

		CALCULATION COVER SHEET		CALC NO. NEE-323-CALC-003	
				REV. 00	
				PAGE NO. 1 of 9	
Title:	Documentation of the RU1 Emergency Action Levels			Client: Duane Arnold Energy Center	
				Project Identifier: NEE-323	
Item	Cover Sheet Items	Yes	No		
1	Does this calculation contain any open assumptions, including preliminary information, that require confirmation? (If YES , identify the assumptions.)	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
2	Does this calculation serve as an "Alternate Calculation"? (If YES , identify the design verified calculation.) Design Verified Calculation No. _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
3	Does this calculation supersede an existing Calculation? (If YES , identify the design verified calculation.) Superseded Calculation No. _____	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Scope of Revision: Initial Issue					
Revision Impact on Results: Initial Issue					
Study Calculation <input type="checkbox"/> Final Calculation <input checked="" type="checkbox"/>					
Safety-Related <input type="checkbox"/> Non-Safety-Related <input checked="" type="checkbox"/>					
<i>(Print Name and Sign)</i>					
Originator: Jay Bhatt				Date: 12/12/17	
Design Verifier¹ (Reviewer if NSR): Ryan Skaggs				Date: 12/12/17	
Approver: Aaron Holloway				Date: 12/12/17	


Note 1: For non-safety-related calculation, design verification can be substituted by review.

 ENERCON <i>Excellence—Every project. Every day.</i>		CALCULATION REVISION STATUS SHEET		CALC NO. NEE-323-CALC-003	
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<u>CALCULATION REVISION STATUS</u>					
<u>REVISION</u> 00		<u>DATE</u> 12/12/17		<u>DESCRIPTION</u> Initial Issue	
<u>PAGE REVISION STATUS</u>					
<u>PAGE NO.</u> All		<u>REVISION</u> 00		<u>PAGE NO.</u>	
				<u>REVISION</u>	
<u>APPENDIX/ATTACHMENT REVISION STATUS</u>					
<u>APPENDIX NO.</u>	<u>NO. OF PAGES</u>	<u>REVISION NO.</u>	<u>ATTACHMENT NO.</u>	<u>NO. OF PAGES</u>	<u>REVISION NO.</u>
			1	4	00
			2	18	00
			3	9	00

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1.0 Purpose and Scope

The Duane Arnold Energy Center site is implementing the guidance of Revision 6 to the Document NEI 99-01, "Development of Emergency Action Levels for Non-Passive Reactors," which is the industry-developed methodology for emergency classification for the current operating fleet. Changes to the definitions of the condition for entry into the Emergency Action Level (EAL) RU1 result in the development of a new entry threshold value for this EAL.

This calculation provides calculated threshold values for the following EALs (from NEI 99-01, Rev. 6). Note that NEI 99-01 designates abnormal radiological conditions as "AU," NEE has adopted the "RU" designation permitted under the guidance.

(1) Reading on ANY effluent radiation monitor greater than 2 times the (site-specific effluent release controlling document) limits for 60 minutes or longer.

(2) Reading on ANY effluent radiation monitor greater than 2 times the alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer.

This calculation uses the latest radiation monitor setpoints to determine the resultant EAL thresholds.

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2.0 Summary of Results and Conclusions

Values for the RU1 Gaseous EALs were determined and are shown below.

Table 1 – Gaseous Effluent Setpoints

Location	Detector	RU1 Threshold (μCi/cc)
Offgas Stack	Kaman 10	1.97E-01
Turbine Building Vent	Kaman 2	7.74E-04
Reactor Building Vent	Kaman 4	6.00E-04
Reactor Building Vent	Kaman 6	9.60E-04
Reactor Building Vent	Kaman 8	9.60E-04
LLRPSF Building Vent	Kaman 12	1.19E-03

Values for the Liquid Effluent RU1 EALs were determined and are shown below.


Table 2 – Liquid Effluent Setpoints

Location	Equipment ID	RU1 Unusual Event Level (cps)
GSW	RE-4767	1.53E+03
RHRSW/ESW	RE-1997	8.42E+02
RHRSW Dilution Line*	RE-4268	1.06E+03

*RE-4268 was previously known as the RHRSW Rupture Disk

3.0 References

- 3.1 NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors." November 2012.
- 3.2 DAEC Offsite Dose Assessment Manual (ODAM), Rev. 37.
- 3.3 Plant Chemistry Procedure PCP 8.3, Alarm Setpoints and Background Determination for KAMAN Normal Range Monitors.
- 3.4 Plant Chemistry Procedure PCP 8.7, Alarm Setpoints For Liquid Rad Monitors.
- 3.5 Technical Specifications, Section 5.5.4, Radioactive Effluent Controls Program.
- 3.6 DAEC Emergency Plan, Section 'I', Rev. 27

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4.0 Assumptions

It is assumed that the current setpoint for the Kaman 4 monitor is 3.00E-04 $\mu\text{Ci/cc}$. The latest setpoint determination received is from 3/4/2016 which exceeds the 18 month frequency specified by PCP 8.3.

5.0 Design Inputs

5.1 The setpoint determinations from Attachment 2 and Attachment 3, represent the latest responses at the associated gaseous and liquid effluent monitors. While the three most recent surveillances for each monitor are included for information, only the latest setpoint is used to determine the EAL threshold. It should be noted that the "RM" equipment designations are equivalent to the "RE" equipment IDs.

5.2 The gaseous effluent equipment ID number, monitor common name and range are taken from DAEC Emergency Plan Section "I" and ODAM Figure 3-1, and are presented in Table 3.

Table 3 – Gaseous Effluent Design Inputs

Location	Monitor Common Name	Equipment ID	Monitor Range ($\mu\text{Ci/cc}$)
Offgas Stack	KAMAN 9/10	RE-4176, RE-4175	1E-07 - 1E+05
Turbine Building Vent	KAMAN 1/2	RE-5945 / RE-5946	1E-07 - 1E+05
Reactor Building Vent	KAMAN 3/4	RE-7645, RE-7644	1E-07 - 1E+05
	KAMAN 5/6	RE-7647, RE-7646	
	KAMAN 7/8	RE-7649, RE-7648	
LLRPSF Building Vent	KAMAN 12	RE-8801	1E-07 - 3E-01

5.3 The liquid effluent equipment ID number, and range are taken from ODAM Table I-2, and are presented in Table 4.

Table 4 – Liquid Effluent Design Inputs

Location	Equipment ID	Monitor Range (cps)
GSW	RE-4767	1E-01 - 1E+06
RHRWSW/ESW	RE-1997	1E-01 - 1E+06
RHRWSW Dilution Line	RE-4268	1E-01 - 1E+06

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6.0 Methodology

The alarm setpoint of a radioactive noble gas effluent monitor is calculated on the basis of whole body dose equivalent rate offsite of 500 mrem/yr per the ODAM. The alarm setpoint for liquid radwaste effluent line provides automatic isolation when 10 times the water effluent concentration listed in 10 CFR 20 Appendix B, Table 2, is being exceeded in the unrestricted area per the ODAM. These setpoints are in accordance with Technical Specifications limits specified in 5.5.4b and 5.5.4g. This calculation considers historical setpoint determination for gaseous release (PCP 8.3) and liquid effluent (PCP 8.7). The latest three setpoints for each monitor were reviewed. Due to the high variance for some of the monitors, the latest alarm setpoint is used to determine the EAL thresholds.

7.0 Calculation

7.1 Gaseous Setpoints

Plant Chemistry Procedure PCP 8.3 is used by Chemistry Technicians to calculate setpoints for building vent KAMAN monitors at least once every 18 months. The three latest setpoint determinations for each location are shown in Attachment 2 for information. It should be noted that where the original PCP 8.3 setpoint calculation sheet is unavailable, the value is taken from the associated monitor calibration procedure.

Thresholds corresponding to the latest setpoints are calculated and presented here. For example the latest PCP 8.3 setpoint for Offgas stack is 9.84E-02 $\mu\text{Ci/cc}$. This value is doubled to 1.97E-01 $\mu\text{Ci/cc}$ to correspond to the RU1 threshold. The remaining threshold values are shown in Table 5.

Table 5 – Gaseous Effluent Setpoints and Thresholds

Location	Detector	Latest PCP 8.3 Setpoint ($\mu\text{Ci/cc}$)	RU1 Threshold ($\mu\text{Ci/cc}$)
Offgas Stack	Kaman 10	9.84E-02	1.97E-01
Turbine Building Vent	Kaman 2	3.87E-04	7.74E-04
Reactor Building Vent	Kaman 4	3.00E-04	6.00E-04
Reactor Building Vent	Kaman 6	4.80E-04	9.60E-04
Reactor Building Vent	Kaman 8	4.80E-04	9.60E-04
LLRPSF Building Vent	Kaman 12	5.95E-04	1.19E-03

7.2 Liquid Setpoints

As a result of variability in the isotopic mix of reactor water, background radiation levels and detector efficiencies, the calculated liquid effluent setpoints will fluctuate over time.

Chemistry Technicians perform effluent liquid radiation monitor setpoint calculations at least once per 18 months with guidance provided by Plant

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Chemistry Procedure PCP 8.7. The three latest setpoint determinations for each location are shown in Attachment 3. It should be noted that where the original PCP 8.7 setpoint calculation sheet is unavailable, the value is taken from the associated monitor calibration procedure.

Thresholds corresponding to the latest setpoints are calculated and presented here. For example the latest PCP 8.7 setpoint for the RHRSW Dilution Line is 421 cps. This value is doubled to 842 cps to correspond to the RU1 threshold. The remaining threshold values are shown in Table 6.

Table 6 – Liquid Effluent Setpoints and Thresholds


Location		Latest PCP 8.7 Setpoint (cps)	RU1 Threshold (cps)
GSW		7.65E+02	1.53E+03
RHRSW/ESW		4.21E+02	8.42E+02
RHRSW	Dilution Line	5.30E+02	1.06E+03

8.0 Computer Software


None.

9.0 Impact Assessment


This calculation is based on “realistic” conditions for the purpose of declaring EALs, rather than typical conservative “bounding” type design basis analyses. The calculation documents the order of magnitude setpoints to assist Operations and Emergency Response personnel in determining an unusual event in accordance with NEI 99-01 Rev. 6.

	Attachment 1 CALCULATION PREPARATION CHECKLIST	CALC NO.	NEE-323-CALC-003
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CHECKLIST ITEMS ¹	YES	NO	N/A
GENERAL REQUIREMENTS			
1. If the calculation is being performed to a client procedure, is the procedure being used the latest revision?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
The calculation is being prepared to ENERCON's procedures.			
2. Are the proper forms being used and are they the latest revision?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Have the appropriate client review forms/checklists been completed?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
The calculation is being prepared to ENERCON's procedures.			
4. Are all pages properly identified with a calculation number, calculation revision and page number consistent with the requirements of the client's procedure?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Is all information legible and reproducible?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Is the calculation presented in a logical and orderly manner?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Is there an existing calculation that should be revised or voided?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
This is a new calculation to support implementing NEI 99-01 Rev. 6			
8. Is it possible to alter an existing calculation instead of preparing a new calculation for this situation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9. If an existing calculation is being used for design inputs, are the key design inputs, assumptions and engineering judgments used in that calculation valid and do they apply to the calculation revision being performed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Is the format of the calculation consistent with applicable procedures and expectations?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Were design input/output documents properly updated to reference this calculation?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12. Can the calculation logic, methodology and presentation be properly understood without referring back to the originator for clarification?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OBJECTIVE AND SCOPE			
13. Does the calculation provide a clear concise statement of the problem and objective of the calculation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Does the calculation provide a clear statement of quality classification?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Is the reason for performing and the end use of the calculation understood?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Does the calculation provide the basis for information found in the plant's license basis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. If so, is this documented in the calculation?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
18. Does the calculation provide the basis for information found in the plant's design basis documentation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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CHECKLIST ITEMS ¹		YES	NO	N/A
19.	If so, is this documented in the calculation?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
20.	Does the calculation otherwise support information found in the plant's design basis documentation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
21.	If so, is this documented in the calculation?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22.	Has the appropriate design or license basis documentation been revised, or has the change notice or change request documents being prepared for submittal?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
DESIGN INPUTS				
23.	Are design inputs clearly identified?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24.	Are design inputs retrievable or have they been added as attachments?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25.	If Attachments are used as design inputs or assumptions are the Attachments traceable and verifiable?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26.	Are design inputs clearly distinguished from assumptions?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27.	Does the calculation rely on Attachments for design inputs or assumptions? If yes, are the attachments properly referenced in the calculation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28.	Are input sources (including industry codes and standards) appropriately selected and are they consistent with the quality classification and objective of the calculation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29.	Are input sources (including industry codes and standards) consistent with the plant's design and license basis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30.	If applicable, do design inputs adequately address actual plant conditions?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.	Are input values reasonable and correctly applied?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32.	Are design input sources approved?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33.	Does the calculation reference the latest revision of the design input source?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34.	Were all applicable plant operating modes considered?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ASSUMPTIONS				
35.	Are assumptions reasonable/appropriate to the objective?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
36.	Is adequate justification/basis for all assumptions provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
37.	Are any engineering judgments used?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
38.	Are engineering judgments clearly identified as such?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
39.	If engineering judgments are utilized as design inputs, are they reasonable and can they be quantified or substantiated by reference to site or industry standards, engineering principles, physical laws or other appropriate criteria?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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CHECKLIST ITEMS ¹		YES	NO	N/A
METHODOLOGY				
40.	Is the methodology used in the calculation described or implied in the plant's licensing basis?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
41.	If the methodology used differs from that described in the plant's licensing basis, has the appropriate license document change notice been initiated?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
42.	Is the methodology used consistent with the stated objective?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43.	Is the methodology used appropriate when considering the quality classification of the calculation and intended use of the results?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BODY OF CALCULATION				
44.	Are equations used in the calculation consistent with recognized engineering practice and the plant's design and license basis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45.	Is there reasonable justification provided for the use of equations not in common use?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
46.	Are the mathematical operations performed properly and documented in a logical fashion?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47.	Is the math performed correctly?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48.	Have adjustment factors, uncertainties and empirical correlations used in the analysis been correctly applied?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
49.	Has proper consideration been given to results that may be overly sensitive to very small changes in input?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SOFTWARE/COMPUTER CODES				
50.	Are computer codes or software languages used in the preparation of the calculation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
51.	Have the requirements of CSP 3.09 for use of computer codes or software languages, including verification of accuracy and applicability been met?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
52.	Are the codes properly identified along with source vendor, organization, and revision level?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
53.	Is the computer code applicable for the analysis being performed?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
54.	If applicable, does the computer model adequately consider actual plant conditions?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
55.	Are the inputs to the computer code clearly identified and consistent with the inputs and assumptions documented in the calculation?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
56.	Is the computer output clearly identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
57.	Does the computer output clearly identify the appropriate units?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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CHECKLIST ITEMS ¹		YES	NO	N/A
58.	Are the computer outputs reasonable when compared to the inputs and what was expected?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
59.	Was the computer output reviewed for ERROR or WARNING messages that could invalidate the results?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
RESULTS AND CONCLUSIONS				
60.	Is adequate acceptance criteria specified?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
61.	Are the stated acceptance criteria consistent with the purpose of the calculation, and intended use?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
62.	Are the stated acceptance criteria consistent with the plant's design basis, applicable licensing commitments and industry codes, and standards?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
63.	Do the calculation results and conclusions meet the stated acceptance criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
64.	Are the results represented in the proper units with an appropriate tolerance, if applicable?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
65.	Are the calculation results and conclusions reasonable when considered against the stated inputs and objectives?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
66.	Is sufficient conservatism applied to the outputs and conclusions?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
67.	Do the calculation results and conclusions affect any other calculations?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
68.	If so, have the affected calculations been revised?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
69.	Does the calculation contain any conceptual, unconfirmed or open assumptions requiring later confirmation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
70.	If so, are they properly identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
DESIGN REVIEW				
71.	Have alternate calculation methods been used to verify calculation results?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
No, a Design Review was performed.				

Note:

- Where required, provide clarification/justification for answers to the questions in the space provided below each question. An explanation is required for any questions answered as "No" or "N/A".

Originator: Jay Bhatt

12/12/17

Print Name and Sign

Date

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ALARM SETPOINTS AND BACKGROUND DETERMINATION FOR KAMAN NORMAL RANGE MONITORS	Rev. 33 Page 14 of 14

ATTACHMENT 2

KAMAN OFFGAS STACK GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. K10 CHARMAR 2. Sample No. 17-5560
 3. Sample Date 8-30-17 4. Sample Time 0854 5. MWT 1906
 6. Count Date 8-30-17 7. Count Time 0915
 8. Monitor Reading ($\mu\text{Ci/cc}$) 7.70e-7 9. Process Flow Rate (CFM) 5.17e3 10,000
 10. Sample Volume (mL) 4.50e4 cc

Flow meter ID # L729 Cal Due Date 10-6-17

Isotope	$\mu\text{Ci/mL}$ k_i	Dose Factor Stack * $\frac{\text{mrem sec}}{\text{yr} \cdot \mu\text{Ci}}$	$k_i \times \text{DFS}_i$
Xe 133		4.09E-5	
Kr 85m		1.81E-4	
Kr 88		1.91E-3	
Xe 135		2.84E-4	
Kr 87		6.97E-4	
Xe 138		1.08E-3	
Xe 135m		3.39E-4	
Xe 133m		3.61E-5	
Ar 41		1.32E-3	
N 13	<u>1.41e-7</u>	<u>1.08E-3</u> **	<u>1.52e-10</u>

14. Bkg = instrument background
 Bkg = 2.15e-7 $\mu\text{Ci/cc}$

* These dose factors are from ODAM:
 stack release at a distance of 1260
 meters NNW of DAEC

** Arbitrarily set equal to Xe-138

15. $\sum k_i = \underline{1.41e-7}$ ✓ 15a. $\sum (k_i \cdot \text{DFS}_i) = \underline{1.52e-10}$ ✓

15b. $\frac{\sum k_i}{\sum (k_i \cdot \text{DFS}_i)} = \frac{(\#15)}{(\#15a)} = \frac{1.41e-7}{1.52e-10} = \underline{9.28e^2}$ ✓

16. Limit = $L = \frac{1.06}{F} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFS}_i)} = \frac{1.06}{(\#9)} \times (\text{The Less of \#15b OR 3436})$

Limit = $L = \frac{1.06}{(10,000)} (928) = \underline{9.84e-2}$ ✓

17. Hi Hi ALARM = $A \times (\#16) = (1.0) (9.84e-2) = \underline{9.84e-2}$ $\mu\text{Ci/cc}$ ✓

The radioactive gas flow corresponding to the HI HI setpoint:

Performed by: [Signature] Date: 8-30-17

Independent Verification by: [Signature] Date: 8-30-17

PLANT CHEMISTRY PROCEDURES 3200 MANUAL	PCP 8.3
ALARM SETPOINTS AND BACKGROUND DETERMINATION FOR KAMAN NORMAL RANGE MONITORS	Rev. 33 Page 14 of 14

ATTACHMENT 2

KAMAN OFFGAS STACK GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. K10 Char Mar 2. Sample No. 16-1390
 3. Sample Date 2-26-16 4. Sample Time 1520 5. MWT 1911
 6. Count Date 2-26-16 7. Count Time 1558
 8. Monitor Reading ($\mu\text{Ci/cc}$) 6.61×10^{-7} 9. Process Flow Rate (CFM) 10,000
 10. Sample Volume (mL) 45,000 mL

Flow meter ID # L729Cal Due Date 10-6-17

Isotope	11 $\mu\text{Ci/mL}$ k_i	12 Dose Factor Stack mrem sec $\text{yr} - \mu\text{Ci}$	13 $k_i \times \text{DFS}_i$
Xe 133	4.27×10^{-9}	4.09×10^{-5}	1.75×10^{-13}
Kr 85m	2.02×10^{-9}	1.81×10^{-4}	3.66×10^{-13}
Kr 88		1.91×10^{-3}	
Xe 135	3.35×10^{-9}	2.84×10^{-4}	9.51×10^{-13}
Kr 87	2.43×10^{-9}	6.97×10^{-4}	2.04×10^{-12}
Xe 138		1.08×10^{-3}	
Xe 135m		3.39×10^{-4}	
Xe 133m		3.61×10^{-5}	
Ar 41	3.07×10^{-9}	1.32×10^{-3}	4.05×10^{-12}
N 13	9.75×10^{-8}	$1.08 \times 10^{-3}^{**}$	1.05×10^{-10}

14. Bkg = instrument background
 Bkg = $1.08 \times 10^{-6} \mu\text{Ci/cc}$

* These dose factors are from ODAM.
 stack release at a distance of 1260
 meters NNW of DAEC

** Arbitrarily set equal to Xe-138

15. $\sum k_i = 1.13 \times 10^{-7}$

15a. $\sum (k_i \cdot \text{DFS}_i) = 1.13 \times 10^{-10}$

15b. $\frac{\sum k_i}{\sum (k_i \cdot \text{DFS}_i)} = \frac{(\#15)}{(\#15a)} = \frac{1.13 \times 10^{-7}}{1.13 \times 10^{-10}} = 1.00 \times 10^3$

16. Limit = $L = \frac{1.06}{F} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFS}_i)} = \frac{1.06}{(\#9)} \times (\text{The Less of \#15b OR 3436})$

Limit = $L = \frac{1.06}{(10000)} (1000) = \frac{1.06}{10} = 0.106 = 1.06 \times 10^{-1}$

17. Hi Hi ALARM = $A \times (\#16) = (1.0) (1.06 \times 10^{-1}) = 1.06 \times 10^{-1} \mu\text{Ci/cc}$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: Asantha M. / Ranydsaw

Date: 2-26-16

Independent Verification by: DA B. Smith

Date: 2-26-16

DAEC DUANE ARNOLD ENERGY CENTER	SURVEILLANCE TEST PROCEDURE TITLE: K10 CALIBRATION	STP NS791013 Page 10 of 68 Rev. 17
	Prerequisites	Performance Date: <u>18 APR 2014</u>

6.0 PREREQUISITES

6.1 Make a copy of the EMS database display.

JK
(CHEM)

6.2 From the Chemistry Supervisor or designee, obtain and record the following alarm setpoints. (Values will be used to confirm AS FOUND data.)

6.2.1 HI 8.60 E-6 $\mu\text{Ci/cc}$

JK
(CHEM)

6.2.2 HIHI 3.64 E-1 $\mu\text{Ci/cc}$

JK
(CHEM)

6.3 From the Chemistry Supervisor or designee, obtain and record the desired New HI alarm setpoint. (Value will be used for the AS LEFT setpoint.)

6.3.1 Desired HI 8.60 E-6 $\mu\text{Ci/cc}$

JK
(CHEM)

6.4 Verify Sr-90 0.09 μCi source (UID #687) is available for use.

JK
(CHEM)

6.5 Verify the KAMAN/EMS IDT time and the HPGe System Computer time are within ± 30 seconds.

JK PM
(CHEM)

NOTE

When Kaman point sources are decay corrected, decay is to be from the date marked on the source to the test date.

6.6 Decay correct permissible range ($8.5\text{E}4 - 9.0\text{E}4$ cpm) for UID #687 and record below.

JK
(CHEM)

PERMISSIBLE DECAY CORRECTED RANGE:

3.80 E4 cpm to 4.11 E4 cpm

JK
(IV)

40479068

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. K-2 Charmer 2. Sample No 17-2746
 3. Sample Date 5-5-17 4. Sample Time 1542-1410 5. MWT 1911
 6. Count Date 5-5-17 7. Count Time 1415
 8. Monitor Reading ($\mu\text{Ci/cc}$) 2.70E-7 9. Process Flow Rate (CFM) 72000
 10. Sample Volume (mL) 47,600

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$ $\frac{\text{m}^3}{\mu\text{Ci}}$	13 Product $k_i \times \text{DFV}_i$
Xe 133		294	
Kr 85m		1.17E3	
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41		8.84E3	
N 13	<u>4.71E-9</u>	<u>8.83E3</u> **	<u>4.16E-5</u>
16. $\sum k_i$ =	<u>4.71E-9</u>	16a. $\sum (k_i \cdot \text{DFV}_i)$ =	<u>4.16E-5</u>

Flow Meter ID# L-729
 Cal Due Date: 10-06-17

14. Bkg = Instrument background
 Bkg = 1.76E-7 $\mu\text{Ci/cc}$

15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
 (atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{4.71E-9}{4.16E-5} = 1.13E-4$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81E-4) =$$

$$\text{Limit} = L = \frac{1.06}{(72000)(4.3E-6)} (1.13E-4) = 3.87E-4$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0)(3.87E-4) = 3.87E-4 \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: SEM Date: 05-05-17

Independent Verification by: RL Date: 5-5-17

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. Kaman 2 2. Sample No. 16-841
 3. Sample Date 2-5-16 4. Sample Time 11:13 5. MWT 1911
 6. Count Date 2-5-16 7. Count Time 11:19
 8. Monitor Reading ($\mu\text{Ci/cc}$) 7.65×10^{-8} 9. Process Flow Rate (CFM) 72,000
 10. Sample Volume (mL) 45,000

Isotope	k_i $\mu\text{Ci/mL}$	Dose Factor Vent DFV _i		Product $k_i \times \text{DFV}_i$
		mrem yr	$\frac{\text{m}^3}{\mu\text{Ci}}$	
Xe 133	none identified	294		none identified
Kr 85m		1.17E3		
Kr 88		1.47E4		
Xe 135		1.81E3		
Kr 87		5.92E3		
Xe 138		8.83E3		
Xe 135m		3.12E3		
Xe 133m		2.51E2		
Ar 41		8.84E3		
N 13	7.05×10^{-9}	8.83E3 **		6.23×10^{-5}
16. $\sum k_i$	7.05×10^{-9}	16a. $\sum (k_i \text{ DFV}_i)$	6.23×10^{-5}	

Flow Meter ID# L729Cal Due Date: 10-6-1714. Bkg = Instrument background
Bkg = 6.35×10^{-7} $\mu\text{Ci/cc}$ 15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
(atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{7.05 \times 10^{-9}}{6.23 \times 10^{-5}} = 1.13 \times 10^{-4}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of } \#16b \text{ OR } 1.81 \times 10^{-4}) =$$

$$\text{Limit} = L = \frac{1.06}{(72,000)(4.3 \times 10^{-6})} (1.13 \times 10^{-4}) = 3.87 \times 10^{-4}$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (3.87 \times 10^{-4}) = 3.87 \times 10^{-4} \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: 280 B z Mink Date: 2-5-16Independent Verification by: S. K. A. Date: 2-5-16

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. Kaman 2 2. Sample No. 14-2682
 3. Sample Date 5-8-14 4. Sample Time 12:37 - 13:03 5. MWT 1907
 6. Count Date 5-8-14 7. Count Time 1324
 8. Monitor Reading ($\mu\text{Ci/cc}$) 2.18×10^{-2} 9. Process Flow Rate (CFM) 72000
 10. Sample Volume (mL) 49400

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$	13 Product $k_i \times \text{DFV}_i$ $\frac{\text{m}^3}{\mu\text{Ci}}$
Xe 133	NONE	294	NONE
Kr 85m		1.17E3	
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41	NONE	8.84E3	NONE
N 13	7.84×10^{-9}	8.83E3 **	6.92×10^{-5}
16. $\sum k_i$	7.84×10^{-9}	16a. $\sum (k_i \text{ DFV}_i)$	6.92×10^{-5}

Flow Meter ID# L715
 Cal Due Date: 7-22-16

14. Bkg = Instrument background
 Bkg = $1.10 \times 10^{-6} \mu\text{Ci/cc}$

15. $X/Q = 4.3 \times 10^{-4} \text{ sec/m}^3$
 (atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{7.84 \times 10^{-9}}{6.92 \times 10^{-5}} = 1.13 \times 10^{-4}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81 \times 10^{-4}) =$$

$$\text{Limit} = L = \frac{1.06}{(72000)(4.3 \times 10^{-4})} (1.13 \times 10^{-4}) = 3.87 \times 10^{-4} \checkmark$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (3.87 \times 10^{-4}) = 3.87 \times 10^{-4} \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: Kelly Date: 5-8-14

Independent Verification by: Tom Mann Date: 5-8-14

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. Kamen 7 2. Sample No. 16-1551
 3. Sample Date 3-4-16 4. Sample Time 1147 5. MWT 1911
 6. Count Date 3-4-16 7. Count Time 1156
 8. Monitor Reading ($\mu\text{Ci/cc}$) $4.43e-8$ 9. Process Flow Rate (CFM) 93,000
 10. Sample Volume (mL) 45,000

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$ $\frac{\text{m}^3}{\mu\text{Ci}}$	13 Product $k_i \times \text{DFV}_i$
Xe 133	<u>none identified</u>	294 <u>none identified</u>	
Kr 85m		1.17E3	
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41		8.84E3	
N 13	<u>$6.19e-9$</u>	8.83E3 **	<u>$5.47e-5$</u>
16. $\sum k_i =$	<u>$6.19e-9$</u>	16a. $\sum (k_i \text{ DFV}_i) =$	<u>$5.47e-5$</u>

Flow Meter ID# L729
 Cal Due Date: 10/6/17

14. Bkg = Instrument background
 Bkg = $6.19e-9$ $\mu\text{Ci/cc}$

15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
 (atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{6.19e-9}{5.47e-5} = 1.13e-4$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81E-4) =$$

$$\text{Limit} = L = \left(\frac{1.06}{(93000)(4.3e-6)} \right) (1.13e-4) = 3.00e-4$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (3.00e-4) = 3.00e-4 \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: Jonathan Horn (Jm)

Date: 3-4-16

Independent Verification by: WAB-elli

Date: 3-4-16

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. KAMAN 4 CHARWICK 2. Sample No. 14-7631
 3. Sample Date 12-9-14 4. Sample Time 1130 5. MWT 1036
 6. Count Date 12-9-14 7. Count Time 1138 8. 12-9-14
 8. Monitor Reading ($\mu\text{Ci/cc}$) 5.47E-9 9. Process Flow Rate (CFM) 570E4 93000
 10. Sample Volume (mL) 46600

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV_i $\frac{\text{mrem}}{\text{yr}}$ $\frac{\text{m}^3}{\mu\text{Ci}}$	13 Product $k_i \times \text{DFV}_i$
Xe 133		294	
Kr 85m	<u>none</u>	1.17E3	<u>none</u>
Kr 88	<u>none</u>	1.47E4	<u>none</u>
Xe 135	<u>none</u>	1.81E3	<u>none</u>
Kr 87	<u>none</u>	5.92E3	<u>none</u>
Xe 138	<u>none</u>	8.83E3	<u>none</u>
Xe 135m	<u>none</u>	3.12E3	<u>none</u>
Xe 133m	<u>none</u>	2.51E2	<u>none</u>
Ar 41	<u>none</u>	8.84E3	<u>none</u>
N 13	<u>none</u>	8.83E3 **	<u>none</u>
16. $\sum k_i =$	<u>N/A</u>	16a. $\sum (k_i \text{ DFV}_i) =$	<u>N/A</u>

Flow Meter ID# L-760
 Cal Due Date: 7.11.17

14. Bkg = Instrument background
 Bkg = 5.45E-7 $\mu\text{Ci/cc}$

15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
 (atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81E-4) =$$

$$\text{Limit} = L = \frac{1.06}{(93000)(4.3E-6)} (1.81E-4) = \underline{4.80E-4}$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (4.80E-4) = \underline{4.80E-4} \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: ZATE SKY Date: 12-9-14

Independent Verification by: Tom Mow Date: 12-9-14

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. K-4 13-1159 cal 2. Sample No. 13-1159
 3. Sample Date 3-1-13 4. Sample Time 1330 5. MWT 1910
 6. Count Date 3-1-13 7. Count Time 1338
 8. Monitor Reading ($\mu\text{Ci/cc}$) $1.76 \text{ E}-8$ 9. Process Flow Rate (CFM) $5.79 \text{ E}-3$
 10. Sample Volume (mL) 4.18 E^4

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$	13 Product $k_i \times \text{DFV}_i$ $\frac{\text{m}^3}{\mu\text{Ci}}$
Xe 133	NONE	294	NONE
Kr 85m	IDENTIFIED	1.17E3	IDENTIFIED
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41		8.84E3	
N 13		8.83E3 **	
16. $\sum k_i$	<u>N/A</u>	16a. $\sum (k_i \text{ DFV}_i)$	<u>N/A</u>

Flow Meter ID# L760Cal Due Date: 5-7-1414. Bkg = Instrument background
Bkg = $5.62 \text{ E}-7$ $\mu\text{Ci/cc}$ 15. $X/Q = 4.3 \times 10^{-8} \text{ sec/m}^3$
(atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b or } 1.81\text{E}-4) =$$

$$\text{Limit} = L = \frac{1.06}{(93000)(4.3 \times 10^{-8})} (1.81 \text{ E}^{-4}) = 4.80 \text{ E}^{-4}$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (4.80 \text{ E}^{-4}) = 4.80 \text{ E}^{-4} \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

$$19. Q = 472 (A \cdot \#17) \#9$$

$$Q = 472 (1.0) (4.80 \text{ E}^{-4}) (93000) = 2.11 \text{ E}^4 \mu\text{Ci/sec}$$

Performed by: [Signature] Date: 3-1-13Independent Verification by: [Signature] Date: 3-1-13

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ALARM SETPOINTS AND BACKGROUND DETERMINATION FOR KAMAN NORMAL RANGE MONITORS	Rev. 33 Page 13 of 14

ATTACHMENT 1**VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT**

1. Sample I.D. K-6 Charmar 2. Sample No. 16-8-841
 3. Sample Date 11-30-16 4. Sample Time 1514 5. MWT 1911
 6. Count Date 11-30-16 7. Count Time 1537
 8. Monitor Reading ($\mu\text{Ci/cc}$) 2.78E-7 9. Process Flow Rate (CFM) 93000
 10. Sample Volume (mL) 48000

Isotope	k_i $\mu\text{Ci/mL}$	Dose Factor Vent DFV _i		Product $k_i \times \text{DFV}_i$
		$\frac{\text{mrem}}{\text{yr}}$	$\frac{\text{m}^3}{\mu\text{Ci}}$	
Xe 133	<u>None Identified</u>	294		<u>None Identified</u>
Kr 85m		1.17E3		
Kr 88		1.47E4		
Xe 135		1.81E3		
Kr 87		5.92E3		
Xe 138		8.83E3		
Xe 135m		3.12E3		
Xe 133m		2.51E2		
Ar 41		8.84E3		
N 13		8.83E3 **		
16. $\sum k_i =$	<u>N/A</u>	16a. $\sum (k_i \cdot \text{DFV}_i) =$	<u>N/A</u>	

Flow Meter ID# L-729Cal Due Date 10-6-1714. Bkg = Instrument background
Bkg = 7.67E-7 $\mu\text{Ci/cc}$ 15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
(atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{\text{N/A}}{\text{N/A}}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } (1.81E-4)) =$$

$$\text{Limit} = L = \frac{1.06}{(93000)(4.3E-6)} (1.81E-4) = 4.80E-4$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0)(4.80E-4) = 4.80E-4 \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: SL Date: 11-30-16Independent Verification by: 8 Date: 11-30-16

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. NS791009 K-6 2. Sample No. 15-2125
 3. Sample Date 4-16-15 4. Sample Time 1600 5. MWT 1911
 6. Count Date 4-16-15 7. Count Time 1614
 8. Monitor Reading ($\mu\text{Ci/cc}$) 1.70E-7 9. Process Flow Rate (CFM) 93,000
 10. Sample Volume (mL) 4.35E4

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$	13 Product $k_i \times \text{DFV}_i$ $\frac{\text{m}^3}{\mu\text{Ci}}$
Xe 133	None Identified	294	None Identified
Kr 85m		1.17E3	
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41		8.84E3	
N 13		8.83E3 **	
16. $\sum k_i$ =	N/A	16a. $\sum (k_i \text{ DFV}_i)$ =	N/A

Flow Meter ID# L729Cal Due Date: 10-6-1714. Bkg = Instrument background
Bkg = $\mu\text{Ci/cc}$ 15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
(atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{\text{N/A}}{\text{N/A}}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(93,000)(4.3E-6)} \times \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81E-4) =$$

$$\text{Limit} = L = \frac{1.06}{(93,000)(4.3E-6)} (1.81E-4) = 4.80E-4$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0)(4.80E-4) = 4.80E-4 \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: ZAKESKY Date: 4-16-15Independent Verification by: ZAKESKY Date: 4-16-15

DAEC DUANE ARNOLD ENERGY CENTER	SURVEILLANCE TEST PROCEDURE TITLE: K6 CALIBRATION	STP NS791009 Page 64 of 66 Rev. 14
	Performance Date: <u>9-6-13</u>	<u>INITIALS</u>

7.15.6 Record the following AS LEFT values:

a. AS LEFT HI-HI ALARM SETPOINT (from Step 7.15.4):

4.50E-4 ⁹⁻⁶⁻¹³ 9.80E-4 $\mu\text{Ci/cc}$

b. AS LEFT HI ALARM SETPOINT (from Prerequisite 6.3.1):

3.5E-6 $\mu\text{Ci/cc}$

c. AS LEFT BACKGROUND (from Step 7.13.50 or 7.14.49):

7.84E-7 $\mu\text{Ci/cc}$

7.15.7 At the Kaman EMS IDT, verify the following has been correctly entered into the EMS database:

a. HI-HI alarm setpoint (from Step 7.15.6.a)

b. HI alarm setpoint (from Step 7.15.6.b)

c. Background concentration (from Step 7.15.6.c)

7.15.8 Update database values on the status board and in Labstats.

7.15.9 Attach completed setpoint calculation documentation (Step 7.15.4) to this STP.

(PRINT / SIGN)

<u>Larry Isaacs</u>	/ <u>Larry Isaacs</u>	<u>9-6-13</u>	<u>1309</u>	<u>RA</u>
<u>Richard Potter</u>	/ <u>Richard Potter</u>	<u>9-6-13</u>	<u>1312</u>	<u>GP</u>
Performed by:		Date:	Time:	Init.

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. K8 Char May 2. Sample No. 17-2246
 3. Sample Date 4-13-17 4. Sample Time 1249 5. MWT 1900
 6. Count Date 4-13-17 7. Count Time 1254
 8. Monitor Reading ($\mu\text{Ci/cc}$) 8.76×10^{-9} 9. Process Flow Rate (CFM) 93000
 10. Sample Volume (mL) 47500

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$ $\frac{\text{m}^3}{\mu\text{Ci}}$	13 Product $k_i \times \text{DFV}_i$
Xe 133	none identified	294	none identified
Kr 85m		1.17E3	
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41		8.84E3	
N 13		8.83E3 **	
16. $\sum k_i =$	<u>N/A</u>	16a. $\sum (k_i \text{ DFV}_i) =$	<u>N/A</u>

Flow Meter ID# L-729
 Cal Due Date: 10-6-17

14. Bkg = Instrument background
 Bkg = 4.47×10^{-7} $\mu\text{Ci/cc}$

15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
 (atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{N/A}{N/A} = \frac{N/A}{N/A}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of } \#16b \text{ OR } 1.81\text{E-4}) =$$

$$\text{Limit} = L = \frac{1.06}{(93,000)(4.3 \times 10^{-6})} (1.81 \times 10^{-4}) = 4.80 \times 10^{-4}$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (4.80 \times 10^{-4}) = 4.80 \times 10^{-4} \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: B. Schind Date: 4-13-17

Independent Verification by: Randy Isaacs Date: 4-13-17

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. Kaman 8 2. Sample No. 15-5934
 3. Sample Date 10-8-15 4. Sample Time 1130 5. MWT 1911
 6. Count Date 10-8-15 7. Count Time 1139
 8. Monitor Reading ($\mu\text{Ci/cc}$) $7.59e^{-9}$ 9. Process Flow Rate (CFM) 93000
 10. Sample Volume (mL) 45e4

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$ $\frac{\text{m}^3}{\mu\text{Ci}}$	13 Product $k_i \times \text{DFV}_i$
Xe 133	<u>None Ident.</u>	294	<u>None</u>
Kr 85m		1.17E3	<u>Identified</u>
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41		8.84E3	
N 13	<u>$4.62e^{-9}$</u>	8.83E3 **	<u>$4.08e^{-5}$</u>
16. $\sum k_i$	<u>$4.62e^{-9}$</u>	16a. $\sum (k_i \text{ DFV}_i)$	<u>$4.08e^{-5}$</u>

Flow Meter ID# L 729Cal Due Date: 10-6-1714. Bkg = Instrument background
Bkg = $3.33e^{-7}$ $\mu\text{Ci/cc}$ 15. $X/Q = 4.3 \times 10^{-4} \text{ sec/m}^3$
(atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{4.62e^{-9}}{4.08e^{-5}} = 1.13e^{-4}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(93000)(4.3e^{-4})} \times \frac{1.13e^{-4}}{4.08e^{-5}} = \frac{1.06}{(93000)(4.3e^{-4})} \times (1.13e^{-4}) = 2.9e^{-4}$$

$$\text{Limit} = L = \frac{1.06}{(93000)(4.3e^{-4})} (1.13e^{-4}) = 2.9e^{-4}$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (3.00e^{-4}) = 3.00e^{-4} \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: [Signature]Date: 10-8-15Independent Verification by: [Signature]Date: 10-8-15

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. Kaman 8 2. Sample No. 14-2491
 3. Sample Date 4-29-14 4. Sample Time 1103 5. MWT 1901
 6. Count Date 4-29-14 7. Count Time 1110
 8. Monitor Reading ($\mu\text{Ci/cc}$) 1.22 E-7 9. Process Flow Rate (CFM) 93000
 10. Sample Volume (mL) 48600

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$	13 Product $k_i \times \text{DFV}_i$ $\frac{\text{m}^3}{\mu\text{Ci}}$
Xe 133	NONE	294	NONE
Kr 85m	Identified	1.17E3	Identified
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41		8.84E3	
N 13		8.83E3 **	
16. $\sum k_i =$	N/A	16a. $\sum (k_i \text{ DFV}_i) =$	N/A

Flow Meter ID# L 760Cal Due Date: 5-7-1414. Bkg = Instrument background
Bkg = N/A $\mu\text{Ci/cc}$ 15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
(atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{N/A}{N/A} = N/A$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81E-4) =$$

$$\text{Limit} = L = \frac{1.06}{(93000)(4.3 E^{-6})} (1.81 E^{-4}) = 4.80 E^{-4} \checkmark$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (4.80 E^{-4}) = 4.80 E^{-4} \mu\text{Ci/cc} \checkmark$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: [Signature] Date: 4-29-14Independent Verification by: [Signature] Date: 4-29-14

[Signature]
4-29-14

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. K-12 Charmar 2. Sample No. 17-2396
 3. Sample Date 4-20-17 4. Sample Time 1322 5. MWT 1910
 6. Count Date 4-20-17 7. Count Time 1345
 8. Monitor Reading ($\mu\text{Ci/cc}$) $2.61\text{E}-8$ 9. Process Flow Rate (CFM) 75000
 10. Sample Volume (mL) 48,000

Isotope	k_i $\mu\text{Ci/mL}$	Dose Factor Vent DFV _i		Product $k_i \times \text{DFV}_i$
		mrem yr	$\frac{\text{m}^3}{\mu\text{Ci}}$	
Xe 133	<u>None Ident</u>	294		<u>None Ident</u>
Kr 85m		1.17E3		
Kr 88		1.47E4		
Xe 135		1.81E3		
Kr 87		5.92E3		
Xe 138		8.83E3		
Xe 135m		3.12E3		
Xe 133m		2.51E2		
Ar 41		8.84E3		
N 13		8.83E3 **		
16. $\sum k_i =$	<u>N/A</u>	16a. $\sum (k_i \text{ DFV}_i) =$	<u>N/A</u>	

Flow Meter ID# L-729Cal Due Date: 10-6-1714. Bkg = Instrument background
Bkg = $4.05\text{E}-7$ $\mu\text{Ci/cc}$ 15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
(atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{N/A}{N/A} = N/A$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81\text{E-4}) =$$

$$\text{Limit} = L = \frac{1.06}{(75000)(4.3\text{E-6})} (1.81\text{E-4}) = 5.95\text{E-4}$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0)(5.95\text{E-4}) = 5.95\text{E-4 } \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: RK Date: 4-20-17Independent Verification by: 46 Date: 4-20-17

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. Kaman 12 2. Sample No. 15-6930
 3. Sample Date 11-19-15 4. Sample Time 13:18 5. MWT 1910
 6. Count Date 11-19-15 7. Count Time 13:27
 8. Monitor Reading ($\mu\text{Ci/cc}$) $5.3e^{-7}$ 9. Process Flow Rate (CFM) 7500
 10. Sample Volume (mL) 3.99e4

Isotope	11 k_i $\mu\text{Ci/mL}$	12 Dose Factor Vent DFV _i $\frac{\text{mrem}}{\text{yr}}$	13 Product $k_i \times \text{DFV}_i$ $\frac{\text{m}^3}{\mu\text{Ci}}$
Xe 133		294	
Kr 85m		1.17E3	
Kr 88		1.47E4	
Xe 135		1.81E3	
Kr 87		5.92E3	
Xe 138		8.83E3	
Xe 135m		3.12E3	
Xe 133m		2.51E2	
Ar 41		8.84E3	
N 13	<u>$5.4e^{-4}$</u>	8.83E3 **	<u>$4.80e^{-5}$</u>
16. $\sum k_i =$	<u>$5.44e^{-7}$</u>	16a. $\sum (k_i \cdot \text{DFV}_i) =$	<u>$4.80e^{-5}$</u>

Flow Meter ID# L715
 Cal Due Date: 9-12-17

14. Bkg = Instrument background
 Bkg = $5.79e^{-7}$ $\mu\text{Ci/cc}$

15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
 (atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{5.44e^{-7}}{4.80e^{-5}} = 1.13e^{-4}$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81E-4) =$$

$$\text{Limit} = L = \frac{1.06}{(7500)(4.3 \times 10^{-6})} (1.13e^{-4}) = 3.71e^{-4}$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (3.71e^{-4}) = 3.71e^{-4} \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: [Signature] Date: 11-19-15

Independent Verification by: [Signature] Date: 11-19-15

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ATTACHMENT 1

VENT MONITORS GASEOUS DETECTOR HI HI SETPOINT

1. Sample I.D. K12 Charmer 2. Sample No. 14-438
 3. Sample Date 1-22-14 4. Sample Time _____ 5. MWT 1911
 6. Count Date 1-22-14 7. Count Time 1252
 8. Monitor Reading ($\mu\text{Ci/cc}$) 1.44e-7 9. Process Flow Rate (CFM) 75000
 10. Sample Volume (mL) 48600

Isotope	k_i $\mu\text{Ci/mL}$	Dose Factor Vent DFV _i		Product $k_i \times \text{DFV}_i$
		$\frac{\text{mrem}}{\text{yr}}$	$\frac{\text{m}^3}{\mu\text{Ci}}$	
Xe 133	N/A	294	N/A	N/A
Kr 85m		1.17E3		
Kr 88		1.47E4		
Xe 135		1.81E3		
Kr 87		5.92E3		
Xe 138		8.83E3		
Xe 135m		3.12E3		
Xe 133m		2.51E2		
Ar 41		8.84E3		
N 13		8.83E3 **		N/A
16. $\sum k_i =$	N/A	16a. $\sum (k_i \text{ DFV}_i) =$	N/A	

Flow Meter ID# L729Cal Due Date: 10-9-1414. Bkg = Instrument background
Bkg = 4.61E-7 $\mu\text{Ci/cc}$ 15. $X/Q = 4.3 \times 10^{-6} \text{ sec/m}^3$
(atmospheric dispersion)

** Arbitrarily set equal to Xe-138

$$16b. \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{(\#16)}{(\#16a)} = \frac{N/A}{N/A} = N/A$$

$$17. \text{Limit} = L = \frac{1.06}{(F)(X/Q)} \times \frac{\sum k_i}{\sum (k_i \cdot \text{DFV}_i)} = \frac{1.06}{(\#9)(\#15)} \times (\text{The lesser of \#16b OR } 1.81E-4) =$$

$$\text{Limit} = L = \frac{1.06}{(75000)(4.3 \times 10^{-6})} \left(\frac{1}{1.51E-4} \right) = \frac{5.95E-5}{1.22E-4} = 5.95E-4$$

$$18. \text{Hi Hi ALARM} = A \times (\#17) = (1.0) (5.95E-5) = 5.95E-5 \mu\text{Ci/cc}$$

The radioactive gas flow corresponding to the Hi Hi setpoint:

Performed by: Reley Date: 1-22-14Independent Verification by: Sikma Date: 1-22-14

START 1159

STOP 1825

46800 - 1.80 LPM

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LIQUID EFFLUENT RADIOACTIVITY MONITOR SETPOINT

1. Sample No. 17-5499
2. Sample Date & Time 8-28-17 / 0035
3. Stream/Monitor Description GSW RM - 4767
4. Effluent Monitor Reading (cps) 10
5. Effluent Flow (gpm) 9600
6. Average effluent flow during time represented by sample, F_1 (gpm) N/A
7. Average dilution (discharge canal) flow during time represented by sample, F_2 (gpm) N/A
8. Monitor calibration factor, g , (cps/ μ Ci/mL) 2.19e6
9. Previous alarm value setpoint (cps) 765
10. Fraction to apply as a safety margin, $A = 0.5$

$$\text{Setpoint} = 10 \times \left[\frac{\sum_i K_i}{\sum_i (K_i + WEC_i)} \times g \times \frac{F_2}{F_1} \times A \right] + Bkg = \text{Setpoint} = 10 \times \left[\frac{(15)(8)(7)}{(16)(6)} \times (10) \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(15)(8)(7)}{(16)(6)} \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(1.06e^{-2})(2.19e^6)(N/A)}{(219)(N/A)} \right] + (10)$$

$$11. \text{ Setpoint} = \frac{1060 - 288-28-17}{540} \checkmark$$

$$\text{Fractional Change} = \frac{\text{New value} - \text{Previous Value}}{\text{Previous Value}} = \frac{(11) - (9)}{(9)} = \frac{(540) - (765)}{(765)}$$

$$12. \text{ Fractional Change} = -0.294 \checkmark$$

If fractional change is greater than ± 0.3 , adopt a new monitor alarm setting.

Continuous Monitor Hi Alarm = Setpoint

$$13. \text{ Monitor Hi Alarm} = 765 \checkmark$$

$$14. \text{ Radwaste Monitor Hi Alarm} = .16 (11) = .16 () = N/A \text{ cps} \checkmark$$

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LIQUID EFFLUENT RADIOACTIVITY MONITOR SETPOINT

1. Sample No. 15-7198 ✓ 2. Sample Date & Time 12-1-15/11:03 ✓
 3. Stream/Monitor Description GSW rad monitor RM-4767 ✓
 4. Effluent Monitor Reading (cps) 10 ✓
 5. Effluent Flow (gpm) 9600 gpm ✓
 6. Average effluent flow during time represented by sample, F_1 (gpm) NR ✓
 7. Average dilution (discharge canal) flow during time represented by sample, F_2 (gpm) NR ✓
 8. Monitor calibration factor, g , (cps/ μ Ci/mL) ~~162.15~~ 2.19 e⁶ ✓
 9. Previous alarm value setpoint (cps) 765 cps ✓
 10. Fraction to apply as a safety margin, $A = 0.5$

$$\text{Setpoint} = 10 \times \left[\frac{\sum_i K_i}{\sum_i (K_i + WEC_i)} \times g \times \frac{F_2}{F_1} \times A \right] + Bkg = \text{Setpoint} = 10 \times \left[\frac{(15)(8)(7)}{(16)(6)} \times (10) \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(15)(8)(7)}{(16)(6)} \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(9.43 \text{ e}^{-3})(2.19 \text{ e}^6)(\text{NR})}{(177.54)(\text{NR})} \right] + (10)$$

11. Setpoint = 592 ✓

$$\text{Fractional Change} = \frac{\text{New value} - \text{Previous Value}}{\text{Previous Value}} = \frac{(11) - (9)}{(9)} = \frac{(592) - (765)}{(765)}$$

12. Fractional Change = -0.226 ✓

If fractional change is greater than ± 0.3 , adopt a new monitor alarm setting.

Continuous Monitor Hi Alarm = Setpoint

13. Monitor Hi Alarm = 765 cps ✓

14. Radwaste Monitor Hi Alarm = $.16(11) = .16(\quad) = \underline{\text{N/A}}$ cps ✓

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LIQUID EFFLUENT RADIOACTIVITY MONITOR SETPOINT

- Sample No. 14-1787 ✓
- Sample Date & Time 3-28-14/0030 ✓
- Stream/Monitor Description G5W 4767 ✓
- Effluent Monitor Reading (cps) 9 ✓
- Effluent Flow (gpm) 9600 ✓
- Average effluent flow during time represented by sample, F₁ (gpm) N/A ✓
- Average dilution (discharge canal) flow during time represented by sample, F₂ (gpm) N/A ✓
- Monitor calibration factor, g, (cps/μCi/mL) 2.19E6 ✓
- Previous alarm value setpoint (cps) 2254 ✓
- Fraction to apply as a safety margin, A = 0.5 ✓

$$\text{Setpoint} = 10 \times \left[\frac{\sum_i K_i}{\sum_i (K_i + WEC_i)} \times g \times \frac{F_2}{F_1} \times A \right] + Bkg = \text{Setpoint} = 10 \times \left[\frac{(15)(8)(7)}{(16)(6)} \times (10) \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(15)(8)(7)}{(16)(6)} \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(7.69E-3)(2.19E6)(N/A)}{(111.32)(N/A)} \right] + (9)$$

11. Setpoint = 765 ✓

$$\text{Fractional Change} = \frac{\text{New value} - \text{Previous Value}}{\text{Previous Value}} = \frac{(11) - (9)}{(9)} = \frac{(765) - (2254)}{(2254)}$$

12. Fractional Change = -0.66 ✓

If fractional change is greater than ±0.3, adopt a new monitor alarm setting.

Continuous Monitor Hi Alarm = Setpoint

13. Monitor Hi Alarm = 765 ✓

14. Radwaste Monitor Hi Alarm = .16 (11) = .16 (N/A) = N/A cps ✓

DAEC DUANE ARNOLD ENERGY CENTER	SURVEILLANCE TEST PROCEDURE TITLE: RHR SW RADIATION MONITOR CALIBRATION RM-1997	STP NS790305 Page 6 of 18 Rev. 14
	Prerequisites	Performance Date: <u>2-13-17</u>
	<u>INITIALS</u>	

6.0 PREREQUISITES

- 6.1 From the Chemistry Supervisor, obtain the current UPSCALE HI alarm setpoint. Record below and in the trip column of the step indicated.

RD
Chemistry

Step 7.1.10 614 cps

- 6.2 From the Chemistry Supervisor, obtain the current high voltage setting. Record below and in the step indicated.

RD
Chemistry

Step 7.1.25 750 VDC

RD

NOTE

Original Transfer Calibration Count Rate is the count rate of the 8 μ Ci source taken from the last time that the mockup was used to determine the detector efficiency. This can be found in the Effluent Monitor Alarm Setpoint book. It is then decay corrected to the date that this STP is being performed.

- 6.3 From the Chemistry Supervisor, obtain the following source information and record below:

6.3.1 Original Trans Cal Count Rate 2.29E4 cps

RD
Chemistry

6.3.2 Source Number UID# 647 Cs-137

RD
Chemistry

6.3.3 Original Date of Cal Count Rate 8-24-15

RD
Chemistry

6.3.4 Geometry Point

RD
Chemistry

6.3.5 Old Efficiency 6.62E-7 μ Ci/cc/cps

RD
Chemistry

- 6.4 Decay correct the Original Transfer Calibration Count Rate. Record and transfer the value to the step indicated below:

RD
Chemistry

Decay Corrected Transfer Count Rate 2.21E4 cps

(Transfer to Step 7.1.37.)

- 6.5 As directed by PCP 8.7, analyze a sample of unfiltered reactor water and calculate the UPSCALE HI setpoint. Record below and in the trip column of the table listed.

RD
Chemistry

Step 7.1.28 421 cps

w/o 40328724

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LIQUID EFFLUENT RADIOACTIVITY MONITOR SETPOINT

1. Sample No. 15-4896
2. Sample Date & Time 8-24-15 / 0027
3. Stream/Monitor Description Rm-1997 (RM/LSW/ESW)
4. Effluent Monitor Reading (cps) 30
5. Effluent Flow (gpm) 4800
6. Average effluent flow during time represented by sample, F_1 (gpm) N/A
7. Average dilution (discharge canal) flow during time represented by sample, F_2 (gpm) N/A
8. Monitor calibration factor, g , (cps/ μ Cl/mL) $1.51e^6$
9. Previous alarm value setpoint (cps) 614
10. Fraction to apply as a safety margin, $A = 0.5$

$$\text{Setpoint} = 10 \times \left[\frac{\sum_i K_i}{\sum_i (K_i + WEC_i)} \times g \times \frac{F_2}{F_1} \times A \right] + Bkg = \text{Setpoint} = 10 \times \left[\frac{(15)(8)(7)}{(16)(6)} \times (10) \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(15)(8)(7)}{(16)(6)} \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(\text{Late } 1.10e^{-2})(1.51e^6)(N/A)}{(\text{Late } 108.078)(N/A)} \right] + (30)$$

153.84

11. Setpoint = ~~735.6~~ 569.85
- Fractional Change = $\frac{\text{New value} - \text{Previous Value}}{\text{Previous Value}} = \frac{(11) - (9)}{(9)} = \frac{(\text{Late } 569.9) - (614)}{(614)}$
12. Fractional Change = ~~0.20~~ - 0.07

If fractional change is greater than ± 0.3 , adopt a new monitor alarm setting.

Continuous Monitor Hi Alarm = Setpoint

13. Monitor Hi Alarm = 614
14. Radwaste Monitor Hi Alarm = $.16(11) = .16() = \text{N/A}$ cps

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LIQUID EFFLUENT RADIOACTIVITY MONITOR SETPOINT

- Sample No. 14-884
- Sample Date & Time 2-14-10 / 0021
- Stream/Monitor Description RHESW / ESWS Rm 177
- Effluent Monitor Reading (cps) 25
- Effluent Flow (gpm) RHESW 'A' = 4800 gpm / RHESW 'B' = 4800 gpm
- Average effluent flow during time represented by sample, F_1 (gpm) N/A
- Average dilution (discharge canal) flow during time represented by sample, F_2 (gpm) N/A
- Monitor calibration factor, g , (cps/ μ Ci/mL) 1.5186
- Previous alarm value setpoint (cps) 614
- Fraction to apply as a safety margin, $A = 0.5$

$$\text{Setpoint} = 10 \times \left[\frac{\sum_i K_i}{\sum_i (K_i + WEC_i)} \times g \times \frac{F_2}{F_1} \times A \right] + Bkg = \text{Setpoint} = 10 \times \left[\frac{(15)(8)(7)}{(16)(6)} \times (10) \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(15)(8)(7)}{(16)(6)} \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(.767E-3)(1.5186)(N/A)}{(.11186)(N/A)} \right] + (25)$$

11. Setpoint = 543 ✓

$$\text{Fractional Change} = \frac{\text{New value} - \text{Previous Value}}{\text{Previous Value}} = \frac{(11) - (9)}{(9)} = \frac{(543) - (614)}{(614)}$$

12. Fractional Change = -0.12 ✓

If fractional change is greater than ± 0.3 , adopt a new monitor alarm setting.

Continuous Monitor Hi Alarm = Setpoint \Rightarrow OLD SETPOINT ✓

13. Monitor Hi Alarm = 614 ✓

14. Radwaste Monitor Hi Alarm = $.16(11) = .16(N/A) =$ N/A cps

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LIQUID EFFLUENT RADIOACTIVITY MONITOR SETPOINT

1. Sample No. 17-316
2. Sample Date & Time 1-16-17 / 0016
3. Stream/Monitor Description RM-4268 RHASW/ESW Dilution Line (Rupture)
4. Effluent Monitor Reading (cps) 10
5. Effluent Flow (gpm) 9600
6. Average effluent flow during time represented by sample, F_1 (gpm) N/A
7. Average dilution (discharge canal) flow during time represented by sample, F_2 (gpm) N/A
8. Monitor calibration factor, g , (cps/ μ Ci/mL) 1.92×10^6
9. Previous alarm value setpoint (cps) 530
10. Fraction to apply as a safety margin, $A = 0.5$

$$\text{Setpoint} = 10 \times \left[\frac{\sum_i K_i}{\sum_i (K_i + WEC_i)} \times g \times \frac{F_2}{F_1} \times A \right] + Bkg = \text{Setpoint} = 10 \times \left[\frac{(15)(8)(7)}{(16)(6)} \times (10) \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(15)(8)(7)}{(16)(6)} \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(8.34 \times 10^{-3})(1.92 \times 10^6)(N/A)}{(139.13)(N/A)} \right] + (10)$$

11. Setpoint = 585.5

$$\text{Fractional Change} = \frac{\text{New value} - \text{Previous Value}}{\text{Previous Value}} = \frac{(11) - (9)}{(9)} = \frac{(585.5) - (530)}{(530)}$$

12. Fractional Change = 0.105

If fractional change is greater than ± 0.3 , adopt a new monitor alarm setting.

Continuous Monitor Hi Alarm = Setpoint

13. Monitor Hi Alarm = 530

14. Radwaste Monitor Hi Alarm = $.16(11) = .16(\quad) = \underline{N/A}$ cps

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LIQUID EFFLUENT RADIOACTIVITY MONITOR SETPOINT

- Sample No. 15-6175
- Sample Date & Time 10-19-15/0019
- Stream/Monitor Description RHRSW/ESW Rupture RM-4268
- Effluent Monitor Reading (cps) 20
- Effluent Flow (gpm) RHRSW A - 4800 gpm, RHRSW B 4800 gpm
- Average effluent flow during time represented by sample, F_1 (gpm) N/A
- Average dilution (discharge canal) flow during time represented by sample, F_2 (gpm) N/A
- Monitor calibration factor, g , (cps/ μ Ci/mL) 2.29E6
- Previous alarm value setpoint (cps) 863
- Fraction to apply as a safety margin, $A = 0.5$

$$\text{Setpoint} = 10 \times \left[\frac{\sum_i K_i}{\sum_i (K_i + WEC_i)} \times g \times \frac{F_2}{F_1} \times A \right] + Bkg = \text{Setpoint} = 10 \times \left[\frac{(15)(8)(7)}{(16)(6)} \times (10) \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(15)(8)(7)}{(16)(6)} \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(9.40E-3)(2.29E6)(N/A)}{(174.97)(N/A)} \right] + (20)$$

11. Setpoint = 668 ✓

$$\text{Fractional Change} = \frac{\text{New value} - \text{Previous Value}}{\text{Previous Value}} = \frac{(11) - (9)}{(9)} = \frac{(668) - (863)}{(863)}$$

12. Fractional Change = -0.226 ✓

If fractional change is greater than ± 0.3 , adopt a new monitor alarm setting.

Continuous Monitor Hi Alarm = Setpoint

13. Monitor Hi Alarm = 863 ✓

14. Radwaste Monitor Hi Alarm = .16 (11) = .16 () = N/A cps ✓

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LIQUID EFFLUENT RADIOACTIVITY MONITOR SETPOINT

- Sample No. 14-884
- Sample Date & Time 2-14-14 / 0021
- Stream/Monitor Description RHRSW/ESW RUPTURE: RM 4268
- Effluent Monitor Reading (cps) 20
- Effluent Flow (gpm) RHRSW A = 4800 gpm, RHRSW B = 4800 gpm
- Average effluent flow during time represented by sample, F_1 (gpm) N/A
- Average dilution (discharge canal) flow during time represented by sample, F_2 (gpm) N/A
- Monitor calibration factor, g , (cps/ μ Ci/mL) 2.29E6 ✓
- Previous alarm value setpoint (cps) 863 ✓
- Fraction to apply as a safety margin, A = 0.5

$$\text{Setpoint} = 10 \times \left[\frac{\sum_i K_i}{\sum_i (K_i + WEC_i)} \times g \times \frac{F_2}{F_1} \times A \right] + Bkg = \text{Setpoint} = 10 \times \left[\frac{(15)(8)(7)}{(16)(6)} \times (10) \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(15)(8)(7)}{(16)(6)} \right] + (4)$$

$$\text{Setpoint} = 5 \times \left[\frac{(7.67E-3) (2.29E6) (N/A)}{(111.86) (N/A)} \right] + (20)$$

11. Setpoint = 805 ✓

$$\text{Fractional Change} = \frac{\text{New value} - \text{Previous Value}}{\text{Previous Value}} = \frac{(11) - (9)}{(9)} = \frac{(805) - (863)}{(863)}$$

12. Fractional Change = -0.07 ✓

If fractional change is greater than ± 0.3 , adopt a new monitor alarm setting.

Continuous Monitor Hi Alarm = Setpoint DOES SETPOINT ✓

13. Monitor Hi Alarm = 863 ✓

14. Radwaste Monitor Hi Alarm = $.16(11) = .16(N/A) =$ N/A cps

3.7 PLANT SYSTEMS

3.7.8 Spent Fuel Storage Pool Water Level

LCO 3.7.8 The spent fuel storage pool water level shall be ≥ 36 ft.

APPLICABILITY: During movement of irradiated fuel assemblies in the spent fuel storage pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Spent fuel storage pool water level not within limit.	<p>A.1 -----NOTE----- LCO 3.0.3 is not applicable. -----</p> <p>Suspend movement of irradiated fuel assemblies in the spent fuel storage pool.</p>	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.8.1 Verify the spent fuel storage pool water level is ≥ 36 ft.	In accordance with the Surveillance Frequency Control Program

PROBABLE ANNUNCIATORS

- 1C03A A1 FUEL POOL EXHAUST HIGH-HIGH RADIATION
B1 FUEL POOL EXHAUST HIGH RADIATION
- 1C04B B6 NEW FUEL STORAGE AREA ARM HI RAD
- 1C04B C6 SPENT FUEL STORAGE AREA ARM HI RAD
- 1C05B C8 PCIS GROUP "3" ISOLATION INITIATED
- 1C09A A2 NW DRYWELL RADIATION LEVEL HI-HI
B2 NW DRYWELL RADIATION LEVEL HI
- 1C09B A2 SOUTH DRYWELL RADIATION LEVEL HI-HI
B2 SOUTH DRYWELL RADIATION LEVEL HI
- 1C35A A1 REFUELING FLOOR NORTH END HI RADIATION
A2 REFUELING FLOOR SOUTH END HI RADIATION

PROBABLE INDICATIONS

1. Lowering cavity and/or Spent Fuel Pool level on the 5th floor. **Visual**
2. Lowering cavity level Floodup Range on level indicator, LI-4541 (at 1C04).
3. Lowering Skimmer Surge Tank level on level indicator, LI-3412 (at 1C04). **not used in EAL**
4. Lowering Fuel Pool level on level indicator, LI-3413 (at 1C04).
5. Rising radiation levels on any of the following ARMs:
 - Spent Fuel Pool Area, RI-9178
 - North Refuel Floor, RI-9163
 - New Fuel Vault Area, RI-9153
 - South Refuel Floor, RI-9164
6. Rising Drywell radiation levels on either of the following (at 1C09):
 - NW Drywell Area Hi Range Rad Monitor, RIM-9184A
 - South Drywell Area Hi Range Rad Monitor, RIM-9184B