EALs	Calculation	Revision	Status
RU1.1 RA1.1 RS1.1 RG1.1	NE-02-09-12 - CGS Emergency Action Levels (EALs) Technical Bases	Rev. 3	Dated 3/30/15

ENERGY NORTHWEST
CALCULATION COVER SHEET

EC Page

Equipment Piece No.
FW-SOFT-TECH-RASCAL; FW-SOFT-COTS-URI

Page 1.000 | Cont'd on Page 1.001

PRM-RE-1A; PRM-RE-1B; PRM-RE-1C;PRM-RR-3

TEA-RE-13; TEA-RIS-13

WEA-RE-14; WEA-RIS-14

SW-RIS-604; SW-RIS-605; SW-RE-4; SW-RE-5

FDR-RIS-606; FDR-RE-6

TSW-RIS-5; TSW-RIT-5; TSW-RE-5

Discipline: NUCLEAR

Calculation No.: NE-02-09-12

Quality Class: II+

Remarks

TITLE/SUBJECT/PURPOSE

Title/Subject
CGS EMERGENCY ACTION LEVELS (EALs) TECHNICAL BASES

Purpose
PPM 13.1.1A provides the technical bases for emergency classificaiton per PPM 13.1.1 and the Emergency Plan. This calculation derives selection of EAL values using the design database, QAR records and regulatory correspondence and is intended to be the source reference in PPM 13.1.1A for these EALs.

CALCULATION REVISION RECORD

REV NO.	STATUS/ F,P, OR S	REVISION DESCRIPTION	INITIATING DOCUMENTS
0	F	INITIAL ISSUANCE	AR 00184268-06
1	F	Document basis for NRC approved NUMARC/NESP-007 EALs and update to current configuration per CR 244578; void rev 0 license withdr	CR 00244578, CR 00247379-01, CR 00246173-
2	F	CMR 0000010715, CMR 0000011948, CMR 0000012565	CR00257071, CR00251948, CR00260848, AR00268160,
3	F	Incorporate CMR 13192. Software update URI replaces QEDPS	AR 319446-04

PERFORMANCE/VERIFICATION RECORD

REV NO.	PERFORMED BY/DATE	VERIFIED BY/DATE	OWNER'S REVIEW BY/DATE	APPROVED BY/DATE
0	SJ Rejniak 12/28/09	LS Woosley 12/29/09	N/A	MA Armenta 12/30/09
1	LS Woosley 8/9/11	JD Fisher 9/9/11	N/A	JL Tansy 11/08/11
2	JD Fisher 2/4/14	LS Woosley 2/4/14	N/A	MJ Kennedy 2/5/14
3	LS Woosley 3/29/15	JD Fisher 3/30/15	N/A	MJ Kennedy 3/30/15

* Study Calculations shall be used only for the purpose of evaluating alternate design options or assisting the engineer in performing assessments.

ENERGY NORTHWEST
CALCULATION REVISION SUMMARY

Page	Cont'd On Page
1.001	1.100

Calculation No.
NE-02-09-12

Prepared By/Date	Verified by/Date	Revision No.
LS Woosley 2/2/15	JD Fisher 2/12/15	3

REVISION NO.	REVISION SUMMARY
0	PPM 13.1.1A provides the technical bases for emergency classification per PPM 13.1.1 and the Emergency Plan. The revision 0 of this calculation contained a vendor calculation, and documented assumptions, calculations and results for the gaseous monitor parameter values used to establish the CGS site specific Radiological Effluent Emergency Action Level values implementing the guidance of NEI 99-01 Revision 5.
1	Revision 1 voids the vendor calculation because adoption of NEI 99-01 Revision 5 was withdrawn from NRC review. Correct PRM-RE-1A calibration factor in QEDPS per CR 246173.
2	Resolution of CRs CR00257071, CR00251948, CR00260848, AR00268160, CR00281061, CR00301589 and incorporation of CMRs 10715, 11948, and 12565.
3	Update Table 3 values using new URI-RASCAL software, replacing QEDPS/EDPS. Incorporate CMR 13192. Update calculation forms; since every single page of the calculation has the forms updated, software cases rerun and the content manipulated, there are no revision bars.

ENERGY NORTHWEST
CALCULATION INDEX

Page	Cont'd on Page
1.100	1.200

Calculation No.
NE-02-09-12

Revision No.
3

ITEM	PAGE NO. SEQUENCE	
Calculation Cover Sheet	1.000 -	& 1.001
Calculation Index	1.100 -	
Verification Checklist for Calculations and CMR's	1.200 -	1.208
Calculation Reference List	1.300 -	1.303
Calculation Output Interface Documents Revision Index	1.400 -	
Calculation Output Summary	2.000 -	2.001
Calculation Method	3.000 -	3.002
Sketches	4.000 -	
Manual Calculation	5.000 -	5.016

APPENDICES:

Computer runs URI Rascal dose assessment runs	Appendix	A	150	Pages
	Appendix	B		Pages
	Appendix	C		Pages
Support Calculations	Appendix	D	112	Pages
	Appendix			Pages
	Appendix			Pages
Historical information	Appendix	H	156	Pages
	Appendix			Pages
	Appendix			Pages

ENERGY NORTHWEST
VERIFICATION CHECKLIST FOR CALCULATIONS AND CMRs

Page	Cont'd On Page
1.200	1.201

Calculation/CMR NE-02-09-12 **Revision** 003

was verified using the following methods:

☒ Checklist Below ☐ Alternate Calculation(s)

Checklist Item	Verifier Initials
Clear statement of purpose of analysis	JR
Methodology is clearly stated, sufficiently detailed, and appropriate for the proposed application.	JDF
Is raw data (PDIS) being used as a calculation/CMR input? ☐ Yes ☒ No	JDF
If yes, ensure the data was adequately validated (ref. DES-4-1 step 2.3).	JDF
Does the analysis/calculation result require revising any existing output interface document as identified in DES 4-1, Attachment 7.3? ☒ Yes ☐ No	JDF
If yes, ensure that the appropriate actions are taken to revise the output interface document per DES-4-1, Section 3.1.8. (i.e., document change is initiated in accordance with applicable procedures.)	JDF
Does the Calculation's Summary of Results (or CMR's Predicted Results) include a discussion of available margin? ☐ Yes ☐ No ☒ Not Applicable	JDF
Logical consistency of analysis	JF
• Completeness of documenting references	JDF
• Completeness of input	JDF
• Accuracy of input data	JDF
• Consistency of input data with approved criteria	JDF
• Completeness in stating assumptions	JDF
• Validity of assumptions	JDF
• Calculation sufficiently detailed	JDF
• Arithmetical accuracy	JDF
• Physical units specified and correctly used	JDF
• Reasonableness of output conclusion	JDF
Supervisor independency check (if acting as Verifier)	N/A
- Did not specify analysis approach - Did not rule out specific analysis options - Did not establish analysis inputs	N/A
If a computer program was used:	
- Is the program appropriate for the proposed application? ☒ Yes ☐ No	JDF
- Have the program error notices been reviewed to determine if they pose any limitations for this application? ☒ Yes ☐ No	JDF
- Is the program name, revision number, and date of run inscribed on the output? ☒ Yes ☐ No	JDF
- Is the program identified on the Calculation Method Form? ☒ Yes ☐ No	JDF
If so, is it listed in the Software Catalog or if the software is used for calculations completed by vendors is it done under an approved (10 CFR Appendix B) software program? ☒ Yes ☐ No	JDF

ENERGY NORTHWEST
VERIFICATION CHECKLIST FOR CALCULATIONS AND CMRs

Calculation/CMR NE-02-09-12 **Revision** 003

Checklist Item	**Verifier Initials**
If a CMR or calculation revision was prepared against calculation E/I-02-90-01:	
- Verify that manual calculations agree with automatic calculations on rows with modified input data.	N/A
- Verify that changes in loading are reflected at the upstream load centers.	N/A
- Verify that other calculation cells have been checked as deemed appropriate by the verifier using manual calculations to assure accuracy has been maintained.	N/A
- Discussion of Results/Conclusions are still valid after calculation update. (i.e., bus & transformer rating not exceeded, etc.)	N/A
If the calculation involves an instrument, verify that the calculated values are within the instrument display range..... {AR-244578}	JDF

Other elements considered:	**Verifier Initials**

Based on the above, the Calculation/CMR is adequate for the purpose intended.

Verifier(s) Print Name/Signature/Date JDF 3/31/15	**Verifier Initials**
JD Fisher JDF 3/30/15 3/31/2015	JDF

#	Verifier Comment	Preparer Response
1.	p. 2.0, refers to supporting information contained in a previous revision. That information needs to be retained in the current revision to be used in the calculation output. "and variations in the dose output with the variation allowed in input range was evaluated in the previous revision."	We started this rev by saying how we should reduce the math to one page and reduce the rest to historical stuff available in passport. Will readjust which components are part of this revision and are rerun with URI.
2.	p. 3.001 Cont'd On Page is 4.000. It should be 3.002	ok
3.	p. 4.0 refers to QEDPS. The figure should be updated to URI or annotated.	I can't edit it, so it was deleted.
4.	p. 2.0 refers to Appendices A, B and C which do not exist in this revision and cannot, therefore, be calculation output. Recommend removing the discussion of previous revision content or retaining that content and justifying its applicability to a URI based Table 3.	Appendix A is attached. Appendices B & C are not needed.
5.	p.2.0 The QEDPS sensitivity study in Appendix D that forms the basis for the PPM limits on background variation needs to be updated for URI and spreadsheet tabs cal range and PPM INPUT updated.	I updated the table on page D.1 and pages D.70-D.71.
6.	p. 1.4 PPM 5.4.1 and SAG2 Table 26 need to be listed the output revision index Table 2 changed and the GE column is used per p. 2.001.	Ok
7.	p. 2.001 Error! Bookmark not defined. Appears twice. FDR results need to be re-linked to footnote 1.	It is your form. Will delete the link.
8.	p. 2.001 references pp. 5.008 and 5.023 as the sources for Tables 1 and 2. These are not correct. p. 5.012 contains tab FINAL but incorrectly reports the results for Table 2; it should have Table 1 results. Table 1 does not appear to be documented in the spreadsheet since tab EP EALs was not updated to provide Table 2 values.	I can't follow so you will have to show me. Perhaps my editing up to this point has moved enough things to prevent following the issue.
9.	p. 3.0 Unverified Program box needs to be checked.	Software is classified as "commercial off the shelf" which does not need to be verified beyond functionality check.
10.	p. 3.0 The method discusses benchmarking the current model against the 1994 results, but tab 1994 was not included in this revision. Discussion of the benchmark of URI needs to be added and	Will think about it consistent with #1 response. I have edited the method section so see if it is sufficient.

#	Verifier Comment	Preparer Response
	the benchmarking against 1994 updated. "The calculation in the body of this document is validated by reproducing the results from the 1994 certification package [reference 12] and then updating the input parameters for the current plant configuration:"	
11.	Reconstruction of the basis is no longer present in the calculation and does not appear to be needed since Appendix H contains the 1994 method. Recommend deleting: "The details of the method used to reconstruct the basis, with spreadsheet names and considerations, are presented on pages 5.000-5.001."	consistent with #1 response, discussion does explain the steps in how the calculation was derived, but there is more text saying when the spreadsheet pages are no longer needed.
12.	p. 3.0 FW-SOFT-COTS-URI v2.0.0 is not listed in the software catalog, which lists v1.1.	What EP wants is what was used. Sid Bauman's version number disagrees with Gary Ash's EPN number but neither are within my control.
13.	p. 3.001 the change in method to URI is noted but the basis for the methodology change is not provided. Please document or reference the technical basis for URI and provide justification for the change in method, e.g. it's within a small factor of QEDPS results.	SVVR added to the references.
14.	Please annotate URI printouts per DES-4-1. You might want to move these to Appendix A, since your can't have a cover page easily in Part 5 and marking each "run" separately is tedious. **INCLUDE** the software name, revision number, and date of run on the first page of the computer output or computer output cover page.	See Appendix A Software output labeled appropriately.
15.	p. 3.002 Pathway O discussion does not explain why QEDPS and URI are different. MAN-QEDPS-01 does not indicate that suppression pool scrubbing is modeled. Containment reduction factors for QEDPS are much larger for the first 3 hours in QEDPS ~1.75 times larger. The stack monitor response factors are different in URI. SGT filtration is less efficient than QEDPS. Recommend deleting the Path O discussion. Path J appears consistent with QEDPS based on the user manual.	ok
16.	p. 3.002 Software notes does not mention WEA or TEA monitored paths selected. Please add.	Will do that with pathway selection and flow rate for each EAL.

#	Verifier Comment	Preparer Response
17.	p. 5.00, Item 2 use of the QEDPS default flow rates becomes problematic when QEDPS is retired. Rev 2 page 5.0 provides an approach.	Added input selection table
18.	Please justify or correct the default flow rates in URI for SGT, WEA and TEA. They are not specified in NE-02-10-05.	I don't have the power to do either. I can declare what I used in the input/output section 5, and fill in the table intended for that purpose, with source references.
19.	p. 5.0 Error! Bookmark not defined. Appears under Item 5. Assumptions and References are missing as a result.	Will delete link.
20.	p. 5.0 Item 5.d, discusses QEDPS usage; it should discuss URI usage since the monitor scaling is completely different.	Edited
21.	p. 5.0 footnote 1 discusses QEDPS output. Update to URI output. Ref 83 should be Rev 2 and the output interface discussion in the footnote deleted.	Footnote was supposed to be on page 3.000 or so and migrated when the form was changed. Has been deleted.
22.	p. 5.001 Output interfaces are not numbered and Ref # is not filled in.	Edited.
23.	p. 5.001 Emergency Plan Table 1 (updated Table 3) does not exist. Table 3 is present in 13.1.1 and 1A but not EP-01. Output not needed.	Deleted.
24.	pp. 5.0 – 5.001 What is meant by LBD in LBD data source. In the Outputs, most items in that column are not licensing basis documents.	Edited.
25.	p. 5.002 Emergency Plan Table 3 should be PPM 13.1.1A Table 3 since EP-01 no longer contains a copy of Table 3.	Deleted per comment 23.
26.	P. 5.3 Assumption 2 should be applicable since NE-02-10-05 references NE-02-09-12 as the source for background in URI.	Edited.
27.	Assumption 3 supports BKGD shading of the URI derived EAL draft column. The greyed out text needs to be updated to reflect URI. It would be easier to annotate BKGD instead of having an assumption.	Ok
28.	Assumption 9 is not consistent with the results reported on p. 2.001 in Tables 1 and 2. Assumption 9 defines a factor of 10 as the acceptance criteria for EAL selection and applies 50% of that or a factor of 5 as the analytical limit.	We are using assumption 9A. Will use a goal of factor of 10 and factor of 2 or 3 satisfies 50.54(q) screening criteria.

#	Verifier Comment	Preparer Response
	The analytical limit should be reduced to a factor of 2 or 3, based upon the design limit in NE-02-10-05 for QEDPS v. URI. Determine whether the Alternate Assumption 9 can be eliminated if the factor of 2 or 3 satisfies 50.54(q) screening criteria. The results reported in p. 2.001 appear to be already applying this logic—i.e., the exact 1000 mrem results are reported in Table 1 and the rounded, within some dose factor are reported in Table 2. This is the opposite of the current Assumption 9, which would report the exact results in Table 2.	
29.	p. 5.5 Assumption 9 needs to be updated for URI; it still refers to QEDPS. LDCN-EP-023 should be LDCN-EP-11-023 in the Justification.	Ok
30.	p. 5.6 needs to be updated for URI. QEDPS is referenced. Steps 1 and 2 were not included in Rev 3. In order to use URI, without maintaining QEDPS as the basis code, the calculations in Step 1 need to be repeated with URI and compared to the 1994 EALs. Recommend not retaining the 1SGT case and going directly to NEW since we don't need to reverse engineer the 1994 results, having them in Appendix H now. Steps 2 and 3 could be combined.	Yes, because that was how it was developed. Is this direction to change history? You are correct, did not include those steps in this version. Sufficient explanation exists for the pages that are included to follow what was done. Agree… didn't keep that 1SGT page (says "historical – do not use"), and did start with the NEW page.
31.	p. 5.6 Step 4 should be incorporated into Input Item 5 (p5.0). The stack monitor calibration factors used in URI need to be explained as well as tied back to CR 244578. p. 5.11 should be updated to use the monitor detection efficiency used in URI, not the IMDS value.	Used in cal range page. ok
32.	p. 5.7 background discussion needs to be included under Input 3 p. 5.0. The 1A gain discussion under Input 5.	Understand this is direction to remove the contents of assumption
33.	p. 5.7 Step 5 is not relevant to URI. Step 6 refers to lower limit of detection. MDL is the	Ok

#	Verifier Comment	Preparer Response
	term used on p. 5.11.	
34.	Step 7 should be replaced with p 5.3 from CMR 12865. Photos are not good design references.	There is no 5.3, only …4,5,6,7, then 5.23, 5.24...
35.	Steps 8 and 9 do not exist in Rev 3. Do we need them?	no
36.	p. 5.9 recommend using hidden text rather than gray for 1C UE. It looks like poor printing rather than info not used. Deleting the cells would also work.	ok
37.	p. 5.9 URI page numbers need to be added for 1C and WEA/TEA results reported.	done
38.	p. 2.1 The 1B UE in both tables does not match p. 5.12. The UE should not be affected by URI.	Agree. Calculated then picked the bounding, but I can just remove it.
39.	p. 5.12 does not report dose results consistent with the EAL 1.77 mrem should be divided by 3 for comparison to the UE dose rate from 13.1.1A Table 4.	5.12 is page FINAL; I did not change that case from previous rev. see sheet NEW for comparison to values that were altered. Method same, just ran with same input.
40.	pp. 5.9 and 5.12 the results are not reported in a manner consistent with the EAL limits in Assumption 9. The units should be mrem/hr, not mrem or mrem/3hr. The URI results need to be divided by the release duration.	ok
41.	p. 5.009 reports dose results but the URI cases are not documented in the calculation. Please add the missing cases.	You just complained about one of those in comment #39.
42.	Selection of the Rx Bldg HUT needs to be discussed under INPUT or Assumptions and justification for the selection provided. This feature was not available in QEDPS and it is not clear why the HUT is 2 – 24 Hours instead of <2 Hours; there was no PRF for Rx Bldg. Drywell spray and Precipitation inputs need to be identified in Assumptions even though this feature was not available in QEDPS. Selection of Reactor Core Accident – Clad needs to be discussed in Assumptions since QEDPS was based on a melt accident	Agree, will be in the table inserted for input values. See page 3.002 for methodology parameter inputs decided by EP, and see page 5.001 for URI Run parameter values with references.
43.	p. 3.2 RCS should be included in the pathway description.	Ok
44.	pp. 5.12 and 5.17 1C GE does not appear to be	Math performed in the spreadsheet FINAL page 5.012

#	Verifier Comment	Preparer Response
	correct. 7000 cps results in 1.07E3 mrem over 3 hours, not 1070 mrem/hr as reported. The correct value appears to be 1.9E4 cps for 3.01E3 mrem. Similarly the SAE should be 2.14E3. WEA and TEA results are essentially a factor of three low as well.	EP says they do not want to change from the 3 hour base. Their procedure says round up plus 2 hours for an ongoing release of unknown duration, so they have selected 3 hrs. Beaver Valley just got a violation from the NRC for using 1 hour base for the estimate. Took the runs you cited to EP and current value was selected, so table will remain unchanged.
45.	Page 1.200, on this page the "Does the Calculation Summary of results…" is not checked…, probably is N/A.	ok
46.	Page 1.303, on this page Sequence 89…should read "Unified RASCAL Interface"	Ok, spell check got me on the "uniform" versus "unified" rascal interface
47.	Page 2.001, Table 1 EP EAL Limits, Heading for Site Area Emergency should read "SAE"	Fixed typo.
48.	Should provide justification for the UE thresholds using pathway <RCS><Drywell><Rx Bldg><SBGT><Stack><Env> with clad failure similar to the justification for ALERT and higher emergencies using the Reactor Building monitors. There is not enough information from a cold read to conclude that this is the appropriate pathway. For example <RCS><Rx Bldg><Stack><Env> might be appropriate, using normal coolant similar to the pathways used for the Turbine or Radwaste Buildings. I attached an example. Note in this example the thyroid dose drives the threshold. Would gaseous effluents at 2x ODCM start SBGT and realign ventilation?	At the low end, EP has decided for us that we are to use the LOCA pathway to keep it the same as QEDPS used even though now we are using different software. We use the UE thresholds based on 2x ODCM settings for each instrument. See page 5.013. On the pathways question and the issue of whether SGT would start, the Z-signal is at 13 mrem heading up the stack. During our AST submittal we checked to see if it would start SGT and found that the release concentrations during the DBA LOCA would easily do it in the first few minutes.
49.	All the dose assessments in Appendix A are based on a 3-hour duration of release. However, all the EALs are based on a dose in any one hour for a specific time period (e.g., for UE 60-minutes and ALERT 15-minutes). The duration of release should be based on 1-hour for development of the radiation monitor thresholds.	We understand your concern and appreciate that you are making sure CGS understands what we are doing. The NESP says "…for the duration of the release" and our SER says the EALs are set based on dose projection software; our dose projection procedure PPM 13.8.1 says releases of unknown duration consist of 1 hour plus the 2 hours to confirm the end of the release by the field team for a total of 3 hours. So initial dose projections are performed for a minimum of 3 hours entered in the software, and the alert limits are based on that dose projection divided by 3 hours to get the 1 hour rate. Independent confirmation of this approach is noted by the fact that Beaver Valley got a violation for using a 1 hour and not using a 3-hour release duration.
50.	pp. A.1, 4, 16 and 20, URI runs for the UE's and PRM-RE-1B Alert did not add background to the UE/Alert value from spreadsheet NEW. URI	None requested

#	Verifier Comment	Preparer Response
	subtracts background. However, the dose results are not used to establish an EAL. Also, given the large margin to background, the calculated doses should not be affected. Therefore, these URI cases do not need to be re-run.	

ENERGY NORTHWEST
CALCULATION REFERENCE LIST

SEQUENCE NO.	AUTHOR	ISSUE DATE, EDITION OR REVISION	TITLE	DOCUMENT NO.
1	Nuclear Management and Resources Council, Inc. (NUMARC)	Rev 2 January 1992	Methodology for Development of Emergency Action Levels	NUMARC/ NESP-007
2	EPA	1991	Manual of Protective Action Guides and Protective Actions for Nuclear Incidents	EPA 400-R-92-001
3	Kocher, David C.	1981	Radioactive Decay Data Tables	DOE/TIC-11026
4	Energy Northwest	Amend. 60 DEC 2009	Gaseous Waste Management Systems	FSAR 11.3
5	Energy Northwest	Amend. 60 DEC 2009	Process and Effluent Radiological Monitoring and Sampling Systems	FSAR 11.5
6	Energy Northwest	Amend. 60 DEC 2009	Radioactive Gas Waste System Leak or Failure	FSAR 15.7.1
7	Energy Northwest	Amend 44 May 2005	Gaseous Effluent Radiation Monitoring System	ODCM 3.2
8	Energy Northwest	Revision 0	CC/RC - WEA Intermediate Range Noble Gas Monitor	ISP-WEA/PRM-X301
9	Energy Northwest	Revision 2	CC/RC - TEA Intermediate Range Noble Gas Monitor	ISP-TEA/PRM-X301
10	Energy Northwest	Amend 47 Aug 2008	Offsite Dose Calculation Manual	ODCM
11	Energy Northwest	7	EOP/SAG Technical Document	TM-2120
12	Energy Northwest	10/13/94	Response to NRC Request for Additional Information Regarding WNP-2 Emergency Action Levels	GO2-94-235
13	Energy Northwest	0	EDPS/QEDPS Input files	NE-02-10-01
14	Energy Northwest	29	EMERGENCY DOSE PROJECTION SYSTEM OPERATIONS	PPM 13.8.1
15	Energy Northwest	30	AED IMDS	SW-RIS-604
16	Energy Northwest	33	AED IMDS	SW-RIS-605
17	Energy Northwest	0	AED IMDS	FDR-RE-6
18	Energy Northwest	33	AED IMDS	TSW-RIS-5
19	Energy Northwest	1	AED IMDS	TSW-RIT-5
20	Energy Northwest	1	AED IMDS	PRM-RE-1B
21	Energy Northwest	1	AED IMDS	PRM-RA-1B
22	Energy Northwest	2	AED IMDS	PRM-RE-1C
23	Energy Northwest	1	AED IMDS	PRM-RA-1C
24	Energy Northwest	1	AED IMDS	PRM-RA-2
25	Energy Northwest	2	AED IMDS	PRM-XAY-1B
26	Energy Northwest	2	AED IMDS	PRM-XAY-1C
27				Deleted
28	Energy Northwest	24	AED IMDS	PRM-RR-3
29	Energy Northwest	34	AED IMDS	TEA-RIS-13
30	~~Energy Northwest~~	~~22~~	~~AED IMDS~~	~~TEA-RIS-13A~~
31	Energy Northwest	32	AED IMDS	WEA-RIS-14
32	~~Energy Northwest~~	~~16~~	~~AED IMDS~~	~~WEA-RIS-14A~~

SEQUENCE NO.	AUTHOR	ISSUE DATE, EDITION OR REVISION	TITLE	DOCUMENT NO.
33	Energy Northwest	9	AED IMDS	PRM-LCRM-1B
34	Energy Northwest	5	AED IMDS	PRM-LCRM-1C
35	Energy Northwest	Amend 37 Jan 2003	Radioactive Liquid Effluent Monitoring Instrumentation	ODCM Table 6.1.1-1
36	Energy Northwest	PDC 4788	Setpoint Calculation for RadWaste Building Exhaust Air Noble Gas Effluent Monitor	NE-02-08-08
37	Energy Northwest	PDC 4789	Setpoint Calculation for Turbine Building Exhaust Air Noble Gas Effluent Monitor	NE-02-08-09
38				Deleted
39	Energy Northwest	1	MAXIMUM SETPOINT DETERMINATION FOR INSTRUMENT LOOP PLANT SERVICE WATER RIS-5	E/I-02-02-03
40	Energy Northwest	1	MAXIMUM SETPOINT DETERMINATION FOR INSTRUMENT LOOP SW RADIATION INDICATING SWITCH 604	E/I-02-91-1050
41	Energy Northwest	1	MAXIMUM SETPOINT DETERMINATION FOR INSTRUMENT LOOP SW RADIATION INDICATING SWITCH 605	E/I-02-91-1051
42	Energy Northwest	7/14/05	Liquid Monitoring Setpoint Calculations SW-RIS-604 calibration QAR 09282007 00701	16.14.2
43	Energy Northwest	11/12/07	Liquid Monitoring Setpoint Calculations SW-RIS-605 calibration QAR 10082010 01508	16.14.2
44	Energy Northwest	5/19/05	Gaseous Monitoring Setpoint Calculations PRM-RE-1A calibration (also for -1B) QAR 09272007 00701	16.14.1
45	NRC	11/30/2010	Appendix B to Part 20—Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage	10CFR 20 Appendix B, Table 2
46	NRC	12/9/94	Safety Evaluation by Office of NRR for NUMARC /NESP-007 Based Emergency Action Levels at the WNP-2	GI2-94-349, Enclosure
47	Energy Northwest	1	UNCERTAINTY DETERMINATION FOR INSTRUMENT LOOP PRM RADIATION RECORDER 3, RECORDER POINT 1	E/I-02-94-1306
48	Energy Northwest	4	AED IMDS	SW-RR-1
49	Energy Northwest	8	AED IMDS	SW-RR-2
50	~~Energy Northwest~~	~~2 12/11/1983~~	~~Radwaste Effluent Monitor~~	~~12.13.11~~
51	~~Energy Northwest~~	~~5/19/05~~	~~Gaseous Monitoring Setpoint Calculations TEA-RIS-13 calibration~~ ~~QAR 09272007 00701~~	~~PPM 16.14.1~~

SEQUENCE NO.	AUTHOR	ISSUE DATE, EDITION OR REVISION	TITLE	DOCUMENT NO.
52	~~Energy Northwest~~	~~5/19/05~~	~~Gaseous Monitoring Setpoint Calculations WEA-RIS-14 calibration~~ ~~QAR 09272007-00701~~	~~PPM 16.14.1~~
53	Energy Northwest	4/1/84	NMC Midrange noble gas calibration	PPM 12.13.14
54	Energy Northwest	3/25/09	Rx Bldg Effluent Monitor Intermediate Range W/O 01160310-01	CSP-PRMRE-X301
55	Energy Northwest	6/29/09	Rx Bldg Effluent Monitor High Range W/O 0116705203-03	CSP-PRMRE-X302
56	Energy Northwest	6/29/84	Effluent Radiation Monitors	GO2-84-413
57	Energy Northwest	10/10/03	Rx Bldg Effluent Monitor High Range W/O 01062336-06	CSP-STACK-M201
58	Energy Northwest	12/12/83	RADWASTE EFFLUENT MONITOR FDR-RIS-606	PPM 12.13.11
59	Energy Northwest	6	AED IMDS	PRM-LCRM-1A
60	Energy Northwest	3/19/1996	Stack Monitor Gross Efficiency Calculation Chemistry Calculation DIC 1441.6	96-001
61	~~Energy Northwest~~	~~6/1/84~~	~~QAR CHM - WEA RADIATION CALIBRATION NUC MEASUREMENTS MIDRANGE NOBLE GAS MONITOR~~	~~PPM 12.13.24~~
62	~~Energy Northwest~~	~~5/18/84~~	~~QAR CHM - TEA RADIATION CALIBRATION NUC MEASUREMENTS MIDRANGE NOBLE GAS MONITOR~~	~~PPM 12.13.24~~
63	Energy Northwest	7	AED IMDS	PRM-RE-1A
64	~~Energy Northwest~~		~~WEA-RIS-14 instrument setpoint change request (Appendix H)~~	~~ISCR-1341~~
65	~~Energy Northwest~~	~~new~~	~~Comparison of Gaseous Effluent Grab Sample with ODCM and EAL Thresholds - Quick Test~~	~~CI-11.6~~
66	Energy Northwest	1	UNCERTAINTY DETERMINATION FOR INSTRUMENT LOOP PRM RADIATION RECORDER 3 RECORDER POINT NUMBER 4	E/I-02-94-1323
67	Energy Northwest	1	UNCERTAINTY DETERMINATION FOR THE LOOP WHICH IDENTIFIES THE REACTOR BUILDING ELEVATED RELEASE DUCT ACTIVITY	E/I-02-93-01
68	Energy Northwest	1	PRM RADIATION RECORDER 3 AND POINTS 2 AND 3	E/I-02-94-1312
69	Energy Northwest	7	LIQUID RADWASTE EFFLUENT RADIATION MONITOR - CC	PPM 16.7.1
70	Energy Northwest	6	RADIOACTIVE LIQUID WASTE DISCHARGE TO THE RIVER	PPM 16.10.1
71	Energy Northwest	5	RADIOLOGICAL EFFLUENT MONITORING-LIQUID	PPM 12.11.1B
72	Energy Northwest	16	CHEMISTRY MONTHLY SOURCE AND CHANNEL CHECKS	CSP-INST-M201
73	Energy Northwest	39	CLASSIFYING THE EMERGENCY	13.1.1

SEQUENCE NO.	AUTHOR	ISSUE DATE, EDITION OR REVISION	TITLE	DOCUMENT NO.
74	Energy Northwest	23	CLASSIFYING THE EMERGENCY - TECHNICAL BASES	13.1.1A
75	Energy Northwest	19	PRIMARY CONTAINMENT CONTROL	5.2.1
76	~~Energy Northwest~~	~~14~~	~~RADIOACTIVITY RELEASE CONTROL~~	~~5.4.1~~
77	Energy Northwest	3	CONTAINMENT AND RADIOACTIVITY RELEASE CONTROL	SAG2
78	Energy Northwest	1	QUICK EMERGENCY DOSE PROJECTION SYSTEM	MAN-QEDPS
79	Energy Northwest	0	Setpoint Calculation for Radwaste Building Exhaust Air Noble Gas Effluent Monitor	NE-02-08-08
80	Energy Northwest	0	Setpoint Calculation for Turbine Building Exhaust Air Noble Gas Effluent Monitor	NE-02-08-09
81	General Atomics Electronic Systems	0	ANSI N42.18 Performance Report for TEA (04391601) Gas Monitor	04391199 CVI 1057-00,100
82	General Atomics Electronic Systems	00E 0	ANSI N42.18 Performance Report for WEA (04391701) Gas Monitor	04391197 CVI 1057-00,95
83	Energy Northwest	1	Plant Data Information System Software Design Description	SDD-PDIS-01
84	Energy Northwest	4	PRM INSTRUMENTATION	EWD-36E-027
85	Energy Northwest	PDC 4788 PDC 4789	GASEOUS MONITOR SETPOINT DETERMINATIONS	16.14.1
86	Energy Northwest	0	Determination of Low Range Stack Monitor Xe-133 Equivalent Efficiency	NE-02-13-10
87	Energy Northwest	0	RASCAL DOSE PROJECTION SOFTWARE	NE-02-10-05
88	Energy Northwest	3	EMERGENCY PROCEDURE GUIDELINES SECONDARY CONTAINMENT CONTROL	NE-02-84-33
89	Energy Northwest	0	Software Validation and Verification Report for Unified Rascal Interface (URI)	FW-SOFT-COTS-URI
90	Energy Northwest	0	ELECTRICAL WIRING DIAGRAM PROCESS RADIATION MONITORING SYSTEM TEA-RIS-13	EWD-36E-035
91	Energy Northwest	1	ELECTRICAL WIRING DIAGRAM PROCESS RADIATION MONITORING SYSTEM WEA-RIT-14	EWD-36E-037
92	Energy Northwest	10	Reactor Building	AED SPC 318A
93	Energy Northwest	1	EDPS/QEDPS	NE-02-10-01

ENERGY NORTHWEST
CALCULATION OUTPUT INTERFACE
DOCUMENTS REVISION INDEX

Calculation No. NE-02-09-12

Prepared By/Date	Verified by/Date	Revision No.
LS Woosley 3/8/15	JD Fisher 3/30/15	003

The below listed output interface calculations and/or documents are impacted by the current revision of the subject calculation. The listed output interfaces require revision as a result of this calculation. The documents have been revised, or the revision deferred with Manager approval, as indicated below.

AFFECTED DOCUMENT NO.	CHANGED BY (e.g., PDC, LDCN, CMR, Rev.)	CHANGED DEFERRED (e.g., AR, LETTER NO.)	DEPT. MANAGER *
PPM 13.1.1	LDCN-EP-15-001		
PPM 13.1.1A	LDCN-EP-15-001		
Emergency Plan	LDCN-EP-15-001		
NE-02-10-01	LDCN-EP-15-001 AR 283069-09		
FW-SOFT-COTS-URI	LDCN-EP-15-001 AR 319446-14		

* Required for deferred changes only. Design Engineering Manager approval required for deferred design calculations.

Prepared By/Date	Verified by/Date
LS Woosley 2/2/15	JD Fisher 3/30/15

Results and Conclusions

REV. BAR

This calculation provides the basis for the PPM 13.1.1A Table 3 values as committed in Reference 12, and uses current flow rates and alarm analytical limits to calculate new EAL values.

- The instruments with limits based on alarm values use the ODCM setpoint calculation procedures as the reference for the analytical limit for the alarm. The draft EAL is computed from the requisite multiplier on the alarm analytical limit.
- The instrument limits based on dose used the target dose values from reference 12 to iterate until the dose rate target is reached. The draft EAL is the input value to the software URI, and the output is the dose rate at the dose target selected.
- Background radiation values are incorporated into the limits and EAL's selected to minimize sensitivity to variations in background.
- Consideration is given to the minimum detectable level for the instrument so that all limits can be detected.
- Minimum and maximum instrument range is considered so that selected EAL's are on-scale.
- Final values are based on all these considerations and rounded to the nearest readable increment on the log chart recorder. This includes variation in calibration factors and tolerance for background changes. Doses at the rounded EALs are within a factor of 3 of the dose target, since an acceptable result is within a factor of 10 per reference 1.

The analytical limit for each instrument was calculated on spreadsheet tab BKGD (page 5.010) using the formula on page 3.002. Range checking of the final values was performed on sheet RANGE CHK (page 5.011) and all EALs still meet the constraints from page 5.011. The limits that were close based on background variation were evaluated using URI runs and variations in the dose output with the variation allowed in input range was evaluated on page 5.011.

The exception to this approach is for selecting the reactor building intermediate range alarm value, using ODCM limits. The UE value for PRM-RE-1B was derived for use in sheet NEW using the Chemistry department spreadsheet for that purpose, located in Appendix D.. See page 5.009 for the ODCM limits.

The Appendix A cases that were the first try at developing dose values consistent with the historical commitments are pages A.1-A.13. The process description starting on page 5.006 describes the historical path to development. Final EAL values are shown on page 5.015 and the computer runs are in Appendix A. All of the Unusual Event values were selected based on the ODCM limits and UE/2 calculated on page 5.014 for EOP and TM-2120 Table PC-1.

Conclusion

Table of ANALYTICAL results for use for Emergency Response EAL limits (page 5.015):

Table 1 EP EALs Emergency Action Limits

Instrument	*UE*	*A*	*SAE*	*GE*
PRM-RE-1B	6.0E3 cps	--	--	--
PRM-RE-1C	--	400 cps	2000 cps	20000 cps
TEA-RIS-13	1.02E-04 µCi/cc	8.35E-04 µCi/cc	8.35E-03 µCi/cc	8.35E-02 µCi/cc
WEA-RIS-14	1.98E-03 µCi/cc	3.45E-03 µCi/cc	3.45E-02 µCi/cc	3.45E-01 µCi/cc
SW-RIS-604	1E2 cps	1E4 cps	--	--
SW-RIS-605	1E2 cps	1E4 cps	--	--
FDR-RIS-606	70 cps [1]	7E3 cps [1]	--	--
TSW-RIS-5	3E-5 µCi/cc	3E-3 µCi/cc	--	--

[1] Value based on HIGH-HIGH alarm setpoint with no discharge in progress. PPM 13.1.1A Table 3 should use 2 and 200 times the HIGH-HIGH alarm for UE and A, respectively since the alarm setpoint is adjusted prior to discharge for the isotopic mixture determined by laboratory analysis.

The **background ranges** for PRM-RE-1C, TEA-RIS-13 and WEA-RIS-14 are specified on page 5.016 for use in surveillance procedures.

PPM 5.2.1 and SAG2 Table 27 values for the effluent radiation monitors are specified below:

INSTRUMENT	TABLE 27 LIMIT		BASIS
PRM-RE-1B	3.0E+03	CPS	UE / 2
TEA-RIS-13	5.1E-05	µCi/cc	UE / 2
WEA-RIS-14	9.9E-04	µCi/cc	UE / 2

Conclusion

The Emergency Action Levels (EALs) comply with regulatory requirements and commitments.

The EALs were developed to provide margin to accommodate slight variations in inputs, with upper and lower background values evaluated and the EALs centered in their ranges.

Analysis Method (Check appropriate boxes)

☒ Manual (As required, document source of equations in Reference List)

☐ Computer

☒ Verified Program: Software/Revision FW-SOFT-COTS-URI v2.0.0 Unified RASCAL Interface

☒ Unverified Program: Document in Appendix B GaseousEffluentMonitorSetpointCalculationsRev7-NE-02-09-12 R1-CMR0000011948-001.xlsx

Approach/Methodology

REV. BAR

NUMARC/NESP-007 methodology for determining Emergency Action Levels (EALs) was adopted with NRC approval in 1994 (GI2-94-349). The approved methodology was initially submitted in GO2-93-302 and largely revised as part of an NRC request for information (RAI) response (GO2-94-235). The underlying calculations were documented in the licensing certification package for GO2-94-235 and are included here as Appendix H.

The approved 1994 methodology is described below followed by the changes in methods required to update the EALs to the current CGS configuration.

Paragraph numbers are based on the current PPM 13.1.1A format. The NUMARC/NESP-007 Initiating Conditions (IC) related to the EALs are included as the underlying requirement that the values in PPM 13.1.1A Table 3 support. Page numbers are from the enclosure to GO2-94-235 found in Appendix H. The details of the method, with spreadsheet names and considerations, are presented on pages 5.006-5.007.

5.1.U.1 Unusual Event

NUMARC IC: AU1 - Any unplanned release of gaseous or liquid radioactivity to the environment that exceeds two times ODCM limits for 60 minutes or longer.

From Appendix H [reference 12]:

- Threshold values for Emergency Action Levels under Initiating Condition AU1 were established at two times the applicable ODCM limit. For gaseous effluents, the threshold takes into account the partitioning of total allowable release between the release points. The high alarm is used for the elevated release intermediate range monitor and the high-high alarm is used for the radwaste and turbine building low range monitors. Liquid effluent thresholds for SW and TSW are based on high alarms and take into account the 80% of allowable setting of the alarm. The FDR threshold is based on 100% of the high-high alarm.

5.1.A.1 Alert

NUMARC IC: AA1 - Any unplanned release of gaseous or liquid radioactivity to the environment that exceeds 200 times the radiological specifications for 15 minutes or longer.

From Appendix H [reference 12] pages 4 – 5:

- With effluent monitor readings that approximate 200 times normal operating limits, it is reasonable to assume the presence of an isotopic mixture that is more representative of an accident source term mixture than a normal operating source term. The CGS evaluation in 1994 showed that a minimal containment bypass event with fuel gap release, as evaluated by the RASCAL emergency dose projection code, closely approximates the Alert level threshold. CGS therefore revised this EAL to use effluent monitor threshold values equivalent to 10 mrem/hr TEDE or 50 mrem/hr thyroid CDE based on emergency dose calculation methods and parameters as opposed to ODCM methodology. Where Standby Gas Treatment is applicable, it was assumed to be operating as this provides the more conservative level for beginning assessment of the release.

- The effect is to more realistically maintain the gradient from Unusual Event to Alert to Site Area emergency through consideration of the change in source term isotopic mixture that is expected to occur between two and two hundred times ODCM limits. It also reduces the threshold for beginning assessment of a release without impacting the level at which declaration of an alert will occur. Assuming an accident source term allows assessment to be performed using monitor readings and an emergency dose projection code in accordance with PPM 13.8.1, Emergency Dose Projection System Operation.

- Columbia ODCM *RFO 6.2.2.1* limits restrict Site Boundary dose rate to 500 mrem/yr *whole body* and 1500 mrem/yr to *any organ*. Two hundred (200x) times the thyroid dose rate equates to approximately 34 mrem/hr. Fifty (50) mrem/hr is used in the EAL for IC *AA1* where thyroid CDE is found to be most limiting, to maintain the desired gradient between Alert and Site Area EALs.

5.1.S.1 Site Area Emergency

NUMARC IC: AS1 - Offsite dose resulting from an actual or imminent release of gaseous radioactivity that exceeds 100 mrem TEDE or 500 mrem thyroid CDE for the actual or projected duration of the release.

From Appendix H [reference 12] pages 5 – 7:

- The EAL has been revised using 5 mph wind speed and stability class E, conditions that are representative of annual average meteorology at Columbia. Other assumptions used in the calculations are release duration of one hour, one train of standby gas treatment where SGTS is in use, and design building effluent flow rates where SGTS is not applicable.

- Gaseous effluent monitor thresholds for entry into the revised Alert EAL were developed using the same methodology and source term isotopic mixture as was used to establish the threshold values for the Site Area EALs. The desired gradient of one order of magnitude is maintained by basing the Alert threshold on 10 mrem/hr TEDE and 50 mrem/hr CDE to the thyroid while the Site Area threshold is based on 100 mrem/hr TEDE and 500 mrem/hr thyroid CDE.

- Columbia originally adopted an Emergency Dose Projection code QEDPS and is now replacing by URI-Rascal with this revision. For consistency between values used in the EALs and the code which will be used by the Control Room staff in assessing the EAL indicators, EALs under Initiating Conditions AA1, AS1 and AG1 have been recalculated using URI.

5.1.G.1 General Emergency

NUMARC IC: AG1 - Offsite dose resulting from an actual or imminent release of gaseous radioactivity that exceeds 1000 mrem TEDE or 5000 mrem thyroid CDE for the actual or projected duration of the release using actual meteorology.

FORMULAS (page 5.006)

Minimum Detectable Level [MDL] = 4.66 * SQRT(background) or 4.66 * STDEV.S(background) (1)
[Ref. 10, Definition Lower Limit of Detectability (LLD), Reference 56 (page 87) and Reference 50, LLD]

Decade rounding [x] = truncate (LOG10(AL', 0 decimal digits)) (2)

Draft Analytical Limit [AL'] = MAX((MDL + background), (draft EAL + background)) (3)

SOFTWARE METHODOLOGY NOTES

The use of URI RASCAL instead of QEDPS/EDPS provides flexibility in selection of the release path that did not exist in QEDPS.

- The RAPID assessment capability of URI has 6 pathways to pick from instead of assuming LOCA; the LOCA pathway is the 5th one in the list RCS - DW – RB – SGT – RB effluent (stack) – ENV
- The DETAILED assessment of URI, pathway J was selected, which is the same drywell LOCA pathway RCS - DW – RB – SGT – RB effluent (stack) – ENV

The input run parameters for the Detailed assessment are as follows:

Meteorological data	33 ft CGS Met tower 5 mph, 330 W/D, Stab class = E
Selected pathway option(1)	Path J LOCA
Hold up time	2-24 hours (Reactor Bldg/2 hr (DW))
Monitored release point	Stack (Hi)
Release Point Flow Rate	4500 cfm
Selected pathway option (2)	Path C Turbine building
Monitored release point	TEA (Hi) Turbine Generator Bldg < 2 hr holdup
Release Point Flow Rate	360,000 cfm
Selected pathway option (3)	Path V Radwaste building
Monitored release point	WEA (Hi) RadWaste Bldg <2 hr holdup
Release Point Flow Rate	84,000 cfm

INPUTS AND OUTPUT INTERFACES

Many of the references were used for general understanding of the parameters selected for input. Only the values cited in these tables have been used as a specific source of data values, the rest were generic references.

INPUTS

ITEM	Data of interest	data source	Ref #
1	Certification package is used as the baseline for the basis of the emergency plan Table 3 values. The submittal certification package contains the technical basis for each limit, the dose projections from QEDPS rev. 1 substantiating the limits, and the IMDS sheets for the instrument settings. Attached in Appendix H.	G02-94-235 Appendix H	-
2	DELETED		-
3	Background and detection efficiency values are from the calibration references for the specific instruments	-	13, 38, 39, 42, 43, 44, 54, 55, 58, 60, 79, 80, 86
4	1. Liquid Calibration Factors (detector efficiencies equivalent Cs-137): a. FDR-RIS-606 liquid calibration factor is 3.151E6 cps/µCi/cc (Reference 50). PPM 16.7.1, Rev 6, reports 3.301E6 cps/µCi/cc, which is incorrect based on CR 00223352, which corrected PPM 16.7.2. CR 00248950 initiated to correct PPM 16.7.1. GO2-84-413 reported 2.92E6 based upon the uncorrected version of QAR 12.13.11 (Reference 50).	-	50
5	2. Gaseous Calibration Factors (detector efficiencies equivalent Xe-133) a. PRM-RE-1A is 3.69E8 cps/µCi/cc (References 63 and 86). References 59 and 44 contain erroneous values per CR 00202259, CR 00246173 and CR 00248448. Reference 86 added per CR 00281061. b. PRM-RE-1B is 5.51E5 cps/µCi/cc (References 60 and 33). Reference 54 contained an incorrect value, which has been removed in Rev 6. c. PRM-RE-1C is 12.8 cps/µCi/cc (Reference 60 and 34). Reference 55 contained an incorrect value, which has been corrected in Rev 8. d. URI stack monitor gains are 1/0.367 (Reference 3) times the calibration factors. URI does not normalize to gamma-abundance, equivalent Xe-133; the ODCM spreadsheet does. e. TEA-RIS-13 is 2.15E7 cpm/µCi/cc (Reference 37 p. 5.002). f. WEA-RIS-14 is 1.81E7 cpm/µCi/cc (Reference 36 p. 5.002).	NE-02-13-10 Chemistry Calc 96-001	63, 86 59, 44 60, 33 60, 34 54 55 80 79 86
6	SDD-PDIS-01 defines the radiation monitor displays in the emergency centers. 1. PRM-RE-1A "Stack Lo" 10 - 10^6 cps format integer "*nnn,nnn*" 2. PRM-RE-1B "Stack Int" 10 - 10^6 cps format integer "*nnn,nnn*" 3. PRM-RE-1C "Stack Hi" 10 - 10^6 cps format integer "*nnn,nnn*" 4. TEA-RIS-13 "TG Exh COMP" 10^{-7} – 10^3 µCi/cc format exponential		83

	"*n.nn E nnn*"[1] 5. WEA-RIS-14 "RW Exh COMP" $10^{-6} – 10^{3}$ µCi/cc format exponential "*n.nn E nnn*"[1]		
7	The maximum allowed background for TEA-RIS-13 Channel 1 is 388 cpm (1.80E-5 µCi/cc). This is larger than the Alert Alarm setpoint. NE-02-08-09 [reference 80] page 5.005, TEA-RIS-13 Channel 1 and Channel 3 Alert Alarm setpoint is 9.97E-6 µCi/cc. The setpoint was established at 4.66 * background as a value reasonably above expected background to indicate that an actual release may be in progress. FSAR 11.5.2.2.1.6 states that normal activity is expected to be below detectable levels. In the absence of an actual release, the Alert Alarm setpoint represents an upper bound on background variation because a spurious alarm would alert the operators to a potentially degraded condition. A spurious alarm would result in a functionality evaluation, so there is no need for a separate procedural limit on background for Channel 1. The same conclusion applies to WEA-RIS-14.	NE-02-08-09 NE-02-08-08	80 79

URI Run Parameter Inputs

#	Data of interest	Data source	Ref #
1	Reactor building HVAC flow rates: SGT flow rate =4500 cfm (historical practice)	NE-02-10-01 MAN-QEDPS-01	13 78
2	Turbine Generator building HVAC flow rate: TEA flow rate = 360,000 cfm (historical practice)	NE-02-10-01 MAN-QEDPS-01	13 78
3	Radwaste building HVAC flow rate: WEA flow rate = 84,000 cfm (historical practice)	NE-02-10-01 MAN-QEDPS-01	13 78
4	Meteorology conditions = site nominal selections of 5mph wind speed, 330 direction, condition E, no precipitation	page 3.001	-
5	Rx Bldg. hold up time (HUT) = instead of <2 hrs, use 2-24 hours This feature not available in QEDPS; there's no process reduction factor (PRF) for Rx Bldg.	AED-SPC-318A	92
6	Selection of Reactor Core Accident = Clad.	NUMARC/NESP-007	1
7	NUMARC/NESP-007 Table 3 EAL bases are 2-20% clad failure. Time since reactor shutdown = 0 min 0 sec selected consistent with reference 12 application.	Appendix H	-
8	Projected release duration = 3 hours selected consistent with historical practice Originally developed due to limitation in QEDPS model.	MAN-QEDPS-01	78

OUTPUT INTERFACES

#	Data of interest	Output reference	
	Appendix C for analytical limit, lower limit of detection and allowed range for background from sheet BKGD page 5.010: • E/I-02-02-03 (TSW-RIS-5) • E/I-02-91-1050 (SW-RIS-604) • E/I-02-91-1051 (SW-RIS-605) • E/I-02-94-1306 (PRM-RE-1B) • E/I-02-94-1323 (PRM-RE-1C) • E/I-02-93-01 (PRM-RE-1A) • E/I-02-94-1312, NE-02-08-08 & NE-02-08-09 (TEA-RIS-13, WEA-RIS-14) • FDR-RIS-606 does not have instrument loop or setpoint calculations.	E/I-02-02-03 E/I-02-91-1050 E/I-02-91-1051 E/I-02-94-1306 E/I-02-94-1323 E/I-02-93-01 E/I-02-94-1312 NE-02-08-08 NE-02-08-09	
	Analytical Limit and background range: • PPM 16.14.1 (PRM-RE-1A, TEA-RIS-13, WEA-RIS-14) • PPM 16.14.2 (SW, TSW) • CSP-PRMRE-X301 (PRM-RE-1B) • CSP-PRMRE-X302 (PRM-RE-1C) • ISP-TEA/PRM-X301 (TEA-RIS-13) • ISP-WEA/PRM-X301 (WEA-RIS-14) • PPM 16.7.1 (FDR) • PPM 16.10.1 (FDR) • PPM 12.11.1B (FDR) • CSP-STACK-M201 (PRM-RE-1B, PRM-RE-1C) CSP-INST-M201 (TEA,WEA,SW,TSW,FDR)		
	PPM 13.1.1 and the bases PPM 13.1.1A	PPM 13.1.1 PPM 13.1.1A	
	EOP/SAG Technical Document EOPs and SAGs: • PPM 5.2.1 Table 27 • ~~PPM 5.4.1 Table 26~~ • SAG2 ~~Table 26 and~~ Table 27 Table 26 contained the Emergency Plan Table 3 General Emergency Offsite Radioactivity Release Limits but has been removed from EOPs. Table 27 contains the Table 3 UE limits divided by 2 to produce the ODCM RFO Offsite Radioactivity Release Limits.	NE-02-84-33 for TM-2120 PPM 5.2.1 ~~PPM 5.4.1~~ SAG2	
	URI RASCAL CGS ANNEX	NE-02-10-05	

ASSUMPTIONS

#	Data of interest	data source	Ref #
1	The equation for the minimum detectable activity concentration for each instrument is characterized by Minimum Detectable Level [MDL] = 4.66 * SQRT(background) , equation (1) above. Justification: submission to the NRC described the equation and demonstrated this formula as more conservative than ANSI 13.10. It is used to characterize the impact of the background radiation field on the instrument analytical limit of the instrument that is operating in the field, and conservative estimation of impact allows for variations in plant conditions.	GO2-84-413	56
2	Background radiation values are from the calibration references for the specific instruments. An attempt was made to use the most recent documented value that represents shutdown or low power operation. Justification: Plant surveillance data is reliable and retrievable for the purpose of this calculation. The principal use of the emergency plan will be in the shutdown or low power configurations, so basing the anticipated radiation field strength on that condition, and not requiring the software user (dose assessor) to manually make the adjustment, will improve accuracy of results.	-	44, 54, 55, 79, 80
3	Draft analytical limits consist of the preliminary EAL value plus applicable background. Justification: Draft analytical limits are developed using equation (3), either by actually adding the terms together or by using software that performs that addition during use. The math in the spreadsheet cell (shaded blocks on page 5.010) is derived from the URI runs already including background, so it does not need to be added.	-	Page 5.010
4	The EAL thresholds for SW and TSW are rounded to the nearest discernable meter graduation. Justification: GO2-94-235 submitted this for approval (RAI #4b, page 5). GI2-94-349 approved the associated EAL's for SW and TSW.	GO2-94-235 GI2-94-349	-
5	The formula for the tolerance on the EAL threshold is the largest value of the MDL or the draft analytical limit with background. Justification: Useful limits should at least be on scale, above the minimum value detected by the instrument. If any of the values do not meet that criterion, either dose-derived or setpoint-derived, then the final analytical limit is adjusted to account for it.		Page 5.010

6	Rounding on final analytical limit is expected and practical for use in the Emergency Plan. Justification: Readings on the graphical output on a log scale are not readable by Operations to more than one significant digit. Operators are not experienced at interpolation, even on linear scales, having a training expectation if not a procedural requirement to use the next higher value. The next higher value rounded off to one significant digit is the expectation for log scale instruments, and the appropriate readings have been calculated for the final analytical limit.		Page 5.012
7	Gaseous and liquid calibration factors are accurate to within 20% of the primary calibration results. Justification: EAL values do not need to account for variations due to calibration accuracy. This is the level of variation allowed in surveillance procedures before re-scaling with the transfer source or a new gaseous/liquid calibration is performed.	-	42, 43, 44
8	DELETED		
9	NUMARC/NESP-007 EAL Thresholds are evaluated within a factor of 10 for dose resulting in the following acceptable range for each dose threshold General = 1000 mrem TEDE Site Area = 100 mrem TEDE Alert = 10 mrem TEDE OR General = 5000 mrem CDE Site Area = 500 mrem CDE Alert = 50 mrem CDE • Operator ability to read the exact values specified in Table 3 on the log chart recorders is not required. Alternate indications such as TDAS/eDNA or manually selected digital displays on the chart recorders may be used where available. • Table 3 values must be on-scale and above minimum detectable values for the instruments. • Existing calibration tolerance (20%) is allowed without change to Table 3 values. This is based on the existing functionality, acceptance criteria in current procedures. Larger variations require a recalculation of Table 3. • Background variations are restricted such that dose varies by no more than the amount allowed by existing calibration variation—i.e the dose impact of a 20% change in calibration factor. Changes to background or calibration variations in excess of the above criteria require recalculation of Table 3. Justification: Provided by LDCN-EP-11-023 output interface. Calibration tolerances in plant procedures have been in place since initial approval of the NUMARC/NESP-007 EAL scheme.	NUMARC/NESP-007 Appendix H SER	-
10	DELETED		

11	EOP/SAG Table 27 ODCM RFO Limit is ½ of the UE for PRM-RE-1B, TEA-RIS-13 and WEA-RIS-14 Justification: TM-2120 Table PC-1, documents that Table 27 is based on PPM 13.1.1 Table 3. Table 27 was established in Rev 2 of TM-2120 and was based on ½ of the UE value in PPM 13.1.1, Rev 33. The methodology for 5.1.U.1 defines the UE as 2 x the ODCM limit. The converse should also be true. This assumption is validated by comparison to the instrument readings corresponding to the ODCM limit, using ODCM methodology (see Chemistry department spreadsheet documented in Appendix D). Page 5.016 references the specific results in Appendix D, all of which are higher than the proposed Table 27 values. Final Calculation of these values on page 5.014.	TM-2120 NE-02-03-05 NE-02-03-06 PPM 13.1.1	

Constructing the basis for the EAL table for the Emergency Plan

1. Start with the approved bases of the Emergency Action Levels (EALs) from 1994 [NRC SER letter [reference 46] and the certification package [12] in Appendix H]

2. Fix the parameter values determined to be in error during the AR 244578 root cause.

    a. Gain for the high range stack monitor PRM-RE-1C was changed from 12.8 to 34.9. [CR 244578, reference 60]

    b. Gain for the intermediate range stack monitor PRM-RE-1B was changed from 5.5e5 to 1.5e6. [reference 54, 60]

    c. Background for the low range stack monitor PRM-RE-1A was changed from 15000 cps (100% power background value) to 3300 cps (shutdown background value) since most of the events that dose projection would be used for begin with direction to shut down the reactor. Alarm setpoints are based on shutdown too [Ref. 44]. Gain for the low range stack monitor PRM-RE-1A was changed from 3.0e8 to 1.01e9. [CR 246173]

3. Spreadsheet "NEW" [page 5.009]

    a. Use the chemistry department ODCM spreadsheet to determine a useful, valid setpoint for the intermediate range stack monitor. This validation study is found in Appendix D.

    b. Perform dose analysis for the dose-based setpoints using URI and the dose targets shown on sheet NEW.

    c. Liquid monitors are based on multiples of the alarm ODCM setpoints. No calculations are performed.

    d. QEDPS is replaced by URI RASCAL in this revision 3

4. Spreadsheet "BKGD" calculates acceptable variation in background for each instrument that would invalidate Table 3 and/or URI. [page 5.010]

    a. Fill in the reference for each background value, usually the calibration, or average historical data.

    b. Provide the analytical limit from the monitor detection efficiency and the minimum detectable level, using the same methodology for all gaseous detectors and the ODCM methodology for the liquid detectors.

    c. TEA and WEA monitor background have been updated to use engineering units of uCi/cc.

5. Determine if the EALs fall within the ranges of the instruments, making adjustments if needed. The results are on sheet RANGE CHK page 5.011.

6. Perform a sensitivity study of calibration range consistent with assumption 9 and +/- 20%. The results are on sheet "CAL RANGE" pages 5.012-5.013.

[/][data]/[Dose]/[NE-02-09-12]/[NE-02-09-12.003]/

Name	Size	Date/Time Modified	CRC	Perm	Owner
NE-02-09-12 003.xlsx	199451	Mar 31 2015 09:34:44	09071	-rw-dc	jfishe

Calculation assembly directions

Insert files as follows:			
filename	Pages	Description	
NE-02-09-12 003 p1000 cover.docx	1.000	Cover	
NE-02-09-12 003 p1005 summary.docx	1.001	Summary	
NE-02-09-12 003 p1100 index.docx	1.100	Index	
NE-02-09-12 003 p1200 ver.docx	1.200-1.201	Verification checklist	
NE-02-09-12 003 p1200 verifier comments.docx	1.202-1.207	Verification issue resolution	
NE-02-09-12 003 p1300 refs.docx	1.300-1.303	References list	
NE-02-09-12 003 p1400 output.docx	1.400	Output cross reference	
NE-02-09-12 003 p2000 results.docx	2.000-2.002	Output summary / results	
NE-02-09-12 003 p3000 method.docx	3.000-3.001	Methodology	
NE-02-09-12 003 p5000 IO.docx	5.000-5.002	Calculation inputs and outputs	
NE-02-09-12 003 p5000 assumpt.docx	5.003-5.007	Calculation assumptions and method of calc construction	
NE-02-09-12 003 p5000 calclist.docx	5.008	FILE LIST (this sheet)	
NE-02-09-12 003.xlsx sheet NEW	5.009	New input values from software	
NE-02-09-12 003.xlsx sheet BKGD	5.010	Calculated min level of detection with decade rounding to develop final analytical limits	
NE-02-09-12 003.xlsx sheet RANGE CHK	5.011	Background range check	
NE-02-09-12 003.xlsx sheet CAL RANGE	5.012-5.013	Allowed +/-20% impact	
NE-02-09-12 003.xlsx sheet Table PC-1	5.014	Final ODCM limits from UE/2	
NE-02-09-12 003.xlsx sheet FINAL	5.015	Final EALs with dose results using URI software	
NE-02-09-12 003.xlsx sheet PPM INPUTS	5.016	Calibration background ranges	
NE-02-09-12 003 AppA.pdf	A	Computer runs	
NE-02-09-12 003 AppC.pdf	C	Meteorology Sensitivity Study	
NE-02-09-12 003 AppD.pdf	D	Chemistry Dept support calcs	
NE-02-09-12 003 AppH.pdf	H	Historical licensing information	
NE-02-09-12 003 p1000 DMS.docx	last	DMS reference document list	

NEW EALs

CR MONITOR	INSTRUMENT		EAL	INPUT	BASIS	ALARM TARGET	REFERENCES	dose goal in 3 hrs
PRM-RR-3	PRM-RE-1B	UE	5,000	CPS	2XODCM = 5 X HI ALARM , Hi =	1000 CPS	D.2-5. page A.1	mrem
		ALERT	500,000	CPS	200XODCM = 500X HI ALARM		page A.4	
PRM-RR-3	PRM-RE-1C	ALERT	404	CPS	10 MR/HR TEDE OR 50 MR/HR THY CDE	10 mrem/hr TEDE	page A.7	30
		SAE	2100	CPS	100 MR/HR TEDE OR 500 MR/HR THY CDE	100 mrem/hr TEDE	page A.10	300
		GE	1.95E+04	CPS	1000 MR/HR TEDE OR 5000 MR/HR THY CDE	1000 mrem/hr TEDE	page A.13	3000
PRM-RR-3	TEA-RIS-13	UE	1.00E-04	µCi/cc	2XODCM = 5X HI ALARM H=	2.00E-05 µCi/cc	page A.16; ref 37 p5.5	
		ALERT	8.35E-04	µCi/cc	10 MR/HR TEDE OR 50 MR/HR THY CDE	50 mrem/hr THY	page A.19	150
		SAE	8.35E-03	µCi/cc	100 MR/HR TEDE OR 500 MR/HR THY CDE	500 mrem/hr THY	page A.22	1500
		GE	8.35E-02	µCi/cc	1000 MR/HR TEDE OR 5000 MR/HR THY CDE	5000 mrem/hr THY	page A.25	15000
PRM-RR-3	WEA-RIS-14	UE	1.98E-03	µCi/cc	2XODCM = 10X HI ALARM , H =	1.98E-04 µCi/cc	page A.28; ref 36 p 5.5	
		ALERT	3.450E-03	µCi/cc	10 MR/HR TEDE OR 50 MR/HR THY CDE	50 mrem/hr THY	page A.31	150
		SAE	3.450E-02	µCi/cc	100 MR/HR TEDE OR 500 MR/HR THY CDE	500 mrem/hr THY	page A.34	1500
		GE	3.450E-01	µCi/cc	1000 MR/HR TEDE OR 5000 MR/HR THY CDE	5000 mrem/hr THY	page A.37	15000
SW-RR-1	SW-RIS-604	UE	92	CPS	2XODCM = 2X HI ALARM , Hi =alarm/0.8	37 CPS	ref 42	
		ALERT	9,240	CPS	200xODCM = 200x HI alarm/0.8			
SW-RR-2	SW-RIS-605	UE	90	CPS	2XODCM = 2X HI ALARM , Hi = alarm/0.8	36 CPS	ref 43	
		ALERT	8,980	CPS	200xODCM = 200*hi alarm/0.8			
SW-RR-1	FDR-RIS-606	UE	53	CPS	2XODCM = 2X HI-HI ALARM, Hi-HI =	26 CPS	ref 50	
		ALERT	5,280	CPS	200xODCM = 200*HI-HI alarm			
PRM-RR-3	TSW-RIS-5	UE	2.00E-05	µCi/cc	2XODCM = 2X Alert ALARM/0.8 , Alert =	8.00E-06 µCi/cc	ref 18, 19, 39	
		ALERT	2.00E-03	µCi/cc	200xODCM = 200*hi alarm/0.8			

ANALYTICAL LIMIT DEVELOPMENT				BACKGROUND DATA					monitor		(1) minimum		draft analytical	(2) AL	(3)	A.L. analytical
MONITOR		NEW EAL draft		bkgd		REF	LIQ factor	REF	detection efficiency		detection MDL+bkgd		limit w/ bkgd	decade rounding		limit FINAL
PRM-RE-1A	shutdown		CPS	3300	cps	44		58	1.01E+09	CPS/uCi/cc	3.57E+03	cps				
	normal ops		CPS	15000	cps	44		58	1.01E+09	CPS/uCi/cc	1.56E+04	cps				
PRM-RE-1B	UE	5,000	CPS	550	cps	54		60	1.50E+06	CPS/uCi/cc	6.59E+02	cps	5.6E+03	3	5550	6E+03
	ALERT	500,000	CPS	550	cps	54							5.0E+05	5	500550	5E+05
PRM-RE-1C	ALERT	404	CPS	210	cps	55		60	3.49E+01	CPS/uCi/cc	2.78E+02	cps	4.0E+02	2	404	4E+02
	SAE	2100	CPS	210	cps	55							2.1E+03	3	2100	2E+03
	GE	19500	CPS	210	cps	55							2.0E+04	4	19500	2E+04
TEA-RIS-13	UE	1.00E-04	µCi/cc	46	cpm	80		80	2.15E+07	cpm/uCi/cc	2.40E-07	µCi/cc	1.02E-04			1.02E-04
	ALERT	8.35E-04	µCi/cc	46	cpm	80							8.35E-04			8.35E-04
	SAE	8.35E-03	µCi/cc	46	cpm	80							8.35E-03			8.35E-03
	GE	8.35E-02	µCi/cc	46	cpm	80		81	7.85E+03	cpm/uCi/cc	6.52E-04	µCi/cc	8.35E-02			8.35E-02
WEA-RIS-14	UE	1.98E-03	µCi/cc	46	cpm	79		79	1.81E+07	cpm/uCi/cc	4.68E-07	µCi/cc	1.98E-03			1.98E-03
	ALERT	3.45E-03	µCi/cc	46	cpm	79							3.45E-03			3.45E-03
	SAE	3.45E-02	µCi/cc	46	cpm	79							3.45E-02			3.45E-02
	GE	3.45E-01	µCi/cc	46	cpm	79		82	8.58E+03	cpm/uCi/cc	6.19E-04	µCi/cc	3.45E-01			3.45E-01
SW-RIS-604	UE	92	CPS	4.5	cps	42	2	42	4.62E+06	cps/uCi/cc	1.44E+01	cps	97	1	97	1E+02
	ALERT	9,240	CPS	4.5	cps	42	200	42					9245	3	9245	1E+04
SW-RIS-605	UE	90	CPS	5.5	cps	43	2	43	4.49E+06	cps/uCi/cc	1.64E+01	cps	95	1	95	1E+02
	ALERT	8,980	CPS	5.5	cps	43	200	43					8986	3	8986	1E+04
FDR-RIS-606	UE	53	CPS	9	cpm	50	2	58	3.15E+06	cpm/uCi/cc	2.30E+01	cpm	62	1	62	7E+01
	ALERT	5,280	CPS	9	cpm	50	200						5289	3	5289	7E+03
TSW-RIS-5	UE	2.00E-05	µCi/cc	300	cpm	39	2	38	1.28E+08	cpm/uCi/cc	2.97E-06	µCi/cc	2.23E-05	-5	2.2E-05	3E-05
	ALERT	2.00E-03	µCi/cc	300	cpm	39	200	38					2.00E-03	-2	2.0E-03	3E-03

Effluent Concentration per 10CFR 20 [reference 51]
EC for Cs-137 1.00E-06 uCi/ml

formula changed from pattern

TEA-RIS-13 & WEA-RIS-14 AL selected to match display units of QEDPS output.

NE-02-09-12 range checking for analytical limit

CR MONITOR	INSTRUMENT		EAL from BKGD	(1) min detect level (MDL)		Range decade per CR panels low	high	Ref	MDL met?	within range?
PRM-RR-3	PRM-RE-1B	UE	6000	6.59E+02	cps	1.00E+01	1.00E+06	28, 33	Yes	OK
		ALERT	500000						Yes	OK
PRM-RR-3	PRM-RE-1C	ALERT	400	2.78E+02	cps	1.00E+01	1.00E+06	28, 34	Yes	OK
		SAE	2000							OK
		GE	20000							OK
PRM-RR-3	TEA-RIS-13	UE	1.02E-04	2.40E-07	µCi/cc	1.00E-07	1.00E-01	81, 90 (CH1)	Yes	OK
	Low Range	ALERT	8.35E-04							OK
	Low Range	SAE	8.35E-03							OK
	Low Range	GE	8.35E-02							OK
	High Range	GE	8.35E-02	6.52E-04	µCi/cc	1.00E-03	1.00E+03	81, 90 (CH2)	Yes	OK
PRM-RR-3	WEA-RIS-14	UE	1.98E-03	4.68E-07	µCi/cc	1.00E-06	1.00E-01	82, 91 (CH1)	Yes	OK
	Low Range	ALERT	3.45E-03							OK
	Low Range	SAE	3.45E-02							OK
	Low Range	GE	3.45E-01							BAD
	High Range	GE	3.45E-01	6.19E-04	µCi/cc	1.00E-03	1.00E+03	82, 91 (CH2)	Yes	OK
SW-RR-1	SW-RIS-604	UE	1E+02	1.44E+01	cps	1.00E-01	1.00E+06		Yes	OK
		ALERT	1E+04							OK
SW-RR-2	SW-RIS-605	UE	1E+02	1.64E+01	cps	1.00E-01	1.00E+06		Yes	OK
		ALERT	1E+04							OK
SW-RR-1	FDR-RIS-606	UE	7E+01	2.30E+01	cpm	1.00E-01	1.00E+06		Yes	OK
		ALERT	7E+03							OK
PRM-RR-3	TSW-RIS-5	UE	3E-05	2.97E-06	µCi/cc	1.00E-08	1.00E-02		Yes	OK
		ALERT	3E-03							OK

NE-02-09-12 SENSITIVITY STUDY --explore range of calibration factors that can be tolerated
CAL RANGE Alternate solution investigation using Assumption 9
This is the method that EP prefers, but there are issues (see last column)
Dose-based EALs only

ALERT	10 MR/HR TEDE OR 50 MR/HR THY CDE
SAE	100 MR/HR TEDE OR 500 MR/HR THY CDE
GE	1000 MR/HR TEDE OR 5000 MR/HR THY CDE

HIDE?

MONITOR	EAL input range goal mrem/hr		Uri dose result per 3 hours		input value w/cal URI input		CHECK variations dose-based background check			LLD @ bkgd Units Check	reference URI run	ISSUES
PRM-RE-1C	from AL on BKGD sheet =		400	ALERT EAL	400	CPS	LLD =	67.5				
	from BKGD sheet >			BKGD	210	CPS	LLD @ bkgd	277.5		CPS		
80%	12.0	35.9	35.9		4.38E+02	cps	min bkgd >	172	233	ok	A.97	
	10.0	29.9	29.9	mrem TEDE/3hr	4.00E+02	cps	norm bkgd >	210	278	ok	A.49	
120%	8.0	23.9	24.0		3.62E+02	cps	max bkgd >	248	321	ok	A.100	
PRM-RE-1C	from AL on BKGD sheet =		2000	SAE EAL	2000	CPS	LLD =	67.5				
	from BKGD sheet >			BKGD	210	CPS	LLD @ bkgd	277.5		CPS		
80%	112.8	338	338.0		2.36E+03	cps	min bkgd >	-148	0	not ok	A.103	0 min bkgd
	94.0	282	282.0	mrem TEDE/3hr	2.00E+03	cps	norm bkgd >	210	278	ok	A.52	
120%	75.2	226	225.0		1.64E+03	cps	max bkgd >	568	679	ok	A.106	
PRM-RE-1C	from AL on BKGD sheet =		20000	GE EAL	20000	CPS	LLD =	67.5				
	from BKGD sheet >			BKGD	210	CPS	LLD @ bkgd	277.5		CPS		
80%	1248	3744	3750		2.40E+04	cps	min bkgd >	-3748	0	not ok	A.109	0 min bkgd
	1040	3120	3120	mrem TEDE/3hr	2.00E+04	cps	norm bkgd >	210	278	ok	A.55	
120%	832	2496	2490		1.60E+04	cps	max bkgd >	4168	4469	ok	A.112	
TEA-RIS-13	from AL on BKGD sheet =		8.35E-04	ALERT EAL	8.35.E-04	µCi/cc	LLD =	32	cpm	**Low Range Detector**		
	from BKGD sheet >			BKGD	46	cpm	LLD @ bkgd	78	cpm	µCi/cc		
80%	60.0	180	180		1.00E-03	µCi/cc	min bkgd >	-3535	0.00E+00	not ok	A.115	0 min bkgd
	50.0	150	150	mrem/hr CDE/3hr	8.35E-04	µCi/cc	norm bkgd >	46	3.61E-06	ok	A.61	
120%	40.0	120	120		6.68E-04	µCi/cc	max bkgd >	3627	1.82E-04	ok	A.118	
TEA-RIS-13	from AL on BKGD sheet =		8.35E-03	SAE EAL	8.35.E-03	µCi/cc	LLD =	32	cpm	**Low Range Detector**		
	from BKGD sheet >			BKGD	46	cpm	LLD @ bkgd	78	cpm	µCi/cc		
80%	600	1800	1800		1.00E-02	µCi/cc	min bkgd >	-35850	0.00E+00	not ok	A.121	0 min bkgd
	500	1500	1500	mrem/hr CDE/3hr	8.35E-03	µCi/cc	norm bkgd >	46	3.61E-06	ok	A.64	
120%	400	1200	1210		6.68E-03	µCi/cc	max bkgd >	35942	1.71E-03	ok	A.124	

TEA-RIS-13		from AL on BKGD sheet =		8.35E-02	GE EAL	8.35E-02	µCi/cc	LLD =	32	cpm	**Low Range Detector**				
		from BKGD sheet >			BKGD	46	cpm	LLD @ bkgd	78	cpm	µCi/cc				
	80%	6000	18000	18000		1.00E-01	µCi/cc	min bkgd >	-358995	0.00E+00	not ok	A.127	0 min bkgd
		5000	15000	15000	mrem/hr CDE/3hr	8.35E-02	µCi/cc	norm bkgd >	46	3.61E-06	ok	A.67	
	120%	4000	12000	12100		6.68E-02	µCi/cc	max bkgd >	359087	1.68E-02	ok	A.130	
		from AL on BKGD sheet =		8.94E-02	GE EAL	8.94E-02	µCi/cc	LLD =	32	cpm	**High Range Detector**				
		from BKGD sheet >			BKGD	46	cpm	LLD @ bkgd	78	cpm	µCi/cc				
	80%					1.06E-01	µCi/cc	min bkgd >	-85	0.00E+00	not ok		Estimated
					mrem/hr CDE/3hr	8.94E-02	µCi/cc	norm bkgd >	46	9.89E-03	ok		can't
	120%					7.27E-02	µCi/cc	max bkgd >	177	3.05E-02	ok		test
WEA-RIS-14		from AL on BKGD sheet =		3.45E-03	ALERT EAL	3.45E-03	µCi/cc	LLD =	32	cpm	**Low Range Detector**				
		from BKGD sheet >			BKGD	46	cpm	LLD @ bkgd	78	cpm	µCi/cc				
	80%	60.0	180	180		4.14E-03	µCi/cc	min bkgd >	-12434	0.00E+00	not ok	A.133	0 min bkgd
		50.0	150	150	mrem/hr CDE/3hr	3.45E-03	µCi/cc	norm bkgd >	46	4.29E-06	ok	A.73	
	120%	40.0	120	120		2.76E-03	µCi/cc	max bkgd >	12526	7.21E-04	ok	A.136	
WEA-RIS-14		from AL on BKGD sheet =		3.45E-02	SAE EAL	3.45E-02	µCi/cc	LLD =	32		**Low Range Detector**				
		from BKGD sheet >			BKGD	46	cpm	LLD @ bkgd	78		µCi/cc				
	80%	600	1800	1800		4.14E-02	µCi/cc	min bkgd >	-124835	0.00E+00	not ok	A.139	0 min bkgd
		500	1500	1500	mrem/hr CDE/3hr	3.45E-02	µCi/cc	norm bkgd >	46	4.29E-06	ok	A.76	
	120%	400	1200	1200		2.76E-02	µCi/cc	max bkgd >	124927	6.99E-03	ok	A.142	
WEA-RIS-14		from AL on BKGD sheet =		3.45E-01	GE EAL	3.45E-01	µCi/cc	LLD =	32		**Low Range Detector**				
		from BKGD sheet >			BKGD	46	cpm	LLD @ bkgd	78		µCi/cc				
	80%	6000	18000	18000		4.14E-01	µCi/cc	min bkgd >	-1248845	0.00E+00	not ok	A.145	0 min bkgd
		5000	15000	15000	mrem/hr CDE/3hr	3.45E-01	µCi/cc	norm bkgd >	46	4.29E-06	ok	A.79	
	120%	4000	12000	12000		2.76E-01	µCi/cc	max bkgd >	1248937	6.93E-02	ok	A.148	
		from AL on BKGD sheet =		3.50E-01	GE EAL	3.50E-01	µCi/cc	LLD =	32		**High Range Detector**				
		from BKGD sheet >			BKGD	46	cpm	LLD @ bkgd	78		µCi/cc				
	80%					4.19E-01	µCi/cc	min bkgd >	-546	0.00E+00	not ok		Estimated
					mrem/hr CDE/3hr	3.50E-01	µCi/cc	norm bkgd >	46	9.04E-03	ok	A.79	can't
	120%					2.81E-01	µCi/cc	max bkgd >	638	8.81E-02	ok		test

method:
1. Use the reference URI run from sheet FINAL to establish the dose goal.
2. change URI input by 80% and record the dose value for the target input from step 1.
3. change URI input by 120% and record the dose value for the target input from step 1.
4. Find the input values that result in those dose values from steps 2 and 3. Record input in center column.
5. check EAL values found in step 4 for LLD and drift to see if there is a margin problem with that instrument.
   Check sum = -1*(value from step 4)+EAL+BKGD
   If check sum <= LLD@ BKGD then not ok else ok represents margin for drift/ cal errors beyond LLD
6. establish EAL value as target dose value in the middle row.

TM-2120 Table PC-1

ODCM RFO Offsite Radioactivity Release Limits	UE value		URI case	UE/2 value		URI case
PRM-RE-1B	6.00E+03	cps	A.82	3.0E+03	cps	A.88
TEA-RIS-13	1.02E-04	uCi/cc	A.58	5.1E-05	uCi/cc	A.91
WEA-RIS-14	1.98E-03	uCi/cc	A.70	9.9E-04	uCi/cc	A.94

NE-02-09-12 EMERGENCY PLAN Table 3 for PPM 13.1.1

CR MONITOR	INSTRUMENT		EAL		BASIS	actual hourly dose rate at EAL		URI run REFERENCE
PRM-RR-3	PRM-RE-1B	UE	6,000	CPS	2XODCM = 5 X HI ALARM	0.0	mrem TEDE	A.82
		N/A	500,000	CPS	200XODCM = 500X HI ALARM	0.6	mrem/hr TEDE	A.85
PRM-RR-3	PRM-RE-1C	ALERT	400	CPS	10 MR/HR TEDE OR 50 MR/HR THY CDE	10	mrem/hr TEDE	A.49
		SAE	2,000	CPS	100 MR/HR TEDE OR 500 MR/HR THY CDE	94	mrem/hr TEDE	A.52
		GE	20,000	CPS	1000 MR/HR TEDE OR 5000 MR/HR THY CDE	1040	mrem/hr TEDE	A.55
PRM-RR-3	TEA-RIS-13	UE	1.02E-04	µCi/cc	2XODCM = 5X HI ALARM	6	mrem/hr THY	A.58
		ALERT	8.35E-04	µCi/cc	10 MR/HR TEDE OR 50 MR/HR THY CDE	50	mrem/hr THY	A.61
		SAE	8.35E-03	µCi/cc	100 MR/HR TEDE OR 500 MR/HR THY CDE	500	mrem/hr THY	A.64
		GE	8.35E-02	µCi/cc	1000 MR/HR TEDE OR 5000 MR/HR THY CDE	5000	mrem/hr THY	A.67
PRM-RR-3	WEA-RIS-14	UE	1.98E-03	µCi/cc	2XODCM = 10X HI ALARM	29	mrem/hr THY	A.70
		ALERT	3.45E-03	µCi/cc	10 MR/HR TEDE OR 50 MR/HR THY CDE	50	mrem/hr THY	A.73
		SAE	3.45E-02	µCi/cc	100 MR/HR TEDE OR 500 MR/HR THY CDE	500	mrem/hr THY	A.76
		GE	3.45E-01	µCi/cc	1000 MR/HR TEDE OR 5000 MR/HR THY CDE	5000	mrem/hr THY	A.79
SW-RR-1	SW-RIS-604	UE	1E+02	CPS	2XODCM = 2X HI ALARM , Hi =alarm/0.8			
		ALERT	1E+04	CPS	200xODCM = 200x HI alarm/0.8			
SW-RR-2	SW-RIS-605	UE	1E+02	CPS	2XODCM = 2X HI ALARM , Hi = alarm/0.8			
		ALERT	1E+04	CPS	200xODCM = 200*hi alarm/0.8			
SW-RR-1	FDR-RIS-606	UE	7E+01	CPS	2XODCM = 2X HI-HI ALARM			
		ALERT	7E+03	CPS	200xODCM = 200*HI-HI alarm			
PRM-RR-3	TSW-RIS-5	UE	3.E-05	µCi/cc	2XODCM = 2X Alert ALARM/0.8			
		ALERT	3.E-03	µCi/cc	200xODCM = 200*hi alarm/0.8			

change from pattern
changed in this revision

NE-02-09-12

PPM INPUTS SUMMARY OF RESULTS from sheet CAL RANGE

CR MONITOR	INSTRUMENT			ALLOWED BACKGROUND RANGE MIN	NORMAL	MAX
PRM-RR-3	PRM-RE-1B	UE	CPS			
		ALERT	CPS			
PRM-RR-3	PRM-RE-1C	ALERT	CPS	172	210	248
		SAE	CPS			
		GE	CPS			
PRM-RR-3	TEA-RIS-13		CPM	0.0	46	150
Channel	1	UE	µCi/cc			
Channel	2	GE	µCi/cc	0.0	5.86E-03	1.91E-02
Channel	3		µCi/cc			Bkg ok
PRM-RR-3	WEA-RIS-14		CPM			
Channel	1	UE	µCi/cc			
Channel	2	GE	µCi/cc			
Channel	3		µCi/cc			

No value cited means there is no limitation on background for that instrument
Background is more constrained than value presented on sheet CAL RANGE.

PPM 5.2.1 & SAG2 Table 27 Input

NE-02-09-12

PPM INPUTS SUMMARY OF RESULTS from sheet FINAL

ODCM RFO Offsite Radioactivity Release Limits

INSTRUMENT	TABLE 27 LIMIT		BASIS	2xODCM +Bkg	1xODCM +Bkg		REFERENCE
PRM-RE-1B	3.0E+03	CPS	UE / 2	6550	3550	cps	D.90, D.103
TEA-RIS-13	5.1E-05	µCi/cc	UE / 2	1.02E-04	5.22E-05	µCi/cc	D.94, D.107
WEA-RIS-14	9.9E-04	µCi/cc	UE / 2	1.98E-03	9.92E-04	µCi/cc	D.98, D.111

Appendix A

COMPUTER RUNS WITH URI

Description	Pages	Notes
Cases from spreadsheet page NEW	A.1 – A.39	Initial values
Not referenced	A.40 – A.48	skip
Cases from spreadsheet page FINAL	A.49 – A.87	Final values
Cases from spreadsheet page PC-1	A.88 – A.96	Procedure values
Cases from spreadsheet page cal range	A.97 – A.150	Calibration range checking

Dose Assessment

Columbia Generating Station **Monday, March 09, 2015 13:43**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

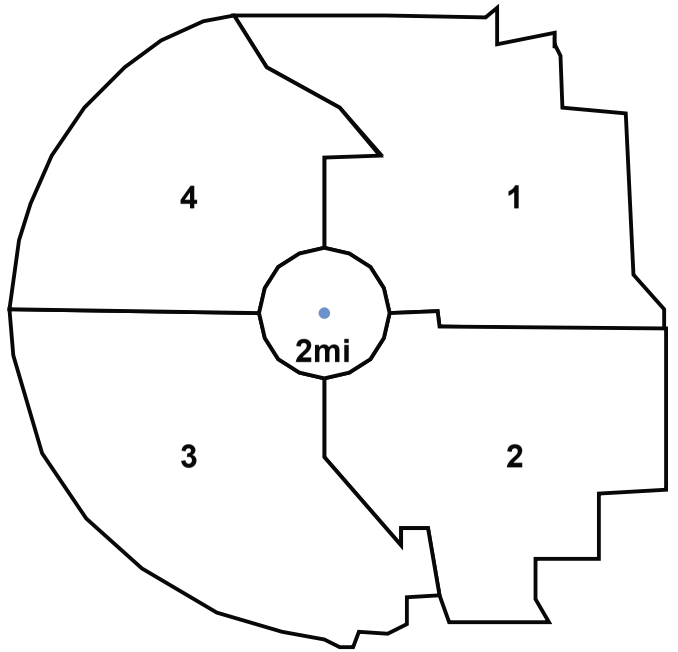
Precipitation: None

Monitor: Stack (INT) Readings: 5.00E+03 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03092015 134354.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	6.26E-08 (0.0%)
Iodine	1.53E-06 (0.0%)
Noble Gas	6.30E-03 (100.0%)

Reviewed By: REVIEWED
By John D. Fisher at 12:53 pm, Mar 30, 2015

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Isotopic Release Rates

Columbia Generating Station **Monday, March 09, 2015 13:43**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.15E-05	Kr-85m	2.56E-04	Kr-87	5.10E-04	Kr-88	7.05E-04	Xe-131m	1.51E-05
Xe-133	2.25E-03	Xe-133m	7.13E-05	Xe-135	5.89E-04	Xe-138	1.89E-03		

Iodines in Ci/sec									
I-131	1.77E-07	I-132	2.57E-07	I-133	3.60E-07	I-134	3.96E-07	I-135	3.44E-07

Particulates in Ci/sec									
Cs-134	3.11E-08	Cs-136	9.89E-09	Cs-137	2.16E-08	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.2

Additional Meteorological Inputs

Columbia Generating Station **Monday, March 09, 2015 13:43**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (INT) reads in units of CPS
- Conversion Factor: 1.5000E+12
- Background Subtract: 5.5000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	Unable To Calculate	1.00
5 - Miles	Unable To Calculate	1.00
10 - Miles	Unable To Calculate	1.00

Dose Assessment

Columbia Generating Station **Monday, March 09, 2015 13:50**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

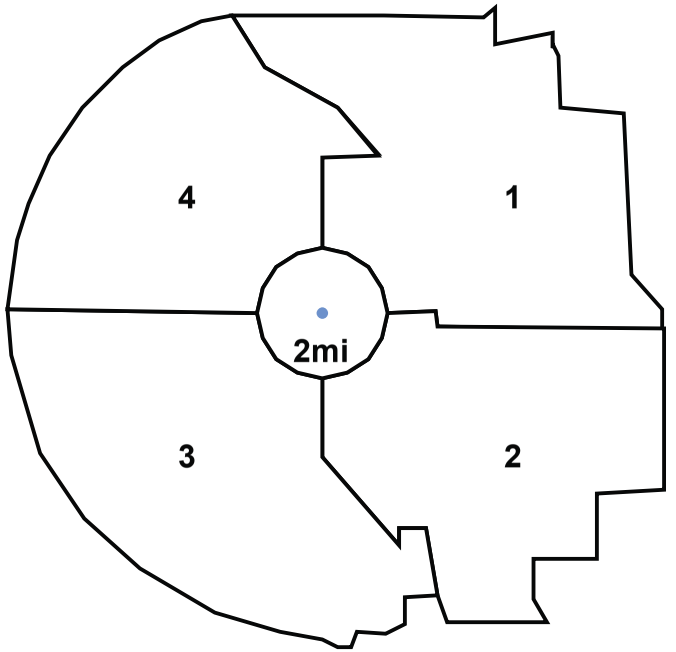
Precipitation: None

Monitor: Stack (INT) Readings: 5.00E+05 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	8.37E-01	1.66E+00	0.00E+00	1.13E-01	1.77E+00	3.87E-01
1.5	6.96E-01	1.34E+00	0.00E+00	1.21E-01	1.47E+00	3.10E-01
2.0	5.36E-01	1.00E+00	0.00E+00	1.32E-01	1.14E+00	2.41E-01
3.0	3.45E-01	6.27E-01	0.00E+00	0.00E+00	6.27E-01	1.60E-01
4.0	3.34E-01	5.96E-01	0.00E+00	0.00E+00	5.96E-01	1.33E-01
5.0	2.68E-01	4.71E-01	0.00E+00	0.00E+00	4.71E-01	1.10E-01
7.0	1.57E-01	2.84E-01	0.00E+00	0.00E+00	2.84E-01	0.00E+00
10.0	1.42E-01	2.60E-01	0.00E+00	0.00E+00	2.60E-01	0.00E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03092015 135028.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	7.02E-06 (0.0%)
Iodine	1.72E-04 (0.0%)
Noble Gas	7.07E-01 (100.0%)

Reviewed By: _____

REVIEWED
By John D. Fisher at 12:53 pm, Mar 30, 2015

Isotopic Release Rates

Columbia Generating Station **Monday, March 09, 2015 13:50**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.29E-03	Kr-85m	2.87E-02	Kr-87	5.72E-02	Kr-88	7.91E-02	Xe-131m	1.70E-03
Xe-133	2.53E-01	Xe-133m	8.01E-03	Xe-135	6.61E-02	Xe-138	2.12E-01		

Iodines in Ci/sec									
I-131	1.99E-05	I-132	2.89E-05	I-133	4.04E-05	I-134	4.45E-05	I-135	3.86E-05

Particulates in Ci/sec									
Cs-134	3.49E-06	Cs-136	1.11E-06	Cs-137	2.42E-06	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Monday, March 09, 2015 13:50**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (INT) reads in units of CPS
- Conversion Factor: 1.5000E+12
- Background Subtract: 5.5000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	1.00	1.00
5 - Miles	1.00	1.00
10 - Miles	1.00	1.00

Dose Assessment

Columbia Generating Station **Monday, March 09, 2015 09:33**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

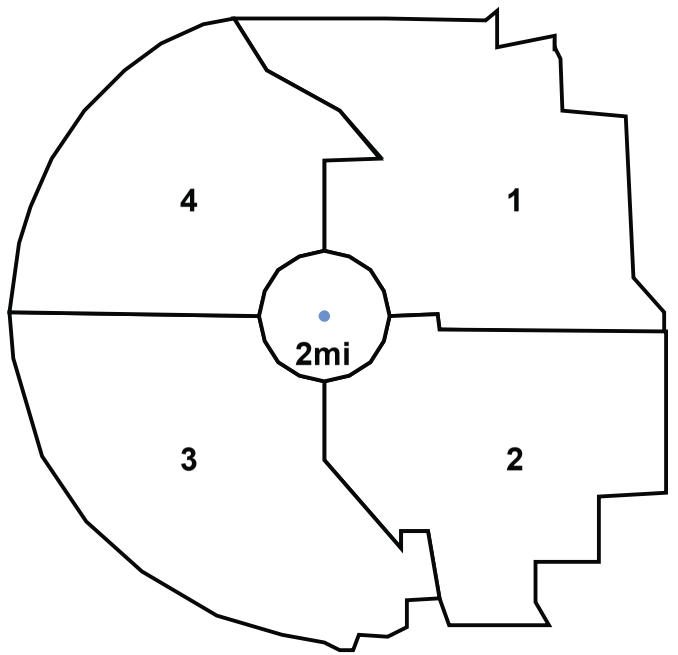
Precipitation: None

Monitor: Stack (HI) Readings: 4.04E+02 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.40E+01	2.76E+01	1.05E+00	1.89E+00	3.05E+01	6.47E+00
1.5	1.16E+01	2.24E+01	1.08E+00	2.03E+00	2.56E+01	5.17E+00
2.0	8.96E+00	1.68E+01	1.17E+00	2.20E+00	2.02E+01	4.03E+00
3.0	5.76E+00	1.05E+01	7.02E-01	1.28E+00	1.25E+01	2.66E+00
4.0	5.56E+00	9.95E+00	6.79E-01	1.20E+00	1.18E+01	2.23E+00
5.0	4.48E+00	7.87E+00	5.93E-01	1.01E+00	9.47E+00	1.83E+00
7.0	2.63E+00	4.73E+00	3.84E-01	6.15E-01	5.73E+00	1.16E+00
10.0	2.38E+00	4.35E+00	3.61E-01	4.72E-01	5.18E+00	1.17E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03092015 093303.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.17E-04 (0.0%)
Iodine	2.87E-03 (0.0%)
Noble Gas	1.18E+01 (100.0%)

Reviewed By: REVIEWED
By John D. Fisher at 12:52 pm, Mar 30, 2015

Isotopic Release Rates

Columbia Generating Station **Monday, March 09, 2015 09:33**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	2.16E-02	Kr-85m	4.79E-01	Kr-87	9.56E-01	Kr-88	1.32E+00	Xe-131m	2.84E-02
Xe-133	4.22E+00	Xe-133m	1.34E-01	Xe-135	1.10E+00	Xe-138	3.54E+00		

Iodines in Ci/sec									
I-131	3.32E-04	I-132	4.82E-04	I-133	6.74E-04	I-134	7.42E-04	I-135	6.44E-04

Particulates in Ci/sec									
Cs-134	5.83E-05	Cs-136	1.85E-05	Cs-137	4.04E-05	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Monday, March 09, 2015 09:33**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Wednesday, March 25, 2015 11:47**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

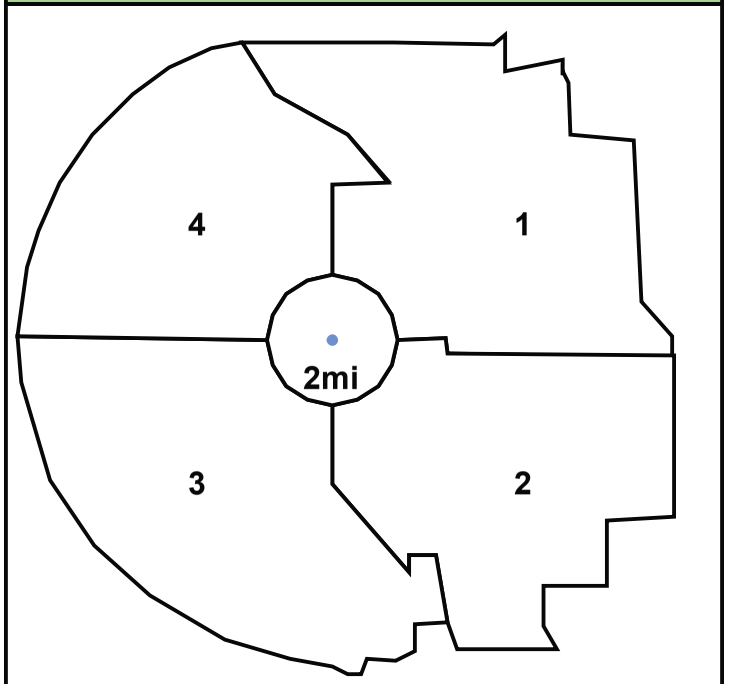
Precipitation: None

Monitor: Stack (HI) Readings: 2.10E+03 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.36E+02	2.69E+02	1.03E+01	1.84E+01	2.98E+02	6.29E+01
1.5	1.13E+02	2.18E+02	1.06E+01	1.98E+01	2.49E+02	5.03E+01
2.0	8.76E+01	1.63E+02	1.15E+01	2.15E+01	1.96E+02	3.92E+01
3.0	5.60E+01	1.02E+02	6.85E+00	1.24E+01	1.21E+02	2.59E+01
4.0	5.44E+01	9.71E+01	6.63E+00	1.17E+01	1.15E+02	2.17E+01
5.0	4.36E+01	7.68E+01	5.78E+00	9.86E+00	9.24E+01	1.78E+01
7.0	2.56E+01	4.62E+01	3.75E+00	6.00E+00	5.60E+01	1.13E+01
10.0	2.32E+01	4.24E+01	3.52E+00	4.61E+00	5.05E+01	1.14E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03252015 114708.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.14E-03 (0.0%)
Iodine	2.80E-02 (0.0%)
Noble Gas	1.15E+02 (100.0%)

Reviewed By: _____

REVIEWED
By John D. Fisher at 12:52 pm, Mar 30, 2015

Isotopic Release Rates

Columbia Generating Station **Wednesday, March 25, 2015 11:47**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	2.10E-01	Kr-85m	4.67E+00	Kr-87	9.31E+00	Kr-88	1.29E+01	Xe-131m	2.76E-01
Xe-133	4.11E+01	Xe-133m	1.30E+00	Xe-135	1.07E+01	Xe-138	3.45E+01		

Iodines in Ci/sec									
I-131	3.23E-03	I-132	4.70E-03	I-133	6.56E-03	I-134	7.23E-03	I-135	6.27E-03

Particulates in Ci/sec									
Cs-134	5.68E-04	Cs-136	1.80E-04	Cs-137	3.94E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Wednesday, March 25, 2015 11:47**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Wednesday, March 25, 2015 11:57**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:01

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

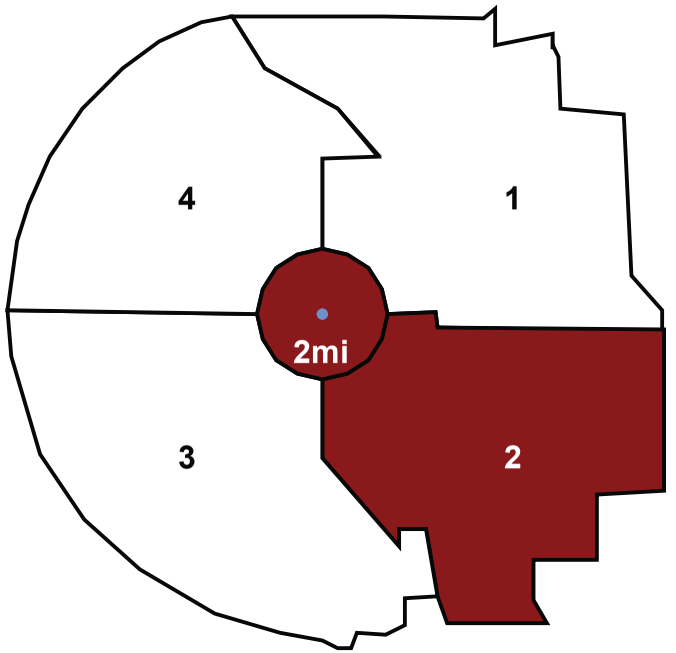
Precipitation: None

Monitor: Stack (HI) Readings: 1.95E+04 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.38E+03	2.71E+03	1.04E+02	1.83E+02	3.00E+03	6.52E+02
1.5	1.14E+03	2.21E+03	1.07E+02	1.97E+02	2.51E+03	5.21E+02
2.0	8.84E+02	1.66E+03	1.16E+02	2.14E+02	1.99E+03	4.06E+02
3.0	5.68E+02	1.03E+03	6.92E+01	1.24E+02	1.23E+03	2.69E+02
4.0	5.48E+02	9.84E+02	6.70E+01	1.16E+02	1.17E+03	2.25E+02
4.03	5.48E+02	9.84E+02	6.70E+01	1.16E+02	1.17E+03	2.25E+02
5.0	4.40E+02	7.79E+02	5.85E+01	9.81E+01	9.36E+02	1.84E+02
7.0	2.60E+02	4.69E+02	3.80E+01	5.98E+01	5.67E+02	1.17E+02
10.0	2.36E+02	4.32E+02	3.58E+01	4.60E+01	5.14E+02	1.18E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03252015 115750.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.18E-02 (0.0%)
Iodine	2.89E-01 (0.0%)
Noble Gas	1.17E+03 (100.0%)

Reviewed By: REVIEWED
By John D. Fisher at 12:58 pm, Mar 30, 2015

NE-02-09-12 Rev 3, page A.13

Isotopic Release Rates

Columbia Generating Station **Wednesday, March 25, 2015 11:57**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	2.18E+00	Kr-85m	4.83E+01	Kr-87	9.57E+01	Kr-88	1.33E+02	Xe-131m	2.87E+00
Xe-133	4.26E+02	Xe-133m	1.35E+01	Xe-135	1.11E+02	Xe-138	3.41E+02		

Iodines in Ci/sec									
I-131	3.35E-02	I-132	4.85E-02	I-133	6.80E-02	I-134	7.40E-02	I-135	6.49E-02

Particulates in Ci/sec									
Cs-134	5.89E-03	Cs-136	1.87E-03	Cs-137	4.08E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Wednesday, March 25, 2015 11:57**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Monday, March 09, 2015 09:36**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A | Drywell Sprays: = N/A | Supp Pool HUT: = N/A | Supp Pool Status: = N/A

Rx Bldg HUT: = N/A | SBGT Filters: = N/A | Turb Bldg HUT: = < 2 Hours | RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

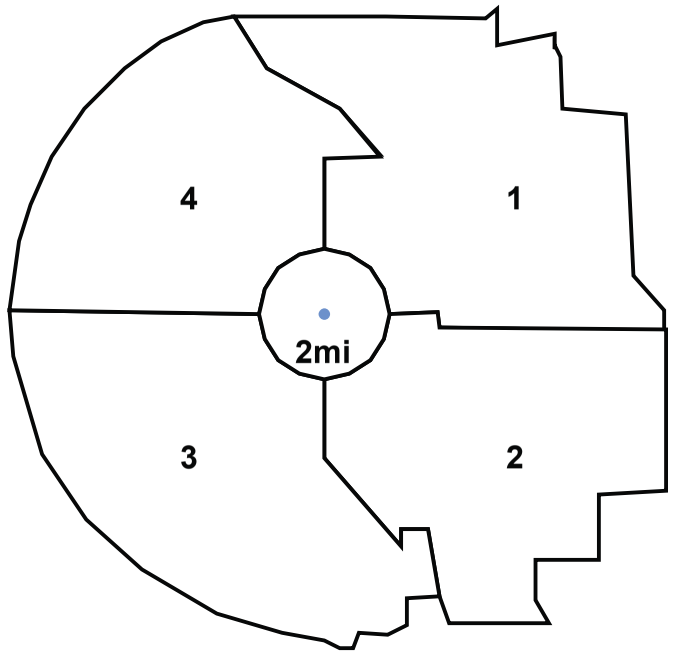
Precipitation: None

Monitor: Turb Bldg Readings: 1.00E-04 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	0.00E+00	0.00E+00	6.96E-01	2.87E-01	9.83E-01	1.76E+01
1.5	0.00E+00	0.00E+00	5.51E-01	2.26E-01	7.77E-01	1.39E+01
2.0	0.00E+00	0.00E+00	4.15E-01	1.69E-01	5.84E-01	1.05E+01
3.0	0.00E+00	0.00E+00	2.75E-01	1.06E-01	3.81E-01	6.96E+00
4.0	0.00E+00	0.00E+00	2.14E-01	0.00E+00	2.14E-01	5.41E+00
5.0	0.00E+00	0.00E+00	1.77E-01	0.00E+00	1.77E-01	4.47E+00
7.0	0.00E+00	0.00E+00	1.11E-01	0.00E+00	1.11E-01	2.83E+00
10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03092015 093601.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	2.62E-04 (1.5%)
Iodine	6.41E-03 (37.3%)
Noble Gas	1.05E-02 (61.1%)

Reviewed By: **REVIEWED** *By John D. Fisher at 12:58 pm, Mar 30, 2015*

NE-02-09-12 Rev 3, page A.16

Isotopic Release Rates

Columbia Generating Station **Thursday, February 05, 2015 15:22**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.97E-05	Kr-85m	4.37E-04	Kr-87	8.70E-04	Kr-88	1.20E-03	Xe-131m	2.58E-05
Xe-133	3.84E-03	Xe-133m	1.22E-04	Xe-135	1.00E-03	Xe-138	3.23E-03		

Iodines in Ci/sec									
I-131	7.56E-04	I-132	1.10E-03	I-133	1.53E-03	I-134	1.69E-03	I-135	1.47E-03

Particulates in Ci/sec									
Cs-134	1.33E-04	Cs-136	4.22E-05	Cs-137	9.20E-05	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.17

Additional Meteorological Inputs

Columbia Generating Station **Thursday, February 05, 2015 15:22**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.00	0.00
5 - Miles	0.00	0.00
10 - Miles	Unable To Calculate	1.00

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 18:06**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

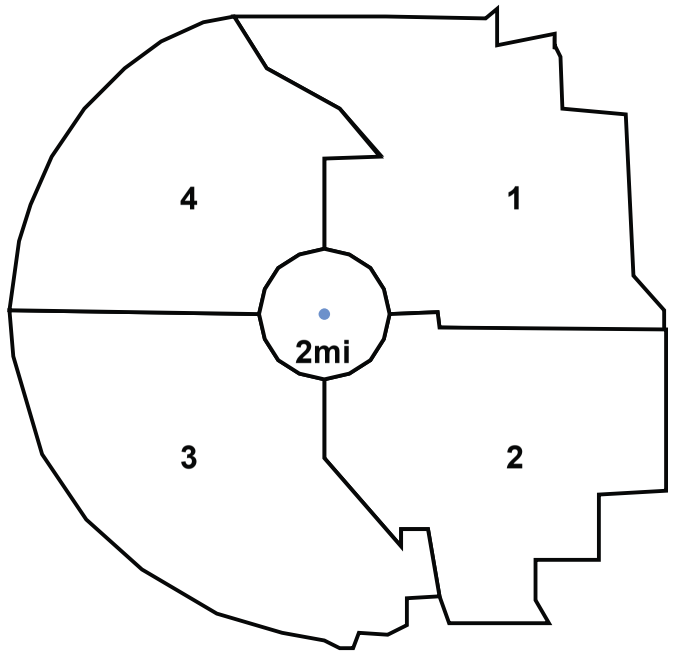
Precipitation: None

Monitor: Turb Bldg Readings: 8.35E-04 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.72E-01	5.88E-01	5.93E+00	2.44E+00	8.96E+00	1.50E+02
1.5	3.68E-01	4.57E-01	4.69E+00	1.92E+00	7.07E+00	1.19E+02
2.0	2.58E-01	3.18E-01	3.54E+00	1.43E+00	5.29E+00	8.94E+01
3.0	1.78E-01	2.25E-01	2.34E+00	9.02E-01	3.47E+00	5.93E+01
4.0	1.36E-01	1.82E-01	1.82E+00	6.85E-01	2.69E+00	4.61E+01
5.0	1.14E-01	1.48E-01	1.50E+00	5.59E-01	2.21E+00	3.81E+01
7.0	0.00E+00	0.00E+00	9.49E-01	3.46E-01	1.30E+00	2.41E+01
10.0	0.00E+00	0.00E+00	7.92E-01	2.58E-01	1.05E+00	2.01E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 180603.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	2.23E-03 (1.5%)
Iodine	5.46E-02 (37.3%)
Noble Gas	8.97E-02 (61.2%)

Reviewed By: **REVIEWED** *By John D. Fisher at 12:59 pm, Mar 30, 2015*

NE-02-09-12 Rev 3, page A.19

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 18:06**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.64E-04	Kr-85m	3.64E-03	Kr-87	7.26E-03	Kr-88	1.00E-02	Xe-131m	2.15E-04
Xe-133	3.20E-02	Xe-133m	1.01E-03	Xe-135	8.38E-03	Xe-138	2.69E-02		

Iodines in Ci/sec									
I-131	6.30E-03	I-132	9.16E-03	I-133	1.28E-02	I-134	1.41E-02	I-135	1.22E-02

Particulates in Ci/sec									
Cs-134	1.11E-03	Cs-136	3.52E-04	Cs-137	7.67E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.20

Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 18:06**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 18:06**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

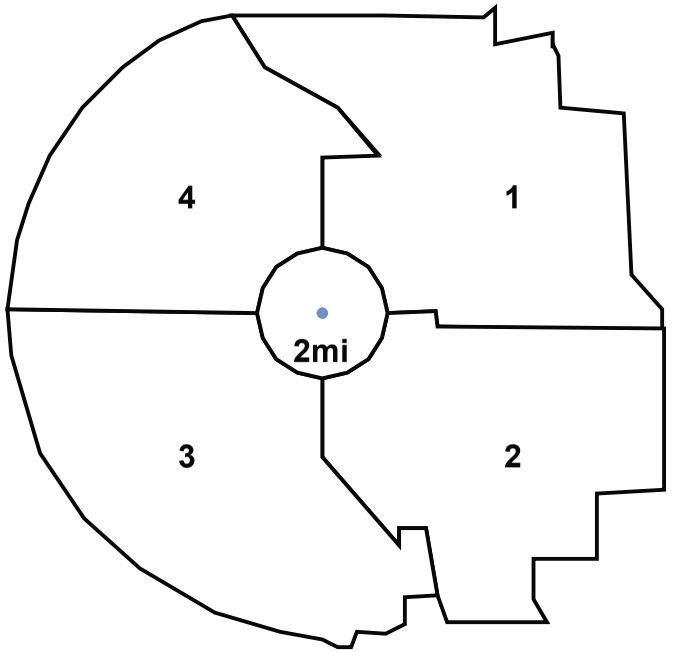
Precipitation: None

Monitor: Turb Bldg Readings: 8.35E-03 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.72E+00	5.90E+00	5.94E+01	2.45E+01	8.98E+01	1.50E+03
1.5	3.69E+00	4.60E+00	4.70E+01	1.93E+01	7.10E+01	1.19E+03
2.0	2.60E+00	3.19E+00	3.55E+01	1.43E+01	5.30E+01	8.96E+02
3.0	1.79E+00	2.26E+00	2.35E+01	9.04E+00	3.48E+01	5.94E+02
4.0	1.37E+00	1.82E+00	1.83E+01	6.87E+00	2.69E+01	4.62E+02
5.0	1.14E+00	1.48E+00	1.51E+01	5.60E+00	2.22E+01	3.82E+02
7.0	6.76E-01	9.06E-01	9.51E+00	3.47E+00	1.39E+01	2.41E+02
10.0	5.08E-01	7.12E-01	7.93E+00	2.58E+00	1.12E+01	2.02E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 180640.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.23E-02 (1.5%)
Iodine	5.47E-01 (37.3%)
Noble Gas	8.99E-01 (61.2%)

Reviewed By: _____

REVIEWED
By John D. Fisher at 12:59 pm, Mar 30, 2015

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 18:06**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.64E-03	Kr-85m	3.65E-02	Kr-87	7.27E-02	Kr-88	1.01E-01	Xe-131m	2.16E-03
Xe-133	3.21E-01	Xe-133m	1.02E-02	Xe-135	8.40E-02	Xe-138	2.70E-01		

Iodines in Ci/sec									
I-131	6.32E-02	I-132	9.18E-02	I-133	1.28E-01	I-134	1.41E-01	I-135	1.23E-01

Particulates in Ci/sec									
Cs-134	1.11E-02	Cs-136	3.52E-03	Cs-137	7.69E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 18:06**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 18:07**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

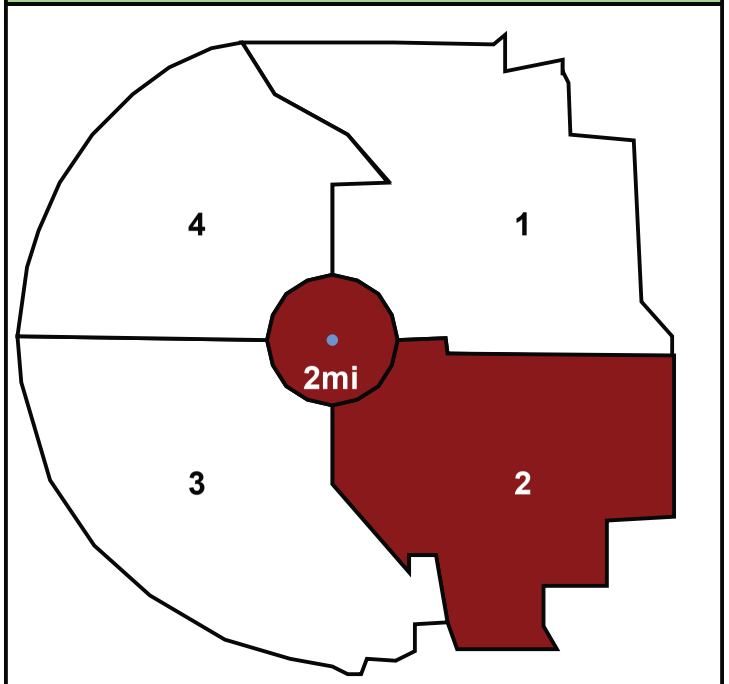
Precipitation: None

Monitor: Turb Bldg Readings: 8.35E-02 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.72E+01	5.90E+01	5.94E+02	2.45E+02	8.99E+02	1.50E+04
1.5	3.69E+01	4.60E+01	4.70E+02	1.93E+02	7.10E+02	1.19E+04
2.0	2.60E+01	3.19E+01	3.55E+02	1.43E+02	5.30E+02	8.96E+03
3.0	1.79E+01	2.26E+01	2.35E+02	9.04E+01	3.48E+02	5.94E+03
3.35	1.61E+01	2.05E+01	2.04E+02	7.79E+01	3.03E+02	5.17E+03
4.0	1.37E+01	1.82E+01	1.83E+02	6.87E+01	2.70E+02	4.62E+03
5.0	1.14E+01	1.48E+01	1.51E+02	5.60E+01	2.22E+02	3.82E+03
7.0	6.76E+00	9.06E+00	9.51E+01	3.47E+01	1.39E+02	2.41E+03
10.0	5.08E+00	7.12E+00	7.93E+01	2.58E+01	1.12E+02	2.02E+03

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 180709.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.23E-01 (1.5%)
Iodine	5.47E+00 (37.3%)
Noble Gas	8.99E+00 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 12:59 pm, Mar 30, 2015

NE-02-09-12 Rev 3, page A.25

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 18:07**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.64E-02	Kr-85m	3.65E-01	Kr-87	7.28E-01	Kr-88	1.01E+00	Xe-131m	2.16E-02
Xe-133	3.21E+00	Xe-133m	1.02E-01	Xe-135	8.40E-01	Xe-138	2.70E+00		

Iodines in Ci/sec									
I-131	6.32E-01	I-132	9.18E-01	I-133	1.28E+00	I-134	1.41E+00	I-135	1.23E+00

Particulates in Ci/sec									
Cs-134	1.11E-01	Cs-136	3.53E-02	Cs-137	7.69E-02	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 18:07**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Monday, March 09, 2015 09:38**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

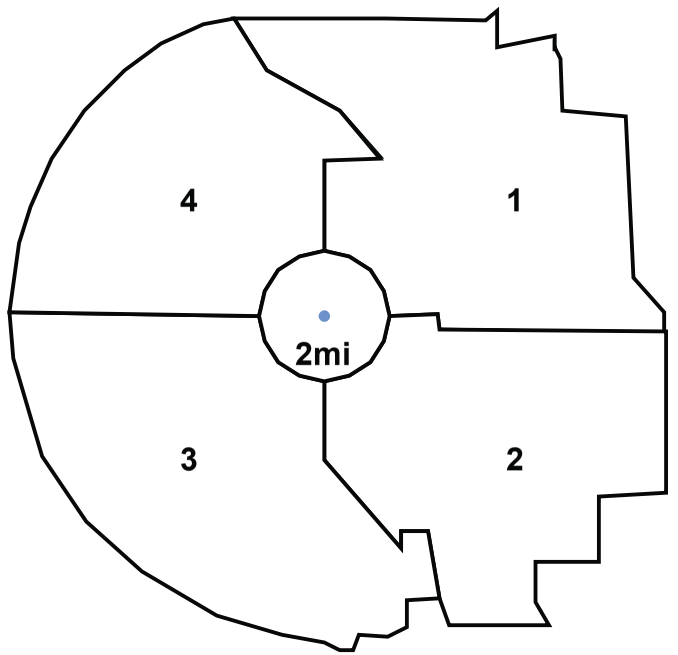
Precipitation: None

Monitor: RW Bldg Readings: 1.98E-03 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	2.70E-01	3.37E-01	3.40E+00	1.40E+00	5.13E+00	8.59E+01
1.5	2.10E-01	2.60E-01	2.70E+00	1.11E+00	4.07E+00	6.82E+01
2.0	1.47E-01	1.80E-01	2.02E+00	8.16E-01	3.01E+00	5.10E+01
3.0	1.01E-01	1.30E-01	1.30E+00	4.91E-01	1.93E+00	3.30E+01
4.0	0.00E+00	1.03E-01	1.05E+00	3.83E-01	1.53E+00	2.65E+01
5.0	0.00E+00	0.00E+00	8.18E-01	2.94E-01	1.11E+00	2.07E+01
7.0	0.00E+00	0.00E+00	5.16E-01	1.81E-01	6.97E-01	1.31E+01
10.0	0.00E+00	0.00E+00	3.85E-01	1.21E-01	5.06E-01	9.80E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03092015 093830.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.23E-03 (1.5%)
Iodine	3.01E-02 (37.2%)
Noble Gas	4.95E-02 (61.2%)

Reviewed By: REVIEWED By John D. Fisher at 1:00 pm, Mar 30, 2015

NE-02-09-12 Rev 3, page A.28

Isotopic Release Rates

Columbia Generating Station **Monday, March 09, 2015 09:38**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	9.06E-05	Kr-85m	2.01E-03	Kr-87	4.01E-03	Kr-88	5.54E-03	Xe-131m	1.19E-04
Xe-133	1.77E-02	Xe-133m	5.60E-04	Xe-135	4.63E-03	Xe-138	1.49E-02		

Iodines in Ci/sec									
I-131	3.48E-03	I-132	5.06E-03	I-133	7.06E-03	I-134	7.78E-03	I-135	6.75E-03

Particulates in Ci/sec									
Cs-134	6.11E-04	Cs-136	1.94E-04	Cs-137	4.24E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Monday, March 09, 2015 09:38**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.00	0.00
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

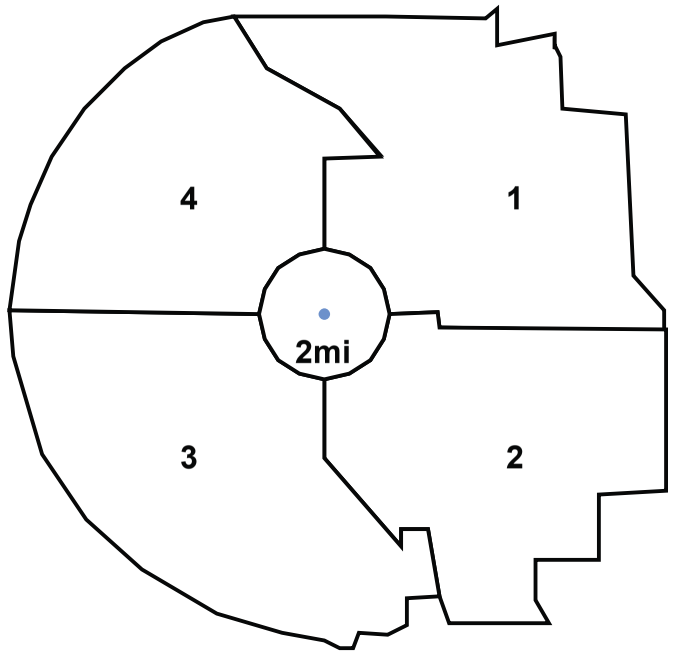
Precipitation: None

Monitor: RW Bldg Readings: 3.45E-03 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.71E-01	5.87E-01	5.93E+00	2.44E+00	8.96E+00	1.50E+02
1.5	3.66E-01	4.55E-01	4.70E+00	1.93E+00	7.09E+00	1.19E+02
2.0	2.56E-01	3.13E-01	3.52E+00	1.42E+00	5.25E+00	8.89E+01
3.0	1.77E-01	2.27E-01	2.28E+00	8.58E-01	3.36E+00	5.76E+01
4.0	1.40E-01	1.80E-01	1.83E+00	6.69E-01	2.68E+00	4.62E+01
5.0	1.04E-01	1.38E-01	1.43E+00	5.13E-01	2.08E+00	3.61E+01
7.0	0.00E+00	0.00E+00	9.00E-01	3.16E-01	1.22E+00	2.28E+01
10.0	0.00E+00	0.00E+00	6.72E-01	2.09E-01	8.82E-01	1.71E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03252015 130405.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	2.14E-03 (1.5%)
Iodine	5.25E-02 (37.2%)
Noble Gas	8.63E-02 (61.2%)

Reviewed By: ***REVIEWED*** ***By John D. Fisher at 1:00 pm, Mar 30, 2015***

Isotopic Release Rates

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.58E-04	Kr-85m	3.50E-03	Kr-87	6.99E-03	Kr-88	9.65E-03	Xe-131m	2.07E-04
Xe-133	3.08E-02	Xe-133m	9.77E-04	Xe-135	8.06E-03	Xe-138	2.59E-02		

Iodines in Ci/sec									
I-131	6.07E-03	I-132	8.81E-03	I-133	1.23E-02	I-134	1.36E-02	I-135	1.18E-02

Particulates in Ci/sec									
Cs-134	1.07E-03	Cs-136	3.38E-04	Cs-137	7.38E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

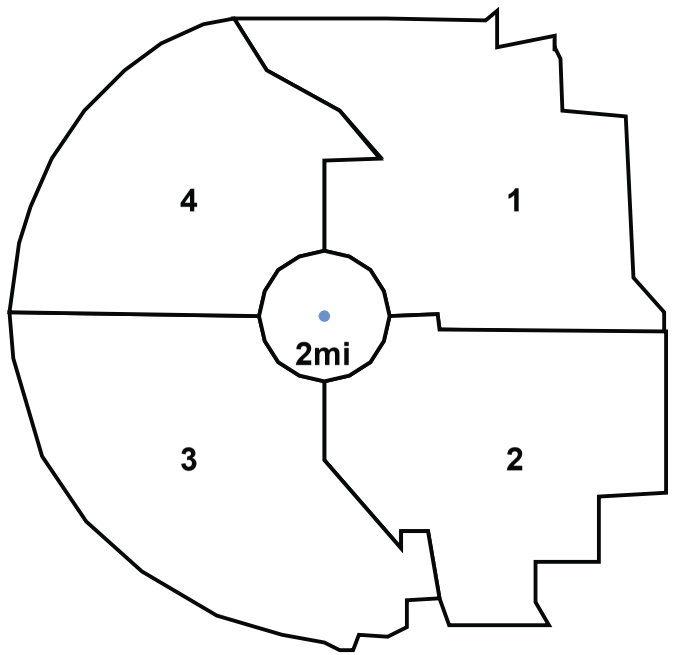
Precipitation: None

Monitor: RW Bldg Readings: 3.45E-02 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.71E+00	5.88E+00	5.93E+01	2.45E+01	8.96E+01	1.50E+03
1.5	3.67E+00	4.55E+00	4.70E+01	1.93E+01	7.09E+01	1.19E+03
2.0	2.56E+00	3.13E+00	3.52E+01	1.42E+01	5.25E+01	8.89E+02
3.0	1.77E+00	2.27E+00	2.28E+01	8.58E+00	3.36E+01	5.76E+02
4.0	1.40E+00	1.81E+00	1.83E+01	6.69E+00	2.68E+01	4.62E+02
5.0	1.04E+00	1.38E+00	1.43E+01	5.14E+00	2.08E+01	3.61E+02
7.0	6.32E-01	8.40E-01	9.00E+00	3.17E+00	1.30E+01	2.28E+02
10.0	4.24E-01	5.89E-01	6.72E+00	2.09E+00	9.41E+00	1.71E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03252015 130426.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.14E-02 (1.5%)
Iodine	5.26E-01 (37.3%)
Noble Gas	8.63E-01 (61.2%)

Reviewed By: **REVIEWED** *By John D. Fisher at 1:00 pm, Mar 30, 2015*

NE-02-09-12 Rev 3, page A.34

Isotopic Release Rates

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.58E-03	Kr-85m	3.51E-02	Kr-87	6.99E-02	Kr-88	9.66E-02	Xe-131m	2.07E-03
Xe-133	3.09E-01	Xe-133m	9.78E-03	Xe-135	8.07E-02	Xe-138	2.59E-01		

Iodines in Ci/sec									
I-131	6.07E-02	I-132	8.82E-02	I-133	1.23E-01	I-134	1.36E-01	I-135	1.18E-01

Particulates in Ci/sec									
Cs-134	1.07E-02	Cs-136	3.39E-03	Cs-137	7.39E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

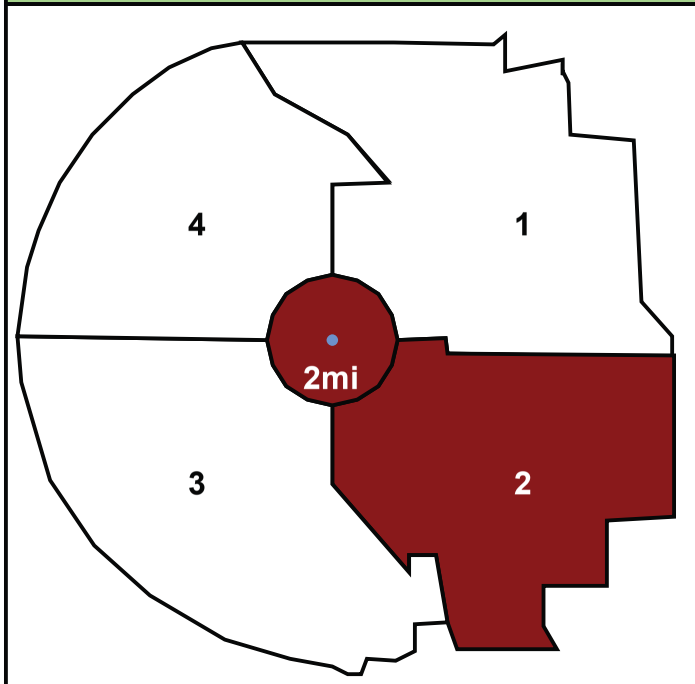
Precipitation: None

Monitor: RW Bldg Readings: 3.45E-01 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.71E+01	5.88E+01	5.93E+02	2.45E+02	8.96E+02	1.50E+04
1.5	3.67E+01	4.55E+01	4.70E+02	1.93E+02	7.09E+02	1.19E+04
2.0	2.56E+01	3.13E+01	3.52E+02	1.42E+02	5.25E+02	8.89E+03
3.0	1.77E+01	2.27E+01	2.28E+02	8.58E+01	3.36E+02	5.76E+03
3.35	1.54E+01	2.02E+01	2.03E+02	7.57E+01	2.99E+02	5.14E+03
4.0	1.40E+01	1.81E+01	1.83E+02	6.69E+01	2.68E+02	4.62E+03
5.0	1.04E+01	1.38E+01	1.43E+02	5.14E+01	2.08E+02	3.61E+03
7.0	6.32E+00	8.40E+00	9.00E+01	3.17E+01	1.30E+02	2.28E+03
10.0	4.24E+00	5.89E+00	6.72E+01	2.09E+01	9.41E+01	1.71E+03

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03252015 130448.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.14E-01 (1.5%)
Iodine	5.26E+00 (37.3%)
Noble Gas	8.64E+00 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 1:01 pm, Mar 30, 2015

Isotopic Release Rates

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.58E-02	Kr-85m	3.51E-01	Kr-87	6.99E-01	Kr-88	9.66E-01	Xe-131m	2.07E-02
Xe-133	3.09E+00	Xe-133m	9.78E-02	Xe-135	8.07E-01	Xe-138	2.59E+00		

Iodines in Ci/sec									
I-131	6.07E-01	I-132	8.82E-01	I-133	1.23E+00	I-134	1.36E+00	I-135	1.18E+00

Particulates in Ci/sec									
Cs-134	1.07E-01	Cs-136	3.39E-02	Cs-137	7.39E-02	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Wednesday, March 25, 2015 13:04**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Monday, March 09, 2015 14:54**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

Precipitation: None

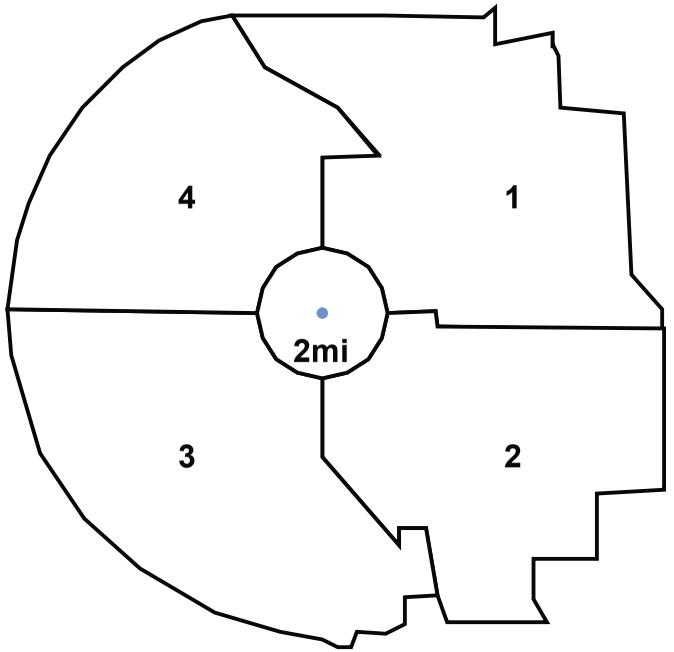
Monitor: Stack (INT) Readings: 3.00E+03 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

VOID

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03092015 145400.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	3.44E-08 (0.0%)
Iodine	8.45E-07 (0.0%)
Noble Gas	3.47E-03 (100.0%)

Reviewed By: _____

NE-02-09-12 Rev 3, page A.40

Isotopic Release Rates

Columbia Generating Station **Monday, March 09, 2015 14:54**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	6.35E-06	Kr-85m	1.41E-04	Kr-87	2.81E-04	Kr-88	3.88E-04	Xe-131m	8.33E-06
Xe-133	1.24E-03	Xe-133m	3.93E-05	Xe-135	3.24E-04	Xe-138	1.04E-03		

Iodines in Ci/sec									
I-131	9.75E-08	I-132	1.42E-07	I-133	1.98E-07	I-134	2.18E-07	I-135	1.89E-07

VOID

Particulates in Ci/sec									
Cs-134	1.71E-08	Cs-136	5.44E-09	Cs-137	1.19E-08	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.41

Additional Meteorological Inputs

Columbia Generating Station **Monday, March 09, 2015 14:54**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (INT) reads in units of CPS
- Conversion Factor: 1.5000E+12
- Background Subtract: 5.5000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	Unable To Calculate	1.00
5 - Miles	Unable To Calculate	1.00
10 - Miles	Unable To Calculate	1.00

VOID

NE-02-09-12 Rev 3, page A.42

Dose Assessment

Columbia Generating Station **Monday, March 09, 2015 14:52**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

Precipitation: None

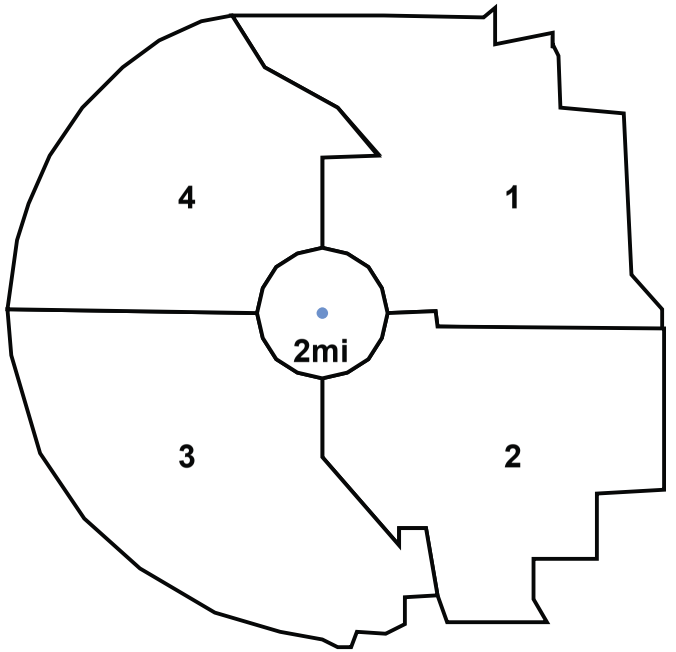
Monitor: Turb Bldg Readings: 5.10E-05 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	0.00E+00	0.00E+00	3.47E-01	1.43E-01	4.91E-01	8.79E+00
1.5	0.00E+00	0.00E+00	2.75E-01	1.13E-01	3.88E-01	6.96E+00
2.0	0.00E+00	0.00E+00	2.08E-01	0.00E+00	2.08E-01	5.26E+00
3.0	0.00E+00	0.00E+00	1.38E-01	0.00E+00	1.38E-01	3.48E+00
4.0	0.00E+00	0.00E+00	1.07E-01	0.00E+00	1.07E-01	2.71E+00
5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.24E+00
7.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E+00
10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E+00

VOID

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03092015 145215.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.31E-04 (1.5%)
Iodine	3.20E-03 (37.2%)
Noble Gas	5.26E-03 (61.2%)

Reviewed By: _____

NE-02-09-12 Rev 3, page A.43

Isotopic Release Rates

Columbia Generating Station **Monday, March 09, 2015 14:52**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	9.62E-06	Kr-85m	2.14E-04	Kr-87	4.26E-04	Kr-88	5.88E-04	Xe-131m	1.26E-05
Xe-133	1.88E-03	Xe-133m	5.95E-05	Xe-135	4.92E-04	Xe-138	1.58E-03		

Iodines in Ci/sec									
I-131	3.70E-04	I-132	5.37E-04	I-133	7.50E-04	I-134	8.27E-04	I-135	7.17E-04

Particulates in Ci/sec									
Cs-134	6.49E-05	Cs-136	2.06E-05	Cs-137	4.50E-05	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

VOID

NE-02-09-12 Rev 3, page A.44

Additional Meteorological Inputs

Columbia Generating Station **Monday, March 09, 2015 14:52**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.00	0.00
5 - Miles	Unable To Calculate	1.00
10 - Miles	Unable To Calculate	1.00

VOID

NE-02-09-12 Rev 3, page A.45

Dose Assessment

Columbia Generating Station **Monday, March 09, 2015 14:53**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

Precipitation: None

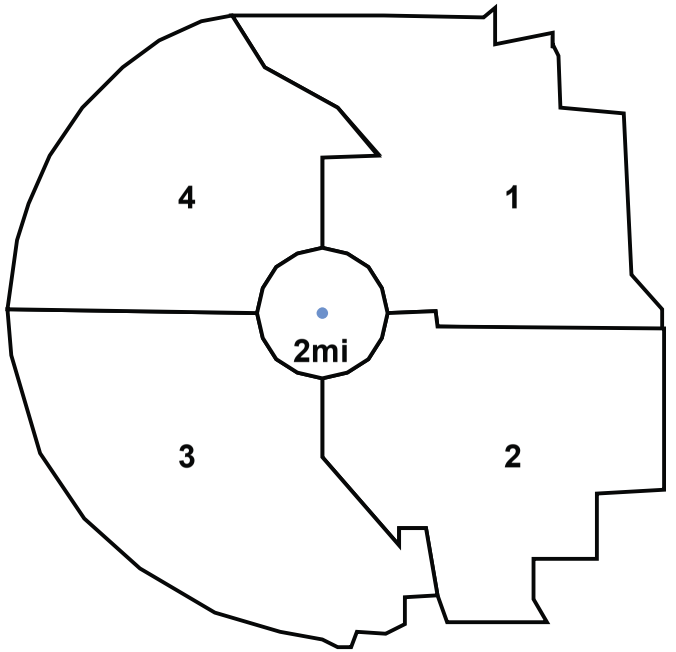
Monitor: RW Bldg Readings: 9.90E-04 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.35E-01	1.68E-01	1.70E+00	6.99E-01	2.56E+00	4.29E+01
1.5	1.05E-01	1.30E-01	1.34E+00	5.53E-01	2.03E+00	3.41E+01
2.0	0.00E+00	0.00E+00	1.01E+00	4.00E-01	1.41E+00	2.54E+01
3.0	0.00E+00	0.00E+00	6.51E-01	2.43E-01	8.97E-01	1.65E+01
4.0	0.00E+00	0.00E+00	5.23E-01	1.91E-01	7.14E-01	1.32E+01
5.0	0.00E+00	0.00E+00	4.09E-01	1.46E-01	5.55E-01	1.04E+01
7.0	0.00E+00	0.00E+00	2.58E-01	0.00E+00	2.58E-01	6.54E+00
10.0	0.00E+00	0.00E+00	1.93E-01	0.00E+00	1.93E-01	4.90E+00

VOID

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03092015 145313.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	6.14E-04 (1.5%)
Iodine	1.50E-02 (37.2%)
Noble Gas	2.47E-02 (61.3%)

Reviewed By: _____

NE-02-09-12 Rev 3, page A.46

Isotopic Release Rates

Columbia Generating Station **Monday, March 09, 2015 14:53**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	4.52E-05	Kr-85m	1.00E-03	Kr-87	2.00E-03	Kr-88	2.77E-03	Xe-131m	5.94E-05
Xe-133	8.83E-03	Xe-133m	2.80E-04	Xe-135	2.31E-03	Xe-138	7.42E-03		

Iodines in Ci/sec									
I-131	1.74E-03	I-132	2.52E-03	I-133	3.53E-03	I-134	3.88E-03	I-135	3.37E-03

Particulates in Ci/sec									
Cs-134	3.05E-04	Cs-136	9.70E-05	Cs-137	2.11E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

VOID

NE-02-09-12 Rev 3, page A.47

Additional Meteorological Inputs

Columbia Generating Station **Monday, March 09, 2015 14:53**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.00	0.00
5 - Miles	0.00	0.00
10 - Miles	0.00	0.00

VOID

NE-02-09-12 Rev 3, page A.48

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 18:42**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

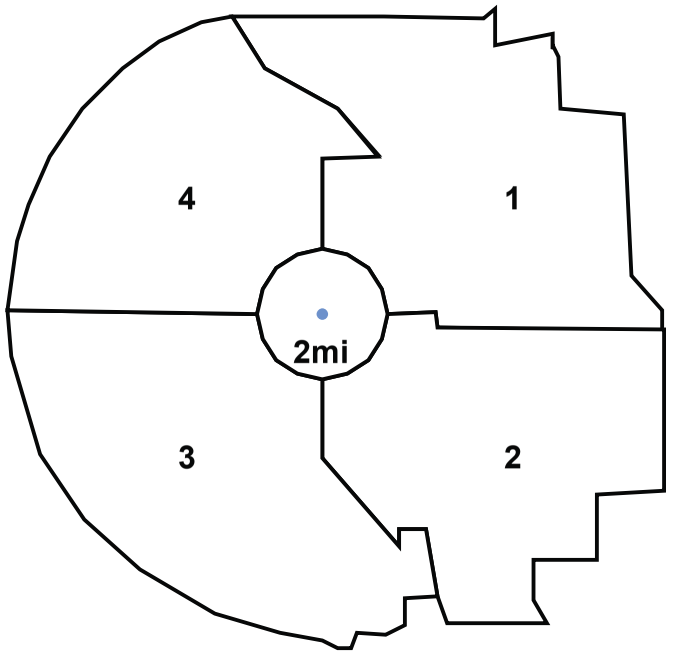
Precipitation: None

Monitor: Stack (HI) Readings: 4.00E+02 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.37E+01	2.70E+01	1.03E+00	1.85E+00	2.99E+01	6.33E+00
1.5	1.14E+01	2.20E+01	1.06E+00	1.99E+00	2.50E+01	5.06E+00
2.0	8.80E+00	1.64E+01	1.15E+00	2.16E+00	1.98E+01	3.95E+00
3.0	5.64E+00	1.03E+01	6.88E-01	1.25E+00	1.22E+01	2.61E+00
4.0	5.44E+00	9.74E+00	6.65E-01	1.17E+00	1.16E+01	2.18E+00
5.0	4.36E+00	7.70E+00	5.80E-01	9.91E-01	9.27E+00	1.79E+00
7.0	2.57E+00	4.63E+00	3.76E-01	6.03E-01	5.61E+00	1.14E+00
10.0	2.32E+00	4.25E+00	3.53E-01	4.63E-01	5.07E+00	1.15E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 184231.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.15E-04 (0.0%)
Iodine	2.81E-03 (0.0%)
Noble Gas	1.16E+01 (100.0%)

Reviewed By: REVIEWED By John D. Fisher at 2:38 pm, Mar 30, 2015

NE-02-09-12 Rev 3, page A.49

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 18:42**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	2.12E-02	Kr-85m	4.70E-01	Kr-87	9.36E-01	Kr-88	1.29E+00	Xe-131m	2.78E-02
Xe-133	4.13E+00	Xe-133m	1.31E-01	Xe-135	1.08E+00	Xe-138	3.47E+00		

Iodines in Ci/sec									
I-131	3.25E-04	I-132	4.72E-04	I-133	6.60E-04	I-134	7.27E-04	I-135	6.31E-04

Particulates in Ci/sec									
Cs-134	5.71E-05	Cs-136	1.81E-05	Cs-137	3.96E-05	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.50

Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 18:42**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 18:42**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

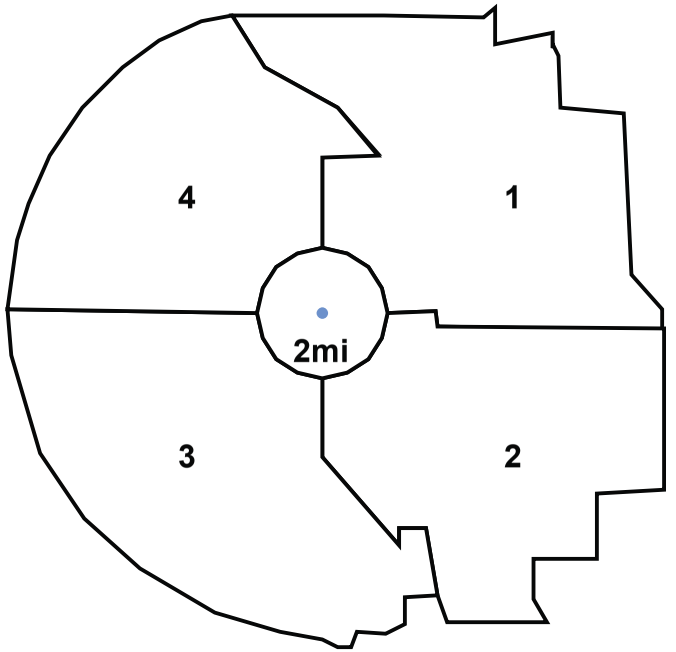
Precipitation: None

Monitor: Stack (HI) Readings: 2.00E+03 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.29E+02	2.55E+02	9.74E+00	1.75E+01	2.82E+02	5.96E+01
1.5	1.07E+02	2.08E+02	1.00E+01	1.87E+01	2.36E+02	4.76E+01
2.0	8.28E+01	1.55E+02	1.09E+01	2.04E+01	1.86E+02	3.71E+01
3.0	5.32E+01	9.67E+01	6.49E+00	1.18E+01	1.15E+02	2.46E+01
4.0	5.16E+01	9.20E+01	6.28E+00	1.11E+01	1.09E+02	2.05E+01
5.0	4.12E+01	7.27E+01	5.48E+00	9.34E+00	8.75E+01	1.68E+01
7.0	2.43E+01	4.38E+01	3.55E+00	5.68E+00	5.30E+01	1.07E+01
10.0	2.20E+01	4.01E+01	3.33E+00	4.36E+00	4.78E+01	1.08E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 184256.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.08E-03 (0.0%)
Iodine	2.65E-02 (0.0%)
Noble Gas	1.09E+02 (100.0%)

Reviewed By: REVIEWED
By John D. Fisher at 8:47 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.52

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 18:42**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.99E-01	Kr-85m	4.42E+00	Kr-87	8.82E+00	Kr-88	1.22E+01	Xe-131m	2.62E-01
Xe-133	3.89E+01	Xe-133m	1.23E+00	Xe-135	1.02E+01	Xe-138	3.27E+01		

Iodines in Ci/sec									
I-131	3.06E-03	I-132	4.45E-03	I-133	6.22E-03	I-134	6.85E-03	I-135	5.94E-03

Particulates in Ci/sec									
Cs-134	5.38E-04	Cs-136	1.71E-04	Cs-137	3.73E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 18:42**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 18:43**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

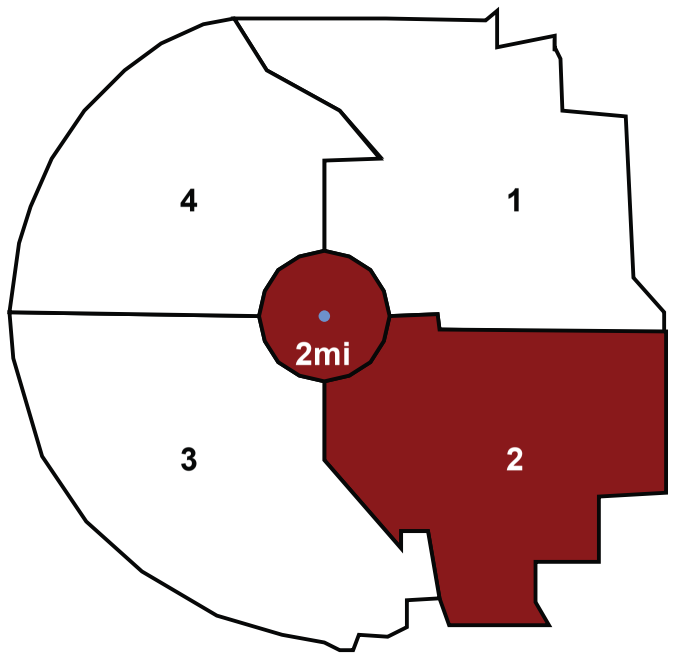
Precipitation: None

Monitor: Stack (HI) Readings: 2.00E+04 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.43E+03	2.82E+03	1.08E+02	1.93E+02	3.12E+03	6.60E+02
1.5	1.18E+03	2.29E+03	1.11E+02	2.07E+02	2.61E+03	5.28E+02
2.0	9.16E+02	1.70E+03	1.20E+02	2.25E+02	2.05E+03	4.12E+02
3.0	5.88E+02	1.07E+03	7.17E+01	1.30E+02	1.27E+03	2.72E+02
4.0	5.68E+02	1.02E+03	6.94E+01	1.22E+02	1.21E+03	2.27E+02
4.03	5.68E+02	1.02E+03	6.94E+01	1.22E+02	1.21E+03	2.27E+02
5.0	4.56E+02	8.04E+02	6.05E+01	1.03E+02	9.67E+02	1.86E+02
7.0	2.68E+02	4.84E+02	3.93E+01	6.28E+01	5.86E+02	1.18E+02
10.0	2.43E+02	4.44E+02	3.68E+01	4.82E+01	5.29E+02	1.20E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 184353.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

Release Rates (Ci / sec)	
Particulate	1.20E-02 (0.0%)
Iodine	2.93E-01 (0.0%)
Noble Gas	1.20E+03 (100.0%)

*** * * Classification: General Emergency * * ***

Reviewed By: _____

REVIEWED
By John D. Fisher at 8:48 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 18:43**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	2.20E+00	Kr-85m	4.89E+01	Kr-87	9.75E+01	Kr-88	1.35E+02	Xe-131m	2.89E+00
Xe-133	4.30E+02	Xe-133m	1.36E+01	Xe-135	1.13E+02	Xe-138	3.61E+02		

Iodines in Ci/sec									
I-131	3.39E-02	I-132	4.92E-02	I-133	6.87E-02	I-134	7.57E-02	I-135	6.57E-02

Particulates in Ci/sec									
Cs-134	5.95E-03	Cs-136	1.89E-03	Cs-137	4.12E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 18:43**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Thursday, February 05, 2015 15:22**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A | Drywell Sprays: = N/A | Supp Pool HUT: = N/A | Supp Pool Status: = N/A

Rx Bldg HUT: = N/A | SBGT Filters: = N/A | Turb Bldg HUT: = < 2 Hours | RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

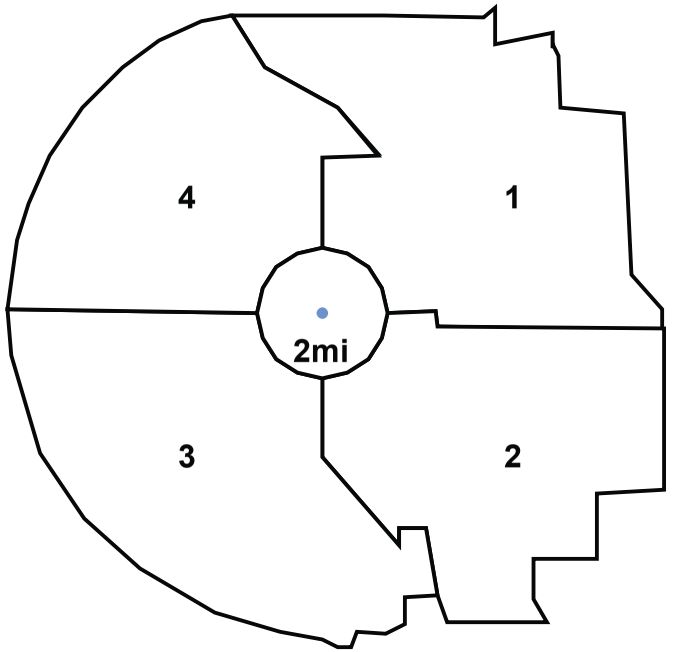
Precipitation: None

Monitor: Turb Bldg Readings: 1.02E-04 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	0.00E+00	0.00E+00	7.11E-01	2.93E-01	1.00E+00	1.80E+01
1.5	0.00E+00	0.00E+00	5.63E-01	2.31E-01	7.94E-01	1.42E+01
2.0	0.00E+00	0.00E+00	4.25E-01	1.72E-01	5.97E-01	1.07E+01
3.0	0.00E+00	0.00E+00	2.81E-01	1.08E-01	3.89E-01	7.11E+00
4.0	0.00E+00	0.00E+00	2.18E-01	0.00E+00	2.18E-01	5.52E+00
5.0	0.00E+00	0.00E+00	1.80E-01	0.00E+00	1.80E-01	4.57E+00
7.0	0.00E+00	0.00E+00	1.14E-01	0.00E+00	1.14E-01	2.88E+00
10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 02052015 152229.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	2.67E-04 (1.5%)
Iodine	6.54E-03 (37.4%)
Noble Gas	1.07E-02 (61.1%)

Reviewed By: **REVIEWED** *By John D. Fisher at 8:48 am, Mar 31, 2015*

Isotopic Release Rates

Columbia Generating Station **Thursday, February 05, 2015 15:22**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.97E-05	Kr-85m	4.37E-04	Kr-87	8.70E-04	Kr-88	1.20E-03	Xe-131m	2.58E-05
Xe-133	3.84E-03	Xe-133m	1.22E-04	Xe-135	1.00E-03	Xe-138	3.23E-03		

Iodines in Ci/sec									
I-131	7.56E-04	I-132	1.10E-03	I-133	1.53E-03	I-134	1.69E-03	I-135	1.47E-03

Particulates in Ci/sec									
Cs-134	1.33E-04	Cs-136	4.22E-05	Cs-137	9.20E-05	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Thursday, February 05, 2015 15:22**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.00	0.00
5 - Miles	0.00	0.00
10 - Miles	Unable To Calculate	1.00

Columbia Generating Station — **Thursday, February 05, 2015 14:32**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> — PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad — CGS 33ft Tower

Time After S/D (hh:mm): 0:00 — Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] — Stability Class: E

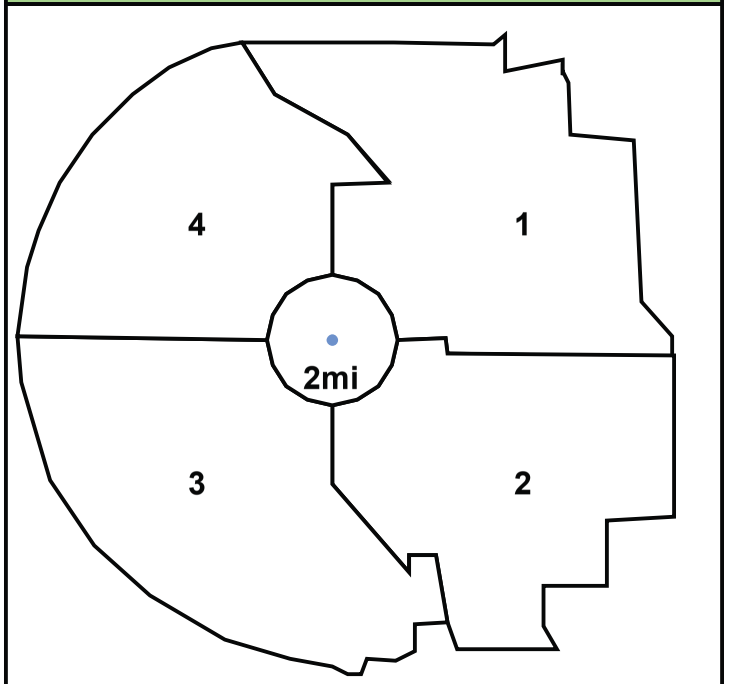
Precipitation: None

Monitor: Turb Bldg Readings: 8.35E-04 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.72E-01	5.88E-01	5.93E+00	2.44E+00	8.96E+00	1.50E+02
1.5	3.68E-01	4.57E-01	4.69E+00	1.92E+00	7.07E+00	1.19E+02
2.0	2.58E-01	3.18E-01	3.54E+00	1.43E+00	5.29E+00	8.94E+01
3.0	1.78E-01	2.25E-01	2.34E+00	9.02E-01	3.47E+00	5.93E+01
4.0	1.36E-01	1.82E-01	1.82E+00	6.85E-01	2.69E+00	4.61E+01
5.0	1.14E-01	1.48E-01	1.50E+00	5.59E-01	2.21E+00	3.81E+01
7.0	0.00E+00	0.00E+00	9.49E-01	3.46E-01	1.30E+00	2.41E+01
10.0	0.00E+00	0.00E+00	7.92E-01	2.58E-01	1.05E+00	2.01E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 02052015 143218.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	2.23E-03 (1.5%)
Iodine	5.46E-02 (37.3%)
Noble Gas	8.97E-02 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:48 am, Mar 31, 2015

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Isotopic Release Rates

This is a Drill

Columbia Generating Station **Thursday, February 05, 2015 14:32**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.64E-04	Kr-85m	3.64E-03	Kr-87	7.26E-03	Kr-88	1.00E-02	Xe-131m	2.15E-04
Xe-133	3.20E-02	Xe-133m	1.01E-03	Xe-135	8.38E-03	Xe-138	2.69E-02		

Iodines in Ci/sec									
I-131	6.30E-03	I-132	9.16E-03	I-133	1.28E-02	I-134	1.41E-02	I-135	1.22E-02

Particulates in Ci/sec									
Cs-134	1.11E-03	Cs-136	3.52E-04	Cs-137	7.67E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

This is a Drill

Columbia Generating Station **Thursday, February 05, 2015 14:32**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

This is a Drill

Miscellaneous Inputs and Data

This is a Drill

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

This is a Drill

EDE to TEDE Ratios

This is a Drill

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 17:36**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

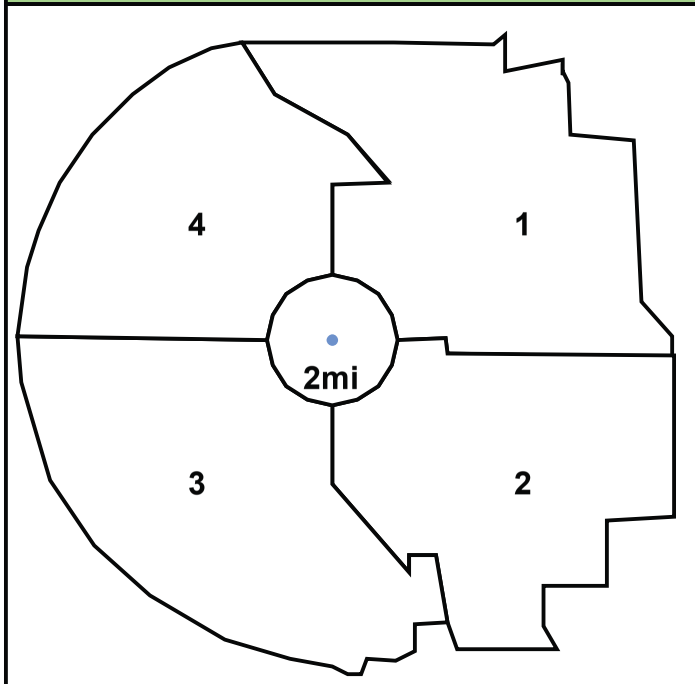
Precipitation: None

Monitor: Turb Bldg Readings: 8.35E-03 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.72E+00	5.90E+00	5.94E+01	2.45E+01	8.98E+01	1.50E+03
1.5	3.69E+00	4.60E+00	4.70E+01	1.93E+01	7.10E+01	1.19E+03
2.0	2.60E+00	3.19E+00	3.55E+01	1.43E+01	5.30E+01	8.96E+02
3.0	1.79E+00	2.26E+00	2.35E+01	9.04E+00	3.48E+01	5.94E+02
4.0	1.37E+00	1.82E+00	1.83E+01	6.87E+00	2.69E+01	4.62E+02
5.0	1.14E+00	1.48E+00	1.51E+01	5.60E+00	2.22E+01	3.82E+02
7.0	6.76E-01	9.06E-01	9.51E+00	3.47E+00	1.39E+01	2.41E+02
10.0	5.08E-01	7.12E-01	7.93E+00	2.58E+00	1.12E+01	2.02E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 173625.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.23E-02 (1.5%)
Iodine	5.47E-01 (37.3%)
Noble Gas	8.99E-01 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:48 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 17:36**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.64E-03	Kr-85m	3.65E-02	Kr-87	7.27E-02	Kr-88	1.01E-01	Xe-131m	2.16E-03
Xe-133	3.21E-01	Xe-133m	1.02E-02	Xe-135	8.40E-02	Xe-138	2.70E-01		

Iodines in Ci/sec									
I-131	6.32E-02	I-132	9.18E-02	I-133	1.28E-01	I-134	1.41E-01	I-135	1.23E-01

Particulates in Ci/sec									
Cs-134	1.11E-02	Cs-136	3.52E-03	Cs-137	7.69E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 17:36**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 18:53**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

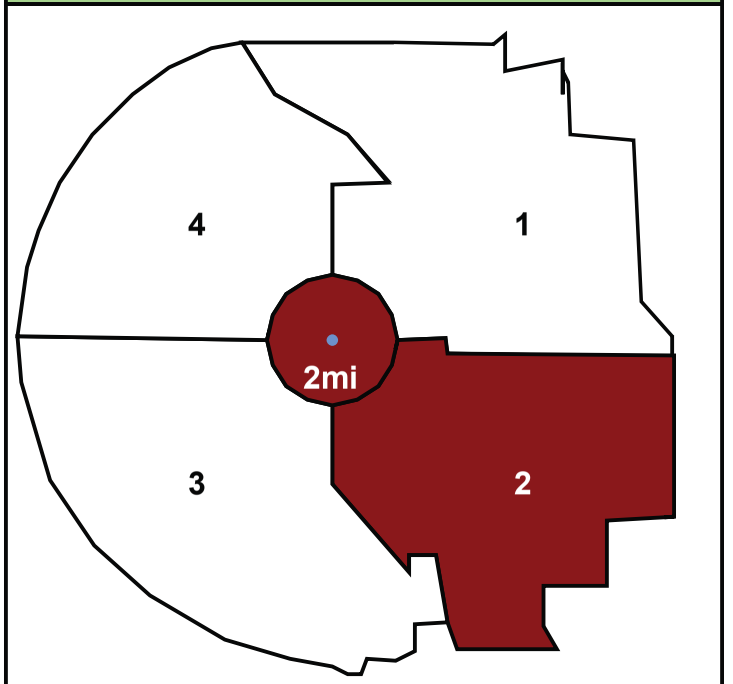
Precipitation: None

Monitor: Turb Bldg Readings: 8.35E-02 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.72E+01	5.90E+01	5.94E+02	2.45E+02	8.99E+02	1.50E+04
1.5	3.69E+01	4.60E+01	4.70E+02	1.93E+02	7.10E+02	1.19E+04
2.0	2.60E+01	3.19E+01	3.55E+02	1.43E+02	5.30E+02	8.96E+03
3.0	1.79E+01	2.26E+01	2.35E+02	9.04E+01	3.48E+02	5.94E+03
3.35	1.61E+01	2.05E+01	2.04E+02	7.79E+01	3.03E+02	5.17E+03
4.0	1.37E+01	1.82E+01	1.83E+02	6.87E+01	2.70E+02	4.62E+03
5.0	1.14E+01	1.48E+01	1.51E+02	5.60E+01	2.22E+02	3.82E+03
7.0	6.76E+00	9.06E+00	9.51E+01	3.47E+01	1.39E+02	2.41E+03
10.0	5.08E+00	7.12E+00	7.93E+01	2.58E+01	1.12E+02	2.02E+03

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 185344.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.23E-01 (1.5%)
Iodine	5.47E+00 (37.3%)
Noble Gas	8.99E+00 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:48 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 18:53**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.64E-02	Kr-85m	3.65E-01	Kr-87	7.28E-01	Kr-88	1.01E+00	Xe-131m	2.16E-02
Xe-133	3.21E+00	Xe-133m	1.02E-01	Xe-135	8.40E-01	Xe-138	2.70E+00		

Iodines in Ci/sec									
I-131	6.32E-01	I-132	9.18E-01	I-133	1.28E+00	I-134	1.41E+00	I-135	1.23E+00

Particulates in Ci/sec									
Cs-134	1.11E-01	Cs-136	3.53E-02	Cs-137	7.69E-02	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 18:53**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Thursday, March 26, 2015 19:22**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

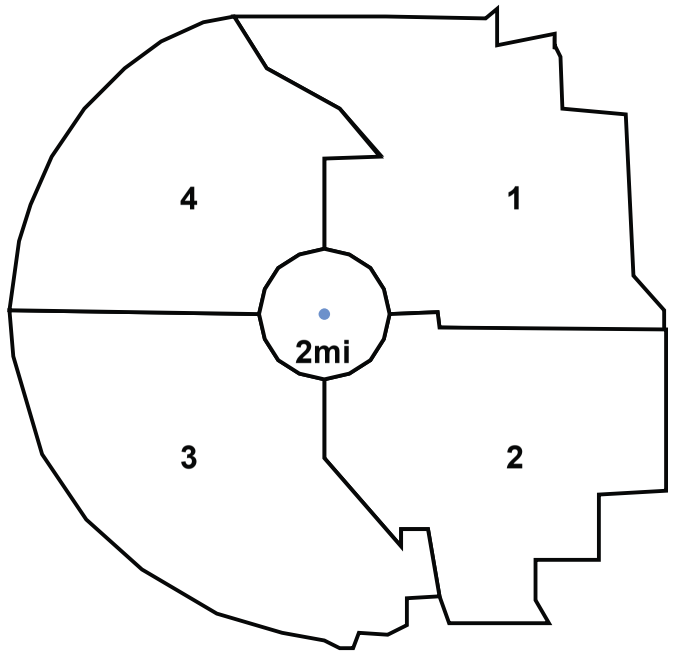
Precipitation: None

Monitor: RW Bldg Readings: 1.98E-03 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	2.70E-01	3.37E-01	3.40E+00	1.40E+00	5.13E+00	8.59E+01
1.5	2.10E-01	2.60E-01	2.70E+00	1.11E+00	4.07E+00	6.82E+01
2.0	1.47E-01	1.80E-01	2.02E+00	8.16E-01	3.01E+00	5.10E+01
3.0	1.01E-01	1.30E-01	1.30E+00	4.91E-01	1.93E+00	3.30E+01
4.0	0.00E+00	1.03E-01	1.05E+00	3.83E-01	1.53E+00	2.65E+01
5.0	0.00E+00	0.00E+00	8.18E-01	2.94E-01	1.11E+00	2.07E+01
7.0	0.00E+00	0.00E+00	5.16E-01	1.81E-01	6.97E-01	1.31E+01
10.0	0.00E+00	0.00E+00	3.85E-01	1.21E-01	5.06E-01	9.80E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03262015 192219.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.23E-03 (1.5%)
Iodine	3.01E-02 (37.2%)
Noble Gas	4.95E-02 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:49 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Thursday, March 26, 2015 19:22**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	9.06E-05	Kr-85m	2.01E-03	Kr-87	4.01E-03	Kr-88	5.54E-03	Xe-131m	1.19E-04
Xe-133	1.77E-02	Xe-133m	5.60E-04	Xe-135	4.63E-03	Xe-138	1.49E-02		

Iodines in Ci/sec									
I-131	3.48E-03	I-132	5.06E-03	I-133	7.06E-03	I-134	7.78E-03	I-135	6.75E-03

Particulates in Ci/sec									
Cs-134	6.11E-04	Cs-136	1.94E-04	Cs-137	4.24E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Thursday, March 26, 2015 19:22**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.00	0.00
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 11:22**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

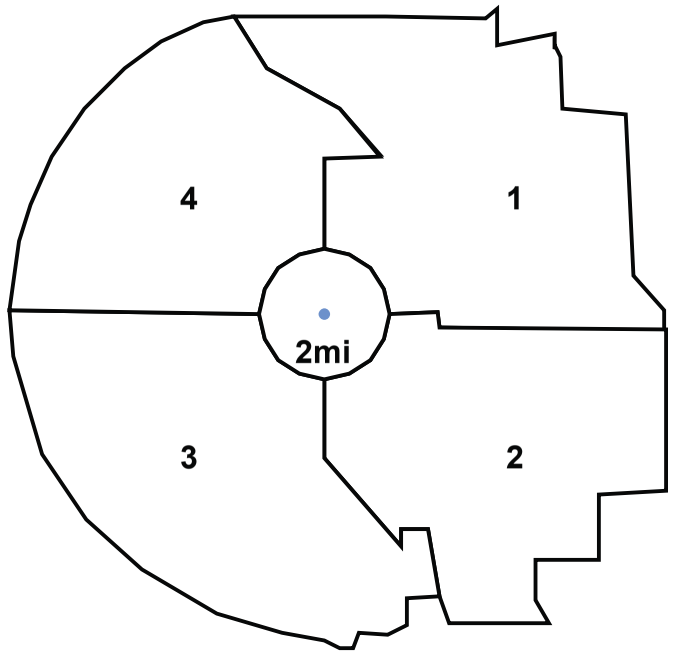
Precipitation: None

Monitor: RW Bldg Readings: 3.45E-03 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.71E-01	5.87E-01	5.93E+00	2.44E+00	8.96E+00	1.50E+02
1.5	3.66E-01	4.55E-01	4.70E+00	1.93E+00	7.09E+00	1.19E+02
2.0	2.56E-01	3.13E-01	3.52E+00	1.42E+00	5.25E+00	8.89E+01
3.0	1.77E-01	2.27E-01	2.28E+00	8.58E-01	3.36E+00	5.76E+01
4.0	1.40E-01	1.80E-01	1.83E+00	6.69E-01	2.68E+00	4.62E+01
5.0	1.04E-01	1.38E-01	1.43E+00	5.13E-01	2.08E+00	3.61E+01
7.0	0.00E+00	0.00E+00	9.00E-01	3.16E-01	1.22E+00	2.28E+01
10.0	0.00E+00	0.00E+00	6.72E-01	2.09E-01	8.82E-01	1.71E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 112246.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	2.14E-03 (1.5%)
Iodine	5.25E-02 (37.2%)
Noble Gas	8.63E-02 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:49 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 11:22**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.58E-04	Kr-85m	3.50E-03	Kr-87	6.99E-03	Kr-88	9.65E-03	Xe-131m	2.07E-04
Xe-133	3.08E-02	Xe-133m	9.77E-04	Xe-135	8.06E-03	Xe-138	2.59E-02		

Iodines in Ci/sec									
I-131	6.07E-03	I-132	8.81E-03	I-133	1.23E-02	I-134	1.36E-02	I-135	1.18E-02

Particulates in Ci/sec									
Cs-134	1.07E-03	Cs-136	3.38E-04	Cs-137	7.38E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 11:22**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 11:23**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

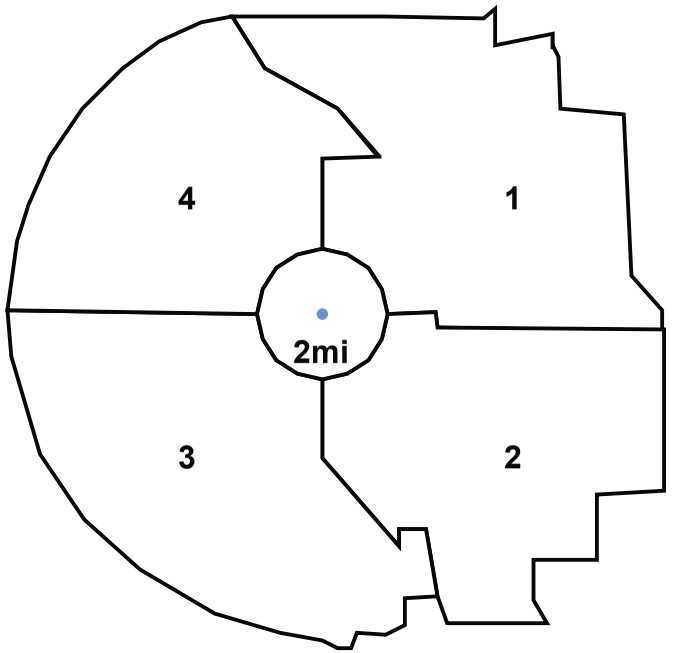
Precipitation: None

Monitor: RW Bldg Readings: 3.45E-02 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.71E+00	5.88E+00	5.93E+01	2.45E+01	8.96E+01	1.50E+03
1.5	3.67E+00	4.55E+00	4.70E+01	1.93E+01	7.09E+01	1.19E+03
2.0	2.56E+00	3.13E+00	3.52E+01	1.42E+01	5.25E+01	8.89E+02
3.0	1.77E+00	2.27E+00	2.28E+01	8.58E+00	3.36E+01	5.76E+02
4.0	1.40E+00	1.81E+00	1.83E+01	6.69E+00	2.68E+01	4.62E+02
5.0	1.04E+00	1.38E+00	1.43E+01	5.14E+00	2.08E+01	3.61E+02
7.0	6.32E-01	8.40E-01	9.00E+00	3.17E+00	1.30E+01	2.28E+02
10.0	4.24E-01	5.89E-01	6.72E+00	2.09E+00	9.41E+00	1.71E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 112318.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.14E-02 (1.5%)
Iodine	5.26E-01 (37.3%)
Noble Gas	8.63E-01 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:49 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.76

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 11:23**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.58E-03	Kr-85m	3.51E-02	Kr-87	6.99E-02	Kr-88	9.66E-02	Xe-131m	2.07E-03
Xe-133	3.09E-01	Xe-133m	9.78E-03	Xe-135	8.07E-02	Xe-138	2.59E-01		

Iodines in Ci/sec									
I-131	6.07E-02	I-132	8.82E-02	I-133	1.23E-01	I-134	1.36E-01	I-135	1.18E-01

Particulates in Ci/sec									
Cs-134	1.07E-02	Cs-136	3.39E-03	Cs-137	7.39E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 11:23**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 11:25**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

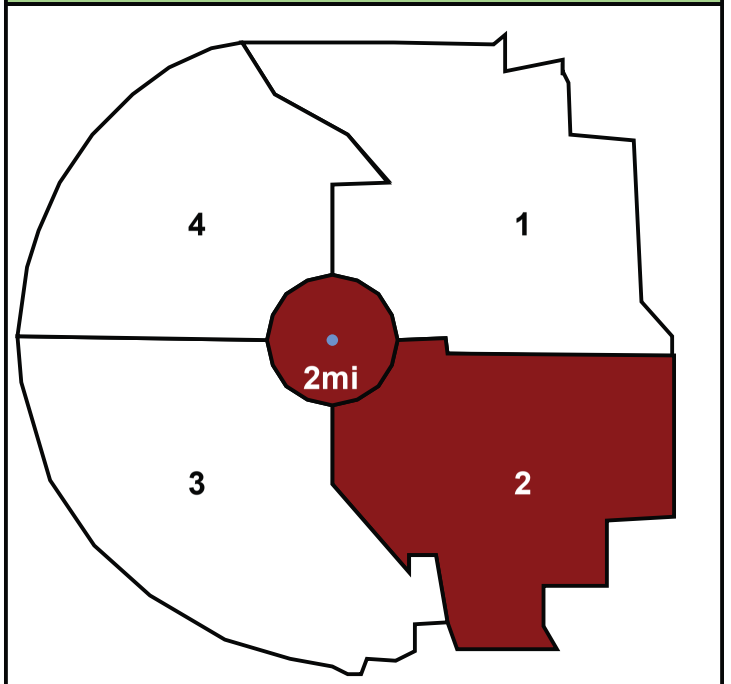
Precipitation: None

Monitor: RW Bldg Readings: 3.45E-01 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	4.71E+01	5.88E+01	5.93E+02	2.45E+02	8.96E+02	1.50E+04
1.5	3.67E+01	4.55E+01	4.70E+02	1.93E+02	7.09E+02	1.19E+04
2.0	2.56E+01	3.13E+01	3.52E+02	1.42E+02	5.25E+02	8.89E+03
3.0	1.77E+01	2.27E+01	2.28E+02	8.58E+01	3.36E+02	5.76E+03
3.35	1.54E+01	2.02E+01	2.03E+02	7.57E+01	2.99E+02	5.14E+03
4.0	1.40E+01	1.81E+01	1.83E+02	6.69E+01	2.68E+02	4.62E+03
5.0	1.04E+01	1.38E+01	1.43E+02	5.14E+01	2.08E+02	3.61E+03
7.0	6.32E+00	8.40E+00	9.00E+01	3.17E+01	1.30E+02	2.28E+03
10.0	4.24E+00	5.89E+00	6.72E+01	2.09E+01	9.41E+01	1.71E+03

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 112523.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.14E-01 (1.5%)
Iodine	5.26E+00 (37.3%)
Noble Gas	8.64E+00 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:50 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.79

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 11:25**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.58E-02	Kr-85m	3.51E-01	Kr-87	6.99E-01	Kr-88	9.66E-01	Xe-131m	2.07E-02
Xe-133	3.09E+00	Xe-133m	9.78E-02	Xe-135	8.07E-01	Xe-138	2.59E+00		

Iodines in Ci/sec									
I-131	6.07E-01	I-132	8.82E-01	I-133	1.23E+00	I-134	1.36E+00	I-135	1.18E+00

Particulates in Ci/sec									
Cs-134	1.07E-01	Cs-136	3.39E-02	Cs-137	7.39E-02	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 11:25**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 11:31**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

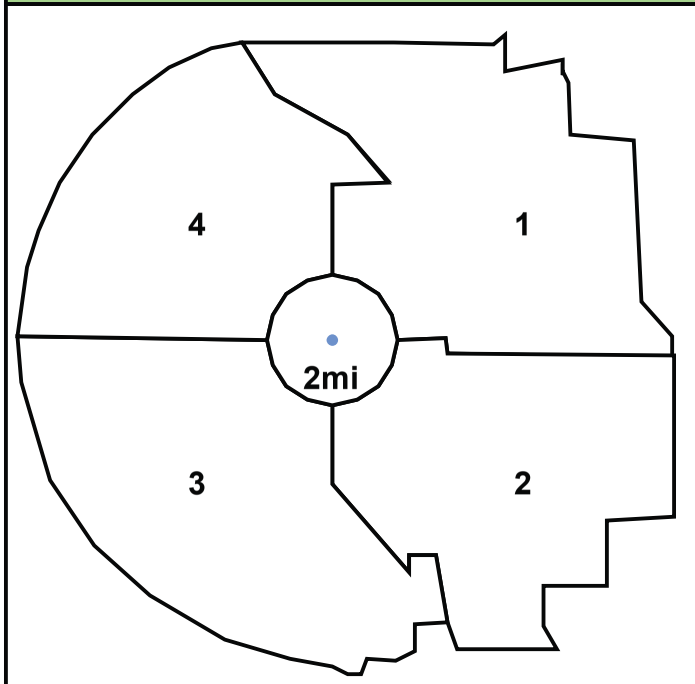
Precipitation: None

Monitor: Stack (INT) Readings: 6.00E+03 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 113103.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	7.66E-08 (0.0%)
Iodine	1.88E-06 (0.0%)
Noble Gas	7.72E-03 (100.0%)

Reviewed By: REVIEWED
By John D. Fisher at 8:50 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 11:31**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.41E-05	Kr-85m	3.13E-04	Kr-87	6.25E-04	Kr-88	8.63E-04	Xe-131m	1.85E-05
Xe-133	2.76E-03	Xe-133m	8.74E-05	Xe-135	7.21E-04	Xe-138	2.32E-03		

Iodines in Ci/sec									
I-131	2.17E-07	I-132	3.15E-07	I-133	4.40E-07	I-134	4.85E-07	I-135	4.21E-07

Particulates in Ci/sec									
Cs-134	3.81E-08	Cs-136	1.21E-08	Cs-137	2.64E-08	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 11:31**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (INT) reads in units of CPS
- Conversion Factor: 1.5000E+12
- Background Subtract: 5.5000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	Unable To Calculate	1.00
5 - Miles	Unable To Calculate	1.00
10 - Miles	Unable To Calculate	1.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 11:39**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

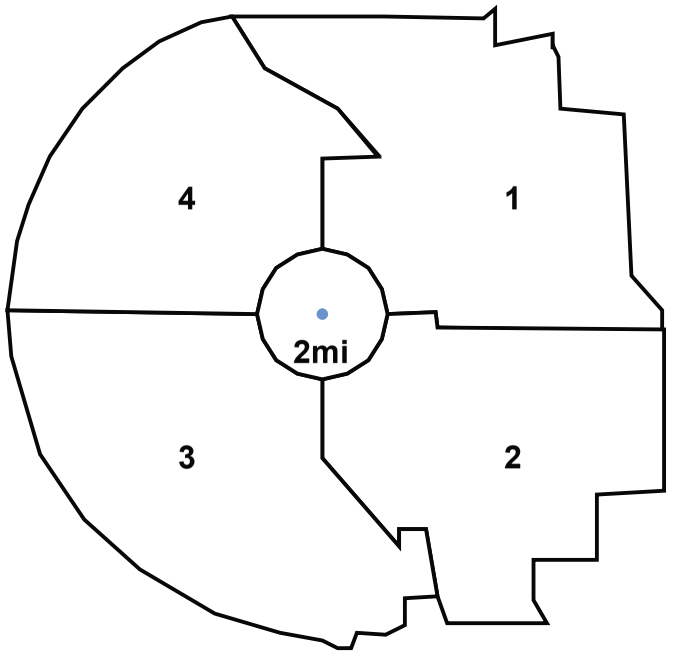
Precipitation: None

Monitor: Stack (INT) Readings: 5.00E+05 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	8.37E-01	1.66E+00	0.00E+00	1.13E-01	1.77E+00	3.87E-01
1.5	6.96E-01	1.34E+00	0.00E+00	1.21E-01	1.47E+00	3.10E-01
2.0	5.36E-01	1.00E+00	0.00E+00	1.32E-01	1.14E+00	2.41E-01
3.0	3.45E-01	6.27E-01	0.00E+00	0.00E+00	6.27E-01	1.60E-01
4.0	3.34E-01	5.96E-01	0.00E+00	0.00E+00	5.96E-01	1.33E-01
5.0	2.68E-01	4.71E-01	0.00E+00	0.00E+00	4.71E-01	1.10E-01
7.0	1.57E-01	2.84E-01	0.00E+00	0.00E+00	2.84E-01	0.00E+00
10.0	1.42E-01	2.60E-01	0.00E+00	0.00E+00	2.60E-01	0.00E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 113901.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	7.02E-06 (0.0%)
Iodine	1.72E-04 (0.0%)
Noble Gas	7.07E-01 (100.0%)

Reviewed By: REVIEWED
By John D. Fisher at 8:50 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 11:39**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.29E-03	Kr-85m	2.87E-02	Kr-87	5.72E-02	Kr-88	7.91E-02	Xe-131m	1.70E-03
Xe-133	2.53E-01	Xe-133m	8.01E-03	Xe-135	6.61E-02	Xe-138	2.12E-01		

Iodines in Ci/sec									
I-131	1.99E-05	I-132	2.89E-05	I-133	4.04E-05	I-134	4.45E-05	I-135	3.86E-05

Particulates in Ci/sec									
Cs-134	3.49E-06	Cs-136	1.11E-06	Cs-137	2.42E-06	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 11:39**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (INT) reads in units of CPS
- Conversion Factor: 1.5000E+12
- Background Subtract: 5.5000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	1.00	1.00
5 - Miles	1.00	1.00
10 - Miles	1.00	1.00

Dose Assessment

Columbia Generating Station **Monday, March 30, 2015 15:28**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

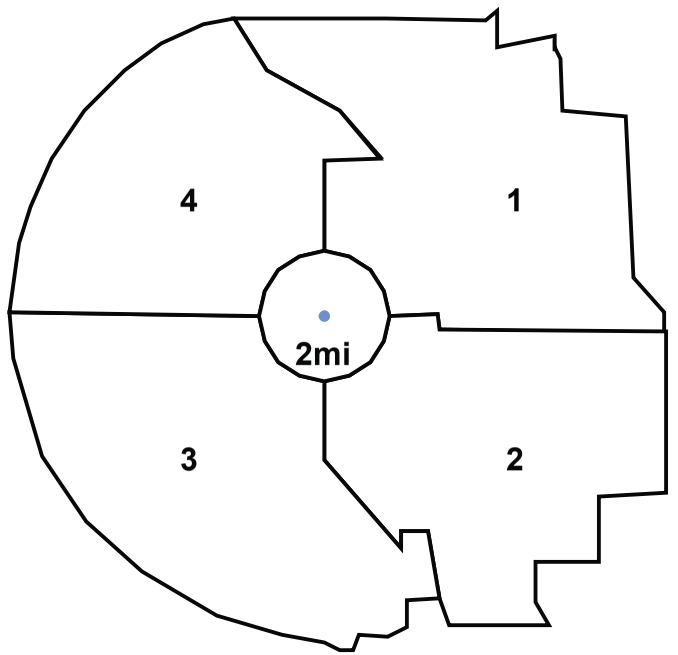
Precipitation: None

Monitor: Stack (INT) Readings: 3.00E+03 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03302015 152845.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	3.44E-08 (0.0%)
Iodine	8.45E-07 (0.0%)
Noble Gas	3.47E-03 (100.0%)

Reviewed By: REVIEWED
By John D. Fisher at 8:51 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Monday, March 30, 2015 15:28**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	6.35E-06	Kr-85m	1.41E-04	Kr-87	2.81E-04	Kr-88	3.88E-04	Xe-131m	8.33E-06
Xe-133	1.24E-03	Xe-133m	3.93E-05	Xe-135	3.24E-04	Xe-138	1.04E-03		

Iodines in Ci/sec									
I-131	9.75E-08	I-132	1.42E-07	I-133	1.98E-07	I-134	2.18E-07	I-135	1.89E-07

Particulates in Ci/sec									
Cs-134	1.71E-08	Cs-136	5.44E-09	Cs-137	1.19E-08	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Monday, March 30, 2015 15:28**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (INT) reads in units of CPS
- Conversion Factor: 1.5000E+12
- Background Subtract: 5.5000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	Unable To Calculate	1.00
5 - Miles	Unable To Calculate	1.00
10 - Miles	Unable To Calculate	1.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 11:34**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

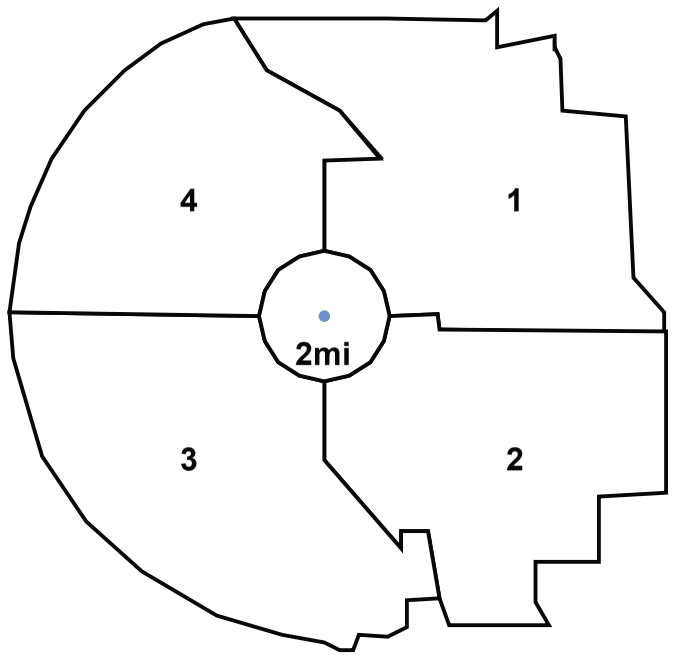
Precipitation: None

Monitor: Turb Bldg Readings: 5.10E-05 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	0.00E+00	0.00E+00	3.47E-01	1.43E-01	4.91E-01	8.79E+00
1.5	0.00E+00	0.00E+00	2.75E-01	1.13E-01	3.88E-01	6.96E+00
2.0	0.00E+00	0.00E+00	2.08E-01	0.00E+00	2.08E-01	5.26E+00
3.0	0.00E+00	0.00E+00	1.38E-01	0.00E+00	1.38E-01	3.48E+00
4.0	0.00E+00	0.00E+00	1.07E-01	0.00E+00	1.07E-01	2.71E+00
5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.24E+00
7.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E+00
10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 113436.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.31E-04 (1.5%)
Iodine	3.20E-03 (37.2%)
Noble Gas	5.26E-03 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:51 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 11:34**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	9.62E-06	Kr-85m	2.14E-04	Kr-87	4.26E-04	Kr-88	5.88E-04	Xe-131m	1.26E-05
Xe-133	1.88E-03	Xe-133m	5.95E-05	Xe-135	4.92E-04	Xe-138	1.58E-03		

Iodines in Ci/sec									
I-131	3.70E-04	I-132	5.37E-04	I-133	7.50E-04	I-134	8.27E-04	I-135	7.17E-04

Particulates in Ci/sec									
Cs-134	6.49E-05	Cs-136	2.06E-05	Cs-137	4.50E-05	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 11:34**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.00	0.00
5 - Miles	Unable To Calculate	1.00
10 - Miles	Unable To Calculate	1.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 11:35**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

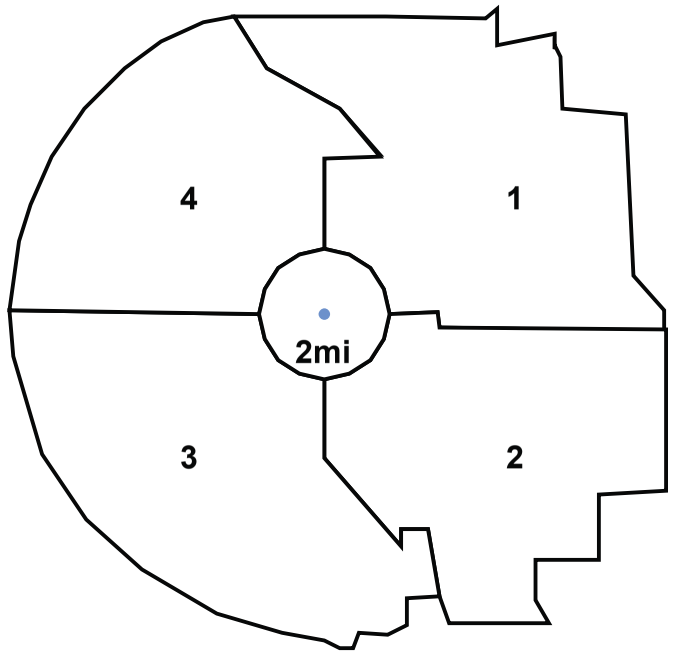
Precipitation: None

Monitor: RW Bldg Readings: 9.90E-04 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.35E-01	1.68E-01	1.70E+00	6.99E-01	2.56E+00	4.29E+01
1.5	1.05E-01	1.30E-01	1.34E+00	5.53E-01	2.03E+00	3.41E+01
2.0	0.00E+00	0.00E+00	1.01E+00	4.08E-01	1.41E+00	2.54E+01
3.0	0.00E+00	0.00E+00	6.51E-01	2.45E-01	8.97E-01	1.65E+01
4.0	0.00E+00	0.00E+00	5.23E-01	1.91E-01	7.14E-01	1.32E+01
5.0	0.00E+00	0.00E+00	4.09E-01	1.46E-01	5.55E-01	1.04E+01
7.0	0.00E+00	0.00E+00	2.58E-01	0.00E+00	2.58E-01	6.54E+00
10.0	0.00E+00	0.00E+00	1.93E-01	0.00E+00	1.93E-01	4.90E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 113522.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	6.14E-04 (1.5%)
Iodine	1.50E-02 (37.2%)
Noble Gas	2.47E-02 (61.3%)

Reviewed By: REVIEWED By John D. Fisher at 8:51 am, Mar 31, 2015

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Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 11:35**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	4.52E-05	Kr-85m	1.00E-03	Kr-87	2.00E-03	Kr-88	2.77E-03	Xe-131m	5.94E-05
Xe-133	8.83E-03	Xe-133m	2.80E-04	Xe-135	2.31E-03	Xe-138	7.42E-03		

Iodines in Ci/sec									
I-131	1.74E-03	I-132	2.52E-03	I-133	3.53E-03	I-134	3.88E-03	I-135	3.37E-03

Particulates in Ci/sec									
Cs-134	3.05E-04	Cs-136	9.70E-05	Cs-137	2.11E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 11:35**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.00	0.00
5 - Miles	0.00	0.00
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:11**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

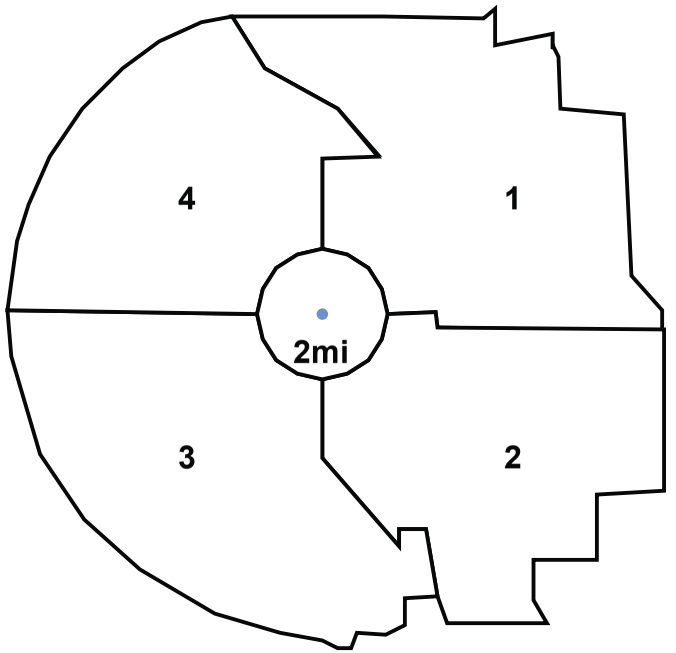
Precipitation: None

Monitor: Stack (HI) Readings: 4.38E+02 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.64E+01	3.24E+01	1.24E+00	2.22E+00	3.59E+01	7.59E+00
1.5	1.36E+01	2.64E+01	1.27E+00	2.38E+00	3.01E+01	6.07E+00
2.0	1.06E+01	1.97E+01	1.38E+00	2.59E+00	2.37E+01	4.73E+00
3.0	6.76E+00	1.23E+01	8.25E-01	1.50E+00	1.46E+01	3.13E+00
4.0	6.56E+00	1.17E+01	7.99E-01	1.41E+00	1.39E+01	2.62E+00
5.0	5.24E+00	9.24E+00	6.96E-01	1.19E+00	1.11E+01	2.15E+00
7.0	3.08E+00	5.56E+00	4.52E-01	7.23E-01	6.74E+00	1.37E+00
10.0	2.79E+00	5.10E+00	4.24E-01	5.55E-01	6.08E+00	1.38E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 101152.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.38E-04 (0.0%)
Iodine	3.38E-03 (0.0%)
Noble Gas	1.39E+01 (100.0%)

Reviewed By: REVIEWED By John D. Fisher at 8:52 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.97

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:11**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	2.54E-02	Kr-85m	5.63E-01	Kr-87	1.12E+00	Kr-88	1.55E+00	Xe-131m	3.33E-02
Xe-133	4.96E+00	Xe-133m	1.57E-01	Xe-135	1.30E+00	Xe-138	4.16E+00		

Iodines in Ci/sec									
I-131	3.90E-04	I-132	5.67E-04	I-133	7.92E-04	I-134	8.72E-04	I-135	7.57E-04

Particulates in Ci/sec									
Cs-134	6.85E-05	Cs-136	2.18E-05	Cs-137	4.75E-05	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.98

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:11**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:10**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

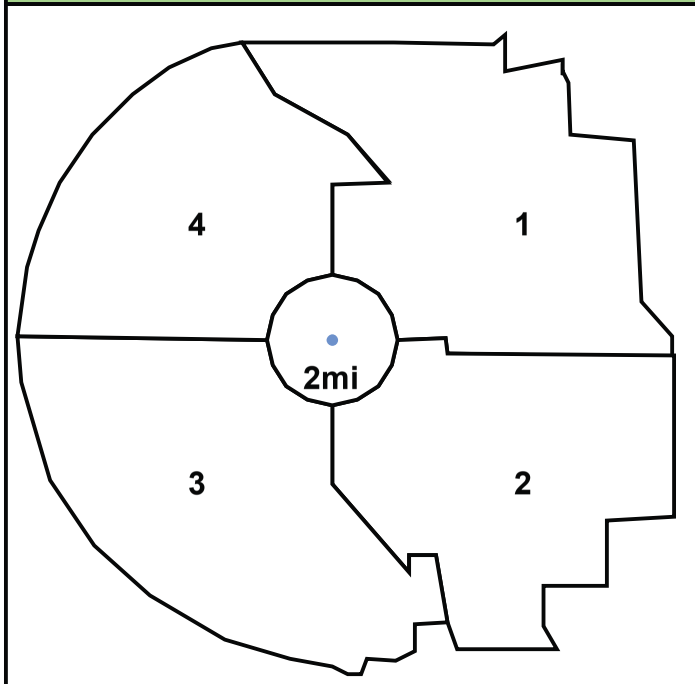
Precipitation: None

Monitor: Stack (HI) Readings: 3.62E+02 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.09E+01	2.17E+01	8.26E-01	1.48E+00	2.40E+01	5.06E+00
1.5	9.08E+00	1.76E+01	8.50E-01	1.59E+00	2.01E+01	4.04E+00
2.0	7.04E+00	1.31E+01	9.20E-01	1.73E+00	1.57E+01	3.16E+00
3.0	4.52E+00	8.20E+00	5.50E-01	1.00E+00	9.76E+00	2.09E+00
4.0	4.36E+00	7.79E+00	5.32E-01	9.41E-01	9.27E+00	1.74E+00
5.0	3.50E+00	6.16E+00	4.64E-01	7.93E-01	7.42E+00	1.43E+00
7.0	2.06E+00	3.71E+00	3.01E-01	4.83E-01	4.49E+00	9.10E-01
10.0	1.86E+00	3.40E+00	2.82E-01	3.70E-01	4.05E+00	9.18E-01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 101049.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	9.19E-05 (0.0%)
Iodine	2.25E-03 (0.0%)
Noble Gas	9.25E+00 (100.0%)

Reviewed By: REVIEWED
By John D. Fisher at 8:52 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.100

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:10**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.69E-02	Kr-85m	3.76E-01	Kr-87	7.49E-01	Kr-88	1.03E+00	Xe-131m	2.22E-02
Xe-133	3.31E+00	Xe-133m	1.05E-01	Xe-135	8.64E-01	Xe-138	2.78E+00		

Iodines in Ci/sec									
I-131	2.60E-04	I-132	3.78E-04	I-133	5.28E-04	I-134	5.82E-04	I-135	5.05E-04

Particulates in Ci/sec									
Cs-134	4.57E-05	Cs-136	1.45E-05	Cs-137	3.17E-05	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.101

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:10**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:11**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

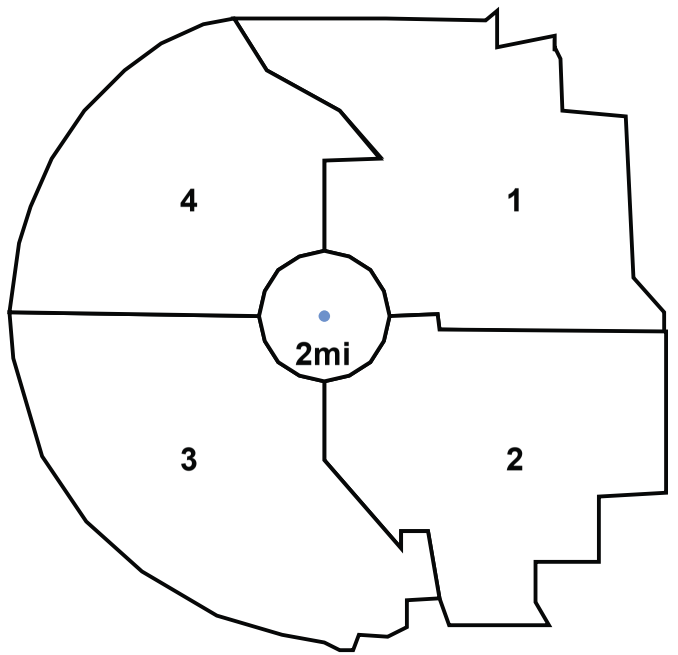
Precipitation: None

Monitor: Stack (HI) Readings: 2.36E+03 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.55E+02	3.06E+02	1.17E+01	2.10E+01	3.38E+02	7.16E+01
1.5	1.29E+02	2.48E+02	1.20E+01	2.25E+01	2.83E+02	5.72E+01
2.0	9.96E+01	1.86E+02	1.31E+01	2.45E+01	2.24E+02	4.46E+01
3.0	6.40E+01	1.16E+02	7.79E+00	1.42E+01	1.38E+02	2.95E+01
4.0	6.16E+01	1.10E+02	7.53E+00	1.33E+01	1.31E+02	2.47E+01
5.0	4.96E+01	8.72E+01	6.57E+00	1.12E+01	1.05E+02	2.03E+01
7.0	2.91E+01	5.25E+01	4.26E+00	6.82E+00	6.36E+01	1.29E+01
10.0	2.63E+01	4.81E+01	4.00E+00	5.24E+00	5.74E+01	1.30E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 101128.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.30E-03 (0.0%)
Iodine	3.19E-02 (0.0%)
Noble Gas	1.31E+02 (100.0%)

Reviewed By: REVIEWED By John D. Fisher at 8:52 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.103

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:11**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	2.39E-01	Kr-85m	5.31E+00	Kr-87	1.06E+01	Kr-88	1.46E+01	Xe-131m	3.14E-01
Xe-133	4.68E+01	Xe-133m	1.48E+00	Xe-135	1.22E+01	Xe-138	3.93E+01		

Iodines in Ci/sec									
I-131	3.68E-03	I-132	5.35E-03	I-133	7.47E-03	I-134	8.23E-03	I-135	7.14E-03

Particulates in Ci/sec									
Cs-134	6.46E-04	Cs-136	2.05E-04	Cs-137	4.48E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.104

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:11**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:13**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

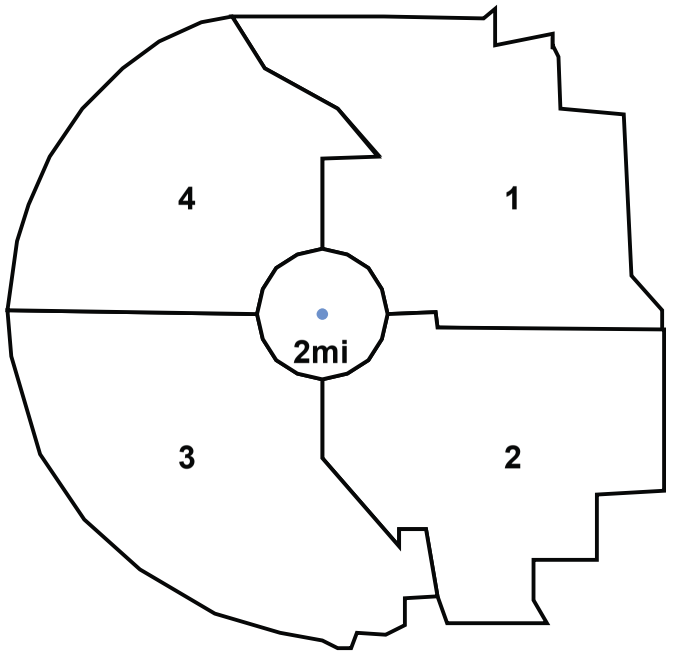
Precipitation: None

Monitor: Stack (HI) Readings: 1.64E+03 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.03E+02	2.04E+02	7.77E+00	1.39E+01	2.25E+02	4.77E+01
1.5	8.56E+01	1.66E+02	7.99E+00	1.49E+01	1.89E+02	3.82E+01
2.0	6.64E+01	1.24E+02	8.66E+00	1.63E+01	1.49E+02	2.98E+01
3.0	4.24E+01	7.72E+01	5.18E+00	9.42E+00	9.18E+01	1.97E+01
4.0	4.12E+01	7.34E+01	5.01E+00	8.84E+00	8.73E+01	1.64E+01
5.0	3.30E+01	5.81E+01	4.37E+00	7.46E+00	6.99E+01	1.35E+01
7.0	1.94E+01	3.49E+01	2.83E+00	4.54E+00	4.23E+01	8.57E+00
10.0	1.75E+01	3.20E+01	2.66E+00	3.48E+00	3.82E+01	8.65E+00

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 101356.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	8.64E-04 (0.0%)
Iodine	2.12E-02 (0.0%)
Noble Gas	8.70E+01 (100.0%)

Reviewed By: REVIEWED By John D. Fisher at 8:52 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.106

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:13**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.59E-01	Kr-85m	3.53E+00	Kr-87	7.04E+00	Kr-88	9.74E+00	Xe-131m	2.09E-01
Xe-133	3.11E+01	Xe-133m	9.85E-01	Xe-135	8.13E+00	Xe-138	2.61E+01		

Iodines in Ci/sec									
I-131	2.45E-03	I-132	3.56E-03	I-133	4.97E-03	I-134	5.47E-03	I-135	4.75E-03

Particulates in Ci/sec									
Cs-134	4.30E-04	Cs-136	1.37E-04	Cs-137	2.98E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:13**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:15**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

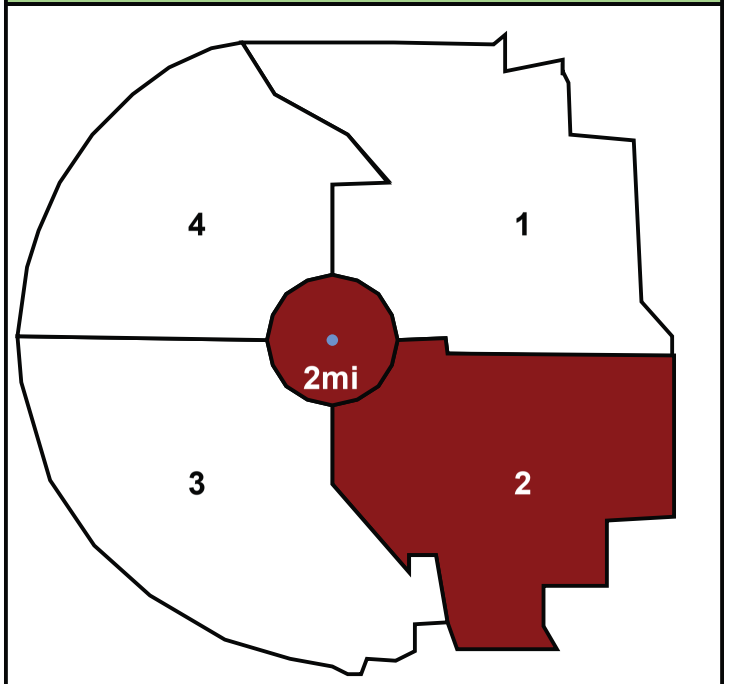
Precipitation: None

Monitor: Stack (HI) Readings: 2.40E+04 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.71E+03	3.38E+03	1.29E+02	2.32E+02	3.75E+03	7.93E+02
1.5	1.42E+03	2.75E+03	1.33E+02	2.49E+02	3.13E+03	6.34E+02
2.0	1.10E+03	2.05E+03	1.44E+02	2.70E+02	2.47E+03	4.93E+02
3.0	7.08E+02	1.28E+03	8.62E+01	1.57E+02	1.53E+03	3.27E+02
4.0	6.84E+02	1.22E+03	8.34E+01	1.47E+02	1.45E+03	2.73E+02
5.0	5.48E+02	9.65E+02	7.27E+01	1.24E+02	1.16E+03	2.24E+02
5.59	4.68E+02	8.33E+02	6.44E+01	1.08E+02	1.01E+03	1.96E+02
7.0	3.22E+02	5.81E+02	4.71E+01	7.54E+01	7.03E+02	1.43E+02
10.0	2.92E+02	5.33E+02	4.42E+01	5.79E+01	6.35E+02	1.44E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 101515.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.44E-02 (0.0%)
Iodine	3.52E-01 (0.0%)
Noble Gas	1.45E+03 (100.0%)

Reviewed By: REVIEWED By John D. Fisher at 8:52 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:15**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	2.65E+00	Kr-85m	5.88E+01	Kr-87	1.17E+02	Kr-88	1.62E+02	Xe-131m	3.48E+00
Xe-133	5.17E+02	Xe-133m	1.64E+01	Xe-135	1.35E+02	Xe-138	4.34E+02		

Iodines in Ci/sec									
I-131	4.07E-02	I-132	5.92E-02	I-133	8.26E-02	I-134	9.10E-02	I-135	7.90E-02

Particulates in Ci/sec									
Cs-134	7.15E-03	Cs-136	2.27E-03	Cs-137	4.95E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.110

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:15**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:55**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Drywell> <Rx Bldg> <SBGT> <Stack> <Env> PRF: 1.60E-04

Drywell HUT: = < 2 Hours	Drywell Sprays: = OFF	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = 2 - 24 Hours	SBGT Filters: = Working	Turb Bldg HUT: = N/A	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

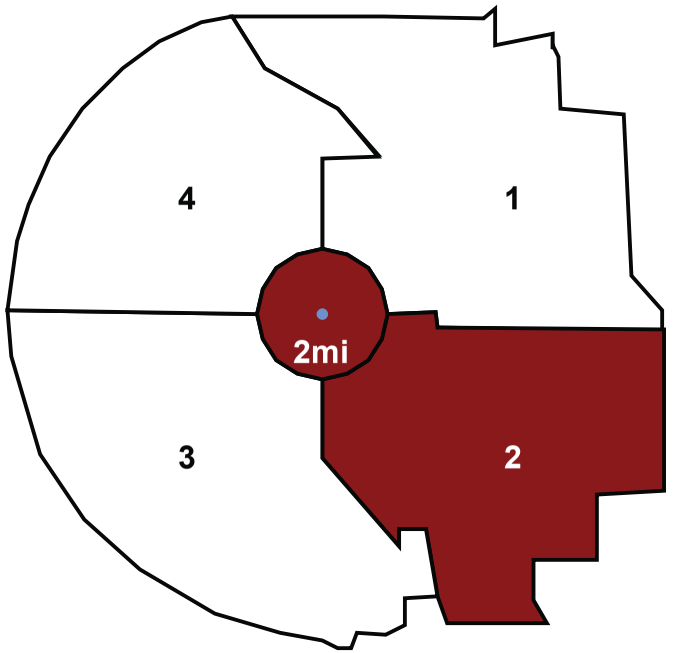
Precipitation: None

Monitor: Stack (HI) Readings: 1.60E+04 CPS Flowrate: 4500 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	1.14E+03	2.25E+03	8.59E+01	1.54E+02	2.49E+03	5.26E+02
1.5	9.48E+02	1.84E+03	8.84E+01	1.65E+02	2.09E+03	4.20E+02
2.0	7.32E+02	1.37E+03	9.58E+01	1.79E+02	1.64E+03	3.28E+02
2.92	4.68E+02	8.54E+02	5.73E+01	1.04E+02	1.01E+03	2.17E+02
3.0	4.68E+02	8.54E+02	5.73E+01	1.04E+02	1.01E+03	2.17E+02
4.0	4.56E+02	8.12E+02	5.54E+01	9.76E+01	9.65E+02	1.81E+02
5.0	3.65E+02	6.42E+02	4.83E+01	8.23E+01	7.73E+02	1.48E+02
7.0	2.14E+02	3.86E+02	3.14E+01	5.01E+01	4.68E+02	9.45E+01
10.0	1.94E+02	3.55E+02	2.94E+01	3.85E+01	4.23E+02	9.53E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 105515.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	9.54E-03 (0.0%)
Iodine	2.34E-01 (0.0%)
Noble Gas	9.61E+02 (100.0%)

Reviewed By: REVIEWED By John D. Fisher at 8:53 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.112

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:55**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.76E+00	Kr-85m	3.90E+01	Kr-87	7.78E+01	Kr-88	1.08E+02	Xe-131m	2.31E+00
Xe-133	3.43E+02	Xe-133m	1.09E+01	Xe-135	8.98E+01	Xe-138	2.88E+02		

Iodines in Ci/sec									
I-131	2.70E-02	I-132	3.93E-02	I-133	5.48E-02	I-134	6.04E-02	I-135	5.24E-02

Particulates in Ci/sec									
Cs-134	4.75E-03	Cs-136	1.51E-03	Cs-137	3.29E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:55**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 70 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Stack (HI) reads in units of CPS
- Conversion Factor: 3.4900E+07
- Background Subtract: 2.1000E+02

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.93	0.94
5 - Miles	0.93	0.94
10 - Miles	0.92	0.93

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 09:53**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

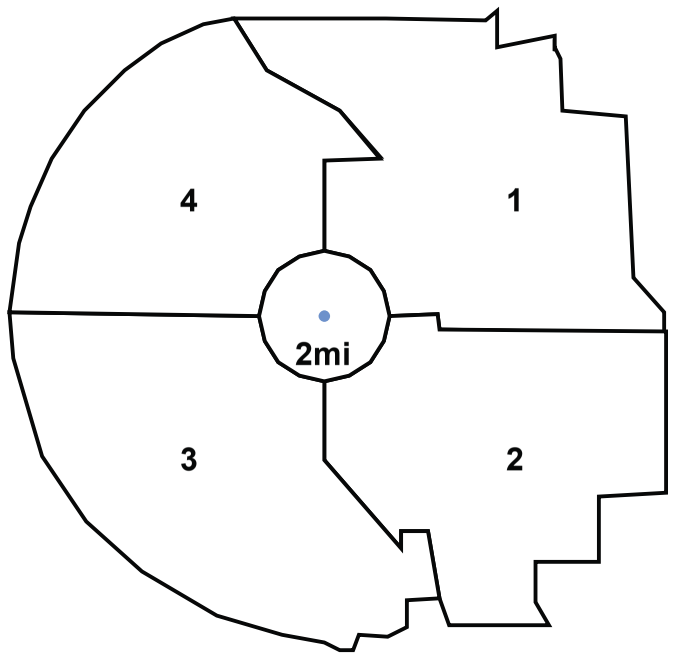
Precipitation: None

Monitor: Turb Bldg Readings: 1.00E-03 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	5.65E-01	7.05E-01	7.10E+00	2.92E+00	1.07E+01	1.80E+02
1.5	4.40E-01	5.48E-01	5.63E+00	2.30E+00	8.48E+00	1.42E+02
2.0	3.10E-01	3.80E-01	4.24E+00	1.71E+00	6.33E+00	1.07E+02
3.0	2.14E-01	2.69E-01	2.81E+00	1.08E+00	4.16E+00	7.10E+01
4.0	1.63E-01	2.18E-01	2.18E+00	8.20E-01	3.22E+00	5.52E+01
5.0	1.36E-01	1.77E-01	1.80E+00	6.69E-01	2.65E+00	4.56E+01
7.0	0.00E+00	1.08E-01	1.14E+00	4.15E-01	1.66E+00	2.88E+01
10.0	0.00E+00	0.00E+00	9.48E-01	3.08E-01	1.26E+00	2.41E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 095354.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	2.67E-03 (1.5%)
Iodine	6.54E-02 (37.4%)
Noble Gas	1.07E-01 (61.1%)

Reviewed By: _____

REVIEWED
By John D. Fisher at 8:53 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 09:53**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.97E-04	Kr-85m	4.36E-03	Kr-87	8.70E-03	Kr-88	1.20E-02	Xe-131m	2.58E-04
Xe-133	3.84E-02	Xe-133m	1.22E-03	Xe-135	1.00E-02	Xe-138	3.22E-02		

Iodines in Ci/sec									
I-131	7.55E-03	I-132	1.10E-02	I-133	1.53E-02	I-134	1.69E-02	I-135	1.46E-02

Particulates in Ci/sec									
Cs-134	1.33E-03	Cs-136	4.21E-04	Cs-137	9.19E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 09:53**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 09:55**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

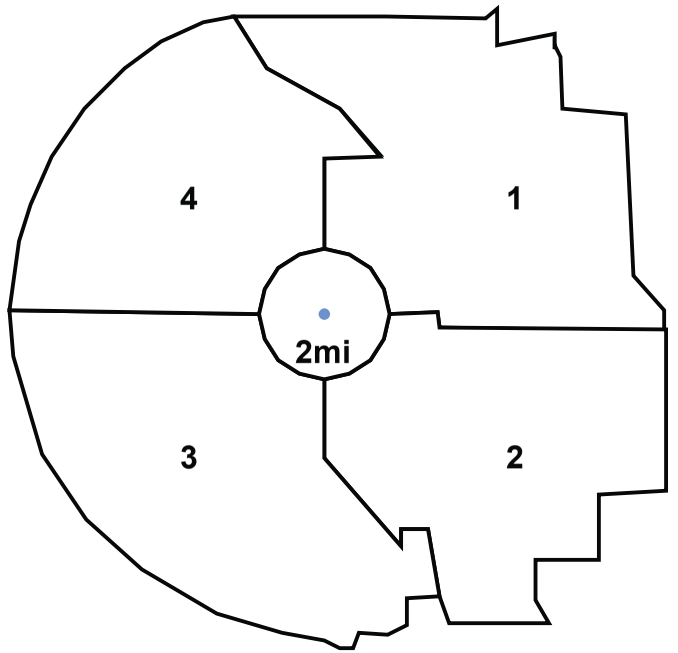
Precipitation: None

Monitor: Turb Bldg Readings: 6.68E-04 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	3.78E-01	4.70E-01	4.74E+00	1.95E+00	7.16E+00	1.20E+02
1.5	2.94E-01	3.66E-01	3.76E+00	1.54E+00	5.66E+00	9.48E+01
2.0	2.07E-01	2.54E-01	2.83E+00	1.15E+00	4.23E+00	7.15E+01
3.0	1.43E-01	1.80E-01	1.87E+00	7.20E-01	2.77E+00	4.74E+01
4.0	1.09E-01	1.45E-01	1.46E+00	5.47E-01	2.15E+00	3.68E+01
5.0	0.00E+00	1.18E-01	1.20E+00	4.46E-01	1.77E+00	3.04E+01
7.0	0.00E+00	0.00E+00	7.59E-01	2.77E-01	1.04E+00	1.92E+01
10.0	0.00E+00	0.00E+00	6.33E-01	2.06E-01	8.39E-01	1.61E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 095520.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.78E-03 (1.5%)
Iodine	4.36E-02 (37.2%)
Noble Gas	7.17E-02 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 8:56 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 09:55**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.31E-04	Kr-85m	2.91E-03	Kr-87	5.80E-03	Kr-88	8.02E-03	Xe-131m	1.72E-04
Xe-133	2.56E-02	Xe-133m	8.11E-04	Xe-135	6.70E-03	Xe-138	2.15E-02		

Iodines in Ci/sec									
I-131	5.04E-03	I-132	7.32E-03	I-133	1.02E-02	I-134	1.13E-02	I-135	9.77E-03

Particulates in Ci/sec									
Cs-134	8.85E-04	Cs-136	2.81E-04	Cs-137	6.13E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 09:55**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:52**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

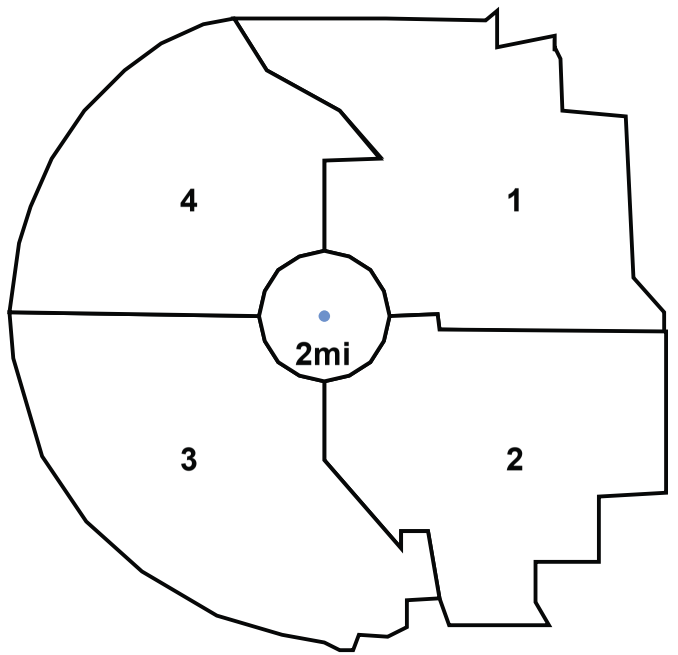
Precipitation: None

Monitor: Turb Bldg Readings: 1.00E-02 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	5.65E+00	7.06E+00	7.12E+01	2.93E+01	1.08E+02	1.80E+03
1.5	4.40E+00	5.50E+00	5.64E+01	2.31E+01	8.50E+01	1.43E+03
2.0	3.10E+00	3.82E+00	4.25E+01	1.72E+01	6.35E+01	1.07E+03
3.0	2.14E+00	2.70E+00	2.81E+01	1.08E+01	4.17E+01	7.12E+02
4.0	1.64E+00	2.18E+00	2.19E+01	8.23E+00	3.23E+01	5.53E+02
5.0	1.36E+00	1.78E+00	1.80E+01	6.71E+00	2.65E+01	4.57E+02
7.0	8.08E-01	1.08E+00	1.14E+01	4.16E+00	1.66E+01	2.89E+02
10.0	6.08E-01	8.52E-01	9.50E+00	3.09E+00	1.35E+01	2.41E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 105242.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.67E-02 (1.5%)
Iodine	6.55E-01 (37.2%)
Noble Gas	1.08E+00 (61.3%)

Reviewed By: **REVIEWED** *By John D. Fisher at 8:56 am, Mar 31, 2015*

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:52**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.97E-03	Kr-85m	4.37E-02	Kr-87	8.71E-02	Kr-88	1.20E-01	Xe-131m	2.59E-03
Xe-133	3.85E-01	Xe-133m	1.22E-02	Xe-135	1.01E-01	Xe-138	3.23E-01		

Iodines in Ci/sec									
I-131	7.56E-02	I-132	1.10E-01	I-133	1.54E-01	I-134	1.69E-01	I-135	1.47E-01

Particulates in Ci/sec									
Cs-134	1.33E-02	Cs-136	4.22E-03	Cs-137	9.21E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:52**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:21**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

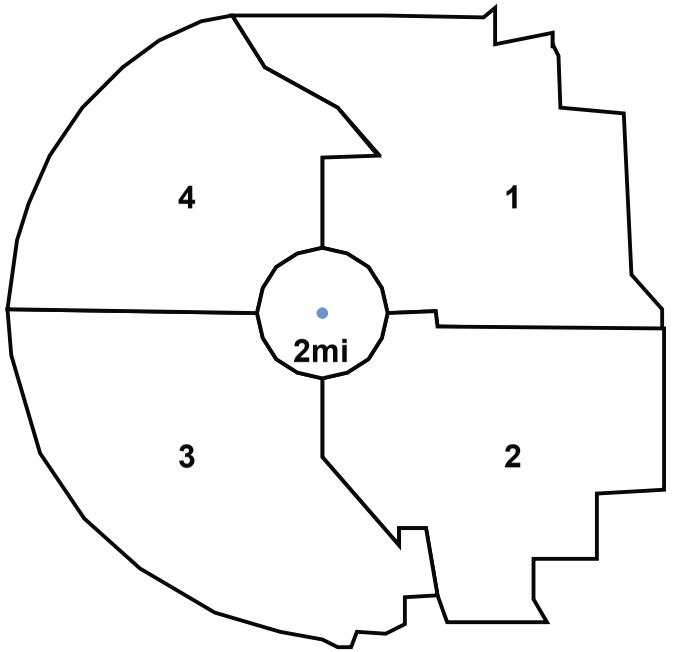
Precipitation: None

Monitor: Turb Bldg Readings: 6.68E-03 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	3.79E+00	4.72E+00	4.76E+01	1.96E+01	7.19E+01	1.21E+03
1.5	2.95E+00	3.67E+00	3.77E+01	1.54E+01	5.68E+01	9.52E+02
2.0	2.08E+00	2.54E+00	2.84E+01	1.15E+01	4.25E+01	7.18E+02
3.0	1.43E+00	1.80E+00	1.88E+01	7.24E+00	2.78E+01	4.76E+02
4.0	1.09E+00	1.46E+00	1.46E+01	5.50E+00	2.16E+01	3.70E+02
5.0	9.12E-01	1.19E+00	1.21E+01	4.48E+00	1.77E+01	3.05E+02
7.0	5.40E-01	7.24E-01	7.61E+00	2.78E+00	1.11E+01	1.93E+02
10.0	4.08E-01	5.69E-01	6.35E+00	2.06E+00	8.98E+00	1.61E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 102118.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.78E-02 (1.5%)
Iodine	4.38E-01 (37.3%)
Noble Gas	7.19E-01 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 9:09 am, Mar 31, 2015

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Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:21**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.32E-03	Kr-85m	2.92E-02	Kr-87	5.82E-02	Kr-88	8.04E-02	Xe-131m	1.73E-03
Xe-133	2.57E-01	Xe-133m	8.14E-03	Xe-135	6.72E-02	Xe-138	2.16E-01		

Iodines in Ci/sec									
I-131	5.05E-02	I-132	7.34E-02	I-133	1.03E-01	I-134	1.13E-01	I-135	9.80E-02

Particulates in Ci/sec									
Cs-134	8.88E-03	Cs-136	2.82E-03	Cs-137	6.15E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:21**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:53**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

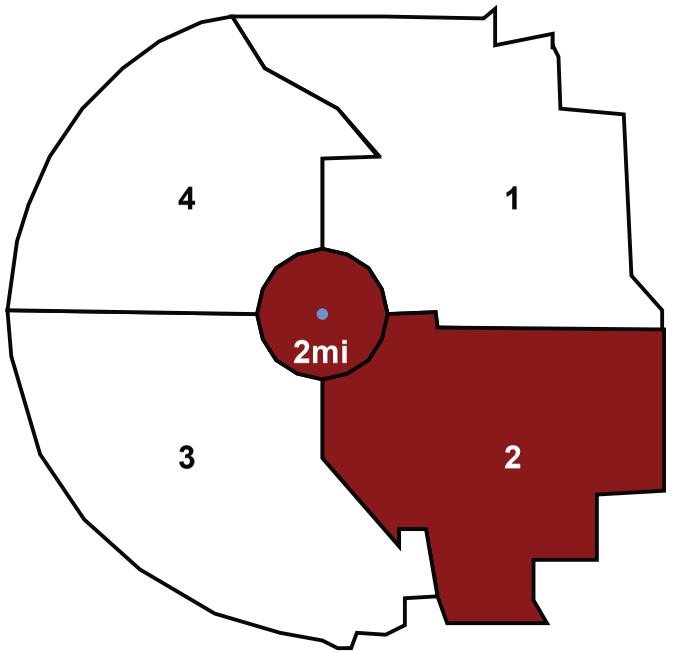
Precipitation: None

Monitor: Turb Bldg Readings: 1.00E-01 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	5.67E+01	7.06E+01	7.13E+02	2.93E+02	1.08E+03	1.80E+04
1.5	4.40E+01	5.50E+01	5.64E+02	2.31E+02	8.50E+02	1.43E+04
2.0	3.10E+01	3.82E+01	4.25E+02	1.72E+02	6.35E+02	1.08E+04
3.0	2.14E+01	2.70E+01	2.82E+02	1.08E+02	4.17E+02	7.12E+03
4.0	1.64E+01	2.18E+01	2.19E+02	8.23E+01	3.23E+02	5.54E+03
4.03	1.64E+01	2.18E+01	2.19E+02	8.23E+01	3.23E+02	5.54E+03
5.0	1.36E+01	1.78E+01	1.81E+02	6.71E+01	2.65E+02	4.58E+03
7.0	8.08E+00	1.08E+01	1.14E+02	4.17E+01	1.67E+02	2.89E+03
10.0	6.08E+00	8.52E+00	9.51E+01	3.09E+01	1.35E+02	2.42E+03

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 105347.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.67E-01 (1.5%)
Iodine	6.55E+00 (37.2%)
Noble Gas	1.08E+01 (61.3%)

Reviewed By: **REVIEWED** *By John D. Fisher at 9:10 am, Mar 31, 2015*

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:53**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.97E-02	Kr-85m	4.37E-01	Kr-87	8.71E-01	Kr-88	1.20E+00	Xe-131m	2.59E-02
Xe-133	3.85E+00	Xe-133m	1.22E-01	Xe-135	1.01E+00	Xe-138	3.23E+00		

Iodines in Ci/sec									
I-131	7.57E-01	I-132	1.10E+00	I-133	1.54E+00	I-134	1.69E+00	I-135	1.47E+00

Particulates in Ci/sec									
Cs-134	1.33E-01	Cs-136	4.22E-02	Cs-137	9.21E-02	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:53**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 09:57**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <Turb Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = < 2 Hours	RW Bldg HUT: = N/A

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

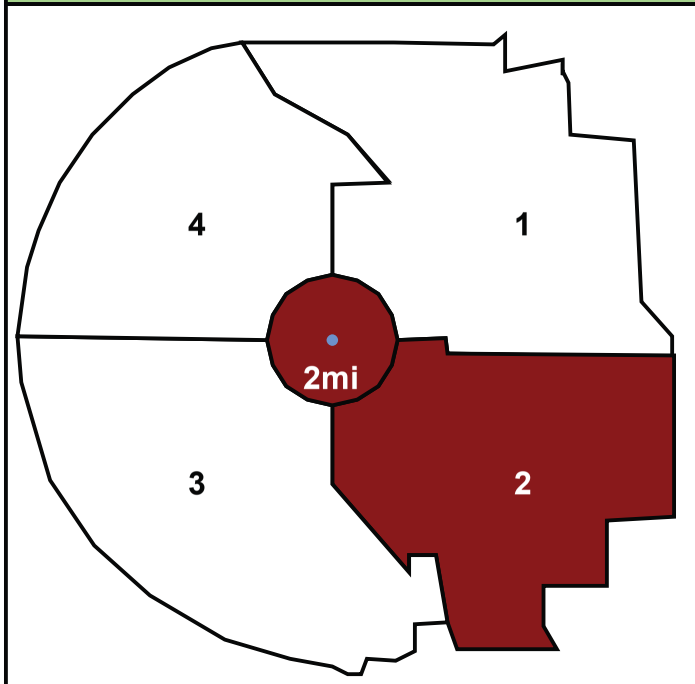
Precipitation: None

Monitor: Turb Bldg Readings: 6.68E-02 uCi/cc Flowrate: 360000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	3.79E+01	4.72E+01	4.76E+02	1.96E+02	7.19E+02	1.21E+04
1.5	2.95E+01	3.67E+01	3.77E+02	1.54E+02	5.68E+02	9.52E+03
2.0	2.08E+01	2.54E+01	2.84E+02	1.15E+02	4.25E+02	7.18E+03
2.24	1.53E+01	1.77E+01	2.26E+02	8.86E+01	3.33E+02	5.73E+03
3.0	1.43E+01	1.81E+01	1.88E+02	7.24E+01	2.78E+02	4.76E+03
4.0	1.10E+01	1.46E+01	1.46E+02	5.50E+01	2.16E+02	3.70E+03
5.0	9.12E+00	1.19E+01	1.21E+02	4.48E+01	1.77E+02	3.05E+03
7.0	5.40E+00	7.25E+00	7.61E+01	2.78E+01	1.11E+02	1.93E+03
10.0	4.08E+00	5.69E+00	6.35E+01	2.06E+01	8.98E+01	1.61E+03

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 095713.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.79E-01 (1.5%)
Iodine	4.38E+00 (37.3%)
Noble Gas	7.19E+00 (61.2%)

Reviewed By: REVIEWED By John D. Fisher at 9:10 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 09:57**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.32E-02	Kr-85m	2.92E-01	Kr-87	5.82E-01	Kr-88	8.05E-01	Xe-131m	1.73E-02
Xe-133	2.57E+00	Xe-133m	8.14E-02	Xe-135	6.72E-01	Xe-138	2.16E+00		

Iodines in Ci/sec									
I-131	5.05E-01	I-132	7.34E-01	I-133	1.03E+00	I-134	1.13E+00	I-135	9.81E-01

Particulates in Ci/sec									
Cs-134	8.88E-02	Cs-136	2.82E-02	Cs-137	6.15E-02	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 09:57**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 36 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: Turb Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.1400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 09:58**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

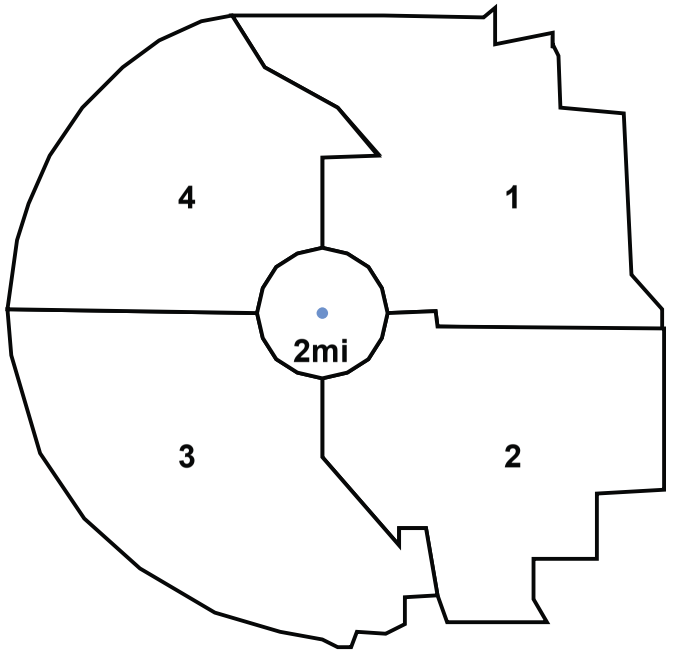
Precipitation: None

Monitor: RW Bldg Readings: 4.14E-03 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	5.65E-01	7.05E-01	7.11E+00	2.93E+00	1.07E+01	1.80E+02
1.5	4.40E-01	5.45E-01	5.65E+00	2.31E+00	8.51E+00	1.43E+02
2.0	3.07E-01	3.76E-01	4.22E+00	1.71E+00	6.31E+00	1.07E+02
3.0	2.12E-01	2.73E-01	2.73E+00	1.03E+00	4.03E+00	6.91E+01
4.0	1.68E-01	2.16E-01	2.19E+00	8.02E-01	3.21E+00	5.55E+01
5.0	1.25E-01	1.66E-01	1.71E+00	6.16E-01	2.49E+00	4.34E+01
7.0	0.00E+00	1.01E-01	1.08E+00	3.80E-01	1.56E+00	2.74E+01
10.0	0.00E+00	0.00E+00	8.07E-01	2.51E-01	1.06E+00	2.05E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 095834.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	2.57E-03 (1.5%)
Iodine	6.30E-02 (37.2%)
Noble Gas	1.04E-01 (61.3%)

Reviewed By: REVIEWED
By John D. Fisher at 9:10 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 09:58**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.89E-04	Kr-85m	4.21E-03	Kr-87	8.38E-03	Kr-88	1.16E-02	Xe-131m	2.49E-04
Xe-133	3.70E-02	Xe-133m	1.17E-03	Xe-135	9.68E-03	Xe-138	3.11E-02		

Iodines in Ci/sec									
I-131	7.28E-03	I-132	1.06E-02	I-133	1.48E-02	I-134	1.63E-02	I-135	1.41E-02

Particulates in Ci/sec									
Cs-134	1.28E-03	Cs-136	4.06E-04	Cs-137	8.86E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

NE-02-09-12 Rev 3, page A.134

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 09:58**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 09:59**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

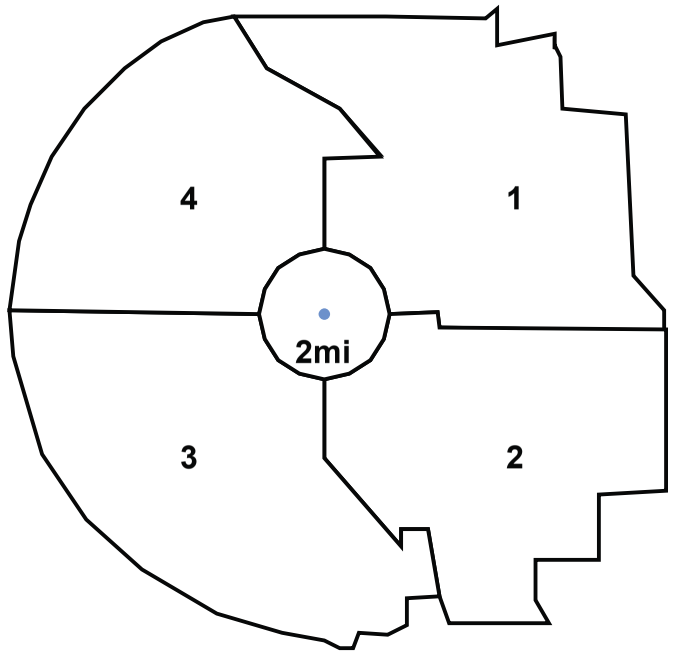
Precipitation: None

Monitor: RW Bldg Readings: 2.76E-03 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	3.75E-01	4.68E-01	4.73E+00	1.95E+00	7.15E+00	1.20E+02
1.5	2.93E-01	3.62E-01	3.76E+00	1.54E+00	5.66E+00	9.50E+01
2.0	2.04E-01	2.50E-01	2.81E+00	1.14E+00	4.20E+00	7.10E+01
3.0	1.41E-01	1.81E-01	1.82E+00	6.85E-01	2.69E+00	4.60E+01
4.0	1.12E-01	1.44E-01	1.46E+00	5.34E-01	2.14E+00	3.69E+01
5.0	0.00E+00	1.10E-01	1.14E+00	4.10E-01	1.66E+00	2.89E+01
7.0	0.00E+00	0.00E+00	7.19E-01	2.53E-01	9.73E-01	1.83E+01
10.0	0.00E+00	0.00E+00	5.37E-01	1.67E-01	7.04E-01	1.36E+01

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 095912.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Validate against Emergency Action Levels * * ***

Release Rates (Ci / sec)	
Particulate	1.71E-03 (1.5%)
Iodine	4.20E-02 (37.3%)
Noble Gas	6.90E-02 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 9:11 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.136

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 09:59**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.26E-04	Kr-85m	2.80E-03	Kr-87	5.59E-03	Kr-88	7.72E-03	Xe-131m	1.66E-04
Xe-133	2.47E-02	Xe-133m	7.81E-04	Xe-135	6.45E-03	Xe-138	2.07E-02		

Iodines in Ci/sec									
I-131	4.85E-03	I-132	7.05E-03	I-133	9.85E-03	I-134	1.08E-02	I-135	9.41E-03

Particulates in Ci/sec									
Cs-134	8.52E-04	Cs-136	2.71E-04	Cs-137	5.91E-04	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 09:59**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.00	0.00

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 09:59**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

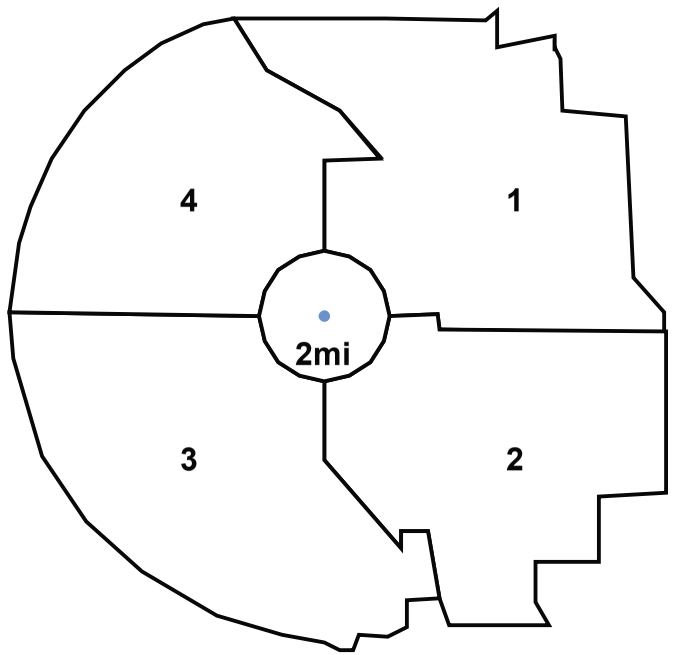
Precipitation: None

Monitor: RW Bldg Readings: 4.14E-02 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	5.65E+00	7.05E+00	7.11E+01	2.93E+01	1.07E+02	1.80E+03
1.5	4.40E+00	5.45E+00	5.65E+01	2.31E+01	8.51E+01	1.43E+03
2.0	3.07E+00	3.76E+00	4.22E+01	1.71E+01	6.31E+01	1.07E+03
3.0	2.12E+00	2.73E+00	2.73E+01	1.03E+01	4.03E+01	6.91E+02
4.0	1.68E+00	2.16E+00	2.19E+01	8.02E+00	3.21E+01	5.55E+02
5.0	1.25E+00	1.66E+00	1.71E+01	6.16E+00	2.49E+01	4.34E+02
7.0	7.56E-01	1.01E+00	1.08E+01	3.80E+00	1.56E+01	2.74E+02
10.0	5.08E-01	7.07E-01	8.07E+00	2.51E+00	1.13E+01	2.05E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 095949.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.57E-02 (1.5%)
Iodine	6.31E-01 (37.2%)
Noble Gas	1.04E+00 (61.3%)

Reviewed By: REVIEWED
By John D. Fisher at 9:11 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 09:59**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.90E-03	Kr-85m	4.21E-02	Kr-87	8.39E-02	Kr-88	1.16E-01	Xe-131m	2.49E-03
Xe-133	3.70E-01	Xe-133m	1.17E-02	Xe-135	9.68E-02	Xe-138	3.11E-01		

Iodines in Ci/sec									
I-131	7.28E-02	I-132	1.06E-01	I-133	1.48E-01	I-134	1.63E-01	I-135	1.41E-01

Particulates in Ci/sec									
Cs-134	1.28E-02	Cs-136	4.06E-03	Cs-137	8.87E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 09:59**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:00**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad

Time After S/D (hh:mm): 0:00

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A]

CGS 33ft Tower

Wind: From 330° @ 5 mph

Stability Class: E

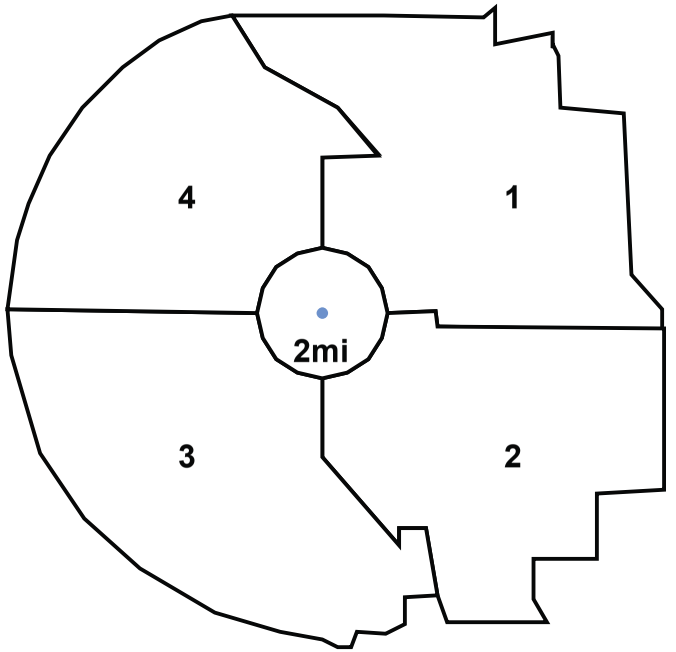
Precipitation: None

Monitor: RW Bldg Readings: 2.76E-02 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	3.78E+00	4.70E+00	4.74E+01	1.96E+01	7.17E+01	1.20E+03
1.5	2.94E+00	3.64E+00	3.77E+01	1.54E+01	5.67E+01	9.52E+02
2.0	2.05E+00	2.51E+00	2.82E+01	1.14E+01	4.21E+01	7.12E+02
3.0	1.42E+00	1.82E+00	1.82E+01	6.86E+00	2.69E+01	4.61E+02
4.0	1.12E+00	1.44E+00	1.46E+01	5.35E+00	2.14E+01	3.70E+02
5.0	8.32E-01	1.10E+00	1.14E+01	4.11E+00	1.66E+01	2.89E+02
7.0	5.04E-01	6.72E-01	7.20E+00	2.53E+00	1.04E+01	1.83E+02
10.0	3.38E-01	4.71E-01	5.38E+00	1.68E+00	7.53E+00	1.37E+02

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 100026.URI7

Evacuation Areas From 0 to 10 Miles



No PAGs Exceeded

*** * * Classification: Site Area Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.71E-02 (1.5%)
Iodine	4.20E-01 (37.2%)
Noble Gas	6.91E-01 (61.3%)

Reviewed By: REVIEWED By John D. Fisher at 9:11 am, Mar 31, 2015

NE-02-09-12 Rev 3, page A.142

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:00**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.26E-03	Kr-85m	2.81E-02	Kr-87	5.59E-02	Kr-88	7.73E-02	Xe-131m	1.66E-03
Xe-133	2.47E-01	Xe-133m	7.82E-03	Xe-135	6.46E-02	Xe-138	2.07E-01		

Iodines in Ci/sec									
I-131	4.86E-02	I-132	7.06E-02	I-133	9.86E-02	I-134	1.09E-01	I-135	9.42E-02

Particulates in Ci/sec									
Cs-134	8.53E-03	Cs-136	2.71E-03	Cs-137	5.91E-03	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:00**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:23**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

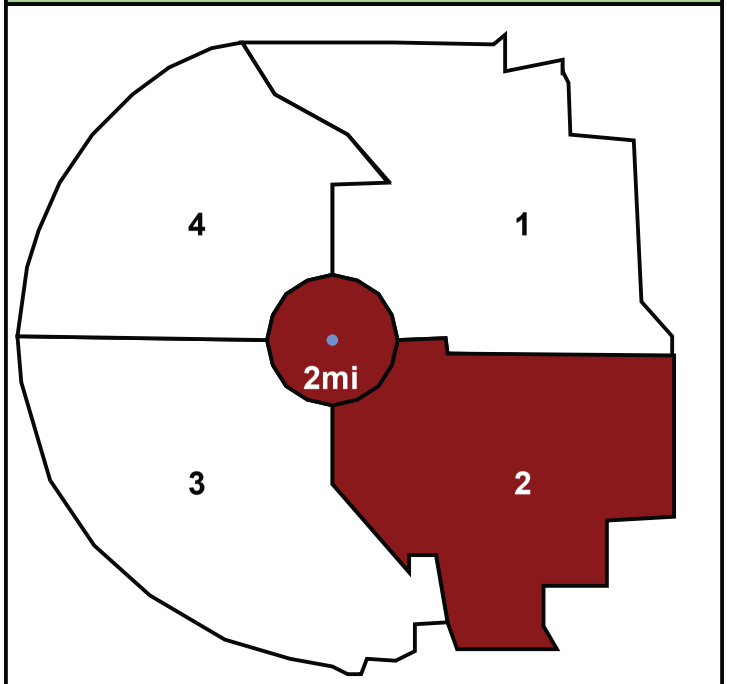
Precipitation: None

Monitor: RW Bldg Readings: 4.14E-01 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	5.65E+01	7.05E+01	7.11E+02	2.93E+02	1.07E+03	1.80E+04
1.5	4.40E+01	5.45E+01	5.65E+02	2.31E+02	8.51E+02	1.43E+04
2.0	3.07E+01	3.76E+01	4.22E+02	1.71E+02	6.31E+02	1.07E+04
3.0	2.12E+01	2.73E+01	2.73E+02	1.03E+02	4.03E+02	6.91E+03
4.0	1.68E+01	2.16E+01	2.19E+02	8.02E+01	3.21E+02	5.55E+03
4.03	1.68E+01	2.16E+01	2.19E+02	8.02E+01	3.21E+02	5.55E+03
5.0	1.25E+01	1.66E+01	1.71E+02	6.16E+01	2.49E+02	4.34E+03
7.0	7.56E+00	1.01E+01	1.08E+02	3.80E+01	1.56E+02	2.74E+03
10.0	5.08E+00	7.07E+00	8.07E+01	2.51E+01	1.13E+02	2.05E+03

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 102304.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	2.57E-01 (1.5%)
Iodine	6.31E+00 (37.2%)
Noble Gas	1.04E+01 (61.3%)

Reviewed By: REVIEWED
By John D. Fisher at 9:12 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:23**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.90E-02	Kr-85m	4.21E-01	Kr-87	8.39E-01	Kr-88	1.16E+00	Xe-131m	2.49E-02
Xe-133	3.70E+00	Xe-133m	1.17E-01	Xe-135	9.68E-01	Xe-138	3.11E+00		

Iodines in Ci/sec									
I-131	7.28E-01	I-132	1.06E+00	I-133	1.48E+00	I-134	1.63E+00	I-135	1.41E+00

Particulates in Ci/sec									
Cs-134	1.28E-01	Cs-136	4.06E-02	Cs-137	8.87E-02	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:23**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Dose Assessment

Columbia Generating Station **Sunday, March 29, 2015 10:01**

Method: Detailed Assessment - Monitored Release

Release Pathway: <RCS> <RW Bldg> <Exhaust> <Env> PRF: 4.00E-01

Drywell HUT: = N/A	Drywell Sprays: = N/A	Supp Pool HUT: = N/A	Supp Pool Status: = N/A
Rx Bldg HUT: = N/A	SBGT Filters: = N/A	Turb Bldg HUT: = N/A	RW Bldg HUT: = < 2 Hours

Source Term: Reactor Core Accident - Clad CGS 33ft Tower

Time After S/D (hh:mm): 0:00 Wind: From 330° @ 5 mph

Release Duration (hh:mm): 3:00 ETE (hh:mm): [N/A] Stability Class: E

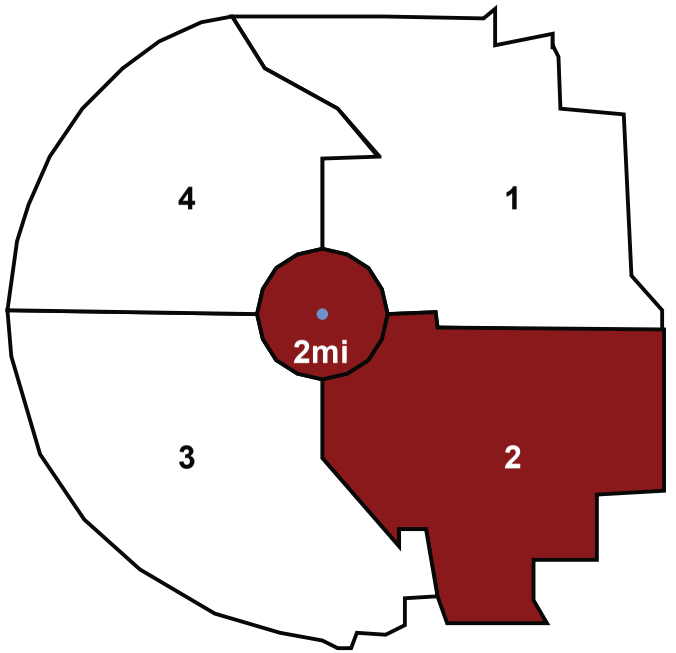
Precipitation: None

Monitor: RW Bldg Readings: 2.76E-01 uCi/cc Flowrate: 84000 CFM

Distance (Miles)	Exposure Rate (mR/hr)	External Plume DDE (mRem)	Inhalation CEDE (mRem)	Deposition Ground DDE (mRem)	TEDE (mRem)	CDE Thyroid (mRem)
S.B.	3.78E+01	4.70E+01	4.74E+02	1.96E+02	7.17E+02	1.20E+04
1.5	2.94E+01	3.64E+01	3.77E+02	1.54E+02	5.67E+02	9.52E+03
2.0	2.05E+01	2.51E+01	2.82E+02	1.14E+02	4.21E+02	7.12E+03
2.24	1.68E+01	2.09E+01	2.31E+02	8.88E+01	3.41E+02	5.85E+03
3.0	1.42E+01	1.82E+01	1.82E+02	6.86E+01	2.69E+02	4.61E+03
4.0	1.12E+01	1.44E+01	1.46E+02	5.35E+01	2.14E+02	3.70E+03
5.0	8.32E+00	1.10E+01	1.14E+02	4.11E+01	1.66E+02	2.89E+03
7.0	5.04E+00	6.72E+00	7.20E+01	2.53E+01	1.04E+02	1.83E+03
10.0	3.38E+00	4.71E+00	5.38E+01	1.68E+01	7.53E+01	1.37E+03

Assessment Data Results Saved to File:
Columbia Generating Station 10Miles Monitored Release 03292015 100106.URI7

Evacuation Areas From 0 to 10 Miles



PAGs Exceeded in Designated Areas

*** * * Classification: General Emergency * * ***

Release Rates (Ci / sec)	
Particulate	1.72E-01 (1.5%)
Iodine	4.20E+00 (37.2%)
Noble Gas	6.91E+00 (61.2%)

Reviewed By: REVIEWED
By John D. Fisher at 9:13 am, Mar 31, 2015

Isotopic Release Rates

Columbia Generating Station **Sunday, March 29, 2015 10:01**

Method: Detailed Assessment - Monitored Release \ Source Term: Reactor Core Accident - Clad

Noble Gasses in Ci/sec									
Kr-85	1.26E-02	Kr-85m	2.81E-01	Kr-87	5.59E-01	Kr-88	7.73E-01	Xe-131m	1.66E-02
Xe-133	2.47E+00	Xe-133m	7.82E-02	Xe-135	6.46E-01	Xe-138	2.07E+00		

Iodines in Ci/sec									
I-131	4.86E-01	I-132	7.06E-01	I-133	9.86E-01	I-134	1.09E+00	I-135	9.42E-01

Particulates in Ci/sec									
Cs-134	8.53E-02	Cs-136	2.71E-02	Cs-137	5.91E-02	Sb-127	0.00E+00	Sb-129	0.00E+00
Te-129m	0.00E+00	Te-131m	0.00E+00	Te-132	0.00E+00	Ba-140	0.00E+00	Sr-89	0.00E+00
Sr-90	0.00E+00	Sr-91	0.00E+00	Mo-99	0.00E+00	Ru-103	0.00E+00	Ru-106	0.00E+00
La-140	0.00E+00	Y-91	0.00E+00	Ce-144	0.00E+00	Np-239	0.00E+00		

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Additional Meteorological Inputs

Columbia Generating Station **Sunday, March 29, 2015 10:01**

CGS 33ft Tower	Wind Speed: 5.0 mph	Wind Direction From: 330°	Delta T:	Stab Class: E	Precip: None

Miscellaneous Inputs and Data

Release Point Elevation: 20 meters

Plume Exposure Duration (Release duration + Plume travel time): 5.00 hours

Additional Monitor Information: RW Bldg reads in units of uCi/cc
- Conversion Factor: 1.0000E+06
- Background Subtract: 2.5400E-06
- Isotopic Conversion Factors are in place for this monitor and were used in the calculation.)

EDE to TEDE Ratios

Distance	EDE / TEDE Ratio with Iodine	EDE / TEDE Ratio without Iodine
2 - Miles	0.08	0.27
5 - Miles	0.09	0.29
10 - Miles	0.08	0.27

Appendix D

Support Spreadsheets from Chemistry Dept.

Description	#Pages	Page label ranges
DELETED	1	
Derivation of intermediate range ODCM alarm, and PPM 16.14.1	36	D.2 – D.37
DELETED	33	
PPM 5.2.1 & SAG2 Table PC-1 input and ODCM spreadsheet cases that support it	40	D.72 – D.112

Appendix D

Support Spreadsheets from Chemistry Dept.

Description	#Pages	Page label ranges
DELETED	1	
Derivation of intermediate range ODCM alarm, and PPM 16.14.1	36	D.2 – D.37
DELETED	33	
PPM 5.2.1 & SAG2 Table PC-1 input and ODCM spreadsheet cases that support it	40	D.72 – D.112

D.Z

This spreadsheet was derived from PPM 16.14.1 Rev 2 (ODCM dispersion value changes) and I/E 2-94-1312 loop uncertainties/instrument drift

Reactor Building Low Range Monitor PRM-RE-1A			
Gas Mixture			See ODCM Table 3-15 and FSAR Table 11.3-1
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	4.48E+07	cc/sec	The maximum exhaust flow rate (Rj) is 4.48E+07 cc/sec (95,000 cfm).
E(Xe-133)	5.51E+05	ccps/uCi/cc	Xenon-133 efficiency (Gas Calibration factor from PPM 16.1.2 Rev 7)
Bkg	5.50E+02	cps	Background
Upper Level	1.00E+03	Step 4.13 value = 1550	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13

Turbine Building Low Range Monitor (TEA-RE-13)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Turbine Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Turbine building. Fj is 0.4.
Rj	1.79E+08	cc/sec	The maximum exhaust flow rate (Rj) is 1.79E+08 cc/sec (380,000 cfm).
E(Xe-133)	4.83E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc From PPM 16.2.1 Rev 6
Bkg	40	cpm	Background
Upper Level	4.80E+03	Step 4.13 value = 4850	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

Radwaste Building Low Range Monitor (WEA-RE-14)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Radwaste Building release pathway from ODCM Table 3-3.
Fj	0.2		Twenty percent (20%) of the site boundary dose rate limit is allocated to the Radwaste building. Fj is 0.2.
Rj	3.91E+07	cc/sec	The maximum exhaust flow rate (Rj) is 3.91E+07 cc/sec (83,000 cfm)
E(Xe-133)	4.83E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from PPM 16.3.1 Rev 7
Bkg	36	cpm	Background
Upper Level	2.67E+04	Step 4.13 value = 26718	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

Mechanical Vacuum Pump (AR-RIS-21)			
Gas Mixture			Setpoint Calculation 98-01 of 3/3/98 & B&R Calculation 5.03.01 of 3/80 by E Stergokes
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	1.13E+06	cc/sec	The maximum exhaust flow rate (Rj) is 1.13E+06 cc/sec (2400 cfm)
E(Xe-133)	7.14E+01	mR/hr/uCi/cc	Xenon-133 efficiency mR/hr/uCi/cc from Setpoint Calculation 98-01. Isoshield calculation of initial mixture=0.34 mr/hr. (0.34/4.56E-3)=71.3686 mR/hr/uCi/cc
Bkg	0.1	cpm	Background
Upper Level	7.5	Step 4.13 value = 7.6	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

PRM-RE-13 D.Z

D.3

Reactor Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
Kr83m	6.47E-05	2.25E-03	2.88E-02
Kr85m	1.25E-04	2.25E-03	5.57E-02
Kr87	3.35E-07	2.25E-03	1.49E-04
Kr88	3.35E-04	2.25E-03	1.49E-01
Kr89	4.02E-04	2.25E-03	1.79E-01
Xe131m	3.35E-07	2.25E-03	1.49E-04
Xe133m	6.25E-06	2.25E-03	2.78E-03
Xe133	1.83E-04	2.25E-03	8.15E-02
Xe135m	1.54E-04	2.25E-03	6.86E-02
Xe135	4.91E-04	2.25E-03	2.19E-01
Xe137	1.50E-05	2.25E-03	6.66E-03
Xe138	4.69E-04	2.25E-03	2.09E-01
Sum	2.25E-03		1.00E+00

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	2.88E-02	0.0756	2.18E-03
Kr85m	5.57E-02	1170	6.51E+01
Kr87	1.49E-04	5920	8.83E-01
Kr88	1.49E-01	14700	2.19E+03
Kr89	1.79E-01	16600	2.97E+03
Xe131m	1.49E-04	91.5	1.36E-02
Xe133m	2.78E-03	251	6.99E-01
Xe133	8.15E-02	294	2.40E+01
Xe135m	6.86E-02	3120	2.14E+02
Xe135	2.19E-01	1810	3.96E+02
Xe137	6.66E-03	1420	9.46E+00
Xe138	2.09E-01	8830	1.84E+03
	Sum of πij*Ki=		7.72E+03

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released (unitless)

Whole Body Dose Rate

QTj Maximum Release Rate based on Whole Body Dose (uCi/sec)
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit (mrem/yr)
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = (Fj*500)/(X/Qi*Sum πij*Ki)

QTj =

4.00E-01	5.00E+02
8.20E-07	7.72E+03

= 3.16E+04 uCi/sec

D.3

PRM-RE-113

D.4

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	2.88E-02	0	0.00E+00
Kr85m	5.57E-02	2.81E+03	1.56E+02
Kr87	1.49E-04	1.65E+04	2.46E+00
Kr88	1.49E-01	1.91E+04	2.85E+03
Kr89	1.79E-01	2.91E+04	5.21E+03
Xe131m	1.49E-04	6.48E+02	9.66E-02
Xe133m	2.78E-03	1.35E+03	3.76E+00
Xe133	8.15E-02	6.94E+02	5.66E+01
Xe135m	6.86E-02	4.41E+03	3.03E+02
Xe135	2.19E-01	2.30E+03	5.03E+02
Xe137	6.66E-03	1.39E+04	9.26E+01
Xe138	2.09E-01	1.43E+04	2.99E+03
	Sum(πij)(Li+1.1Mi) =		1.22E+04

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	2.88E-02	7.06E-04	2.03E-05
Kr85m	5.57E-02	7.06E-04	3.93E-05
Kr87	1.49E-04	7.06E-04	1.05E-07
Kr88	1.49E-01	7.06E-04	1.05E-04
Kr89	1.79E-01	7.06E-04	1.26E-04
Xe131m	1.49E-04	7.06E-04	1.05E-07
Xe133m	2.78E-03	7.06E-04	1.96E-06
Xe133	8.15E-02	7.06E-04	5.75E-05
Xe135m	6.86E-02	7.06E-04	4.84E-05
Xe135	2.19E-01	7.06E-04	1.54E-04
Xe137	6.66E-03	7.06E-04	4.70E-06
Xe138	2.09E-01	7.06E-04	1.47E-04

Skin Dose Calculation
3000 Dose Rate Limit

QTj = | 4.00E-01 | 3.00E+03 | 8.20E-07 | 1.22E+04 | = | 1.20E+05 | uCi/sec

Lowest Dose Rate Value
QTj = 3.16E+04 uCi/sec

Step 4.7
Maximum Allowable Value
CTj = (QTj/Rj)
Rj = Release Rate
CTj = maximum allowed concentration
CTj = | 3.16E+04 | 4.48E+07 | = | 7.06E-04 | uCi/cc

D.4

0.5

For Gamma Detectors (REA) the relative efficiencies is calculated in the following table.

Table 4.9a
Relative Efficiency

Nuclide	Gamma Abundance	Relative Abundance	E(Xe-133)	Eij
Kr83m	0.09	0.245	5.51E+05	1.35E+05
Kr85m	0.74	2.016	5.51E+05	1.11E+06
Kr87	0.837	2.281	5.51E+05	1.26E+06
Kr88	1.372	3.738	5.51E+05	2.06E+06
Kr89	1.6	4.36	5.51E+05	2.40E+06
Xe131m	0.0196	0.053	5.51E+05	2.92E+04
Xe133m	0.14	0.381	5.51E+05	2.10E+05
Xe133	0.367	1	5.51E+05	5.51E+05
Xe135m	0.81	2.207	5.51E+05	1.22E+06
Xe135	0.939	2.559	5.51E+05	1.41E+06
Xe137	0.33	0.899	5.51E+05	4.95E+05
Xe138	1.222	3.33	5.51E+05	1.83E+06

Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	2.03E-05	1.35E+05	2.75E+00
Kr85m	3.93E-05	1.11E+06	4.36E+01
Kr87	1.05E-07	1.26E+06	1.32E-01
Kr88	1.05E-04	2.06E+06	2.17E+02
Kr89	1.26E-04	2.40E+06	3.03E+02
Xe131m	1.05E-07	2.92E+04	3.07E-03
Xe133m	1.96E-06	2.10E+05	4.12E-01
Xe133	5.75E-05	5.51E+05	3.17E+01
Xe135m	4.84E-05	1.22E+06	5.89E+01
Xe135	1.54E-04	1.41E+06	2.18E+02
Xe137	4.70E-06	4.95E+05	2.33E+00
Xe138	1.47E-04	1.83E+06	2.70E+02
		C.Rj =	1.00E+03

C.Rj = **Count rate above background (cps)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Reactor Building

Step 4.13
Maximum Allowable Setpoint =
Bkg+C.Rj = 1,550

Step 4.14
Upper Level (UL) = 1,000 → use on page 5.005

Note, there is only one alarm on this system
Step 4.16.2
Alarm

UL	1,000	
Nominal	910	91% of UL
Lower Level	820	82% of UL

D.5

Revision Notes

Revision 4 contains a first cut at including loop uncertainties and instrument drift into the setpoint calculations
Revision 5 takes out the loop uncertainty and instrument drift calculation as engineering determined it unnecessary.
Revision 6 corrects the relative beta efficiencies and matches PPM 16.14.1 Rev 2
Revision 7 adds a sheet that determines the efficiency of the RD-52 to betas.

D.6

INPUT VALUES

This spreadsheet was derived from PPM 16.14.1 Rev 2 (ODCM dispersion value changes) and I/E 2-94-1312 loop uncertainties/instrument drift

Reactor Building Low Range Monitor PRM-RE-1A			
Gas Mixture			See ODCM Table 3-15 and FSAR Table 11.3-1
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	4.48E+07	cc/sec	The maximum exhaust flow rate (Rj) is 4.48E+07 cc/sec (95,000 cfm).
E(Xe-133)	3.72E+08	ccps/uCi/cc	Xenon-133 efficiency (Gas Calibration factor from PPM 16.1.2 Rev 7)
Bkg	3.30E+03	cps	Background
		Step 4.13 value =	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or
Upper Level	7.75E+06	738300	equal to the maximum allowable setpoint value determined in Step 4.13

Turbine Building Low Range Monitor (TEA-RE-13)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Turbine Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Turbine building. Fj is 0.4.
Rj	1.79E+08	cc/sec	The maximum exhaust flow rate (Rj) is 1.79E+08 cc/sec (380,000 cfm).
E(Xe-133)	4.83E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc From PPM 16.2.1 Rev 6
Bkg	40	cpm	Background
		Step 4.13 value =	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or
Upper Level	4.80E+03	4850	equal to the maximum allowable setpoint value determined in Step 4.13.

Radwaste Building Low Range Monitor (WEA-RE-14)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Radwaste Building release pathway from ODCM Table 3-3.
Fj	0.2		Twenty percent (20%) of the site boundary dose rate limit is allocated to the Radwaste building. Fj is 0.2.
Rj	3.91E+07	cc/sec	The maximum exhaust flow rate (Rj) is 3.91E+07 cc/sec (83,000 cfm)
E(Xe-133)	4.83E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from PPM 16.3.1 Rev 7
Bkg	36	cpm	Background
		Step 4.13 value =	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or
Upper Level	2.67E+04	26718	equal to the maximum allowable setpoint value determined in Step 4.13.

D.7

INPUT VALUES

Mechanical Vacuum Pump (AR-RIS-21)			
Gas Mixture			Setpoint Calculation 98-01 of 3/3/98 & B&R Calculation 5.03.01 of 3/80 by E Stergokes
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	1.13E+06	cc/sec	The maximum exhaust flow rate (Rj) is 1.13E+06 cc/sec (2400 cfm)
E(Xe-133)	7.14E+01	mR/hr/uCi/cc	Xenon-133 efficiency mR/hr/uCi/cc from Setpoint Calculation 98-01. Isoshield calculation of initial mixture=0.34 mr/hr. (0.34/4.56E-3)=71.3686 mR/hr/uCi/cc
Bkg	0.1	cpm	Background
Upper Level	7.5	Step 4 13 value = 7.6	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

D.8

Reactor Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
Kr83m	6.47E-05	2.25E-03	2.88E-02
Kr85m	1.25E-04	2.25E-03	5.57E-02
Kr87	3.35E-07	2.25E-03	1.49E-04
Kr88	3.35E-04	2.25E-03	1.49E-01
Kr89	4.02E-04	2.25E-03	1.79E-01
Xe131m	3.35E-07	2.25E-03	1.49E-04
Xe133m	6.25E-06	2.25E-03	2.78E-03
Xe133	1.83E-04	2.25E-03	8.15E-02
Xe135m	1.54E-04	2.25E-03	6.86E-02
Xe135	4.91E-04	2.25E-03	2.19E-01
Xe137	1.50E-05	2.25E-03	6.66E-03
Xe138	4.69E-04	2.25E-03	2.09E-01
Sum	2.25E-03		1.00E+00

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	2.88E-02	0.0756	2.18E-03
Kr85m	5.57E-02	1170	6.51E+01
Kr87	1.49E-04	5920	8.83E-01
Kr88	1.49E-01	14700	2.19E+03
Kr89	1.79E-01	16600	2.97E+03
Xe131m	1.49E-04	91.5	1.36E-02
Xe133m	2.78E-03	251	6.99E-01
Xe133	8.15E-02	294	2.40E+01
Xe135m	6.86E-02	3120	2.14E+02
Xe135	2.19E-01	1810	3.96E+02
Xe137	6.66E-03	1420	9.46E+00
Xe138	2.09E-01	8830	1.84E+03
	Sum of πij*Ki=		7.72E+03

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released (unitless)

Whole Body Dose Rate

QTj Maximum Release Rate based on Whole Body Dose (uCi/sec)
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit (mrem/yr)
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = (Fj*500)/(X/Qi*Sum πij*Ki)

QTj = | 4.00E-01 | 5.00E+02 | = | 3.16E+04 | uCi/sec
| 8.20E-07 | 7.72E+03 |

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Reactor Building Low Range Monitor Setpoint Calculation

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	2.88E-02	0	0.00E+00
Kr85m	5.57E-02	2.81E+03	1.56E+02
Kr87	1.49E-04	1.65E+04	2.46E+00
Kr88	1.49E-01	1.91E+04	2.85E+03
Kr89	1.79E-01	2.91E+04	5.21E+03
Xe131m	1.49E-04	6.48E+02	9.66E-02
Xe133m	2.78E-03	1.35E+03	3.76E+00
Xe133	8.15E-02	6.94E+02	5.66E+01
Xe135m	6.86E-02	4.41E+03	3.03E+02
Xe135	2.19E-01	2.30E+03	5.03E+02
Xe137	6.66E-03	1.39E+04	9.26E+01
Xe138	2.09E-01	1.43E+04	2.99E+03
	Sum(πij)(Li+1.1Mi) =		1.22E+04

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	2.88E-02	7.06E-04	2.03E-05
Kr85m	5.57E-02	7.06E-04	3.93E-05
Kr87	1.49E-04	7.06E-04	1.05E-07
Kr88	1.49E-01	7.06E-04	1.05E-04
Kr89	1.79E-01	7.06E-04	1.26E-04
Xe131m	1.49E-04	7.06E-04	1.05E-07
Xe133m	2.78E-03	7.06E-04	1.96E-06
Xe133	8.15E-02	7.06E-04	5.75E-05
Xe135m	6.86E-02	7.06E-04	4.84E-05
Xe135	2.19E-01	7.06E-04	1.54E-04
Xe137	6.66E-03	7.06E-04	4.70E-06
Xe138	2.09E-01	7.06E-04	1.47E-04

Skin Dose Calculation
3000 Dose Rate Limit

QTj = | 4.00E-01 | 3.00E+03 | = | 1.20E+05 | uCi/sec
| 8.20E-07 | 1.22E+04 |

Lowest Dose Rate Value
QTj = 3.16E+04 uCi/sec

Step 4.7
Maximum Allowable Value
CTj = (QTj/Rj)
Rj = Release Rate
CTj = maximum allowed concentration
CTj = 3.16E+04 / 4.48E+07 = 7.06E-04 uCi/cc

D.10

Reactor Building Low Range Monitor Setpoint Calculation

For Gamma Detectors (REA) the relative efficiencies is calculated in the following table.

Table 4.9a
Relative Efficiency

Nuclide	Gamma Abundance	Relative Abundance	E(Xe-133)	Eij
Kr83m	0.09	0.245	3.72E+08	9.11E+07
Kr85m	0.74	2.016	3.72E+08	7.50E+08
Kr87	0.837	2.281	3.72E+08	8.49E+08
Kr88	1.372	3.738	3.72E+08	1.39E+09
Kr89	1.6	4.36	3.72E+08	1.62E+09
Xe131m	0.0196	0.053	3.72E+08	1.97E+07
Xe133m	0.14	0.381	3.72E+08	1.42E+08
Xe133	0.367	1	3.72E+08	3.72E+08
Xe135m	0.81	2.207	3.72E+08	8.21E+08
Xe135	0.939	2.559	3.72E+08	9.52E+08
Xe137	0.33	0.899	3.72E+08	3.34E+08
Xe138	1.222	3.33	3.72E+08	1.24E+09

Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	2.03E-05	9.11E+07	1.85E+03
Kr85m	3.93E-05	7.50E+08	2.95E+04
Kr87	1.05E-07	8.49E+08	8.93E+01
Kr88	1.05E-04	1.39E+09	1.46E+05
Kr89	1.26E-04	1.62E+09	2.05E+05
Xe131m	1.05E-07	1.97E+07	2.07E+00
Xe133m	1.96E-06	1.42E+08	2.78E+02
Xe133	5.75E-05	3.72E+08	2.14E+04
Xe135m	4.84E-05	8.21E+08	3.97E+04
Xe135	1.54E-04	9.52E+08	1.47E+05
Xe137	4.70E-06	3.34E+08	1.57E+03
Xe138	1.47E-04	1.24E+09	1.82E+05
		C.Rj =	7.75E+05

C.Rj = **Count rate above background (cps)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide **i** (ccps/µCi/cc)

Reactor Building

Step 4.13
Maximum Allowable Setpoint =
Bkg+C.Rj = 778,300

Step 4.14
Upper Level (UL) = 775,000

Note, there is only one alarm on this system
Step 4.16.2
Alarm

UL	775,000	
Nominal	705,250	91% of UL
Lower Level	635,500	82% of UL

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16.14.1

DIC 1507.1

USE CURRENT REVISION 5/A/05 OM

ENERGY NORTHWEST
People·Vision·Solutions

COLUMBIA GENERATING STATION
PLANT PROCEDURES MANUAL

NUMBER	APPROVED BY	DATE
16.14.1	CMK - Revision 2	05/17/05

VOLUME NAME
ODCM IMPLEMENTING PROCEDURES

SECTION
SETPOINT CALCULATIONS

TITLE
GASEOUS MONITOR SETPOINT DETERMINATIONS

Setpoint Calculation for (EPN): PRM-RE-1A / PRM-RP-3

Calculation Performed By: CLAY MADDEN / 5/A/05 (OM) /

Comments: _____

Test Completed _____ Performer Date 5/19/05

Assigned Reviewer: M. Shobe Date 5-26-05

Comments: _____

RECEIVED
MAY 26 2005
RECORDS STORAGE

NUMBER	REVISION	PAGE
16.14.1	Vault 2 09272007	000011 of 18

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TABLE OF CONTENTS

1.0 PURPOSE

To provide instructions for determining the setpoint(s) for radiation monitors as required by ODCM RFO 6.1.2.1. {R-5560}

2.0 PREREQUISITES

None

3.0 PRECAUTIONS AND LIMITATIONS

None

4.0 PROCEDURE

4.1 Due to the repetitious nature of these calculations, use of a spreadsheet is recommended. If one is used, the data may be transferred to the corresponding tables in this procedure, or a hard copy of the spreadsheet may be printed and attached. If a hardcopy is attached, mark the corresponding tables N/A, and reference the appropriate hardcopy. It is recommended that any spreadsheet tables used be numbered to match the corresponding procedure table number.

4.2 Based on the following, determine the appropriate gas mixture to be used for this radiation monitor: {R-5559}, {R-5561}, {R-5562}

4.2.1 For the Reactor Building:

a. The values from ODCM Table 3-15 are recommended, but a different mixture may be selected based on operational conditions or expected effluent activity. Any mixture selected should be representative of an effluent condition that could actually reach the setpoint.

NOTE: The ODCM Table 3-15 values are for a design base mixture at 30 minutes decay, and produce a setpoint which is appropriate for operation of the offgas system in the charcoal bypass mode. The setpoint resulting from the use of these values is lower than the value obtained by using a gas mixture appropriate for offgas system operation with the charcoal beds in service.

b. If a gas mixture other than ODCM Table 3-15 is used, it may be necessary to limit the operation of the offgas system to require the use of the charcoal beds.

c. If a mixture other than ODCM Table 3-15 is used, document this fact and the reasoning for its use along with any operational limitations on the offgas treatment system, and attach to this procedure.

d. The setpoint for the Reactor Building effluent is on the Low Range Monitor, PRM-RE-1A.

e. X/Q_j for the Reactor Building release pathway is 8.2E-07 sec/m³, from ODCM Table 3-3.

f. Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, F_j is 0.4.

g. The maximum exhaust flow rate (R_j) is 4.48E+07 cc/sec (95,000 cfm).

4.2.2 For the Turbine Building:

a. The values from FSAR Table 11.3-7 are recommended, but a different mixture may be selected based on operational conditions or expected effluent activity.

b. If a mixture other than FSAR Table 11.3-7 is used, document this fact, and the reasoning for its use, and attach to this procedure.

c. The setpoint for the Turbine Building effluent is on the Low Range Monitor, TEA-RIS-13.

d. X/Q_j for the Turbine Building release pathway is 1.5E-05 sec/m^3, from ODCM Table 3-3.

e. Forty percent (40%) of the site boundary dose rate limit is allocated to the Turbine building. F_j is 0.4.

f. The maximum exhaust flow rate (R_j) is 1.79E+08 cc/sec (380,000 cfm).

4.2.3 For the Radwaste Building:

a. The values from FSAR Table 11.3-7 are recommended, but a different mixture may be selected based on operational conditions or expected effluent activity.

b. If a mixture other than FSAR Table 11.3-7 is used, document this fact, and the reasoning for its use, and attach to this procedure.

c. The setpoint for the Radwaste Building effluent is on the Low Range Monitor, WEA-RIS-14.

d. X/Q_j for the Radwaste Building release pathway is 1.5E-05 sec/m^3, from ODCM Table 3-3.

e. Twenty percent (20%) of the site boundary dose rate limit is allocated to the Radwaste building. F_j is 0.2.

f. The maximum exhaust flow rate (R_j) is 3.91E+07 cc/sec (83,000 cfm).

4.3 Determine the fraction for each nuclide of total activity released by completing Table 4.3a as follows: {R-5564}

Fraction = $\pi_{ij} = \frac{M_{ij}}{M_{Tj}}$

where:

M_{ij} = Measured or estimated concentration of nuclide i in release path j.

M_{Tj} = Measured or estimated total concentration of all gases in release path j.

4.3.1 Enter the selected nuclide concentration or activity for each nuclide in the M_{ij} column. Mark nuclides not present in the mixture N/A.

4.3.2 Enter the selected total concentration or activity for each nuclide in the M_{Tj} column.

4.3.3 Calculate the fraction for each applicable nuclide and record in the π_{ij} column.

Table 4.3a

Nuclide	M_{ij}	M_{Tj}	π_{ij}
Kr83m	6.47E-5	2.25E-3	2.88E-2
Kr85m	1.25E-4		5.57E-2
Kr87	3.35E-7		1.49E-4
Kr88	3.35E-4		1.49E-1
Kr89	4.02E-4		1.79E-1
Xe131m	3.35E-7		1.49E-4
Xe133m	6.25E-6		2.78E-3
Xe133	1.83E-4		8.15E-2
Xe135m	1.54E-4		6.86E-2
Xe135	4.91E-4		2.19E-1
Xe137	1.50E-5		6.66E-3
Xe138	4.69E-4		2.09E-1

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4.4 Determine the maximum release rate based on whole body dose by completing Table 4.4a as follows:

Max release rate = $$Q_{Tj} = \frac{F_j\,500}{\frac{X}{Q_j}\sum_{i=1}^{m}(K_i)(\pi_{ij})} \quad (\mu Ci/sec)$$

where:

F_j = Fraction of total dose allocated to this release pathway (Dimensionless).

500 = Whole body dose rate limit.

X/Q_j = Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m^3).

K_i = Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per $\mu Ci/m^3$).

π_{ij} = Is the fraction of the total activity for nuclide i (Dimensionless).

m = Total number of nuclides in the gaseous effluent.

j = Release pathway.

4.4.1 Enter the π_{ij} values from Table 4.3a. Mark nuclides not present in the mixture N/A.

4.4.2 Multiply the π_{ij} value by its corresponding K_i, and record the result in the $K_i\pi_{ij}$ column.

4.4.3 Sum the values in the $(\pi_{ij})(K_i)$ column.

Table 4.4a			
Maximum Release Rate			
Nuclide	π_{ij}	K_i	$(\pi_{ij})(K_i)$
Kr83m	2.88E-2	0.0756	2.18E-3
Kr85m	5.57E-2	1170	6.51E+1
Kr87	1.49E-4	5920	8.83E-1
Kr88	1.49E-1	14700	2.19E+3
Kr89	1.79E-1	16600	2.97E+3
Xe131m	1.49E-4	91.5	1.36E-2
Xe133m	2.78E-3	251	6.99E-1
Xe133	8.15E-2	294	2.40E+1
Xe135m	6.86E-2	3120	2.14E+2
Xe135	2.19E-1	1810	3.96E+2
Xe137	6.66E-3	1420	9.46E+0
Xe138	2.09E-1	8830	1.84E+3
		$\sum \pi_{ij}*K_i =$	7.72E+3

4.4.4 Determine Q_{Tj} by entering the appropriate values for the applicable effluent pathway in the spaces provided below and completing the indicated calculation:

{R-5565}

$$Q_{Tj} = \frac{F_j 500}{\frac{X}{Q_j}\sum_{i=1}^{m}(K_i)(\pi_{ij})} \text{ (}\mu\text{Ci/sec)}$$

$$Q_{Tj} = \frac{(0.4)500}{(8.2E-7)(7.72E+3)} = \frac{3.16E+4}{} \text{ (}\mu\text{Ci/sec)}$$

4.5 Determine the maximum release rate based on skin dose by completing Table 4.5a as follows: {R-5567}

$$\text{Max release rate} = Q_{Tj} = \frac{F_j 3000}{\frac{\chi}{Q_j}\sum_{i=1}^{m}(L_i + 1.1M_i)(\pi_{ij})} \quad (\mu Ci/sec)$$

where:

F_j = Fraction of total dose allocated to this release pathway (Dimensionless)

3000 = Skin dose limit

X/Qi = Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m^3)

Li = Skin dose factor due to beta emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 ($mrem/year$ per $\mu Ci/m^3$)

Mi = Air dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 ($mrem/year$ per $\mu Ci/m^3$)

πij = Is the fraction of the total activity for nuclide i (Dimensionless)

m = Total number of nuclides in the gaseous effluent

j = Release pathway

4.5.1 Enter the π_{ij} values from Table 4.3a. Mark nuclides not present in the mixture N/A.

4.5.2 Multiply the π_{ij} value by its corresponding $L_i + 1.1M_i$, and record the result in the $(L_i+1.1M_i)\pi_{ij}$ column.

4.5.3 Sum the values in the $(\pi_{ij})(L_i+1.1M_i)$ column.

Table 4.5a			
Maximum Release Rate			
Nuclide	π_{ij}	$L_i+1.1M_i$	$(\pi_{ij})(L_i+1.1M_i)$
Kr83m	2.88E-2	0	0
Kr85m	5.57E-2	2.81E+03	1.56E+2
Kr87	1.49E-4	1.65E+04	2.46E+0
Kr88	1.49E-1	1.91E+04	2.85E+3
Kr89	1.79E-1	2.91E+04	5.21E+3
Xe131m	1.49E-4	6.48E+02	9.66E-2
Xe133m	2.78E-3	1.35E+03	3.76E+0
Xe133	8.15E-2	6.94E+02	5.66E+1
Xe135m	6.86E-2	4.41E+03	3.03E+2
Xe135	2.19E-1	2.30E+03	5.03E+2
Xe137	6.66E-3	1.39E+04	9.26E+1
Xe138	2.09E-1	1.43E+04	2.99E+3
		$\sum(\pi_{ij})(L_i+1.1M_i)$ =	1.22E+4

4.5.4 Determine Q_{Tj} by entering the appropriate values for the applicable effluent pathway in the spaces provided below, and completing the indicated calculation:

$$Q_{Tj} = \frac{F_j 3000}{\frac{X}{Q_j}\sum_{i=1}^{m}(L_i + 1.1M_i)(\pi_{ij})} \ (\mu Ci/sec)$$

$$Q_{Tj} = \frac{(0.4)3000}{(8.2E-7)(1.22E+4)} = 1.2E+5 \ (\mu Ci/sec)$$

4.6 Compare the whole body and skin Q_{Tj} values calculated above and select the lower of the two values. Record the selected value below: {R-5563}

Q_{Tj} = 3.16E+4

4.7 Determine the maximum allowable concentration as follows: {R-5566}

$$\text{Max concentration} = C_{Tj} = \frac{Q_{Tj}}{R_j}(\mu Ci/cc)$$

$$\text{Max concentration} = C_{Tj} = \frac{Q_{Tj}}{R_j} = \frac{(3.16E+4)}{(4.48E+7)} = 7.06E-4\ (\mu Ci/cc)$$

where:

C_{Tj} = Total allowed concentration of all noble gases (μCi/cc)

Q_{Tj} = Maximum acceptable release rate for all noble gases (μCi/sec)

R_j = Effluent release rate (cc/sec)

4.8 Determine the maximum allowable concentration for each nuclide by completing Table 4.8a as follows:

$$\text{Max concentration}_i = C_{ij} = \pi_{ij} C_{Tj}(\mu Ci/cc)$$

where:

π_{ij} = As defined in Section 5.3

C_{ij} = As defined above

4.8.1 Enter the π_{ij} values from Table 4.3a. Mark nuclides not present N/A.

4.8.2 Enter the C_{Tj} value from Step 4.8.

4.8.3 Multiply the applicable π_{ij} values by the C_{Tj} value, and record the result in the C_{ij} column.

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	π_{ij}	C_{ij}	C_{ij}
Kr83m	2.88E-2	7.06E-4	2.03E-5
Kr85m	5.57E-2		3.93E-5
Kr87	1.49E-4		1.05E-7
Kr88	1.49E-1		1.05E-4
Kr89	1.79E-1		1.26E-4
Xe131m	1.49E-4		1.05E-7
Xe133m	2.78E-3		1.96E-6
Xe133	8.15E-2		5.75E-5
Xe135m	6.86E-2		4.84E-5
Xe135	2.19E-1		1.54E-4
Xe137	6.66E-3		4.70E-6
Xe138	2.09E-1		1.47E-4

4.9 For gamma radiation detectors, (REA), determine the efficiency for the applicable nuclides by completing Table 4.9a as follows:

4.9.1 Enter the Xe^{133} efficiency in column for E_{Xe-133}.

4.9.2 Multiply the Relative Abundance for nuclides present in the mixture times the E_{Xe-133}, and record the result in the E_{ij} column. Mark nuclides not present in the mixture N/A.

Table 4.9a

Relative Efficiency

Nuclide	Gamma Abundance	Relative Abundance	E_{Xe-133}	E_{ij}
Kr83m	0.09	0.245	3.72E+8	9.11E+7
Kr85m	0.74	2.016		7.5E+8
Kr87	0.837	2.281		8.49E+8
Kr88	1.372	3.738		1.39E+9
Kr89	1.6	4.360		1.62E+9
Xe131m	0.0196	0.053		1.97E+7
Xe133m	0.14	0.381		1.42E+8
Xe133	0.367	1.000		3.72E+8
Xe135m	0.81	2.207		8.21E+8
Xe135	0.939	2.559		9.52E+8
Xe137	0.33	0.899		3.34E+8
Xe138	1.222	3.330		1.24E+9

4.10 For beta radiation detectors, (TEA, WEA), determine the efficiency for the applicable nuclides by completing Table 4.10a as follows:

4.10.1 Enter the Xe^{133} efficiency in column for $E_{Xe\text{-}133}$.

4.10.2 Multiply the Relative Efficiency for nuclides present in the mixture times the $E_{Xe\text{-}133}$, and record the result in the E_{ij} column. Mark nuclides not present in the mixture N/A.

Table 4.10a

Relative Efficiency

Nuclide	Relative Efficiency(1)	$E_{Xe\text{-}133}$	E_{ij}
Kr83m	0.07		
Kr85m	4.63		
Kr87	13.66		
Kr88	7.15		
Kr89	13.66		
Xe131m	0.99		
Xe133m	1.63		
Xe133	1.00		
Xe135m	0.36		
Xe135	5.85		
Xe137	13.66		
Xe138	13.01		

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4.11 Determine the count rate above background by completing Table 4.11a as follows:

Count Rate above Background = $C.R_j = \sum_{i=1}^{m} C_{ij} E_{ij}$(cpm)

where:

$C.R_j$ = Count rate above background (cpm)

C_{ij} = Maximum acceptable concentration of noble gas i (μCi/cc)

E_{ij} = Effluent monitor detection efficiency for nuclide i (cpm/μCi/cc)

4.11.1 Enter the applicable C_{ij} values from Table 4.8a. Mark nuclides not present in the mixture N/A.

4.11.2 Enter the applicable E_{ij} values from Table 4.9a. Mark nuclides not present in the mixture N/A.

4.11.3 Multiply the applicable values in the C_{ij} column times the values in the E_{ij} column, and record in the $C.R_{ij}$ column. Mark nuclides not present in the mixture N/A.

4.11.4 Determine the $C.R_j$ value by summing the values in the $C.R_{ij}$ column. This is the setpoint count rate above background.

Table 4.11a

Counts above Background

Nuclide	C_{ij}	E_{ij}	$C.R_{ij}$
Kr83m	2.03E-5	9.11E+7	1.85E+3
Kr85m	3.93E-5	7.50E+8	2.95E+4
Kr87	1.05E-7	8.49E+8	8.93E+1
Kr88	1.05E-4	1.39E+9	1.46E+5
Kr89	1.26E-4	1.62E+9	2.05E+5
Xe131m	1.05E-7	1.97E+7	2.07E+0
Xe133m	1.96E-6	1.42E+8	2.78E+2
Xe133	5.75E-5	3.72E+8	2.14E+4
Xe135m	4.84E-5	8.21E+8	3.97E+4
Xe135	1.54E-4	9.52E+8	1.47E+5
Xe137	4.70E-6	3.34E+8	1.57E+3
Xe138	1.47E-4	1.24E+9	1.82E+5
		$C.R_j$ =	7.75E+5

4.12 Based on available instrument data, select an operating background. Record the value below:

Background = ~15,500 AT 100% POWER 4/05 ~ 3,300 AT 0% POWER 5/05

4.13 Calculate the instrument maximum allowable setpoint as follows:

Maximum Allowable Setpoint = Background + $C.R_j$ = (3,300) + (7.75E+5 = 778,300

4.14 Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.15.

Upper Level = 775,000

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4.15 If the Upper Level is less than 80% of the calculated value, document the rational for this selection, and attach to this procedure.

4.16 Assign the Upper Level to a specific alarm as follows:

4.16.1 For TEA-RIS-13 and WEA-RIS-14:

a. Assign the Upper Level to the High-High alarm.

b. Determine the nominal and lower level values for the High-High alarm as follows:

NOTE: Since the High-High alarm setpoint is based on a regulatory limit, the upper level value must be LE the selected setpoint.

Upper level (UL) = _____ (from Step 4.15)

Nominal value = (Upper Level) * 0.91 = _____

Lower Level (LL) = (Upper Level) * 0.82 = _____

c. Determine the normal background value of the monitor based on instrument operating history.

Background = _____

d. Multiply the background value by 4.66.

High Alarm = (Background)(4.66) = (_____)(4.66) = _____

e. Round the High Alarm up to the nearest interger value that can be clearly read on the instrument.

High Alarm = _____

f. Assign this value to the High alarm setpoint, or if is desirable to assign a different value, document the justification for the different High alarm setpoint and attach to this procedure.

g. Determine the nominal, upper level and lower level values for the High as follows:

NOTE: The High alarm is not based on a regulatory limit, therefore it is acceptable to have values that are greater, or less than the selected value.

N/A

Upper level (UL) = High Alarm * 1.2 = _____

Nominal value = High Alarm = _____

Lower Level (LL) = High Alarm * 0.80 = _____

4.16.2 For PRM-RE-1B (REA):

a. There is only one alarm on this system.

b. Determine the nominal and lower level values as follows:

NOTE: Since this alarm setpoint is based on a regulatory limit, the upper level value must be LE the selected setpoint.

Upper level (UL) = 775,000 (from Step 4.15)

Nominal value = (Upper Level) * 0.91 = 705,250

Lower Level (LL) = (Upper Level) * 0.82 = 635,500

5.0 DOCUMENTATION

Maintain the completed procedure in the permanent plant file in accordance with the appropriate record procedure(s).

6.0 REFERENCES

6.1 Offsite Dose Calculation Manual, Section 3.4 {R-5560}, {R-5561}, {R-5562}, {R-5563}, {R-5564}, {R-5565}, {R-5566}, {R-5567}

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7.0 ATTACHMENTS

None

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Reactor Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
Kr83m	6.43E-05	2.25E-03	2.88E-02
Kr85m	1.25E-04	2.25E-03	5.57E-02
Kr87	3.35E-07	2.25E-03	1.49E-04
Kr88	3.35E-04	2.25E-03	1.49E-01
Kr89	4.02E-04	2.25E-03	1.79E-01
Xe131m	3.35E-07	2.25E-03	1.49E-04
Xe133m	6.25E-06	2.25E-03	2.78E-03
Xe133	1.83E-04	2.25E-03	8.15E-02
Xe135m	1.54E-04	2.25E-03	6.86E-02
Xe135	4.91E-04	2.25E-03	2.19E-01
Xe137	1.50E-05	2.25E-03	6.68E-03
Xe138	4.69E-04	2.25E-03	2.09E-01
Sum	2.25E-03		1.00E+00

Mij Measured or estimated concentration of nuclide i in release path j (μCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (μCi/cc)
πij Fraction of each nuclide released (unitless)

Table 4.4a Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	2.88E-02	0.0756	2.18E-03
Kr85m	5.57E-02	1170	6.51E+01
Kr87	1.49E-04	5920	8.83E-01
Kr88	1.49E-01	14700	2.19E+03
Kr89	1.79E-01	16600	2.97E+03
Xe131m	1.49E-04	91.5	1.36E-02
Xe133m	2.78E-03	251	6.99E-01
Xe133	8.15E-02	294	2.40E+01
Xe135m	6.86E-02	3120	2.14E+02
Xe135	2.19E-01	1810	3.96E+02
Xe137	6.68E-03	1420	9.48E+00
Xe138	2.09E-01	8830	1.84E+03
		Sum of πij*Ki=	7.72E+03

Whole Body Dose Rate

QTj Maximum Release Rate based on Whole Body Dose (uCi/sec)
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit (mrem/yr)
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per μCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = (Fj*500)/(X/Qi*Sum πij*Ki)

QTj = (4.00E-01 · 5.00E+02) / (8.20E-07 · 7.72E+03) = 3.16E+04 uCi/sec

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Reactor Building Low Range Monitor Setpoint Calculation

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	2.88E-02	0	0.00E+00
Kr85m	5.57E-02	2.81E+03	1.56E+02
Kr87	1.49E-04	1.65E+04	2.46E+00
Kr88	1.49E-01	1.91E+04	2.85E+03
Kr89	1.79E-01	2.91E+04	5.21E+03
Xe131m	1.49E-04	6.48E+02	9.68E-02
Xe133m	2.78E-03	1.35E+03	3.76E+00
Xe133	8.15E-02	6.94E+02	5.66E+01
Xe135m	6.86E-02	4.41E+03	3.03E+02
Xe135	2.19E-01	2.30E+03	5.03E+02
Xe137	6.66E-03	1.39E+04	9.26E+01
Xe138	2.09E-01	1.43E+04	2.99E+03
	Sum(πij)(Li+1.1Mi) =		1.22E+04

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	2.88E-02	7.06E-04	2.03E-05
Kr85m	5.57E-02	7.06E-04	3.93E-05
Kr87	1.49E-04	7.06E-04	1.05E-07
Kr88	1.49E-01	7.06E-04	1.05E-04
Kr89	1.79E-01	7.06E-04	1.26E-04
Xe131m	1.49E-04	7.06E-04	1.05E-07
Xe133m	2.78E-03	7.06E-04	1.96E-06
Xe133	8.15E-02	7.06E-04	5.75E-05
Xe135m	6.86E-02	7.06E-04	4.84E-05
Xe135	2.19E-01	7.06E-04	1.54E-04
Xe137	6.66E-03	7.06E-04	4.70E-06
Xe138	2.09E-01	7.06E-04	1.47E-04

Skin Dose Calculation

3000 Dose Rate Limit

$$QTj = \frac{4.00E{-}01 \quad 3.00E{+}03}{8.20E{-}07 \quad 1.22E{+}04} = 1.20E{+}05 \text{ uCi/sec}$$

Lowest Dose Rate Value

QTj = 3.16E+04 uCi/sec

Step 4.7

Maximum Allowable Value

CTj = (QTj/Rj)

Rj = Release Rate

CTj = maximum allowed concentration

$$CTj = \frac{3.16E{+}04}{4.48E{+}07} = 7.06E{-}04 \text{ uCi/cc}$$

Reactor Building Low Range Monitor Setpoint Calculation

For Gamma Detectors (REA) the relative efficiencies is calculated in the following table.

Table 4.9a
Relative Efficiency

Nuclide	Gamma Abundance	Relative Abundance	E(Xe-133)	Eij
Kr83m	0.09	0.245	3.72E+08	9.11E+07
Kr85m	0.74	2.016	3.72E+08	7.50E+08
Kr87	0.837	2.281	3.72E+08	8.49E+08
Kr88	1.372	3.738	3.72E+08	1.39E+09
Kr89	1.6	4.36	3.72E+08	1.62E+09
Xe131m	0.0196	0.053	3.72E+08	1.97E+07
Xe133m	0.14	0.381	3.72E+08	1.42E+08
Xe133	0.367	1	3.72E+08	3.72E+08
Xe135m	0.81	2.207	3.72E+08	8.21E+08
Xe135	0.939	2.559	3.72E+08	9.52E+08
Xe137	0.33	0.899	3.72E+08	3.34E+08
Xe138	1.222	3.33	3.72E+08	1.24E+09

Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	2.03E+05	9.11E+07	1.85E+13
Kr85m	3.93E+05	7.50E+08	2.95E+14
Kr87	1.95E+07	8.49E+08	1.66E+16
Kr88	1.95E+05	1.39E+09	1.46E+15
Kr89	1.25E+05	1.62E+09	2.01E+15
Xe131m	1.95E+07	1.97E+07	3.07E+08
Xe133m	1.99E+06	1.42E+08	2.78E+12
Xe133	5.75E+05	3.72E+08	2.14E+14
Xe135m	4.93E+05	8.21E+08	3.92E+14
Xe135	1.54E+06	9.52E+08	1.47E+15
Xe137	4.79E+06	3.34E+08	1.52E+15
Xe138	1.49E+06	1.24E+09	1.82E+15
		C.Rj =	775000

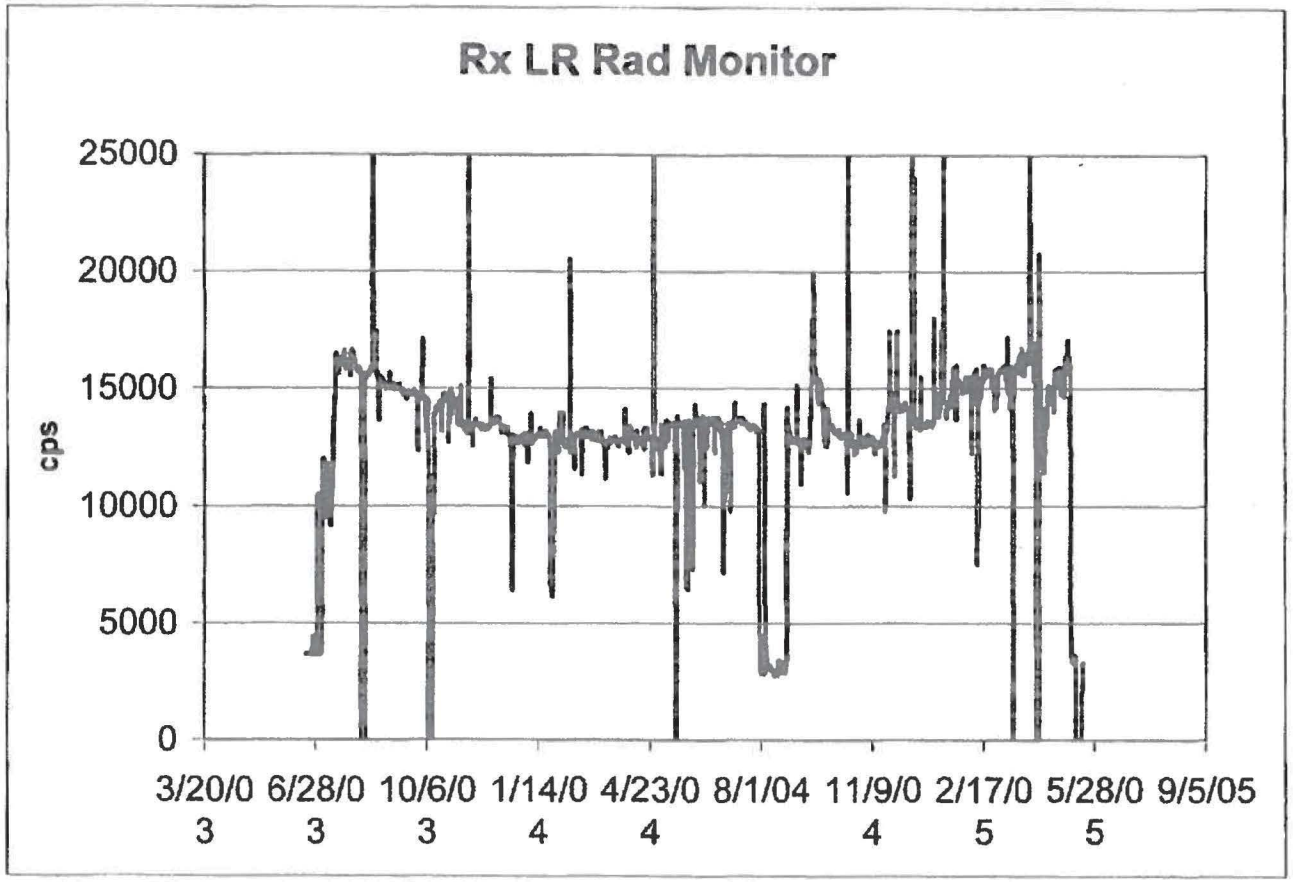
C Rj = Count rate above background (cps)
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Reactor Building

Step 4.13
Maximum Allowable Setpoint =
Bkg+C.Rj = 778300

Step 4.14
Upper Level (UL) = 775000

Note, there is only one alarm on this system
Step 4.16 2
Alarm
UL 775000
Nominal 705250 91% of UL
Lower Level 635500 82% of UL



D033

NOTE: The High alarm is not based on a regulatory limit, therefore it is acceptable to have values that are greater, or less than the selected value.

Upper level (UL) = High Alarm * 1.2 = _____

Nominal value = High Alarm = _____

Lower Level (LL) = High Alarm * 0.80 = _____

4.16.2 For ~~PRM-RE-1B~~ (REA): PRM-RE-1A EDITORIAL Clay L Madden 5/19/05

a. There is only one alarm on this system.

b. Determine the nominal and lower level values as follows:

NOTE: Since this alarm setpoint is based on a regulatory limit, the upper level value must be LE the selected setpoint.

Upper level (UL) = _____ (from Step 4.16) ← 4.14

Nominal value = (Upper Level) * 0.91 = _____

Lower Level (LL) = (Upper Level) * 0.82 = _____

5.0 DOCUMENTATION

Maintain the completed procedure in the permanent plant file in accordance with the appropriate record procedure(s).

6.0 REFERENCES

6.1 Offsite Dose Calculation Manual, Section 3.4 {R-5560}, {R-5561}, {R-5562}, {R-5563}, {R-5564}, {R-5565}, {R-5566}, {R-5567}

6.2 CVI-02-92B-00,134,1

7.0 ATTACHMENTS

None

NUMBER	REVISION	PAGE
16.14.1	2 Vault 03272007	18 of 18

4.15 If the Upper Level is less than 80% of the calculated value, document the rational for this selection, and attach to this procedure.

4.16 Assign the Upper Level to a specific alarm as follows:

4.16.1 For TEA-RIS-13 and WEA-RIS-14:

a. Assign the Upper Level to the High-High alarm.

b. Determine the nominal and lower level values for the High-High alarm as follows:

NOTE: Since the High-High alarm setpoint is based on a regulatory limit, the upper level value must be LE the selected setpoint.

Upper level (UL) = _____ (from Step 4.15) 4.14

Nominal value = (Upper Level) * 0.91 = _____

Lower Level (LL) = (Upper Level) * 0.82 = _____

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c. Determine the normal background value of the monitor based on instrument operating history.

Background = _____

d. Multiply the background value by 4.66.

High Alarm = (Background)(4.66) = (_____)(4.66) = _____

e. Round the High Alarm up to the nearest interger value that can be clearly read on the instrument.

High Alarm = _____

f. Assign this value to the High alarm setpoint, or if is desirable to assign a different value, document the justification for the different High alarm setpoint and attach to this procedure.

g. Determine the nominal, upper level and lower level values for the High as follows:

INPUT VALUES

This spreadsheet was derived from PPM 16.14.1 Rev 2 (ODCM dispersion value changes) and I/E 2-94-1312 loop uncertainties/instrument drift

Reactor Building Low Range Monitor PRM-RE-1A			
Gas Mixture			See ODCM Table 3-15 and FSAR Table 11.3-1
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway is 8.6E-07 sec/m3, from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	4.48E+07	cc/sec	The maximum exhaust flow rate (Rj) is 4.48E+07 cc/sec (95,000 cfm).
E(Xe-133)	3.72E+08	ccps/uCi/cc	Xenon-133 efficiency (Gas Calibration factor from PPM 16.1.2 Rev 7)
Bkg	3.30E+03	cps	Background
Upper Level	7.75E+05	Step 4.13 value = 778300	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13

Turbine Building Low Range Monitor (TEA-RE-13)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Turbine Building release pathway is 1.5E-05 sec/m3, from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Turbine building. Fj is 0.4.
Rj	1.79E+08	cc/sec	The maximum exhaust flow rate (Rj) is 1.79E+08 cc/sec (380,000 cfm).
E(Xe-133)	4.83E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc From PPM 16.2.1 Rev 6
Bkg	40	cpm	Background
Upper Level	4.80E+03	Step 4.13 value = 4854	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

Radwaste Building Low Range Monitor (WEA-RE-14)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Radwaste Building release pathway is 1.5E-05 sec/m3, from ODCM Table 3-3.
Fj	0.2		Twenty percent (20%) of the site boundary dose rate limit is allocated to the Radwaste building. Fj is 0.2.
Rj	3.91E+07	cc/sec	The maximum exhaust flow rate (Rj) is 3.91E+07 cc/sec (83,000 cfm)
E(Xe-133)	4.83E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from PPM 16.3.1 Rev 7
Bkg	36	cpm	Background
Upper Level	2.67E+04	Step 4.13 value = 26718	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

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INPUT VALUES

Mechanical Vacuum Pump (AR-RIS-21)			
Gas Mixture			Setpoint Calculation 98-01 of 3/3/98 & B&R Calculation 5.03.01 of 3/80 by E Stergokes
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway is 8.2E-07 sec/m3, from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	1.13E+06	cc/sec	The maximum exhaust flow rate (Rj) is 1.13E+06 cc/sec (2400 cfm)
E(Xe-133)	7.14E+01	mR/hr/uCi/cc	Xenon-133 efficiency mR/hr/uCi/cc from Setpoint Calculation 98-01. Isoshield calculation of initial mixture=0.34 mr/hr. (0.34/4.56E-3)=71.3686 mR/hr/uCi/cc
Bkg	0.1	cpm	Background
Upper Level	7.5	Step 4.13 value = 7.6	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

Revision 4 contains a first cut at including loop uncertainties and instrument drift into the setpoint calculations
Revision 5 takes out the loop uncertainty and instrument drift calculation as engineering determined it unnecessary.
Revision 6 corrects the relative beta efficiencies and matches PPM 16.14.1 Rev 2
Revision 7 adds a sheet that determines the efficiency of the RD-52 to betas.
NE-02-09-12.001 PRM-RE-1A inputs changed to PRM-RE-1B
CMR0000011948-001 TEA Calculations & WEACalculations updated to NE-02-08-09 and NE-02-08-08 Setpoint Calculations

This spreadsheet was derived from PPM 16.14.1 Rev 2 (ODCM dispersion value changes) and E/I-02-94-1312 loop uncertainties/instrument drift

Reactor Building Intermediate Range Monitor PRM-RE-1B			
Gas Mixture			See ODCM Table 3-15 and FSAR Table 11.3-1
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	4.48E+07	cc/sec	The maximum exhaust flow rate (Rj) is 4.48E+07 cc/sec (95,000 cfm).
E(Xe-133)	5.51E+05	ccps/uCi/cc	Xenon-133 efficiency (Gas Calibration factor from Chemistry Calculation 96-001, Attachment 3 Page 5)
Bkg	5.50E+02	cps	Background (NE-02-10-01 CMR 0000010357)
Upper Level	1.00E+03	Step 4.13 value = 1550	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13

Turbine Building Low Range Monitor (TEA-RE-13)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Turbine Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Turbine building. Fj is 0.4.
Rj	1.79E+08	cc/sec	The maximum exhaust flow rate (Rj) is 1.79E+08 cc/sec (380,000 cfm).
E(Xe-133)	2.15E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from NE-02-08-09
Bkg	46	cpm	Background (NE-02-10-01 CMR 0000011647)
Upper Level	3.81E+02	Step 4.13 value = 477	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

Radwaste Building Low Range Monitor (WEA-RE-14)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Radwaste Building release pathway from ODCM Table 3-3.
Fj	0.2		Twenty percent (20%) of the site boundary dose rate limit is allocated to the Radwaste building. Fj is 0.2.
Rj	3.91E+07	cc/sec	The maximum exhaust flow rate (Rj) is 3.91E+07 cc/sec (83,000 cfm)
E(Xe-133)	1.81E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from PPM 16.3.1 Rev 7
Bkg	46	cpm	Background (NE-02-10-01 CMR 0000011647)
Upper Level	2.90E+03	Step 4.13 value = 3626	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

INPUT VALUES

Mechanical Vacuum Pump (AR-RIS-21)			
Gas Mixture			Setpoint Calculation 98-01 of 3/3/98 & B&R Calculation 5.03.01 of 3/80 by E Stergokes
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	1.13E+06	cc/sec	The maximum exhaust flow rate (Rj) is 1.13E+06 cc/sec (2400 cfm)
E(Xe-133)	7.14E+01	mR/hr/uCi/cc	Xenon-133 efficiency mR/hr/uCi/cc from Setpoint Calculation 98-01. Isoshield calculation of initial mixture=0.34 mr/hr. (0.34/4.56E-3)=71.3686 mR/hr/uCi/cc
Bkg	0.1	cpm	Background
Upper Level	7.5	Step 4.13 value = 7.6	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

Reactor Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
Kr83m	6.47E-05	2.25E-03	2.88E-02
Kr85m	1.25E-04	2.25E-03	5.57E-02
Kr87	3.35E-07	2.25E-03	1.49E-04
Kr88	3.35E-04	2.25E-03	1.49E-01
Kr89	4.02E-04	2.25E-03	1.79E-01
Xe131m	3.35E-07	2.25E-03	1.49E-04
Xe133m	6.25E-06	2.25E-03	2.78E-03
Xe133	1.83E-04	2.25E-03	8.15E-02
Xe135m	1.54E-04	2.25E-03	6.86E-02
Xe135	4.91E-04	2.25E-03	2.19E-01
Xe137	1.50E-05	2.25E-03	6.66E-03
Xe138	4.69E-04	2.25E-03	2.09E-01
Sum	2.25E-03		1.00E+00

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	2.88E-02	0.0756	2.18E-03
Kr85m	5.57E-02	1170	6.51E+01
Kr87	1.49E-04	5920	8.83E-01
Kr88	1.49E-01	14700	2.19E+03
Kr89	1.79E-01	16600	2.97E+03
Xe131m	1.49E-04	91.5	1.36E-02
Xe133m	2.78E-03	251	6.99E-01
Xe133	8.15E-02	294	2.40E+01
Xe135m	6.86E-02	3120	2.14E+02
Xe135	2.19E-01	1810	3.96E+02
Xe137	6.66E-03	1420	9.46E+00
Xe138	2.09E-01	8830	1.84E+03
	Sum of πij*Ki=		7.72E+03

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released (unitless)

Whole Body Dose Rate

QTj Maximum Release Rate based on Whole Body Dose (uCi/sec)
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit (mrem/yr)
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = (Fj*500)/(X/Qi*Sum πij*Ki)

QTj =

4.00E-01	5.00E+02
8.20E-07	7.72E+03

= 3.16E+04 uCi/sec

Reactor Building Intermediate Range Monitor Setpoint Calculation

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	2.88E-02	0	0.00E+00
Kr85m	5.57E-02	2.81E+03	1.56E+02
Kr87	1.49E-04	1.65E+04	2.46E+00
Kr88	1.49E-01	1.91E+04	2.85E+03
Kr89	1.79E-01	2.91E+04	5.21E+03
Xe131m	1.49E-04	6.48E+02	9.66E-02
Xe133m	2.78E-03	1.35E+03	3.76E+00
Xe133	8.15E-02	6.94E+02	5.66E+01
Xe135m	6.86E-02	4.41E+03	3.03E+02
Xe135	2.19E-01	2.30E+03	5.03E+02
Xe137	6.66E-03	1.39E+04	9.26E+01
Xe138	2.09E-01	1.43E+04	2.99E+03
	Sum(πij)(Li+1.1Mi) =		1.22E+04

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	2.88E-02	7.06E-04	2.03E-05
Kr85m	5.57E-02	7.06E-04	3.93E-05
Kr87	1.49E-04	7.06E-04	1.05E-07
Kr88	1.49E-01	7.06E-04	1.05E-04
Kr89	1.79E-01	7.06E-04	1.26E-04
Xe131m	1.49E-04	7.06E-04	1.05E-07
Xe133m	2.78E-03	7.06E-04	1.96E-06
Xe133	8.15E-02	7.06E-04	5.75E-05
Xe135m	6.86E-02	7.06E-04	4.84E-05
Xe135	2.19E-01	7.06E-04	1.54E-04
Xe137	6.66E-03	7.06E-04	4.70E-06
Xe138	2.09E-01	7.06E-04	1.47E-04

Skin Dose Calculation
3000 Dose Rate Limit

QTj = 4.00E-01 | 3.00E+03 / 8.20E-07 | 1.22E+04 = 1.20E+05 uCi/sec

Lowest Dose Rate Value
QTj = 3.16E+04 uCi/sec

Step 4.7
Maximum Allowable Value
CTj = (QTj/Rj)
Rj = Release Rate
CTj = maximum allowed concentration
CTj = 3.16E+04 / 4.48E+07 = 7.06E-04 uCi/cc

Reactor Building Intermediate Range Monitor Setpoint Calculation

For Gamma Detectors (REA) the relative efficiencies is calculated in the following table.

Table 4.9a
Relative Efficiency

Nuclide	Gamma Abundance	Relative Abundance	E(Xe-133)	Eij
Kr83m	0.09	0.245	5.51E+05	1.35E+05
Kr85m	0.74	2.016	5.51E+05	1.11E+06
Kr87	0.837	2.281	5.51E+05	1.26E+06
Kr88	1.372	3.738	5.51E+05	2.06E+06
Kr89	1.6	4.36	5.51E+05	2.40E+06
Xe131m	0.0196	0.053	5.51E+05	2.92E+04
Xe133m	0.14	0.381	5.51E+05	2.10E+05
Xe133	0.367	1	5.51E+05	5.51E+05
Xe135m	0.81	2.207	5.51E+05	1.21E+06
Xe135	0.939	2.559	5.51E+05	1.41E+06
Xe137	0.33	0.899	5.51E+05	4.95E+05
Xe138	1.222	3.33	5.51E+05	1.83E+06

Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	2.03E-05	1.35E+05	2.74E+00
Kr85m	3.93E-05	1.11E+06	4.36E+01
Kr87	1.05E-07	1.26E+06	1.32E-01
Kr88	1.05E-04	2.06E+06	2.17E+02
Kr89	1.26E-04	2.40E+06	3.03E+02
Xe131m	1.05E-07	2.92E+04	3.07E-03
Xe133m	1.96E-06	2.10E+05	4.12E-01
Xe133	5.75E-05	5.51E+05	3.17E+01
Xe135m	4.84E-05	1.21E+06	5.88E+01
Xe135	1.54E-04	1.41E+06	2.17E+02
Xe137	4.70E-06	4.95E+05	2.33E+00
Xe138	1.47E-04	1.83E+06	2.70E+02
		C.Rj =	1.00E+03

C.Rj = **Count rate above background (cps)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Reactor Building

Step 4.13
Maximum Allowable Setpoint =
Bkg+C.Rj = 1,550

Step 4.14
Upper Level (UL) = 1,000

Note, there is only one alarm on this system
Step 4.16.2
Alarm

UL	1,000	
Nominal	910	91% of UL
Lower Level	820	82% of UL

Turbine Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
Kr83m	0.00E+00	1.15E+02	0.00
Kr85m	2.25E+00	1.15E+02	0.02
Kr87	6.34E+00	1.15E+02	0.05
Kr88	7.61E+00	1.15E+02	0.07
Kr89	0.00E+00	1.15E+02	0.00
Xe131m	0.00E+00	1.15E+02	0.00
Xe133m	0.00E+00	1.15E+02	0.00
Xe133	9.19E+00	1.15E+02	0.08
Xe135m	2.15E+01	1.15E+02	0.19
Xe135	2.09E+01	1.15E+02	0.18
Xe137	0.00E+00	1.15E+02	0.00
Xe138	4.75E+01	1.15E+02	0 41
Sum	1.15E+02		1.00

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	0.00	0.0756	0.00E+00
Kr85m	0.02	1170	2.28E+01
Kr87	0.05	5920	3.25E+02
Kr88	0.07	14700	9.69E+02
Turbine Bu	0.00	16600	0.00E+00
Xe131m	0.00	91.5	0.00E+00
Xe133m	0.00	251	0.00E+00
Xe133	0.08	294	2.34E+01
Xe135m	0.19	3120	5.83E+02
Xe135	0.18	1810	3.28E+02
Xe137	0.00	1420	0.00E+00
Xe138	0.41	8830	3.64E+03
		Sum of πij*Ki=	5.89E+03

Whole Body Dose Rate = (Fj*500)/(X/Qi*Sum(πij*Ki)
QTj Maximum Release Rate based on Whole Body Dose
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = | 4.00E-01 | 5.00E+02 | = | 2.26E+03 | uCi/sec
| 1.50E-05 | 5.89E+03 |

Turbine Building Monitor Setpoint Calculation

Table 4.5a Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	0.00	0	0.00E+00
Kr85m	0.02	2.81E+03	5.48E+01
Kr87	0.05	1.65E+04	9.06E+02
Kr88	0.07	1.91E+04	1.26E+03
Kr89	0.00	2.91E+04	0.00E+00
Xe131m	0.00	6.48E+02	0.00E+00
Xe133m	0.00	1.35E+03	0.00E+00
Xe133	0.08	6.94E+02	5.53E+01
Xe135m	0.19	4.41E+03	8.24E+02
Xe135	0.18	2.30E+03	4.17E+02
Xe137	0.00	1.39E+04	0.00E+00
Xe138	0.41	1.43E+04	5.89E+03
	Sum(πij)(Li+1.1Mi) =		9.41E+03

Skin Dose Rate = (Fj*3000)/(X/Qi*Sum(πij*Ki)

3000 Dose Rate Limit

QTj = 4.00E-01 | 3.00E+03 / 1.50E-05 | 9.41E+03 = 8.50E+03 uCi/sec

Release rate for lowest dose rate value (Whole body or Skin)

QTj = 2.26E+03 uCi/sec

Table 4.8a Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	0.00	1.26E-05	0.00E+00
Kr85m	0.02	1.26E-05	2.47E-07
Kr87	0.05	1.26E-05	6.95E-07
Kr88	0.07	1.26E-05	8.34E-07
Kr89	0.00	1.26E-05	0.00E+00
Xe131m	0.00	1.26E-05	0.00E+00
Xe133m	0.00	1.26E-05	0.00E+00
Xe133	0.08	1.26E-05	1.01E-06
Xe135m	0.19	1.26E-05	2.36E-06
Xe135	0.18	1.26E-05	2.29E-06
Xe137	0.00	1.26E-05	0.00E+00
Xe138	0.41	1.26E-05	5.21E-06

Step 4.7

Maximum Allowable Concentration (CTj)

CTj = (QTj/Rj)

QTj=maximum acceptable release rate for all noble gases (uCi/sec)

Rj = Release Rate (cc/sec)

CTj = 2.26E+03 / 1.79E+08 = 1.26E-05 uCi/cc

For the TEA Beta detector the relative efficiency is calculated in the following table.

Table 4.10a
Relative Efficiency

Nuclide	Relative Efficiency(1)	E(Xe-133)	Eij
Kr83m	0.050	2.15E+07	n/a
Kr85m	1.622	2.15E+07	3.49E+07
Kr87	2.205	2.15E+07	4.74E+07
Kr88	1.544	2.15E+07	3.32E+07
Kr89	2.255	2.15E+07	n/a
Xe131m	1.119	2.15E+07	n/a
Xe133m	1.444	2.15E+07	n/a
Xe133	1.000	2.15E+07	2.15E+07
Xe135m	0.387	2.15E+07	8.32E+06
Xe135	1.949	2.15E+07	4.19E+07
Xe137	2.315	2.15E+07	n/a
Xe138	1.999	2.15E+07	4.30E+07

Eij=Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)

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Table 4.11a
Count Rate Contributions

Nuclide	Cij	Eij	C.Rij
Kr83m	0.00E+00	n/a	0.00E+00
Kr85m	2.47E-07	3.49E+07	8.60E+00
Kr87	6.95E-07	4.74E+07	3.29E+01
Kr88	8.34E-07	3.32E+07	2.77E+01
Kr89	0.00E+00	n/a	0.00E+00
Xe131m	0.00E+00	n/a	0.00E+00
Xe133m	0.00E+00	n/a	0.00E+00
Xe133	1.01E-06	2.15E+07	2 17E+01
Xe135m	2.36E-06	8.32E+06	1.96E+01
Xe135	2.29E-06	4.19E+07	9.61E+01
Xe137	0 00E+00	n/a	0.00E+00
Xe138	5.21E-06	4.30E+07	2.24E+02
		C.Rj =	4 31E+02

cpm 2.00E-05 **µCi/cc**

C.Rj = **Count rate above background (cpm)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)

Turbine Building Monitor Setpoint Calculation

	Turbine Building			3.97E+03	µCi/s
Step 4.13	Maximum Allowable Setpoint=Bkg+C.Rj=	46+431	=	477	cpm
				2.22E-05	µCi/cc

Step 4.14 Upper Level = 381 Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

Activity Signals Ch 1 & Ch 3 in µCi/cc			**Effluent Activity Signal Ch 4 µCi/s**		
High Alarm			**High Alarm**		
UL	1.77E-05		UL	3.17E+03	
Nominal	1.61E-05	91% of UL	Nominal	2.89E+03	91% of UL
Lower Level	1.45E-05	82% of UL	Lower Level	2.60E+03	82% of UL
Bkg	2.14E-06		Bkg	3.83E+02	
Alert Alarm	9.97E-06	Bkg*4.66	**Alert Alarm**	1.78E+03	Bkg*4.66
Alert Alarm	9.98E-06	Rounded up	Alert Alarm	1.79E+03	Rounded up
UL	1.20E-05	120% of Nominal	UL	2.15E+03	120% of Nominal
Nominal	9.98E-06	Alarm	Nominal	1.79E+03	Alarm
LL	7.98E-06	80% of Nominal	LL	1.43E+03	80% of Nominal

Radwaste Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
Kr83m	0.00E+00	1.74E+00	0.00E+00
Kr85m	0.00E+00	1.74E+00	0.00E+00
Kr87	0.00E+00	1.74E+00	0.00E+00
Kr88	0.00E+00	1.74E+00	0.00E+00
Kr89	0.00E+00	1.74E+00	0.00E+00
Xe131m	0.00E+00	1.74E+00	0.00E+00
Xe133m	0.00E+00	1.74E+00	0.00E+00
Xe133	3.17E-01	1.74E+00	1.82E-01
Xe135m	0.00E+00	1.74E+00	0.00E+00
Xe135	1.43E+00	1.74E+00	8.18E-01
Xe137	0.00E+00	1.74E+00	0.00E+00
Xe138	0.00E+00	1.74E+00	0.00E+00
Sum	1.74E+00		

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	0.00E+00	0.0756	0.00E+00
Kr85m	0.00E+00	1170	0.00E+00
Kr87	0.00E+00	5920	0.00E+00
Kr88	0.00E+00	14700	0.00E+00
Kr89	0.00E+00	16600	0.00E+00
Xe131m	0.00E+00	91.5	0.00E+00
Xe133m	0.00E+00	251	0.00E+00
Xe133	1.82E-01	294	5.35E+01
Xe135m	0.00E+00	3120	0.00E+00
Xe135	8.18E-01	1810	1.48E+03
Xe137	0.00E+00	1420	0.00E+00
Xe138	0.00E+00	8830	0.00E+00
	Sum of πij*Ki=		1.53E+03

Whole Body Dose Rate = (Fj*500)/(X/Qi*Sum(πij*Ki)
QTj Maximum Release Rate based on Whole Body Dose
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = | 2.00E-01 | 5.00E+02 | = | 4.34E+03 | uCi/sec
| 1.50E-05 | 1.53E+03 |

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	0.00E+00	0	0.00E+00
Kr85m	0.00E+00	2.81E+03	0.00E+00
Kr87	0.00E+00	1.65E+04	0.00E+00
Kr88	0.00E+00	1.91E+04	0.00E+00
Kr89	0.00E+00	2.91E+04	0.00E+00
Xe131m	0.00E+00	6.48E+02	0.00E+00
Xe133m	0.00E+00	1.35E+03	0.00E+00
Xe133	1.82E-01	6.94E+02	1.26E+02
Xe135m	0.00E+00	4.41E+03	0.00E+00
Xe135	8.18E-01	2.30E+03	1.88E+03
Xe137	0.00E+00	1.39E+04	0.00E+00
Xe138	0.00E+00	1.43E+04	0.00E+00
	Sum(πij)(Li+1.1Mi) =		2.01E+03

Skin Dose Rate = (Fj*3000)/(X/Qi*Sum(πij*Ki)
3000 Dose Rate Limit

QTj = 2.00E-01 / 1.50E-05 × 3.00E+03 / 2.01E+03 = 1.99E+04 uCi/sec

Lowest Dose Rate Value
4.34E+03 uCi/sec

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	0.00E+00	1.11E-04	0.00E+00
Kr85m	0.00E+00	1.11E-04	0.00E+00
Kr87	0.00E+00	1.11E-04	0.00E+00
Kr88	0.00E+00	1.11E-04	0.00E+00
Kr89	0.00E+00	1.11E-04	0.00E+00
Xe131m	0.00E+00	1.11E-04	0.00E+00
Xe133m	0.00E+00	1.11E-04	0.00E+00
Xe133	1.82E-01	1 11E-04	2.02E-05
Xe135m	0.00E+00	1.11E-04	0 00E+00
Xe135	8.18E-01	1 11E-04	9 09E-05
Xe137	0.00E+00	1.11E-04	0 00E+00
Xe138	0.00E+00	1.11E-04	0.00E+00

Step 4.7
Maximum Allowable Value
CTj = (QTj/Rj)
Rj = Release Rate
CTj = maximum allowed concentration
CTj = 4.34E+03 / 3.91E+07 = 1.11E-04

For Beta detectors (WEA) the relative efficiency is calculated in the following table.

Table 4.10a
Relative Efficiency

Nuclide	Relative Efficiency(1)	E(Xe-133)	Eij
Kr83m	0.050	1.81E+07	n/a
Kr85m	1.626	1.81E+07	n/a
Kr87	2.208	1.81E+07	n/a
Kr88	1.549	1.81E+07	n/a
Kr89	2.259	1.81E+07	n/a
Xe131m	1.122	1.81E+07	n/a
Xe133m	1.449	1.81E+07	n/a
Xe133	1.000	1.81E+07	1.81E+07
Xe135m	0.387	1.81E+07	n/a
Xe135	1.953	1.81E+07	3.54E+07
Xe137	2.318	1.81E+07	n/a
Xe138	2.005	1.81E+07	n/a

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Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	0.00E+00	n/a	0.00E+00
Kr85m	0.00E+00	n/a	0.00E+00
Kr87	0.00E+00	n/a	0.00E+00
Kr88	0.00E+00	n/a	0.00E+00
Kr89	0.00E+00	n/a	0.00E+00
Xe131m	0.00E+00	n/a	0.00E+00
Xe133m	0.00E+00	n/a	0.00E+00
Xe133	2.02E-05	1.81E+07	3.66E+02
Xe135m	0.00E+00	n/a	0.00E+00
Xe135	9.09E-05	3.54E+07	3.21E+03
Xe137	0.00E+00	n/a	0.00E+00
Xe138	0.00E+00	n/a	0.00E+00
	C.Rj =		3.58E+03 cpm

C.Rj = **Count rate above background (cpm)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)

1.98E-04 **µCi/cc**

Radioactive Waste Building Monitor Setpoint Calculation

	Radwaste Building			7.83E+03	µCi/s
Step 4.13	Maximum Allowable Setpoint	=	46+3580	= 3626	cpm
				2.00E-04	µCi/cc

Step 4.14 Upper Level = 2901 Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

Activity Signals Ch 1 & Ch 3 in µCi/cc			Effluent Activity Signal Ch 4 µCi/s		
High Alarm			High Alarm		
UL	1.60E-04	80% of Max	UL	6.27E+03	
Nominal	1.46E-04	91% of UL	Nominal	5.70E+03	91% of UL
Lower Level	1.31E-04	82% of UL	Lower Level	5.14E+03	82% of UL
Bkg	2.54E-06		Bkg	9.94E+01	
Alert Alarm	1.18E-05	Bkg*4.66	High Alarm	4.63E+02	Bkg*4.66
Alert Alarm	1.19E-05	Rounded up	High Alarm	4.64E+02	Rounded up
UL	1.43E-05	120% of Nominal	UL	5.57E+02	120% of Nominal
Nominal	1.19E-05	Alarm	Nominal	4.64E+02	Alarm
LL	9.52E-06	80% of Nominal	LL	3.71E+02	80% of Nominal

This spreadsheet was derived from PPM 16.14.1 Rev 2 (ODCM dispersion value changes) and E/I-02-94-1312 loop uncertainties/instrument drift

Reactor Building Intermediate Range Monitor PRM-RE-1B			
Gas Mixture			See ODCM Table 3-15 and FSAR Table 11.3-1
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	1		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	4.48E+07	cc/sec	The maximum exhaust flow rate (Rj) is 4.48E+07 cc/sec (95,000 cfm).
E(Xe-133)	5.51E+05	ccps/uCi/cc	Xenon-133 efficiency (Gas Calibration factor from Chemistry Calculation 96-001, Attachment 3 Page 5)
Bkg	5.50E+02	cps	Background (NE-02-10-01 CMR 0000010357)
Upper Level	1.00E+03	Step 4.13 value = 3550	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13

Turbine Building Low Range Monitor (TEA-RE-13)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Turbine Building release pathway from ODCM Table 3-3.
Fj	1		Forty percent (40%) of the site boundary dose rate limit is allocated to the Turbine building. Fj is 0.4.
Rj	1.79E+08	cc/sec	The maximum exhaust flow rate (Rj) is 1.79E+08 cc/sec (380,000 cfm).
E(Xe-133)	2.15E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from NE-02-08-09
Bkg	46	cpm	Background (NE-02-10-01 CMR 0000011647)
Upper Level	3.81E+02	Step 4.13 value = 1122	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

Radwaste Building Low Range Monitor (WEA-RE-14)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Radwaste Building release pathway from ODCM Table 3-3.
Fj	1		Twenty percent (20%) of the site boundary dose rate limit is allocated to the Radwaste building. Fj is 0.2.
Rj	3.91E+07	cc/sec	The maximum exhaust flow rate (Rj) is 3.91E+07 cc/sec (83,000 cfm)
E(Xe-133)	1.81E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from PPM 16.3.1 Rev 7
Bkg	46	cpm	Background (NE-02-10-01 CMR 0000011647)
Upper Level	2.90E+03	Step 4.13 value = 17948	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

INPUT VALUES

Mechanical Vacuum Pump (AR-RIS-21)			
Gas Mixture			Setpoint Calculation 98-01 of 3/3/98 & B&R Calculation 5.03.01 of 3/80 by E Stergokes
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	1.13E+06	cc/sec	The maximum exhaust flow rate (Rj) is 1.13E+06 cc/sec (2400 cfm)
E(Xe-133)	7.14E+01	mR/hr/uCi/cc	Xenon-133 efficiency mR/hr/uCi/cc from Setpoint Calculation 98-01. Isoshield calculation of initial mixture=0.34 mr/hr. (0.34/4.56E-3)=71.3686 mR/hr/uCi/cc
Bkg	0.1	cpm	Background
Upper Level	7.5	Step 4.13 value = 7.6	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

Reactor Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
1	6.47E-05	2.25E-03	2.88E-02
Kr85m	1.25E-04	2.25E-03	5.57E-02
Kr87	3.35E-07	2.25E-03	1.49E-04
Kr88	3.35E-04	2.25E-03	1.49E-01
Kr89	4.02E-04	2.25E-03	1.79E-01
Xe131m	3.35E-07	2.25E-03	1.49E-04
Xe133m	6.25E-06	2.25E-03	2.78E-03
Xe133	1.83E-04	2.25E-03	8.15E-02
Xe135m	1.54E-04	2.25E-03	6.86E-02
1	4.91E-04	2.25E-03	2.19E-01
Xe137	1.50E-05	2.25E-03	6.66E-03
Xe138	4.69E-04	2.25E-03	2.09E-01
Sum	2.25E-03		1.00E+00

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	2.88E-02	0.0756	2.18E-03
1	5.57E-02	1170	6.51E+01
Kr87	1.49E-04	5920	8.83E-01
Kr88	1.49E-01	14700	2.19E+03
Kr89	1.79E-01	16600	2.97E+03
Xe131m	1.49E-04	91.5	1.36E-02
Xe133m	2.78E-03	251	6.99E-01
Xe133	8.15E-02	294	2.40E+01
Xe135m	6.86E-02	3120	2.14E+02
Xe135	2.19E-01	1810	3.96E+02
Xe137	6.66E-03	1420	9.46E+00
Xe138	2.09E-01	8830	1.84E+03
	Sum of πij*Ki=		7.72E+03

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released (unitless)

Whole Body Dose Rate

QTj Maximum Release Rate based on Whole Body Dose (uCi/sec)
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit (mrem/yr)
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = (Fj*500)/(X/Qi*Sum πij*Ki)

QTj =	1.00E+00	5.00E+02	=	7.90E+04 uCi/sec
	8.20E-07	7.72E+03		

Reactor Building Intermediate Range Monitor Setpoint Calculation

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	2.88E-02	0	0.00E+00
Kr85m	5.57E-02	2.81E+03	1.56E+02
Kr87	1.49E-04	1.65E+04	2.46E+00
Kr88	1.49E-01	1.91E+04	2.85E+03
Kr89	1.79E-01	2.91E+04	5.21E+03
Xe131m	1.49E-04	6.48E+02	9.66E-02
Xe133m	2.78E-03	1.35E+03	3.76E+00
Xe133	8.15E-02	6.94E+02	5.66E+01
Xe135m	6.86E-02	4.41E+03	3.03E+02
Xe135	2.19E-01	2.30E+03	5.03E+02
Xe137	6.66E-03	1.39E+04	9.26E+01
Xe138	2.09E-01	1.43E+04	2.99E+03
	Sum(πij)(Li+1.1Mi) =		1.22E+04

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	2.88E-02	1.76E-03	5.09E-05
Kr85m	5.57E-02	1.76E-03	9.82E-05
Kr87	1.49E-04	1.76E-03	2.63E-07
Kr88	1.49E-01	1.76E-03	2.63E-04
Kr89	1.79E-01	1.76E-03	3.16E-04
Xe131m	1.49E-04	1.76E-03	2.63E-07
Xe133m	2.78E-03	1.76E-03	4.91E-06
Xe133	8.15E-02	1.76E-03	1.44E-04
Xe135m	6.86E-02	1.76E-03	1.21E-04
Xe135	2.19E-01	1.76E-03	3.86E-04
Xe137	6.66E-03	1.76E-03	1.17E-05
Xe138	2.09E-01	1.76E-03	3.68E-04

Skin Dose Calculation

3000 Dose Rate Limit

QTj = | 1.00E+00 | 3.00E+03 | = | 3.01E+05 | uCi/sec
| 8.20E-07 | 1.22E+04 |

Lowest Dose Rate Value

QTj = 7.90E+04 uCi/sec

Step 4.7

Maximum Allowable Value

CTj = (QTj/Rj)

Rj = Release Rate

CTj = maximum allowed concentration

CTj = 7.90E+04 / 4.48E+07 = 1.76E-03 uCi/cc

Reactor Building Intermediate Range Monitor Setpoint Calculation

For Gamma Detectors (REA) the relative efficiencies is calculated in the following table.

Table 4.9a
Relative Efficiency

Nuclide	Gamma Abundance	Relative Abundance	E(Xe-133)	Eij
Kr83m	0.09	0.245	5.51E+05	1.35E+05
Kr85m	0.74	2.016	5.51E+05	1.11E+06
Kr87	0.837	2.281	5.51E+05	1.26E+06
Kr88	1.372	3.738	5.51E+05	2.06E+06
Kr89	1.6	4.36	5.51E+05	2.40E+06
Xe131m	0.0196	0.053	5.51E+05	2.92E+04
Xe133m	0.14	0.381	5.51E+05	2.10E+05
Xe133	0.367	1	5.51E+05	5.51E+05
Xe135m	0.81	2.207	5.51E+05	1.21E+06
Xe135	0.939	2.559	5.51E+05	1.41E+06
Xe137	0.33	0.899	5.51E+05	4.95E+05
Xe138	1.222	3.33	5.51E+05	1.83E+06

Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	5.09E-05	1.35E+05	6.86E+00
Kr85m	9.82E-05	1.11E+06	1.09E+02
Kr87	2.63E-07	1.26E+06	3.30E-01
Kr88	2.63E-04	2.06E+06	5.41E+02
Kr89	3.16E-04	2.40E+06	7.58E+02
Xe131m	2.63E-07	2.92E+04	7.67E-03
Xe133m	4.91E-06	2.10E+05	1.03E+00
Xe133	1.44E-04	5.51E+05	7.92E+01
Xe135m	1.21E-04	1.21E+06	1.47E+02
Xe135	3.86E-04	1.41E+06	5.43E+02
Xe137	1.17E-05	4.95E+05	5.81E+00
Xe138	3.68E-04	1.83E+06	6.75E+02
		C.Rj =	3.00E+03

C.Rj = **Count rate above background (cps)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Reactor Building

Step 4.13
Maximum Allowable Setpoint =
Bkg+C.Rj = 3,550

Step 4 14
Upper Level (UL) = 1,000

Note, there is only one alarm on this system
Step 4.16 2
Alarm

UL	1,000	
Nominal	910	91% of UL
Lower Level	820	82% of UL

Turbine Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
1	0.00E+00	1.15E+02	0.00
Kr85m	2.25E+00	1.15E+02	0.02
Kr87	6.34E+00	1.15E+02	0.05
Kr88	7.61E+00	1.15E+02	0.07
Kr89	0.00E+00	1.15E+02	0.00
Xe131m	0.00E+00	1.15E+02	0.00
Xe133m	0.00E+00	1.15E+02	0.00
Xe133	9.19E+00	1.15E+02	0.08
Xe135m	2.15E+01	1.15E+02	0.19
1	2.09E+01	1.15E+02	0.18
Xe137	0.00E+00	1.15E+02	0.00
Xe138	4.75E+01	1.15E+02	0.41
Sum	1.15E+02		1.00

Mij Measured or estimated concentration of nuclide i in release path j (μCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (μCi/cc)
πij Fraction of each nuclide released

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	0.00	0.0756	0.00E+00
1	0.02	1170	2.28E+01
Kr87	0.05	5920	3.25E+02
Kr88	0.07	14700	9.69E+02
Turbine Bu	0.00	16600	0.00E+00
Xe131m	0.00	91.5	0.00E+00
Xe133m	0.00	251	0.00E+00
Xe133	0.08	294	2.34E+01
Xe135m	0.19	3120	5.83E+02
Xe135	0.18	1810	3.28E+02
Xe137	0.00	1420	0.00E+00
Xe138	0.41	8830	3.64E+03
	Sum of πij*Ki=		5.89E+03

Whole Body Dose Rate = (Fj*500)/(X/Qi*Sum(πij*Ki)
QTj Maximum Release Rate based on Whole Body Dose
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per μCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = | 1.00E+00 | 5.00E+02 | / | 1.50E-05 | 5.89E+03 | = 5.66E+03 uCi/sec

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	0.00	0	0.00E+00
Kr85m	0.02	2.81E+03	5.48E+01
Kr87	0.05	1.65E+04	9.06E+02
Kr88	0.07	1.91E+04	1.26E+03
Kr89	0.00	2.91E+04	0.00E+00
Xe131m	0.00	6.48E+02	0.00E+00
Xe133m	0.00	1.35E+03	0.00E+00
Xe133	0.08	6.94E+02	5.53E+01
Xe135m	0.19	4.41E+03	8.24E+02
Xe135	0.18	2.30E+03	4.17E+02
Xe137	0.00	1.39E+04	0.00E+00
Xe138	0.41	1.43E+04	5.89E+03
	Sum(πij)(Li+1.1Mi) =		9.41E+03

Skin Dose Rate = (Fj*3000)/(X/Qi*Sum(πij*Ki)

3000 Dose Rate Limit

QTj = 1.00E+00 / 1.50E-05 × 3.00E+03 / 9.41E+03 = 2.13E+04 uCi/sec

Release rate for lowest dose rate value (Whole body or Skin)

QTj = 5.66E+03 uCi/sec

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	0.00	3.16E-05	0.00E+00
Kr85m	0.02	3.16E-05	6.17E-07
Kr87	0.05	3.16E-05	1.74E-06
Kr88	0.07	3.16E-05	2.08E-06
Kr89	0.00	3.16E-05	0.00E+00
Xe131m	0.00	3.16E-05	0.00E+00
Xe133m	0.00	3.16E-05	0.00E+00
Xe133	0.08	3.16E-05	2.52E-06
Xe135m	0.19	3.16E-05	5.91E-06
Xe135	0.18	3.16E-05	5.73E-06
Xe137	0.00	3.16E-05	0.00E+00
Xe138	0.41	3.16E-05	1.30E-05

Step 4.7

Maximum Allowable Concentration (CTj)

CTj = (QTj/Rj)

QTj=maximum acceptable release rate for all noble gases (uCi/sec)

Rj = Release Rate (cc/sec)

CTj = 5.66E+03 / 1.79E+08 = 3.16E-05 uCi/cc

For the TEA Beta detector the relative efficiency is calculated in the following table.

Table 4.10a			
Relative Efficiency			
Nuclide	Relative Efficiency(1)	E(Xe-133)	Eij
Kr83m	0.050	2.15E+07	n/a
Kr85m	1.622	2.15E+07	3.49E+07
Kr87	2.205	2.15E+07	4.74E+07
Kr88	1.544	2.15E+07	3.32E+07
Kr89	2.255	2.15E+07	n/a
Xe131m	1.119	2.15E+07	n/a
Xe133m	1.444	2.15E+07	n/a
Xe133	1.000	2.15E+07	2.15E+07
Xe135m	0.387	2.15E+07	8.32E+06
Xe135	1.949	2.15E+07	4.19E+07
Xe137	2.315	2.15E+07	n/a
Xe138	1.999	2.15E+07	4.30E+07

Eij=Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)

(1) NE-02-08-09

Table 4.11a					
Count Rate Contributions					
Nuclide	Cij	Eij	C.Rij		
Kr83m	0.00E+00	n/a	0.00E+00		
Kr85m	6.17E-07	3.49E+07	2 15E+01	C Rj	= **Count rate above background (cpm)**
Kr87	1.74E-06	4.74E+07	8.23E+01	Cij	= Maximum acceptable concentration of noble gas i (µCi/cc)
Kr88	2.08E-06	3.32E+07	6.92E+01	Eij	= Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)
Kr89	0.00E+00	n/a	0.00E+00		
Xe131m	0.00E+00	n/a	0.00E+00		
Xe133m	0.00E+00	n/a	0.00E+00		
Xe133	2.52E-06	2.15E+07	5.42E+01		
Xe135m	5.91E-06	8.32E+06	4.91E+01		
Xe135	5.73E-06	4.19E+07	2.40E+02		
Xe137	0 00E+00	n/a	0.00E+00		
Xe138	1 30E-05	4.30E+07	5 60E+02		
		C.Rj =	1 08E+03	cpm	5.01E-05 **µCi/cc**

Turbine Building Monitor Setpoint Calculation

	Turbine Building			9.35E+03	µCi/s
Step 4.13	Maximum Allowable Setpoint=Bkg+C.Rj=	46+1076	=	1122	cpm
				5.22E-05	µCi/cc

Step 4.14 Upper Level = 381 Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

Activity Signals Ch 1 & Ch 3 in µCi/cc			Effluent Activity Signal Ch 4 µCi/s		
High Alarm			**High Alarm**		
UL	1.77E-05		UL	3.17E+03	
Nominal	1.61E-05	91% of UL	Nominal	2.89E+03	91% of UL
Lower Level	1.45E-05	82% of UL	Lower Level	2.60E+03	82% of UL
Bkg	2.14E-06		Bkg	3.83E+02	
Alert Alarm	9.97E-06	Bkg*4.66	**Alert Alarm**	1.78E+03	Bkg*4.66
Alert Alarm	9.98E-06	Rounded up	Alert Alarm	1.79E+03	Rounded up
UL	1.20E-05	120% of Nominal	UL	2.15E+03	120% of Nominal
Nominal	9.98E-06	Alarm	Nominal	1.79E+03	Alarm
LL	7.98E-06	80% of Nominal	LL	1.43E+03	80% of Nominal

Radwaste Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
1	0.00E+00	1.74E+00	0.00E+00
Kr85m	0.00E+00	1.74E+00	0.00E+00
Kr87	0.00E+00	1.74E+00	0.00E+00
Kr88	0.00E+00	1.74E+00	0.00E+00
Kr89	0.00E+00	1.74E+00	0.00E+00
Xe131m	0.00E+00	1.74E+00	0.00E+00
Xe133m	0.00E+00	1.74E+00	0.00E+00
Xe133	3.17E-01	1.74E+00	1.82E-01
Xe135m	0.00E+00	1.74E+00	0.00E+00
1	1.43E+00	1.74E+00	8.18E-01
Xe137	0.00E+00	1.74E+00	0.00E+00
Xe138	0.00E+00	1.74E+00	0.00E+00
Sum	1.74E+00		

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	0.00E+00	0.0756	0.00E+00
1	0.00E+00	1170	0.00E+00
Kr87	0.00E+00	5920	0.00E+00
Kr88	0.00E+00	14700	0.00E+00
Kr89	0.00E+00	16600	0.00E+00
Xe131m	0.00E+00	91.5	0.00E+00
Xe133m	0.00E+00	251	0.00E+00
Xe133	1.82E-01	294	5.35E+01
Xe135m	0.00E+00	3120	0.00E+00
Xe135	8.18E-01	1810	1.48E+03
Xe137	0.00E+00	1420	0.00E+00
Xe138	0.00E+00	8830	0.00E+00
	Sum of πij*Ki=		1.53E+03

Whole Body Dose Rate = (Fj*500)/(X/Qi*Sum(πij*Ki)
QTj Maximum Release Rate based on Whole Body Dose
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = | 1.00E+00 | 5.00E+02 | / | 1.50E-05 | 1.53E+03 | = 2.17E+04 uCi/sec

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	0.00E+00	0	0.00E+00
Kr85m	0.00E+00	2.81E+03	0.00E+00
Kr87	0.00E+00	1.65E+04	0.00E+00
Kr88	0.00E+00	1.91E+04	0.00E+00
Kr89	0.00E+00	2.91E+04	0.00E+00
Xe131m	0.00E+00	6.48E+02	0.00E+00
Xe133m	0.00E+00	1.35E+03	0.00E+00
Xe133	1.82E-01	6.94E+02	1.26E+02
Xe135m	0.00E+00	4.41E+03	0.00E+00
Xe135	8.18E-01	2.30E+03	1.88E+03
Xe137	0.00E+00	1.39E+04	0.00E+00
Xe138	0.00E+00	1.43E+04	0.00E+00
	Sum(πij)(Li+1.1Mi) =		2.01E+03

Skin Dose Rate = (Fj*3000)/(X/Qi*Sum(πij*Ki)
3000 Dose Rate Limit

QTj = 1.00E+00 / 1.50E-05 = 3.00E+03 / 2.01E+03 = 9.96E+04 uCi/sec

Lowest Dose Rate Value
2.17E+04 uCi/sec

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	0.00E+00	5.56E-04	0.00E+00
Kr85m	0.00E+00	5.56E-04	0.00E+00
Kr87	0.00E+00	5.56E-04	0.00E+00
Kr88	0.00E+00	5.56E-04	0.00E+00
Kr89	0.00E+00	5.56E-04	0.00E+00
Xe131m	0.00E+00	5.56E-04	0.00E+00
Xe133m	0.00E+00	5.56E-04	0.00E+00
Xe133	1.82E-01	5.56E-04	1.01E-04
Xe135m	0.00E+00	5.56E-04	0.00E+00
Xe135	8.18E-01	5.56E-04	4.55E-04
Xe137	0.00E+00	5.56E-04	0.00E+00
Xe138	0.00E+00	5.56E-04	0.00E+00

Step 4.7
Maximum Allowable Value
CTj = (QTj/Rj)
Rj = Release Rate
CTj = maximum allowed concentration
CTj = 2.17E+04 / 3.91E+07 = 5.56E-04

For Beta detectors (WEA) the relative efficiency is calculated in the following table.

Table 4.10a
Relative Efficiency

Nuclide	Relative Efficiency(1)	E(Xe-133)	Eij
Kr83m	0.050	1.81E+07	n/a
Kr85m	1.626	1.81E+07	n/a
Kr87	2.208	1.81E+07	n/a
Kr88	1.549	1.81E+07	n/a
Kr89	2.259	1.81E+07	n/a
Xe131m	1.122	1.81E+07	n/a
Xe133m	1.449	1.81E+07	n/a
Xe133	1.000	1.81E+07	1.81E+07
Xe135m	0.387	1.81E+07	n/a
Xe135	1.953	1.81E+07	3.54E+07
Xe137	2.318	1.81E+07	n/a
Xe138	2.005	1.81E+07	n/a

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Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	0.00E+00	n/a	0.00E+00
Kr85m	0.00E+00	n/a	0.00E+00
Kr87	0.00E+00	n/a	0.00E+00
Kr88	0.00E+00	n/a	0.00E+00
Kr89	0.00E+00	n/a	0.00E+00
Xe131m	0.00E+00	n/a	0.00E+00
Xe133m	0.00E+00	n/a	0.00E+00
Xe133	1.01E-04	1.81E+07	1.83E+03
Xe135m	0.00E+00	n/a	0.00E+00
Xe135	4.55E-04	3.54E+07	1.61E+04
Xe137	0.00E+00	n/a	0.00E+00
Xe138	0.00E+00	n/a	0.00E+00
		C.Rj =	1.79E+04

C.Rj = **Count rate above background (cpm)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)

cpm 9.89E-04 **µCi/cc**

Radioactive Waste Building Monitor Setpoint Calculation

	Radwaste Building				3.88E+04	µCi/s
Step 4.13	Maximum Allowable Setpoint	=	46+17902	=	17948	cpm
					9.92E-04	µCi/cc

Step 4.14 Upper Level = 2901 Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

Activity Signals Ch 1 & Ch 3 in µCi/cc			Effluent Activity Signal Ch 4 µCi/s		
High Alarm			High Alarm		
UL	1.60E-04	80% of Max	UL	6.27E+03	
Nominal	1.46E-04	91% of UL	Nominal	5.70E+03	91% of UL
Lower Level	1.31E-04	82% of UL	Lower Level	5.14E+03	82% of UL
Bkg	2.54E-06		Bkg	9.94E+01	
Alert Alarm	1.18E-05	Bkg*4.66	High Alarm	4.63E+02	Bkg*4.66
Alert Alarm	1.19E-05	Rounded up	High Alarm	4.64E+02	Rounded up
UL	1.43E-05	120% of Nominal	UL	5.57E+02	120% of Nominal
Nominal	1.19E-05	Alarm	Nominal	4.64E+02	Alarm
LL	9.52E-06	80% of Nominal	LL	3.71E+02	80% of Nominal

INPUT VALUES

This spreadsheet was derived from PPM 16.14.1 Rev 2 (ODCM dispersion value changes) and E/I-02-94-1312 loop uncertainties/instrument drift

Reactor Building Intermediate Range Monitor PRM-RE-1B			
Gas Mixture			See ODCM Table 3-15 and FSAR Table 11.3-1
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	2		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building. Fj is 0.4
Rj	4.48E+07	cc/sec	The maximum exhaust flow rate (Rj) is 4.48E+07 cc/sec (95,000 cfm).
E(Xe-133)	5.51E+05	ccps/uCi/cc	Xenon-133 efficiency (Gas Calibration factor from Chemistry Calculation 96-001, Attachment 3 Page 5)
Bkg	5.50E+02	cps	Background (NE-02-10-01 CMR 0000010357)
Upper Level	1.00E+03	Step 4.13 value = 6550	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13

Turbine Building Low Range Monitor (TEA-RE-13)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Turbine Building release pathway from ODCM Table 3-3.
Fj	2		Forty percent (40%) of the site boundary dose rate limit is allocated to the Turbine building. Fj is 0.4.
Rj	1.79E+08	cc/sec	The maximum exhaust flow rate (Rj) is 1.79E+08 cc/sec (380,000 cfm).
E(Xe-133)	2.15E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from NE-02-08-09
Bkg	46	cpm	Background (NE-02-10-01 CMR 0000011647)
Upper Level	3.81E+02	Step 4.13 value = 2199	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

Radwaste Building Low Range Monitor (WEA-RE-14)			
Gas Mixture			See FSAR Table 11.3-7
X/Qj	1.50E-05	sec/m3	X/Qj for the Radwaste Building release pathway from ODCM Table 3-3.
Fj	2		Twenty percent (20%) of the site boundary dose rate limit is allocated to the Radwaste building. Fj is 0.2.
Rj	3.91E+07	cc/sec	The maximum exhaust flow rate (Rj) is 3.91E+07 cc/sec (83,000 cfm)
E(Xe-133)	1.81E+07	cpm/uCi/cc	Xenon-133 efficiency cpm/uCi/cc from PPM 16.3.1 Rev 7
Bkg	46	cpm	Background (NE-02-10-01 CMR 0000011647)
Upper Level	2.90E+03	Step 4.13 value = 35850	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

INPUT VALUES

Mechanical Vacuum Pump (AR-RIS-21)			
Gas Mixture			Setpoint Calculation 98-01 of 3/3/98 & B&R Calculation 5.03.01 of 3/80 by E Stergokes
X/Qj	8.20E-07	sec/m3	X/Qj for the Reactor Building release pathway from ODCM Table 3-3.
Fj	0.4		Forty percent (40%) of the site boundary dose rate limit is allocated to the Reactor building, Fj is 0.4
Rj	1.13E+06	cc/sec	The maximum exhaust flow rate (Rj) is 1.13E+06 cc/sec (2400 cfm)
E(Xe-133)	7.14E+01	mR/hr/uCi/cc	Xenon-133 efficiency mR/hr/uCi/cc from Setpoint Calculation 98-01. Isoshield calculation of initial mixture=0.34 mr/hr. (0.34/4.56E-3)=71.3686 mR/hr/uCi/cc
Bkg	0.1	cpm	Background
Upper Level	7.5	Step 4.13 value = 7.6	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to the maximum allowable setpoint value determined in Step 4.13.

Reactor Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
2	6.47E-05	2.25E-03	2.88E-02
Kr85m	1.25E-04	2.25E-03	5.57E-02
Kr87	3.35E-07	2.25E-03	1.49E-04
Kr88	3.35E-04	2.25E-03	1.49E-01
Kr89	4.02E-04	2.25E-03	1.79E-01
Xe131m	3.35E-07	2.25E-03	1.49E-04
Xe133m	6.25E-06	2.25E-03	2.78E-03
Xe133	1.83E-04	2.25E-03	8.15E-02
Xe135m	1.54E-04	2.25E-03	6.86E-02
2	4.91E-04	2.25E-03	2.19E-01
Xe137	1.50E-05	2.25E-03	6.66E-03
Xe138	4.69E-04	2.25E-03	2.09E-01
Sum	2.25E-03		1.00E+00

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	2.88E-02	0.0756	2.18E-03
2	5.57E-02	1170	6.51E+01
Kr87	1.49E-04	5920	8.83E-01
Kr88	1.49E-01	14700	2.19E+03
Kr89	1.79E-01	16600	2.97E+03
Xe131m	1.49E-04	91.5	1.36E-02
Xe133m	2.78E-03	251	6.99E-01
Xe133	8.15E-02	294	2.40E+01
Xe135m	6.86E-02	3120	2.14E+02
Xe135	2.19E-01	1810	3.96E+02
Xe137	6.66E-03	1420	9.46E+00
Xe138	2.09E-01	8830	1.84E+03
	Sum of πij*Ki=		7.72E+03

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released (unitless)

Whole Body Dose Rate

QTj Maximum Release Rate based on Whole Body Dose (uCi/sec)
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit (mrem/yr)
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = (Fj*500)/(X/Qi*Sum πij*Ki)

QTj =	2.00E+00	5.00E+02	=	1.58E+05 uCi/sec
	8.20E-07	7.72E+03		

Reactor Building Intermediate Range Monitor Setpoint Calculation

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	2.88E-02	0	0.00E+00
Kr85m	5.57E-02	2.81E+03	1.56E+02
Kr87	1.49E-04	1.65E+04	2.46E+00
Kr88	1.49E-01	1.91E+04	2.85E+03
Kr89	1.79E-01	2.91E+04	5.21E+03
Xe131m	1.49E-04	6.48E+02	9.66E-02
Xe133m	2.78E-03	1.35E+03	3.76E+00
Xe133	8.15E-02	6.94E+02	5.66E+01
Xe135m	6.86E-02	4.41E+03	3.03E+02
Xe135	2.19E-01	2.30E+03	5.03E+02
Xe137	6.66E-03	1.39E+04	9.26E+01
Xe138	2.09E-01	1.43E+04	2.99E+03
	Sum(πij)(Li+1.1Mi) =		1.22E+04

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	2.88E-02	3.53E-03	1.02E-04
Kr85m	5.57E-02	3.53E-03	1.96E-04
Kr87	1.49E-04	3.53E-03	5.26E-07
Kr88	1.49E-01	3.53E-03	5.26E-04
Kr89	1.79E-01	3.53E-03	6.31E-04
Xe131m	1.49E-04	3.53E-03	5.26E-07
Xe133m	2.78E-03	3.53E-03	9.82E-06
Xe133	8.15E-02	3.53E-03	2.88E-04
Xe135m	6.86E-02	3.53E-03	2.42E-04
Xe135	2.19E-01	3.53E-03	7.72E-04
Xe137	6.66E-03	3.53E-03	2.35E-05
Xe138	2.09E-01	3.53E-03	7.37E-04

Skin Dose Calculation
3000 Dose Rate Limit

QTj = 2.00E+00 / 8.20E-07 × 3.00E+03 / 1.22E+04 = 6.02E+05 uCi/sec

Lowest Dose Rate Value
QTj = 1.58E+05 uCi/sec

Step 4.7
Maximum Allowable Value
CTj = (QTj/Rj)
Rj = Release Rate
CTj = maximum allowed concentration
CTj = 1.58E+05 / 4.48E+07 = 3.53E-03 uCi/cc

Reactor Building Intermediate Range Monitor Setpoint Calculation

For Gamma Detectors (REA) the relative efficiencies is calculated in the following table.

Table 4.9a
Relative Efficiency

Nuclide	Gamma Abundance	Relative Abundance	E(Xe-133)	Eij
Kr83m	0.09	0.245	5.51E+05	1.35E+05
Kr85m	0.74	2.016	5.51E+05	1.11E+06
Kr87	0.837	2.281	5.51E+05	1.26E+06
Kr88	1.372	3.738	5.51E+05	2.06E+06
Kr89	1.6	4.36	5.51E+05	2.40E+06
Xe131m	0.0196	0.053	5.51E+05	2.92E+04
Xe133m	0.14	0.381	5.51E+05	2.10E+05
Xe133	0.367	1	5.51E+05	5.51E+05
Xe135m	0.81	2.207	5.51E+05	1.21E+06
Xe135	0.939	2.559	5.51E+05	1.41E+06
Xe137	0.33	0.899	5.51E+05	4.95E+05
Xe138	1.222	3.33	5.51E+05	1.83E+06

Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	1.02E-04	1.35E+05	1.37E+01
Kr85m	1.96E-04	1.11E+06	2.18E+02
Kr87	5.26E-07	1.26E+06	6.61E-01
Kr88	5.26E-04	2.06E+06	1.08E+03
Kr89	6.31E-04	2.40E+06	1.52E+03
Xe131m	5.26E-07	2.92E+04	1.53E-02
Xe133m	9.82E-06	2.10E+05	2.06E+00
Xe133	2.88E-04	5.51E+05	1.58E+02
Xe135m	2.42E-04	1.21E+06	2.94E+02
Xe135	7.72E-04	1.41E+06	1.09E+03
Xe137	2.35E-05	4.95E+05	1.16E+01
Xe138	7.37E-04	1.83E+06	1.35E+03
		C.Rj =	6.00E+03

C.Rj = **Count rate above background (cps)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (ccps/µCi/cc)

Reactor Building

Step 4.13
Maximum Allowable Setpoint =
Bkg+C.Rj = 6,550

Step 4 14
Upper Level (UL) = 1,000

Note, there is only one alarm on this system
Step 4.16 2
Alarm

UL	1,000	
Nominal	910	91% of UL
Lower Level	820	82% of UL

Turbine Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
2	0.00E+00	1.15E+02	0.00
Kr85m	2.25E+00	1.15E+02	0.02
Kr87	6.34E+00	1.15E+02	0.05
Kr88	7.61E+00	1.15E+02	0.07
Kr89	0.00E+00	1.15E+02	0.00
Xe131m	0.00E+00	1.15E+02	0.00
Xe133m	0.00E+00	1.15E+02	0.00
Xe133	9.19E+00	1.15E+02	0.08
Xe135m	2.15E+01	1.15E+02	0.19
2	2.09E+01	1.15E+02	0.18
Xe137	0.00E+00	1.15E+02	0.00
Xe138	4.75E+01	1.15E+02	0.41
Sum	1.15E+02		1.00

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	0.00	0.0756	0.00E+00
2	0.02	1170	2.28E+01
Kr87	0.05	5920	3.25E+02
Kr88	0.07	14700	9.69E+02
Turbine Bu	0.00	16600	0.00E+00
Xe131m	0.00	91.5	0.00E+00
Xe133m	0.00	251	0.00E+00
Xe133	0.08	294	2.34E+01
Xe135m	0.19	3120	5.83E+02
Xe135	0.18	1810	3.28E+02
Xe137	0.00	1420	0.00E+00
Xe138	0.41	8830	3.64E+03
	Sum of πij*Ki=		5.89E+03

Whole Body Dose Rate = (Fj*500)/(X/Qi*Sum(πij*Ki)
QTj Maximum Release Rate based on Whole Body Dose
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = | 2.00E+00 | 5.00E+02 | = | 1.13E+04 | uCi/sec
| 1.50E-05 | 5.89E+03 |

Turbine Building Monitor Setpoint Calculation

Table 4.5a Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	0.00	0	0.00E+00
Kr85m	0.02	2.81E+03	5.48E+01
Kr87	0.05	1.65E+04	9.06E+02
Kr88	0.07	1.91E+04	1.26E+03
Kr89	0.00	2.91E+04	0.00E+00
Xe131m	0.00	6.48E+02	0.00E+00
Xe133m	0.00	1.35E+03	0.00E+00
Xe133	0.08	6.94E+02	5.53E+01
Xe135m	0.19	4.41E+03	8.24E+02
Xe135	0.18	2.30E+03	4.17E+02
Xe137	0.00	1.39E+04	0.00E+00
Xe138	0.41	1.43E+04	5.89E+03
	Sum(πij)(Li+1.1Mi) =		9.41E+03

Skin Dose Rate = (Fj*3000)/(X/Qi*Sum(πij*Ki)

3000 Dose Rate Limit

QTj = 2.00E+00 / 1.50E-05 × 3.00E+03 / 9.41E+03 = 4.25E+04 uCi/sec

Release rate for lowest dose rate value (Whole body or Skin)

QTj = 1.13E+04 uCi/sec

Table 4.8a Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	0.00	6.32E-05	0.00E+00
Kr85m	0.02	6.32E-05	1.23E-06
Kr87	0.05	6.32E-05	3.47E-06
Kr88	0.07	6.32E-05	4.17E-06
Kr89	0.00	6.32E-05	0.00E+00
Xe131m	0.00	6.32E-05	0.00E+00
Xe133m	0.00	6.32E-05	0.00E+00
Xe133	0.08	6.32E-05	5.04E-06
Xe135m	0.19	6.32E-05	1.18E-05
Xe135	0.18	6.32E-05	1.15E-05
Xe137	0.00	6.32E-05	0.00E+00
Xe138	0.41	6.32E-05	2.61E-05

Step 4.7

Maximum Allowable Concentration (CTj)

CTj = (QTj/Rj)

QTj=maximum acceptable release rate for all noble gases (uCi/sec)

Rj = Release Rate (cc/sec)

CTj = 1.13E+04 / 1.79E+08 = 6.32E-05 uCi/cc

Turbine Building Monitor Setpoint Calculation

For the TEA Beta detector the relative efficiency is calculated in the following table.

Table 4.10a
Relative Efficiency

Nuclide	Relative Efficiency(1)	E(Xe-133)	Eij
Kr83m	0.050	2.15E+07	n/a
Kr85m	1.622	2.15E+07	3.49E+07
Kr87	2.205	2.15E+07	4.74E+07
Kr88	1.544	2.15E+07	3.32E+07
Kr89	2.255	2.15E+07	n/a
Xe131m	1.119	2.15E+07	n/a
Xe133m	1.444	2.15E+07	n/a
Xe133	1.000	2.15E+07	2.15E+07
Xe135m	0.387	2.15E+07	8.32E+06
Xe135	1.949	2.15E+07	4.19E+07
Xe137	2.315	2.15E+07	n/a
Xe138	1.999	2.15E+07	4.30E+07

Eij=Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)

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Table 4.11a
Count Rate Contributions

Nuclide	Cij	Eij	C.Rij
Kr83m	0.00E+00	n/a	0.00E+00
Kr85m	1.23E-06	3.49E+07	4.30E+01
Kr87	3.47E-06	4.74E+07	1.65E+02
Kr88	4.17E-06	3.32E+07	1.38E+02
Kr89	0.00E+00	n/a	0.00E+00
Xe131m	0.00E+00	n/a	0.00E+00
Xe133m	0.00E+00	n/a	0.00E+00
Xe133	5.04E-06	2.15E+07	1.08E+02
Xe135m	1.18E-05	8.32E+06	9.82E+01
Xe135	1.15E-05	4.19E+07	4.80E+02
Xe137	0.00E+00	n/a	0.00E+00
Xe138	2.61E-05	4.30E+07	1.12E+03
		C.Rj =	2.15E+03

cpm 1.00E-04 **µCi/cc**

C Rj = **Count rate above background (cpm)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)

Turbine Building Monitor Setpoint Calculation

Step 4.13	Turbine Building Maximum Allowable Setpoint=Bkg+C.Rj=	46+2153	=	1.83E+04 µCi/s 2199 cpm 1.02E-04 µCi/cc	
Step 4.14	Upper Level =	381	Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.		

Activity Signals Ch 1 & Ch 3 in µCi/cc			Effluent Activity Signal Ch 4 µCi/s		
High Alarm			**High Alarm**		
UL	1.77E-05		UL	3.17E+03	
Nominal	1.61E-05	91% of UL	Nominal	2.89E+03	91% of UL
Lower Level	1.45E-05	82% of UL	Lower Level	2.60E+03	82% of UL
Bkg	2.14E-06		Bkg	3.83E+02	
Alert Alarm	9.97E-06	Bkg*4.66	**Alert Alarm**	1.78E+03	Bkg*4.66
Alert Alarm	9.98E-06	Rounded up	Alert Alarm	1.79E+03	Rounded up
UL	1.20E-05	120% of Nominal	UL	2.15E+03	120% of Nominal
Nominal	9.98E-06	Alarm	Nominal	1.79E+03	Alarm
LL	7.98E-06	80% of Nominal	LL	1.43E+03	80% of Nominal

Radwaste Building Setpoint Calculation

Table 4.3a			
Nuclide	Mij	MTj	πij
2	0.00E+00	1.74E+00	0.00E+00
Kr85m	0.00E+00	1.74E+00	0.00E+00
Kr87	0.00E+00	1.74E+00	0.00E+00
Kr88	0.00E+00	1.74E+00	0.00E+00
Kr89	0.00E+00	1.74E+00	0.00E+00
Xe131m	0.00E+00	1.74E+00	0.00E+00
Xe133m	0.00E+00	1.74E+00	0.00E+00
Xe133	3.17E-01	1.74E+00	1.82E-01
Xe135m	0.00E+00	1.74E+00	0.00E+00
2	1.43E+00	1.74E+00	8.18E-01
Xe137	0.00E+00	1.74E+00	0.00E+00
Xe138	0.00E+00	1.74E+00	0.00E+00
Sum	1.74E+00		

Mij Measured or estimated concentration of nuclide i in release path j (µCi/cc)
MTj Measured or estimated total concentration of all gases in release path j (µCi/cc)
πij Fraction of each nuclide released

Table 4.4a			
Maximum Release Rate			
Nuclide	πij	Ki	(πij)(Ki)
Kr83m	0.00E+00	0.0756	0.00E+00
2	0.00E+00	1170	0.00E+00
Kr87	0.00E+00	5920	0.00E+00
Kr88	0.00E+00	14700	0.00E+00
Kr89	0.00E+00	16600	0.00E+00
Xe131m	0.00E+00	91.5	0.00E+00
Xe133m	0.00E+00	251	0.00E+00
Xe133	1.82E-01	294	5.35E+01
Xe135m	0.00E+00	3120	0.00E+00
Xe135	8.18E-01	1810	1.48E+03
Xe137	0.00E+00	1420	0.00E+00
Xe138	0.00E+00	8830	0.00E+00
	Sum of πij*Ki=		1.53E+03

Whole Body Dose Rate = (Fj*500)/(X/Qi*Sum(πij*Ki)

QTj Maximum Release Rate based on Whole Body Dose
Fj Fraction of total dose allocated to this release pathway (Dimensionless)
500 Whole body dose rate limit
X/Qi Maximum normalized diffusion coefficient for this pathway at and beyond the site boundary (sec/m3)
Ki Total whole body dose factor due to gamma emission from nuclide i, as listed in the ODCM or Reg Guide 1.109, revision 1 (mrem/year per µCi/m3)
πij Is the fraction of the total activity for nuclide i (Dimensionless)
m Total number of nuclides in the gaseous effluent
j Release pathway

QTj = | 2.00E+00 | 5.00E+02 | / | 1.50E-05 | 1.53E+03 | = 4.34E+04 uCi/sec

Radioactive Waste Building Monitor Setpoint Calculation

Table 4.5a			
Maximum Release Rate			
Nuclide	πij	Li+1.1Mi	(πij)(Li+1.1Mi)
Kr83m	0.00E+00	0	0.00E+00
Kr85m	0.00E+00	2.81E+03	0.00E+00
Kr87	0.00E+00	1.65E+04	0.00E+00
Kr88	0.00E+00	1.91E+04	0.00E+00
Kr89	0.00E+00	2.91E+04	0.00E+00
Xe131m	0.00E+00	6.48E+02	0.00E+00
Xe133m	0.00E+00	1.35E+03	0.00E+00
Xe133	1.82E-01	6.94E+02	1.26E+02
Xe135m	0.00E+00	4.41E+03	0.00E+00
Xe135	8.18E-01	2.30E+03	1.88E+03
Xe137	0.00E+00	1.39E+04	0.00E+00
Xe138	0.00E+00	1.43E+04	0.00E+00
	Sum(πij)(Li+1.1Mi) =		2.01E+03

Skin Dose Rate = (Fj*3000)/(X/Qi*Sum(πij*Ki)

3000 Dose Rate Limit

QTj = 2.00E+00 / 1.50E-05 × 3.00E+03 / 2.01E+03 = 1.99E+05 uCi/sec

Lowest Dose Rate Value

4.34E+04 uCi/sec

Table 4.8a			
Maximum Nuclide Concentration			
Nuclide	πij	CTj	Cij
Kr83m	0.00E+00	1.11E-03	0.00E+00
Kr85m	0.00E+00	1.11E-03	0.00E+00
Kr87	0.00E+00	1.11E-03	0.00E+00
Kr88	0.00E+00	1.11E-03	0.00E+00
Kr89	0.00E+00	1.11E-03	0.00E+00
Xe131m	0.00E+00	1.11E-03	0.00E+00
Xe133m	0.00E+00	1.11E-03	0.00E+00
Xe133	1.82E-01	1.11E-03	2.02E-04
Xe135m	0.00E+00	1.11E-03	0.00E+00
Xe135	8.18E-01	1.11E-03	9.09E-04
Xe137	0.00E+00	1.11E-03	0.00E+00
Xe138	0.00E+00	1.11E-03	0.00E+00

Step 4.7

Maximum Allowable Value

CTj = (QTj/Rj)

Rj = Release Rate

CTj = maximum allowed concentration

CTj = 4.34E+04 / 3.91E+07 = 1.11E-03

Radioactive Waste Building Monitor Setpoint Calculation

For Beta detectors (WEA) the relative efficiency is calculated in the following table.

Table 4.10a
Relative Efficiency

Nuclide	Relative Efficiency(1)	E(Xe-133)	Eij
Kr83m	0.050	1.81E+07	n/a
Kr85m	1.626	1.81E+07	n/a
Kr87	2.208	1.81E+07	n/a
Kr88	1.549	1.81E+07	n/a
Kr89	2.259	1.81E+07	n/a
Xe131m	1.122	1.81E+07	n/a
Xe133m	1.449	1.81E+07	n/a
Xe133	1.000	1.81E+07	1.81E+07
Xe135m	0.387	1.81E+07	n/a
Xe135	1.953	1.81E+07	3.54E+07
Xe137	2.318	1.81E+07	n/a
Xe138	2.005	1.81E+07	n/a

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Table 4.11a
Counts above Background

Nuclide	Cij	Eij	C.Rij
Kr83m	0.00E+00	n/a	0.00E+00
Kr85m	0.00E+00	n/a	0.00E+00
Kr87	0.00E+00	n/a	0.00E+00
Kr88	0.00E+00	n/a	0.00E+00
Kr89	0.00E+00	n/a	0.00E+00
Xe131m	0.00E+00	n/a	0.00E+00
Xe133m	0.00E+00	n/a	0.00E+00
Xe133	2.02E-04	1.81E+07	3.66E+03
Xe135m	0.00E+00	n/a	0.00E+00
Xe135	9.09E-04	3.54E+07	3.21E+04
Xe137	0.00E+00	n/a	0.00E+00
Xe138	0.00E+00	n/a	0.00E+00
		C.Rj =	3.58E+04

C.Rj = **Count rate above background (cpm)**
Cij = Maximum acceptable concentration of noble gas i (µCi/cc)
Eij = Effluent monitor detection efficiency for nuclide i (cpm/µCi/cc)

cpm 1.98E-03 **µCi/cc**

Radioactive Waste Building Monitor Setpoint Calculation

	Radwaste Building				7.74E+04	µCi/s
Step 4.13	Maximum Allowable Setpoint	=	46+35804	=	35850	cpm
					1.98E-03	µCi/cc

Step 4.14 Upper Level = 2901 Based on instrument range, accuracy, and the ability to accurately read instrument values, select an Upper Level that is less than or equal to 80% of the maximum allowable setpoint value determined in Step 4.13.

Activity Signals Ch 1 & Ch 3 in µCi/cc			Effluent Activity Signal Ch 4 µCi/s		
High Alarm			High Alarm		
UL	1.60E-04	80% of Max	UL	6.27E+03	
Nominal	1.46E-04	91% of UL	Nominal	5.70E+03	91% of UL
Lower Level	1.31E-04	82% of UL	Lower Level	5.14E+03	82% of UL
Bkg	2.54E-06		Bkg	9.94E+01	
Alert Alarm	1.18E-05	Bkg*4.66	High Alarm	4.63E+02	Bkg*4.66
Alert Alarm	1.19E-05	Rounded up	High Alarm	4.64E+02	Rounded up
UL	1.43E-05	120% of Nominal	UL	5.57E+02	120% of Nominal
Nominal	1.19E-05	Alarm	Nominal	4.64E+02	Alarm
LL	9.52E-06	80% of Nominal	LL	3.71E+02	80% of Nominal