorways, accessways, stairways, ladders, or equipment which require frequent maintenance. Sample lines should be routed and protected so that physical damage during construction and plant operation is improbable. When required for a specific monitor, sample lines shall be routed and supported to allow sufficient clearance for installation of heat tracing and/or insulation.

Where changes in direction of the inlet tubing run for gaseous monitors with a particulate collection function are required, large radius bends should be utilized. Sample line bend radii in these cases should be a minimum of 5 times the tube O.D. to minimize line losses and, in general, to be consistent with current practices of the nuclear industry for sample line design for collection of particulates. For cases where this bend radius requirement cannot be met, an analysis shall be performed to properly account for adverse effect in obtaining a representative particulate sample. The above requirements shall not apply to purge and/or test connections, bypass lines, control valve feed back lines, and portions of the sample line downstream of the point at which the particulates are collected or filtered. The particle loss calculation of Reference 8.5.24 determines the transmission efficiency for monitors: 0-RE-90-101, 1,2-RE-106, & 112 and 1,2-RE-90-402.

3.6.3 RMS Sample Line Design Criteria (continued)

Sample line valves should be ball valves, or similar nonrestrictive type, in lines where the build up of radioactive contaminants could result when flow path discontinuities are present, or in the portion of particulate sample lines prior to the particulate filters. Examples of such lines include the liquid waste disposal and containment atmosphere sample lines. Valves should be accessible for maintenance. Restriction orifices should be avoided. For cases where other types of valves are used in particulate sample lines, an analysis shall be performed to confirm that there is no adverse effect on obtaining a representative particulate sample. Valves in sample lines for particulate monitors have been evaluated in the particle loss calculation of Reference 8.5.24.

Where root valves are used in addition to isolation valves, the root valves should be installed as close as practical to process connections. Where root valves must be located in an inaccessible area an isolation valve (i.e., a valve in addition to the root valve at the sample connection) should be installed at a point where the sample line becomes accessible.

Off-line liquid sample systems shall have isolation valves in addition to process root valves on both the sample intake and sample return tubing to isolate the monitor from the process pipe.

B. Line Classification Criteria

The sample line portion of off-line monitors shall be seismically classified in accordance with Section 3.5 of WB-DC-40-36 (Reference 8.3.10) for those monitors connected to piping, or WB-DC-40-36 & -36.1 (References 8.3.10 and 8.3.19, respectively) for those monitors connected to ductwork, and designed in accordance with that classification subject to the following clarifications. The skid-mounted portions of the monitor shall be designed to the requirements which satisfy its safety function or to the requirements imposed by virtue of its location in a Seismic Category I building area, which ever is greater.

In-line components of RMS sample lines such as heat exchangers, valves, fittings, or other in-line mechanical components are subject to TVA code class requirements as described in WB-DC-40-36 (Reference 8.3.10) for those monitors connected to piping, or WB-DC-40-36 & -36.1 (References 8.3.10 and 8.3.19, respectively) for those monitors connected to ductwork. Other off line mechanical components such as pressure or flow measurement devices are instruments and shall comply with interfacing requirements described in Section 3.5 of WB-DC-40-36 (Reference 8.3.10). As defined in Section 3.5 of WB-DC-40-36 (Reference 8.3.10), the RMS monitor skid constitutes an instrument and is subject to the interfacing requirements of that section.

Sample lines connected to ANS Safety Class 2.b ductwork (TVA Class Q or S) shall be designed in accordance with the code requirements of TVA Class C piping. Sample lines for the Shield Building Vent monitors shall be designed and installed to the requirements of TVA Class C, Seismic I including the portions located in the non-Seismic Additional Equipment Building.

Sample lines attached to non-ASME piping shall be designed to TVA Class G requirements within seismic structures and Class H requirements in non-seismic structures.

3.6.3 RMS Sample Line Design Criteria (continued)

Sample lines for monitors that are required for post-accident monitoring and are not attached to either ASME piping or TVA Class Q or S duct work and that are not located in seismically qualified buildings should be designed to the requirements of TVA Class H piping.

Sample lines for the containment airborne radioactivity monitors shall be Class C except that those parts of the sample lines, including the containment isolation valves, which form a part of the primary containment isolation boundary shall be Class B.

Sample lines which may be subjected to severe vibration shall be pre-engineered and analyzed based on their code classifications. Sample lines that are connected to process piping, vessels or line-mounted equipment, which are subject to thermal and seismic movement, shall be routed and analyzed to insure sufficient flexibility between the root valve and the first support of the sample lines. See Section 3.6.3C, Seismic Criteria for Sample Lines, for thermal expansion requirements that apply to Seismic I and I(L) sample tubing.

Inlet sample lines shall be fabricated of stainless steel tubing or piping. Internal surfaces of associated in-line components which come in contact with the sample fluid prior to its reaching the detector(s) should also be stainless steel in order to minimize potential changes to the sample characteristics due to corrosion products. The internal surfaces of liquid sample heat exchangers may also be of material other than stainless steel provided the selection of the materials used considers the corrosion properties of the fluid being transported and the material characteristics of interfacing systems and if the sample fluid is drawn from a piping system that is not stainless steel such as the steam generator blowdown liquid monitor. Discharge sample lines and other in-line components downstream of the detector(s) may be fabricated of materials other than stainless steel provided the selection of the materials used considers the corrosion properties of the fluid being transported and the material characteristics of interfacing systems.

Flexible stainless steel metal hose may be used for short distances on filter holders, where the filters must be removed frequently. The hose shall only be used on the downstream side of the filter holder.

C. Seismic Criteria for Sample Lines

1. Seismic Category I and I(L) Instrumentation Sample Lines

   Requirements for the seismic design and analysis of Category I and I(L) instrumentation sample line tubing and tubing supports are given in WB-DC-40-31.7 (Reference 8.3.3) and WB-DC-40-31.9 (Reference 8.3.4).

   Sample lines routed across seismic zones shall be analyzed to include consideration of the building movement in accordance with WB-DC-40-31.7 (Reference 8.3.3).

3.6.3 RMS Sample Line Design Criteria (continued)

2. Seismic Category I and I(L) Instrumentation Sample Line Supports

Sample line supports shall meet seismic requirements not less than that required of the piping system from which the sample is being drawn until such point that the sample line incorporates a class break. Support design shall consider the effects of seismic events and thermal expansion which the source piping or sample line may be subjected to during normal and accident conditions in accordance with ISA-S67.10, Section 5.10 (Reference 8.2.4).

Requirements for design of tubing supports can be found in Design Criteria WB-DC-40-31.9 (Reference 8.3.4).

Sample line support structures such as channels, struts, etc., shall be supported independently of equipment supports such as cabinets, racks, stands, brackets, etc., and shall have no direct connection to them or contact with them. Where independent support is not possible, equipment qualification approval is required.

D. Heat Tracing Criteria for Sample Lines:

Monitors whose sample lines transport gaseous or liquid samples subject to the physical changes described below and which do not meet the requirements of Section 3.6.3E.2 shall be heat traced, chilled, and/or insulated as appropriate to provide a representative sample at the channel detector.

1. Gaseous Sample Line Heat Tracing or Insulation Requirements (Particulate and Non-particulate)

Sample lines for gaseous fluids that have the potential for condensation during transit to the RMS sample skid should be insulated or heat traced to maintain the fluid at a temperature which prevents condensation. Minimum slope requirements may be used to protect gas (non-particulate) monitors from condensation in sample lines. Insulation should be considered for those cases where condensation is possible due to short term variations in the surrounding air temperature. For those cases where it has been determined that insulation alone cannot maintain the fluid temperature above the dew point, heat tracing should be considered to maintain the temperature at a level which precludes condensation. The addition of heat tracing shall not produce a sample which exceeds the maximum temperature capability of either the detector or sample collection media.

Evaluation or analysis were performed for the gas and PIG monitors to determine the potential for condensation. Based on the potential for condensation and sample line routing, monitors 1,2-RE-90-106, -112, -400 & -402, and condenser vacuum exhaust sampling point shall be insulated and heat traced, or shall be analyzed to show such condensation will have a negligible affect on the proper operation of the monitors (references 8.5.25, 8.5.27 and 8.5.28).
Monitor 0-RE-90-101 shall be insulated and heat traced on the section of the sample line external to the auxiliary building (reference 8.5.26).

3.6.3 RMS Sample Line Design Criteria (continued)

Portions of gas sample lines which are subject to temperatures which could cause freezing of the sample line shall be insulated. In instances where it has been determined that insulation alone cannot prevent freezing or precipitation, heat tracing and insulation shall be required.

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2. Liquid Sample Line Heat Tracing or Insulation Requirements

Liquid sample lines which are subject to temperatures which could cause freezing of the sample fluid or precipitation of a solute shall be insulated. In instances where it has been determined that insulation alone cannot prevent freezing or precipitation, heat tracing and insulation shall be required.

E. Gaseous Sample Line Criteria

This section provides the design criteria for gaseous RMS sample lines which are divided up into those that sample gas only (non-particulate), those that also include an iodine and particulate collection or monitoring functions (particulate), and those that sample open areas.

1. General Criteria for Gaseous Sample Lines (Particulate and Non-particulate)

For gaseous monitors that utilize a single sample probe, the sample may be taken from either a vertical or horizontal pipe or duct run. Sample probes, when used with intake sample lines, shall be installed with nozzle openings facing upstream into the direction of flow.

Sample connections on horizontal rectangular ducts should be on the side or on the top of the duct. Sample connections on horizontal round ducts should be located above the horizontal midplane of the duct. Sample connections may be on the bottom of horizontal rectangular ducts or below the horizontal midplane of horizontal round ducts as long as the probe design internal to the duct does not allow condensate that may form in the duct to enter the sample line. These restrictions do not apply to vertical ducts (rectangular or round).

The discharge flow from sample skids should be returned to the duct sufficiently downstream of the sample withdrawal location to preclude creating disturbances at the sample withdrawal location (see Sections 3.6.3E.3 and 3.6.3E.6 for additional criteria).

2. Routing of Gaseous Sample Lines (Particulate and Non-particulate)

Horizontal runs for monitors with a particulate collection function and laminar flow conditions in the sample lines should be avoided to minimize particulate gravitational deposition in accordance with the guidance of ANSI N13.1, Section 4.2.2.1 and B2 (Reference 8.2.5). Per ANSI N13.1, Appendix B, this restriction applies to sample lines with laminar flow conditions only (Reference 8.2.5).

3.6.3 RMS Sample Line Design Criteria (continued)

It is good engineering practice for sample lines, except for short horizontal sections such as those at the sample intake, wall penetrations, and the final isolation valve at the RMS skid assembly, to have a continuous upward slope from the source sample withdrawal point toward the RMS assembly to promote keeping the line free of liquids due to condensation. Sample lines should have a continuous slope of one-inch, or more, per foot and shall have a minimum continuous slope of 1/4-inch per foot in accordance with the guidance of Section 5.5 of ANSI/ISA S67.10 (Reference 8.2.4) if condensation is possible in the sample lines. If condensation is not a design concern or if other measures, such as heat tracing, are employed, then minimum and/or continuous slope requirements shall not be required. See Section 3.6.3D.1 for monitors which have been analyzed for heat tracing and/or insulation requirements.

The sample line requirements of this Section are not required to be met for the sample lines of the Service Building Vent Monitor, 0-RE-90-132 since the temperature of the air exhausted through the service building vent is nearly the same temperature as at the monitor's location. This precludes the possibility of condensation formation in the sample lines since the temperature of the sample cannot decrease significantly.

3. Non-particulate Sampling

This subsection provides design criteria for sample lines from ducts when monitoring of particulates is not required. The criteria are applicable to ducts of any size in which the sample can be expected to be uniform over the duct cross section containing the sample withdrawal point (with the exception of the area near the duct wall). The criteria are based on Sections 3.1.1, 3.1.2, and 3.2 of 40 CFR 60 Appendix B, Specification 2 (Reference 8.1.5). The use of fewer sample nozzles than are required for particulate sampling in Section 3.6.3E.5 is allowed for non-particulate sampling.

Sample withdrawal points shall be from an area that is well mixed and should be located at least two diameters or equivalent diameters downstream of flow disturbances and 1/2 diameter or equivalent diameters upstream of flow disturbances. For rectangular ducts an equivalent diameter (ED) is determined from the following (Reference 8.1.5):

$$ED = \frac{2*(HW)}{(H+W)}$$

where: H = height of the duct and
W = width of the duct.

Regardless of duct size, a single withdrawal point may be used and shall be located in the duct outside the stagnant wall film (reference 8.2.4).

3.6.3 RMS Sample Line Design Criteria (continued)

4. Particulate Sample Line Sizing

   For gaseous monitors which include a particulate collection function and employ more than one sample nozzle, the total cross sectional area of the nozzles should be approximately equal to the cross sectional area of the sample nozzle manifold. The cross sectional area of the connecting tubing should be approximately equal to the cross sectional area of the sample nozzle manifold. For gaseous monitors which include a particulate collection function and have one sample intake nozzle, the cross sectional area of the nozzle and the connecting tubing should be approximately equal.

5. Sample Nozzle Requirements for Particulate Sampling

   This subsection provides design criteria in accordance with the guidance of ANSI N13.1, Section A.3.2 (Reference 8.2.5).

   For circular ducts the minimum number of sample nozzles shall be as follows:

Duct Diameter in Inches	Minimum Number of Nozzles
2 - 6	1
8 - 12	2
14 - 18	3
20 - 28	4
30 - 48	5
50 and larger	6

   For rectangular ducts the number of sample nozzles shall be as follows:

Duct Area	Number of Nozzles
Less than 0.5 sq. ft.	1
1 - 2 sq. ft.	4
2 - 25 sq. ft.	6 - 12
> 25 sq. ft.	20

   Sample withdrawal points should be selected to obtain a representative sample. In general, withdrawal points should be spaced to obtain samples from the total duct cross section.

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3.6.3 RMS Sample Line Design Criteria (continued)

6. Location of Particulate Sample Withdrawal Point in the Duct

   Sample withdrawal points should be located at least 5 duct diameters downstream of flow disturbances such as bends or transitions as described in ANSI N13.1 Appendix A, Section A3 (Reference 8.2.5). For rectangular ducts use the major dimension of the duct as the diameter. For configurations where this recommendation is not met, other engineering features, such as flow straighteners, additional nozzles, etc., may be used to ensure a representative sample.

7. Particulate Sampling Probe and Probe Manifold Design Requirements

   Air sampling for particulate monitoring shall be considered isokinetic when the difference between the air velocity in the duct and the air velocity entering the sample nozzle is plus or minus 20 percent of the duct velocity (Reference 8.1.14).

   Probes for isokinetic sampling may be specified to be designed in accordance with the guidance of ANSI N13.1 Appendix A Figures A2 or A5 (Reference 8.2.5). The selected location of the sample sites within the duct shall be accessible for easy removal of the sample probe for cleaning, inspection and replacement as recommended in ANSI N13.1, Section A3.4 (Reference 8.2.5).

8. Gaseous Sampling From Open Areas

   The sample collection point (inlet nozzle(s), if nozzles are used) should be located in an area where the air is well mixed by natural or forced circulation. Isokinetic sampling requirements have no meaning and thus are not applicable when sampling from open areas

   For single inlet nozzle installations, the sample collection point location may be in proximity to a location, such as an air exhaust outlet, where the airborne radioactivity would be expected to make a rapid appearance albeit diluted.

   When it is desirable to have a monitor sample more than one location in an open volume, multiple sample points may be installed and connected to one monitor. Multiple intake nozzles may provide a capability to determine the relative location of a system leak from measured radioactivity by manipulation of the sample line valves, if present. This can be useful in volumes such as containment.

F. Liquid Sample Lines

This section provides the general design criteria for liquid radiation monitoring sample lines.

3.6.3 RMS Sample Line Design Criteria (continued)

1. Selection of Liquid Sample Points

   Liquid samples should be taken at only one point in the cross section. Sample points shall be located where the fluid is well mixed and should be located where there is a minimum disturbance of the flow pattern due to fittings and other physical characteristics of the piping or in-line components in accordance with Regulatory Guide 1.21, Section C6 (Reference 8.1.7). To meet this requirement the return point should be a sufficient distance downstream of the intake point to minimize disturbance of the inlet sample.

   Liquid sample connections shall not be located on the bottom and should be located on the side of horizontal pipe runs. Liquid sample connections which must be located on vertical piping runs may be located at any azimuth. Batch release samples shall be well mixed prior to determining its isotopic content.

2. Routing of Liquid Sample Lines

   Liquid-filled sample lines that connect to normally radioactive process systems should not be routed with dead legs or low points that cannot be flushed and drained.

3.7 Instrumentation Requirements

Sample flow measuring instrumentation should be accurate to within ±10 percent of full scale between 10% and 100% of scale reading. Current pressure measuring instrumentation has an accuracy of ±5% which is accounted for in the instrument accuracy calculations.

3.8 Safety Limits

Safety limits or references to documents governing the determination of safety limits for monitor channels which provide an automatic control function are provided in Table 9.0-4. References to documents governing the determination of maximum allowable response times corresponding to these safety limits are shown in Table 9.0-3.

3.9 Maintenance

Off-line gaseous monitoring systems shall have appropriate connections to allow for purging the gas sample chamber with clean air as needed to remove loose contamination prior to opening the system for component maintenance or replacement. Liquid monitoring systems, except those that monitor systems designed to be clean such as the CCS, shall be provided with taps and sampler isolation to allow the sampler chamber to be flushed with clean water for removal of loose contamination prior to opening the system. Low point taps should be provided to allow for drainage of the gaseous and liquid sampling systems.

4.0 LAYOUT AND ARRANGEMENT

Radiation monitoring detection systems should be located in areas where the effects of background radiation levels and sources of EMI are minimized. The location of a sampling skid should also take into account the design requirements of the sample line. Monitors that are located in areas where potentially adverse conditions may exist, e.g., water spray, airborne dust, should include design features such as appropriate NEMA graded enclosures or spray shields that will adequately protect the sensitive components of the system. The monitoring system should be readily accessible for purposes of periodic system testing, maintenance, and calibration. Monitor components that require frequent maintenance or calibration should be located in the lowest practical radiation fields.

Off-line air-sampling systems and in-containment leak detection should include an installed spare pump with appropriate flow control and isolation capabilities to allow for continued sampling in the event of primary pump failure.

Monitors identified in Table 9.0-1 under WB-DC-30-7 (Reference 8.3.5) as Category 1 shall have a redundant monitor installed and powered from the opposite train such that the combination of the two monitors shall be capable of providing the monitoring function in the presence of any single component failure or design basis event.

The separation requirements of this section are established to meet the intent of the single failure criteria of IEEE-279-1971 (Reference 8.2.9). Sample lines for redundant monitors which perform a primary safety function as identified in Table 9.0-4 shall be routed with sufficient separation such that no single event can prevent more than one redundant channel from performing its safety function.

Minimum required separation for sample lines for redundant primary safety function monitors shall be achieved in as short a distance as possible after their sample intakes. The minimum required separation between sample lines attached to redundant monitors shall be at least 18 inches in air.

Redundant monitors that perform a primary safety function as identified in Table 9.0-4 and whose sample lines do not meet the 18 inch minimum separation stated above or whose sample lines are located in a common area subject to possible missiles, jets and pipe-whip, shall have analysis or calculations performed as necessary to document that the existing separation protects the redundant sample lines from failure due to common cause.

As an alternative a suitable steel or concrete barrier may be used. When a barrier is used, it shall extend at least one inch beyond the line of sight between redundant lines and shall be designed and mounted to Seismic Category I requirements.

The sample lines for the containment purge radiation monitors (1,2-RE-90-130 & -131) originate from the same duct and run approximately 6 inches apart for a distance of approximately 6 feet. These lines are inaccessible to personnel and there is no potential for sample line damage due to high or moderate energy line breaks, pipe whip or postulated missiles. Therefore, the sample line separation criteria of this section for the area where there is less than 18 inches separation between the sample lines of these monitors is not required to be met since the sample lines are not threatened by any credible failure that would compromise the safety function of these monitors.

5.0 TESTS AND INSPECTIONS

5.1 Vendor Testing

The vendor shall by test or other means as set forth in the procurement specification, comply with the specified functions as described in the procurement specification.

5.2 Site Testing

At completion of installation of each of the monitors, an integrated system test shall then be undertaken to test system functions such as (a) the communication links with the control room for operation of the recorder, actuation of the visual and audible alarm(s) annunciators, response of measurements readout and (b) the communications to the Technical Support Center. The communication test shall also test the capability of remote operation of the check sources, purge valve(s), and filter advance as applicable. Operability tests of the sample pump(s) and flow control valves shall be completed locally for the appropriate monitors. The monitoring systems interaction with other plant systems shall also be demonstrated by introduction of input signals at the appropriate locations on RMS equipment to initiate the automatic control functions described in Section 3.1. Where practical, interactive systems such as the HVAC duct flow velocity detection system shall be tested to observe changes in sample system flow rate resulting from input signals originating from the duct flow velocity detection systems.

5.3 Monitor Calibrations (Vendor or Site Testing)

Primary and secondary calibrations shall be performed for each monitor system. The Upper and Lower Compartment Reactor Building Post-accident Monitors shall be calibrated in accordance with the requirements of NUREG-0737 (Reference 8.1.14).

6.0 QUALITY ASSURANCE

The Quality Assurance Program is defined and described in TVA-NQA-PLN89-A (Reference 8.6.2).

Components of the radiation monitoring system shall meet the mechanical and electrical QA requirements applicable to the classifications and safety function described in Tables 9.0-1 and 9.0-4.

7.0 EXCEPTIONS

Consideration shall be given where exceptions to these criteria are necessary due to, for example, incompatibility of plant structural configuration and location of radiation monitoring systems, and it can be shown that the criteria is overly conservative and/or the proposed exception does not jeopardize the safety-related or effective performance of the affected system. Any approved or disapproved request for an exception shall be technically supported and adequately documented.

7.1 Approved Exceptions

All exceptions approved prior to Revision 4 are incorporated or canceled by Revision 4.

8.0 REFERENCES

8.1 NRC Documents

NOTE

Contact Licensing to determine the revision of the NRC documents Watts Bar is committed to.

8.1.1 10 CFR 50 Appendix A, General Design Criteria (GDC) for Nuclear Power Plants:

GDC 2: Design Basis for Protection Against Natural Phenomena

GDC 19: Control Room

GDC 30: Quality of Reactor Coolant Pressure Boundary

GDC 60: Control of Releases of Radioactive Materials to the Environment

GDC 63: Monitoring of Fuel and Waste Storage

GDC 64: Monitoring Radioactivity Releases

8.1.2 10 CFR 50 Appendix I, Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion As Low As Practicable for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents

8.1.3 10 CFR 20:

Paragraph 20.1101(b): ALARA

Paragraph 20.1204: Determination of Internal Exposure

Paragraph 20.1301: Dose Limits for Individual Members of the Public

Paragraph 20.1302: Compliance With Dose Limits for Individual Members of the Public

Paragraph 20.1601, Control of Access to High Radiation Areas

Table 2 of Appendix B to 20.1001-20.2401: Annual Limits on Intake (ALIs) and derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage

8.1.4 10 CFR 100, Reactor Site Criteria

8.1.5 40 CFR 60:

Method 1 of Appendix A: Sample and Velocity Traverses for Stationary Sources

8.1 NRC Documents (continued)

Method 5 of Appendix A: Determination of Particulate Emissions from Stationary Sources

Spec. 2 of Appendix B: Performance Specification 2 - Specification and Test Procedures for SO_2 and NO_x Continuous Emission Monitoring Systems in Stationary Sources

8.1.6 NRC Regulatory Guide (RG) 8.8, Second Proposed Revision 4, Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable (ALARA)

8.1.7 NRC RG 1.21, Revision 1, Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light Water Reactors.

8.1.8 NRC RG 1.45, Guidance On Monitoring and Responding to Reactor Coolant System Leakage

8.1.9 NRC RG 1.53, Application of the Single Failure Criterion to Nuclear Power Generation Station Protection Systems

8.1.10 NRC RG 1.76, Design Basis Tornado For Nuclear Power Plants

8.1.11 NRC RG 1.97, Rev. 2, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

8.1.12 NRC NUREG 0133, Preparation of Radiological Technical Specification for Nuclear Power Plant

8.1.13 NRC NUREG 0696, Functional Criteria For Emergency Response Facilities

8.1.14 NRC NUREG 0737, R0, Clarification of TMI Action Plan Requirements

8.1.15 NRC NUREG-0800, Standard Review Plan

8.1.16 IE Information Notice 82-49, Correction for Sample Conditions For Air and Gas Monitoring.

8.2 Industry Standards

NOTE

Unless otherwise noted, use the latest issued revision of the industry standards.

8.2.1 ANSI A59.1, Nuclear Safety Related Cooling Water Systems for Nuclear Reactors

8.2.2 ANSI B40.1-1980, Gauges - Pressure Indicating Dial Type Elastic Element

8.2 Industry Standards (continued)

8.2.3 ANSI/ANS-HPSSC-6.8.1-1981, Location and Design Criteria for Area Radiation Monitoring Systems for Light Water Nuclear Plants

8.2.4 ANSI/ISA-S67.10, Sample-Line Piping and Tubing Standard for Use in Nuclear Power Plants

8.2.5 ANSI N13.1:

Section 4: Sampling From a Duct or Exhaust Stack

Appendix A: Guides for Sampling from Ducts and Stacks

Appendix B: Particle Deposition in Sample Lines

8.2.6 ANSI N18.2, Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants

8.2.7 ANSI N42.18-1974, American National Standard Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents

8.2.8 ANSI N320-1979, Performance Specification for Reactor Emergency Radiological Monitoring Instrumentation

8.2.9 IEEE 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations

8.2.10 IEEE 344-1971, Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

8.2.11 IEEE 344-1975, Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

8.2.12 ISA 57.3, Quality Standard for Instrument Air.

8.3 Design Criteria

NOTE

Use the latest issued revision of the design criteria documents.

8.3.1 TVA WB-DC-40-31.2, Seismic/Structural Qualification of Seismic Category I Electrical and Mechanical Equipment

8.3.2 TVA WB-DC-40-31.13, Seismic/Structural Qualification of Category I (L) Electrical and Mechanical Equipment

8.3.3 TVA WB-DC-40-31.7, Analysis of Category I and I (L) Piping Systems

8.3 Design Criteria (continued)

8.3.4 TVA WB-DC-40-31.9, Criteria for Design of Piping Supports and Supplemental Steel in Category I Structures

8.3.5 TVA WB-DC-30-7, Post Accident Monitoring Instrumentation

8.3.6 TVA WB-DC-30-4, Separation/Isolation

8.3.7 TVA WB-DC-30-5, Power, Control, and Signal Cables for Use in Category I Structures

8.3.8 TVA WB-DC-40-42, Environmental Design

8.3.9 TVA WB-DC-40-54, Environmental Qualification to 10 CFR 50.49

8.3.10 TVA WB-DC-40-36, The Classification of Piping, Pumps, Valves, and Vessels

8.3.11 TVA WB-DC-30-27, AC and DC Control Power Systems

8.3.12 TVA WB-DC-30-28, Low and Medium Voltage Power Systems

8.3.13 TVA WB-DC-30-32, Design Criteria For Grounding

8.3.14 TVA WB-DC-20-21, Miscellaneous Steel Components for Category I Structures

8.3.15 TVA WB-DC-20-1, Concrete Structure - General

8.3.16 TVA WB-DC-40-29, Flood Protection Provisions

8.3.17 TVA WB-DC-40-64, Design Basis Events Design Criteria

8.3.18 TVA WB-DC-30-16, Instrument Sensing Lines - Slope and Separation

8.3.19 TVA WB-DC-40-36.1, The Classification of Heating Ventilating and Air Conditioning Systems

8.3.20 TVA WB-DC-20-24, Dynamic Earthquake Analysis of Category I Structures and Earth Embankments

8.3.21 TVA WB-DC-20-32, Integrated Interaction Program Screening and Acceptance Criteria

8.3.22 TVA WB-DC-40-31.12, Seismic/Structural Qualification of Seismic Category I and I(L) In-Line Valves and Other In-Line Fluid System Components

8.4 System Descriptions

NOTE
Use the latest issued revision of the system descriptions.

8.4.1 N3-30AB-4001, Auxiliary Building Heating, Ventilation, Air Conditioning System

8.4.2 N3-30CB-4002, Control Building Heating Ventilating, Air Conditioning and Air Cleanup System

8.4.3 N3-30RB-4002, Reactor Building Ventilation System

8.4.4 N3-15-4002 Steam Generator Blowdown System

8.4.5 N3-77C-4001, Liquid Radwaste Processing System

8.4.6 N3-70-4002, Component Cooling System

8.4.7 N3-14-4002, Condensate Polishing Demineralizer System

8.4.8 N3-77A-4001, Gaseous Waste Disposal System

8.4.9 N3-65-4001, Emergency Gas Treatment System

8.4.10 WBN2-30RB-4002, Reactor Building Ventilation System

8.4.11 WBN2-15-4002, Steam Generator Blowdown System

8.4.12 WBN2-65-4001, Emergency Gas Treatment System

8.5 TVA Calculations

8.5.1 EPMCC022495, R7 (T93 100415 013) - Temperatures and Pressures of the Fluids Processed by the Off Line Detectors of the Radiation Monitoring System

8.5.2 WBNAPS3-048, R20 (T71 100702 808) - RG 1.97 Type E Variables - Range and Accuracy Requirements and Demonstrated Range

8.5.3 WBNTSR-062, R10 (T71 081124 801) - Requirements for the Containment Upper and Lower Compartment Radiation Monitors

8.5.4 WBNTSR-037, R2 (T71 100717 824) - Service Building Vent Monitor RE-90-132B Required Range and Accuracy

8.5.5 WBNTSR-028, R8 (T93 110412 001) - Main Control Room Normal Air Intake Radiation Monitors Required Range, Safety Limit, Maximum Allowable Response Time and Accuracy

8.5 TVA Calculations (continued)

8.5.6 WBNTSR-038, R8 (T95 090507 801) - Required Response Time, Range and Accuracy for the Containment Purge Exhaust Monitors

8.5.7 WBNTSR-043, R4 (T71 040614 803) - Required Range and Accuracy for the WBNP Airborne Particulate Radiation Monitors (APRM)

8.5.8 WBN-OSG4-095, R20 (T71 110823 810) - Selection Criteria for MOVs Requiring Thermal Overload Bypass and/or Torque Switch Bypas

8.5.9 WBNTSR-024, R4 (T71 001011 814) - Steam Generator Blowdown Monitors - RE-90-120, 121 Required Response Time, Range, and Accuracy Calculation

8.5.10 WBNTSR-033, R4 (T95 090520 801) - Waste Disposal System Liquid Effluent Monitor RE-90-122 Required Range, Accuracy and Response Time Calculation

8.5.11 WBNTSR-042, R1 (B26 950508 306) - Component Cooling System Monitor 0,1,2-RE-90-123 Required Range, Accuracy, Safety Limit and Response Time Calculation

8.5.12 WBNTSR-020, R7 (T71 070611 801) - Safety Limit for Spent Fuel Pool Radiation Monitors

8.5.13 WBNTSR-072, R1 - (B26 950213394) - Refined Requirements for the ERCW Discharge Radiation Monitors

8.5.14 WBNTSR-023, R6 (T71 021003 800) - Response Time, Range and Accuracy for the Spent Fuel Pool Radiation Monitors (TSFPRM)

8.5.15 WBNTSR-027, R6 (T71 090701 800) - Containment High Range Radiation Monitors

8.5.16 WBNTSR-031, R4 (T71 060912 808) - Turbine Building Sump Monitor RE-90-212 - Required Range, Accuracy and the Maximum Allowable Response Time Calculation

8.5.17 WBNTSR-034, R4 (T95 090507 802) - Condensate Demineralizer Effluent Monitor RE-90-225 - Required Range, Accuracy and the Maximum Allowable Response Time Calculation

8.5.18 WBNTSR-032, R3 (B26 000713 496) - Response Time, Safety Limit, Range and Accuracy for the Reactor Coolant Drain Tank

8.5.19 WBNTSR-029, R3 (B26 000713 497) - Response Time, Safety Limit, Range and Accuracy for the Reactor Building Floor & Equipment Drain Sump Radiation Monitors

8.5.20 WBNTSR-036, R5 (B26 000713 495) - Required Range and Accuracy for the Residual Heat Removal (RHR) Radiation Monitors

8.5 TVA Calculations (continued)

8.5.21 WBNTSR-040, R5 (T71 101110 800) - Required Response Time, Range and Accuracy for the Waste Disposal System (WDS) Gaseous Effluent Radiation Monitors

8.5.22 WBNTSR-044, R4 (T93 100415 012) - Required Range and Accuracy for the WBNP Area Radiation Monitors

8.5.23 WBNTSR-103, R3 (T95 080910 805) - Evaluation of 10 DAC-hr Detection Capability of the Auxiliary Building Exhaust Radiation Monitors

8.5.24 WBNTSR-060, R8 (T95 080918 814) - Analysis of Particle Transmission by Sample Lines for Watts Bar Units 1 and 2 System 90 Air Monitors

8.5.25 EPMAPA-111694, R6 (T93 110811 002) - Condenser Vacuum Pump Exhaust Line to Radiation Monitors -Condensation

8.5.26 EPMSKS-012095, R2 (T93 100713 002) - Aux Bldg Vent Sample Line to radiation Monitor - Potential for Condensation

8.5.27 EPMJK-111794, R1 (T71 100717 805) - Containment Lower and Upper Compartment Monitors Sample Tubing - Potential for Condensation

8.5.28 EPMSCS-013095, R3 (T93 100713 003) - Shield Building Exhaust Vent (SBEV) Radiation Monitors (RM) Sample Tubing - Potential for Condensation

8.5.29 WBNAPS3-052 R6 (T71 090604 805) - Minimum Detectable Leak Rate for the Steam Generator Blowdown System

8.5.30 WBNAPS3-053, R5 (T71 090604 802) - Steam Generator Leakage Detection With The Condenser Vacuum Pump Air Exhaust Monitor

8.5.31 WBNAPS3-054, R5 (T71 081124 800) - Reactor Coolant Leakage Detection With the Containment Lower Compartment Airborne Radiation Monitor

8.5.32 WBNTSR-108, R2 (T95 081007 811) - Evaluation of Sample Plateout With Reduced Flow

8.5.33 WBNTSR-066, R7 (T93 100310 012) - Design Flowrate for the Offline Liquid Radiation Monitors.

8.5.34 WBNTSR-009, R14 (T71 110920 801) - Control Room Operator and Offsite Doses From a Fuel Handling Accident

8.5.35 Calculation 1RE90120, R10, (T71 070810 807) - Demonstrated Accuracy Calculation for WBNP Liquid Effluent Compliance Radiation Monitors

8.5.36 Calculation WBPE0909002007, R8 (T71 101119 804) - Demonstrated Accuracy Calculation for Waste Disposal System Gas Effluent Radiation Monitor

8.5 TVA Calculations (continued)

8.5.37 WBNTSR115, R2 (T71 100824 801) - Radiological Emergency Plan Effluent Radiation Monitor EALs and Radiation Alert Levels

8.6 Other

8.6.1 Technical Specification Change TVA-WBN-TS-00-015, "Revision of Boron Concentration Limits and Reactor Core Limitations for Tritium Production Cores (TPCs)" (T04 010821 812).

8.6.2 TVA-NQA-PLN89-A, "Nuclear Quality Assurance Plan (NQAP) (Quality Assurance Program Description)" (Use the latest issued revision.)

9.0 TABLES

9.1 Table 9.0-1 - Radiation Monitoring Classification

TABLE 9.0-1
RADIATION MONITORING CLASSIFICATION

Tag No.	Service	Electrical Safety Class	Seismic Category of Detection Asmbly.	WB-DC-30-7 Cat./Type	Process Pipe or Duct Safety Class/ Seismic Category	Sample Line Safety Class/ Seismic Category
Particulate, Iodine, & Noble Gas Monitors:						
0-RE-90-101	Effluent	Non-1E (3)	I(L) (7)	2/E(1)	Q or S/Seismic I	C/Seismic I
1,2-RE-90-106*	Airborne	1E (5)	I(5)	N/A	N/A	(4)/Seismic I
1,2-RE-90-112	Airborne	1E (5)	I(5)	N/A	N/A	(4)/Seismic I
1,2-RE-90-119	Effluent	Non-1E (3)	Non-seismic	2/E	H/Non-seismic (2)	H/Non-seismic
0-RE-90-132	Effluent	Non-1E	Non-seismic (2)	N/A	Non-seismic (2)	H/Non-seismic
1,2-RE-90-400	Effluent	Non-1E (3)	I(L) (7)	2/C,2/E	Q or S/Seismic I	C/Seismic I
1-RE-90-404	Effluent	Non-1E (3)	Non-seismic (2)	2/E	H/Non-seismic (2)	H/Non-seismic
1,2-RE-90-402	Effluent	Non-1E	I(L) (7)	3/E	Q or S/Seismic I	C/Seismic I
*Monitor 1,2-RE-90-106 does not perform real time iodine monitoring, but does have an iodine filter.						
Tritium Samplers:						
0-SMPL-90-800	Effluent	Non-1E	I(L) (7)	N/A	Q or S/Seismic I	C/Seismic I
1-SMPL-90-801	Effluent	Non-1E	I(L) (7)	N/A	Q or S/Seismic I	C/Seismic I
2-SMPL-90-801	Effluent	Non-1E	I(L) (7)	N/A	Q or S/Seismic I	C/Seismic I
Off-line Gas Monitors:						
0-RE-90-125	Process	1E	I	N/A	Q or S/Seismic I	C/Seismic I
0-RE-90-126	Process	1E	I	N/A	Q or S/Seismic I	C/Seismic I
1,2-RE-90-130	Process	1E	I	N/A	Q or S/Seismic I	C/Seismic I
1,2-RE-90-131	Process	1E	I	N/A	Q or S/Seismic I	C/Seismic I
0-RE-90-205	Process	1E	I	N/A	Q or S/Seismic I	C/Seismic I
0-RE-90-206	Process	1E	I	N/A	Q or S/Seismic I	C/Seismic I
Off-line Liquid Monitors:						
1,2-RE-90-120, 121	Effluent	Non-1E	Non-seismic (2)	N/A	H/Non-seismic(2)	H/Non-seismic

9.1 Table 9.0-1 - Radiation Monitoring Classification (continued)

TABLE 9.0-1
RADIATION MONITORING CLASSIFICATION

Tag No.	Service	Electrical Safety Class	Seismic Category of Detection Asmbly.	WB-DC-30-7 Cat./Type	Process Pipe or Duct Safety Class/ Seismic Category	Sample Line Safety Class/ Seismic Category
0-RE-90-122	Effluent	Non-1E	I(L)	N/A	G/Seismic I(L)	G/Seismic I(L)
0-RE-90-123	Process	Non-1E	I(L)	N/A	C/Seismic I	C/Seismic I
1,2-RE-90-123	Process	Non-1E	I(L)	N/A	C/Seismic I	C/Seismic I
0-RE-90-133,140	Effluent	1E(5)	I(5 & 6)	2/E	C/Seismic I	C/Seismic I
0-RE-90-134,141	Effluent	1E(5)	I(5 & 6)	2/E	C/Seismic I	C/Seismic I
0-RE-90-225	Effluent	Non-1E	Non-seismic(2)	N/A	H/Non-seismic(2)	H/Non-seismic
<u>On/In-Line Monitor</u>:						
0-RE-90-102	Airborne	1E	I(5)	N/A	N/A	N/A
0-RE-90-103	Airborne	1E	I(5)	N/A	N/A	N/A
0-RE-90-212	Effluent	Non-1E	Non-seismic (2)	N/A	N/A	N/A
1,2-RE-90-421	Effluent	Non-1E (3)	I(L)	2/C,E	N/A	N/A
1,2-RE-90-422	Effluent	Non-1E (3)	I(L)	2/C,E	N/A	N/A
1,2-RE-90-423	Effluent	Non-1E (3)	I(L)	2/C,E	N/A	N/A
1,2-RE-90-424	Effluent	Non-1E (3)	I(L)	2/C,E	N/A	N/A
0-RE-90-118	Effluent	Non-1E (3)	I(L)	N/A	G/Seismic I(L)	N/A
2-RE-90-255	Effluent	Non-1E (3)	Non-seismic(2)	2/E	N/A	N/A
2-RE-90-256	Effluent	Non-1E (3)	Non-seismic(2)	2/E	N/A	N/A
<u>Area Type Monitors</u>:						
1,2-RE-90-001	Area	Non-1E	I(L)	N/A	N/A	N/A
1,2-RE-90-002	Airborne	Non-1E	I(L)	N/A	N/A	N/A
0-RE-90-003	Area	Non-1E	I(L)	N/A	N/A	N/A
0-RE-90-004	Area	Non-1E	I(L)	N/A	N/A	N/A
0-RE-90-005	Area	Non-1E	I(L)	N/A	N/A	N/A
1,2-RE-90-006	Area	Non-1E	I(L)	N/A	N/A	N/A
1,2-RE-90-007	Area	Non-1E	I(L)	N/A	N/A	N/A
1,2-RE-90-008	Area	Non-1E	I(L)	N/A	N/A	N/A

9.1 Table 9.0-1 - Radiation Monitoring Classification (continued)

TABLE 9.0-1
RADIATION MONITORING CLASSIFICATION

Tag No.	Service	Electrical Safety Class	Seismic Category of Detection Asmbly.	WB-DC-30-7 Cat./Type	Process Pipe or Duct Safety Class/ Seismic Category	Sample Line Safety Class/ Seismic Category
0-RE-90-009	Area	Non-1E	I(L)	N/A	N/A	N/A
1,2-RE-90-010	Area	Non-1E	I(L)	N/A	N/A	N/A
0-RE-90-011	Area	Non-1E	I(L)	N/A	N/A	N/A
1,2-RE-90-059	Area	Non-1E	I(L)	N/A	N/A	N/A
1,2-RE-90-060	Area	Non-1E	I(L)	N/A	N/A	N/A
1,2-RE-90-061	Area	Non-1E	I(L)	N/A	N/A	N/A
0-RE-90-135	Area	Non-1E	I(L)	2/D	N/A	N/A
0-RE-90-230	Area	Non-1E	Non-seismic(2)	N/A	N/A	N/A
0-RE-90-231	Area	Non-1E	Non-seismic(2)	N/A	N/A	N/A
1,2-RE-90-271	Airborne	1E	I	1/A,E;3/C	N/A	N/A
1,2-RE-90-272	Airborne	1E	I	1/A,E;3/C	N/A	N/A
1,2-RE-90-273	Airborne	1E	I	1/A,E;3/C	N/A	N/A
1,2-RE-90-274	Airborne	1E	I	1/A,E;3/C	N/A	N/A

Notes:

(1) Applies to Noble Gas Channel only.

(2) Turbine Building and Service Building are non-seismic, WB-DC-20-24 (Reference 8.3.20).

(3) Highly reliable power which is Non-1E, but is diesel backed.

(4) Class B between the containment isolation valves and Class C elsewhere.

(5) TVA design decision (see Section 3.0).

(6) Sample pumps included in this monitor assembly are only required to meet Seismic Category I(L) pressure boundary retention requirements.

9.1 Table 9.0-1 - Radiation Monitoring Classification (continued)

Notes:

(7) Radiation monitoring and associated flow monitoring and sample flow control equipment in the class "instrument" boundary (Reference WB-DC-40-36 Section 3.5) is connected to TVA class C sample lines. Fluid retaining portions within the instrument boundary are required to meet seismic category 1(L)B, position retention only. This is acceptable because these instruments are not required to perform a primary safety function. Loss of the Class C fluid is not a concern since the fluid is gaseous and is either connected to atmosphere, or discharges into the same ventilation system as does the air in the space surrounding the monitor. There are no spray concerns since the fluid is gaseous, and the fluid is not of a high enough temperature or pressure to adversely impact primary safety related equipment in the compartment. This meets the intent of R. G. 1.29 Section C.2.

9.2 Table 9.0-2 - Radiation Monitor Characteristics

TABLE 9.0-2
RADIATION MONITOR CHARACTERISTICS

Tag No.	Name	Monitor Service	Type of Channel and Detectors Type (5)	Readout		High Radiation Alarm Visual=V Audible=A		Required Range (Reference)	Required Accuracy (Reference)
				Local	Remote	Local	Remote		
Particulate Iodine & Noble Gas Monitors:									
0-RE-90-101	Auxiliary Building Ventilation	Effluent		No	Yes	None	V&A		
0-RE-90-101A			Particulate (B)(1)					8.5.2	8.5.2
0-RE-90-101B			Noble Gas (B)(1)					8.5.2	8.5.2
0-RE-90-101C			Iodine (G)(1)					8.5.2	8.5.2
1,2-RE-90-106	Containment Lower Compartment	Airborne		Yes	Yes	V&A	V&A		
1,2-RE-90-106A			Particulate (B)(2)(6)					8.5.3	8.5.3
1,2-RE-90-106B			Noble Gas (B)(2)(6)					8.5.3	8.5.3
1,2-RE-90-112	Containment Upper Compartment	Airborne		Yes	Yes	V&A	V&A		
1,2-RE-90-112A			Particulate (B)(2)(6)					8.5.3	8.5.3
1,2-RE-90-112B			Noble Gas (B)(2)(6)					8.5.3	8.5.3
1,2-RE-90-112C			Iodine (G)(2)(6)			None	None		
1,2-RE-90-119	Condenser Vacuum Pump Exhaust (Normal Range)	Effluent	Gas (B)(1)(6)	No	Yes	None	V&A	8.5.2	8.5.2
0-RE-90-132	Service Bldg Ventilation	Effluent		No	Yes	None	V&A		

9.2 Table 9.0-2 - Radiation Monitor Characteristics (continued)

TABLE 9.0-2
RADIATION MONITOR CHARACTERISTICS

Tag No.	Name	Monitor Service	Type of Channel and Detectors Type (5)	Readout		High Radiation Alarm Visual=V Audible=A		Required Range (Reference)	Required Accuracy (Reference)
				Local	Remote	Local	Remote		
0-RE-90-132B			Noble Gas (B)(2)					8.5.4	8.5.4
1,2-RE-90-400	Shield Bldg Vent	Effluent	Noble Gas (B,GM or Cd-Te)(3)	Yes	Yes	V&A	V&A	8.5.2	8.5.2
1,2-RE-90-402	Shield Bldg Vent	Effluent	N/A	N/A	N/A	N/A	N/A	8.5.2	8.5.2
1-RE-90-404	Condenser Vacuum Vent Accident Range	Effluent	Gas (GM)(1)	Yes	Yes	V&A	V&A	8.5.2	8.5.2
0-SMPL-90-800	Auxiliary Building Tritium Sampler	Effluent	N/A	*	N/A	N/A	N/A	N/A	N/A
1-SMPL-90-801	Unit 1 Shield Building Tritium Sampler	Effluent	N/A	*	N/A	N/A	N/A	N/A	N/A
2-SMPL-90-801	Unit 2 Shield Building Tritium Sampler	Effluent	N/A	*	N/A	N/A	N/A	N/A	N/A
			*Totalized Flow Only						
<u>Off-Line Gas Monitors</u>:									
0-RE-90-125	Main Control Room Normal Air Intake	Process	Gas (B)(2)	No	Yes	None	V&A	8.5.5	8.5.5
0-RE-90-126	Main Control Room Normal Air Intake	Process	Gas (B)(2)	No	Yes	None	V&A	8.5.5	8.5.5
1,2-RE-90-130	Containment Purge Air Exhaust	Process	Gas (B)(2)(6)	Yes	No	None	V&A	8.5.6	8.5.6
1,2-RE-90-131	Containment Purge Air Exhaust	Process	Gas (B)(2)(6)	Yes	No	None	V&A	8.5.6	8.5.6
0-RE-90-205	Main Control Room Emergency Air Intake	Process	Gas (B)(2)	No	Yes	None	V&A	8.5.5	8.5.5

9.2 Table 9.0-2 - Radiation Monitor Characteristics (continued)

TABLE 9.0-2
RADIATION MONITOR CHARACTERISTICS

Tag No.	Name	Monitor Service	Type of Channel and Detectors Type (5)	Readout		High Radiation Alarm Visual=V Audible=A		Required Range (Reference)	Required Accuracy (Reference)
				Local	Remote	Local	Remote		
0-RE-90-206	Main Control Room Emergency Air Intake	Process	Gas (B)(2)	No	Yes	None	V&A	8.5.5	8.5.5
Off-Line Liquid Monitors:									
1,2-RE-90-120, 121	Steam Generator Blowdown Liquid	Effluent	Liquid (G)(2)(6)	No	Yes	None	V&A	8.5.9	8.5.9
0-RE-90-122	Waste Disposal System Liquid	Effluent	Liquid (G)(2)	No	Yes	None	V&A	8.5.10	8.5.10
0-RE-90-123	Component Cooling System	Process	Liquid (G)(2)	No	Yes	None	V&A	8.5.11	8.5.11
1,2-RE-90-123A	Component Cooling System	Process	Liquid (G)(2)	No	Yes	None	V&A	8.5.11	8.5.11
0-RE-90-133,140	Essential Raw Cooling Water Effluent	Effluent	Liquid (G)(2)	No	Yes	None	V&A	8.5.13	8.5.13
0-RE-90-134,141	Essential Raw Cooling Water Effluent	Effluent	Liquid (G)(2)	No	Yes	None	V&A	8.5.13	8.5.13
0-RE-90-225	Condensate Demineralizer Regenerant Waste Discharge	Effluent	Liquid (G)(2)	No	Yes	None	V&A	8.5.17	8.5.17
On/In-Line Monitors:									
0-RE-90-102	Spent Fuel Pool Area Accident Monitor	Airborne	Area (GM)(4)	No	Yes	None	V&A	8.5.14	8.5.14
0-RE-90-103	Spent Fuel Pool Area Accident Monitor	Airborne	Area (GM)(4)	No	Yes	None	V&A	8.5.14	8.5.14

9.2 Table 9.0-2 - Radiation Monitor Characteristics (continued)

TABLE 9.0-2
RADIATION MONITOR CHARACTERISTICS

Tag No.	Name	Monitor Service	Type of Channel and Detectors Type (5)	Readout		High Radiation Alarm Visual=V Audible=A		Required Range (Reference)	Required Accuracy (Reference)
				Local	Remote	Local	Remote		
0-RE-90-212	Turbine Building Sump Discharge Monitor	Effluent	Liquid (G)(2)	Yes	No	V&A	V&A	8.5.16	8.5.16
2-RE-90-255	Condenser Vacuum Vent Accident Mid Range	Effluent	Gas (GM)(1)	No	Yes	None	V&A	8.5.2	8.5.2
2-RE-90-256	Condenser Vacuum Vent Accident High Range	Effluent	Gas (IC)(1)	No	Yes	None	V&A	8.5.2	8.5.2
1,2-RE-90-421	Main Steam Line	Effluent	Area (IC)(1)	No	Yes	No	V&A	8.5.2	8.5.2
1,2-RE-90-422	Main Steam Line	Effluent	Area (IC)(1)	No	Yes	No	V&A	8.5.2	8.5.2
1,2-RE-90-423	Main Steam Line	Effluent	Area (IC)(1)	No	Yes	No	V&A	8.5.2	8.5.2
1,2-RE-90-424	Main Steam Line	Effluent	Area (IC)(1)	No	Yes	No	V&A	8.5.2	8.5.2
0-RE-90-118	Waste Disposal System Gas Effluent	Effluent	In-line (B)(4)	Yes	Yes	V&A	V&A	8.5.21	8.5.21
<u>Area Type Monitors</u>:									
1,2-RE-90-001	Spent Fuel Pool Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
1,2-RE-90-002	Personnel Lock	Airborne	Area (IC)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
0-RE-90-003	Waste Packaging Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
0-RE-90-004	Decontamination Room	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
0-RE-90-005	Spent Fuel Pool Pumps Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
1,2-RE-90-006	Component Cooling Heat Exchanger Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22

9.2 Table 9.0-2 - Radiation Monitor Characteristics (continued)

TABLE 9.0-2
RADIATION MONITOR CHARACTERISTICS

Tag No.	Name	Monitor Service	Type of Channel and Detectors Type (5)	Readout		High Radiation Alarm Visual=V Audible=A		Required Range (Reference)	Required Accuracy (Reference)
				Local	Remote	Local	Remote		
1,2-RE-90-007	Sample Room	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
1,2-RE-90-008	Aux FW Pump Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
0-RE-90-009	Waste Evap Condensate Tank Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
1,2-RE-90-010	CVCS Board Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
0-RE-90-011	Containment Spray & RHR Pump Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
1,2-RE-90-059	RB Upper Compartment	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
1,2-RE-90-060	RB Upper Compartment	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
1,2-RE-90-061	RB Lower Compartment Instrument Room	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
0-RE-90-135	Main Control Room	Area	Area (GM)(4)	No	Yes	None	V&A	8.5.22	8.5.22
0-RE-90-230	Condensate Demin Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
0-RE-90-231	Condensate Demin Area	Area	Area (GM)(4)	Yes	Yes	V&A	V&A	8.5.22	8.5.22
1,2-RE-90-271	RB Upper Compartment PAM	Airborne	Area (IC)(1)	No	Yes	None	V&A	8.5.2	8.5.2
1,2-RE-90-272	RB Upper Compartment PAM	Airborne	Area (IC)(1)	No	Yes	None	V&A	8.5.2	8.5.2
1,2-RE-90-273	RB Lower Compartment PAM	Airborne	Area (IC)(1)	No	Yes	None	V&A	8.5.2	8.5.2

9.2 Table 9.0-2 - Radiation Monitor Characteristics (continued)

TABLE 9.0-2
RADIATION MONITOR CHARACTERISTICS

Tag No.	Name	Monitor Service	Type of Channel and Detectors Type (5)	Readout		High Radiation Alarm Visual=V Audible=A		Required Range (Reference)	Required Accuracy (Reference)
				Local	Remote	Local	Remote		
1,2-RE-90-274	RB Lower Compartment PAM	Area	Area (IC)(1)	No	Yes	None	V&A	8.5.2	8.5.2

Notes:

(1) Calculation WBNAPS3-048 (Reference 8.5.2)

(2) General Atomics Calibration Reports E-115-388, E-199-349, E-199-352, E-115-59 and E-199-35

(3) Eberline Calibration Data and System Specific Information Manual, contract number 83X62-829854

(4) Radiation Monitoring System for TVA E-199-263, Oct. 1975, pp 1-2,3

(5) G = Gamma Scintillator GM = Geiger Muller Cd-Te = Cadmium Telluride
B = Beta Scintillator IC = Ionization Chamber

(6) General Atomics Calibration Reports E-115-789 Rev. 3, E-115-789-1SP Rev. 2, E-115-791 Rev. 2, E-115-647 Rev. 6, E-115-0904 Rev. B

9.3 Table 9.0-3 - Radiation Monitors that Initiate Automatic Control Functions

TABLE 9.0-3
RADIATION MONITORS THAT INITIATE AUTOMATIC CONTROL FUNCTIONS

Tag No.	Name	Sample Fluid	Channel Type	Monitor Function	Control Function	Response Time Reference
Off-Line Gas Monitors:						
0-RE-90-125	Main Control Room Normal Air Intake	Air	Off-line Gas	Continuously measures normal ventilation air intake into Control Room	Initiates Control Room isolation	8.5.5
0-RE-90-126	Main Control Room Normal Air Intake	Air	Off-line Gas	Continuously measures normal ventilation air intake into Control Room	Initiates Control Room isolation	8.5.5
1,2-RE-90-130	Containment Purge Air Exhaust	Air	Off-line Gas	Measures Containment Bldg. releases to environment	Initiates containment ventilation isolation. Also isolates Aux. Bldg. ventilation exhaust & causes startup of ABGTS during refuel operations.	8.5.6
1,2-RE-90-131	Containment Purge Air Exhaust	Air	Off-line Gas	Measures Containment Bldg. releases to environment	Initiates containment ventilation isolation. Also isolates Aux. Bldg. ventilation exhaust & causes startup of ABGTS during refuel operations.	8.5.6
Off-Line Liquid Monitors:						
1,2-RE-90-120 -121	Steam Generator Blowdown Liquid	Water	Off-line Liquid	Measures releases to environment	Terminates release and diverts flow to condensate system	8.5.9
0-RE-90-122	Waste Disposal System Liquid	Water	Off-line Liquid	Measures releases to environment	Terminates discharge from liquid waste tanks	8.5.10
0-RE-90-123	Component Cooling System	Water	Off-line Liquid	Measures component cooling system activity	Closes component cooling surge tank vent valve	8.5.11

9.3 Table 9.0-3 - Radiation Monitors that Initiate Automatic Control Functions (continued)

TABLE 9.0-3
RADIATION MONITORS THAT INITIATE AUTOMATIC CONTROL FUNCTIONS

Tag No.	Name	Sample Fluid	Channel Type	Monitor Function	Control Function	Response Time Reference
1,2-RE-90-123A	Component Cooling System	Water	Off-line Liquid	Measures component cooling system activity	Closes component cooling surge tank vent valve	8.5.11
0-RE-90-225	Condensate Demineralizer Regenerant Waste Discharge	Water	Off-line Liquid	Measures condensate demineralizer regenerant effluent activity	Terminates discharge to Cooling Tower blowdown	8.5.17
<u>On/In-line Monitors</u>:						
0-RE-90-102	Spent Fuel Pool Area Accident Monitor	N/A	Area	Monitors Spent Fuel Pool for fuel damage	Isolates Auxiliary Bldg. ventilation exhaust and causes startup of ABGTS. Also initiates containment vent isolation during refuel operations.	8.5.14
0-RE-90-103	Spent Fuel Pool Area Accident Monitor	N/A	Area	Monitors Spent Fuel Pool for fuel damage	Isolates Auxiliary Bldg. ventilation exhaust and causes startup of ABGTS. Also initiates containment vent isolation during refuel operations.	8.5.14
0-RE-90-118	Waste Disposal System Gas Effluent	Air	In-line Gas	Continuously monitors gaseous release from waste gas decay tanks	Terminates release from the waste gas decay tanks	8.5.21

9.4 Table 9.0-4 - Radiation Monitoring Functions

TABLE 9.0-4
RADIATION MONITORING FUNCTIONS

Tag No.	Service	Primary Safety Function (2)	RG 1.97 Post Accident Monitoring Function	High Alarm Safety Limit Reference (3)
Particulate, Iodine, & Noble Gas Monitors:				
0-RE-90-101	Effluent	No	Yes	ODCM
1,2-RE-90-106	Airborne	No(4)	No	8.5.3
1,2-RE-90-112	Airborne	No(4)	No	8.5.3
1,2-RE-90-119	Effluent	No	Yes	ODCM
0-RE-90-132	Effluent	No	No	ODCM
1,2-RE-90-400	Effluent	No	Yes	ODCM
1,2-RE-90-402	Effluent	No	Yes	N/A
1-RE-90-404	Effluent	No	Yes	8.5.37
Off-Line Gas Monitors:				
0-RE-90-125	Process	Yes	No	8.5.5
0-RE-90-126	Process	Yes	No	8.5.5
1,2-RE-90-130	Process	Yes	No	8.5.6, ODCM
1,2-RE-90-131	Process	Yes	No	8.5.6, ODCM
0-RE-90-205	Process	Yes	No	8.5.5
0-RE-90-206	Process	Yes	No	8.5.5
Continuous Tritium Sampler:				
0-SMPL-90-800	Effluent	No	No	N/A
1,2-SMPL-90-801	Effluent	No	No	N/A
Off-Line Liquid Monitors:				
1,2-RE-90-120,121	Effluent	No	No	ODCM
0-RE-90-122	Effluent	No	No	ODCM
0-RE-90-123	Process	No	No	8.5.11
1,2-RE-90-123A	Process	No	No	8.5.11
0-RE-90-133,140	Process	No(4)	Yes	8.5.13
0-RE-90-134,141	Process	No(4)	Yes	8.5.13
0-RE-90-225	Effluent	No	No	ODCM
On/In-Line Monitors:				
0-RE-90-102	Airborne	Yes	No	8.5.12
0-RE-90-103	Airborne	Yes	No	8.5.12
0-RE-90-118	Effluent	No	No	8.5.21
0-RE-90-212	Effluent	No	No	ODCM
2-RE-90-255	Effluent	No	Yes	8.5.37
2-RE-90-256	Effluent	No	Yes	8.5.37
1,2-RE-90-421	Effluent	No	Yes	(3)
1,2-RE-90-422	Effluent	No	Yes	(3)

9.4 Table 9.0-4 - Radiation Monitoring Functions (continued)

TABLE 9.0-4
RADIATION MONITORING FUNCTIONS

Tag No.	Service	Primary Safety Function (2)	RG 1.97 Post Accident Monitoring Function	High Alarm Safety Limit Reference (3)
1,2-RE-90-423	Effluent	No	Yes	(3)
1,2-RE-90-424	Effluent	No	Yes	(3)
Area Type Detectors:				
1,2-RE-90-001	Area	No	No	BY RADCON
1,2-RE-90-002	Airborne	No	No(1)	BY RADCON
0-RE-90-003	Area	No	No	BY RADCON
0-RE-90-004	Area	No	No	BY RADCON
0-RE-90-005	Area	No	No	BY RADCON
1,2-RE-90-006	Area	No	No	BY RADCON
1,2-RE-90-007	Area	No	No	BY RADCON
1,2-RE-90-008	Area	No	No	BY RADCON
0-RE-90-009	Area	No	No	BY RADCON
1,2-RE-90-010	Area	No	No	BY RADCON
0-RE-90-011	Area	No	No	BY RADCON
1,2-RE-90-059	Area	No	No	BY RADCON
1,2-RE-90-060	Area	No	No	BY RADCON
1,2-RE-90-061	Area	No	No	BY RADCON
0-RE-90-135	Area	No	Yes	BY RADCON
0-RE-90-230	Area	No	No	BY RADCON
0-RE-90-231	Area	No	No	BY RADCON
1,2-RE-90-271	Airborne	Yes	Yes	8.5.15
1,2-RE-90-272	Airborne	Yes	Yes	8.5.15
1,2-RE-90-273	Airborne	Yes	Yes	8.5.15
1,2-RE-90-274	Airborne	Yes	Yes	8.5.15

Notes:

(1) Provides backup post-accident monitor capability, not required by WB-DC-30-7 (Reference 8.3.5).

(2) This column represents only primary safety related functions as defined in Section 3.0.

(3) See also the applicable setpoint and scaling documents.

(4) See discussion in text regarding safety related, seismic, and electrical power classifications in the Q-List and in Table 9.0-1.

Source Notes
(Page 1 of 1)

Source Note Number	Source Note Tracking Number/Document	Applicable Sections/Summary
1	CATD 22911-WBN-01	Various - Not Specifically Noted
2	NCO850404193	3.1.4B, 3.1.4C, 3.1.4E -Automatic Termination of Liquid Discharges
3	NCO850404354	3.1.2B, 3.1.2C -Requirement for Radiation Monitors in Control Building Air Intake
4	NCO850404213	3.1.5D -High Range Radiation Monitors in Upper and Lower Compartments
5	NCO820253045	3.1.5D -Containment High Range Monitor
6	NCO850404214	3.1.5D -High Range Radiation Monitors in Upper and Lower Containment
7	NCO890112037 and MSC-04387	1.0 -Revise Design Criteria to Establish Design Basis
8	NCO850192001	3.1.1B, 3.1.1C, 3.1.1E, 3.1.1F, 3.1.1G, 3.1.2D, 3.1.6B -Provide Capabilities for Continuous Collection of Effluents (Gaseous) When Exhaust Flows Occur
9	NCO920054491	3.1.6C -Provide Radiation Monitors Around Fuel Storage Area
10	50.55(e) 390/86-49	Various - not specifically and 391/86-46 noted