

Enclosure B
L-16-277

EAL Calculations for Beaver Valley Power Station, Unit No. 1
(219 Pages Follow)

Beaver Valley Power Station

Radiation Protection Technical Position/Evaluation/Calculation

Subject

**BVPS – U1 Gaseous Radioactivity Monitor
Emergency Action Levels**

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Reference

HPP _____

EPP _____

X

T/S _____

CR _____

DCP _____

Category



Technical Position



Technical Evaluation



Calculation

Unit 1

Unit 2



Purpose

To apply guidance contained in the NEI 99-01 EAL document to the appropriate gaseous radiation monitors at BVPS Unit 1.

Note: This Technical Evaluation is not an implementing document. Any application of the information contained herein must be reviewed and approved using the established review/approval process for that application.



ORIGINAL ISSUE

REVISION # 11

Revision description:

Revised to include guidance from NEI 99-01 revision 6, which changed the methodology for Alert Level Declarations.

by

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checked/reviewer

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10-27-15

independent review (calculation only)

N/A

date

Checklist

☒ Purpose☒ Methodology☒ Input Data☒ Results☒ References

Attachments

☒ Data Sheets☐ Illustrations☐ Printouts☐ Code Listings☒ Transmittal to BVRC☒ Original RP ERF FILE☐ MGR, Radiation Protection☐ Supt, Rad Ops☐ Supv, RP Services☐ Supv, Rad Waste/Effluents☐ Author: _____☒ Hal Szklinski BV-SIM☐ _____☐ _____

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DISCUSSION

This technical evaluation uses accident source terms, radiation monitor nuclide detection efficiencies, ODCM dispersion factors (X/Q), and nuclide dose conversion factors (TEDE and child thyroid) to calculate radiation monitor readings that correspond to offsite doses of 10, 100 and 1000 mrem TEDE and 50, 500 and 5000 mrem child thyroid. These are used as Emergency Action Level (EAL) indicators for the Alert, Site Area Emergency (SAE) and General Emergency (GE) classifications. The values shown in the results section are based on the most limiting of all accident type source terms and the ODCM annual average atmospheric dispersion factor (X/Q). These monitor indicator values are used in Emergency Plan Emergency Action Levels (EALs), EPP-I-1a. Additionally, indicators for the Unusual Event classification are listed. These are taken from ERS-HHM-87-014, and are simply multiples of the ODCM limit, i.e., 2xODCM limit for the Unusual Event (UE). The calculated radiation monitor readings may be used for Emergency Action Level (EAL) determination following an accident with consequent release of radioactivity, and when the results of more rigorous assessments are not available.

Revision 11 calculates EAL values associated with the most current NEI guidance from NEI 99-01 revision 6. Values are calculated for the Ventilation Vent gaseous effluent pathway, the Supplementary Leak Collection Release System (SLCRS) effluent pathway and Process Ventilation effluent release pathway. The Mirion monitors each have a low range and a high range noble gas channel. EAL values will be calculated for each range, however the value(s) provided in the Results will include only on-scale values.

The Mirion monitors can provide indication in units of uCi/s, uCi/cc or cps (low range) and amps (high range). While any of these could serve as the EAL value, the final values will be in units of uCi/s because they are valid at any release flow rate. ODCM flow rates are used in the calculations to the point of calculating flow dependent uCi/cc, but are unimportant when the EAL is expressed in units of uCi/s. Values expressed as uCi/cc or cps/amps will vary with release flow rate and are accurate only at the flow rate used to calculate them. This limitation applies to all monitors that are incapable of indication in units of uCi/s. This is consistent with the Unit 2 monitors, where the wide range gas monitor and the main steam monitor indicate in units of uCi/s, and the EAL values are expressed as uCi/s.

METHODOLOGY

The methodology described below remains unchanged from previous revisions. Previously, the Unit 1 effluent radiation monitors only indicated in cpm. The Mirion monitors indicate in cps (counts per second), uCi/cc and uCi/s. Because this is similar to Unit 2 monitors (see ERS-MPD-93-008), conversion methodology used for those monitors is used in this technical evaluation.

The bases for the EAL values for the four emergency classifications are:

UE ODCM limit multiplied by two (x2) for greater than 60 minutes.

Alert Effluent pathway radiation monitor indication that corresponds to 10 mrem TEDE or 50 mrem child thyroid dose at the site boundary. The lower of the two values is used.

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SAE Effluent pathway radiation monitor indication that corresponds to 100 mrem TEDE or 500 mrem child thyroid dose at the site boundary. The lower of the two values is used.

GE Effluent pathway radiation monitor indication that corresponds to 1000 mrem TEDE or 5000 mrem child thyroid dose at the site boundary. The lower of the two values is used.

For the Alert, SAE and GE evaluations a release duration is necessary to calculate an integrated dose. Consistent with previous revisions, a release duration of one hour is used.

All of the UFSAR accidents that have a radiological consequence analysis, and several variants of the Loss of Coolant Accident (LOCA) are considered, each having a unique source term. The radiation monitor EAL for each radiation monitor is the lowest monitor indication calculated among all accident types associated with that release pathway.

When input data more specific to accident and actual meteorological conditions are used to perform a dose projection, the results are expected to differ to some degree. Efforts to obtain effluent or environmental samples followed-up with isotopic analysis should be made to produce a more accurate assessment of offsite dose following any release of radioactivity that may warrant a protective action recommendation.

The following is a description of the math performed by the EXCEL spreadsheets used in this Technical Evaluation.

An EXCEL spreadsheet was made for each accident type and radiation monitor combination that is appropriate for the accident type. Each spreadsheet consists of 15 columns with a row for each radionuclide. At the bottom of each spreadsheet, there is a section used to convert cps (low range) or amps (high range) to TEDE and child thyroid CDE. Additionally, each spreadsheet has cells used for inputting release flow rate (cfm) and the atmospheric dispersion factor (X/Q) (s/m³). Details of all spreadsheet math is provided below:

Column 1 – List of the individual isotopes that comprise the accident source term. Each isotope occupies a row.

Column 2 – Total release quantity (Ci) for each isotope specific to the accident type.

Column 3 – Activity fraction for each nuclide. This is a unitless fraction of the total for each nuclide calculated by:

$$\text{Col 3 fraction} = \frac{\text{col 2} / \sum \text{col 2}}{\text{Ci} / \text{Ci}}$$

Column 4 & 10 - List of the TEDE & child thyroid dose conversion factors (DCFs) for each radionuclide (mrem-m³/uCi-yr).

Column 5 & 11 – Effective DCF

$$\text{Col 5 or Col 11 (mrem-m}^3\text{/uCi-yr)} = \text{unitless} * \text{col 3} * \text{col 4}$$

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The sum of column 5 & 11 represents mrem in a year at a concentration of 1 uCi/m³ of the total nuclide mix.

When calculations are complete to this point, a release rate conversion factor (uCi/s per mrem/hr) is calculated at the top of each spreadsheet. This is done separately for TEDE and for child thyroid dose as follows. Values in this example below are from the RM-1VS-109 Low worksheet for the LOCA with Gap activity accident TEDE.

The sum of column 3 (always 1 uCi/m³) is the specific accident mix total concentration that will result in the sum of column 5 dose, 7.24E2 mrem in a year. To calculate the associated release rate (uCi/s) from the point of release that will cause a concentration of 1 uCi/m³ at the EAB, 1 uCi/m³ is divided by the ODCM site boundary X/Q for the release point (1.03E-4 s/m³).

$$\frac{1 \text{ uCi}}{\text{m}^3} * \frac{\text{m}^3}{1.03\text{E}-4 \text{ s}} = \frac{9.71\text{E}3 \text{ uCi}}{\text{s}}, \text{ release rate for 1 year will deliver } 7.24\text{E}2 \text{ mrem TEDE}$$

$$\text{Converting the dose to mrem/h, } \frac{7.24\text{E}2 \text{ mrem}}{\text{yr}} * \frac{\text{yr}}{8760 \text{ h}} = \frac{8.26\text{E}-2 \text{ mrem}}{\text{h}}$$

Therefore, a release rate of 9.71E3 uCi/s will produce a dose rate of 8.26E-2 mrem/h.

Dividing 9.71E3 uCi/s by 8.26E-2 mrem/h gives 1.17E5 uCi/s per mrem/hr. The simplified spreadsheet math for this is:

$$CF_{\text{TEDE}} = \frac{1 \text{ uCi}}{\text{m}^3} * \frac{\text{yr}}{7.24\text{E}2 \text{ mrem}} * \frac{8760 \text{ hr}}{\text{yr}} * \frac{\text{m}^3}{1.03\text{E}-4 \text{ s}} = \frac{1.17\text{E}5 \text{ uCi-hr}}{\text{s-mrem}}$$

or 1.17E5 uCi/s per mrem/hr TEDE for the full 1 uCi/m³ mix. The same is done for child thyroid dose using the sum of column 11 instead of column 5.

As this uCi/s/mrem/hr TEDE or child thyroid dose conversion factor (CF) value is the calculated release rate is for 1 uCi/m³ of the total mix, it can be used as a release rate conversion factor for each nuclide by multiplying this conversion factor by each column 3 nuclide fraction.

Column 6 & column 12 – Release rate (uCi/s/mrem/hr) that, for each nuclide in the specific accident mix, will result in a TEDE or child thyroid dose rate of 1 mrem per hour of exposure to the total mix.

$$\text{uCi/s/mrem/hr} = \frac{\text{col 3}}{\text{unitless fraction}} * \frac{\text{conversion factor (TEDE or child thyroid)}}{CF_{\text{TEDE or child thyroid}} (\text{uCi/s/mrem/hr})}$$

Column 7 & 13 – Release concentration (uCi/cc) that, for each nuclide in the specific accident mix, will result in a TEDE and child thyroid dose rate of 1 mrem per hour of exposure to the total mix.

$$\text{uCi/cc/mrem/hr} = \frac{\text{col 6 \& 12 / flow rate}}{\text{uCi/s/mrem/hr / cc/s}}$$

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The release pathway flow rate (cfm) listed in the ODCM for the radiation monitor is entered in a cell at the top of each spreadsheet and converted to cc/s.

Column 8 & 14 – List of the monitor specific isotope detection efficiencies. A set of calculations is done for the low range channel (isotope efficiencies in units of cps/uCi/cc) and a set for the high range channel (isotope efficiencies in units of amps/uCi/cc).

Column 9 & 15 – The radiation monitor count rate (cps) or current (amps) that, if sustained for 1 hour, will cause 1 mrem TEDE and child thyroid dose to an individual located at the EAB.

$$\text{cps/mrem/hr} = \frac{\text{col 7 \& 13}}{\text{uCi/cc/mrem/hr}} * \frac{\text{col 8 \& col 14}}{\text{cps/uCi/cc}}$$

The sum of column 9 is the monitor count rate or current that will cause 1 mrem TEDE in 1 hour at the EAB for the specific accident mix. The sum of column 15 is the monitor count rate or current that will cause 1 mrem child thyroid dose in 1 hour at the EAB for the specific accident mix.

Monitor response at the EAL doses of 10, 100 and 1000 mrem for TEDE, and 50, 500 and 5000 mrem child thyroid dose are calculated at the bottom of each spreadsheet. This is done in three sets of units:

1) EAL in cps for the low range channel. Substitute amps for cps for the high range channel.

$$\begin{aligned} \text{cps} &= \text{cps/mrem/hr} * \text{mrem/hr} \\ \text{EAL}_{\text{TEDE Alert}} &= \sum \text{col 9} * 10 \\ \text{EAL}_{\text{TEDE SAE}} &= \sum \text{col 9} * 100 \\ \text{EAL}_{\text{TEDE GE}} &= \sum \text{col 9} * 1000 \end{aligned}$$

$$\begin{aligned} \text{EAL}_{\text{child thy Alert}} &= \sum \text{col 15} * 50 \\ \text{EAL}_{\text{child thy SAE}} &= \sum \text{col 15} * 500 \\ \text{EAL}_{\text{child thy GE}} &= \sum \text{col 15} * 5000 \end{aligned}$$

2) EAL in uCi/cc for both the low range and the high range channels. Substitute amps for cps for the high range channel.

Each monitor channel has a volumetric efficiency value (cps or amps/uCi/cc) entered in the database. These are based on the ODCM nuclide mix for the pathway and are used to convert cps or amps to uCi/cc. The volumetric efficiency value is entered in each spreadsheet and the following math is performed for each EAL value.

$$\begin{aligned} \text{uCi/cc} &= \text{cps} / \text{cps/uCi/cc} \\ \text{EAL} &= \text{EAL} / \text{monitor conversion factor} \end{aligned}$$

3) EAL in uCi/s for both the low range and the high range channels

$$\begin{aligned} \text{uCi/s} &= \text{uCi/cc} * \text{cc/s} \\ \text{EAL} &= \text{EAL} * \text{pathway flow rate} \end{aligned}$$

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When expressed in units of $\mu\text{Ci/s}$, the EAL value will be valid with variation in the pathway flow rate.

INPUT DATA / ASSUMPTIONS

Reference

1. Release source terms

[7]

The release source terms used to determine the monitor EAL values are listed in the Attachment 1 spreadsheets.

2. Unit 1 release point data

[4, 8, 9]

Release Point	Radiation monitor	¹ Range	ODCM flow rate (cfm)	ODCM X/Q (s/m^3)
Ventilation Vent	RM-VS-109 Low Range	0.18 to 4.93E4 cps	62000	1.03E-04
	RM-VS-109 High Range	1.13E-13 to 9.36E-10 amps		
Supplementary Collection and Release System (SLCRS)	RM-VS-110 Low Range	0.18 to 4.93E4 cps	49300	9.24E-05
	RM-VS-110 High Range	1.13E-13 to 9.36E-10 amps		
Process Vent	RM-GW-109 Low Range	0.18 to 4.93E4 cps	1450	2.31E-06
	RM-GW-109 High Range	1.13E-13 to 9.36E-10 amps		

¹The listed monitor ranges are taken from Mirion 12-00038 Page 15 and 12-00023 Page 17 Xe-133 measured linearity testing. Actual range may be wider, however these data are sufficient to demonstrate that the calculated EAL values will be "on-scale". See Attachment 3 for additional discussion of the monitor measurement ranges.

3. Radiation monitor nuclide detection efficiencies

[10]

Detection efficiencies for each monitor and for each nuclide are taken from ERS-SFL-85-031 and are listed in the Attachment 1 spreadsheets.

4. Dose conversion factors

[11]

The TEDE conversion factors (DCF_s) are taken from ERS-MPD-91-046 (units of $\text{mrem-m}^3/\mu\text{Ci-yr}$). In this emergency dose projection application, 4-day dose from ground deposition is included. These DCF_s are equivalent to those in EPA Report 400 and are expressed with three significant digits.

The child thyroid conversion factors (DCF_s) are taken from ERS-MPD-91-046 (units of $\text{mrem-m}^3/\mu\text{Ci-yr}$). These were developed from child thyroid DCF_s provided in USNRC Regulatory Guide 1.109 Table E-9.

All DCF_s are listed in the Attachment 1 spreadsheets.

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5. Volumetric Monitor Detection Efficiency

[6]

The individual monitor volumetric detection efficiency is calculated associated with the ODCM and are taken from ERS-HHM-87-014. These values are used in the monitor database to convert detector signal (cps or amps) to uCi/cc. Note that these values are entered in the monitor database in units of cps or amps/Bq/m³ as provided in ERS-HHM-87-014.

Release Point	Radiation monitor	ODCM Volumetric Monitor Efficiency
Ventilation Vent	RM-VS-109 low range	6.92E4 cps/uCi/cc
	RM-VS-109 high range	3.94E-10 amps/uCi/cc
Supplementary Collection and Release System (SLCRS)	RM-VS-110 low range	8.54E4 cps/uCi/cc
	RM-VS-110 high range	3.31E-10 amps/uCi/cc
Process Vent	RM-VS-109 low range	6.71E4 cps/uCi/cc
	RM-VS-109 high range	3.97E-10 amps/uCi/cc

6. Accident Types

[Previously established basis]

Gap LOCA	Loss of Coolant Accident with release of a fraction of fuel rod gap activity
DBA LOCA	Design Basis Loss of Coolant Accident
RCS LOCA	Loss of Coolant Accident with release of T.S. limit concentration RCS activity
TID LOCA	TID 14844 source term release assumptions (failed ESFs)
SB LOCA	Small Break LOCA outside of containment
FHA	Fuel Handling Accident
RCCA	Rod Control Cluster Ejection Accident
LACP/LRA	Loss of Non-emergency AC Power/Locked (reactor coolant pump) Rotor Accident
MSLB	Main Steam Line Break
SGTR	Steam Generator Tube Rupture
GWS	Gaseous Waste System Failure

7. Accident Types and Applicable Release Pathways

[Previously established basis]

This technical evaluation provides conversions for all accident source terms for each radiation monitor. Because not all accident types necessarily have a release pathway applicable to each monitor, the following tables are provided to identify the most likely combinations.

Monitors RM-1VS-109 Ventilation Vent

DBA LOCA, GAP LOCA, RCS LOCA, TID LOCA, RCCA	Leakage via penetrations and/or in SI piping and equipment
SB LOCA	Piping in PAB
SGTR, LACP/LRA, GWS, MSLB, FHA	No reasonable path to this release point

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Monitors RM-1VS-110 SLCRS

DBA LOCA, GAP LOCA, RCS
LOCA, TID LOCA, RCCA

Leakage from penetrations and/or in SI piping
and equipment

FHA

Fuel handling accident in containment/FB

SB LOCA

Piping in safeguards

GWS, SGTR, MSLB, LACP/LRA

Not a significant source for this pathway

Monitors RM-1GW-109 Process Vent

Two accident types are used for this calculation: SGTR and GWS. Because the SGTR source term is based on a release via the main steam valves (unfiltered pathway), and the process vent is a normally filtered pathway, iodines in the release source term are reduced by 0.01 to account for removal by filtration for this application. This adjustment provides an appropriate nuclide mix for use in determining monitor response. The Low range monitor alarm set points are ODCM limit based.

For the EAL Unusual Event classification values for gaseous releases (multiples of the ODCM limit), an ODCM source term is used. Details regarding the ODCM limit value calculations may be found in the technical evaluation ERS-HHM-87-014.

8. Application of Monitor Background

Because the Mirion monitors have a background subtract feature, the indicated values are the net values. Therefore, monitor background need not be considered in the EAL calculation.

RESULTS

Attachment 1 details the calculations that determined the monitor EAL values listed in the below. See Attachment 2 for additional discussion regarding the monitor measurement ranges and on-scale values.

		From ERS-HHM-87-014 Based on ODCM limit multiple	Based on PAG dose values		
Release Point	Radiation monitor	UE (2x ODCM)	Alert	SAE	GE
Ventilation Vent	RM-1VS-109 low range	5.28E3 uCi/s	Out of range	Out of range	Out of range
	RM-1VS-109 high range	Out of range	1.18E+5 uCi/s	1.18E+6 uCi/s	1.18E+7 uCi/s

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		From ERS-HHM-87-014 Based on ODCM limit multiple	Based on PAG dose values		
Release Point	Radiation monitor	UE (2x ODCM)	Alert	SAE	GE
Supplementary Collection and Release System (SLCRS)	RM-1VS-110 low range	7.58E3 uCi/s	<i>Out of range</i>	<i>Out of range</i>	<i>Out of range</i>
	RM-1VS-110 high range	<i>Out of range</i>	1.56E+5 uCi/s	1.56E+6 uCi/s	1.56E+7 uCi/s

		From ERS-HHM-87-014 Based on ODCM limit multiple	Based on PAG dose values		
Release Point	Radiation monitor	UE (2x ODCM)	Alert	SAE	GE
Process Vent	RM-1GW-109 low range	<i>Out of range</i>	<i>Out of range</i>	<i>Out of range</i>	<i>Out of range</i>
	RM-1GW-109 high range	2.18E6 uCi/s	7.83E7 uCi/s	7.83E8 uCi/s	7.83E9 uCi/s

The values in the above tables have been compared to the monitor ranges to ensure that any used as an EAL value or alarm set point will be within the monitor range. Values outside of these ranges will be considered as off scale. See Attachment 2 for the discussion of the monitor range values.

REFERENCES

1. NEI 99-01, Methodology for Development of Emergency Action Levels, November 2012.
2. BVPS Offsite Dose Calculation Manual (ODCM), 1/2-ODC-2.02.
3. ERS-MPD-93-008, BVPS-2 Gaseous Radioactivity Monitor Emergency Action Levels
4. 1/2-ODC-2.02, ODCM: Gaseous Effluents
5. BVPS Emergency Plan Procedure EPP-I-1a, Recognition and Classification of Emergency conditions.

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6. ERS-HHM-87-014, BVPS Technical Evaluation, Unit 1/Unit 2 ODCM Gaseous Effluent Monitor Setpoints.
7. ERS-MPD-01-002, BVPS Technical Evaluation, Determination of Release Source Terms for BVPS Accidents for Emergency Planning Purposes.
8. Mirion document 12-00038, Primary Calibration Report for Noble Gas Monitor NGM 204
9. Mirion document 12-00023, Primary Calibration Report for Noble Gas Monitor NGM 203
10. ERS-SFL-85-031, BVPS Technical Evaluation, Gaseous Effluent Monitor Efficiency Data.
11. ERS-MPD-91-046, BVPS Technical Evaluation, Determination of Dose Conversion Factors for Use in EPP Emergency Action Level (EAL) Indicators.
12. USEPA 400-R-92-001, "Manual of Protective Action Guides and Protection Actions for Nuclear Incidents".
13. USNRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I".

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Below is a summary of the calculation results. These are evaluated in Attachment 2 with regard to the upper and lower monitor measurement capabilities.

Alert, Site Area and General Emergency Calculation Summary – Release Point 1, Ventilation Vent:

	Alert Criteria (uCi/s)		SAE Criteria (uCi/s)		GE Criteria (uCi/s)		
	100 TEDE	500 Ch Thy	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
PING VS-109 Low	9.14E+05	2.01E+05	9.14E+06	2.01E+06	9.14E+07	2.01E+07	GAP LOCA
	1.04E+06	2.95E+05	1.04E+07	2.95E+06	1.04E+08	2.95E+07	DBA LOCA
	7.75E+06	2.14E+06	7.75E+07	2.14E+07	7.75E+08	2.14E+08	RCS LOCA
	3.62E+05	3.60E+05	3.62E+06	3.60E+06	3.62E+07	3.60E+07	TID LOCA
	8.34E+05	4.19E+05	8.34E+06	4.19E+06	8.34E+07	4.19E+07	SB LOCA
	1.56E+06	4.30E+06	1.56E+07	4.30E+07	1.56E+08	4.30E+08	RCCA
Minimum values =	2.01E+05		2.01E+06		2.01E+07		

	Alert Criteria (uCi/s)		SAE Criteria (uCi/s)		GE Criteria (uCi/s)		
	100 TEDE	500 Ch Thy	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
PING VS-109 High	1.30E+06	2.86E+05	1.30E+07	2.86E+06	1.30E+08	2.86E+07	GAP LOCA
	1.52E+06	4.30E+05	1.52E+07	4.30E+06	1.52E+08	4.30E+07	DBA LOCA
	5.07E+06	1.40E+06	5.07E+07	1.40E+07	5.07E+08	1.40E+08	RCS LOCA
	1.18E+05	1.18E+05	1.18E+06	1.18E+06	1.18E+07	1.18E+07	TID LOCA
	7.16E+05	3.60E+05	7.16E+06	3.60E+06	7.16E+07	3.60E+07	SB LOCA
	2.24E+06	6.19E+06	2.24E+07	6.19E+07	2.24E+08	6.19E+08	RCCA
Minimum values =	1.18E+05		1.18E+06		1.18E+07		

Alert, Site Area and General Emergency Calculation Summary – Release Point 2, SLCRS:

	Alert Criteria (uCi/s)		SAE Criteria (uCi/s)		GE Criteria (uCi/s)		
	100 TEDE	500 Ch Thy	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
PING VS-110 Low	8.26E+05	1.81E+05	8.26E+06	1.81E+06	8.26E+07	1.81E+07	GAP LOCA
	9.39E+05	2.66E+05	9.39E+06	2.66E+06	9.39E+07	2.66E+07	DBA LOCA
	7.00E+06	1.93E+06	7.00E+07	1.93E+07	7.00E+08	1.93E+08	RCS LOCA
	3.27E+05	3.25E+05	3.27E+06	3.25E+06	3.27E+07	3.25E+07	TID LOCA
	7.53E+05	3.78E+05	7.53E+06	3.78E+06	7.53E+07	3.78E+07	SB LOCA
	2.88E+06	6.83E+06	2.88E+07	6.83E+07	2.88E+08	6.83E+08	FHA
Minimum values =	1.81E+05		1.81E+06		1.81E+07		

	Alert Criteria (uCi/s)		SAE Criteria (uCi/s)		GE Criteria (uCi/s)		
	100 TEDE	500 Ch Thy	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
PING VS-110 High	1.73E+06	3.79E+05	1.73E+07	3.79E+06	1.73E+08	3.79E+07	GAP LOCA
	2.01E+06	5.71E+05	2.01E+07	5.71E+06	2.01E+08	5.71E+07	DBA LOCA
	6.73E+06	1.86E+06	6.73E+07	1.86E+07	6.73E+08	1.86E+08	RCS LOCA
	1.57E+05	1.56E+05	1.57E+06	1.56E+06	1.57E+07	1.56E+07	TID LOCA
	9.50E+05	4.77E+05	9.50E+06	4.77E+06	9.50E+07	4.77E+07	SB LOCA
	7.54E+06	1.79E+07	7.54E+07	1.79E+08	7.54E+08	1.79E+09	FHA
Minimum values =	1.56E+05		1.56E+06		1.56E+07		

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

REVISION: 11

Subject:

**BVPS-U1 Gaseous Radioactivity Monitor
Emergency Action Levels**

No.:

**ERS-MPD-93-007
Attachment 1**

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Alert, Site Area and General Emergency Calculation Summary – Release Point 3, Process Vent:

	Alert Criteria (uCi/s)		SAE Criteria (uCi/s)		GE Criteria (uCi/s)		
	100 TEDE	500 Ch Thy	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
PING GW-109 Low	8.43E+07	1.11E+08	8.43E+08	1.11E+09	8.43E+09	1.11E+10	SGTR
	1.85E+08	n/a	1.85E+09	n/a	1.85E+10	n/a	WGSR
Minimum values =	8.43E+07		8.43E+08		8.43E+09		

	Alert Criteria (uCi/s)		SAE Criteria (uCi/s)		GE Criteria (uCi/s)		
	100 TEDE	500 Ch Thy	100 TEDE	500 Ch Thy	1000 TEDE	5000 Ch Thy	
PING GW-109 High	7.83E+07	1.03E+08	7.83E+08	1.03E+09	7.83E+09	1.03E+10	SGTR
	1.32E+08	n/a	1.32E+09	n/a	1.32E+10	n/a	WGSR
Minimum values =	7.83E+07		7.83E+08		7.83E+09		

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RM-1RM-VS-109 Low Range

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Attachment 2

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Monitor efficiencies from ERS-SFL-85-031

PING VS-109 Low

Release Flow Rate = 6.20E+04 cfm

= 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³
(uCi/s/mrem/h) CF for TEDE = 1.17E+05
(uCi/s/mrem/h) CF for Child Thyroid = 5.16E+03

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	8.11E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E+01	3.56E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	1.99E-05	1.14E+05	2.27E+00	0.00E+00	0.00E+00	2.56E+01	8.74E-07	1.14E+05	9.96E-02
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	1.14E-04	1.14E+05	1.30E+01	0.00E+00	0.00E+00	1.47E+02	5.02E-06	1.14E+05	5.72E-01
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.22E+02	7.60E-06	1.77E+05	1.35E+00	0.00E+00	0.00E+00	9.78E+00	3.34E-07	1.77E+05	5.91E-02
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	3.22E-05	1.05E+05	3.38E+00	0.00E+00	0.00E+00	4.14E+01	1.42E-06	1.05E+05	1.49E-01
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	6.75E-09	1.89E+05	1.28E-03	0.00E+00	0.00E+00	8.68E-03	2.96E-10	1.89E+05	5.60E-05
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	6.53E-05	7.22E+04	4.72E+00	0.00E+00	0.00E+00	8.40E+01	2.87E-06	7.22E+04	2.07E-01
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	5.70E-05	1.28E+05	7.29E+00	0.00E+00	0.00E+00	7.32E+01	2.50E-06	1.28E+05	3.20E-01
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	9.79E+04	3.35E-03	4.39E+04	1.47E+02	0.00E+00	0.00E+00	4.30E+03	1.47E-04	4.39E+04	6.46E+00
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.88E+01	3.26E+03	1.12E-04	3.26E+04	3.68E+00	0.00E+00	0.00E+00	1.43E+02	4.96E-06	3.26E+04	1.61E-01
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	2.44E-04	1.37E+05	3.34E+01	0.00E+00	0.00E+00	3.14E+02	1.07E-05	1.37E+05	1.47E+00
Xe-137	2.55E-01	5.72E-06	9.55E-02	5.46E-03	6.71E-01	2.29E-08	1.83E+05	4.20E-03	0.00E+00	0.00E+00	2.95E-02	1.01E-09	1.83E+05	1.84E-04
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	7.02E-07	1.43E+05	1.00E-01	0.00E+00	0.00E+00	9.02E-01	3.08E-08	1.43E+05	4.41E-03
I-131	2.73E+01	6.12E-04	4.68E+05	2.85E+02	7.19E+01	2.46E-06	9.25E+02	2.27E-03	2.44E+07	1.49E+04	3.16E-00	1.08E-07	9.25E+02	9.98E-05
I-132	1.32E+01	2.86E-04	4.33E+04	1.28E+01	3.48E+01	1.18E-06	1.44E+03	1.71E-03	2.90E+05	8.58E+01	1.53E-00	5.22E-08	1.44E+03	7.61E-05
I-133	1.00E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	9.54E-07	1.38E+03	1.32E-03	5.77E+06	1.37E+03	1.23E+00	4.19E-08	1.38E+03	5.78E-05
I-134	6.51E+01	1.46E-05	2.69E+04	3.93E-01	1.71E+00	5.89E-08	1.59E+03	9.31E-04	7.60E+04	1.11E+00	7.53E-02	2.57E-09	1.59E+03	4.09E-06
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	3.04E-07	1.26E+03	3.83E-04	1.19E+06	9.02E+01	3.91E-01	1.34E-08	1.26E+03	1.68E-05
	4.49E+04			7.24E+02	1.17E+05			2.16E+02		1.65E+04	5.16E+03			9.50E+00
Monitor detection efficiency (cps/uCi/cc) = 6.92E+04									Child Thyroid					
				TEDE	uCi/s	uCi/cc	cps				uCi/s	uCi/cc	cps	
				1.0E+01	9.14E+05	3.12E-02	2.16E+03				5.00E+01	2.01E+05	6.86E-03	4.75E+02
				1.0E+02	9.14E+06	3.12E-01	2.16E+04				5.0E+02	2.01E+06	6.86E-02	4.75E+03
				1.0E+03	9.14E+07	3.12E+00	2.16E+05				5.0E+03	2.01E+07	6.86E-01	4.75E+04

Monitor efficiencies from ERS-SFL-85-031

PING VS-109 Low

Release Flow Rate = 6.20E+04 cfm

= 2.93E+07 cc/s

X/Q = 1.03E-04 s/m³
Release (uCi/s) CF for TEDE = 1.36E+05
Release (uCi/s) CF for Child Thyroid = 7.70E+03

Isotope	U1 & U2 DBA LOCA	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	2.78E+02	9.51E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E+01	5.39E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E-02	4.10E+00	6.82E+02	2.33E-05	1.14E+05	2.66E+00	0.00E+00	0.00E+00	3.87E+01	1.32E-06	1.14E+05	1.51E-01
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	6.71E-05	1.14E+05	7.65E+00	0.00E+00	0.00E+00	1.11E+02	3.80E-06	1.14E+05	4.34E-01
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.80E+00	2.61E+02	8.93E-06	1.77E+05	1.58E+00	0.00E+00	0.00E+00	1.48E+01	5.06E-07	1.77E+05	8.96E-02
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	3.78E-05	1.05E+05	3.97E+00	0.00E+00	0.00E+00	6.28E+01	2.14E-06	1.05E+05	2.25E-01
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	7.82E-09	1.89E+05	1.50E-03	0.00E+00	0.00E+00	1.31E-02	4.49E-10	1.89E+05	8.49E-05
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	7.66E-05	7.22E+04	5.53E+00	0.00E+00	0.00E+00	1.27E+02	4.34E-06	7.22E+04	3.14E-01
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	1.98E+03	6.71E-05	1.28E+05	8.59E+00	0.00E+00	0.00E+00	1.11E+02	3.80E-06	1.28E+05	4.87E-01
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	3.92E-03	4.39E+04	1.72E+02	0.00E+00	0.00E+00	6.51E+03	2.23E-04	4.39E+04	9.77E+00
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	1.31E-04	3.28E+04	4.30E+00	0.00E+00	0.00E+00	2.17E+02	7.43E-06	3.28E+04	2.44E-01
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	2.86E-04	1.37E+05	3.92E+01	0.00E+00	0.00E+00	4.75E+02	1.62E-05	1.37E+05	2.22E+00
Xe-137	5.08E+00	5.80E-06	9.55E-02	5.54E-03	7.87E-01	2.69E-08	1.83E+05	4.92E-03	0.00E+00	0.00E+00	4.46E-02	1.52E-09	1.83E+05	2.79E-04
Xe-138	1.58E+02	1.78E-04	6.27E+03	1.11E+00	2.41E+01	8.24E-07	1.43E+05	1.18E-01	0.00E+00	0.00E+00	1.37E+00	4.67E-08	1.43E+05	6.68E-03
I-131	3.41E+02	3.89E-04	4.66E+05	1.81E+02	5.27E+01	1.80E-06	9.25E+02	1.67E-03	2.44E+07	9.48E+03	2.89E+00	1.02E-07	9.25E+02	9.45E-05
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	1.39E-06	1.44E+03	2.01E-03	2.90E+05	8.72E+01	2.31E+00	7.91E-08	1.44E+03	1.14E-04
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	1.12E-06	1.38E+03	1.55E-03	5.77E+06	1.39E+03	1.86E+00	6.35E-08	1.38E+03	8.76E-05
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.01E+00	6.87E-08	1.59E+03	1.09E-04	7.60E+04	1.13E+00	1.14E-01	3.89E-09	1.59E+03	8.19E-08
I-135	6.75E+01	7.69E-05	7.10E+04	5.46E+00	1.04E+01	3.57E-07	1.26E+03	4.49E-04	1.19E+06	9.15E+01	5.92E-01	2.02E-08	1.26E+03	2.55E-05
	8.78E+05			6.27E+02	1.36E+05			2.46E+02		1.10E+04	7.70E+03			1.39E+01
Monitor detection efficiency (cps/uCi/cc) = 6.92E+04									Child Thyroid					
				TEDE	uCi/s	uCi/cc	cps				uCi/s	uCi/cc	cps	
				1.00E+01	1.04E+08	3.55E-02	2.46E+03				5.00E+01	2.95E+05	1.01E-02	6.97E+02
				1.0E+02	1.04E+07	3.55E-01	2.46E+04				5.00E+02	2.95E+06	1.01E-01	6.97E+03
				1.0E+03	1.04E+08	3.55E+00	2.46E+05				5.00E+03	2.95E+07	1.01E+00	6.97E+04

Monitor efficiencies from ERS-SFL-85-031							X/O = 1.03E-04 s/m ³ Release (uCi/s) CF for TEDE = 2.03E+04 Release (uCi/s) CF for Child Thyroid = 4.04E+03								
PING VS-109 Low		Release Flow Rate = 6.20E+04 cfm = 2.93E+07 cc/s													
Isotope	U1 & U2 LOCA TID (Ci)	Activity Ratio	DCF (mrem·m ² / uCi·y)	Effective DCF (mrem·m ² / uCi·y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	DCF (mrem·m ² / uCi·y)	Effective DCF (mrem·m ² / uCi·y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	9.07E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.28E+01	1.80E-06	0.00E+00	0.00E+00	
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	1.67E+05	2.13E+00	0.00E+00	0.00E+00	1.09E+02	3.72E-06	1.14E+05	4.24E+01	1.41E+05	
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	7.92E-07	1.14E+05	9.03E-02	0.00E+00	0.00E+00	4.61E+00	1.58E-07	1.41E+05	1.80E-02	
Ki-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	3.75E-05	1.77E+05	6.63E+00	0.00E+00	0.00E+00	2.16E+02	7.45E-06	1.77E+05	1.32E+00	
Ki-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	5.20E-05	1.05E+05	5.46E+00	0.00E+00	0.00E+00	3.03E+02	1.04E-05	1.05E+05	1.09E+00	
Ki-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.69E+03	6.47E-05	1.89E+05	1.22E+01	0.00E+00	0.00E+00	3.77E+02	1.28E-05	1.89E+05	2.43E+00	
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.03E+01	1.03E-06	7.22E+04	7.47E-02	0.00E+00	0.00E+00	6.03E-03	2.06E-07	7.22E+04	1.48E-02	
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	4.84E-06	1.28E+05	6.19E-01	0.00E+00	0.00E+00	2.82E+01	9.63E-07	1.28E+05	1.23E-01	
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	1.53E-04	4.39E+04	6.73E+00	0.00E+00	0.00E+00	8.93E-02	3.05E-05	4.39E+04	1.34E+00	
Xe-135m	3.36E+07	4.84E-02	2.15E+03	9.97E-01	9.42E+02	3.22E-05	3.28E+04	1.00E+00	0.00E+00	0.00E+00	1.87E+02	6.41E-06	3.28E+04	2.10E-01	
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	4.64E-05	1.37E+05	6.35E+00	0.00E+00	0.00E+00	2.70E+02	9.23E-06	1.37E+05	1.26E+00	
Xa-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.09E+03	1.40E-04	1.83E+05	2.56E+01	0.00E+00	0.00E+00	8.15E+02	2.78E-05	1.83E+05	5.09E+00	
Xa-138	1.39E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	1.30E-04	1.43E+05	1.86E+01	0.00E+00	0.00E+00	7.59E+02	2.59E-05	1.43E+05	3.71E+00	
I-131	3.89E+05	5.37E-04	4.68E+05	2.50E+02	1.09E+01	3.73E-07	9.25E-02	3.45E-04	2.44E+07	1.31E+04	2.17E+00	7.42E-08	9.25E+02	6.86E-05	
I-132	5.76E+05	7.87E-04	4.33E+04	3.41E+01	1.60E+01	5.46E-07	1.44E+03	7.87E-04	2.90E+05	2.28E+02	3.18E+00	1.09E-07	1.44E+03	1.56E-04	
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.24E+01	7.67E-07	1.38E+03	1.06E-03	5.77E+06	6.37E+03	4.46E+00	1.53E-07	1.38E+03	2.10E-04	
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.48E+01	8.48E-07	1.59E+03	1.35E-03	7.60E-04	9.28E+01	4.94E+00	1.69E-07	1.59E+03	2.68E-04	
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	7.28E-07	1.26E+03	9.18E-04	1.19E+06	1.25E+03	4.24E+00	1.45E-07	1.26E+03	1.83E-04	
	7.24E+08			4.19E+03	2.03E+04			8.56E+01		2.10E+04	4.04E+03			1.70E+01	
Monitor detection efficiency (cps/uCi/cc) = 8.92E+04							TEDE		uCi/s		uCi/cc		cps		
							1.00E-01	3.62E+05	1.24E-02	8.56E+02	Child Thyroid		uCi/s	uCi/cc	cps
							1.0E-02	3.62E+06	1.24E-01	8.56E+03	5.0E+02	3.60E+06	1.23E-01	8.52E+03	8.52E+03
							1.0E-03	3.62E+07	1.24E+00	8.56E+04	5.0E+03	3.60E+07	1.23E+00	8.52E+04	8.52E+04

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RM-1RM-VS-109 Low Range (continued)

Monitor efficiencies from ERS-SFL-85-031									X/Q = 1.03E-04 s/m ³						
PING VS-109 Low									Release (uCi/s) CF for TEDE = 9.40E-04						
Release Flow Rate = 6.20E+04 cfm = 2.93E+07 cc/s									Release (uCi/s) CF for Child Thyroid = 9.45E+03						
Isotope	U1 & U2 SB LOCA (Ci)	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)	
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	5.84E+01	2.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E+00	2.01E-07	0.00E+00	0.00E+00	
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.09E+02	7.13E-06	1.14E+05	8.13E-01	0.00E+00	0.00E+00	2.10E+01	7.17E-07	1.14E+05	8.17E-02	
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	1.85E+04	6.33E-04	1.14E+05	7.22E+01	0.00E+00	0.00E+00	1.86E+03	6.36E-05	1.14E+05	7.26E+00	
Kr-67	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.32E+02	4.52E-06	1.77E+05	8.00E-01	0.00E+00	0.00E+00	1.33E+01	4.54E-07	1.77E+05	8.04E-02	
Kr-68	1.64E+00	4.09E-03	1.13E+04	4.62E+01	3.85E+02	1.31E-05	1.05E+05	1.38E+00	0.00E+00	0.00E+00	3.87E+01	1.32E-06	1.05E+05	1.39E-01	
Kr-69	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.38E+00	1.15E-07	1.89E+05	2.18E-02	0.00E+00	0.00E+00	3.40E-01	1.16E-08	1.89E+05	2.19E-03	
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	7.88E+02	2.69E-05	7.22E+04	1.94E+00	0.00E+00	0.00E+00	7.82E+01	2.71E-06	7.22E+04	1.95E-01	
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.06E+02	2.41E-05	1.28E+05	3.09E+00	0.00E+00	0.00E+00	7.10E+01	2.42E-06	1.28E+05	3.10E-01	
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	4.74E+04	1.62E-03	4.39E+04	7.11E+01	0.00E+00	0.00E+00	4.76E+03	1.63E-04	4.39E+04	7.14E+00	
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.09E+04	7.14E-04	3.28E+04	2.34E+01	0.00E+00	0.00E+00	2.10E+03	7.18E-05	3.28E+04	2.35E+00	
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	4.69E+03	1.60E-04	1.37E+05	2.20E+01	0.00E+00	0.00E+00	4.72E+02	1.61E-05	1.37E+05	2.21E+00	
Xe-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.02E+01	3.49E-07	1.83E+05	6.40E-02	0.00E+00	0.00E+00	1.03E+00	3.51E-08	1.83E+05	6.43E-03	
Xe-138	3.03E-01	7.58E-04	6.27E+03	4.74E+00	7.11E+01	2.43E-06	1.43E+05	3.47E-01	0.00E+00	0.00E+00	7.14E+00	2.44E-07	1.43E+05	3.49E-02	
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.33E+01	7.95E-07	9.25E+02	7.35E-04	2.44E+07	6.04E+03	2.34E+00	7.99E-08	9.25E+02	7.39E-05	
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.39E+01	8.18E-07	1.44E+03	1.18E-03	2.90E+05	7.38E+01	2.40E+00	8.22E-06	1.44E+03	1.18E-04	
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.03E+01	1.38E-06	1.38E+03	1.90E-03	5.77E+06	2.48E+03	4.06E+00	1.39E-07	1.38E+03	1.91E-04	
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	2.77E+01	9.46E-07	1.59E+03	1.50E-03	7.60E+04	2.24E+01	2.78E+00	6.51E-08	1.59E+03	1.51E-04	
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.07E+01	1.05E-06	1.26E+03	1.32E-03	1.19E+06	3.89E+02	3.09E+00	1.06E-07	1.26E+03	1.33E-04	
	4.01E+02			9.05E+02	9.40E+04			1.97E+02		9.00E+03	9.45E+03			1.98E+01	
Monitor detection efficiency (cps/uCi/cc) = 6.92E+04									Child Thyroid						
									uCi/s						
									uCi/cc						
									cps						
									TEDE						
									1.00E+01						
									8.34E+05						
									2.85E-02						
									1.97E+04						
									8.34E+06						
									2.85E-01						
									8.34E+07						
									2.85E+00						
									1.97E+05						

Monitor efficiencies from ERS-SFL-85-031										X/Q = 1.03E-04 s/m ³									
PING VS-109 Low										Release (uCi/s) CF for TEDE = 1.98E+05									
Release Flow Rate = 6.20E+04 cfm = 2.93E+07 cc/s										Release (uCi/s) CF for Child Thyroid = 1.09E+05									
Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)					
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	4.89E+02	1.67E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E+02	9.23E-06	0.00E+00	0.00E+00					
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.63E+00	1.17E+03	3.99E-05	1.14E+05	4.55E+00	0.00E+00	0.00E+00	6.45E+02	2.20E-05	1.14E+05	2.51E+00					
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	2.84E+03	9.71E-05	1.14E+05	1.11E+01	0.00E+00	0.00E+00	1.57E+03	5.37E-05	1.14E+05	6.12E+00					
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	6.68E+02	2.28E-05	1.77E+05	4.04E+00	0.00E+00	0.00E+00	3.69E+02	1.26E-05	1.77E+05	2.23E+00					
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.09E+03	7.13E-05	1.05E+05	7.49E+00	0.00E+00	0.00E+00	1.15E+03	3.94E-05	1.05E+05	4.14E+00					
Kr-89	3.78E+00	2.44E-04	1.02E+04	2.49E+00	4.81E+01	1.65E-06	1.89E+05	3.11E-01	0.00E+00	0.00E+00	2.66E+01	9.09E-07	1.89E+05	1.72E-01					
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.38E+03	8.14E-05	7.22E+04	5.89E+00	0.00E+00	0.00E+00	1.32E+03	4.50E-05	7.22E+04	3.25E+00					
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	2.88E+03	9.76E-05	1.28E+05	1.25E+01	0.00E+00	0.00E+00	1.58E+03	5.39E-05	1.28E+05	6.90E+00					
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.69E+05	5.78E-03	4.39E+04	2.54E+02	0.00E+00	0.00E+00	9.34E+04	3.18E-03	4.39E+04	1.40E+02					
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	1.82E+03	6.21E-05	3.28E+04	2.04E+00	0.00E+00	0.00E+00	1.00E+03	3.43E-05	3.28E+04	1.13E+00					
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.36E+04	4.64E-04	1.37E+05	6.35E+01	0.00E+00	0.00E+00	7.50E+03	2.56E-04	1.37E+05	3.51E+01					

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Monitor efficiencies from ERS-SFL-85-031

U1 & U2 LOCA Gap		Activity Ratio	Effective DCF		Release		Efficiency		Current		Effective DCF		Release		Efficiency		Current	
Isotope	(Ci)		(mrem-m ² / uCi-y)	(mrem-m ² / uCi-y)	(uCi/s/ mrem/hr)	(uCi/cc/ mrem/hr)	(amps/uCi/cc)	(amps/mrem/h)	(amps/mrem/h)	(amps/mrem/h)	(mrem-m ² / uCi-y)	(mrem-m ² / uCi-y)	(uCi/s/ mrem/hr)	(uCi/cc/ mrem/hr)	(amps/uCi/cc)	(amps/mrem/h)	(amps/mrem/h)	(amps/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.37E+02	8.11E-06	4.74E-10	3.84E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E+01	3.56E-07	4.74E-10	1.69E-16	1.69E-16	1.69E-16
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	5.82E+02	1.99E-05	1.69E-10	3.39E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E+01	8.74E-07	1.69E-10	1.48E-16	1.48E-16	1.48E-16
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.34E+03	1.14E-04	1.79E-10	2.05E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E+02	5.02E-06	1.79E-10	8.99E-16	8.99E-16	8.99E-16
Kr-87	8.45E+01	1.85E-03	4.47E+03	8.47E+00	2.22E+02	7.60E-06	1.08E-10	8.21E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.78E+00	3.34E-07	1.08E-10	3.61E-17	3.61E-17	3.61E-17
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	9.43E+02	3.22E-05	2.31E-10	7.44E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E+01	1.42E-06	2.31E-10	3.27E-16	3.27E-16	3.27E-16
Kr-89	7.50E+02	1.68E-06	1.02E+04	1.72E-02	1.97E-01	6.75E-06	1.77E-10	1.19E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.68E-03	2.96E-10	1.77E-10	5.25E-20	5.25E-20	5.25E-20
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	1.91E+03	6.53E-05	2.77E-10	1.81E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.40E+01	2.87E-06	2.77E-10	7.95E-16	7.95E-16	7.95E-16
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.67E+03	5.70E-05	2.27E-10	1.29E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.32E+01	2.50E-06	2.27E-10	5.68E-16	5.68E-16	5.68E-16
Xe-133	3.72E+04	6.34E-01	1.76E+02	1.47E+02	9.79E+04	3.35E-03	4.89E-10	1.64E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.40E+03	1.47E-04	4.89E-10	7.19E-14	7.19E-14	7.19E-14
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.26E+03	1.12E-04	1.20E-11	1.34E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E+02	4.80E-06	1.20E-11	5.88E-17	5.88E-17	5.88E-17
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.14E+03	2.44E-04	1.95E-10	4.75E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E+02	1.07E-05	1.95E-10	2.09E-15	2.09E-15	2.09E-15
Xe-137	2.55E+01	5.72E-06	9.55E+02	5.46E-03	6.71E-01	2.29E-08	1.17E-10	2.68E-18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.95E-02	1.01E-09	1.17E-10	1.18E-19	1.18E-19	1.18E-19
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.05E+01	7.02E-07	1.69E-10	1.19E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.02E-01	3.08E-08	1.69E-10	5.21E-16	5.21E-16	5.21E-16
I-131	2.73E+01	6.12E-04	4.56E+05	2.85E+02	7.19E+01	2.46E-06	2.26E-12	5.55E-18	2.44E+07	1.49E+04	3.16E+00	1.08E-07	2.26E-12	2.26E-12	2.26E-12	2.44E-19	2.44E-19	2.44E-19
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.48E-01	1.19E-06	1.72E-12	2.04E-18	2.90E+05	8.58E+01	1.53E+00	5.22E-09	1.72E-12	1.72E-12	1.72E-12	6.98E-20	6.98E-20	6.98E-20
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	2.79E+01	9.54E-07	1.65E-12	1.57E-18	5.77E+08	1.37E+03	1.23E+00	4.19E-08	1.65E-12	1.65E-12	1.65E-12	6.91E-20	6.91E-20	6.91E-20
I-134	6.51E-01	1.48E-05	2.69E+04	3.93E-01	1.71E+00	5.86E-08	1.58E-12	9.25E-20	7.60E+04	1.11E+00	7.53E-02	2.57E-09	1.58E-12	1.58E-12	1.58E-12	4.07E-21	4.07E-21	4.07E-21
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	8.90E+00	3.04E-07	1.66E-12	5.66E-19	1.19E+08	9.02E+01	3.91E-01	1.34E-08	1.66E-12	1.66E-12	1.66E-12	2.49E-20	2.49E-20	2.49E-20
	4.46E+04			7.24E+02	1.17E+05			1.75E-12			1.65E+04	5.16E+03				7.70E-14	7.70E-14	7.70E-14
Monitor detection efficiency (amp/uCi/cc) = 3.94E-10										TEDE	uCi/s	uCi/cc	amps	Child Thyroid	uCi/s	uCi/cc	amps	
										1.00E+01	1.30E+06	4.45E-02	1.75E-11	5.00E+01	2.88E+05	9.77E-03	3.85E-12	
										1.0E+02	1.30E+07	4.45E-01	1.75E-10	5.0E+02	2.88E+06	9.77E-02	3.85E-11	
										1.0E+03	1.30E+08	4.45E+00	1.75E-09	5.0E+03	2.88E+07	9.77E-01	3.85E-10	

Monitor efficiencies from ERS-SFL-85-031

PING VS-109 High		Release Flow Rate = 6.20E+04 cfm = 2.93E+07 cc/s		Release (uCi/s) CF for Child Thyroid = 7.70E+03										
U1 & U2 DBA LOCA		Activity Ratio	Effective DCF	DCF	Release	Release	Efficiency	Current	DCF	Effective DCF	Release	Release	Efficiency	Current
Isotope	(Ci)		(mrem-m ² /uCi-y)	(mrem-m ² /uCi-y)	(uCi/s/mrem/hr)	(uCi/cc/mrem/hr)	(amps/uCi/cc)	(amps/mrem/hr)	(mrem-m ² /uCi-y)	(mrem-m ² /uCi-y)	(uCi/s/mrem/hr)	(uCi/cc/mrem/hr)	(amps/uCi/cc)	(amps/mrem/hr)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.51E-04	2.78E+02	9.51E-06	4.74E-10	4.51E-15	0.00E+00	0.00E+00	1.58E+01	5.39E-07	4.74E-10	2.56E-16
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	6.82E+02	2.33E-05	1.69E-10	3.94E-15	0.00E+00	0.00E+00	3.87E+01	1.32E-06	1.69E-10	2.23E-16
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	1.96E+03	6.71E-05	1.79E-10	1.20E-14	0.00E+00	0.00E+00	1.11E+02	3.80E-06	1.79E-10	6.81E-16
Kr-87	1.69E+03	1.92E-03	4.47E+03	8.60E+00	2.61E+02	8.93E-06	1.08E-10	9.64E-16	0.00E+00	0.00E+00	1.48E+01	5.06E-07	1.08E-10	5.47E-17
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.11E+03	3.78E-05	2.31E-10	8.74E-15	0.00E+00	0.00E+00	6.28E+01	2.14E-06	2.31E-10	4.95E-16
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.32E-01	7.92E-09	1.77E-10	1.40E-18	0.00E+00	0.00E+00	1.31E-02	4.49E-10	1.77E-10	7.95E-20
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.24E+03	7.68E-05	2.77E-10	2.12E-14	0.00E+00	0.00E+00	1.27E+02	4.34E-06	2.77E-10	1.20E-15
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.18E+00	1.96E+03	6.71E-05	2.27E-10	1.52E-14	0.00E+00	0.00E+00	1.11E+02	3.80E-06	2.27E-10	8.64E-16
Xe-133	7.43E+05	8.46E-01	1.76E+02	1.49E+02	1.15E+05	3.92E-03	4.89E-10	1.92E-12	0.00E+00	0.00E+00	6.51E+03	2.23E-04	4.89E-10	1.09E-13
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	3.83E+03	1.31E-04	1.20E-11	1.57E-15	0.00E+00	0.00E+00	2.17E+02	7.43E-06	1.20E-11	8.92E-17
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	8.38E+03	2.86E-04	1.95E-10	5.58E-14	0.00E+00	0.00E+00	4.75E+02	1.62E-05	1.95E-10	3.17E-15
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	7.87E-01	2.69E-08	1.17E-10	3.15E-18	0.00E+00	0.00E+00	4.46E-02	1.52E-09	1.17E-10	1.78E-19
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.41E-01	8.24E-07	1.69E-10	1.39E-16	0.00E+00	0.00E+00	1.37E+00	4.67E-08	1.69E-10	7.90E-18
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.27E+01	1.80E-06	2.26E-12	4.07E-18	2.44E+07	9.48E+03	2.99E+00	1.02E-07	2.26E-12	2.31E-19
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.08E+01	1.39E-06	1.72E-12	2.40E-18	2.90E+05	8.72E+01	2.31E+00	7.91E-08	1.72E-12	1.36E-19
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.28E+01	1.12E-06	1.65E-12	1.85E-18	5.77E+06	1.39E+03	1.88E+00	6.35E-08	1.65E-12	1.05E-19
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.01E+00	6.87E-08	1.50E-12	1.09E-19	7.60E+04	1.13E+00	1.14E-01	3.69E-09	1.58E-12	6.15E-21
I-135	6.75E+01	7.69E-05	7.10E+04	5.48E+00	1.04E+01	3.57E-07	1.86E-12	6.83E-19	1.19E+06	9.15E+01	5.92E-01	2.02E-08	1.86E-12	3.78E-20
	8.78E+05			6.27E+02	1.36E+05			2.04E-12		1.10E+04	7.70E+03			1.16E-13
Monitor detection efficiency (amp/uCi/cc) = 3.94E-10														
		TEDE	uCi/s	uCi/cc	amps	Child Thyroid								
		1.00E+01	1.52E+06	5.19E-02	2.04E-11			5.00E+01	4.30E+05	1.47E-02	5.79E-12			
		1.0E+02	1.52E+07	5.19E-01	2.04E-10			5.00E+02	4.30E+06	1.47E-01	5.79E-11			
		1.0E+03	1.52E+08	5.19E+00	2.04E-09			5.00E+03	4.30E+07	1.47E+00	5.79E-10			

Isotope	U1 & U2 LOCA TID (Ci)	Activity Ratio	Effective DCF		Release	Release	Efficiency	Current	Effective DCF		Release	Efficiency	Current	
			(mrem-m ³ / uCi-y)	(mrem-m ³ / uCi-y)	(uCi/s/ mrem/hr)	(uCi/cc/ mrem/hr)	(amps/uCi/cc)	(amps/mrem/hr)	(mrem-m ³ / uCi-y)	(mrem-m ³ / uCi-y)	(uCi/s/ mrem/hr)	(uCi/cc/ mrem/hr)	(amps/uCi/cc)	(amps/mrem/hr)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.65E+02	9.07E-06	4.74E-10	4.30E-15	0.00E+00	0.00E+00	5.28E+01	1.80E-06	4.74E-10	8.55E-16
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	5.47E+02	1.87E-05	1.69E-10	3.16E-15	0.00E+00	0.00E+00	1.09E+02	3.72E-06	1.69E-10	6.28E-16
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.32E+01	7.92E-07	1.79E-10	1.42E-16	0.00E+00	0.00E+00	4.81E+00	1.58E-07	1.79E-10	2.82E-17
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.10E+03	3.75E-05	1.08E-10	4.05E-15	0.00E+00	0.00E+00	2.18E+02	7.45E-06	1.08E-10	8.05E-18
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.52E+03	5.20E-05	2.31E-10	1.20E-14	0.00E+00	0.00E+00	3.03E+02	1.04E-05	2.31E-10	2.39E-15
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	1.89E+03	6.47E-05	1.77E-10	1.14E-14	0.00E+00	0.00E+00	3.77E+02	1.29E-05	1.77E-10	2.28E-15
Xe-131m	1.08E+06	1.49E-03	4.29E+01	5.40E-02	3.03E+01	1.03E-06	2.77E-10	2.87E-18	0.00E+00	0.00E+00	6.03E+00	2.06E-07	2.77E-10	5.70E-17
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.42E+02	4.84E-06	2.27E-10	1.10E-15	0.00E+00	0.00E+00	2.82E+01	9.63E-07	2.27E-10	2.19E-16
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	4.49E+03	1.53E-04	4.89E-10	7.50E-14	0.00E+00	0.00E+00	8.93E+02	3.05E-05	4.89E-10	1.49E-14
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	9.42E+02	3.22E-05	1.20E-11	3.86E-16	0.00E+00	0.00E+00	1.87E+02	6.41E-06	1.20E-11	7.69E-17
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.36E+03	4.64E-05	1.95E-10	9.04E-15	0.00E+00	0.00E+00	2.70E+02	9.23E-06	1.95E-10	1.80E-15
Xe-137	1.46E+08	2.02E-01	9.55E-02	1.93E+02	4.09E+03	1.40E-04	1.17E-10	1.64E-14	0.00E+00	0.00E+00	8.15E+02	2.78E-05	1.17E-10	3.26E-15
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	3.81E+03	1.30E-04	1.69E-10	2.20E-14	0.00E+00	0.00E+00	7.99E+02	2.59E-05	1.69E-10	4.38E-15
I-131	3.69E+05	5.37E-04	4.66E+05	2.50E-02	1.09E+01	3.73E-07	2.26E-12	8.42E-18	2.44E+07	1.31E+04	2.17E+00	6.92E-08	2.26E-12	1.68E-19
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.60E+01	5.46E-07	1.72E-12	9.38E-19	2.90E+05	2.26E-02	3.18E+00	1.09E-07	1.72E-12	1.07E-19
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E-02	2.24E+01	7.67E-07	1.65E-12	1.26E-18	5.77E+06	6.37E+03	4.46E+00	1.53E-07	1.65E-12	2.52E-19
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.49E+01	8.48E-07	1.58E-12	1.34E-18	7.60E+04	9.29E+01	4.94E+00	1.69E-07	1.58E-12	2.67E-19
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.13E+01	7.28E-07	1.86E-12	1.35E-18	1.19E+08	1.25E+03	4.24E+00	1.45E-07	1.86E-12	2.69E-19
	7.24E+08		4.19E+03	2.03E+04			1.59E-13				4.04E+03		3.17E-14	
Monitor detection efficiency (amps/uCi/cc) =			3.94E-10		TEDE		uCi/s	uCi/cc	amps	Child Thyroid		uCi/s	uCi/cc	amps
					1.00E+01		1.18E+05	4.04E-03	1.59E-12	5.00E+01		1.18E+05	4.02E-03	1.58E-12
					1.0E-02		1.18E+06	4.04E-02	1.59E-11	5.0E+02		1.18E+06	4.02E-02	1.58E-11
					1.0E-03		1.18E+07	4.04E-01	1.59E-10	5.0E+03		1.18E+07	4.02E-01	1.58E-10

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject:
BVPs-U1 Gaseous Radioactivity Monitor
Emergency Action Levels

RM-1RM-VS-110 Low Range

REVISION: 11

Page:

No.:
ERS-MPD-93-007
Attachment 2
19

Monitor efficiencies from ERS-SFL-85-031

PING VS-110 Low

Release Flow Rate = 4.93E+04 cfm = 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.31E+05
Release (uCi/s) CF for Child Thyroid = 5.75E+03

Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	1.14E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E+01	4.99E-07	0.00E+00	0.00E+00
Kr-85m	2.21E+02	4.98E-03	8.17E+02	4.05E+00	6.49E+02	2.79E-05	1.14E+05	3.18E+00	0.00E+00	0.00E+00	2.85E+01	1.22E-08	1.14E+05	1.40E-01
Kr-85	1.27E+03	2.85E-02	1.12E+01	3.19E-01	3.73E+03	1.60E-04	1.14E+05	1.83E+01	0.00E+00	0.00E+00	1.64E+02	7.04E-06	1.14E+05	8.02E-01
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	1.07E-05	1.77E+05	1.89E+00	0.00E+00	0.00E+00	1.09E+01	4.68E-07	1.77E+05	8.28E-02
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	4.52E-05	1.05E+05	4.74E+00	0.00E+00	0.00E+00	4.62E+01	1.88E-06	1.05E+05	2.08E-01
Kr-89	7.50E-02	1.66E-06	1.02E+04	1.72E-02	2.20E-01	9.46E-09	1.89E+05	1.79E-03	0.00E+00	0.00E+00	9.67E-03	4.16E-10	1.89E+05	7.86E-05
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	9.16E-05	7.22E+04	6.81E+06	0.00E+00	0.00E+00	9.36E+01	4.02E-06	7.22E+04	2.90E-01
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	7.98E-05	1.28E+05	1.02E+01	0.00E+00	0.00E+00	8.16E+01	3.51E-06	1.28E+05	4.49E-01
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	4.69E-03	4.39E+04	2.06E+02	0.00E+00	0.00E+00	4.80E+03	2.06E-04	4.39E+04	9.05E+00
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.56E-04	3.28E+04	5.13E+00	0.00E+00	0.00E+00	1.60E+02	6.87E-06	3.28E+04	2.25E-01
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	3.42E-04	1.37E+05	4.68E+01	0.00E+00	0.00E+00	3.49E+02	1.50E-05	1.37E+05	2.06E+00
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.48E-03	7.48E-01	3.22E-08	1.83E+05	5.89E-03	0.00E+00	0.00E+00	3.29E-02	1.41E-09	1.83E+05	2.59E-04
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	9.84E-07	1.43E+05	1.41E-01	0.00E+00	0.00E+00	1.01E+00	4.32E-08	1.43E+05	6.18E-03
I-131	2.73E-01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	3.44E-06	9.25E+02	3.19E-03	2.44E+07	1.49E+04	3.52E+00	1.51E-07	9.25E+02	1.40E-04
I-132	1.32E+01	2.98E-04	4.33E+04	1.28E+01	3.87E+01	1.68E-06	1.44E+03	2.40E-03	2.90E+05	6.58E+01	1.70E+00	7.32E-08	1.44E+03	1.05E-04
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.34E-06	1.38E+03	1.85E-03	5.77E+06	1.37E+03	1.37E+00	5.67E-08	1.38E+03	8.11E-05
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	8.21E-08	1.59E+03	1.31E-04	7.60E+04	8.39E-02	3.61E-02	3.61E-09	1.59E+03	5.74E-06
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	4.26E-07	1.26E+03	5.37E-04	1.19E+06	9.02E+01	4.36E-01	1.87E-08	1.26E+03	2.38E-05
	4.46E+04			7.24E+02	1.31E+05			3.03E+02	1.65E+04	5.75E+03				1.33E+01
Monitor detection efficiency (cps/uCi/cc) = 8.54E+04											Child Thyroid		cps	
									TEDE		uCi/s		uCi/cc	
									1.00E+01		8.26E+05		3.55E-02	
									1.0E+02		8.26E+06		3.55E-01	
									1.0E+03		8.26E+07		3.55E+00	
													cps	
													3.03E+03	
													3.03E+04	
													3.03E+05	

Monitor efficiencies from ERS-SFL-85-031

PING VS-110 Low

Release Flow Rate = 4.93E+04 cfm = 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 1.51E+05
Release (uCi/s) CF for Child Thyroid = 8.58E+03

Isotope	U1 & U2 DBA LOCA	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)
Kr-83m	1.80E+03	2.05E-03	4.69E-01	9.61E-04	3.10E+02	1.33E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+01	7.56E-07	0.00E+00	0.00E+00
Kr-85m	4.41E+03	5.02E-03	8.17E+02	4.10E+00	7.60E+02	3.27E-05	1.14E+05	3.72E+00	0.00E+00	0.00E+00	4.31E+01	1.85E-06	1.14E+05	2.11E-01
Kr-85	1.27E+04	1.45E-02	1.12E+01	1.62E-01	2.19E+03	9.40E-05	1.14E+05	1.07E+01	0.00E+00	0.00E+00	1.24E+02	5.33E-06	1.14E+05	6.08E-01
Kr-87	1.89E+03	1.92E-03	4.47E+03	8.60E+00	2.91E+02	1.25E-05	1.77E+05	2.22E+00	0.00E+00	0.00E+00	1.65E+01	7.10E-07	1.77E+05	1.26E-01
Kr-88	7.16E+03	8.15E-03	1.13E+04	9.21E+01	1.23E+03	5.30E-05	1.05E+05	5.57E+00	0.00E+00	0.00E+00	7.00E+01	3.01E-06	1.05E+05	3.16E-01
Kr-89	1.50E+00	1.71E-06	1.02E+04	1.74E-02	2.58E-01	1.11E-08	1.89E+05	2.10E-03	0.00E+00	0.00E+00	1.47E-02	6.30E-10	1.89E+05	1.19E-04
Xe-131m	1.45E+04	1.65E-02	4.29E+01	7.08E-01	2.50E+03	1.07E-04	7.22E+04	7.75E+00	0.00E+00	0.00E+00	1.42E+02	6.09E-06	7.22E+04	4.40E-01
Xe-133m	1.27E+04	1.45E-02	1.49E+02	2.16E+00	2.16E+03	9.40E-05	1.28E+05	1.20E+01	0.00E+00	0.00E+00	1.24E+02	5.33E-06	1.28E+05	6.83E-01
Xe-133	7.43E+05	8.46E-01	1.78E+02	1.49E+02	1.28E+05	5.50E-03	4.39E+04	2.42E+02	0.00E+00	0.00E+00	7.26E+02	3.12E-04	4.39E+04	1.37E+01
Xe-135m	2.48E+04	2.82E-02	2.15E+03	6.07E+01	4.27E+03	1.84E-04	3.28E+04	6.02E+00	0.00E+00	0.00E+00	2.42E+02	1.04E-05	3.28E+04	3.42E-01
Xe-135	5.42E+04	6.17E-02	1.25E+03	7.72E+01	9.34E+03	4.01E-04	1.37E+05	5.50E+01	0.00E+00	0.00E+00	5.30E+02	2.28E-05	1.37E+05	3.12E+00
Xe-137	5.09E+00	5.80E-06	9.55E+02	5.54E-03	8.77E-01	3.77E-08	1.83E+05	6.90E-03	0.00E+00	0.00E+00	4.97E-02	2.14E-09	1.83E+05	3.91E-04
Xe-138	1.56E+02	1.78E-04	6.27E+03	1.11E+00	2.69E+01	1.16E-06	1.43E+05	1.65E-01	0.00E+00	0.00E+00	1.52E+00	6.55E-08	1.43E+05	9.37E-03
I-131	3.41E+02	3.88E-04	4.66E+05	1.81E+02	5.88E+01	2.53E-06	9.25E+02	2.34E-03	2.44E+07	9.48E+03	3.33E+00	1.43E-07	9.25E+02	1.32E-04
I-132	2.64E+02	3.01E-04	4.33E+04	1.30E+01	4.55E+01	1.96E-06	1.44E+03	2.82E-03	2.90E+05	6.72E+01	2.58E+00	1.11E-07	1.44E+03	1.60E-04
I-133	2.12E+02	2.41E-04	1.28E+05	3.09E+01	3.65E+01	1.57E-06	1.38E+03	2.17E-03	5.77E+06	1.39E+03	2.07E+00	8.90E-08	1.38E+03	1.23E-04
I-134	1.30E+01	1.48E-05	2.69E+04	3.98E-01	2.24E+00	9.63E-08	1.59E+03	1.53E-04	7.60E+04	1.13E+00	1.27E-01	5.45E-09	1.59E+03	8.68E-08
I-135	6.75E+01	7.69E-05	7.10E+04	5.40E+00	1.16E+01	5.00E-07	1.26E+03	6.30E-04	1.19E+06	9.15E+01	6.60E-01	2.83E-08	1.26E+03	3.57E-05
	8.78E+05			6.27E+02	1.51E+05			3.45E+02	1.10E+04	8.58E+03				1.96E+01
Monitor detection efficiency (cps/uCi/cc) = 8.54E+04											Child Thyroid		cps	
									TEDE		uCi/s		uCi/cc	
									1.00E+01		9.39E+05		4.04E-02	
									1.0E+02		9.39E+06		4.04E-01	
									1.0E+03		9.39E+07		4.04E+00	
													cps	
													3.45E+03	
													3.45E+04	
													3.45E+05	

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RM-1RM-VS-110 Low Range (continued)

Monitor efficiencies from ERS-SFL-85-031										X/Q = 9.24E-05 s/m ³				
PING VS-110 Low										Release (uCi/s) CF for TEDE = 7.15E+05				
Release Flow Rate = 4.93E+04 cfm = 2.33E+07 cc/s										Release (uCi/s) CF for Child Thyroid = 3.95E+04				
Isotope	U1 & U2 LOCA RCS (Ci)	Activity Ratio	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)
Kr-83m	1.34E-03	2.27E-05	4.69E-01	1.07E-05	1.63E+01	6.99E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.98E-01	3.66E-08	0.00E+00	0.00E+00
Kr-85m	5.53E-03	9.39E-05	8.17E+02	7.67E-02	6.71E+01	2.88E-06	1.14E+05	3.29E-01	0.00E+00	0.00E+00	3.71E+00	1.59E-07	1.14E+05	1.62E-02
Kr-85	3.27E+01	5.55E-01	1.12E+01	6.22E+00	3.97E+05	1.70E-02	1.14E+05	1.94E+03	0.00E+00	0.00E+00	2.19E+04	9.42E-04	1.14E+05	1.07E+02
Kr-87	7.04E-04	1.19E-05	4.47E+03	5.34E-02	8.54E+00	3.67E-07	1.77E+05	6.50E-02	0.00E+00	0.00E+00	4.72E-01	2.03E-08	1.77E+05	3.59E-03
Kr-88	6.02E-03	1.02E-04	1.13E+04	1.16E+00	7.30E+01	3.14E-06	1.05E+05	3.30E-01	0.00E+00	0.00E+00	4.03E+00	1.73E-07	1.05E+05	1.82E-02
Kr-89	2.92E-08	4.96E-10	1.02E+04	5.06E-06	3.54E-04	1.52E-11	1.89E+05	2.88E-06	0.00E+00	0.00E+00	1.98E-05	8.41E-13	1.89E+05	1.59E-07
Xe-131m	1.18E+00	2.00E-02	4.29E+01	8.59E-01	1.43E+04	6.15E-04	7.22E+04	4.44E+01	0.00E+00	0.00E+00	7.91E+02	3.40E-05	7.22E+04	2.45E+00
Xe-133m	1.81E-01	3.07E-03	1.49E+02	4.58E-01	2.20E+03	9.44E-05	1.28E+05	1.21E+01	0.00E+00	0.00E+00	1.21E+02	5.21E-06	1.28E+05	6.87E-01
Xe-133	2.48E+01	4.21E-01	1.78E+02	7.41E+01	3.01E+05	1.29E-02	4.39E+04	5.68E+02	0.00E+00	0.00E+00	1.66E+04	7.14E-04	4.39E+04	3.14E+01
Xe-135m	1.21E-02	2.05E-04	2.15E+03	4.42E-01	1.47E+02	6.31E-06	3.28E+04	2.07E-01	0.00E+00	0.00E+00	8.11E+00	3.48E-07	3.28E+04	1.14E-02
Xe-135	1.86E-02	3.16E-04	1.25E+03	3.95E-01	2.26E+02	9.70E-06	1.37E+05	1.33E+00	0.00E+00	0.00E+00	1.25E+01	5.36E-07	1.37E+05	7.34E-02
Xe-137	1.19E-07	2.02E-09	9.55E+02	1.93E-06	1.44E-03	6.20E-11	1.83E+05	1.14E-05	0.00E+00	0.00E+00	7.97E-05	3.43E-12	1.83E+05	6.27E-07
Xe-138	1.32E-05	2.24E-07	6.27E+03	1.40E-03	1.60E-01	6.89E-09	1.43E+05	9.84E-04	0.00E+00	0.00E+00	8.65E-03	3.80E-10	1.43E+05	5.44E-05
I-131	5.41E-03	9.18E-05	4.66E+05	4.28E+01	8.56E+01	2.82E-06	9.25E+02	2.61E-03	2.44E+07	2.24E+03	3.63E+00	1.56E-07	9.25E+02	1.44E+04
I-132	3.62E-03	6.14E-05	4.33E+04	2.68E+00	4.39E+01	1.89E-06	1.44E+03	2.72E-03	2.90E+05	1.78E+01	2.43E+00	1.04E-07	1.44E+03	1.50E-04
I-133	1.36E-03	2.34E-05	1.28E+05	3.00E+00	1.67E+01	7.19E-07	1.38E+03	9.93E-04	5.77E+06	1.35E+02	5.92E-01	3.97E-08	1.38E+03	5.48E-05
I-134	3.61E-05	6.13E-07	2.69E+04	1.65E-02	4.38E-01	1.88E-08	1.59E+03	2.98E-05	7.60E+04	4.66E-02	2.42E-02	1.04E-09	1.59E+03	1.65E-06
I-135	3.76E-04	6.38E-06	7.10E+04	4.53E-01	4.58E+00	1.96E-07	1.26E+03	2.47E-04	1.19E+08	7.59E+00	2.52E-01	1.08E-08	1.26E+03	1.36E-05
	5.89E+01			1.33E+02	7.15E+05			2.57E+03		2.40E+03	3.95E+04			1.42E+02
Monitor detection efficiency (cps/uCi/cc) = 8.54E+04					TEDE	uCi/s	uCi/cc	cps	Child Thyroid					
					1.00E+01	7.00E+06	3.01E-01	2.57E+04	5.00E+01	1934058.27	8.31E-02	7.10E+03		
					1.0E+02	7.00E+07	3.01E+00	2.57E+05	5.0E+02	1.93E+07	8.31E-01	7.10E+04		
					1.0E+03	7.00E+08	3.01E+01	2.57E+06	5.0E+03	1.93E+08	8.31E+00	7.10E+05		

Monitor efficiencies from ERS-SFL-85-031									X/Q = 9.24E-05 s/m ³					
PING VS-110 Low									Release (uCi/s) CF for TEDE = 2.26E+04					
Release Flow Rate = 4.93E+04 cfm = 2.33E+07 cc/s									Release (uCi/s) CF for Child Thyroid = 4.50E+03					
Isotope	U1 & U2 LOCA TID	Activity Ratio	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.27E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E+01	2.53E-06	0.00E+00	0.00E+00
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	6.10E+02	2.62E-05	1.14E+05	2.99E+00	0.00E+00	0.00E+00	1.21E+02	5.21E-06	1.14E+05	5.94E-01
Kr-85	6.27E+05	1.14E-03	1.12E+01	1.28E-02	2.59E+01	1.11E-06	1.14E+05	1.27E-01	0.00E+00	0.00E+00	5.14E+00	2.21E-07	1.14E+05	2.52E-02
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	5.25E-05	1.77E+05	9.30E+00	0.00E+00	0.00E+00	2.43E+02	1.04E-05	1.77E+05	1.65E+00
Kr-88	5.43E+07	7.50E-02	1.13E+04	6.47E+02	1.70E+03	7.29E-05	1.05E+05	7.68E+00	0.00E+00	0.00E+00	3.38E+02	1.45E-05	1.05E+05	1.52E+00
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	9.07E-05	1.89E+05	1.71E-01	0.00E+00	0.00E+00	4.20E+02	1.80E-05	1.89E+05	3.41E+00
Xe-131m	1.08E+08	1.49E-03	4.29E+01	8.40E-02	3.38E+01	1.45E-06	7.22E+04	1.05E-01	0.00E+00	0.00E+00	6.72E+00	2.89E-07	7.22E+04	2.08E-02
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+03	1.58E+02	6.78E-06	1.28E+05	8.88E-01	0.00E+00	0.00E+00	3.14E+01	1.35E-06	1.28E+05	1.73E-01
Xe-133	1.60E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	2.15E-04	4.39E+04	9.44E+00	0.00E+00	0.00E+00	9.95E+02	4.28E-05	4.39E+04	1.88E+00
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	4.51E-05	3.28E+04	1.48E+00	0.00E+00	0.00E+00	2.09E+02	8.86E-06	3.28E+04	2.95E-01
Xe-135	4.84E+07	6.68E-02	1.25E+03	8.35E+01	1.51E+03	6.50E-05	1.37E+05	8.91E+00	0.00E+00	0.00E+00	3.01E+02	1.29E-05	1.37E+05	1.77E+00
Xe-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.96E-04	1.83E+05	3.59E+01	0.00E+00	0.00E+00	9.08E+02	3.90E-05	1.83E+05	7.14E+00
Xe-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.83E-04	1.43E+05	2.61E+01	0.00E+00	0.00E+00	8.46E+02	3.63E-05	1.43E+05	5.20E+00
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.22E+01	5.23E-07	9.25E+02	4.83E-04	2.44E+07	1.31E+04	2.42E+00	1.04E-07	9.25E+02	9.62E-05
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.78E+01	7.66E-07	1.44E+03	1.10E-03	2.90E+05	2.26E+02	3.54E+00	1.52E-07	1.44E+03	2.19E-04
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	1.07E-06	1.38E+03	1.48E-03	5.77E+06	6.37E+03	4.98E+00	2.14E-07	1.38E+03	2.95E-04
I-134	8.85E+05	1.22E-03	2.69E+04	3.29E+01	2.77E+01	1.19E-06	1.59E+03	1.89E-03	7.60E+04	9.29E+01	5.50E+00	2.37E-07	1.59E+03	3.76E-04
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	1.02E-06	1.26E+03	1.29E-03	1.19E+08	1.25E+03	4.73E+00	2.03E-07	1.26E+03	2.56E-04
	7.24E+08			4.19E+03	2.26E+04			1.20E+02		2.10E+04	4.50E+03			2.39E+01
Monitor detection efficiency (cps/uCi/cc) = 8.54E+04									TEDE					
									uCi/s					
									uCi/cc					
									cps					
									Child Thyroid					
									uCi/s					
									uCi/cc					
									cps					
									5.00E+01					
									3.25E+06					
									1.40E-01					
									1.19E+04					
									1.19E+05					

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RM-1RM-VS-110 Low Range (continued)

Monitor efficiencies from ERS-SFL-85-031

PING VS-110 Low

Release Flow Rate =

4.93E+04 cfm

= 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³

Release (uCi/s) CF for TEDE = 1.05E+05

Release (uCi/s) CF for Child Thyroid = 1.05E+04

Isotope	U1 & U2 SB LOCA (Ci)	Activity Ratio	DCF (mrem-m ² /uCi-y)	Effective DCF (mrem-m ² /uCi-y)	Release (uCi/s) mrem/hr	Release (uCi/cc) mrem/hr	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	DCF (mrem-m ² /uCi-y)	Effective DCF (mrem-m ² /uCi-y)	Release (uCi/s) mrem/hr	Release (uCi/cc) mrem/hr	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	5.51E+01	2.80E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.54E+00	2.81E-07	0.00E+00	0.00E+00
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	1.00E-05	1.14E+05	1.14E+00	0.00E+00	0.00E+00	2.34E+01	1.01E-06	1.14E+05	1.15E-01
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	8.68E-04	1.14E+05	1.01E+02	0.00E+00	0.00E+00	2.08E+03	8.92E-05	1.14E+05	1.02E+01
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	6.34E-06	1.77E+05	1.12E+00	0.00E+00	0.00E+00	1.48E+01	6.37E-07	1.77E+05	1.13E-01
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.84E-05	1.05E+05	1.93E+00	0.00E+00	0.00E+00	4.31E+01	1.85E-06	1.05E+05	1.94E-01
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.62E-07	1.89E+05	3.06E-02	0.00E+00	0.00E+00	3.78E-01	1.63E-08	1.89E+05	3.07E-03
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.78E-05	7.22E+04	2.73E+00	0.00E+00	0.00E+00	8.83E+01	3.79E-06	7.22E+04	2.74E-01
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	3.38E-05	1.28E+05	4.33E+00	0.00E+00	0.00E+00	7.91E+01	3.40E-06	1.28E+05	4.35E-01
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	2.27E-03	4.39E+04	9.98E+01	0.00E+00	0.00E+00	5.31E+03	2.28E-04	4.39E+04	1.00E+01
Xe-135m	8.91E-01	2.22E-01	2.15E+03	4.78E+02	2.33E+04	1.00E-03	3.28E+04	3.28E+01	0.00E+00	0.00E+00	2.34E+03	1.01E-04	3.28E+04	3.30E+00
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	2.25E-04	1.37E+05	3.08E+01	0.00E+00	0.00E+00	5.26E+02	2.26E-05	1.37E+05	3.09E+00
Xe-137	4.36E-02	1.09E-04	9.55E-02	1.04E-01	1.14E+01	4.90E-07	1.83E+05	8.97E-02	0.00E+00	0.00E+00	1.15E+00	4.92E-08	1.83E+05	9.01E-03
Xe-138	3.03E-01	7.58E-04	6.27E+03	4.74E+00	7.92E+01	3.40E-06	1.43E+05	4.87E-01	0.00E+00	0.00E+00	7.96E+00	3.42E-07	1.43E+05	4.89E-02
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E-02	2.59E+01	1.11E-06	8.25E+02	1.03E-03	2.44E+07	6.04E+03	2.61E+00	1.12E-07	9.25E+02	1.04E-04
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	1.15E-06	1.44E+03	1.65E-03	2.90E+05	7.38E+01	2.68E+00	1.15E-07	1.44E+03	1.66E-04
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.93E-06	1.38E+03	2.67E-03	5.77E+06	2.48E+03	4.52E+00	1.94E-07	1.38E+03	2.68E-04
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.33E-06	1.59E+03	2.11E-03	7.60E+04	2.24E+01	3.10E+00	1.33E-07	1.59E+03	2.12E-04
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.47E-06	1.26E+03	1.85E-03	1.19E+06	3.89E+02	3.44E+00	1.48E-07	1.26E+03	1.86E-04
	4.01E-02			9.05E-02	1.05E+05			2.76E+02		9.00E+03	1.05E+04			2.78E+01
Monitor detection efficiency (cps/uCi/cc) = 8.54E+04									TEDE					
									1.00E+01	uCi/s	uCi/cc	cps	Child Thyroid	uCi/s
									1.0E+02	7.53E+05	3.24E-02	2.76E+03	5.0E+02	6.83E+05
									1.0E+03	7.53E+06	3.24E-01	2.70E+04	5.0E+02	6.83E+06
										7.53E+07	3.24E+00	2.78E+05	5.0E+03	6.83E+07

Monitor efficiencies from ERS-SFL-85-031

PING VS-110 Low

Release Flow Rate =

4.93E+04 cfm

= 2.33E+07 cc/s

X/Q = 9.24E-05 s/m³

Release (uCi/s) CF for TEDE = 5.24E+05

Release (uCi/s) CF for Child Thyroid = 2.48E+05

Isotope	U1 & U2 FHA (Ci)	Activity Ratio	DCF (mrem-m ² /uCi-y)	Effective DCF (mrem-m ² /uCi-y)	Release (uCi/s) mrem/hr	Release (uCi/cc) mrem/hr	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	DCF (mrem-m ² /uCi-y)	Effective DCF (mrem-m ² /uCi-y)	Release (uCi/s) mrem/hr	Release (uCi/cc) mrem/hr	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	6.90E-10	1.14E+05	7.87E-05	0.00E+00	0.00E+00	7.61E-03	3.27E-10	1.14E+05	3.73E-05
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	3.17E-04	1.14E+05	3.62E+01	0.00E+00	0.00E+00	3.50E+03	1.50E-04	1.14E+05	1.71E+01
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	1.77E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E+05	0.00E+00
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	1.05E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.05E+05	0.00E+00
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	1.89E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E+05	0.00E+00
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	3.09E-04	7.22E+04	2.23E+01	0.00E+00	0.00E+00	3.41E+03	1.47E-04	7.22E+04	1.06E+01
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	4.09E-04	1.28E+05	5.23E+01	0.00E+00	0.00E+00	4.51E+03	1.94E-04	1.28E+05	2.48E+01
Xe-133	3.23E+04	9.62E-01	1.76E+02	1.68E+02	4.99E+05	2.14E-02	4.39E+04	9.41E+02	0.00E+00	0.00E+00	2.36E+05	1.02E-02	4.39E+04	4.46E+02
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.76E-06	3.28E+04	5.77E-02	0.00E+00	0.00E+00	1.94E+01	8.33E-07	3.28E+04	2.73E-02
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	4.05E-05	1.37E+05	5.54E+00	0.00E+00	0.00E+00	4.46E+02	1.92E-05	1.37E+05	2.63E+00
Xe-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	1.83E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E+05	0.00E+00
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	1.43E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E+05	0.00E+00
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	3.45E-07	9.25E+02	3.19E-04	2.44E+07	3.74E+02	3.81E+00	1.64E-07	9.25E+02	1.51E-04
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.67E-07	1.44E+03	2.41E-04	2.90E+05	2.15E+00	1.84E+00	7.93E-08	1.44E+03	1.14E-04
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	2.22E-08	1.38E+03	3.07E-05	5.77E+06	5.70E+00	2.45E-01	1.05E-08	1.38E+03	1.45E-05
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.58E+03	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	1.58E+03	0.00E+00
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.48E-11	1.26E+03	1.86E-08	1.19E+06	7.82E-04	1.63E-04	7.01E-12	1.26E+03	8.84E-09
	3.39E+04			1.81E+02	5.24E+05			1.06E+03		3.82E+02	2.48E+05			5.01E+02
Monitor detection efficiency (cps/uCi/cc) = 8.54E+04									TEDE					
									1.00E+01	uCi/s	uCi/cc	cps	Child Thyroid	uCi/s
									1.0E+02	2.88E+06	1.24E-01	1.06E+05	5.0E+02	6.83E+07
									1.0E+03	2.88E+07	1.24E+00	1.06E+06	5.0E+02	6.83E+08
										2.88E+08	1.24E+01	1.06E+06	5.0E+03	6.83E+09

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject:

**BVPS-U1 Gaseous Radioactivity Monitor
Emergency Action Levels**

Revision: 11

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No.:
ERS-MPD-93-007

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RM-1RM-VS-110 Low Range (continued)

Monitor efficiencies from ERS-SFL-85-031

PING VS-110 Low

Release Flow Rate =

4.93E+04 cfm

= 2.327E+07 cc/s

X/Q = 9.24E-05 s/m³
Release (uCi/s) CF for TEDE = 2.20E+05
Release (uCi/s) CF for Child Thyroid = 1.22E+05

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s) mrem/hr	Release (uCi/cc) mrem/hr	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s) mrem/hr	Release (uCi/cc) mrem/hr	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.16E-03	5.45E+02	2.34E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E+02	1.29E-05	0.00E+00	0.00E+00
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	5.59E-05	1.14E+05	6.38E+00	0.00E+00	0.00E+00	7.19E+02	3.09E-05	1.14E+05	3.52E+00
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.36E-04	1.14E+05	1.55E+01	0.00E+00	0.00E+00	1.75E+03	7.52E-05	1.14E+05	6.58E+00
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	3.20E-05	1.77E+05	5.67E+00	0.00E+00	0.00E+00	4.12E+02	1.77E-05	1.77E+05	3.13E+00
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	1.00E-04	1.05E+05	1.05E+01	0.00E+00	0.00E+00	1.29E+03	5.52E-05	1.05E+05	5.80E+00
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	2.31E-06	1.89E+05	4.38E-01	0.00E+00	0.00E+00	2.97E+01	1.27E-06	1.89E+05	2.41E-01
Xe-131m	1.86E+02	1.21E-02	4.29E+01	5.17E-01	2.65E+03	1.14E-04	7.22E+04	8.24E+00	0.00E+00	0.00E+00	1.47E+03	6.30E-05	7.22E+04	4.55E+00
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.37E-04	1.28E+05	1.75E+01	0.00E+00	0.00E+00	1.76E+03	7.56E-05	1.28E+05	9.07E+00
Xe-133	1.32E+04	8.56E-01	1.76E+02	1.51E+02	1.88E+05	8.10E-03	4.39E+04	3.55E+02	0.00E+00	0.00E+00	1.04E+05	4.47E-03	4.39E+04	1.96E+02
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	8.71E-05	3.28E+04	2.88E+00	0.00E+00	0.00E+00	1.12E+03	4.81E-05	3.28E+04	1.58E+00
Xe-135	1.06E+03	6.87E-02	1.25E+03	8.59E+01	1.51E+04	6.50E-04	1.37E+05	8.91E+01	0.00E+00	0.00E+00	8.39E+03	3.59E-04	1.37E+05	4.92E+01
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E+01	1.38E+02	5.94E-06	1.83E+05	1.09E+00	0.00E+00	0.00E+00	7.63E+01	3.26E-06	1.83E+05	6.00E-01
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	2.07E-05	1.43E+05	2.96E+00	0.00E+00	0.00E+00	2.67E+02	1.15E-05	1.43E+05	1.64E+00
I-131	4.53E-01	2.94E-05	4.66E+05	1.37E+01	6.47E+00	2.78E-07	9.25E+02	2.57E-04	2.44E+07	7.17E+02	3.57E+00	1.54E-07	9.25E+02	1.42E-04
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	9.57E-09	1.44E+03	1.38E-05	2.90E+05	2.93E-01	1.23E-01	5.29E-09	1.44E+03	7.61E-06
I-133	1.55E-01	1.00E-05	1.28E+05	1.29E+00	2.21E+00	9.51E-08	1.38E+03	1.31E-04	5.77E+06	5.80E+01	1.22E+00	5.25E-08	1.38E+03	7.25E-05
I-134	9.29E-03	6.02E-07	2.69E+04	1.82E-02	1.33E-01	5.70E-09	1.59E+03	9.06E-06	7.60E+04	4.58E-02	7.33E-02	3.15E-09	1.59E+03	5.01E-06
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.26E-01	3.55E-08	1.26E+03	4.48E-05	1.19E+06	4.47E+00	4.57E-01	1.97E-08	1.26E+03	2.48E-05
	1.54E+04			4.31E+02	2.20E+05			5.16E+02	7.79E+02		1.22E+05			2.85E+02
Monitor detection efficiency (cps/uCi/cc) = 8.54E+04														
TEDE					uCi/s	uCi/cc	cps		Child Thyroid		uCi/s	uCi/cc	cps	
1.00E+01					1.41E+08	6.04E-02	5.16E+03		5.00E+01		3.88E+08	1.67E-01	1.42E+04	
1.00E+02					1.41E+07	6.04E-01	5.16E+04		5.00E+02		3.88E+07	1.67E+00	1.42E+05	
1.00E+03					1.41E+08	6.04E+00	5.16E+05		5.00E+03		3.88E+08	1.67E+01	1.42E+06	

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject:
BVPs-U1 Gaseous Radioactivity Monitor
Emergency Action Levels

No.:
ERS-MPD-93-007
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RM-1RM-VS-110 High Range

Monitor efficiencies from ERS-SFL-65-031									X/Q = 9.24E-05 s/m ³					
PING VS-110 High									Release (uCi/s) CF for TEDE = 1.31E+05					
Release Flow Rate = 4.93E+04 cfm = 2.33E+07 cc/s									Release (uCi/s) CF for Child Thyroid = 5.75E+03					
Isotope	U1 & U2 LOCA Gap (Ci)	Activity Ratio	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/h)	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/h)
Kr-83m	9.01E+01	2.02E-03	4.69E-01	9.48E-04	2.64E+02	1.14E-05	4.74E-10	5.39E-15	0.00E+00	0.00E+00	1.16E+01	4.99E-07	4.74E-10	2.37E-16
Kr-85m	2.21E+02	4.96E-03	8.17E+02	4.05E+00	6.49E+02	2.79E-05	1.69E-10	4.71E-15	0.00E+00	0.00E+00	2.85E+01	1.22E-06	1.69E-10	2.07E-16
Kr-85	1.27E+03	2.65E-02	1.12E+01	3.19E-01	3.73E+03	1.60E-04	1.79E-10	2.87E-14	0.00E+00	0.00E+00	1.64E+02	7.04E-06	1.79E-10	1.26E-15
Kr-87	8.45E+01	1.89E-03	4.47E+03	8.47E+00	2.48E+02	1.07E-05	1.08E-10	1.15E-15	0.00E+00	0.00E+00	1.09E+01	4.68E-07	1.08E-10	5.06E-17
Kr-88	3.58E+02	8.03E-03	1.13E+04	9.07E+01	1.05E+03	4.52E-05	2.31E-10	1.04E-14	0.00E+00	0.00E+00	4.62E+01	1.98E-06	2.31E-10	4.58E-16
Kr-89	7.50E-02	1.68E-06	1.02E+04	1.72E-02	2.20E-01	9.46E-09	1.77E-10	1.67E-18	0.00E+00	0.00E+00	9.67E-03	4.16E-10	1.77E-10	7.36E-20
Xe-131m	7.26E+02	1.63E-02	4.29E+01	6.98E-01	2.13E+03	9.16E-05	2.77E-10	2.54E-14	0.00E+00	0.00E+00	9.36E+01	4.02E-06	2.77E-10	1.11E-15
Xe-133m	6.33E+02	1.42E-02	1.49E+02	2.11E+00	1.86E+03	7.98E-05	2.27E-10	1.81E-14	0.00E+00	0.00E+00	8.16E+01	3.51E-06	2.27E-10	7.96E-16
Xe-133	3.72E+04	8.34E-01	1.76E+02	1.47E+02	1.09E+05	4.69E-03	4.69E-10	2.29E-12	0.00E+00	0.00E+00	4.80E+03	2.06E-04	4.89E-10	1.01E-13
Xe-135m	1.24E+03	2.78E-02	2.15E+03	5.98E+01	3.64E+03	1.56E-04	1.20E-11	1.88E-15	0.00E+00	0.00E+00	1.60E+02	6.87E-06	1.20E-11	8.25E-17
Xe-135	2.71E+03	6.08E-02	1.25E+03	7.60E+01	7.95E+03	3.42E-04	1.95E-10	6.67E-14	0.00E+00	0.00E+00	3.49E+02	1.50E-05	1.95E-10	2.93E-15
Xe-137	2.55E-01	5.72E-06	9.55E+02	5.46E-03	7.48E-01	3.22E-08	1.17E-10	3.76E-18	0.00E+00	0.00E+00	3.29E-02	1.41E-09	1.17E-10	1.65E-19
Xe-138	7.80E+00	1.75E-04	6.27E+03	1.10E+00	2.29E+01	9.84E-07	1.69E-10	1.66E-16	0.00E+00	0.00E+00	1.01E+00	4.32E-08	1.69E-10	7.31E-18
I-131	2.73E+01	6.12E-04	4.66E+05	2.85E+02	8.01E+01	3.44E-06	2.26E-12	7.78E-18	2.44E+07	1.49E+04	3.52E+00	1.51E-07	2.26E-12	3.42E-19
I-132	1.32E+01	2.96E-04	4.33E+04	1.28E+01	3.87E+01	1.66E-06	1.72E-12	2.86E-18	2.90E+05	8.58E+01	1.70E+00	7.32E-08	1.72E-12	1.26E-19
I-133	1.06E+01	2.38E-04	1.28E+05	3.04E+01	3.11E+01	1.34E-06	1.65E-12	2.21E-18	5.77E+06	1.37E+03	1.37E+00	5.87E-08	1.65E-12	9.69E-20
I-134	6.51E-01	1.46E-05	2.69E+04	3.93E-01	1.91E+00	8.21E-08	1.58E-12	1.30E-19	7.60E+04	1.11E+00	8.99E-02	3.61E-09	1.58E-12	5.70E-21
I-135	3.38E+00	7.58E-05	7.10E+04	5.38E+00	9.92E+00	4.26E-07	1.86E-12	7.93E-19	1.19E+06	9.02E+01	4.36E-01	1.67E-08	1.86E-12	3.46E-20
	4.46E+04			7.24E+02	1.31E+05			2.46E-12		1.65E+04	5.75E+03			1.08E-13
Monitor detection efficiency (amp/uCi/cc) = 3.31E-10														
									Child Thyroid					
									uCi/s					
									uCi/cc					
									amps					
									TEDE					
									1.00E+01					
									1.73E+06					
									7.42E-02					
									2.46E-11					
									1.0E+02					
									1.73E+07					
									7.42E-01					
									2.46E-10					
									1.0E+03					
									1.73E+08					
									7.42E+00					
									2.46E-09					

Monitor efficiencies from ERS-SFL-65-031										Release (uCi/s) CF for TEDE = 1.51E+05				
PING VS-110 High										Release (uCi/s) CF for Child Thyroid = 8.58E+03				
Release Flow Rate = 4.93E+04 cfm = 2.33E+07 cc/s														
U1 & U2 DBA LOCA										Effective				
Activity Ratio										DCF				
DCF										Release				
DCP										Release				
(mrem-m ³ / uCi-y)										(uCi/cc/ mrem/hr)				
(mrem-m ³ / uCi-y)										(amps/uCi/cc)				
Efficiency										Current				
Current										Current				
(amps/mrem/h)										(amps/mrem/h)				
Isotope										DCF				
(Ci)										DCF				
										Release				
										Release				
										(amps/uCi/cc)				
										(amps/mrem/h)				
Kr-83m										1.80E+03				
Kr-85m										4.41E+03				
Kr-85										1.27E+04				
Kr-87										1.69E+03				
Kr-88										7.16E+03				
Kr-89										1.50E+00				
Xe-131m										1.45E+04				
Xe-133m										1.27E+04				
Xe-133										7.43E+05				
Xe-135m										2.48E+04				
Xe-135										5.42E+04				
Xe-137										5.09E+00				
Xe-138										1.56E+02				
I-131										3.41E+02				
I-132										2.64E+02				
I-133										2.12E+02				
I-134										1.30E+01				
I-135										6.75E+01				
6.78E+05										6.27E+02				
Monitor detection efficiency (amp/uCi/cc) = 3.31E-10										TEDE				
										uCi/s				
										uCi/cc				
										amps				
										Child Thyroid				
										uCi/s				
										uCi/cc				
										amps				
										TEDE				
										1.00E+01				
										2.01E+06				
										6.65E-02				
										2.86E-11				
										1.0E+02				
										2.01E+07				
										6.65E+00				
										2.86E-09				

Health Physics Technical Position/Evaluation/Calculation

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RM-1RM-VS-110 High Range (continued)

U1 & U2 LOCA TID		Activity Ratio	Effective DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/cc/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/hr)	Effective DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/cc/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/hr)
Kr-83m	9.46E+06	1.31E-02	4.69E-01	6.13E-03	2.96E+02	1.27E-05	4.74E-10	6.02E-15	0.00E+00	0.00E+00	5.68E+01	2.53E-06	4.74E-10	1.20E-15
Kr-85m	1.95E+07	2.69E-02	8.17E+02	2.20E+01	8.10E+02	2.62E-05	1.69E-10	4.43E-15	0.00E+00	0.00E+00	1.21E+02	5.21E-06	1.69E-10	8.81E-16
Kr-85	8.27E+05	1.14E-03	1.12E+01	1.28E-02	2.55E+01	1.11E-06	1.79E-10	1.89E-16	0.00E+00	0.00E+00	5.14E+00	2.21E-07	1.79E-10	3.96E-17
Kr-87	3.91E+07	5.40E-02	4.47E+03	2.41E+02	1.22E+03	5.87E-05	1.08E-10	5.67E-15	0.00E+00	0.00E+00	2.43E+02	1.04E-05	1.08E-10	1.13E-15
Kr-88	5.43E+07	7.50E-02	1.13E+04	8.47E+02	1.70E+03	7.29E-05	2.31E-10	1.69E-14	0.00E+00	0.00E+00	3.38E+02	1.45E-05	2.31E-10	3.35E-15
Kr-89	6.75E+07	9.32E-02	1.02E+04	9.51E+02	2.11E+03	9.07E-05	1.77E-10	1.61E-14	0.00E+00	0.00E+00	4.20E+02	1.80E-05	1.77E-10	3.19E-15
Xe-131m	1.08E+06	1.49E-03	4.29E+01	6.40E-02	3.36E+01	1.45E-06	2.77E-10	4.02E-16	0.00E+00	0.00E+00	6.72E+00	2.89E-07	2.77E-10	8.00E-17
Xe-133m	5.05E+06	6.97E-03	1.49E+02	1.04E+00	1.56E+02	6.78E-06	2.27E-10	1.54E-15	0.00E+00	0.00E+00	3.14E+01	1.35E-06	2.27E-10	3.06E-16
Xe-133	1.80E+08	2.21E-01	1.76E+02	3.89E+01	5.00E+03	2.15E-04	4.89E-10	1.05E-13	0.00E+00	0.00E+00	9.95E+02	4.28E-05	4.89E-10	2.09E-14
Xe-135m	3.36E+07	4.64E-02	2.15E+03	9.97E+01	1.05E+03	4.51E-05	1.20E-11	5.42E-16	0.00E+00	0.00E+00	2.09E+02	8.98E-06	1.20E-11	1.08E-16
Xe-135	4.84E+07	6.68E-02	1.29E+03	8.35E+01	1.51E+03	6.50E-05	1.95E-10	1.27E-14	0.00E+00	0.00E+00	3.01E+02	1.29E-05	1.95E-10	5.25E-15
Xo-137	1.46E+08	2.02E-01	9.55E+02	1.93E+02	4.56E+03	1.96E-04	1.17E-10	2.29E-14	0.00E+00	0.00E+00	9.08E+02	3.90E-05	1.17E-10	4.57E-15
Xo-138	1.36E+08	1.88E-01	6.27E+03	1.18E+03	4.25E+03	1.63E-04	1.69E-10	3.09E-14	0.00E+00	0.00E+00	8.48E+02	3.63E-05	1.69E-10	6.14E-15
I-131	3.89E+05	5.37E-04	4.66E+05	2.50E+02	1.72E+01	5.23E-07	2.26E-12	1.18E-18	2.44E+07	1.31E+04	2.42E+00	1.04E-07	2.26E-12	2.35E-19
I-132	5.70E+05	7.87E-04	4.33E+04	3.41E+01	1.76E+01	7.66E-07	1.72E-12	1.32E-18	2.90E+05	2.28E+02	3.54E+00	1.52E-07	1.72E-12	2.62E-19
I-133	8.00E+05	1.10E-03	1.28E+05	1.41E+02	2.50E+01	1.07E-06	1.65E-12	1.77E-18	5.77E+06	6.37E+03	4.98E+00	2.14E-07	1.65E-12	3.53E-19
I-134	8.85E+05	1.22E-03	2.89E+04	3.29E+01	2.77E+01	1.19E-06	1.58E-12	1.68E-18	7.60E+04	9.29E+01	5.50E+00	2.37E-07	1.58E-12	3.74E-19
I-135	7.60E+05	1.05E-03	7.10E+04	7.45E+01	2.38E+01	1.02E-06	1.86E-12	1.90E-18	1.19E+06	1.25E+03	4.73E+0			

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject:

BVPS-U1 Gaseous Radioactivity Monitor
Emergency Action Levels

No.:

ERS-MPD-93-007
Attachment 2

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RM-1RM-VS-110 High Range (continued)

Monitor efficiencies from ERS-SFL-85-031

PING VS-110 High														X/Q = 9.24E-05 s/m ³	
Release Flow Rate = 4.93E+04 cfm = 2.33E+07 cc/s														Release (uCi/s) CF for TEDE = 1.05E+05	
Release (uCi/s) CF for Child Thyroid = 1.05E+04															
Isotope	U1 & U2 SB LOCA	Activity Ratio	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/h)	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/h)	
Kr-83m	2.49E-01	6.21E-04	4.69E-01	2.91E-04	6.51E+01	2.80E-06	4.74E-10	1.33E-15	0.00E+00	0.00E+00	6.54E+00	2.81E-07	4.74E-10	1.33E-16	
Kr-85m	8.90E-01	2.22E-03	8.17E+02	1.81E+00	2.33E+02	1.00E-05	1.68E-10	1.69E-15	0.00E+00	0.00E+00	2.34E+01	1.01E-06	1.69E-10	1.70E-16	
Kr-85	7.90E+01	1.97E-01	1.12E+01	2.21E+00	2.07E+04	8.68E-04	1.78E-10	1.59E-13	0.00E+00	0.00E+00	2.08E+03	8.92E-05	1.79E-10	1.60E-14	
Kr-87	5.64E-01	1.41E-03	4.47E+03	6.29E+00	1.47E+02	6.34E-06	1.08E-10	6.84E-16	0.00E+00	0.00E+00	1.48E+01	6.37E-07	1.08E-10	6.88E-17	
Kr-88	1.64E+00	4.09E-03	1.13E+04	4.62E+01	4.29E+02	1.84E-05	2.31E-10	4.26E-15	0.00E+00	0.00E+00	4.31E+01	1.85E-06	2.31E-10	4.28E-16	
Kr-89	1.44E-02	3.59E-05	1.02E+04	3.66E-01	3.77E+00	1.62E-07	1.77E-10	2.86E-17	0.00E+00	0.00E+00	3.78E-01	1.63E-08	1.77E-10	2.88E-18	
Xe-131m	3.36E+00	8.38E-03	4.29E+01	3.60E-01	8.79E+02	3.78E-05	2.77E-10	1.05E-14	0.00E+00	0.00E+00	8.83E+01	3.79E-06	2.77E-10	1.05E-15	
Xe-133m	3.01E+00	7.51E-03	1.49E+02	1.12E+00	7.87E+02	3.38E-05	2.27E-10	7.68E-15	0.00E+00	0.00E+00	7.91E+01	3.40E-06	2.27E-10	7.72E-16	
Xe-133	2.02E+02	5.04E-01	1.76E+02	8.87E+01	5.28E+04	2.27E-03	4.89E-10	1.11E-12	0.00E+00	0.00E+00	5.31E+03	2.28E-04	4.89E-10	1.12E-13	
Xe-135m	8.91E+01	2.22E-01	2.15E+03	4.78E+02	2.32E+04	1.00E-03	1.20E-11	1.20E-14	0.00E+00	0.00E+00	2.34E+03	1.01E-04	1.20E-11	1.21E-15	
Xe-135	2.00E+01	4.99E-02	1.25E+03	6.24E+01	5.23E+03	2.25E-04	1.95E-10	4.38E-14	0.00E+00	0.00E+00	5.26E+02	2.26E-05	1.95E-10	4.40E-15	
Xa-137	4.36E-02	1.09E-04	9.55E+02	1.04E-01	1.14E+01	4.90E-07	1.17E-10	5.73E-17	0.00E+00	0.00E+00	1.15E+00	4.92E-08	1.17E-10	5.76E-18	
Xe-138	3.03E-01	7.56E-04	6.27E+03	4.74E+00	7.92E+01	3.40E-06	1.69E-10	5.75E-16	0.00E+00	0.00E+00	7.96E+00	3.42E-07	1.69E-10	5.78E-17	
I-131	9.92E-02	2.48E-04	4.66E+05	1.15E+02	2.55E+01	1.11E-06	2.26E-12	2.52E-18	2.44E+07	6.04E+03	2.61E+00	1.12E-07	2.26E-12	2.53E-19	
I-132	1.02E-01	2.54E-04	4.33E+04	1.10E+01	2.67E+01	1.15E-06	1.72E-12	1.97E-10	2.90E+05	7.39E+01	2.68E+00	1.16E-07	1.72E-12	1.98E-19	
I-133	1.72E-01	4.29E-04	1.28E+05	5.49E+01	4.50E+01	1.93E-08	1.85E-12	3.19E-18	5.77E+06	2.48E+03	4.52E+00	1.94E-07	1.85E-12	3.21E-19	
I-134	1.18E-01	2.94E-04	2.69E+04	7.92E+00	3.09E+01	1.33E-08	1.58E-12	2.09E-18	7.60E+04	2.24E+01	3.10E+00	1.33E-07	1.58E-12	2.11E-19	
I-135	1.31E-01	3.27E-04	7.10E+04	2.32E+01	3.43E+01	1.47E-06	1.86E-12	2.74E-18	1.19E+06	3.89E+02	3.44E+00	1.48E-07	1.86E-12	2.75E-19	
	4.01E+02			9.05E+02	1.05E+05			1.35E-12		9.00E+03	1.05E+04			1.36E-13	
Monitor detection efficiency (amp/uCi/cc) = 3.31E-10															
				TEDE	uCi/s	uCi/cc	amps					Child Thyroid	uCi/s	uCi/cc	amps
				1.00E+01	9.50E+05	4.08E-02	1.35E-11					5.00E+01	4.77E+05	2.05E-02	6.79E-12
				1.0E+02	9.50E+06	4.08E-01	1.35E-10					5.0E+02	4.77E+06	2.05E-01	6.79E-11
				1.0E+03	9.50E+07	4.08E+00	1.35E-09					5.0E+03	4.77E+07	2.05E+00	6.79E-10

Monitor efficiencies from ERS-SFL-85-031

PING VS-110 High														X/Q = 9.24E-05 s/m ³	
Release Flow Rate = 4.93E+04 cfm = 2.33E+07 cc/s														Release (uCi/s) CF for TEDE = 5.24E+05	
Release (uCi/s) CF for Child Thyroid = 2.48E+05															
Isotope	U1 & U2 FHA	Activity Ratio	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/h)	DCF (mrem-m ³ / uCi-y)	Effective DCF (mrem-m ³ / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/h)	
Kr-83m	0.00E+00	0.00E+00	4.69E-01	0.00E+00	0.00E+00	0.00E+00	4.74E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.74E-10	0.00E+00	
Kr-85m	1.04E-03	3.07E-08	8.17E+02	2.50E-05	1.61E-02	6.90E-10	1.69E-10	1.17E-19	0.00E+00	0.00E+00	7.61E-03	3.27E-10	1.69E-10	5.53E-20	
Kr-85	4.78E+02	1.41E-02	1.12E+01	1.58E-01	7.38E+03	3.17E-04	1.79E-10	5.68E-14	0.00E+00	0.00E+00	3.50E+03	1.50E-04	1.79E-10	2.69E-14	
Kr-87	0.00E+00	0.00E+00	4.47E+03	0.00E+00	0.00E+00	0.00E+00	1.08E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-10	0.00E+00	
Kr-88	0.00E+00	0.00E+00	1.13E+04	0.00E+00	0.00E+00	0.00E+00	2.31E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E-10	0.00E+00	
Kr-89	0.00E+00	0.00E+00	1.02E+04	0.00E+00	0.00E+00	0.00E+00	1.77E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-10	0.00E+00	
Xe-131m	4.66E+02	1.37E-02	4.29E+01	5.89E-01	7.19E+03	3.09E-04	2.77E-10	8.56E-14	0.00E+00	0.00E+00	3.41E+03	1.47E-04	2.77E-10	4.06E-14	
Xe-133m	6.16E+02	1.82E-02	1.49E+02	2.71E+00	9.51E+03	4.09E-04	2.27E-10	9.28E-14	0.00E+00	0.00E+00	4.51E+03	1.94E-04	2.27E-10	4.40E-14	
Xe-133	3.23E+04	9.52E-01	1.76E+02	1.68E+02	4.99E+05	2.14E-02	4.89E-10	1.05E-11	0.00E+00	0.00E+00	2.36E+05	1.02E-02	4.89E-10	4.97E-12	
Xe-135m	2.65E+00	7.81E-05	2.15E+03	1.68E-01	4.09E+01	1.76E-06	1.20E-11	2.11E-17	0.00E+00	0.00E+00	1.94E+01	8.33E-07	1.20E-11	1.00E-17	
Xe-135	6.10E+01	1.80E-03	1.25E+03	2.25E+00	9.42E+02	4.05E-05	1.95E-10	7.89E-15	0.00E+00	0.00E+00	4.46E+02	1.92E-05	1.95E-10	3.74E-15	
Xa-137	0.00E+00	0.00E+00	9.55E+02	0.00E+00	0.00E+00	0.00E+00	1.17E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.17E-10	0.00E+00	
Xe-138	0.00E+00	0.00E+00	6.27E+03	0.00E+00	0.00E+00	0.00E+00	1.89E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E-10	0.00E+00	
I-131	5.20E-01	1.53E-05	4.66E+05	7.14E+00	8.03E+00	3.45E-07	2.26E-12	7.60E-19	2.44E+07	3.74E+02	3.81E+00	1.64E-07	2.26E-12	3.70E-19	
I-132	2.52E-01	7.43E-06	4.33E+04	3.22E-01	3.89E+00	1.67E-07	1.72E-12	2.88E-19	2.90E+05	2.15E+00	1.84E+00	7.93E-08	1.72E-12	1.36E-19	
I-133	3.35E-02	9.87E-07	1.28E+05	1.26E-01	5.17E-01	2.22E-08	1.85E-12	3.67E-20	5.77E+06	5.70E+00	2.45E-01	1.05E-08	1.85E-12	1.74E-20	
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.58E-12	0.00E+00	7.60E+04	0.00E+00	0.00E+00	0.00E+00	1.58E-12	0.00E+00	
I-135	2.23E-05	6.57E-10	7.10E+04	4.67E-05	3.44E-04	1.48E-11	1.86E-12	2.75E-23	1.19E+06	7.82E-04	1.63E-04	7.01E-12	1.86E-12	1.30E-23	
	3.39E+04			1.81E+02	5.24E-05			1.07E-11		3.82E+02	2.48E+05			5.08E-12	
Monitor detection efficiency (amp/uCi/cc) = 3.31E-10															
				TEDE	uCi/s	uCi/cc	amps					Child Thyroid	uCi/s	uCi/cc	amps
				1.00E+01	7.54E+06	3.24E-01	1.07E-10					5.00E+01	1.79E+07	7.68E-01	2.54E-10
				1.0E+02	7.54E+07	3.24E+00	1.07E-09					5.0E+02	1.79E+08	7.68E+00	2.54E-09
				1.0E+03	7.54E+08	3.24E+01	1.07E-08					5.0E+03	1.79E+09	7.68E+01	2.54E-08

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

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BVPS-U1 Gaseous Radioactivity Monitor
Emergency Action Levels

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RM-1RM-VS-110 High Range (continued)

Monitor efficiencies from ERS-SFL-65-031
PING VS-110 High

Release Flow Rate = 4.93E+04 cfm = 2.327E+07 cc/s

X/Q = 9.24E-05 sm³
Release (uCi/s) CF for TEDE = 2.20E+05
Release (uCi/s) CF for Child Thyroid = 1.22E+05

Isotope	U1 & U2 RCCA (Ci)	Activity Ratio	DCF (mrem-m ² /uCi-y)	Effective DCF (mrem-m ² /uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/h)	DCF (mrem-m ² /uCi-y)	Effective DCF (mrem-m ² /uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/h)
Kr-83m	3.82E+01	2.48E-03	4.69E-01	1.10E-03	5.45E+02	2.34E-05	4.74E-10	1.11E-14	0.00E+00	0.00E+00	3.01E+02	1.29E-05	4.74E-10	6.14E-15
Kr-85m	9.12E+01	5.91E-03	8.17E+02	4.83E+00	1.30E+03	5.59E-05	1.69E-10	9.45E-15	0.00E+00	0.00E+00	7.19E+02	3.09E-05	1.69E-10	5.22E-15
Kr-85	2.22E+02	1.44E-02	1.12E+01	1.61E-01	3.17E+03	1.36E-04	1.79E-10	2.44E-14	0.00E+00	0.00E+00	1.75E+03	7.52E-05	1.79E-10	1.35E-14
Kr-87	5.22E+01	3.38E-03	4.47E+03	1.51E+01	7.45E+02	3.20E-05	1.08E-10	3.46E-15	0.00E+00	0.00E+00	4.12E+02	1.77E-05	1.08E-10	1.91E-15
Kr-88	1.63E+02	1.06E-02	1.13E+04	1.19E+02	2.33E+03	1.00E-04	2.31E-10	2.31E-14	0.00E+00	0.00E+00	1.29E+03	5.52E-05	2.31E-10	1.28E-14
Kr-89	3.76E+00	2.44E-04	1.02E+04	2.49E+00	5.37E+01	2.31E-06	1.77E-10	4.08E-16	0.00E+00	0.00E+00	2.97E+01	1.27E-06	1.77E-10	2.26E-16
Xe-131m	1.86E+02	1.21E-02	4.25E+01	5.17E-01	2.65E+03	1.14E-04	2.77E-10	3.16E-14	0.00E+00	0.00E+00	1.47E+03	6.30E-05	2.77E-10	1.75E-14
Xe-133m	2.23E+02	1.45E-02	1.49E+02	2.15E+00	3.18E+03	1.37E-04	2.27E-10	3.10E-14	0.00E+00	0.00E+00	1.76E+03	7.56E-05	2.27E-10	1.72E-14
Xe-133	1.32E+04	8.56E-01	1.78E+02	1.51E+02	1.88E+05	8.10E-03	4.89E-10	3.96E-12	0.00E+00	0.00E+00	1.04E+05	4.47E-03	4.89E-10	2.19E-12
Xe-135m	1.42E+02	9.21E-03	2.15E+03	1.98E+01	2.03E+03	8.71E-05	1.20E-11	1.05E-15	0.00E+00	0.00E+00	1.12E+03	4.81E-05	1.20E-11	5.77E-16
Xe-135	1.06E+03	8.87E-02	1.25E+03	8.59E+01	1.51E+04	6.50E-04	1.95E-10	1.27E-13	0.00E+00	0.00E+00	8.36E+03	3.59E-04	1.95E-10	7.01E-14
Xe-137	9.68E+00	6.28E-04	9.55E+02	5.99E-01	1.38E+02	5.94E-06	1.17E-10	6.95E-16	0.00E+00	0.00E+00	7.63E+01	3.28E-06	1.17E-10	3.84E-16
Xe-138	3.38E+01	2.19E-03	6.27E+03	1.37E+01	4.82E+02	2.07E-05	1.69E-10	3.50E-15	0.00E+00	0.00E+00	2.67E+02	1.15E-05	1.69E-10	1.94E-15
I-131	4.53E-01	2.94E-05	4.68E+05	1.37E+01	6.47E+00	2.78E-07	2.26E-12	6.28E-19	2.44E+07	7.17E+02	3.57E+00	1.54E-07	2.26E-12	3.47E-19
I-132	1.56E-02	1.01E-06	4.33E+04	4.38E-02	2.23E-01	9.57E-09	1.72E-12	1.65E-20	2.90E+05	2.93E-01	1.23E-01	5.29E-09	1.72E-12	9.09E-21
I-133	1.55E-01	1.00E-05	1.28E+05	1.28E+00	2.21E+00	9.51E-08	1.85E-12	1.57E-19	5.77E+06	5.80E+01	1.22E+00	5.25E-08	1.85E-12	6.67E-20
I-134	9.29E-03	6.02E-07	2.69E+04	1.62E-02	1.33E-01	5.70E-09	1.58E-12	9.00E-21	7.60E+04	4.58E-02	7.33E-02	3.15E-09	1.58E-12	4.97E-21
I-135	5.80E-02	3.76E-06	7.10E+04	2.67E-01	8.28E-01	3.56E-08	1.86E-12	6.62E-20	1.19E+06	4.47E+00	4.57E-01	1.97E-08	1.86E-12	3.66E-20
	1.54E+04			4.31E+02	2.20E+05		4.23E-12		7.78E+02	1.22E+06				2.33E-12
Monitor detection efficiency (amp/uCi/cc) =					TEDE	uCi/s	uCi/cc	amps						
					1.00E+01	2.97E+06	1.28E-01	4.23E-11	Child Thyroid					
					1.0E+02	2.97E+07	1.28E+00	4.23E-10	5.00E+01					
					1.0E+03	2.97E+08	1.28E+01	4.23E-09	5.0E+02					
									5.0E+03					
									uCi/s					
									8.21E+06					
									uCi/cc					
									3.53E-01					
									amps					
									1.17E-10					
									1.17E-09					
									1.17E-08					

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject:
BVPs-U1 Gaseous Radioactivity Monitor
Emergency Action Levels

RM-1GW-109 Low Range

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ERS-MPD-93-007
Attachment 2
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Monitor efficiencies from ERS-SFL-85-031										X/Q = 2.31E-06		s/m ³		
PING RM-1GW-109 Channel Low										Release (uCi/s) CF for TEDE = 8.71E+06		Release (uCi/s) CF for Child Thyroid = 2.28E+06		
Release Flow Rate = 1.45E+03 cfm = 6.84E+05 cc/s														
Isotope	U1 SGTR	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)
Kr-83m	2.09E+00	7.56E-04	4.69E-01	3.55E-04	6.59E+03	9.62E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E+03	2.52E-03	0.00E+00	0.00E+00
Kr-85m	7.35E+00	2.66E-03	8.17E+02	2.17E+00	2.32E+04	3.38E-02	1.14E+05	3.86E+03	0.00E+00	0.00E+00	6.07E+03	8.88E-03	1.14E+05	1.01E+03
Kr-85	6.74E+02	2.44E-01	1.12E+01	2.73E+00	2.12E+06	3.10E-03	1.14E+05	3.54E+05	0.00E+00	0.00E+00	5.57E+05	8.14E-01	1.14E+05	9.28E+04
Kr-87	4.48E+00	1.62E-03	4.47E+03	7.24E+00	1.41E+04	2.06E-02	1.77E+05	3.65E+03	0.00E+00	0.00E+00	3.70E+03	5.41E-03	1.77E+05	9.58E+02
Kr-88	1.34E+01	4.85E-03	1.13E+04	5.48E+01	4.22E+04	6.17E-02	1.05E+05	6.48E+03	0.00E+00	0.00E+00	1.11E+04	1.62E-02	1.05E+05	1.70E+03
Kr-89	7.66E-02	2.77E-05	1.02E+04	2.83E-01	2.41E+02	3.53E-04	1.89E+05	6.67E+01	0.00E+00	0.00E+00	6.33E+01	9.25E-05	1.89E+05	1.75E+01
Xe-131m	2.76E+01	9.98E-03	4.29E+01	4.28E-01	8.70E+04	1.27E-01	7.22E+04	9.17E+03	0.00E+00	0.00E+00	2.28E+04	3.33E-02	7.22E+04	2.41E+03
Xe-133m	2.34E+01	8.46E-03	1.49E+02	1.28E+00	7.37E+04	1.08E-01	1.28E+05	1.38E+04	0.00E+00	0.00E+00	1.93E+04	2.83E-02	1.28E+05	3.62E+03
Xe-133	1.69E+03	6.11E-01	1.76E+02	1.08E+02	5.33E+06	7.78E+00	4.39E+04	3.42E+05	0.00E+00	0.00E+00	1.40E+06	2.04E+00	4.39E+04	8.96E+04
Xe-135m	2.27E+02	8.21E-02	2.15E+03	1.77E+02	7.15E+05	1.05E+00	3.28E+04	3.43E+04	0.00E+00	0.00E+00	1.88E+05	2.74E-01	3.28E+04	8.99E+03
Xe-135	9.28E+01	3.36E-02	1.25E+03	4.20E+01	2.92E+05	4.27E-01	1.37E+05	5.85E+04	0.00E+00	0.00E+00	7.67E+04	1.12E-01	1.37E+05	1.54E+04
Xe-137	2.33E+01	8.43E-05	9.55E+02	8.05E+02	7.34E+02	1.07E-03	1.63E+05	1.98E+02	0.00E+00	0.00E+00	1.93E+02	2.81E-04	1.83E+05	5.15E+01
Xe-138	1.99E+00	7.20E-04	6.27E+03	4.51E+00	6.27E+03	9.16E-03	1.43E+05	1.31E+03	0.00E+00	0.00E+00	1.64E+03	2.40E-03	1.43E+05	3.44E+02
I-131	1.35E-01	4.88E-05	4.66E+05	2.28E+01	4.25E+02	6.22E-04	9.25E+02	5.75E-01	2.44E+07	1.19E+03	1.12E+02	1.63E-04	9.25E+02	1.51E-01
I-132	4.77E-02	1.73E-05	4.33E+04	7.47E-01	1.50E+02	2.20E-04	1.44E+03	3.16E-01	2.90E+05	5.00E+00	3.94E+01	5.76E-05	1.44E+03	8.29E-02
I-133	1.99E-01	7.20E-05	1.28E+05	9.21E+00	6.27E+02	9.16E-04	1.38E+03	1.26E+00	5.77E+06	4.15E+02	1.64E+02	2.40E-04	1.38E+03	3.32E-01
I-134	2.33E-02	8.43E-06	2.69E+04	2.27E-01	7.34E+01	1.07E-04	1.59E+03	1.71E-01	7.60E+04	6.40E-01	1.93E+01	2.81E-05	1.59E+03	4.47E-02
I-135	1.10E-01	3.98E-05	7.10E+04	2.82E+00	3.47E+02	5.06E-04	1.26E+03	6.38E-01	1.19E+06	4.73E+01	8.09E+01	1.33E-04	1.26E+03	1.67E-01
	2.76E+03			4.35E+02	6.71E+06			8.27E+05		1.66E+03	2.28E+06			2.17E+05
Monitor detection efficiency (cps/uCi/cc) = 6.71E+04														
TEDE										Child Thyroid		uCi/s	uCi/cc	cps
1.00E+01										5.00E+01		1.11E+08	1.62E+02	1.08E+07
1.0E+02										5.0E+02		1.11E+09	1.62E+03	1.08E+08
1.0E+03										5.0E+03		1.11E+10	1.62E+04	1.08E+09

Monitor efficiencies from ERS-SFL-85-031										X/Q = 2.31E-06 s/m ³				
PING RM-1GW-109 Channel Low										Release (uCi/s) CF for TEDE = 1.58E+07 #DIV/0!				
Release Flow Rate = 1.45E+03 cfm = 6.84E+05 cc/s										Release (uCi/s) CF for Child Thyroid = #DIV/0!				
Isotope	U1 GW Fail (Ci)	Activity Ratio	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)	DCF (mrem-m ² / uCi-y)	Effective DCF (mrem-m ² / uCi-y)	Release (uCi/s/ mrem/hr)	Release (uCi/cc/ mrem/hr)	Efficiency (cps/uCi/cc)	Count Rate (cps/mrem/hr)
Kr-83m	2.80E+00	1.05E-03	4.69E-01	4.93E-04	1.64E+04	2.40E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	0.00E+00	#DIV/0!
Kr-85m	1.17E+01	4.39E-03	8.17E+02	3.59E+00	6.88E+04	1.00E-01	1.14E+05	1.14E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.14E+05	#DIV/0!
Kr-85	1.16E+03	4.38E-01	1.12E+01	4.88E+00	6.81E+06	9.94E+00	1.14E+05	1.13E+06	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.14E+05	#DIV/0!
Kr-87	5.89E+00	2.21E-03	4.47E+03	9.88E+00	3.46E+04	5.05E-02	1.77E+05	8.94E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.77E+05	#DIV/0!
Kr-88	2.03E+01	7.82E-03	1.13E+04	8.61E+01	1.19E+05	1.74E-01	1.05E+05	1.83E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.05E+05	#DIV/0!
Kr-89	2.12E-01	7.96E-05	1.02E+04	8.12E-01	1.24E+03	1.82E-03	1.89E+05	3.43E+02	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.89E+05	#DIV/0!
Xe-131m	1.77E+01	6.65E-03	4.29E+01	2.85E-01	1.04E+05	1.52E-01	7.22E+04	1.10E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	7.22E+04	#DIV/0!
Xe-133m	2.45E+01	9.20E-03	1.49E+02	1.37E+00	1.44E+05	2.10E-01	1.28E+05	2.69E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.28E+05	#DIV/0!
Xe-133	1.33E+03	4.99E-01	1.76E+02	8.79E+01	7.80E+06	1.14E-01	4.39E+04	5.00E+05	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.39E+04	#DIV/0!
Xe-135m	3.38E+00	1.27E-03	2.15E+03	2.73E+00	1.98E+04	2.90E-02	3.28E+04	9.50E+02	0.03E+00	0.00E+00	#DIV/0!	#DIV/0!	3.28E+04	#DIV/0!
Xe-135	8.41E+01	3.16E-02	1.25E+03	3.95E+01	4.93E+05	7.21E-01	1.37E+05	9.88E+04	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.37E+05	#DIV/0!
Xe-137	5.59E-01	2.10E-04	9.55E+02	2.00E-01	3.28E+03	4.79E-03	1.83E+05	8.77E+02	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.83E+05	#DIV/0!
Xe-138	2.32E+00	8.71E-04	6.27E+03	5.46E+00	1.36E+04	1.99E-02	1.43E+05	2.84E+03	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.43E+05	#DIV/0!
I-131	0.00E+00	0.00E+00	4.66E+05	0.00E+00	0.00E+00	0.00E+00	9.25E+02	0.00E+00	2.44E+07	0.00E+00	#DIV/0!	#DIV/0!	9.25E+02	#DIV/0!
I-132	0.00E+00	0.00E+00	4.33E+04	0.00E+00	0.00E+00	0.00E+00	1.44E+03	0.00E+00	2.90E+05	0.00E+00	#DIV/0!	#DIV/0!	1.44E+03	#DIV/0!
I-133	0.00E+00	0.00E+00	1.28E+05	0.00E+00	0.00E+00	0.00E+00	1.38E+03	0.00E+00	5.77E+06	0.00E+00	#DIV/0!	#DIV/0!	1.38E+03	#DIV/0!
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.59E+03	0.00E+00	7.60E+04	0.00E+00	#DIV/0!	#DIV/0!	1.59E+03	#DIV/0!
I-135	0.00E+00	0.00E+00	7.10E+04	0.00E+00	0.00E+00	0.00E+00	1.26E+03	0.00E+00	1.19E+06	0.00E+00	#DIV/0!	#DIV/0!	1.26E+03	#DIV/0!
	2.86E+03			2.43E+02	1.56E+07			1.81E+06		0.00E+00	#DIV/0!	#DIV/0!		#DIV/0!
Monitor detection efficiency (cps/uCi/cc) = 6.71E+04														
TEDE										Child Thyroid	uCi/s	uCi/cc	cps	
1.00E+01										5.00E+01	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.0E+02										5.0E+02	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.0E+03										5.0E+03	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

No iodine in this source term. #DIV/0! error is expected in this spreadsheet.

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

Subject:

BVPS-U1 Gaseous Radioactivity Monitor
Emergency Action Levels

Revision: 11

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RM-1GW-109 High Range

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ERS-MPD-93-007
Attachment 2

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Monitor efficiencies from ERS-SFL-85-031
PING RM-1GW-109 Channel High

Release Flow Rate = 1.45E+03 cfm = 6.84E+05 cc/s

X/Q = 2.31E-06 s/m³
Release (uCi/s) CF for TEDE = 8.71E+06
Release (uCi/s) CF for Child Thyroid = 2.28E+06

Isotope	U1 SGTR (Ci)	Activity Ratio	DCF (mrem-m ³ /uCi-y)	Effective DCF (mrem-m ³ /uCi-y)	Release (uCi/s/mrem/hr)	Release (uCi/cc/mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/hr)	DCF (mrem-m ³ /uCi-y)	Effective DCF (mrem-m ³ /uCi-y)	Release (uCi/s/mrem/hr)	Release (uCi/cc/mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/hr)
Kr-83m	2.09E+00	7.56E-04	4.69E-01	3.55E-04	6.59E+03	9.62E-03	4.74E-10	4.56E-12	0.00E+00	0.00E+00	1.73E+03	2.52E-03	4.74E-10	1.20E-12
Kr-85m	7.35E+00	2.66E-03	8.17E+02	2.17E+00	2.32E+04	3.38E-02	1.69E-10	5.72E-12	0.00E+00	0.00E+00	8.07E+03	8.88E-03	1.69E-10	1.50E-12
Kr-85	6.74E+02	2.44E-01	1.12E+01	2.73E+00	2.12E+06	3.10E+00	1.79E-10	5.55E-10	0.00E+00	0.00E+00	5.57E+05	8.14E-01	1.79E-10	1.46E-10
Kr-87	4.48E+00	1.62E-03	4.47E+03	7.24E+00	1.41E+04	2.06E-02	1.08E-10	2.23E-12	0.00E+00	0.00E+00	3.70E+03	5.41E-03	1.08E-10	5.84E-13
Kr-88	1.34E+01	4.65E-03	1.13E+04	5.48E+01	4.22E+04	6.17E-02	2.31E-10	1.43E-11	0.00E+00	0.00E+00	1.11E+04	1.62E-02	2.31E-10	3.74E-12
Kr-89	7.66E-02	2.77E-05	1.02E+04	2.83E-01	2.41E+02	3.53E-04	1.77E-10	6.24E-14	0.00E+00	0.00E+00	6.33E+01	9.25E-05	1.77E-10	1.64E-14
Xe-131m	2.76E+01	9.98E-03	4.29E+01	4.28E-01	8.70E+04	1.27E-01	2.77E-10	3.52E-11	0.00E+00	0.00E+00	2.28E+04	3.33E-02	2.77E-10	9.23E-12
Xe-133m	2.34E+01	8.46E-03	1.49E+02	1.28E+00	7.37E+04	1.08E-01	2.27E-10	2.45E-11	0.00E+00	0.00E+00	1.93E+04	2.83E-02	2.27E-10	6.41E-12
Xe-133	1.69E+03	6.11E-01	1.76E+02	1.08E+02	5.33E+06	7.78E+00	4.89E-10	3.80E-09	0.00E+00	0.00E+00	1.40E+06	2.04E+00	4.89E-10	9.98E-10
Xe-135m	2.27E+02	8.21E-02	2.15E+03	1.77E+02	7.15E+05	1.05E+00	1.20E-11	1.25E-11	0.00E+00	0.00E+00	1.88E+05	2.74E-01	1.20E-11	3.29E-12
Xe-135	9.28E+01	3.36E-02	1.25E+03	4.20E+01	2.92E+05	4.27E-01	1.95E-10	8.33E-11	0.00E+00	0.00E+00	7.67E+04	1.12E-01	1.95E-10	2.19E-11
Xe-137	2.33E+01	8.43E-05	9.55E+02	8.05E-02	7.34E+02	1.07E-03	1.17E-10	1.26E-13	0.00E+00	0.00E+00	1.93E+02	2.81E-04	1.17E-10	3.29E-14
Xe-138	1.99E+00	7.20E-04	6.27E+03	4.51E+00	6.27E+03	9.16E-03	1.69E-10	1.55E-12	0.00E+00	0.00E+00	1.64E+03	2.40E-03	1.69E-10	4.06E-13
I-131	1.35E+01	4.88E-05	4.66E+05	2.28E+01	4.25E+02	6.22E-04	2.26E-12	1.40E-15	2.44E+07	1.19E+03	1.12E+02	1.63E-04	2.26E-12	3.68E-16
I-132	4.77E-02	1.73E-05	4.33E+04	7.47E-01	1.50E+02	2.20E-04	1.72E-12	3.78E-16	2.90E+05	5.00E+00	3.94E+01	5.76E-05	1.72E-12	9.91E-17
I-133	1.99E+01	7.20E-05	1.28E+05	9.21E+00	6.27E+02	9.16E-04	1.65E-12	1.51E-15	5.77E+06	4.15E+02	1.64E+02	2.40E-04	1.65E-12	3.96E-16
I-134	2.33E-02	8.43E-06	2.69E+04	2.27E-01	7.34E-01	1.07E-04	1.58E-12	1.69E-16	7.60E+04	6.40E+01	1.93E+01	2.81E-05	1.58E-12	4.45E-17
I-135	1.10E-01	3.86E-05	7.10E+04	2.82E+00	3.47E-02	5.06E-04	1.86E-12	9.42E-16	1.19E+06	4.73E+01	9.09E+01	1.33E-04	1.86E-12	2.47E-16
	2.76E+03		4.35E+02	8.71E+06			4.54E-09		1.66E+03	2.28E+06			1.66E+03	1.19E-09

Monitor detection efficiency (amp/uCi/cc) = 3.97E-10

TEDE	uCi/s	uCi/cc	amps
1.00E+01	7.83E+07	1.14E+02	4.54E-08
1.0E+02	7.83E+08	1.14E+03	4.54E-07
1.0E+03	7.83E+09	1.14E+04	4.54E-06

Child Thyroid	uCi/s	uCi/cc	amps
5.00E+01	1.03E+08	1.50E+02	5.96E-08
5.0E+02	1.03E+09	1.50E+03	5.96E-07
5.0E+03	1.03E+10	1.50E+04	5.96E-06

Monitor efficiencies from ERS-SFL-85-031
PING RM-1GW-109 Channel High

Release Flow Rate = 1.45E+03 cfm = 6.84E+05 cc/s

X/Q = 2.31E-06 s/m³
Release (uCi/s) CF for TEDE = 1.56E+07
Release (uCi/s) CF for Child Thyroid = #DIV/0!

Isotope	U1 GW Fail	Activity Ratio	DCF (mrem-m ³ /uCi-y)	Effective DCF (mrem-m ³ /uCi-y)	Release (uCi/s/mrem/hr)	Release (uCi/cc/mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/hr)	DCF (mrem-m ³ /uCi-y)	Effective DCF (mrem-m ³ /uCi-y)	Release (uCi/s/mrem/hr)	Release (uCi/cc/mrem/hr)	Efficiency (amps/uCi/cc)	Current (amps/mrem/hr)
Kr-83m	2.80E+00	1.05E-03	4.69E-01	4.93E-04	1.64E+04	2.40E-02	4.74E-10	1.14E-11	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.74E-10	#DIV/0!
Kr-85m	1.17E+01	4.39E-03	8.17E+02	3.59E+00	6.88E+04	1.00E-01	1.69E-10	1.69E-11	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.69E-10	#DIV/0!
Kr-85	1.16E+03	4.38E-01	1.12E+01	4.88E+00	6.81E+06	9.94E+00	1.79E-10	1.78E-09	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.79E-10	#DIV/0!
Kr-87	5.89E+00	2.21E-03	4.47E+03	9.88E+00	3.46E+04	5.05E-02	1.08E-10	5.45E-12	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.08E-10	#DIV/0!
Kr-88	2.03E+01	7.62E-03	1.13E+04	6.61E+01	1.19E+05	1.74E-01	2.31E-10	4.02E-11	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.31E-10	#DIV/0!
Kr-89	2.12E-01	7.96E-05	1.02E+04	8.12E-01	1.24E+03	1.82E-03	1.77E-10	3.22E-13	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.77E-10	#DIV/0!
Xe-131m	1.77E+01	6.65E-03	4.29E+01	2.85E-01	1.04E+05	1.52E-01	2.77E-10	4.20E-11	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.77E-10	#DIV/0!
Xe-133m	2.45E+01	9.20E-03	1.49E+02	1.37E+00	1.44E+05	2.10E-01	2.27E-10	4.77E-11	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	2.27E-10	#DIV/0!
Xe-133	1.33E+03	4.99E-01	1.76E+02	8.79E+01	7.80E+06	1.14E+01	4.89E-10	5.57E-09	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	4.89E-10	#DIV/0!
Xe-135m	3.38E+00	1.27E-03	2.15E+03	2.73E+00	1.98E+04	2.90E-02	1.20E-11	3.48E-13	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.20E-11	#DIV/0!
Xe-135	8.41E+01	3.16E-02	1.25E+03	3.95E+01	4.93E+05	7.21E-01	1.95E-10	1.41E-10	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.95E-10	#DIV/0!
Xe-137	5.59E-01	2.10E-04	9.55E+02	2.00E-01	3.28E+03	4.79E-03	1.17E-10	5.61E-13	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.17E-10	#DIV/0!
Xe-138	2.32E+00	8.71E-04	6.27E+03	5.46E+00	1.36E+04	1.99E-02	1.69E-10	3.36E-12	0.00E+00	0.00E+00	#DIV/0!	#DIV/0!	1.69E-10	#DIV/0!
I-131	0.00E+00	0.00E+00	4.66E+05	0.00E+00	0.00E+00	0.00E+00	2.26E-12	0.00E+00	2.44E+07	0.00E+00	#DIV/0!	#DIV/0!	2.26E-12	#DIV/0!
I-132	0.00E+00	0.00E+00	4.33E+04	0.00E+00	0.00E+00	0.00E+00	1.72E-12	0.00E+00	2.90E+05	0.00E+00	#DIV/0!	#DIV/0!	1.72E-12	#DIV/0!
I-133	0.00E+00	0.00E+00	1.28E+05	0.00E+00	0.00E+00	0.00E+00	1.65E-12	0.00E+00	5.77E+06	0.00E+00	#DIV/0!	#DIV/0!	1.65E-12	#DIV/0!
I-134	0.00E+00	0.00E+00	2.69E+04	0.00E+00	0.00E+00	0.00E+00	1.58E-12	0.00E+00	7.60E+04	0.00E+00	#DIV/0!	#DIV/0!	1.58E-12	#DIV/0!
I-135	0.00E+00	0.00E+00	7.10E+04	0.00E+00	0.00E+00	0.00E+00	1.86E-12	0.00E+00	1.19E+06	0.00E+00	#DIV/0!	#DIV/0!	1.86E-12	#DIV/0!
	2.66E+03		2.43E+02	1.56E+07			7.68E-09		0.00E+00	0.00E+00	#DIV/0!	#DIV/0!		#DIV/0!

Monitor detection efficiency (amp/uCi/cc) = 3.97E-10

TEDE	uCi/s	uCi/cc	amps
1.00E+01	1.32E+08	1.93E+02	7.66E-08
1.0E+02	1.32E+09	1.93E+03	7.66E-07
1.0E+03	1.32E+10	1.93E+04	7.66E-06

Child Thyroid	uCi/s	uCi/cc	amps
5.00E+01	#DIV/0!	#DIV/0!	#DIV/0!
5.0E+02	#DIV/0!	#DIV/0!	#DIV/0!
5.0E+03	#DIV/0!	#DIV/0!	#DIV/0!

No Iodine in this source term. #DIV/0! error is expected in this spreadsheet.

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Mirion PING Monitor Measurement Range

The Mirion PING monitors are configured such that only the low range or the high range will receive sample flow. During periods of routine operation when radioactivity concentrations are low, the low range monitor will be operating with sample flow. This will continue until the low range reaches a user entered value as the High-High alarm set point. This value is also called the cross-over value. At this point, the flow to the low range monitor will be valved over to the high range monitor. Although the low range monitors are capable of producing a higher count rate, the monitors will cease to be in service when the cross-over (to the high range monitors) value is reached.

Monitor range limitation is provided by two references: 1) Values measured during primary calibration (using varying concentrations of Kr-85 and Xe-133), and 2) Values provided by the manufacturer. Due to practical limitations for taking actual measurements, the primary calibration values are a narrower range. For this evaluation, the more restrictive values from the primary calibration will be used.

	From primary calibration	From Attachment 3
Low range noble gas monitor	0.18 to 4.93E4 cps	~0.04 to ~5E4 cps
High range noble gas monitor	1.13E-13 to 9.36E-10 amps	~3E-14 to 1E-4 amps

The cross-over value should be selected such that there is sufficient range overlap of the low and high range monitors. In discussions with the manufacturer, 1E-2 uCi/cc (Xe-133) was stated as a reasonable value and evaluated as such in Revision 10 of this document.

However, NEI 99-01 revision 6 changed the methodology for Alert declaration. At cross-over value 1E-2 uCi/cc, Alert level set points will vary between the low range monitor and the high range monitor, dependent upon flow. Reducing the cross-over to 1E-3 uCi/cc still allows for a sufficient range overlap of the low and high range monitors, while keeping the Alert level declaration set points on the high range monitor. Minimum operating flows were selected based upon historic data. Crossover was evaluated at these minimum flow values to ensure a monitor would be within range over various flow rates.

Cross-over with this value will occur roughly three decades before the low range monitor reaches its maximum measurement value. The listed cross-over values (cps) are the practical maximum range of the low range monitors. For these crossover values to be valid the High-High alarm set point of the low range monitors must be 1E-3 uCi/cc, or similar value evaluated to be adequate.

Low Range	Cross over (uCi/cc)	Low ODCM volumetric monitor efficiency (cps/uCi/cc)	Calculated Cross over (cps)	Low range maximum (cps)	High ODCM volumetric monitor efficiency (amps/uCi/cc)	Amps at low range cross over	High range minimum (amps)
RM-1VS-109	1E-3	6.92E4	6.92E1	4.93E4	3.94E-10	3.94E-13	1.13E-13
RM-1VS-110	1E-3	8.54E4	8.54E1	4.93E4	3.31E-10	3.31E-13	1.13E-13
RM-1GW-109	1E-3	6.71E4	6.71E1	4.93E4	3.97E-10	3.97E-13	1.13E-13

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Data in the tables above are based on the ODCM source terms. To verify that crossover will be adequate for the spectrum of postulated accidents, each accident mix applicable to each monitor was used to calculate a high range monitor value (amps) when cross-over occurs. Details are in Attachment 4. Because the low range crossover count rate is unaffected by the accident mixes no similar calculations are necessary for the low range monitors.

High range	amps at crossover (1E-3 uCi/cc)
RM-1VS-109	1.29E-13 to 5.75E-13
RM-1VS-110	1.59E-13 to 8.66E-13
RM-1GW-109	2.83E-13 to 3.69E-13

Therefore, the high range monitors will be "on-scale" for each of the accident mixes when crossover occurs.

The low range monitor computer divides the detector output (cps) by the ODCM volumetric monitor efficiency (cps/Bq/m³) and performs activity concentration unit conversion to calculate a release concentration (uCi/cc). Then it multiplies by the release flow rate (cc/s) to calculate the radioactivity release rate (uCi/s). The calculated EAL value for each low range monitor is evaluated below. The cps value corresponding to the EAL when the release flow rate is at the ODCM value may be found in the Attachment 1 tables.

	RM-1VS-109 Low			RM-1VS-110 Low			RM-1GW-109 Low		
	EAL uCi/s	62000 cfm cps	25000 cfm cps	EAL uCi/s	49300 cfm cps	24000 cfm cps	EAL uCi/s	1450 cfm cps	950 cfm cps
General Emergency	2.01E+07	4.75E+04	1.18E+05	1.81E+07	6.64E+04	1.36E+05	8.43E+09	8.26E+08	1.26E+09
Site Area Emergency	2.01E+06	4.75E+03	1.18E+04	1.81E+06	6.64E+03	1.36E+04	8.43E+08	8.26E+07	1.26E+08
Alert	2.01E+05	4.75E+02	1.18E+03	1.81E+05	6.64E+02	1.36E+03	8.43E+07	8.26E+06	1.26E+07
Unusual Event (2x ODCM)	5.28E+03	1.25E+01	3.10E+01	7.58E+03	2.78E+01	5.71E+01	2.18E+06	2.14E+05	3.26E+05
	6.92E1 cps cross-over to high range			8.54E1 cps cross-over to high range			6.71E1 cps cross-over to high range		

Bold values are within the measurement range of the monitor 0.18 cps to crossover to high range monitor.

In Attachment 3, the low range monitors are stated as capable of measuring as low as 0.044 cps. As noted above, a measured low value of 0.18 cps was tested in the primary calibration report, 12-00038.

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The high range monitor computer divides the detector output (amps) by the ODCM volumetric monitor efficiency (amps/Bq/m³) and performs activity concentration unit conversion to calculate a release concentration (uCi/cc). Then it multiplies by the release flow rate (cc/s) to calculate the radioactivity release rate (uCi/s). When using the more restrictive maximum range of the instrument from the primary calibration, none of the set points for RM-1GW-109 fall within the range of the monitor. However, they do fall within the range of the monitor when comparing to the measurement range listed in Attachment 3. The calculated EAL value for each high range monitor is evaluated below.

	RM-1VS-109 High			RM-1VS-110 High			RM-1GW-109 High		
	EAL uCi/s	62000 cfm amps	25000 cfm amps	EAL uCi/s	49300 cfm amps	24000 cfm amps	EAL uCi/s	1450 cfm amps	950 cfm amps
General Emergency	1.18E+07	1.59E-10	3.94E-10	1.56E+07	2.22E-10	4.56E-10	7.83E+09	4.54E-06	6.93E-06
Site Area Emergency	1.18E+06	1.59E-11	3.94E-11	1.56E+06	2.22E-11	4.56E-11	7.83E+08	4.54E-07	6.93E-07
Alert	1.18E+05	1.59E-12	3.94E-12	1.56E+05	2.22E-12	4.56E-12	7.83E+07	4.54E-08	6.93E-08
Unusual Event (2x ODCM)	5.28E+03	7.11E-14	1.76E-13	7.58E+03	1.08E-13	2.21E-13	2.18E+06	1.26E-09	1.93E-09
	3.94E-13 amps cross-over from low range			3.31E-13 amps cross-over from low range			3.97E-13 amps cross-over from low range		

Bold values are within the measurement range of the monitor crossover to 1E-4 amps from Attachment 3.

Using a crossover value of 1E-3 uCi/cc, the high range monitors are capable of measuring the General Emergency, Site Area Emergency and Alert EAL values for RM-1VS-109 and RM-1VS-110. The Unusual Event values will be measured by the low range monitors and before cross-over to the high range monitors. For RM-1GW-109, the high range monitor is capable of measuring all declaration criteria.

Conclusions for the low range monitors: The Unusual Event EAL values for Ventilation Vent and SLCRS pathways can be measured by the low range monitors. Appropriate EAL values for the low range monitors are:

RM-1RM-VS-109 Low Range: 5.28E3 uCi/s Unusual Event EAL

RM-1RM-VS-110 Low Range: 7.58E3 uCi/s Unusual Event EAL

Unusual Event set points for the low range monitors are ODCM based, and are calculated in ERS-HHM-87-014. The High-High alarm set points actuate cross-over, and should only be used for the uCi/cc indication and the value of 1E-3 uCi/cc.

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Conclusions for the high range monitors: All EAL values can be measured by the high range monitors. However, the cross-over value determines the minimum range of the monitor and will control the usage of the high range monitors. Appropriate EAL values for the high range monitors are:

RM-1RM-VS-109 High Range: 1.18E5 uCi/s Alert EAL and Alert alarm set point
1.18E6 uCi/s Site Area EAL and High alarm set point
1.18E7 uCi/s General Emergency EAL and High High alarm set point

RM-1RM-VS-110 High Range: 1.56E5 uCi/s Alert EAL and Alert alarm set point
1.56E6 uCi/s Site Area EAL and High alarm set point
1.56E7 uCi/s General Emergency EAL and High High alarm set point

RM-1GW-109 is not currently an EAL monitor. Set points are recommendations and may be different as approved in site procedures. However, appropriate set points may be selected as follows:

RM-1RM-GW-109 High Range: 30% of the ODCM limit (See ODCM) = Alert alarm set point
60% of the ODCM limit (See ODCM) = High alarm set point
1.09E6 uCi/s ODCM limit = High High alarm set point
OR
2.18E6 uCi/s UE EAL and Alert alarm set point
7.83E7 uCi/s Alert EAL and High alarm set point
7.83E8 uCi/s Site Area EAL and High High alarm set point

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Mirion Monitor Range Information



MIRION
TECHNOLOGIES

Radiation Monitoring Systems Division
5000 Highlands Parkway
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Te: 770-432-274
Fax: 770-432-917
www.mirion.com

June 25, 2014

Mr. John Lebda
FENOC - Beaver Valley Power Station
Shippingport, PA 15077

Subject: Noble gas measurement range for Mirion vent radiation monitors

Mr. Lebda,

The purpose of this letter is to provide clarifications and additional information concerning the measurement range of the vent radiation monitors delivered to BVPS by Mirion. Specifically, this letter addresses the noble gas measurement ranges.

For the noble gas monitors, documentation of the minimum and maximum ranges can be found in the monitor primary calibration reports previously provided to FENOC:

- NGM204 normal range noble gas monitor: 12-00038
- NGM203 high range noble gas monitor: 12-00023

NGM204 Low Range NG Monitor:

The minimum range of the monitor can also be referred to as the Minimum Detectable Activity or MDA. The MDA is a calculated value which is a function of the detector sensitivity, detector background (intrinsic + externally induced), allowable response time, and allowable uncertainty.

In the above listed documents, MDA calculations are provided for various combinations of the above parameters. Not every possible combination is calculated, but the MDA formulation is provided such that users could determine the MDA for their own combination of parameter values.

Referring to document 12-00038, Table 15, it is shown that the requirement of 10^{-6} $\mu\text{Ci/cc}$ of Xe-133 is achievable for the NGM204. Using the Xe-133 efficiency of 4.39×10^{-4} cps per $\mu\text{Ci/cc}$, the corresponding raw detector output is 0.044 cps. This count rate is within the measurement range of the silicon diode detector used on the NGM204.

As described in section 4.4.1 of document 12-00038, the maximum activity level of the NGM204 in its standard configuration is approximately 1 $\mu\text{Ci/cc}$ for Xe-133. Using the Xe-133 efficiency of 4.39×10^{-4} cps per $\mu\text{Ci/cc}$, the corresponding raw detector output is 4.39×10^{-4} cps. The saturation point of the silicon diode detector is nominally 5×10^{-4} cps.

NGM203 High Range NG Monitor:

The precise MDA of the NGM203 is not critical when used in conjunction with the NGM204, since the NGM204 covers the lower measurement range. Referring to document 12-00023, the nominal MDA for Xe-133 is 10^{-4} $\mu\text{Ci/cc}$. Using the Xe-133 efficiency of 4.89×10^{-10} A per $\mu\text{Ci/cc}$, the corresponding raw detector output is 4.89×10^{-14} amps. This is within the measurement range of the LPDU/IC processing unit and is higher than the nominal current of 1×10^{-14} to 3×10^{-14} amps produced by the embedded source of the NGM203 detector.

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It is also noted that the transition from NGM204 operation to NGM203 operation is typically set at 1×10^{-3} $\mu\text{Ci/cc}$ (equates to 4.89×10^{-13} amps for Xe-133) or higher.

As described in section 9 of document 12-00023, high-level irradiation testing was used to test the upper range of the NGM203 detector and establish a correlation for noble gas activity measurement. This correlation was necessary because radioactive noble gas could not be obtained in activity levels that would reach the upper decades of the NGM203 measurement range.

An activity level of 10^{-5} $\mu\text{Ci/cc}$ of Xe-133 would result in a current of approximately 4.89×10^{-5} Amps being generated by the detectors. This is within the measurement range of the LPDU3/IC, which is $\sim 3 \times 10^{-14}$ to 1×10^{-4} amps (see appendix below). It is also considered to be within the functional operating range of the NGM203 ion chamber detector.

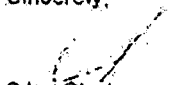
Summary:

It is noted that the BVPS technical specification 8700-DES-0531 requires a minimum measurement capability of 10^{-5} $\mu\text{Ci/cc}$ and a maximum measurement capability of 10^{-5} $\mu\text{Ci/cc}$ for noble gas. This range is commensurate with the requirements of Regulatory Guide 1.97.

Mirion confirms that the measurement range of the combined normal and accident range noble gas monitors meets the BVPS specification requirements with respect to Xe-133: 10^{-5} to 10^{-5} $\mu\text{Ci/cc}$.

Should you have any questions, please do not hesitate to contact us.

Sincerely,


Silas Stark

Mirion Technologies (MGPI), Inc.

Beaver Valley Power Station

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Appendix: LPDU/IC current measurement data

Data collected during primary calibration (12-00023, Figure 1):

Injected value (A)	Average (25pts) indicated value (A)
3.00E-05	3.00E-05
3.00E-06	3.01E-06
3.00E-07	3.01E-07
3.00E-08	3.04E-08
3.00E-09	3.01E-09
3.00E-10	3.01E-10
3.00E-11	3.00E-11
3.00E-12	2.95E-12
3.00E-13	3.23E-13
8.00E-14	8.00E-14
5.00E-14	4.10E-14
3.00E-14	2.06E-14

Data collected during onsite testing at BVPS, November 2013 (1VS-109 high range monitor):

Injected value (μA)	LPDU/IC Indicated Value (A)
1.08	1E-6
10.09	1E-5
50.09	5E-5
90.11	9E-5
100.2	9.93E-5

Noble gas measurement range for Mirion vent radiation monitors

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This attachment provides the calculations performed to determine the high range monitor amps for each applicable accident type when crossover from the low range monitor occurs. This is done to verify that the high range monitors will be "on-scale" when crossover occurs for all the applicable accident source terms.

The math used in the spreadsheets is:

The accident mix total nuclide activities used as uCi/cc concentration, are multiplied by the nuclide detection efficiencies to calculate a low range monitor response (cps).

$$\begin{aligned} \text{Col 4} &= \text{Col 2} * \text{unit conversion} * \text{Col 3} \\ \text{Low range response (cps)} &= \text{Activity (Ci/cc)} * 1\text{E6 uCi/Ci} * \text{Efficiency (cps/uCi/cc)} \end{aligned}$$

The sum of Column 4 (cps) is multiplied by the low range monitor ODCM based efficiency conversion factor (uCi/cc-cps) to calculate the total mix uCi/cc that corresponds to the low range response (cps)

$$\begin{aligned} \text{Col 5} &= \Sigma \text{Col 4} * \text{CF} \\ \text{Total mix uCi/cc} &= \text{cps} * \text{uCi/cc-cps} \end{aligned}$$

The Column 6 values are the individual nuclide concentrations that will be present when the monitor indicates 1E-3 uCi/cc and crossover to the high range monitor occurs. This is the individual nuclide activities (Ci*1E6 uCi/Ci) multiplied by the ratio of 1E-3:Col 5.

$$\begin{aligned} \text{Col 6} &= \text{Col 2} * \text{unit conversion} * (1\text{E-3} / \text{Col 5}) \\ \text{uCi/cc} &= \text{Ci/cc} * 1\text{E6 uCi/Ci} * (1\text{E-3 uCi/cc} / \text{Total uCi/cc}) \end{aligned}$$

Finally the individual nuclide concentrations are multiplied by the nuclide efficiencies, and summed to calculate the high range monitor response at crossover.

$$\begin{aligned} \Sigma \text{Col 8} &= \Sigma (\text{Col 6} * \text{Col 7}) \\ \text{High range monitor response (amps)} &= \Sigma (\text{uCi/cc} * \text{amps/uCi/cc}) \end{aligned}$$

The minimum and maximum values calculated for each of the three high range monitors are summarized in Attachment 2.

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RM-VS-109		LRNG ODCM mix Conversion Factor *		1.45E-05 uCi/cc-cps		2.54E+09 uCi/cc-amp	
		HRNG ODCM mix Conversion Factor *					
Isotope	UI & U2 LOCA RCS (C)	LRNG Efficiency (cps/uCi/cc)	Mix cps	Mix uCi/cc	Actual uCi/cc	HRNG Efficiency (amps/uCi/cc)	amps
Kr-83m	9.01E+01	0.00E+00	0.00E+00		2.60E-06	4.74E-10	1.23E-15
Kr-85m	2.21E+02	1.14E+05	2.52E+13		0.37E-05	1.63E-10	1.00E-15
Kr-85	1.27E+03	1.14E+05	3.66E+05		1.45E+14	1.76E-10	8.56E-15
Kr-87	6.45E+01	1.77E+05	1.50E+13		2.43E-06	1.06E-10	2.63E-16
Kr-88	3.56E+02	1.05E+05	3.76E+13		1.02E-05	2.31E-10	7.35E-15
Kr-89	7.56E+02	1.89E+05	1.42E+10		2.16E-09	1.77E-10	3.82E-19
Xe-131m	7.76E+02	7.22E+04	5.24E+13		2.06E-05	2.77E-10	5.79E-15
Xe-133m	6.33E+02	1.66E+05	8.10E+13		1.82E-05	2.27E-10	4.14E-15
Xe-133	3.72E+04	4.39E+04	1.63E+15		1.07E-03	4.89E-10	5.24E-13
Xe-135m	1.74E+03	3.28E+04	4.07E+13		3.57E-05	1.2E-11	4.29E-16
Xe-135	2.71E+03	1.37E+05	3.71E+14		7.01E-05	1.95E-10	1.52E-14
Xe-137	2.55E+01	1.83E+05	4.97E+10		7.35E-09	1.17E-10	8.58E-19
Xe-138	7.80E+00	1.43E+05	1.12E+12		2.25E-07	1.69E-10	3.80E-17
I-131	2.73E+01	9.25E+02	2.53E+10		7.89E-07	2.70E-12	1.70E-18
I-132	1.32E+01	1.44E+03	1.90E+10		3.80E-07	1.72E-12	6.54E-19
I-133	1.06E+01	1.35E+03	1.46E+10		3.05E-07	1.65E-12	5.04E-18
I-134	6.51E+01	1.59E+03	1.04E+09		1.68E-06	1.58E-12	2.98E-20
I-135	3.38E+00	1.26E+03	4.26E+09		0.74E-06	1.86E-12	1.81E-19
	4.46E+04		2.40E+15	3.47E+10	1.28E-03		5.91E-13

RM-VS-109		LRNG ODCM mix Conversion Factor *		1.45E-05 uCi/cc-cps		2.54E+09 uCi/cc-amp	
		HRNG ODCM mix Conversion Factor *					
Isotope	UI & U2 DBA LOCA (C)	LRNG Efficiency (cps/uCi/cc)	Mix cps	Mix uCi/cc	Actual uCi/cc	HRNG Efficiency (amps/uCi/cc)	amps
Kr-83m	1.80E+03	0.00E+00	0.00E+00		2.68E-06	4.74E-10	1.27E-15
Kr-85m	4.41E+03	1.14E+05	5.03E+14		0.56E-06	1.89E-10	1.11E-15
Kr-85	1.27E+04	1.14E+05	1.45E+15		1.89E-05	1.76E-10	3.38E-15
Kr-87	1.68E+03	1.77E+05	2.80E+14		2.51E-06	1.06E-10	2.71E-16
Kr-88	7.16E+03	1.05E+05	7.52E+14		1.06E-05	2.31E-10	2.46E-15
Kr-89	1.50E+00	1.89E+05	2.84E+11		2.23E-09	1.77E-10	3.66E-16
Xe-131m	1.45E+04	7.22E+04	1.05E+15		2.16E-05	2.77E-10	5.07E-15
Xe-133m	1.27E+04	1.29E+05	1.63E+15		1.85E-05	2.27E-10	4.29E-15
Xe-133	7.43E+05	4.39E+04	3.26E+16		1.10E-03	4.89E-10	5.40E-13
Xe-135m	2.48E+04	3.28E+04	6.13E+14		3.80E-05	1.2E-11	4.42E-15
Xe-135	5.42E+04	1.37E+05	7.43E+15		0.06E-05	1.95E-10	1.57E-14
Xe-137	5.06E+00	1.83E+05	9.31E+11		7.57E-09	1.17E-10	8.65E-16
Xe-138	1.50E+02	1.43E+05	2.22E+13		2.22E-07	1.69E-10	3.62E-17
I-131	3.41E+02	9.25E+02	3.15E+11		5.07E-07	2.26E-12	1.15E-18
I-132	2.84E+02	1.44E+03	3.80E+11		3.92E-07	1.72E-12	6.75E-19
I-133	2.12E+02	1.38E+03	2.03E+11		3.15E-07	1.65E-12	5.70E-19
I-134	1.30E+01	1.59E+03	2.07E+10		1.93E-08	1.58E-12	3.05E-20
I-135	6.75E+01	1.28E+03	6.51E+10		1.00E-07	1.86E-12	1.67E-19
	6.70E+05		4.66E+18	6.73E+11	1.31E-03		5.75E-13

RM-VS-109		LRNG ODCM mix Conversion Factor *		1.45E-05 uCi/cc-cps		2.54E+09 uCi/cc-amp	
		HRNG ODCM mix Conversion Factor *					
Isotope	UI & U2 LOCA RCS (C)	LRNG Efficiency (cps/uCi/cc)	Mix cps	Mix uCi/cc	Actual uCi/cc	HRNG Efficiency (amps/uCi/cc)	amps
Kr-83m	1.54E+03	0.00E+00	0.00E+00		1.88E-06	4.74E-10	8.92E-16
Kr-85m	5.55E+03	1.14E+05	8.30E+08		7.76E-05	1.69E-10	1.31E-17
Kr-85	3.27E+01	1.14E+05	3.73E+12		4.59E-04	1.79E-10	8.22E-14
Kr-87	7.04E+04	1.77E+05	1.25E+08		9.88E-09	1.06E-10	1.07E-18
Kr-88	6.02E+03	1.05E+05	8.32E+08		6.45E-04	2.31E-10	1.69E-17
Kr-89	2.92E+08	1.89E+05	5.30E+03		4.10E-13	1.77E-10	7.28E-20
Xe-131m	1.16E+00	7.22E+04	6.52E+10		1.65E-05	2.77E-10	4.59E-15
Xe-133m	1.81E+01	1.28E+05	2.32E+10		2.54E-06	2.27E-10	5.77E-16
Xe-133	7.48E+01	4.39E+04	1.09E+12		3.48E-04	4.89E-10	1.70E-13
Xe-135m	1.21E+02	3.28E+04	3.97E+08		1.70E-07	1.2E-11	2.04E-18
Xe-135	1.86E+02	1.37E+05	2.59E+08		2.61E-07	1.95E-10	5.06E-17
Xe-137	1.19E+07	1.83E+06	2.18E+04		1.87E-12	1.17E-10	1.66E-22
Xe-138	1.32E+05	1.43E+06	1.85E+10		1.85E-10	1.69E-10	3.13E-20
I-131	5.41E+03	9.25E+02	5.00E+06		7.58E-06	2.26E-12	1.72E-19
I-132	3.62E+03	1.44E+03	5.21E+06		5.08E-06	1.72E-12	8.74E-20
I-133	1.36E+03	1.38E+03	1.90E+06		1.94E-06	1.65E-12	3.70E-20
I-134	3.81E+05	1.59E+03	5.74E+04		5.07E-10	1.58E-12	8.01E-22
I-135	3.76E+04	1.26E+03	4.74E+05		5.28E-09	1.86E-12	9.02E-21
	5.09E+01		4.93E+12	7.12E+07	8.27E-04		2.58E-13

RM-VS-109		LRNG ODCM mix Conversion Factor *		1.45E-05 uCi/cc-cps		2.54E+09 uCi/cc-amp	
		HRNG ODCM mix Conversion Factor *					
Isotope	UI & U2 LOCA TID (C)	LRNG Efficiency (cps/uCi/cc)	Mix cps	Mix uCi/cc	Actual uCi/cc	HRNG Efficiency (amps/uCi/cc)	amps
Kr-83m	9.40E+00	0.00E+00	0.00E+00		7.33E-06	4.74E-10	3.47E-15
Kr-85m	1.95E+07	1.14E+05	2.22E+18		1.51E-05	1.89E-10	2.59E-15
Kr-85	3.27E+05	1.14E+05	0.43E+10		8.41E-07	1.76E-10	1.15E-16
Kr-87	3.91E+07	1.77E+05	8.82E+10		3.03E-05	1.06E-10	3.27E-15
Kr-88	5.43E+07	1.05E+05	5.70E+18		4.21E-05	2.31E-10	6.71E-15
Kr-89	6.75E+07	1.89E+05	1.28E+19		5.23E-05	1.77E-10	6.25E-15
Xe-131m	1.05E+08	7.22E+04	7.80E+16		8.38E-07	2.77E-10	2.32E-16
Xe-133m	5.05E+08	1.28E+05	8.48E+17		3.91E-06	2.27E-10	8.86E-16
Xe-133	1.86E+08	4.39E+04	7.02E+18		1.24E-04	4.89E-10	6.00E-14
Xe-135m	3.36E+07	3.28E+04	1.10E+10		2.60E-05	1.2E-11	3.12E-16
Xe-135	4.84E+07	1.37E+05	6.03E+10		3.75E-05	1.95E-10	7.31E-15
Xe-137	1.46E+08	1.83E+05	2.07E+10		1.13E-04	1.17E-10	1.32E-14
Xe-138	1.36E+08	1.43E+05	1.94E+19		1.05E-04	1.69E-10	1.78E-14
I-131	3.85E+05	9.25E+02	3.02E+14		3.01E-07	2.26E-12	6.81E-16
I-132	5.70E+05	1.44E+03	6.71E+14		4.41E-07	1.72E-12	7.59E-16
I-133	8.09E+05	1.38E+03	1.10E+15		8.20E-07	1.65E-12	1.02E-16
I-134	8.85E+05	1.59E+03	1.41E+15		6.85E-07	1.58E-12	1.06E-16
I-135	7.60E+05	1.26E+03	9.50E+14		5.89E-07	1.86E-12	1.09E-16
	7.24E+08		8.83E+19	1.29E+15	5.81E-04		1.25E-13

RM-VS-109		LRNG ODCM mix Conversion Factor *		1.45E-05 uCi/cc-cps		2.54E+09 uCi/cc-amp	
		HRNG ODCM mix Conversion Factor *					
Isotope	UI & U2 SB LOCA (C)	LRNG Efficiency (cps/uCi/cc)	Mix cps	Mix uCi/cc	Actual uCi/cc	HRNG Efficiency (amps/uCi/cc)	amps
Kr-83m	2.49E+01	0.00E+00	0.00E+00		7.01E-07	4.74E-10	3.32E-16
Kr-85m	8.00E+01	1.14E+05	1.01E+11		2.50E-06	1.69E-10	4.23E-16
Kr-85	7.90E+01	1.14E+05	9.01E+12		2.22E-04	1.79E-10	3.98E-14
Kr-87	5.64E+01	1.77E+05	9.08E+10		1.59E-06	1.06E-10	1.71E-16
Kr-88	1.64E+00	1.05E+05	1.72E+11		4.91E-06	2.31E-10	1.07E-15
Kr-89	1.44E+02	1.89E+05	2.72E+09		4.05E-08	1.77E-10	7.17E-18
Xe-131m	3.36E+00	7.22E+04	2.43E+11		9.45E-06	2.77E-10	6.62E-15
Xe-133m	3.01E+00	1.28E+05	3.85E+11		8.47E-06	2.27E-10	1.92E-15
Xe-133	2.02E+02	4.39E+04	8.87E+12		5.68E-04	4.89E-10	2.78E-13
Xe-135m	8.91E+01	3.28E+04	2.92E+12		2.51E-04	1.2E-11	3.01E-15
Xe-135	2.00E+01	1.37E+05	2.74E+12		5.63E-06	1.95E-10	1.10E-14
Xe-137	4.36E+02	1.83E+05	7.99E+09		1.23E-07	1.17E-10	1.44E-17
Xe-138	3.03E+01	1.43E+05	4.33E+10		6.53E-07	1.69E-10	1.44E-18
I-131	9.92E+02	9.25E+02	9.18E+07		2.79E-07	2.26E-12	6.31E-19
I-132	1.02E+01	1.44E+03	1.47E+08		2.87E-07	1.72E-12	4.64E-19
I-133	1.72E+01	1.38E+03	2.31E+08		4.84E-07	1.65E-12	7.99E-19
I-134	1.18E+01	1.59E+03	1.88E+08		3.31E-07	1.58E-12	5.25E-19
I-135	1.31E+01	1.26E+03	1.65E+08		3.89E-07	1.86E-12	8.88E-19
	4.01E+02		2.46E+13	3.55E+08	1.13E-03		3.38E-13

RM-VS-109		LRNG ODCM mix Conversion Factor *		1.45E-05 uCi/cc-cps		2.54E+09 uCi/cc-amp	
		HRNG ODCM mix Conversion Factor *					
Isotope	UI & U2 RCCA (C)	LRNG Efficiency (cps/uCi/cc)	Mix cps	Mix uCi/cc	Actual uCi/cc	HRNG Efficiency (amps/uCi/cc)	amps
Kr-83m	3.87E+01	0.00E+00	0.00E+00		3.14E-06	4.74E-10	1.49E-15
Kr-85m	9.12E+01	1.14E+05	1.04E+13		7.51E-06	1.89E-10	1.27E-15
Kr-85	2.22E+02	1.14E+05	2.53E+15		1.83E-05	1.76E-10	3.27E-15
Kr-87	5.22E+01	1.77E+05	9.24E+12		4.30E-06	1.06E-10	4.84E-16
Kr-88	1.63E+02	1.05E+05	1.71E+13		1.34E-05	2.31E-10	3.

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UT & U2 DBA LOCA ICG	LRNG Efficiency (cpm/uCi)	Min cpm	Max uCi/cc	1E-3 Indicated Actual uCi/cc	HRNG Efficiency (temp/uCi)	Emps
U-03m	9.01E-01	0.00E+00	0.00E+00	3.70E-08	4.74E-10	1.52E-15
U-05m	2.71E-02	1.14E+00	7.33E-13	7.88E-08	1.80E-10	1.33E-15
U-07	1.77E-03	1.14E+00	1.45E-14	4.31E-05	1.70E-10	0.00E-15
U-08	8.45E-01	1.77E+00	1.50E-13	3.00E-08	1.08E-10	3.24E-15
U-09	3.58E-02	1.00E+00	3.76E-13	1.27E-05	2.31E-10	2.86E-15
U-09	1.50E-02	1.82E+00	1.43E+00	2.87E-09	1.77E-10	4.77E-15
U-131m	2.60E-02	2.22E+04	5.24E-13	2.50E-09	2.77E-10	7.18E-15
U-132m	6.33E-02	4.24E+04	8.10E-13	2.25E-09	2.77E-10	5.11E-15
U-133	3.72E-04	4.30E+04	1.03E-15	1.32E-03	4.40E-10	6.41E-15
U-135m	1.24E+00	3.02E+04	4.07E-13	4.41E-05	1.2E-11	5.20E-15
U-135	2.71E+00	1.37E+00	3.71E-14	9.83E-05	1.90E-10	1.60E-14
U-137	2.55E-01	1.83E+00	4.07E-10	9.07E-09	1.17E-10	1.00E-10
U-138	7.80E-01	1.43E+05	1.12E+12	2.77E-07	1.00E-10	4.69E-17
U-131	2.73E-01	9.75E-02	2.53E-10	9.71E-07	2.26E-12	7.10E-18
U-132	1.32E-01	1.41E-03	1.90E-10	4.69E-07	1.73E-12	6.07E-10
U-133	1.06E-01	1.83E-03	1.45E-10	3.77E-07	1.65E-12	8.77E-10
U-134	0.51E-01	1.50E-03	1.04E-10	2.31E-08	1.56E-12	3.00E-20
U-135	3.38E+00	1.28E+03	4.20E+00	1.20E-07	1.68E-12	7.23E-19
U-136	4.45E+04	7.40E+15	2.81E+10	1.50E-03	1.50E-12	9.93E-13

UT & U2 DBA LOCA ICG	LRNG Efficiency (cpm/uCi)	Min cpm	Max uCi/cc	1E-3 Indicated Actual uCi/cc	HRNG Efficiency (temp/uCi)	Emps
U-03m	1.00E+00	0.00E+00	0.00E+00	3.30189E-08	4.74E-10	1.57E-15
U-05m	4.41E+00	1.14E+00	5.03E+14	8.0894E-08	1.80E-10	1.37E-15
U-07	1.77E+04	1.14E+00	1.43E+13	7.32697E-05	1.70E-10	4.17E-15
U-08	1.69E+00	1.77E+00	2.99E+14	3.10011E-05	1.08E-10	3.25E-15
U-09	7.18E+00	1.00E+00	7.32E+14	1.31347E-05	2.31E-10	2.83E-15
U-09	1.62E+00	1.80E+00	2.84E+11	2.75158E-06	1.77E-10	4.67E-15
U-131m	1.43E+04	2.22E+04	1.05E+15	2.95665E-05	2.77E-10	7.37E-15
U-132m	1.27E+04	1.24E+00	1.82E+15	2.36976E-05	2.77E-10	5.79E-15
U-133	2.43E+05	4.30E+04	2.20E+10	0.00138904	4.40E-10	6.80E-15
U-135m	2.48E+04	3.28E+04	3.13E+14	1.54237E-05	1.2E-11	5.46E-15
U-135	5.42E+04	1.37E+05	1.43E+15	9.04328E-05	1.90E-10	1.64E-14
U-137	9.00E+00	1.62E+05	9.31E+11	9.23702E-05	1.17E-10	1.08E-10
U-138	1.50E+02	1.45E+05	2.23E+13	7.06164E-07	1.00E-10	4.84E-17
U-131	3.41E+02	9.25E-02	3.15E+11	8.26255E-07	2.26E-12	7.10E-18
U-132	2.04E+02	1.44E+03	3.60E+11	4.84277E-07	1.73E-12	6.03E-10
U-133	2.12E+02	1.38E+03	2.93E+11	3.6889E-07	1.65E-12	8.42E-10
U-134	1.30E+01	1.50E+03	2.07E+10	7.3347E-08	1.56E-12	3.17E-20
U-135	8.70E+01	1.20E+03	8.51E+10	7.2381E-07	1.68E-12	7.20E-19
U-136	8.78E+05	7.40E+15	2.81E+10	1.50E+11	1.50E-12	7.10E-13

UT & U2 DBA LOCA ICG	LRNG Efficiency (cpm/uCi)	Min cpm	Max uCi/cc	1E-3 Indicated Actual uCi/cc	HRNG Efficiency (temp/uCi)	Emps
U-03m	1.34E-03	0.00E+00	0.00E+00	2.32E-08	4.74E-10	1.10E-17
U-05m	5.53E-03	1.14E+00	8.30E+00	9.26E-08	1.80E-10	1.62E-17
U-07	3.27E-01	1.14E+00	3.73E+12	9.87E-04	1.70E-10	1.01E-17
U-08	7.04E-04	1.77E+00	1.25E+08	1.23E-08	1.08E-10	1.32E-18
U-09	6.02E-03	1.00E+00	0.32E+08	1.04E-07	2.31E-10	2.41E-17
U-09	7.92E-08	1.80E+05	5.33E+03	5.00E-13	1.77E-10	8.96E-23
U-131m	1.10E+00	7.22E+04	0.23E+10	2.04E-05	2.77E-10	5.80E-15
U-132m	1.81E-01	1.28E+05	2.32E+10	3.14E-06	2.77E-10	7.12E-15
U-133	2.48E+01	4.30E+04	1.00E+12	4.20E-04	4.40E-10	2.10E-15
U-135m	1.21E-02	3.28E+04	3.97E+08	2.10E-07	1.73E-11	2.77E-10
U-135	1.80E-02	1.37E+05	2.95E+09	3.22E-07	1.95E-10	6.28E-17
U-137	1.19E-02	1.83E+05	2.18E+04	2.08E-12	1.17E-10	2.41E-22
U-138	1.32E-03	1.43E+05	1.00E+00	7.70E-10	1.00E-10	3.80E-20
U-131	5.41E-03	9.25E+02	5.00E+00	9.37E-08	2.26E-12	1.27E-18
U-132	3.02E-03	1.44E+03	5.11E+00	6.27E-08	1.73E-12	1.00E-19
U-133	1.38E-03	1.38E+03	1.00E+00	7.70E-08	1.65E-12	3.04E-20
U-134	3.81E-05	1.50E+03	5.74E+04	8.25E-10	1.56E-12	8.84E-22
U-135	3.78E-04	1.28E+03	4.74E+05	8.51E-06	1.68E-12	1.21E-20
U-136	5.60E-01	4.93E+12	5.77E+07	1.02E-03	1.50E-12	5.10E-13

UT & U2 DBA LOCA ICG	LRNG Efficiency (cpm/uCi)	Min cpm	Max uCi/cc	1E-3 Indicated Actual uCi/cc	HRNG Efficiency (temp/uCi)	Emps
U-03m	8.45E-08	0.00E+00	0.00E+00	9.04E-08	4.74E-10	4.74E-15
U-05m	1.95E-07	1.14E+00	7.22E+18	1.89E-07	1.80E-10	3.15E-15
U-07	6.23E-05	1.14E+00	8.45E+18	7.60E-07	1.70E-10	1.41E-15
U-08	3.01E-07	1.77E+00	6.40E+18	3.74E-05	1.08E-10	8.04E-15
U-09	5.43E-07	1.00E+00	5.70E+18	5.10E-05	2.31E-10	1.20E-14
U-09	6.79E-07	1.80E+00	1.20E+19	6.45E-09	1.77E-10	1.14E-14
U-131m	1.00E+00	7.22E+04	2.50E+10	1.03E-06	2.77E-10	2.68E-15
U-132m	3.05E+00	1.28E+05	8.45E+17	4.83E-06	2.77E-10	1.10E-15
U-133	1.00E+00	4.30E+04	7.02E+16	1.52E-04	4.40E-10	2.41E-14
U-135m	3.30E-07	3.28E+04	1.10E+16	2.21E-05	1.2E-11	2.85E-16
U-135	4.84E-07	1.37E+05	6.82E+16	4.83E-05	1.95E-10	9.02E-15
U-137	1.48E-08	1.83E+05	2.87E+19	1.40E-04	1.17E-10	9.02E-14
U-138	1.30E+00	1.43E+05	1.94E+16	1.30E-04	1.00E-10	2.70E-14
U-131	3.69E+00	9.25E+02	3.00E+14	3.72E-07	2.26E-12	8.40E-19
U-132	9.70E+00	1.44E+03	0.21E+14	3.45E-07	1.73E-12	9.31E-19
U-133	6.00E+05	1.38E+03	1.10E+15	7.69E-07	1.65E-12	1.20E-19
U-134	8.95E+00	1.50E+03	1.41E+15	8.46E-07	1.56E-12	1.34E-19
U-135	1.60E+05	1.28E+03	8.50E+14	7.26E-07	1.68E-12	1.35E-19
U-136	7.24E+08	7.40E+15	2.81E+10	1.02E+15	1.50E-12	1.50E-13

UT & U2 DBA LOCA ICG	LRNG Efficiency (cpm/uCi)	Min cpm	Max uCi/cc	1E-3 Indicated Actual uCi/cc	HRNG Efficiency (temp/uCi)	Emps
U-03m	2.45E-01	0.00E+00	0.00E+00	9.85E-07	4.74E-10	1.10E-15
U-05m	8.05E-01	1.14E+00	1.01E+11	3.00E-05	1.80E-10	5.22E-10
U-07	7.60E-01	1.14E+00	0.01E+12	2.74E-04	1.70E-10	4.91E-14
U-08	0.94E-01	1.77E+00	0.00E+10	1.89E-08	1.08E-10	2.12E-10
U-09	1.54E-00	1.00E+00	1.77E+11	5.70E-08	2.31E-10	1.32E-15
U-09	1.44E-02	1.82E+05	2.77E+08	5.00E-08	1.77E-10	6.85E-10
U-131m	3.36E+00	7.22E+04	2.43E+11	1.17E+05	2.77E-10	3.22E-15
U-132m	3.01E+00	1.28E+05	3.85E+11	1.60E+05	2.77E-10	2.57E-15
U-133	2.07E+02	4.30E+04	5.81E+12	7.01E-04	4.40E-10	3.42E-15
U-135m	0.91E-01	3.28E+04	7.02E+12	2.08E-04	1.2E-11	3.71E-15
U-135	2.00E+01	1.37E+05	2.74E+12	6.85E-05	1.95E-10	1.50E-14
U-137	4.26E-02	1.83E+05	7.96E+08	1.51E-07	1.17E-10	1.77E-17
U-138	3.03E-01	1.43E+05	4.33E+10	1.00E-06	1.00E-10	1.77E-15
U-131	9.97E-02	9.25E+02	8.10E+07	3.44E-07	2.26E-12	7.76E-19
U-132	1.02E-01	1.44E+03	1.47E+08	2.34E-07	1.73E-12	9.08E-19
U-133	1.72E-01	1.38E+03	2.37E+08	5.97E-07	1.65E-12	8.08E-19
U-134	1.18E-01	1.50E+03	1.84E+08	4.10E-07	1.56E-12	6.47E-19
U-135	1.31E-01	1.28E+03	1.69E+08	4.50E-07	1.68E-12	6.48E-19
U-136	4.01E+02	2.40E+12	2.80E+08	1.38E-03	1.50E-12	4.12E-13

UT & U2 DBA LOCA ICG	LRNG Efficiency (cpm/uCi)	Min cpm	Max uCi/cc	1E-3 Indicated Actual uCi/cc	HRNG Efficiency (temp/uCi)	Emps
U-03m	3.82E-01	0.00E+00	0.00E+00	3.65E-04	4.74E-10	1.84E-15
U-05m	0.12E+01	1.14E+00	1.04E+13	6.20E-04	1.80E-10	1.57E-15
U-07	2.22E+00	1.14E+00	2.53E+13	2.28E-05	1.70E-10	4.94E-15
U-08	5.72E+01	1.77E+00	9.24E+12	5.30E-06	1.08E-10	5.73E-16
U-09	1.83E+02	1.00E+00	1.71E+13	1.96E-06	2.31E-10	2.82E-16
U-09	3.76E+00	1.80E+05	7.11E+11	3.82E-07	1.77E-10	6.76E-17
U-131m	1.86E+02	7.22E+04	1.34E+13	1.69E-06	2.77E-10	5.23E-15
U-132m	2.23E+02	1.28E+05	2.95E+13	2.27E-06	2.77E-10	3.14E-15
U-133	1.23E+04	4.30E+04	5.75E+14	1.34E-03	4.40E-10	6.66E-13
U-135m	1.42E+02	3.28E+04	4.66E+12	1.44E-05	1.2E-11	1.73E-16
U-135	1.09E+03	1.37E+05	1.45E+14	1.08E-04	1.95E-10	7.10E-14
U-137	6.82E+00	1.83E+05	1.77E+12	8.83E-07	1.17E-10	1.15E-16
U-138	3.81E+01	1.43E+05	4.02E+12	3.43E-06	1.00E-10	5.80E-16
U-131	4.52E-01	9.25E+02	4.10E+08	4.80E-08	2.26E-12	1.04E-19
U-132	1.50E-02	1.44E+03	2.25E+07	1.50E-09	1.73E-12	2.73E-21
U-133	1.55E-01	1.38E+03	2.14E+08	1.97E-08	1.65E-12	2.60E-20
U-134	9.70E-03	1.50E+03	1.48E+07	6.44E-10	1.56E-12	1.49E-21
U-135	5.80E-07	1.28E+03	7.31E+07	5.80E-04	1.68E-12	1.70E-20
U-136	1.54E+04	7.40E+15	2.81E+10	9.84E-06	1.50E-12	7.00E-13

Beaver Valley Power Station

Health Physics Technical Position/Evaluation/Calculation

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**BVPS-U1 Gaseous Radioactivity Monitor
Emergency Action Levels**

**ERS-MPD-93-007
Attachment 4**

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		LRNG ODCM mix Conversion Factor =		1.45E-05 uCi/cc-cps			
		LRNG ODCM mix Conversion Factor =		2.52E-06 uCi/cc-amp			
RM-GW-109							
	UI	LRNG		1-E3 Indicates	HRNG		
Isotope	SOTR (C)	Efficiency (cps/uCi/cc)	Mix cps	Mix uCi/cc	Actual Efficiency (amps/uCi/cc)	amps	
Kr-83m	2.00E+00	0.00E+00	0.00E+00		7.91E-07	4.74E-10	3.70E-10
Kr-85m	7.35E+00	1.14E+05	0.30E+11		2.75E-06	1.60E-10	4.64E-10
Kr-85	0.74E+02	1.14E+05	7.68E+13		2.52E-04	1.70E-10	4.51E-14
Kr-87	4.48E+00	1.77E+05	7.93E+11		1.87E-09	1.00E-10	1.01E-10
Kr-90	1.34E+01	1.05E+05	1.41E+12		5.01E-08	2.31E-10	1.10E-15
Kr-90	7.68E-02	1.80E+05	1.45E+10		2.89E-08	1.77E-10	5.07E-10
Xe-131m	2.76E+01	7.22E+04	1.89E+12		1.03E-05	2.77E-10	2.89E-15
Xe-133m	2.34E+01	1.28E+05	3.00E+12		8.74E-05	2.27E-10	1.90E-15
Xe-133	1.69E+03	4.30E+04	7.42E+13		0.32E-04	4.89E-10	3.09E-13
Xe-135m	2.27E+02	3.20E+04	7.45E+12		8.48E-05	1.2E-11	1.02E-15
Xe-135	9.28E+01	1.37E+05	1.27E+13		3.47E-05	1.95E-10	6.78E-15
Xe-137	2.33E+01	1.83E+05	4.28E+10		6.71E-06	1.17E-10	1.02E-17
Xe-138	1.99E+00	1.43E+05	2.85E+11		7.44E-07	1.69E-10	1.26E-16
I-131	1.35E+01	9.25E+02	1.25E+08		5.04E-09	2.20E-12	1.14E-19
I-132	4.77E-02	1.44E+03	6.87E+07		1.78E-09	1.72E-12	3.07E-20
I-133	1.09E-01	1.38E+03	2.78E+08		7.44E-08	1.85E-12	1.23E-19
I-134	2.33E-02	1.59E+03	3.70E+07		8.71E-09	1.58E-12	1.38E-20
I-135	1.10E-01	1.28E+03	1.38E+08		4.11E-08	1.86E-12	7.65E-20
	2.76E+03		1.00E+14	2.63E+09	1.03E-03		3.69E-13

		LRNG ODCM mix Conversion Factor =		1.45E-05 uCi/cc-cps			
RM-GW-109		LRNG ODCM mix Conversion Factor =		2.52E-06 uCi/cc-amp			
	UI	LRNG		1E-3 Indicates	HRNG		
Isotope	GW/Fil	Efficiency (cps/uCi/cc)	Mix cps	Mix uCi/cc	Actual uCi/cc	Efficiency (amps/uCi/cc)	amps
Kr-83m	2.00E+00	0.00E+00	0.00E+00		8.66E-07	4.74E-10	4.21E-16
Kr-85m	1.17E+01	1.14E+05	1.33E+12		3.71E-06	1.60E-10	6.27E-16
Kr-85	1.16E+03	1.14E+05	1.32E+14		3.68E-04	1.70E-10	6.56E-14
Kr-87	5.59E+00	1.77E+05	1.04E+12		1.87E-06	1.00E-10	2.02E-16
Kr-90	2.03E+01	1.05E+05	2.13E+12		6.44E-05	2.31E-10	1.46E-15
Kr-90	2.12E-01	1.80E+05	4.01E+10		0.72E-05	1.77E-10	1.16E-17
Xe-131m	1.77E+01	7.22E+04	1.29E+12		5.01E-05	2.77E-10	1.55E-15
Xe-133m	2.45E+01	1.28E+05	3.14E+12		7.77E-05	2.27E-10	1.78E-15
Xe-133	1.33E+03	4.30E+04	5.84E+13		4.22E-04	4.89E-10	2.06E-13
Xe-135m	3.35E+00	3.20E+04	1.11E+11		1.07E-06	1.2E-11	1.26E-17
Xe-135	6.41E+01	1.37E+05	1.15E+13		2.87E-05	1.95E-10	5.20E-15
Xe-137	5.59E-01	1.83E+05	1.02E+11		1.77E-07	1.17E-10	2.07E-17
Xe-138	2.32E+00	1.43E+05	3.32E+11		7.35E-07	1.69E-10	1.24E-16
I-131	0.00E+00	9.25E+02	9.00E+00		0.00E+00	2.20E-12	0.00E+00
I-132	0.00E+00	1.44E+03	0.00E+00		0.00E+00	1.72E-12	0.00E+00
I-133	0.00E+00	1.38E+03	0.00E+00		0.00E+00	1.85E-12	0.00E+00
I-134	0.00E+00	1.59E+03	0.00E+00		0.00E+00	1.58E-12	0.00E+00
I-135	0.00E+00	1.28E+03	0.00E+00		0.00E+00	1.86E-12	0.00E+00
	2.68E+03		2.12E+14	3.15E+09	8.44E-04		2.83E+13