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Title : OFF GAS FILTER ANALYSIS

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Sub Type : ENG



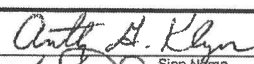
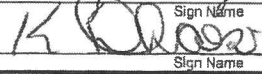
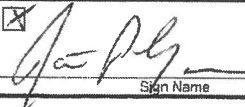
Addl Type :

R Obj ID : 0900e54e81de0ef3

This Record Cover Sheet data is an aid for initial department handling and records turnover purposes.

The data shown may not reflect the Records Index system data due to further editing and refinement by Records Management.

AATTACHMENT 1
Design Analysis Cover Sheet
Page 1

Design Analysis		Last Page No. ⁶ Attachment U, Page 158U	
Analysis No: BYR16-012		Revision: ² 0 Major <input checked="" type="checkbox"/> Minor <input type="checkbox"/>	
Title: ³ Off Gas Filter Analysis			
EC/ECR No. 402667: ⁴		Revision: ⁵ 1	
Station(s): ⁷	BYR	Component(s): ¹⁴	
Unit No.: ⁸	0	N/A K6 12.15.16	
Discipline: ⁹	Mechanical	O O G O I S	
Descrip. Code/Keyword: ¹⁰	N/A		
Safety/QA Class: ¹¹	NSR		
System Code: ¹²	OG		
Structure: ¹³	N/A		
CONTROLLED DOCUMENT REFERENCES ¹⁵			
Document No.:	From/To	Document No.:	From/To
EC 402667	TO		
Is this Design Analysis Safeguards Information? ¹⁶ Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, see SY-AA-101-106			
Does this Design Analysis contain Unverified Assumptions? ¹⁷ Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, ATI/AR#: N/A			
This Design Analysis SUPERCEDES: ¹⁸ N/A in its entirety.			
Description of Revision (list changed pages when all pages of original analysis were not changed): ¹⁹ Initial issue of calculation to evaluate the impact on 10CFR50 Appendix I, 10CFR20 and 40CFR190 design objectives of permanently bypassing the Offgas Filter Unit (OGFU) of the Steam Jet Air Ejector process stream.			
Preparer: ²⁰ Barry Schwartz		 12/14/2016 <small>Print Name Sign Name Date</small>	
Method of Review: ²¹ Detailed Review <input checked="" type="checkbox"/> Alternate Calculations (attached) <input type="checkbox"/> Testing <input type="checkbox"/> Reviewer: ²² Aleksandar Milicevic <small>Print Name Sign Name Date</small>  12/14/2016 Review Notes: ²³ Independent review <input checked="" type="checkbox"/> Peer review <input type="checkbox"/>			
(For External Analyses Only)			
External Approver: ²⁴ Anthony Klazura		 12/14/2016 <small>Print Name Sign Name Date</small>	
Exelon Reviewer: ²⁵ Kevin Dhaseo		 12.15.16 <small>Print Name Sign Name Date</small>	
Independent 3rd Party Review Req'd? ²⁶ Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>			
Exelon Approver: ²⁷ Jon Caranum		 12/16/16 <small>Print Name Sign Name Date</small>	

ATTACHMENT 2

Owner's Acceptance Review Checklist for External Design Analyses

Page 1 of 3

Design Analysis No.: BYR16-012 Rev: 0
 Contract #: 00511302 Release #: 00600.

No	Question	Instructions and Guidance	Yes / No / N/A
1	Do assumptions have sufficient documented rationale?	<p>All Assumptions should be stated in clear terms with enough justification to confirm that the assumption is conservative.</p> <p>For example, 1) the exact value of a particular parameter may not be known or that parameter may be known to vary over the range of conditions covered by the Calculation. It is appropriate to represent or bound the parameter with an assumed value. 2) The predicted performance of a specific piece of equipment in lieu of actual test data. It is appropriate to use the documented opinion/position of a recognized expert on that equipment to represent predicted equipment performance.</p> <p>Consideration should also be given as to any qualification testing that may be needed to validate the Assumptions. Ask yourself, would you provide more justification if you were performing this analysis? If yes, the rationale is likely incomplete.</p>	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
2	Are assumptions compatible with the way the plant is operated and with the licensing basis?	Ensure the documentation for source and rationale for the assumption supports the way the plant is currently or will be operated post change and they are not in conflict with any design parameters. If the Analysis purpose is to establish a new licensing basis, this question can be answered yes, if the assumption supports that new basis.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
3	Do all unverified assumptions have a tracking and closure mechanism in place?	If there are unverified assumptions without a tracking mechanism indicated, then create the tracking item either through an ATI or a work order attached to the implementing WO. Due dates for these actions need to support verification prior to the analysis becoming operational or the resultant plant change being op authorized.	<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>
4	Do the design inputs have sufficient rationale?	The origin of the input, or the source should be identified and be readily retrievable within Exelon's documentation system. If not, then the source should be attached to the analysis. Ask yourself, would you provide more justification if you were performing this analysis? If yes, the rationale is likely incomplete.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
5	Are design inputs correct and reasonable with critical parameters identified, if appropriate?	The expectation is that an Exelon Engineer should be able to clearly understand which input parameters are critical to the outcome of the analysis. That is, what is the impact of a change in the parameter to the results of the analysis? If the impact is large, then that parameter is critical.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6	Are design inputs compatible with the way the plant is operated and with the licensing basis?	Ensure the documentation for source and rationale for the inputs supports the way the plant is currently or will be operated post change and they are not in conflict with any design parameters.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

ATTACHMENT 2

Owner's Acceptance Review Checklist for External Design Analyses

Page 2 of 3

Design Analysis No.: BYR16-012

Rev: 0

No	Question	Instructions and Guidance	Yes / No / N/A
7	Are Engineering Judgments clearly documented and justified?	See Section 2.13 in CC-AA-309 for the attributes that are sufficient to justify Engineering Judgment. Ask yourself, would you provide more justification if you were performing this analysis? If yes , the rationale is likely incomplete.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
8	Are Engineering Judgments compatible with the way the plant is operated and with the licensing basis?	Ensure the justification for the engineering judgment supports the way the plant is currently or will be operated post change and is not in conflict with any design parameters. If the Analysis purpose is to establish a new licensing basis, then this question can be answered yes, if the judgment supports that new basis.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
9	Do the results and conclusions satisfy the purpose and objective of the Design Analysis?	Why was the analysis being performed? Does the stated purpose match the expectation from Exelon on the proposed application of the results? If yes , then the analysis meets the needs of the contract.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
10	Are the results and conclusions compatible with the way the plant is operated and with the licensing basis?	Make sure that the results support the UFSAR defined system design and operating conditions, or they support a proposed change to those conditions. If the analysis supports a change, are all of the other changing documents included on the cover sheet as impacted documents?	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
11	Have any limitations on the use of the results been identified and transmitted to the appropriate organizations?	Does the analysis support a temporary condition or procedure change? Make sure that any other documents needing to be updated are included and clearly delineated in the design analysis. Make sure that the cover sheet includes the other documents where the results of this analysis provide the input.	<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>
12	Have margin impacts been identified and documented appropriately for any negative impacts (Reference ER-AA-2007)?	Make sure that the impacts to margin are clearly shown within the body of the analysis. If the analysis results in reduced margins ensure that this has been appropriately dispositioned in the EC being used to issue the analysis.	<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>
13	Does the Design Analysis include the applicable design basis documentation?	Are there sufficient documents included to support the sources of input, and other reference material that is not readily retrievable in Exelon controlled Documents?	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
14	Have all affected design analyses been documented on the Affected Documents List (ADL) for the associated Configuration Change?	Determine if sufficient searches have been performed to identify any related analyses that need to be revised along with the base analysis. It may be necessary to perform some basic searches to validate this.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
15	Do the sources of inputs and analysis methodology used meet committed technical and regulatory requirements?	Compare any referenced codes and standards to the current design basis and ensure that any differences are reconciled. If the input sources or analysis methodology are based on an out-of-date methodology or code, additional reconciliation may be required if the site has since committed to a more recent code	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

ATTACHMENT 2
Owner's Acceptance Review Checklist for External Design Analyses
Page 3 of 3

Design Analysis No.: BYR16-012 Rev: 0

No	Question	Instructions and Guidance	Yes / No / N/A
16	Have vendor supporting technical documents and references (including GE DRFs) been reviewed when necessary?	Based on the risk assessment performed during the pre-job brief for the analysis (per HU-AA-1212), ensure that sufficient reviews of any supporting documents not provided with the final analysis are performed.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
17	Do operational limits support assumptions and inputs?	Ensure the Tech Specs, Operating Procedures, etc. contain operational limits that support the analysis assumptions and inputs.	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Create an SFMS entry as required by CC-AA-4008. SFMS Number: 56965

TABLE of CONTENTS

	Page
Cover Pages	1-1c
Table of Contents	2
Revision Summary	4
1.0 Purpose and Scope	5
2.0 Calculation Inputs	6
3.0 Assumptions	19
4.0 References	20
5.0 Computer Program	21
6.0 Methodology	21
7.0 Numerical Analysis	24
8.0 Acceptance Criteria	30
9.0 RETDAS Computer Program Results	32
10.0 Summary	38
11.0 Conclusions	39

ATTACHMENT TOPIC		
ATTACHMENT DESIGNATION		Pages
A	Unit requirements for gaseous (airborne) and liquid releases, $\mu\text{Ci/cc}$ and $\mu\text{Ci/ml}$, respectively.	1A-5A
B	UFSAR Section 11.2.3 indicating that liquid releases in UFSAR Table 11.2-2 are on a per unit basis.	1B-23B
C	Initial RETDAS dose reports. Guidance on which reports are unit specific and which are site specific.	1-5C
D	Guidance on the use of the UFSAR and ODCM as design input to the calculation.	1D-5D
E	UFSAR Table 11.3-6 tabulates the NUREG-0017 (PWR-GALE) projected annual gaseous releases on a per unit basis.	1E-5E
F	RETDAS U1 Gaseous Annual (Unfiltered) dose report. Demonstrates 10CFR50 Appendix I compliance for Unit 1 with the OGFU bypassed.	1F-8F
G	RETDAS U2 Gaseous Annual (Unfiltered) dose report. Demonstrates 10CFR50 Appendix I compliance for Unit 2 with the OGFU bypassed.	1G-8G
H	RETDAS Gaseous Instantaneous (Unfiltered) dose report. Demonstrates 10CFR20 compliance on a station basis with the SJAE process stream bypassing the OGFU.	1H-2H
I	RETDAS Gaseous Instantaneous (Filtered) dose report. Demonstrates 10CFR20 compliance on a station basis with the SJAE process stream using the OGFU.	1I-2I
J	RETDAS U1 Liquid Annual dose report for Unit 1. Demonstrates 10CFR50 Appendix I compliance for Unit 1.	1J-11J
K	RETDAS U2 Liquid Annual dose report for Unit 2. Demonstrates 10CFR50 Appendix I compliance for Unit 2.	1K-11K
L	RETDAS 40CFR190 (Unfiltered) dose report. Demonstrates compliance with 40CFR190 on a station basis with the OGFU bypassed.	1L-9L
M	RETDAS 40CFR190 (Filtered) dose report. Demonstrates compliance with 40CFR190 on a station basis using the OGFU.	1M-9M
N	Selected page of the ODCM, Table 1-1-"Regulatory Dose Limit Matrix" tabulates the compliance dose limits for Appendix I, 10CFR20 and 40CFR190.	1N-2N

	ATTACHMENT TOPIC	
O	Byron Station Annual Effluent Report 2015. Provides the basis for the 40CFR190 dose term for contained sources on site being taken as zero.	1O-80O
P	RETDAS U1 Gaseous Annual (Filtered) dose report. Demonstrates 10CFR50 Appendix I compliance for Unit 1 using the OGFU.	1P-8P
Q	RETDAS U2 Gaseous Annual (Filtered) dose report. Demonstrates 10CFR50 Appendix I compliance for Unit 2 using the OGFU bypassed.	1Q-8Q
R	Provides guidance on the maximum χ/Q_s at the Unrestricted and Restricted Boundaries, RETDAS 40CFR190 dose reports and liquid release dose calculations.	1R-8R
S	UFSAR Section 11.2 Tables.	1S-25S
T	Byron Station E-Mail Transmittals of RETDAS Dose Reports.	1T-10T
U	Byron Transfer of Design Information, BYR-16-044, Revision 0, "Transmittal of data associated with BYR16-012".	1U-158U

REVISION SUMMARY

0	Initial issue of calculation to evaluate the impact on 10CFR50 Appendix I, 10CFR20 and 40CFR190 design objectives of permanently bypassing the Offgas Filter Unit (OGFU) of the Steam Jet Air Ejector process stream.

1.0 PURPOSE and SCOPE

The purpose of this calculation is to verify continued compliance with the design objectives of 10CFR50 Appendix I (Ref.4.1) in support of the permanent bypassing of the Off Gas Filter Unit (OGFU) (10G01S) under EC 402667, Rev. 1. This calculation provides the following evaluations, as required by Off-Site Dose Calculation Manual Section 5.4 of the Offsite Dose Calculation Manual, (ODCM, CY-BY-170-301, Revision 12, Ref. 4.2) in support of a major change to the Gaseous Radwaste Treatment Systems:

1. An evaluation of the change which shows the predicted releases of radioactive materials in gaseous effluents that differ from those previously predicted in the License application and amendments.
2. An evaluation of the change, which shows the expected maximum exposures to a member of the public and to the general population that differ from those previously estimated in the License application and amendments while in continued compliance with Appendix I.

In addition, compliance with 10CFR20 (Ref. 4.3) dose criteria and airborne concentration will be verified in this calculation as well as compliance with 40CFR190 (Ref.4.10)

The OGFU does not perform a safety related or accident mitigation function. The OGFU, however, was credited in the analysis presented in UFSAR Section 11.2, Table 11.2-2, UFSAR, Revision 10, 2004 (Ref. 4.4) and UFSAR Section 11.3, Subsection 11.3.3.4 Revision 9, 2002 (Ref. 4.5) to demonstrate compliance with 10CFR50 Appendix I criteria to maintain dose to the general public as low as reasonably achievable as a result of the release of gaseous and liquid effluents. Note that Subsection 11.3.3.4 references the use of the PWR-GALE computer program (NUREG-0017) and PWR-GALE input parameters tabulated in Table 11.2-2, UFSAR, Revision 10, 2004 (Ref. 4.4).

To demonstrate continued compliance with these criteria, the results of the NUREG-0017 Revision 0 (Ref. 4.6) source terms presented in Table 11.3-7 of the UFSAR, Revision 5, 1995 are adjusted to eliminate the iodine removal mechanism provided by the OGFU. Note that the expected annual airborne release via the station vent stack is tabulated in UFSAR Table 11.3-7, Revision 5, 1994 in units of Ci/yr and reproduced and modified for this analysis as Table 2.1-3. Table 2.1-3 is a composite table of UFSAR Table 11.3-6, Revision 1, 1989 with an unfiltered I-131 and I-133 release inserted and UFSAR Table 11.3-7, Revision 5, 1994 with the annual release of the Volume Reduction System shown in UFSAR Table 11.3-6, Revision 1, 1989 removed.

Off-site doses are then calculated using the ODCM computer program, RETDAS, which utilizes a methodology consistent with that specified in Regulatory Guide 1.109 Revision 1 (Ref. 4.7). NUREG-0017 Revision 0 and Regulatory Guide 1.109 Revision 1 specify the criteria to demonstrate compliance with the design objectives of 10CFR50 Appendix I during plant licensing.

It should be noted that the NRC did not credit the OGFU in their calculations to verify Byron and Braidwood Stations' compliance with 10CFR50 Appendix I in the NRC's initial safety

evaluation reports (SERs) (Ref. 4.12). More details are provided in Chapter 11 of Reference 4.12, Page 11-4. The NRC calculations concluded that the Byron Station Gaseous Radwaste Treatment Systems satisfied the design objectives of 10CFR50 Appendix I without the iodine removal capability of the OGFU.

In addition, radioactive liquid releases into the Byron discharge canal based on UFSAR Table 11.2-1, Revision 12, December 2008 are utilized as input to the Byron ODCM computer program RETDAS to produce liquid dose consequences as part of the Appendix I, 10CFR20 and 40CFR190 compliance demonstrated in this analysis. The 40CFR190 compliance also contains a direct dose component from such contained sources as the ISFSI and the containment, which is further discussed in Section 2.13 of this calculation.

BYR16-012 is a non-safety related calculation and the affected system is the Off Gas (OG) system. The initiating document is EC 402667, Rev. 1. Based on the guidance provided in Attachment C, ODCM computer program RETDAS outputs individual computer runs specific to Appendix I airborne and liquid releases, 10CFR20 instantaneous gaseous releases and 40CFR190 airborne and liquid releases. Attachment C also provides guidance that the RETDAS reports provided by Byron Station contain applicable results that are annual in nature, except for the instantaneous reports.

2.0 CALCULATION INPUTS

2.1 The total filtered annual iodine release is presented in UFSAR Table 11.3-6, UFSAR, Revision 1, 1989 (Ref. 4.5), (Attachment E) and presented as follows:

Table 2.1-1			
ISOTOPE	ANNUAL FILTERED IODINE RELEASE PER UNIT VIA THE STEAM JET AIR EJECTORS (Ci/yr)	ANNUAL FILTERED IODINE RELEASE PER UNIT VIA OTHER PLANT SYSTEMS (Ci/yr)	TOTAL ANNUAL FILTERED IODINE RELEASE PER UNIT (Ci/yr)
	A	B	A + B
I-131	2.8E-03	4.8E-02	5.1E-02
I-133	4.0E-03	6.6E-02	7.0E-02

Table 2.1-1 tabulates the airborne I-131 and I-133 effluent release of the SJAE utilizing the OGFU. Based on the PWR-GALE inputs listed in Table 11.2-2 of the UFSAR, Revision 10, 2004 (Ref. 4.4), the OGFU filter efficiency is equivalent to 90%, 10% of the iodine is released to the environment, a release fraction of 0.10. The impact of not crediting the OGFU is to release 100% of iodine in the SJAE process stream to the environment, which is accomplished by increasing the annual iodine release rate from the SJAE by a factor of 10. See Table 2.1-2. Note that the annual iodine release rate from the remainder of the plant systems remains unchanged regardless of the filtration or non-filtration of the SJAE process stream by the

OGFU. Also note that the annual release rate of noble gases and particulates are not impacted by the OGFU.

Table 2.1-2				
ISOTOPE	UNFILTERED ANNUAL IODINE RELEASE PER UNIT VIA THE STEAM JET AIR EJECTORS (Ci/yr)	UNFILTERED ANNUAL IODINE RELEASE PER UNIT VIA OTHER PLANT SYSTEMS (Ci/yr)	TOTAL UNFILTERED IODINE ANNUAL RELEASE PER UNIT (Ci/yr)	TOTAL UNFILTERED IODINE ANNUAL RELEASE PER UNIT (μ Ci/yr)
	A	B	A + B	(A + B) x 1.0E+06
I-131	2.8E-02	4.8E-02	7.6E-02	7.6E+04
I-133	4.0E-02	6.6E-02	1.1E-01	1.1E+05

All nuclides/isotopes of noble gases, particulates, and halogens (iodine) source terms are listed in Table 2.1-3. This table includes both filtered and non-filtered source terms which require revision for the format required by ODCM computer program RETDAS (Ref.4.8). The expected annual airborne release via the station vent stack is tabulated in UFSAR Table 11.3-7, Revision 5, 1994 in units of Ci/yr and reproduced and modified for this analysis as Table 2.1-3. Table 2.1-3 is a composite table of UFSAR Table 11.3-6, Revision 1, 1989 with an unfiltered I-131 and I-133 release inserted and UFSAR Table 11.3-7, Revision 5, 1994 with the annual release of the Volume Reduction System shown in UFSAR Table 11.3-6, Revision 1 1989 removed.

Table 2.1-3			
ISOTOPE	UFSAR TABLE 11.3-7 (Modified) ANNUAL RELEASE FROM ONE UNIT FILTERED (Ci/yr)	UFSAR TABLE 11.3-7 (Modified) ANNUAL RELEASE FROM ONE UNIT FILTERED (μ Ci/yr)	ANNUAL RELEASE FROM ONE UNIT UNFILTERED (μ Ci/yr)
	A	B	C
H-3	1.00E+03	1.00E+09	1.00E+09
C-14	8.00E+00	8.00E+06	8.00E+06
Ar-41	2.50E+01	2.50E+07	2.50E+07
Kr-85m	5.00E+00	5.00E+06	5.00E+06
Kr-85	7.00E+02	7.00E+08	7.00E+08
Kr-87	1.00E+00	1.00E+06	1.00E+06
Kr-88	8.00E+00	8.00E+06	8.00E+06
Xe-131m	3.90E+01	3.90E+07	3.90E+07
Xe-133m	1.50E+01	1.50E+07	1.50E+07
Xe-133	2.00E+03	2.00E+09	2.00E+09
Xe-135	1.50E+01	1.50E+07	1.50E+07
Xe-138	1.00E+00	1.00E+06	1.00E+06
I-131	5.10E-02	5.10E+04	7.60E+04*
I-133	7.00E-02	7.00E+04	1.10E+05*

Table 2.1-3			
ISOTOPE	UFSAR TABLE 11.3-7 (Modified) ANNUAL RELEASE FROM ONE UNIT FILTERED (Ci/yr)	UFSAR TABLE 11.3-7 (Modified) ANNUAL RELEASE FROM ONE UNIT FILTERED (μ Ci/yr)	ANNUAL RELEASE FROM ONE UNIT UNFILTERED (μ Ci/yr)
	A	B	C
Mn-54	4.70E-03	4.70E+03	4.70E+03
Fe-59	1.60E-03	1.60E+03	1.60E+03
Co-58	1.60E-02	1.60E+04	1.60E+04
Co-60	7.30E-03	7.30E+03	7.30E+03
Sr-89	3.40E-04	3.40E+02	3.40E+02
Sr-90	6.20E-05	6.20E+01	6.20E+01
Cs-134	4.70E-03	4.70E+03	4.70E+03
Cs-137	7.80E-03	7.80E+03	7.80E+03

*See Table 2.1-2

The data in Columns B (filtered) and C (unfiltered) of Table 2.1-3 are entered into the ODCM computer program RETDAS by Byron personnel to calculate doses to verify compliance with the airborne aspects of 10CFR50 Appendix I, 10CFR20 and 40CFR190. Attachments F, G, H, I, J, K, L, M, P, Q and R contain the computer outputs provided by Byron on a per unit or per site basis as indicated by RETDAS, (filtered and unfiltered by the OGFU). The tables beginning in Section 2.10 summarize the results of the ODCM calculation for one unit and each case, unfiltered and filtered (the input data for both units are identical). Quarterly doses are not tabulated as compliance is demonstrated by the annual dose.

Note that the explanation of "Attachments" is provided in the Table of Contents.

2.2 The fraction of iodine released from the main condenser air ejector is 0.10, UFSAR Table 11.2-2 Revision 10 December 2004 (Ref. 4.4). This corresponds to a OGFU filter efficiency of 90%, an iodine retention factor 0.9.

2.3 Maximum Vent Release x/Q at the Byron Unrestricted Area Boundary is $4.497\text{E-}07$ sec/m^3 for the SSE sector as tabulated in Table 4-1 of the ODCM, CY-BY-170-301, Revision 12 (Ref. 4.2).

2.4 Maximum Vent Release x/Q at the Byron Restricted Area Boundary is $1.441\text{E-}06$ sec/m^3 as tabulated in Table 4-2 of the ODCM, CY-BY-170-301, Revision 12 for the S sector (Ref. 4.2).

2.5 As described in the Byron ODCM, CY-BY-170-301, Revision 12, Regulatory Dose Limit Matrix, Table 1-1, compliance with 10CFR20 involves a gaseous effluent component and a liquid component. Table 11.3-6 of the Byron UFSAR, Revision 1, 1989, (Ref. 4.5) (Attachment E) is the expected gaseous effluent annual release via the vent stack per unit, in units of Curies/year (Ci/yr), involving a breakdown of the various contributors. Tables 2.1-1, 2.1-2 and 2.1-3 are modifications of this table showing the individual isotopes discharged into the atmosphere, filtered and unfiltered by the OGFU, in units of Ci/yr and μ Ci/yr. Note that the

expected annual airborne release via the station vent stack is tabulated in UFSAR Table 11.3-7, Revision 5, 1994 in units of Ci/yr and reproduced and modified for this analysis as Table 2.1-3. Table 2.1-3 is a composite table of UFSAR Table 11.3-6, Revision 1, 1989 with an unfiltered I-131 and I-133 release inserted and UFSAR Table 11.3-7, Revision 5, 1994 with the annual release of the Volume Reduction System shown in UFSAR Table 11.3-6, Revision 1, 1989 removed. As noted in Attachment C, the required units for gaseous effluent are $\mu\text{Ci/cc}$, requiring a unit adjustment.

2.6 As described in the Byron ODCM, CY-BY-170-301, Revision 12, Regulatory Dose Limit Matrix, ODCM Table 1-1, compliance with 10CFR20 involves a gaseous effluent component and a liquid component. Table 11.2-1 of the Byron UFSAR, Revision 12, December 2008 (Ref. 4.4) (Attachment S) is the expected liquid effluent annual release into the discharge canal in units of Curies/year (Ci/yr), on a per unit basis (Attachment B) involving a breakdown of the various contributors. Table 2.6-1 of this calculation is a modification of this table showing the individual isotopes discharged into the canal in units of Ci/yr and $\mu\text{Ci/yr}$. As noted in Attachment C, the required units for liquid effluent are $\mu\text{Ci/ml}$, requiring a unit adjustment.

Table 2.6-1		
EXTRACTED FROM B/B UFSAR TABLE 11.2-1		
	EXPECTED ANNUAL RELEASE INTO DISCHARGE CANAL	EXPECTED ANNUAL RELEASE INTO DISCHARGE CANAL
NUCLIDE	TOTAL	TOTAL
	Ci/yr	μCi/yr
CR-51	6.16E-05	6.16E+01
MN-54	1.01E-03	1.01E+03
FE-55	5.40E-05	5.40E+01
FE-59	3.47E-05	3.47E+01
CO-58	4.53E-03	4.53E+03
CO-60	8.77E-03	8.77E+03
ZR-95	1.40E-03	1.40E+03
NB-95	2.00E-03	2.00E+03
NP-239	2.32E-05	2.32E+01
BR-83	1.76E-05	1.76E+01
RB-86	4.69E-05	4.69E+01
SR-89	1.28E-05	1.28E+01
MO-99	1.98E-03	1.98E+03
TC-99M	2.31E-03	2.31E+03
RU-103	1.41E-04	1.41E+02
RU-106	2.40E-03	2.40E+03
AG-110M	4.40E-04	4.40E+02
TE-127	1.40E-05	1.40E+01
TE-129M	4.59E-05	4.59E+01
TE-129	3.03E-05	3.03E+01
I-130	1.09E-04	1.09E+02
TE-131M	3.27E-05	3.27E+01
I-131	8.05E-02	8.05E+04
TE-132	6.16E-04	6.16E+02
I-132	1.79E-03	1.79E+03
I-133	3.66E-02	3.66E+04
CS-134	2.80E-02	2.80E+04
I-135	4.35E-03	4.35E+03
CS-136	6.89E-03	6.89E+03
CS-137	3.48E-02	3.48E+04
BA-137M	1.01E-02	1.01E+04
CE-144	5.20E-03	5.20E+03
ALL OTHERS	5.13E-05	5.13E+01
H-3	3.00E+02	3.00E+08

2.7 Based on the Byron guidance provided in Attachment C, regulatory compliance is demonstrated by RETDAS outputs in the following manner:

- a. The gaseous and liquid annual reports demonstrate 10CFR50 Appendix I (per unit compliance), Attachments F and G (Gaseous-Unfiltered), Attachments P and Q (Gaseous-Filtered) and Attachments J and K (Liquid).
- b. The 40CFR190 report demonstrates the 40CFR190 (site) compliance, Attachments L (Unfiltered) and M (Filtered).
- c. The gaseous instantaneous report demonstrates 10CFR20 (site) compliance, Attachments H (Unfiltered) and I (Filtered) by the OGFU, respectively.

2.8 The Unit 1 and Unit 2 vent stack flow rates are 151842 ft³/min for Byron Unit 1 and 147042 ft³/min for Byron Unit 2. These values are documented in ODCM CY-BY-170-301 Revision 12 Figure 2-1 and UFSAR Section 11.3, Revision 9, 2002.

2.9 As described in the B/B UFSAR, Section 11.2.1.3, Revision 15, December 2014, the Byron power uprate has very minimal impact on normal operational liquid release source terms. The following extractions are from the Byron/Braidwood UFSAR:

For liquid releases: "Core uprate results in a maximum potential increase of 0.6% in the liquid effluent release concentrations previously reported. Taking into consideration the accuracy and error bounds of the operational data utilized in NUREG 00017, this small percentage change is well within the uncertainty of the calculated results of the original NUREG 0017 based expected liquid effluent concentrations presented in Table 11.2-4 which remain valid for uprate."

Note that the "Expected Release" column of UFSAR Table 11.2-4, Revision 7, December 1998 is the rounded version of the "Total" column of UFSAR Table 11.2-1. Therefore, Table 11.2-1 of the Byron UFSAR, Revision 12, December 2008 remains valid for power uprate.

As described in the B/B UFSAR, Section 11.3.3.4, Revision 15, December 2014, the Byron power uprate has very minimal impact on normal operational gaseous release source terms. The following extractions are from the Byron/Braidwood UFSAR:

For airborne releases, "Core uprate results in a maximum potential increase of 0.6% for long lived isotopes such as Kr 85. Shorter lived isotopes will have reduced releases or only slight increases as compared to the 0.6% increase in power level. The impact of power uprate on iodine releases is limited to a maximum of 0.6%. The other components of gaseous releases (particulates via the building ventilation systems and water activation gases) are not impacted by uprate. All of the incremental tritium production due to power uprate is assumed to be released via the gaseous pathway resulting in an approximate 0.8% increase in tritium releases via the gaseous pathway. Taking into consideration the accuracy and error bounds of the operational data utilized in NUREG 00017, these small percentage changes are well within the uncertainty of the calculated results of the original NUREG 0017 based maximum offsite airborne concentrations from gaseous radwaste effluents presented in Table 11.3-7."

2.10 The annual gaseous effluent results for 10CFR50, Appendix I compliance applicable to Unit 1 and Unit 2 are provided in Attachment F and Attachment G (Unfiltered) and Attachments P and Q (Filtered), respectively. Note that there is a variation in terminology between Attachment N and the annual effluent reports, though they address the same subject. The Attachment N terminology "Organ Dose Due to Specified Non-Noble Gas Radionuclides" translates to "Iodine and Particulates" in the RETDAS annual gaseous effluent reports, since iodines and particulates are non-noble gases. Depending on the effluent mix, RETDAS prints the results for the appropriate critical organ and age group. For example, see Table 2.10-2. The associated RETDAS computer output for gaseous annual releases are as follows:

Table 2.10-1 APPENDIX I UNFILTERED NOBLE GAS AIRBORNE RELEASE			
Isotope Type	ODCM Regulatory Dose Limit Matrix** (mrad)	Calculated Annual Dose (mrad)	Percent of Limit
Noble Gas Gamma	1.00E+01	6.57E-02	6.57E-01 (0.657%)
Noble Gas Beta	2.00E+01	5.27E-02	2.64E-01 (0.264%)

Table 2.10-2 APPENDIX I UNFILTERED IODINE* and PARTICULATE AIRBORNE RELEASE				
Isotope Type	ODCM Regulatory Dose Limit Matrix** (mrem)	Age Group/Critical Organ	Calculated Annual Dose (mrem)	Percent of Limit
Iodine and Particulate	1.50E+01	Infant/Thyroid	9.82E+00	6.55E+01 (65.5%)

*Only gaseous (airborne) I-131 and I-133 are filtered.

**See Attachment N

Table 2.10-3 APPENDIX I FILTERED NOBLE GAS AIRBORNE RELEASE			
Isotope Type	ODCM Regulatory Dose Limit Matrix** (mrad)	Calculated Annual Dose (mrad)	Percent of Limit
Noble Gas Gamma	1.00E+01	6.57E-02	6.57E-01 (0.657%)
Noble Gas Beta	2.00E+01	5.27E-02	2.64E-01 (0.264%)

*Note that noble gas releases are not impacted by charcoal filtration.

Table 2.10-4 APPENDIX I FILTERED IODINE* and PARTICULATE AIRBORNE RELEASE				
Isotope Type	ODCM Regulatory Dose Limit Matrix** (mrem)	Age Group/Critical Organ	Calculated Annual Dose (mrem)	Percent of Limit
Iodine and Particulate	1.50E+01	Infant/Thyroid	6.64E+00	4.43E+01 (44.3%)

*Only gaseous (airborne) I-131 and I-133 are filtered.

**See Attachment N

2.11 Note that liquid releases are not impacted by bypassing the OGFU. RETDAS annual liquid results are applicable to a filtered and filter bypass OGFU configuration. The annual liquid effluent results for 10CFR50, Appendix I compliance applicable to Unit 1 and Unit 2 on a per unit basis are provided in Attachment J and Attachment K. The RETDAS computer output for liquid annual releases from Attachment J and Attachment K are as follows:

Table 2.11-1 APPENDIX I LIQUID RELEASE ORGAN DOSE					
	ODCM Regulatory Dose Limit Matrix** (mrem)	Organ Type	Organ	Calculated Annual Dose (mrem)	Percent of Limit
Age Group					
Teen	10	Any	Liver	2.12E-02	2.12E-01 (0.212%)

Table 2.11-2 APPENDIX I LIQUID RELEASE WHOLE BODY (TOTAL) DOSE					
	ODCM Regulatory Dose Limit Matrix** (mrem)	Organ Type	Organ	Calculated Annual Dose (mrem)	Percent of Limit
Age Group					
Adult	3	Tot Body	TBody	1.53E-02	5.10E-01 (0.510%)

**See Attachment N

Note that the liquid releases are not impacted by bypassing the OGFU. Therefore, dose consequences analyses utilizing the liquid releases tabulated in UFSAR Table 11.2-1 of the Byron UFSAR, Revision 12, December 2008 and Table 2-4 of the ODCM, CY-BY-170-301, and Revision 12 are also not impacted by this modification.

Note that examination of Attachment N shows that Attachment N is Table 1-1 of the ODCM and the liquid organ dose and the liquid whole body dose Appendix I liquid compliance have respective acceptance criteria. Each dose category, regardless of their comparative magnitude, is compared against its respective acceptance criteria. Appendix I compliance is determined by this comparison.

2.12 As stated in Attachment C, 10CFR20 compliance on a site basis is demonstrated by the gaseous instantaneous computer output of RETDAS, the ODCM computer program. It utilizes the same gaseous release via the vent stack used to determine the results in Section 2.10. The Technical Specification limits tabulated in Table 1-1 of the ODCM are instantaneous limits per site. The Regulatory Dose Limit Matrix, of the ODCM (CYBY-170-301, Revision 12) shown in the third column of Table 2.12-1 and Table 2.12-2 are the regulatory instantaneous limits for 10CFR20 compliance. See Attachment H for Unit 1 and 2 compliance (Unfiltered) and Attachment I for Unit 1 and 2 compliance (Filtered).

Table 2.12-1 UNFILTERED GASEOUS INSTANTANEOUS ANNUAL DOSE (mrem/yr)			
Organ Type	Maximum Possible Dose	ODCM Regulatory Dose Limit Matrix**	Percent of Limit
Total Body	1.15E-01	5.00E+02	2.30E-02 (0.0230%)
Skin	3.01E-01	3.00E+03	1.00E-02 (0.0100%)
Organ	6.07E+01	1.50E+03	4.05E+00 (4.05%)

Table 2.12-2 FILTERED GASEOUS INSTANTANEOUS ANNUAL DOSE (mrem/yr)			
Organ Type	Maximum Possible Dose	ODCM Regulatory Dose Limit Matrix**	Percent of Limit
Total Body	1.15E-01	5.00E+02	2.30E-02 (0.0230%)
Skin	3.01E-01	3.00E+03	1.00E-02 (0.0100%)
Organ	4.09E+01	1.50E+03	2.72E+00 (2.72%)

**See Attachment N

2.13 The following is extracted from Attachment O, the 2015 Annual Report for Byron Station, Item C Page 17 (Ref. 4.11):

“.....As a result, there is currently no offsite dose contribution from the ISFSI facility or any other on-site storage facility, including the Dry Active Waste (DAW) Building and the Old Steam Generator (OSG) Storage Building, as evidenced by dosimetry data that is indistinguishable from the existing environmental dosimeters.”

Therefore, the 40CFR190 dose does not have a direct dose term in the total dose and is taken as zero (0).

As stated in Attachment C, the RETDAS 40CFR190 computer dose results are applicable to the site. This computer program utilizes the airborne concentrations released to the environment via the vent stack and the liquid concentrations released to the environment via

the discharge canal. The doses associated with 40CFR190 and tabulated in Attachment L and Attachment M, Unfiltered and Filtered, respectively, are:

Table 2.13-1 40CFR190 UNFILTERED ANNUAL DOSE BY ORGAN AND AGE GROUP (mrem)					
Age Group	Organ	Liquid Dose Component (mrem/yr)	Gaseous Dose Component (mrem/yr)	Total Dose (mrem/yr)	ODCM Regulatory Dose Limit Matrix (mrem/yr)
Child	Total Body	7.21E-03	5.05E-01	5.12E-01	25
Infant	Thyroid	5.16E-03	1.96E+01	1.97E+01*	75

Table 2.13-2 40CFR190 FILTERED ANNUAL DOSE BY ORGAN AND AGE GROUP (mrem)					
Age Group	Organ	Liquid Dose Component (mrem/yr)	Gaseous Dose Component (mrem/yr)	Total Dose (mrem/yr)	ODCM Regulatory Dose Limit Matrix (mrem/yr)
Child	Total Body	7.21E-03	5.00E-01	5.07E-01	25
Infant	Thyroid	5.16E-03	1.33E+01	1.33E+01*	75

*The calculated Infinite Thyroid dose is less than 25 mrem/yr, which also satisfies the Any/Other Organ acceptance criteria of 40CFR190.

2.14 The B/B UFSAR and ODCM are valid design inputs for this calculation requiring the proper designation. See Attachment D.

2.15 The liquid discharge volumetric dilution rate is 13000 gallons per minute (gpm) per unit. See Attachment B and UFSAR Section 11.3.3.4, Revision 9 December 2002.

2.16 One cubic centimeter equals one milliliter.

2.17 The acceptance criteria below reflects the limits established by the Radioactive Effluent Controls Program, Technical Specification 5.5.4 (Ref. 4.9), to maintain the doses to the general public as low as reasonably achievable:

1. As shown in Attachment N, the ODCM (Ref. 4.2), CY-BY-170-301 Revision 12, establishes the following limits to satisfy the design objectives for gaseous and liquid releases to unrestricted areas as contained in 10CFR50 Appendix I:

Table 2.17-1 APPENDIX I AIRBORNE RELEASES	
Radiation Type	Year
Gamma (air)	10 mrad
Beta (air)	20 mrad
Any Organ	15 mrad

Table 2.17-2 APPENDIX I LIQUID RELEASES	
Radiation Type	Year
Whole(Total) Body	3 mrem
Organ	10 mrem

2. The ODCM (Ref. 4.2), CY-BY-170-301 Revision 12 establishes the following limits to satisfy the design objectives for gaseous and liquid releases to unrestricted areas as contained in 10CFR20. See Attachment N:

Table 2.17-3 10CFR20 GASEOUS and LIQUID RELEASES	
Total Effective Dose Equivalent	100 mrem/year

3. As illustrated in Attachment N, the ODCM (Ref. 4.2) establishes the following limits to satisfy the design objectives for the summation of gaseous and liquid releases to unrestricted areas as contained in 40CFR190.

Table 2.17-4 40CFR190 URANIUM FUEL CYCLE RELEASES*	
Total Body	25 mrem/year
Thyroid Dose	75 mrem/year
Organ Dose	25 mrem/year

*Per Attachment N, compliance with 40CFR190 demonstrates compliance with 10CFR20.

4. The following limits are provided in 10CFR20 Appendix B for I-131 and I-133

Table 2.17-5 10CFR20 Appendix B Limits		
ISOTOPE	OCCUPATIONAL DAC LIMIT ($\mu\text{Ci/ml}$)	EFFLUENT CONCENTRATION LIMIT ($\mu\text{Ci/ml}$)
I-131	2 E-08	2 E-10
I-133	1 E-07	1 E-09

5. As illustrated in Attachment N, the ODCM (Ref. 4.2) establishes the following limits to satisfy the design objectives for the instantaneous releases to the Unrestricted Area Boundary.

Table 2.17-6 ODCM Table 1-1 Regulatory Dose Limit Matrix** (mrem/yr)	
Total Body Dose Rate Due to Noble Gas Radionuclides	500

(instantaneous limit, per site)	
Skin Dose Rate Due to Noble Gas Radionuclides (instantaneous limit, per site)	3,000
Organ Dose Rate Due to Specified Non-Noble Gas Radionuclides (instantaneous limit, per site)	1,500

**See Attachment N

3.0 ASSUMPTIONS

3.1 As described in the UFSAR Table 11.3-6, Revision 6 1996, the Volume Reduction System is not used at Byron Station. Therefore, the off-site release contributions from this system, as listed in UFSAR Table 11.3-6 of the UFSAR, Revision 6, 1996 for this system will not be included in the dose calculations.

3.2 No activity adjustments are made for noble gas and particulate radioactive isotopes for calculations that assume that the OGFU is not in service. The methodology in the NUREG-0017 only credits the OGFU for iodine removal and noble gases and particulates are not affected by the OGFU. Item 44 of Table 11.2-2 describes "Fraction of iodine released from the main condenser air ejector" as 0.10. An iodine release fraction of 0.10 numerically translates to a charcoal filter removal efficiency of 90%, a retention fraction of 0.9. This concept is confirmed in UFSAR Section 10.4.2, Revision 9 December 2002 with the following statement, "decontamination factor for the charcoal filter is a minimum of 10 for iodine". No retention of noble gases or particulates are discussed. Additionally, Section 2.2.12 of NUREG-0017 (Ref. 4.6) discusses iodine removal only by charcoal filtration and particulate removal only by HEPA filtration.

3.3 Maximum relative concentration factors, χ/Q , are conservatively used in this calculation to determine airborne concentrations at the Restricted and Unrestricted Boundaries..

3.4 The requirement in ODCM Revision 12 Section 4.1.5 to operate the appropriate Ventilation Exhaust Treatment Systems to reduce the release of radioactivity when projected doses in a 31 day period from each unit will exceed

- a. 0.2 mrad to air from gamma radiation
- b. 0.4 mrad to air from beta radiation
- c. 0.3 mrem to any organ of a member of the public

is not a 10CFR50 Appendix I design criteria and will not be used as an acceptance criteria for this calculation. In addition to the ODCM, the above text of Section 3.4 is based on the review of References 4.1, 4.2, 4.3 and 4.9, which demonstrates that Items a, b, c, are not Appendix I design criteria.

3.5 Doses based on liquid releases to the environment are conservatively based on liquid releases to the discharge canal, no additional river dilution. See UFSAR Table 11.2-3. This is assumed to be the unrestricted area boundary.

4.0 REFERENCES

- 4.1 10CFR 50 Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low as is Reasonably Achievable" for Radioactive Material in Light Water Cooled Nuclear Power Reactor Effluents
- 4.2 Byron Station Units 1 and 2 Offsite Dose Calculation Manual, ODCM, CY-BY-170-301, Revision 12
- 4.3 10CFR20 "Standards For Protection Against Radiation"
- 4.4 Byron/Braidwood Station Units 1 and 2 UFSAR, Section 11.2
- 4.5 Byron/Braidwood Station Units 1 and 2 UFSAR, Section 11.3
- 4.6 U.S. Nuclear Regulatory Commission, Calculation of Releases of Radioactive Materials In Gaseous and Liquid Effluents from Pressurized Water Reactors (PWR-GALE Code), NUREG-0017, April 1976
- 4.7 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, Revision 1
- 4.8 Byron ODCM Computer Program, RETDAS, Radiological Effluent Tracking and Dose Assessment Software, Gaseous Instantaneous Dose Reports on Version 3.6.4.9, Other Dose Reports on Version 3.6.4.8
- 4.9 Byron Station Units 1 and 2 Technical Specification 5.5.4
- 4.10 U.S. Environmental Protection Agency, 40CFR190 Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, Final Environmental Statement, EPA 520/4-76-016, November 1, 1976
- 4.11 Byron Station 2015 Annual Radiological Effluent Release Report (Attachment O)
- 4.12 NUREG-0876 "Safety Evaluation Report related to the operation of Byron Station, Units 1 and 2", February 1982
- 4.13 E-Mail-05/31/2016 03:44 PM-Jeffery M. Golich :(GenCo-Nuc) Exelon-Byron to Barry C. Schwartz, et. al, (Sargent & Lundy) "Byron Offgas Filter Unit Removal-Design Objectives for Gaseous Releases -RE-TRANSMITTAL NO CHANGES" Text Subject-Unit Requirements for RETDAS Computer Program Inputs (Attachment A)
- 4.14 E-Mail Transmittals Golich, Jeffrey M:(GenCo-Nuc)" jeffrey.golich@exeloncorp.com to: BARRY.C.SCHWARTZ@Sargentlundy.com <BARRY.C.SCHWARTZ@Sargentlundy.com>, et. al" "Dose Reports"-Text Subject-RETDAS Dose Report Word Files (Attachment T)

- 4.15 Byron Transfer of Design Information, BYR-16-044, Revision 0, "Transmittal of data associated with BYR16-012".

5.0 COMPUTER PROGRAM

Byron personnel executed their ODCM computer program, RETDAS Version 3.6.4.9, on the Byron site with input airborne and liquid release data provided via Sargent & Lundy E-mail. As part of the Sargent & Lundy calculation QA based review process, airborne and liquid releases from the UFSAR, data from the ODCM and calculated data here-in were reviewed against the RETDAS computer outputs used by Attachments F, G, H, I, J, K, L, M, P, Q and found acceptable. Note that Attachments F, G, P and Q contain the input summary of the gaseous release isotopic RETDAS input, while Attachments J and K contain the input summary of the liquid release isotopic RETDAS input. The 10CFR20 compliance gaseous instantaneous RETDAS computer outputs, Attachments H and I, and the 40CFR190 compliance RETDAS computer outputs, Attachments L and M, do not explicitly repeat the isotopic inputs, but use the corresponding gaseous and liquid release inputs in the gaseous and liquid RETDAS computer runs. As part of the documentation, the attachments noted above have been retransmitted as part of TODI BYR-16-044 (Ref.4.15).

6.0 METHODOLOGY

6.1 Airborne Releases to the Environment via the Station Vent Stack

UFSAR Table 11.3-6, UFSAR, Revision 1, 1989 lists the curies of radioactive nuclides released per year from several plant systems. Refer to Attachment E.

The gaseous effluent contribution from the air ejector exhaust includes two radioactive iodine isotopes, I-131 and I-133. The data for the air ejector exhaust in Table 11.3-6, of the UFSAR, Revision 1, 1989 reflects the 90% removal capability of the OGFU. To obtain the unfiltered release of radioactive iodine via the air ejector exhaust, the annual curie released data for I-131 and I-133 via this path is multiplied by a factor of 10. New annual release values for isotopes I-131 and I-133 are then calculated by including the contribution of these isotopes from other plant systems. See Table 2.1-1, Table 2.1-2 and Table 2.1-3.

The annual curie (converted to microcuries) release data for each radioactive isotope in Table 11.3-7, UFSAR, Revision 5, 1994 filtered and adjusted for unfiltered, is entered in the ODCM computer program RETDAS (Ref. 4.8) to provide a comparison in the offsite doses for the SJAЕ process stream being filtered by the OGFU and bypassing the OGFU. The resulting doses can be compared to 10CFR50 Appendix I, 10CFR20 and 40CFR190 limitations for gaseous releases to the environment to determine acceptability. Note that the expected annual airborne release via the station vent stack is tabulated in UFSAR Table 11.3-7, Revision 5, 1994 in units of Ci/yr and reproduced and modified for this analysis as Table 2.1-3. Table 2.1-3 is a composite table of UFSAR Table 11.3-6, Revision 1, 1989 with an unfiltered I-131 and I-133 release inserted and UFSAR Table 11.3-7, Revision 5, 1994 with the annual release of the Volume Reduction System shown in UFSAR Table 11.3-6, Revision 1, 1989 removed.

The maximum airborne concentration at the site boundaries (Restricted Area Boundary and Unrestricted Area Boundary) for I-131 and I-133 are calculated based on the output of the

RETDAS computer program. Occupational DAC limits are for plant personnel and applied at the Restricted Area Boundary and the effluent concentration limits are applied at the Unrestricted Area Boundary for the general public.

Using the guidance of Attachment R, the dose point for mixed mode gaseous releases via the vent stack for instantaneous and annual dose assessment is the point of maximum χ/Q on the Unrestricted Area Boundary. From visual inspection of Table 4-1 of the ODCM (CY-BY-170-301, Revision 12), the maximum vent χ/Q at the unrestricted boundary is $4.497\text{E-}07 \text{ sec/m}^3$ in the SSE sector. This applies to the effluent concentration limits for the general public at the unrestricted boundary.

As a section of the RETDAS output "NUCLIDE DATA", shown in Attachments F and G and Attachments P and Q for the gaseous annual releases, isotopic concentrations in the airborne effluent are tabulated in units of $\mu\text{Ci/cc}$, which is equivalent to $\mu\text{Ci/ml}$ for this analysis. This is the I-131 and I-133 concentrations released from the vent stack. The maximum concentrations are calculated at the Unrestricted Area Boundary for OGFU filtered and filter bypass releases by multiplying the vent stack concentrations by the maximum χ/Q s in Table 4-1 of the ODCM.

The DAC applies at the Restricted Area Boundary and is applicable to plant personnel. Since the dose point at the Restricted Area Boundary is impacted by the same gaseous vent effluent as the dose point at the Unrestricted Area Boundary in Attachments F and G and P and Q, iodine concentrations at the Restricted Area Boundary vary by the ratio of χ/Q s. The maximum χ/Q at the Restricted Area Boundary tabulated in Table 4-2 of the ODCM (CY-BY-170-301, Revision 12) is $1.441\text{E-}06 \text{ sec/m}^3$ in the S sector. Though the dose points for comparison are not at the same location, it is conservative to apply the ratio of maximum χ/Q s to the RETDAS iodine concentrations at the Unrestricted Area Boundary in order to maximize the iodine concentrations at the Restricted Area Boundary.

$$\chi/Q \text{ ratio} = 1.441\text{E-}06/4.497\text{E-}07 = 3.20$$

The gaseous release aspects of Appendix I, 10CFR20 and 40CFR190 analyses utilize the vent stack releases tabulated in UFSAR Table 11.3-7, Revision 5, 1994 on a per unit basis or per station basis. Those analyses that are per unit basis utilize the releases via one vent stack as RETDAS input. Those that are on a per site basis utilize the releases from two vent stacks. For simplicity, the vent stacks are postulated to have the same volumetric flow rate. Releases on a per station basis increases the activity released, but preserves the isotopic concentration since the curies released are doubled, but so is the volumetric flow rate.

6.2 Liquid Releases to the Environment via the Discharge Canal

The annual releases into the discharge canal are utilized in Byron's ODCM computer program RETDAS in units of $\mu\text{Ci/ml}$. As extracted from Attachment R, "Liquid doses are not calculated at a specific location like gaseous effluents but are based on the concentration of radioactivity in liquid effluents released to unrestricted areas as defined in ODCM Table 1-1. The dose from radioactive materials in liquid effluents is calculated from the consumption of fish and potable water as defined in ODCM Section 3.4.1. There is a potable intake water near-field dilution factor defined in section 3.4.2, which assumes the potable water intake is at least $\frac{1}{4}$ mile downstream. Fish intake is assumed to occur at the discharge structure after a mixing factor is applied as defined in Section 3.5.5."

The liquid release aspects of Appendix I, 10CFR20 and 40CFR190 analyses utilize the liquid release into the discharge canal tabulated in UFSAR Table 11.2-2, Revision 10, 2004 on a per unit basis or station basis. Those analyses that are per unit basis utilize the liquid releases discharged by one unit as RETDAS input. Those that are on a per site basis utilize the discharge releases from two units. For simplicity, the two discharges are postulated to have the same release rate. Releases on a per site basis increases the activity released, but preserves the isotopic concentration since the curies released are doubled, but so is the volumetric dilution rate. RETDAS utilizes the liquid releases to determine Appendix I, 10CFR20 and 40CFR190 compliances.

The RETDAS results for liquid releases from Unit 1 and Unit 2 are presented in Attachments J and K, respectively. Liquid releases are not filtered by the OGFU, whether the SJAE process stream is filtered through or bypasses the OGFU.

7.0 NUMERICAL ANALYSIS

7.1 Airborne Releases

The expected annual airborne release via the station vent stack is tabulated in UFSAR Table 11.3-7, Revision 5, 1994 in units of Ci/yr and reproduced and modified for this analysis as Table 7.1-1. Table 7.1-1 is a composite table of UFSAR Table 11.3-6, Revision 1, 1989 with an unfiltered I-131 and I-133 release inserted and UFSAR Table 11.3-7, Revision 5, 1994 with the annual release of the Volume Reduction System shown in UFSAR Table 11.3-6, Revision 1, 1989 removed.

Table 7.1-1			
ISOTOPE	UFSAR TABLE 11.3-7 (Modified) ANNUAL RELEASE FROM ONE UNIT FILTERED (Ci/yr)	UFSAR TABLE 11.3-7 (Modified) ANNUAL RELEASE FROM ONE UNIT FILTERED (μ Ci/yr)	ANNUAL RELEASE FROM ONE UNIT UNFILTERED (μ Ci/yr)
	A	B = A x 1E+06	C
H-3	1.00E+03	1.00E+09	1.00E+09
C-14	8.00E+00	8.00E+06	8.00E+06
Ar-41	2.50E+01	2.50E+07	2.50E+07
Kr-85m	5.00E+00	5.00E+06	5.00E+06
Kr-85	7.00E+02	7.00E+08	7.00E+08
Kr-87	1.00E+00	1.00E+06	1.00E+06
Kr-88	8.00E+00	8.00E+06	8.00E+06
Xe-131m	3.90E+01	3.90E+07	3.90E+07
Xe-133m	1.50E+01	1.50E+07	1.50E+07
Xe-133	2.00E+03	2.00E+09	2.00E+09
Xe-135	1.50E+03	1.50E+07	1.50E+07
Xe-138	1.00E+00	1.00E+06	1.00E+06
I-131	5.10E-02	5.10E+04	7.60E+04
I-133	7.00E-02	7.00E+04	1.10E+05
Mn-54	4.70E-03	4.70E+03	4.70E+03
Fe-59	1.60E-03	1.60E+03	1.60E+03
Co-58	1.60E-02	1.60E+04	1.60E+04
Co-60	7.30E-03	7.30E+03	7.30E+03
Sr-89	3.40E-04	3.40E+02	3.40E+02
Sr-90	6.20E-05	6.20E+01	6.20E+01
Cs-134	4.70E-03	4.70E+03	4.70E+03
Cs-137	7.80E-03	7.80E+03	7.80E+03

Table 7.1-1 (Continued)		
ISOTOPE	ANNUAL RELEASE FROM ONE UNIT UNFILTERED ($\mu\text{Ci/cc}$)	ANNUAL RELEASE FROM ONE UNIT FILTERED ($\mu\text{Ci/cc}$)
	$D = C/(2.19\text{E}+15)$ cc/yr	$E = B/(2.19\text{E}+15)$ cc/yr
H-3	4.57E-07	4.57E-07
C-14	3.65E-09	3.65E-09
Ar-41	1.14E-08	1.14E-08
Kr-85m	2.28E-09	2.28E-09
Kr-85	3.20E-07	3.20E-07
Kr-87	4.57E-10	4.57E-10
Kr-88	3.65E-09	3.65E-09
Xe-131m	1.78E-08	1.78E-08
Xe-133m	6.85E-09	6.85E-09
Xe-133	9.13E-07	9.13E-07
Xe-135	6.85E-09	6.85E-09
Xe-138	4.57E-10	4.57E-10
I-131	3.47E-11	2.33E-11
I-133	5.02E-11	3.20E-11
Mn-54	2.15E-12	2.15E-12
Fe-59	7.31E-13	7.31E-13
Co-58	7.31E-12	7.31E-12
Co-60	3.33E-12	3.33E-12
Sr-89	1.55E-13	1.55E-13
Sr-90	2.83E-14	2.83E-14
Cs-134	2.15E-12	2.15E-12
Cs-137	3.56E-12	3.56E-12

Table 7.1-1 is based on Table 2.1-1, Table 2.1-2 and Table 2.1-3 of this calculation. Column C above represents the release to the environment with the SJAE process stream bypassing the OGFU. Only I-131 and I-133 in the SJAE process stream are increased by a factor of 10 as a result of bypassing the OGFU. The other isotopes are not. The I-131 and I-133 in the remaining equipment shown in UFSAR Table 11.3-6, UFSAR, Revision 1, 1989 are not impacted as a result of bypassing the OGFU. Column C represents the annual unfiltered release on a unit basis, which includes the increased release rate of I-131 and I-133 from the bypass of the OGFU and the annual release rate of I-131, I-133 and the other remaining isotopes in the other equipment shown in UFSAR Table 11.3-6, Revision 1, 1989.

Comparing Table 2.1-1 and Table 2.1-2 yields the numerical logic for calculating the annual release rate for I-131 and I-133 from the bypassed OGFU and the remaining equipment shown in UFSAR Table 11.3-6, Revision 1, 1989. Note that the expected annual airborne release via the station vent stack is tabulated in UFSAR Table 11.3-7, Revision 5, 1994 in units of Ci/yr and reproduced and modified for this analysis as Table 2.1-3. Table 2.1-3 is a composite table of UFSAR Table 11.3-6, Revision 1, 1989 with an unfiltered I-131 and I-133 release inserted and UFSAR Table 11.3-7, Revision 5, 1994 with the annual release of the Volume Reduction System shown in UFSAR Table 11.3-6, Revision 1, 1989 removed.

As described in Attachment A, the Byron ODCM computer program RETDAS requires airborne effluent input in units of $\mu\text{Ci/cc}$. The units of Table 7.1-1 require conversion from Ci/yr to $\mu\text{Ci/cc}$.

By cross-checking Figure 2-1 of the ODCM, CY-BY-170-301, Revision 12 against Section 11.3 of the UFSAR, Revision 9, 2002 the vent stack flows are 151842 ft^3/min for Byron Unit 1 and 147042 ft^3/min for Byron Unit 2. Per Input 2.8, these values are design input and can be used to determine radionuclide concentration in the vent stack effluent.

Using Unit 2 stack flow in this analysis will yield a higher effluent concentration since it is the lower value.

$$\begin{aligned}\text{Unit 2 Stack Flow} &= 147042 \text{ ft}^3/\text{min} \times (30.48 \text{ cm})^3/\text{ft}^3 \times 60 \text{ min/hr} \times 24 \text{ hr/day} \times 365 \text{ day/yr} \\ &= 2.18\text{E}+15 \text{ cc/yr}\end{aligned}$$

Concentration example from Table 7.1-1
Using I-131

$$\text{Concentration of unfiltered I-131 in vent stack} = 7.60\text{E}+04 \mu\text{Ci/yr}/(2.18\text{E}+15 \text{ cc/yr}) = 3.49\text{E}-11 \mu\text{Ci/cc}$$

This corresponds to Table 7.1-1, accounting for rounding between spreadsheet and calculator. Therefore, the vent stack concentration is the input to Byron's ODCM computer program RETDAS in units of $\mu\text{Ci/cc}$.

7.2 Liquid Releases

As described in the UFSAR Section 11.2, Revision 9, December 2002, liquid effluent is released into the discharge canal and offsite dose due to liquid releases are based on isotopic concentrations in the discharge canal with dilution, if any, as described in Attachment R. The volumetric dilution rate is 13000 gpm on a per unit basis as defined in UFSAR Section 11.3.3.4, Revision 9 December 2002 and provided in Calculation Input 2.15. The units of release into the discharge canal in UFSAR Table 11.2-1 of the Byron UFSAR, Revision 12, December 2008 are Ci/yr. As described in Attachment A, the desired units of input into RETDAS are $\mu\text{Ci/ml}$.

Table 7.2-1 Expected Annual Liquid Effluent into Discharge Canal*			
NUCLIDE	TOTAL	TOTAL	TOTAL
	Ci/yr	μCi/yr	μCi/ml
A	B	C = B X 1E+06	$D = C \times (1/13000) \times (0.264/1000) \times (1/60) \times (1/24) \times (1/365)$
CR-51	6.16E-05	6.16E+01	2.38E-12
MN-54	1.01E-03	1.01E+03	3.90E-11
FE-55	5.40E-05	5.40E+01	2.09E-12
FE-59	3.47E-05	3.47E+01	1.34E-12
CO-58	4.53E-03	4.53E+03	1.75E-10
CO-60	8.77E-03	8.77E+03	3.39E-10
ZR-95	1.40E-03	1.40E+03	5.41E-11
NB-95	2.00E-03	2.00E+03	7.73E-11
NP-239	2.32E-05	2.32E+01	8.96E-13
BR-83	1.76E-05	1.76E+01	6.80E-13
RB-86	4.69E-05	4.69E+01	1.81E-12
SR-89	1.28E-05	1.28E+01	4.95E-13
MO-99	1.98E-03	1.98E+03	7.65E-11
TC-99M	2.31E-03	2.31E+03	8.93E-11
RU-103	1.41E-04	1.41E+02	5.45E-12
RU-106	2.40E-03	2.40E+03	9.27E-11
AG-110M	4.40E-04	4.40E+02	1.70E-11
TE-127	1.40E-05	1.40E+01	5.41E-13
TE129M	4.59E-05	4.59E+01	1.77E-12
TE-129	3.03E-05	3.03E+01	1.17E-12
I-130	1.09E-04	1.09E+02	4.21E-12
TE-131M	3.27E-05	3.27E+01	1.26E-12
I-131	8.05E-02	8.05E+04	3.11E-09
TE-132	6.16E-04	6.16E+02	2.38E-11
I-132	1.79E-03	1.79E+03	6.92E-11
I-133	3.66E-02	3.66E+04	1.41E-09
CS-134	2.80E-02	2.80E+04	1.08E-09
I-135	4.35E-03	4.35E+03	1.68E-10
CS-136	6.89E-03	6.89E+03	2.66E-10
CS-137	3.48E-02	3.48E+04	1.34E-09
BA-137M	1.01E-02	1.01E+04	3.90E-10
CE-144	5.20E-03	5.20E+03	2.01E-10
H-3	3.00E+02	3.00E+08	1.16E-05

*Based on Table 11.2-1 of the UFSAR, Revision 12, December 2008

UFSAR Table 11.2-2, Revision 10, 2004 tabulates the Byron/Braidwood input to the PWR-GALE computer program on a per unit basis (Attachment B). The radwaste dilution flow rate is tabulated as 13000 gallons per minute (gpm) per unit, Calculation Input 2.15. The required input units for the Byron ODCM computer program are units of $\mu\text{Ci/ml}$. The annual release into the discharge canal in units of $\mu\text{Ci/yr}$ requires a conversion to a isotopic concentration of $\mu\text{Ci/ml}$.

Conversion example using CR-51 from Table 7.2-1

$$6.16\text{E}+01 \mu\text{Ci/yr} \times (1\text{min}/13000\text{gal}) \times (0.264\text{gal}/1000\text{mil}) \times 1\text{hr}/60\text{min} \times 1\text{day}/24\text{hr} \times 1\text{yr}/365\text{days} \\ = 2.38\text{E}-12 \mu\text{Ci/ml}$$

Table 2-4 of the ODCM, CY-BY-170-301, Revision 12 is entitled "Assumed Composition of the Byron Station Liquid Effluent". Considering that the PWR-GALE computer program is also a primary reference of the ODCM, there should be a linkage between the UFSAR Table 11.2-1 of the Byron UFSAR, Revision 12, December 2008 and ODCM Table 2-4, ODCM, CY-BY-170-301, Revision 12 with respect to liquid effluent.

This comparison linkage is demonstrated in the following manner:

Table 7.2-2 Comparison of Expected Annual Liquid Effluent into Discharge Canal		
NUCLIDE	$\mu\text{Ci/ml}^{**}$	$\mu\text{Ci/ml}^*$
CR-51	2.39E-12	2.38E-12
MN-54	3.88E-11	3.90E-11
FE-55	2.08E-12	2.09E-12
FE-59	1.35E-12	1.34E-12
CO-58	1.74E-10	1.75E-10
CO-60	3.40E-10	3.39E-10
ZR-95	5.40E-11	5.41E-11
NB-95	7.72E-11	7.73E-11
NP-239	8.88E-13	8.96E-13
BR-83	6.59E-13	6.80E-13
RB-86	1.81E-12	1.81E-12
SR-89	5.02E-13	4.95E-13
MO-99	7.72E-11	7.65E-11
TC-99M	8.88E-11	8.93E-11
RU-103	5.40E-12	5.45E-12
RU-106	9.26E-11	9.27E-11
AG110M	1.70E-11	1.70E-11
TE-127	5.40E-13	5.41E-13
TE-129M	1.78E-12	1.77E-12
TE-129	1.16E-12	1.17E-12
I-130	4.24E-12	4.21E-12
TE-131M	1.27E-12	1.26E-12

Table 7.2-2 Comparison of Expected Annual Liquid Effluent into Discharge Canal		
NUCLIDE	μCi/ml**	μCi/ml*
I-131	3.09E-09	3.11E-09
TE-132	2.39E-11	2.38E-11
I-132	6.95E-11	6.92E-11
I-133	1.43E-09	1.41E-09
CS-134	1.08E-09	1.08E-09
I-135	1.66E-10	1.68E-10
CS-136	2.66E-10	2.66E-10
CS-137	1.35E-09	1.34E-09
BA-137M	0.00E+00	3.90E-10
CE-144	2.01E-10	2.01E-10
H-3	1.16E-05	1.16E-05

*Based on Table 11.2-1 of the UFSAR, Revision 12, December 2008

** Based on ODCM , CY-BY-170-301, Revision 12, Table 2-4

The documentation does provide justification for the removal of Ba-137m from the ODCM. Comparing the discharge concentrations between the ODCM Table 2-4 and those based on UFSAR Table 11.2-1, Revision 12, December 2008 shows that they are the same, accounting for the variation due to rounding between the two documents. Since the Braidwood analysis used the annual airborne releases, and only the airborne releases, from the UFSAR in their calculation, the Byron analysis will use the airborne and liquid releases based on tables in the UFSAR.

The airborne releases to the environment and the liquid releases to the environment, Table 7.1-1 and Table 7.2-1, respectively, were transmitted to the Byron Station via Sargent & Lundy E-Mail as input to their ODCM computer code RETDAS. As part of the calculation review process, nuclides in Table 7.1-1 and Table 7.2-1 were compared to the respective inputs of RETDAS, where applicable, and found to be acceptable, confirming the use of the same airborne and liquid source terms.

8.0 ACCEPTANCE CRITERIA

The acceptance criteria below reflects the limits established by the Radioactive Effluent Controls Program, Technical Specification 5.5.4 (Ref. 4.9), to maintain the doses to the general public as low as reasonably achievable:

1. As shown in Attachment N, the ODCM (Ref. 4.2), CY-BY-170-301 Revision 12, establishes the following limits to satisfy the design objectives for gaseous and liquid releases to unrestricted areas as contained in 10CFR50 Appendix I:

Table 8.0-1 APPENDIX I AIRBORNE RELEASES	
Radiation Type	Year
Gamma (air)	10 mrad
Beta (air)	20 mrad
Any Organ	15 mrad

Table 8.0-2 APPENDIX I LIQUID RELEASES	
Radiation Type	Year
Whole(Total) Body	3 mrem
Organ	10 mrem

2. The ODCM (Ref. 4.2), CY-BY-170-301 Revision 12 establishes the following limits to satisfy the design objectives for gaseous and liquid releases to unrestricted areas as contained in 10CFR20. See Attachment N:

Table 8.0-3 10CFR20 GASEOUS and LIQUID RELEASES	
Total Effective Dose Equivalent	100 mrem/year

3. As illustrated in Attachment N, the ODCM (Ref. 4.2) establishes the following limits to satisfy the design objectives for the summation of gaseous and liquid releases to unrestricted areas as contained in 40CFR190.

Table 8.0-4 40CFR190 URANIUM FUEL CYCLE RELEASES*	
Total Body	25 mrem/year
Thyroid Dose	75 mrem/year
Organ Dose	25 mrem/year

*Per Attachment N, compliance with 40CFR190 demonstrates compliance with 10CFR20.

4. The following limits are provided in 10CFR20 Appendix B for I-131 and I-133

Table 8.0-5 10CFR20 Appendix B Limits		
ISOTOPE	OCCUPATIONAL DAC LIMIT ($\mu\text{Ci/ml}$)	EFFLUENT CONCENTRATION LIMIT ($\mu\text{Ci/ml}$)
I-131	2 E-08	2 E-10
I-133	1 E-07	1 E-09

5. As illustrated in Attachment N, the ODCM (Ref. 4.2) establishes the following limits to satisfy the design objectives for the instantaneous releases to the Unrestricted Area Boundary.

Table 8.0-6 ODCM Table 1-1 Regulatory Dose Limit Matrix** (mrem/yr)	
Total Body Dose Rate Due to Noble Gas Radionuclides (instantaneous limit, per site)	500
Skin Dose Rate Due to Noble Gas Radionuclides (instantaneous limit, per site)	3,000
Organ Dose Rate Due to Specified Non-Noble Gas Radionuclides (instantaneous limit, per site)	1,500

**See Attachment N

9.0 RETDAS COMPUTER PROGRAM RESULTS

9.1 Airborne Gaseous Releases

Gaseous effluent results for Appendix I compliance applicable to Unit 1 and Unit 2 are provided in Attachment F and Attachment G (Unfiltered) and Attachments P and Q (Filtered), respectively. RETDAS inputs are the same for Unit 1 and Unit 2. Calculated dose results are compared against the Regulatory Dose Limit Matrix, Table 1-1, of the ODCM, CY-BY-170-301, Revision 12, Attachment N.

Table 9.1-1 APPENDIX I UNFILTERED NOBLE GAS AIRBORNE RELEASE			
Isotope Type	ODCM Regulatory Dose Limit Matrix** (mrad)	Calculated Annual Dose (mrad)	Percent of Limit
Noble Gas Gamma	1.00E+01	6.57E-02	6.57E-01 (0.657%)
Noble Gas Beta	2.00E+01	5.27E-02	2.64E-01 (0.264%)

**See Attachment N

Table 9.1-2 APPENDIX I UNFILTERED IODINE and PARTICULATE AIRBORNE RELEASE				
Isotope Type	ODCM Regulatory Dose Limit Matrix** (mrem)	Age Group/Critical Organ	Calculated Annual Dose (mrem)	Percent of Limit
Iodine and Particulate	1.50E+01	Infant/Thyroid	9.82E+00	6.55E+01 (65.5%)

**See Attachment N

Table 9.1-3 APPENDIX I FILTERED** NOBLE GAS AIRBORNE RELEASE			
Isotope Type	ODCM Regulatory Dose Limit Matrix** (mrad)	Calculated Annual Dose (mrad)	Percent of Limit
Noble Gas Gamma	1.00E+01	6.57E-02	6.57E-01 (0.657%)
Noble Gas Beta	2.00E+01	5.27E-02	2.64E-01 (0.264%)

** See Attachment N

Table 9.1-4 APPENDIX I FILTERED IODINE** and PARTICULATE AIRBORNE RELEASE				
Isotope Type	ODCM Regulatory Dose Limit Matrix** (mrem)	Age Group/Critical Organ	Calculated Annual Dose (mrem)	Percent of Limit
Iodine and Particulate	1.50E+01	Infant/Thyroid	6.64E+00	4.43E+01 (44.3%)

** See Attachment N

10CFR20 Appendix B compliance is demonstrated using the iodine concentrations (I-131 and I-133) RETDAS results in Attachments F and G (Unfiltered) and Attachments P and Q (Filtered).

Table 9.1-5 10CFR20 APPENDIX B COMPLIANCE UNFILTERED GASEOUS RELEASE					
ISOTOPE	OCCUPATIONAL DAC LIMIT ($\mu\text{Ci/ml}$)	CALCULATED IODINE CONCENTRATION RESTRICTED AREA BOUNDARY ($\mu\text{Ci/ml}$)	EFFLUENT CONCENTRATION LIMIT ($\mu\text{Ci/ml}$)	VENT STACK ISOTOPIC RELEASE CONCENTRATION ($\mu\text{Ci/ml}$)	CALCULATED IODINE CONCENTRATION UNRESTRICTED AREA BOUNDARY ($\mu\text{Ci/ml}$)
	A	$B = E \times 3.20$	C	D	$E = D \times Y/Q$
I-131	2E-08	4.99E-17	2E-10	3.47E-11	1.56E-17
I-133	1E-07	7.22E-17	1E-09	5.02E-11	2.26E-17

Table 9.1-6 10CFR20 APPENDIX B COMPLIANCE FILTERED GASEOUS RELEASE					
ISOTOPE	OCCUPATIONAL DAC LIMIT ($\mu\text{Ci/ml}$)	CALCULATED IODINE CONCENTRATION RESTRICTED AREA BOUNDARY ($\mu\text{Ci/ml}$)	EFFLUENT CONCENTRATION LIMIT ($\mu\text{Ci/ml}$)	VENT STACK ISOTOPIC RELEASE CONCENTRATION ($\mu\text{Ci/ml}$)	CALCULATED IODINE CONCENTRATION UNRESTRICTED AREA BOUNDARY ($\mu\text{Ci/ml}$)
	A	$B = E \times 3.20$	C	D	$E = D \times \chi/Q$
I-131	2E-08	3.36E-17	2E-10	2.33E-11	1.05E-17
I-133	1E-07	4.61E-17	1E-09	3.20E-11	1.44E-17

As discussed in Section 6.1, the variation in the calculated concentration at the Unrestricted Area Boundary and the Restricted Area Boundary for the gaseous release is proportional to the χ/Q s at those locations. Table 9.1-5 and Table 9.1-6 tabulate the calculated iodine concentration at the Unrestricted Area Boundary for the unfiltered (Attachment F) and filtered (Attachment P) gaseous releases, respectively. From visual inspection of Table 4-1 of the ODCM (CY-BY-170-301, Revision 12), the maximum vent χ/Q at the unrestricted boundary is $4.497\text{E-}07 \text{ sec/m}^3$ in the SSE sector. This applies to the effluent concentration limits for the general public at the unrestricted area boundary.

The maximum χ/Q at the Restricted Area Boundary tabulated in Table 4-2 of the ODCM (CY-BY-170-301, Revision 12) is $1.441\text{E-}06 \text{ sec/m}^3$ in the S sector. Though the dose points are not at the same location, it is conservative to apply the ratio of maximum χ/Q s to the RETDAS iodine concentration at the Unrestricted Area Boundary.

$$\chi/Q \text{ ratio} = 1.441\text{E-}06/4.497\text{E-}07 = 3.20$$

9.2 Liquid Releases

Liquid effluent annual dose results for Appendix I compliance are provided in Attachment J and Attachment K for Unit 1 and Unit 2, respectively. The inputs to RETDAS are identical for both units. Calculated dose results are compared against the Regulatory Dose Limit Matrix, Table 1-1, of the ODCM, CY-BY-170-301, Revision 12.

Table 9.2-1 APPENDIX I LIQUID RELEASE ORGAN DOSE					
	ODCM Regulatory Dose Limit Matrix** (mrem/yr)	Organ Type	Organ	Calculated Annual Dose (mrem/yr)	Percent of Limit
Age Group					
Teen	10	Any	Liver	2.12E-02	2.12E-01 (0.212%)

Table 9.2-2 APPENDIX I LIQUID RELEASE WHOLE BODY (TOTAL) DOSE					
	ODCM Regulatory Dose Limit Matrix** (mrem/yr)	Organ Type	Organ	Calculated Annual Dose (mrem/yr)	Percent of Limit
Age Group					
Adult	3	Tot Body	TBody	1.53E-02	5.10E-01 (0.510%)

**See Attachment N

Note that the liquid releases are not impacted by bypassing the OGFU. Therefore, dose consequences analyses utilizing the liquid releases tabulated in UFSAR Table 11.2-1 of the Byron UFSAR, Revision 12, December 2008 and Table 2-4 of the ODCM, CY-BY-170-301, Revision 12 are also not impacted by this modification.

Note that examination of Attachment N shows that Attachment N is Table 1-1 of the ODCM and the liquid organ dose and the liquid whole body dose Appendix I liquid compliance have respective acceptance criteria. Each dose category, regardless of their comparative magnitude, is compared against its respective acceptance criteria. Appendix I compliance is determined by this comparison.

9.3 10CFR20 Instantaneous Dose Compliance

As stated in Attachment C, 10CFR20 compliance is demonstrated for the site by the gaseous instantaneous computer output of RETDAS, the ODCM computer program, at the unrestricted boundary (Attachment R). It utilizes gaseous releases to determine the results in Section 2.12. The Technical Specification limits tabulated in Table 1-1 (Attachment N), the Regulatory Dose Limit Matrix of the ODCM (CY-BY-170-301, Revision 12) are the regulatory limits for 10CFR20 compliance.

Table 9.3-1 UNFILTERED GASEOUS INSTANTANEOUS ANNUAL DOSE (mrem/yr)			
Organ Type	Maximum Possible Dose (mrem/yr)	ODCM Regulatory Dose Limit Matrix** (mrem/yr)	Percent of Limit
Total Body	1.15E-01	5.00E+02	2.30E-02 (0.0230%)
Skin	3.01E-01	3.00E+03	1.00E-02 (0.0100%)
Organ	6.07E+01	1.50E+03	4.05E+00 (4.05%)

Table 9.3-2 FILTERED GASEOUS INSTANTANEOUS ANNUAL DOSE (mrem/yr)			
Organ Type	Maximum Possible Dose (mrem/yr)	ODCM Regulatory Dose Limit Matrix** (mrem/yr)	Percent of Limit
Total Body	1.15E-01	5.00E+02	2.30E-02 (0.0230%)
Skin	3.01E-01	3.00E+03	1.00E-02 (0.0100%)
Organ	4.09E+01	1.50E+03	2.72E+00 (2.72%)

**See Attachment N

9.4 10CFR20.1301 (a) (1) Compliance

Per guidance tabulated in Table 1-1, the Regulatory Dose Limit Matrix of the ODCM (CY-BY-170-301), Revision 12, compliance to 10CFR20.1301 (a) (1) is demonstrated by complying with 40CFR190. See Attachment N.

9.5 40CFR190 Compliance

Based on the guidance in Attachment N, compliance with 40CFR190 is demonstrated on a station basis in the filtered and bypassed configurations of the OFGFU using the following output tables of RETDAS presented in Attachment L and Attachment M:

Table 9.5-1 40CFR190 UNFILTERED ANNUAL DOSE BY ORGAN AND AGE GROUP (mrem/yr)					
	Organ	Liquid Dose Component (mrem/yr)	Gaseous Dose Component (mrem/yr)	Total Dose (mrem/yr)	ODCM Regulatory Dose Limit Matrix** (mrem/yr)
Child	Total Body	7.21E-03	5.05E-01	5.12E-01	25
Infant	Thyroid	5.16E-03	1.96E+01	1.97E+01*	75

Table 9.5-2 40CFR190 FILTERED ANNUAL DOSE BY ORGAN AND AGE GROUP (mrem/yr)					
	Organ	Liquid Dose Component (mrem/yr)	Gaseous Dose Component (mrem/yr)	Total Dose (mrem/yr)	ODCM Regulatory Dose Limit Matrix** (mrem/yr)
Child	Total Body	7.21E-03	5.00E-01	5.07E-01	25
Infant	Thyroid	5.16E-03	1.33E+01	1.33E+01*	75

*The calculated Infinite Thyroid dose is less than 25 mrem/yr, which also satisfies the Any/Other Organ acceptance criteria of 40CFR190.

**See Attachment N

Based on the discussion in Section 2.13, there are no direct shine contributions from contained sources on the Byron site. The direct shine contribution to the 40CFR190 compliance summation is zero. As observed in Table 9.5-1 and Table 9.5-2, the total annual dose of the three organs of interest are less than those specified in the ODCM Regulatory Dose Matrix, Attachment N regardless of the configuration of the OGFU.

10.0 SUMMARY

10.1 10CFR50 Appendix I

As shown in Tables 9.1-1, 9.1-2, 9.1-3 and 9.1-4, the design objectives dose limitations in 10CFR50 Appendix I for gaseous releases are satisfied for both cases, filtered and unfiltered, as calculated based on the source terms in UFSAR Table 11.3-7, UFSAR, Revision 5, 1994. Yearly doses are well below the criteria in 10CFR50 Appendix I. The only dose affected by the operation of the OGFU is that to the thyroid. Thyroid doses at the Unrestricted Boundary increase by 48% (9.82/6.64) when iodine releases are adjusted for the removal of the OGFU. Since the OGFU charcoal filter units are currently not functional, there will be no actual change in dose due to primary to secondary leakage. In addition, the NRC did not credit the operation of the OGFU in their calculations of offsite dose. Therefore, the permanent bypass of the OGFU will not result in an increase in dose to the general public as calculated by the NRC in support of Byron Station's license application.

The liquid releases are not changed by this modification. Therefore, dose consequences associated with the liquid releases are unchanged. Results tabulated in Table 9.2-1 and Table 9.2-2 demonstrate compliance with Appendix I liquid release dose limits in ODCM Table 1-1.

The ODCM currently considers the OGFU a mechanism in the Ventilation Exhaust Treatment System to reduce the release of radioactivity. Since the requirements of ODCM Section 4.1.5 and Technical Specification 5.5.4 are operational limitations, it is acceptable to assume that operator actions can be taken to limit the release of radioactivity to the environment via the Off-Gas Treatment System in the event of primary to secondary leakage.

10.2 10CFR20 Compliance

Per guidance tabulated in Table 1-1, the Regulatory Dose Limit Matrix of the ODCM (CY-BY-170-301), Revision 12, compliance to 10CFR20.1301 (a) (1) is demonstrated by complying with 40CFR190. See Attachment N.

Compliance with the 10CFR20 instantaneous annual dose requirements of ODCM Table 1-1 is demonstrated in Table 9.3-1 and Table 9.3-2 of this calculation.

10.3 10CFR20 Appendix B Airborne Concentrations:

As indicated in Table 9.1-5 and Table 9.1-6, airborne concentrations for I-131 and I-133 are significantly below the criteria in 10CFR20 Appendix B, though the maximum unfiltered increase in iodine concentration is approximately 48% (I-131) and 60% (I-133).

10.4 40CFR190 Compliance

Based on the discussion in Section 2.13, there are no direct shine contributions from contained sources on the Byron site. The direct shine contribution to the 40CFR190 compliance summation is zero. As observed in Table 9.5-1 and Table 9.5-2, the total annual dose of the three organs of interest are less than those specified in the ODCM Regulatory Dose Matrix, Attachment N regardless of the configuration of the OGFU.

11.0 CONCLUSIONS

11.1 The predicted increase in the release of radioactive materials is insignificant as a result of the permanent bypass of the OGFU. Based on information tabulated in Table 9.1-5 and Table 9.1-6 the following tables are constructed for comparison purposes of filtered and unfiltered iodine concentrations at the restricted and unrestricted area boundaries:

TABLE 11.1-1 10CFR20 APPENDIX B CONCENTRATIONS-RESTRICTED AREA BOUNDARY		
	UNFILTERED GASEOUS RELEASE	FILTERED GASEOUS RELEASE
ISOTOPE	CALCULATED IODINE CONCENTRATION RESTRICTED AREA BOUNDARY ($\mu\text{Ci/ml}$)	CALCULATED IODINE CONCENTRATION RESTRICTED AREA BOUNDARY ($\mu\text{Ci/ml}$)
I-131	4.99E-17	3.36E-17
I-133	7.22E-17	4.61E-17

TABLE 11.1-2 10CFR20 APPENDIX B CONCENTRATIONS-UNRESTRICTED AREA BOUNDARY		
	UNFILTERED GASEOUS RELEASE	FILTERED GASEOUS RELEASE
ISOTOPE	CALCULATED IODINE CONCENTRATION UNRESTRICTED AREA BOUNDARY ($\mu\text{Ci/ml}$)	CALCULATED IODINE CONCENTRATION UNRESTRICTED AREA BOUNDARY ($\mu\text{Ci/ml}$)
I-131	1.56E-17	1.05E-17
I-133	2.26E-17	1.44E-17

As is can be seen in Table 11.1-1 and Table 11.1-2, the filtered and unfiltered concentrations at the restricted and unrestricted boundaries are on the order of $1\text{E-}17$ ($\mu\text{Ci/ml}$) and are considered insignificant.

11.2 The predicted increase in occupational doses to plant personnel at the restricted area boundary and doses to the general public at the unrestricted area boundary are insignificant as a result of the permanent bypass of the OGFU based on the insignificant concentrations of I-131 and I-133 at the restricted and unrestricted area boundaries.

11.3 Liquid releases and associated doses are not changed due to bypassing of the OGFU.

11.4 Items 11.1 and 11.2 above assume that the OGFU is functional, however, the charcoal units are currently not in use and their iodine removal capability is not confirmed. Therefore, the permanent bypassing of the OGFU does not result in an increase in radioactive materials or dose to the general public.

11.5 The off site airborne effluent doses, as calculated by the NRC in support of Byron's Station's license application, are not increased as a result of permanent bypassing of the OGFU.

11.6 Appendix I compliance for filtered and unfiltered airborne releases is tabulated in Tables 9.1-1 through 9.1-4.

Therefore, this calculation justifies the permanent bypassing of the OGFU under EC 402667, Rev. 1.

ATTACHMENT A

GASEOUS RELEASE AND LIQUID RELEASE UNITS BYRON STATION UNITS 1 AND 2



RE: [EXTERNAL] Byron Offgas Filter Unit Removal-Design Objectives for Gaseous Releases -RE-TRANSMITTAL NO CHANGES

Golich, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com

05/31/2016 03:44 PM

Hide Details

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>

To: "BARRY.C.SCHWARTZ@Sargentlundy.com"

<BARRY.C.SCHWARTZ@Sargentlundy.com>,

History: This message has been forwarded.

Barry,

The gaseous releases need to be entered in units of uCi/cc and the liquid releases in units of uCi/ml, so an average microcuries per unit volume concentration will need to be determined.

Jeff

From: BARRY.C.SCHWARTZ@Sargentlundy.com [<mailto:BARRY.C.SCHWARTZ@Sargentlundy.com>]

Sent: Friday, May 27, 2016 3:57 PM

To: Golich, Jeffrey M:(GenCo-Nuc)

Cc: JOHN.RICH@sargentlundy.com; ROBERT.L.MARSH@sargentlundy.com; CM.LAUNI@sargentlundy.com;

IOANNIS.K.GASTOUNIOTIS@sargentlundy.com; PAUL.A.MCGARY@sargentlundy.com;

RICHARD.CHITTENDEN@sargentlundy.com; Englert, Edward James:(GenCo-Nuc);

ALEKSANDAR.MILICEVIC@sargentlundy.com

Subject: [EXTERNAL] Byron Offgas Filter Unit Removal-Design Objectives for Gaseous Releases -RE-TRANSMITTAL NO CHANGES

Jeff,

Based on the information provided in the Byron ODCM, Table 1-1, Regulatory Dose Limit Matrix and Table 1-b, Compliance Matrix:

1. Appendix I compliance has an Airborne Release and a Liquid Release dose component for comparison purposes.

These components are NOT summed for this comparison. The Airborne Release and the Liquid Release components of the dose have their respective regulatory limits for each comparison. Note that these are organ doses in terms of mrad and mrem.

2. 10CFR20 compliance has an Airborne Release and a Liquid Release dose component for comparison purposes.

These dose components are summed for this comparison. Note that this is Total Effective Dose Equivalent in terms of mrem TEDE.

3. 40CFR190 compliance has an Airborne Release, a Liquid Release and a direct dose component from contained sources on the plant site for comparison purposes.

The dose associated with the Airborne Release, the total dose associated with the Liquid Release and the direct dose from the contained plant sources are summed for comparison. Additionally, the organ doses to an adult due to all pathways are required.

4. For the direct dose from the on site contained sources, a term of the 40CFR190 summation, we are assuming that there is a standard, but conservative, value in RETDAS that is combined with the dose results of the airborne and liquid releases, yielding the total for comparison against the regulatory limits.

The B/B UFSAR contains expected annual gaseous releases via the vent stack (Table 11.3-6) and expected annual liquid releases into the discharge canal (Table 11.2-1). The tables are as follows and are extracted from the draft calculation in preparation :

AIRBORNE RELEASE VIA VENT STACK

Table 2.1-3

ISOTOPE	UFSAR TABLE 11.3-6 ANNUAL RELEASE FROM ONE UNIT FILTERED (Ci/yr)	UFSAR TABLE 11.3-6 ANNUAL RELEASE FROM ONE UNIT FILTERED (μ Ci/yr)	ANNUAL RELEASE FROM ONE UNIT UNFILTERED (μ Ci/yr)
	A	B	C
H-3	1.00E+03	1.00E+09	1.00E+09
C-14	8.00E+00	8.00E+06	8.00E+06
Ar-41	2.50E+01	2.50E+07	2.50E+07
Kr-85m	5.00E+00	5.00E+06	5.00E+06
Kr-85	7.00E+02	7.00E+08	7.00E+08
Kr-87	1.00E+00	1.00E+06	1.00E+06
Kr-88	8.00E+00	8.00E+06	8.00E+06
Xe-131m	3.90E+01	3.90E+07	3.90E+07
Xe-133m	1.50E+01	1.50E+07	1.50E+07
Xe-133	2.00E+03	2.00E+09	2.00E+09
Xe-135	1.50E+03	1.50E+07	1.50E+07
Xe-138	1.00E+00	1.00E+06	1.00E+06
I-131	5.10E-02	5.10E+04	7.60E+04
I-133	7.00E-02	7.00E+04	1.10E+05
Mn-54	4.70E-03	4.70E+03	4.70E+03
Fe-59	1.60E-03	1.60E+03	1.60E+03
Co-58	1.60E-02	1.60E+04	1.60E+04
Co-60	7.30E-03	7.30E+03	7.30E+03
Sr-89	3.40E-04	3.40E+02	3.40E+02
Sr-90	6.20E-05	6.20E+01	6.20E+01
Cs-134	4.70E-03	4.70E+03	4.70E+03
Cs-137	7.80E-03	7.80E+03	7.80E+03

LIQUID RELEASE INTO DISCHARGE CANAL

Table 2.6-1

EXTRACTED FROM B/B UFSAR TABLE 11.2-1

EXPECTED ANNUAL RELEASE INTO DISCHARGE CANAL EXPECTED ANNUAL RELEASE INTO DISCHARGE CANAL

NUCLIDE	TOTAL CURIES/YR	TOTAL μCURIES/YR
CR-51	6.16E-05	6.16E+01
MN-54	1.01E-03	1.01E+03
FE-55	5.40E-05	5.40E+01
FE-59	3.47E-05	3.47E+01
CO-58	4.53E-03	4.53E+03
CO-60	8.77E-03	8.77E+03
ZR-95	1.40E-03	1.40E+03
NB-95	2.00E-03	2.00E+03
NP-239	2.32E-05	2.32E+01
BR-83	1.76E-05	1.76E+01
RB-86	4.69E-05	4.69E+01
SR-89	1.28E-05	1.28E+01
MO-99	1.98E-03	1.98E+03
TC-99M	2.31E-03	2.31E+03
RU-103	1.41E-04	1.41E+02
RU-106	2.40E-03	2.40E+03
AG-110M	4.40E-04	4.40E+02
TE-127	1.40E-05	1.40E+01

Table 2.6-1
EXTRACTED FROM B/B UFSAR TABLE 11.2-1

NUCLIDE		
TE-129M	4.59E-05	4.59E+01
TE-129	3.03E-05	3.03E+01
I-130	1.09E-04	1.09E+02
TE-131M	3.27E-05	3.27E+01
I-131	8.05E-02	8.05E+04
TE-132	6.16E-04	6.16E+02
I-132	1.79E-03	1.79E+03
I-133	3.66E-02	3.66E+04
CS-134	2.80E-02	2.80E+04
I-135	4.35E-03	4.35E+03
CS-136	6.89E-03	6.89E+03
CS-137	3.48E-02	3.48E+04
BA-137M	1.01E-02	1.01E+04
CE-144	5.20E-03	5.20E+03
ALL OTHERS	5.13E-05	5.13E+01
H-3	3.00E+02	3.00E+08

Please review the format (units) of the isotopes in the above tables against your requirements for RETDAS. If needed, we will adjust the units and/or format to your requirements.

Thank you for your support,
Barry Schwartz
312-269-7296

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ATTACHMENT B

GUIDANCE ON LIQUID RELEASES PER UNIT BASIS BYRON STATION UNIT 1 OR UNIT 2

11.2 LIQUID WASTE MANAGEMENT SYSTEMS

In general, the liquid radwaste system collects, monitors, and recycles or releases, with or without treatment where appropriate, all potentially radioactive liquid wastes produced by the station during normal operation and maintenance, as well as transient conditions. The only exception is that effluent from the treated water system (Byron only), the condensate polisher sump and the turbine building fire and oil sump, because of minimal activity levels, is normally discharged without being processed through the liquid radwaste system. Effluent from these sumps is monitored by radiation monitors that will automatically terminate sump discharge if unacceptable activity is present in the sump effluent. Corrective action can then be initiated to reroute the sump effluents to the appropriate treatment system prior to release.

11.2.1 Design Bases

11.2.1.1 Safety Design Basis

The liquid radwaste system is designed so that liquid radwaste discharged from the site will have radioactive nuclide concentrations well within the limits specified in 10 CFR 20 and 10 CFR 50, Appendix I.

Each liquid radwaste processing stream terminates in a monitor tank (see Drawing M-48A). Since the liquid radwaste system operates on a batch basis, this arrangement allows each treated batch to be sampled to assure that the treatment was sufficient. If the sample indicates that the waste needs further processing, it is recycled either through the same subsystem or through another subsystem providing a different form of treatment. If the treated waste water is not needed for reuse, the water is sent to either release tank (OWX01T or OWX26T) for discharge. Each batch is sampled prior to discharge from the release tank to verify that its activity level is within limits for discharge. The actual discharge to the circulating water blowdown line requires manually opening a remotely operated valve with a keylocked switch. The key for the valve lock is controlled by administrative procedures.

11.2.1.2 Power Generation Design Basis

The liquid radwaste system is sized to handle maximum expected liquid waste inputs on the basis of both volume and activity as a result of normal operation, including anticipated abnormal occurrences for Units 1 and 2.

The liquid radwaste system is composed of the following two subsystems:

- a. the steam generator blowdown subsystem, and
- b. the nonblowdown radwaste subsystem.

These subsystems are extensively crosstied to provide a high degree of availability and reliability.

The purpose of the steam generator blowdown subsystem is to maintain the steam generator water chemistry within specified limits.

The liquid radwaste system is designed to permit recycling of plant water. The stations are designed to minimize noncontaminated inputs from leakage of service water, circulating water, and groundwater into the plant floor drain system.

A cost-benefit analysis is not required for the liquid radwaste system. This is because Commonwealth Edison has complied with the Guides on Design Objectives for Light-Water-Cooled Nuclear Power Reactors proposed in the concluding statement of the position of the regulatory staff in Docket RM-50-2 dated February 20, 1974, pp. 25-30.

11.2.1.3 Expected Radioactive Releases

Byron and Braidwood Nuclear stations have updated the core power level twice. First to a core power level of 3586.6 MWt, then to the Measurement Uncertainty Recapture uprate power level of 3645 MWt. The original licensed power level was 3411 MWt. The original expected liquid radwaste effluent data presented in the UFSAR is based on a power level of 3565 MWt.

Expected annual average releases of radionuclides from the liquid radwaste system are shown in Table 11.2-1. These releases were determined by using the NUREG 0017/PWR-GALE computer program (References 1 and 2). Both the original as well as the uprated parameters describing the expected normal operation of one unit of the station are listed in Table 11.2-2. These values were used as input to the computer code for the original analyses. The impact of core uprate on the effluent releases was evaluated based on an assessment of the changes in input parameters.

Core uprate results in a maximum potential increase of 0.6% in the liquid effluent release concentrations previously reported. Taking into consideration the accuracy and error bounds of the operational data utilized in NUREG 00017, this small percentage change is well within the uncertainty of the calculated results of the original NUREG 0017 based expected liquid effluent concentrations presented in Table 11.2-4 which remain valid for uprate.

For tables 11.2-1 and 11.2-4 (for Braidwood only), actual data has been used to determine the expected tritium (H-3) release and blowdown concentration values.

11.2.1.4 10 CFR 50 Comparison

Conservatively estimated annual average doses to individuals exposed to radioactive liquid effluents are given in Table 11.2-3. As can be seen from the total dose rates from the various exposure pathways, the numerical guidelines set forth in Appendix I to 10 CFR 50 are satisfied. As discussed in Section 11.2.1.3, this assessment and Table 11.2-3 remain valid for uprate.

For Braidwood only, dose calculations using actual release data and compiled in annual effluent release reports, in accordance with the ODCM, indicate that normal liquid effluents, including tritium, are typically within the estimates of Table 11.2-3 and within guidelines of 10 CFR 50 App.I.

11.2.1.5 10 CFR 20 Comparison

Table 11.2-4 compares expected liquid effluent concentrations with 10 CFR 20 limits. It can be seen that the expected effluent concentrations are significantly below the specified limits. As discussed in Section 11.2.1.3, this assessment and Table 11.2-4 remain valid for uprate.

For Braidwood only, actual liquid effluent release data compiled in annual effluent release reports, in accordance with the ODCM, indicate that effluents are maintained within the concentration and dose guidelines of 10 CFR 20.

11.2.1.6 Component Specifications

Table 11.2-5 gives the design parameters of various radwaste system components.

11.2.1.7 Seismic Design and Quality Group

The structures housing the liquid radwaste system are Safety Category I for the auxiliary building, and Safety Category II for the turbine building and radwaste building. All components (including tanks, pumps, valves, and piping) of the liquid radwaste system containing radioactive wastes are classified as Quality Group D, with the exception of the containment penetration piping out to and including the second isolation valve from the containment sump pump discharge, which is Quality Group B piping and valves (refer to Section 3.2).

11.2.1.8 Facility and Equipment Design

The liquid radwaste system is designed to minimize radiation exposure to operating personnel. Normal operations, maintenance, and nonroutine operations are discussed in the following.

11.2.1.8.1 Maintenance Operations

Wherever practicable, components of the liquid radwaste systems are segregated to the maximum extent practical. To reduce radiation exposure to maintenance personnel, components are arranged so that access to a low activity component does not necessitate passing near a high activity component. Instruments are located in low dose rate areas wherever practical to minimize the radiation exposure to maintenance personnel.

Valves, where practicable, are located outside of compartments to minimize radiation exposure from tanks or components during valve maintenance. Most radwaste pumps are equipped with mechanical seals to minimize maintenance.

In general, components which may require maintenance are capable of being flushed prior to maintenance.

11.2.1.8.2 Floor, Wall, and Ceiling Coatings

In rooms containing radioactive wastes, the floors, and as necessary, the walls and ceilings, are coated with a two-coat water base epoxy paint for ease of decontamination.

11.2.1.9 Tank Level Control

Provisions are made to preclude uncontrolled spills due to tank overflows. The following criteria apply to tanks outside the containment building which may contain radioactive fluids:

- a. Tank level instrumentation is provided on most radwaste tanks with readout devices in the radwaste control room. A high-level condition on these tanks will be annunciated.
- b. Some radwaste tanks overflow to an adjacent sump, as described in Table 11.2-9. Sumps are provided with

duplex or triplex (redundant) pumps as appropriate. Sumps are level controlled and logic is provided to start and stop pumps automatically.

- c. Provisions for tank level indication, level annunciation, and overflows are given in Table 11.2-9 for all tanks outside the containment building containing potentially radioactive liquids.

11.2.1.10 Prevention of Uncontrolled Releases

Based on operating experience during normal operations, it is expected that it will be necessary to make controlled releases of contaminated steam and condensate leakage to the environment. During normal operations, these releases of radioactive liquids to the environment are from the release tank after processing, as needed, by the liquid radwaste system.

As a batch of waste is processed, the effluent is transferred to an appropriate monitor tank (e.g., blowdown monitor tanks, boric acid monitor tanks, and radwaste monitor tanks) for sampling prior to being transferred to the release tanks or being reprocessed. In the release tanks, the liquid is mixed and sampled for activity prior to discharge. The release tanks discharge must pass through either one of two remotely controlled keylocked valves (OWX353 and OWX896 on Drawing M-48-1) to be released from the station. Limit switches supply status information on the valve position to the operator at the radwaste control panel. A radiation monitor is provided to automatically close the valves on a high radiation signal.

In addition, effluents from the treated water system, the condensate polisher sump and the turbine building fire and oil sump are released to the environment. While normally considered non-radioactive, these effluents can potentially become contaminated, and the sump effluents are monitored by radiation monitors which will halt sump pump operation if unacceptable activity levels are present in sump effluent.

11.2.1.11 ETSB-BTP 11-1 Comparison

The liquid radwaste system is designed to meet the design criteria of the former Effluent Treatment Systems Branch (ETSB), Branch Technical Position BTP 11-1, Revision 1, and meets the criteria of Regulatory Guide 1.143, as described in Appendix A.

11.2.2 System Description

The liquid radwaste system is shared by both units. Unit 1 and Unit 2, however, have separate equipment and floor drain collection sump systems. Process flow diagrams are shown in Drawing M-48A. The systems are depicted in Drawings M-48-1 through M-48-40.

Inputs to the system are separated according to origin and/or concentrations of radioactivity and chemical impurity. Separate collection tanks are provided for each input stream. The waste is routed from the collection tanks to the appropriate processing paths. The system processes the radioactive liquid waste by various combinations of filtration, evaporation (Braidwood only), and/or demineralization. At Braidwood, vendor radwaste processing systems may utilize filtration, demineralization, chemical and ultraviolet treatment, and/or reverse osmosis to assist in radioactive liquid waste processing and recycling.

Provisions are made to bypass any processing device. The release tanks cannot be bypassed.

After being processed through the various equipment items, the purified effluent can be reused as secondary cycle makeup at Byron, primary cycle makeup at Braidwood, or released to the environment via the circulating water blowdown line.

The liquid radwaste system is designed to handle wastes generated during design-basis operational occurrences. This is accomplished by providing sufficient process capacity within the subsystems and collection and monitor tanks of adequate size.

The liquid radwaste system consists of two crosstied subsystems:

- a. steam generator blowdown subsystem, and
- b. non-blowdown radwaste subsystem which treats the following waste streams:
 1. auxiliary building equipment drains,
 2. auxiliary building floor drains,
 3. chemical waste drains,
 4. regeneration waste drains,
 5. laundry (detergent) drains,
 6. turbine building equipment and floor drains when contaminated, and
 7. condensate polisher sump when unacceptably contaminated.

Expected concentrations of radioactive nuclides in the various input waste streams to the radwaste subsystems are listed in Table 11.1-6. Expected inventories of radioactive nuclides in major components of the liquid waste system are tabulated in Tables 11.1-7 through 11.1-12. Table 11.2-6 lists the annual average and maximum expected daily flows of each waste stream. The expected activities in Table 11.1-1 correspond to the annual average daily flows. The activities for the maximum daily flows vary significantly. Actual release data are available in the effluent release reports, which are prepared in accordance with the ODCM.

Table 11.2-7 lists the design-basis decontamination factors for the processing components used in the analysis of the systems.

The original steam generator blowdown prefilterers were replaced with larger prefilter units. However, the expected average and maximum waste stream flows and the design basis decontamination factors for the steam generator blowdown prefilterers were not revised to account for the larger prefilter volume.

11.2.2.1 Steam Generator Blowdown Subsystem

The function of the steam generator blowdown subsystem is to maintain steam generator shell side water chemistry within the

specified limits. Continuous blowdown constantly removes impurities from the steam generator. The flow rate is varied as required to maintain the steam generator water chemistry within the required limits.

At Byron, steam generator blowdown may be sent to the condensate polisher sump to improve secondary chemistry when excessive impurities are present that would quickly exhaust steam generator blowdown demineralizers.

For a further description of the steam generator blowdown subsystem, see Subsections 10.4.8 and 10.4.9.3.1.

The components of the steam generator blowdown treatment subsystem include four blowdown prefilters; four blowdown mixed bed demineralizers; four blowdown demineralizer after filters; three blowdown monitor tanks; and associated pumps, valves, and instrumentation.

11.2.2.1.1 Normal Operation

Steam generator blowdown is operated in a normal range of 15 to 90 gpm per steam generator, depending on steam generator chemistry requirements. During normal operation, blowdown is pumped from the steam generator blowdown condenser hotwells through the blowdown prefilters, the blowdown mixed-bed demineralizers, and the blowdown after filters to the condensate storage tanks or respective unit hotwell. In the event of high radioactive material in the purified effluent leaving the blowdown mixed-bed demineralizers, the effluent is diverted to the monitoring tanks. Unit 1 and Unit 2 blowdown is normally segregated, as the Unit 1 and Unit 2 condensate storage tanks are normally segregated.

Blowdown from each steam generator is sampled and analyzed at periodic intervals to determine:

- a. If the blowdown flow rate requires adjustment to maintain the steam generator water chemistry limits.
- b. If leakage condition exists, either at the main condenser or primary to secondary leakage within one or more steam generators so that remedial action can be taken.
- c. If the method of processing the blowdown should be changed.

The time interval between samples of the blowdown from each steam generator depends upon operating experience.

The effluent from each blowdown mixed bed demineralizer is directed through a blowdown afterfilter to a header which is valved so that Unit 1 effluent is normally separated from Unit 2 effluent. Conductivity of each effluent stream from the blowdown mixed bed demineralizers is monitored. The processed liquid can be routed to either Unit 1 or Unit 2 condensate storage tanks as

described above or to a monitor tank. The water in the blowdown monitor tanks is normally drained to the turbine building floor drain system. The water may also be used to sluice blowdown demineralizers or to backwash blowdown demineralizer strainers.

In addition to processing steam generator blowdown, the blowdown mixed bed demineralizers can be used for processing turbine building equipment drains, turbine building floor drains, and for the further processing of the purified effluent from the radwaste subsystems via the radwaste and blowdown monitor tanks. This practice is not recommended for normal operation.

Effluent from the blowdown prefilters of each unit can be diverted to each of the three radwaste evaporators, but normally this flowpath is blocked by a spectacle blank flange (Braidwood only).

11.2.2.1.2 Circulating Water to Secondary System Leakage

In the event of condenser tube or tube sheet leakage, the blowdown rate may be increased to 360 gpm (180,000 lbs/hr) total per unit to keep the steam generator shell side chemistry within operating limits. The blowdown rate from the four steam generators would be approximately 90 gpm for each steam generator.

11.2.2.1.3 Primary-to-Secondary-Leakage Concurrent with Failed Fuel

The radioisotope concentration in the steam generator blowdown is given in Table 12.2-30 and Table 11.1-6. If primary to secondary leakage occurs in only one steam generator, the blowdown rate from nonleaking steam generators remains high enough to maintain chemistry specifications while the blowdown rate from the leaking steam generator may be increased to the design rate of 90 gpm.

11.2.2.1.4 Primary-to-Secondary Leakage Not Concurrent with Failed Fuel

The steam generator blowdown during primary-to-secondary leakage not concurrent with failed fuel will be processed as discussed in Subsection 11.2.2.1.3 during transient operating conditions.

11.2.2.1.5 Transient Operating Conditions

Increased blowdown may be used to keep the steam generator water chemistry within specifications.

11.2.2.2 Nonblowdown Liquid Radwaste Subsystem

This processing train collects and treats liquid radwastes from sources other than steam generator blowdown. The mode of operation is batchwise. The nonblowdown liquid radwaste subsystem includes the following input sources:

- a. auxiliary building equipment drain,
- b. auxiliary building floor drain,
- c. chemical waste drain,
- d. regeneration waste drain,
- e. laundry (detergent) drain,
- f. turbine building equipment and floor drain (when contaminated),
- g. turbine building fire and oil sump (when contaminated) (Byron only),
- h. condensate polisher sump when unacceptably contaminated, and
- i. waste treatment system (when contaminated) (Byron only).

Each drain system except the chemical waste, regeneration waste, and laundry drains, has two drain collection tanks. The chemical waste and regeneration waste drains utilize one tank each plus a shared dual purpose chemical/regeneration waste drain tank. Waste is usually collected in one of two drain tanks. The contents of the other tank may be sampled or processed. The sample is taken from the recirculation line. Chemical additions to adjust the wastewater pH or filter aids may be added to improve waste processing efficiency.

Oil separators are provided in those sumps that could potentially have oil in the water. A filter is installed downstream of each drain tank pump discharge header, or drain tank effluent is sent to vendor-installed equipment for filtration as needed.

The radwaste evaporator inlet header receives liquid wastes from the previously mentioned drain tanks. The liquid wastes entering the radwaste evaporator inlet header normally bypass the evaporators and are processed by the radwaste demineralizers or by the vendor demineralizers.

At Byron, nonessential service water to the radwaste evaporator skids has been isolated permanently. Blank plates have also been installed in the inlets to the evaporators to prevent liquid wastes from entering.

The radwaste monitor tanks collect radwaste demineralizer effluent. The tanks' contents will be mixed and sampled prior to being transferred to the release tank.

Wastewater may be routed from the radwaste monitor tanks to vendor taps in the radwaste building for additional processing, as needed, and returned to the installed radwaste system for monitored discharge.

Based on this sample and station water balance considerations, the water may be reprocessed or discharged via the release tanks.

See Table 11.2-6 for the design-basis average and maximum waste stream flows for the various inputs that are discussed in the following. Also refer to Table 11.1-6 for the realistic source terms for these inputs.

At Byron, effluent from the condensate polisher sump, from the turbine building floor and equipment drains (collected in the turbine building fire and oil sump) and from the waste treatment system is processed by the radwaste system if the contamination exceeds effluent limits for the sumps. The sump effluent is monitored by radiation monitors to ensure that ODCM limits are maintained.

At Braidwood, effluent from the condensate polisher sump and from the turbine building floor and equipment drains is processed by the radwaste system if contamination levels exceed effluent limits. The turbine building fire and oil sump effluent is monitored by a radiation monitor to ensure that ODCM limits are maintained.

At Braidwood, a Radwaste Storage Tank (RST) is used to store and manage the release of radioactive liquid waste containing elevated concentrations of tritium. Based on waste water tritium concentration, influenced by the time period of the fuel cycle of each unit, discharge of the waste water may be delayed and the waste water stored in the RST. The tank's contents are sampled to determine the degree of processing required prior to transferring the contents to the liquid radwaste release tanks for discharge.

11.2.2.2.1 Auxiliary Building Equipment Drain

Input sources to the auxiliary building equipment drain tanks include the following:

- a. auxiliary building equipment drain collection sumps,
- b. reactor coolant drain tank, and
- c. spent resin tank drains (Braidwood only).

The waste is normally processed through demineralizers.

11.2.2.2.2 Auxiliary Building Floor Drain

Input sources to the floor drain tanks include leakage from pump seals and stuffing boxes, valve stem packing, equipment overflows, and spills. Oil separators are provided in the subsystem's sumps.

Input sources to the auxiliary building floor drain tanks include the following:

- a. reactor cavity sumps,
- b. containment floor drain sumps,
- c. auxiliary building floor drain sumps,
- d. fuel handling building floor drain sumps, and
- e. radwaste building sump.

The two tanks are sized to accommodate the maximum accumulation of wastes expected in 1 day. The processing flow paths are the same as in the auxiliary building equipment drain.

11.2.2.2.3 Chemical Waste Drain

Input sources to the chemical drain tank and the dual purpose chemical/regeneration drain tank include the following:

- a. laboratory drains,
- b. fuel handling building decontamination sump,
- c. samples containing tritiated water and chemicals required for analysis,
- d. drumming station sumps,
- e. boric acid processing system,
- f. primary water storage tank, and
- g. any other high-conductivity radioactive drains.

One tank is provided solely for the chemical drains. A second tank is used as a dual purpose chemical/regeneration waste drain tank. These wastes are processed through a demineralizer.

11.2.2.2.4 Regeneration Waste Drain

Input sources to the regeneration waste drain tank and the dual purpose chemical/regeneration waste drain tank include the following:

- a. spent resin sluicing drain header,
- b. drumming station decanting tank overflows (Byron only),
- c. release tanks (regeneration waste drain tank only), and
- d. tendon tunnel sumps (when determined to be a source of radiation contamination into the fire and oil sump).

The blowdown and radwaste mixed bed demineralizers are replaced as often as is required to maintain the demineralizers effluent water quality.

11.2.2.2.5 Laundry Drain

The laundry drain tank collects detergent wastes from the radioactive laundry (Braidwood only), personnel decontamination shower and the TSC drains and showers. These waste streams are sent to the release tanks for release or a radwaste demineralizer for further treatment.

11.2.2.2.6 Turbine Building Equipment Drain

Secondary system drains are divided into turbine building equipment drain and turbine building floor drain. The turbine building equipment drain system can recover a large amount of condensate grade water for station reuse.

Two turbine building equipment drain tanks receive water from the turbine building equipment drain sumps. Since this drain water is from the secondary system, the water in the turbine building equipment drains are normally uncontaminated or only very slightly contaminated. The water is normally treated in the wastewater treatment plant for discharge. There are also flowpaths from the turbine building equipment drain system to the radwaste demineralizers and to the liquid release tank.

At Byron, in the event of excessive leakage of the primary coolant into the secondary system, the water may be processed in the waste treatment plant and returned to the release tank for discharge. At Braidwood, in the event of excessive leakage of the primary coolant into the secondary system, the contaminated water may be processed through the coalescer/carbon filters and through additional filtration as needed and discharged via the release tanks, but normally this flowpath is blocked by a spectacle blank flange.

11.2.2.2.7 Turbine Building Floor Drain

The two turbine building floor drain tanks collect water from the turbine building floor drain sumps, condensate pit sumps, and essential service water sumps. These wastes are normally nonradioactive, except for tritium, and are released to the environment after filtration via the wastewater treatment (TR) system.

11.2.2.2.8 Turbine Building Fire and Oil Sump

Turbine building waste water collected in the fire and oil sump, including equipment and floor drain water, is monitored by a radiation monitor. Water from this sump is normally discharged to the waste treatment system for removal of oil and solids and then released to the environment via the circulating water system and blowdown line. However, if unacceptable radioactive contamination is detected, the sump pumps are automatically stopped and the water may be sent to the liquid radwaste treatment system, via the waste treatment system (Byron only). If the source of radioactive contamination is determined to be one of the tendon tunnel sumps, either tendon tunnel pump discharge can be sent to the regeneration waste drain tank for processing in the radwaste system. The water may be processed by the waste treatment plant and returned to the release tanks for discharge (Byron only).

11.2.2.2.9 Condensate Polisher Sump

Water in the condensate polisher sump is monitored by a radiation monitor on the sump discharge. Water from this sump discharge is normally directed to the circulating water system, and then released to the environment via the blowdown line. If a high radiation signal is detected, pump operation is automatically stopped and major condensate polisher inputs into the sump are automatically isolated. If samples confirm that the water is contaminated, the operator may manually change the valve lineup to send the water to the release tank for a monitored discharge.

11.2.2.2.10 Waste Treatment System

The input to the waste treatment system is the Turbine Building Fire and Oil Sump (see 11.2.2.2.8). Water processed by the waste treatment system is normally released to the environment via

the circulating water system and blowdown line. If the radiation monitor on the Turbine Building Fire and Oil Sump should fail, an alarm will be annunciated in the radwaste control room, and the contents of the treated water system would be sampled. If the sample contains radioactive contamination, the system's contents would be pumped to the liquid radwaste system.

11.2.2.3 Operating Procedures

If the contents of a monitor tank are to be released, the required radioactivity analysis is performed prior to transferring the material to the release tank. The liquid is then pumped to a release tank where a sample is again taken and the required analysis is performed. Based on this analysis, the discharge rate is determined so that, when mixed with cooling water blowdown discharges, the water leaving the plant has a radioactivity level less than the applicable effluent concentration as stated in the Technical Specifications. A remotely operated valve with a keylocked switch may then be manually opened so that water can be discharged. The key for the valve lock is controlled by administrative procedures. As a further backup, a radiation detector monitors the liquid in the discharge line prior to the point where the liquid is mixed with the cooling water blowdown to the river. Upon detecting an abnormal level of radiation, a valve on the release tank line immediately upstream of the mixing point closes and an alarm signal is relayed to the control room. A composite sample of the cooling water blowdown is analyzed to verify that radioactive releases conform with the requirements of the Technical Specifications. Records are maintained of radioactive wastes discharged to the environment.

11.2.2.4 Performance Tests

Liquid wastes may be monitored before and after each processing step on a batch basis. The equipment is therefore subjected to continuous performance testing.

Data on specific isotope decontamination factors are not conclusive. This system was designed using conservative overall decontamination factors. These decontamination factors are based on guidelines from References 2, 4, and 5.

Through system cross-ties, redundancy of equipment, and excess storage capacity, ample provision has been made for equipment maintenance and for reprocessing treated effluents if required.

11.2.2.5 Control and Instrumentation

A large portion of the liquid radwaste system is controlled and monitored from the liquid radwaste control panel (LRCP) located in the radwaste control room. Radwaste and blowdown demineralizers and radwaste evaporator control panels and the liquid/solid radwaste interface are also located in the radwaste control room. The solid radwaste handling system control panel is located in the radwaste building.

Some subsystem operations are controlled by automatic sequencers. Instrumentation on radwaste system tanks includes, as a minimum, a high level detector for LRCP annunciation, a low level detector for pump cutoff, and LRCP level recording. The system instrumentation is shown in detail on Drawings M-48-1 through M-48-40.

11.2.3 Radioactive Releases

11.2.3.1 Release Points

All liquid radwaste system effluent paths for radioactive nuclides to the environment are suitably processed, monitored, and recycled or discharged via the release tanks in accordance with procedures outlined in Subsection 11.2.2.3. The radioactive waste release line joins the circulating water blowdown line. Water from the turbine building fire and oil sump, the condensate polisher sump and the treated water system (Subsections 11.2.2.2.8, 11.2.2.2.9 and 11.2.2.2.10), if not unacceptably contaminated, is discharged after suitable treatment into the circulating water flume, and released via the blowdown line.

11.2.3.2 Dilution Factors

At 100% capacity factor and design-basis ambient air conditions, blowdown from the circulating water system serving the two units is approximately 23,000 gpm. On an average annual basis, the circulating water blowdown is expected to be approximately 13,000 gpm, or 2.6×10^{13} cm³ per year. The annual radionuclide release and the concentration in the cooling tower blowdown line are given in Table 11.2-4.

Circulating water blowdown enters the Rock River approximately 50 yards downstream of the intake structure, so releases do not become entrained in makeup water. The circulating water blowdown warming line to the river screen house is isolated during releases to prevent entraining radionuclides in the circulating water and essential service water makeup lines.

11.2.3.3 Estimated Annual Average Doses

The estimated total annual release of radionuclides in liquid effluents is given in Table 11.2-1. Using an annual dilution volume of 2.6×10^{13} cm³, the concentration of each nuclide in the cooling tower blowdown line can be determined. This is shown in Table 11.2-4.

Estimated annual average doses to individuals exposed to radioactive liquid effluents were calculated using the methodology of Regulatory Guide 1.109 (Reference 3). Fish consumption, drinking water, and recreational exposure pathways were considered. Annual use factors for these pathways are given in Table 11.2-8.

In order to obtain a conservative estimate of the radiation doses, no radioactive decay or dilution by river water was taken into consideration.

Estimates of doses to the whole body and to different organs are summarized in Table 11.2-3. As explained in Subsection 11.2.1.4, these estimated doses are all within Appendix I to 10 CFR 50 guidelines. Actual release data are available in the effluent release reports, which are prepared in accordance with the ODCM.

11.2.3 Radioactive Releases

11.2.3.1 Release Points

All controlled liquid radwaste system effluent releases of radioactive nuclides to the environment are suitably processed, monitored, and recycled or discharged via the release tanks in accordance with procedures outlined in Subsection 11.2.2.3. The radioactive waste release line joins the cooling pond blowdown line as indicated in Drawing M-48-1. Water from the fire and oil sump, and condensate polisher sump (Subsections 11.2.2.2.8 and 11.2.2.2.9), if not unacceptably contaminated, is discharged, after suitable treatment, into the cooling pond at the circulating water discharge canal, where it mixes with circulating water prior to release via the blowdown line.

Temporary groundwater remediation activities, where contaminated water from the Exelon Pond and surrounding groundwater is pumped into the circulating water blowdown line at Vacuum Breakers 1 and 2, contribute to the inventory of radioactive nuclides released to the environment via the blowdown line. Periodic sampling of the water is used to monitor the radioactivity of the water that is discharged into the blowdown line.

11.2.3.2 Dilution Factors

At 100% capacity factor, blowdown from the cooling lake is expected to be 25,000 gpm on an annual average basis, or 4.98×10^{13} cm³ per year. The annual radionuclide release and the concentration in the cooling pond blowdown line are given in Table 11.2-4. Blowdown isotope concentrations were calculated using cooling pond blowdown flow of 12,000 gpm, which is the normally expected blowdown flow rate without the use of blowdown booster pumps.

Cooling pond blowdown enters the Kankakee River approximately 50 yards downstream of the intake structure, so that releases do not become entrained in makeup water.

11.2.3.3 Estimated Annual Average Doses

The estimated total annual release of radionuclides in liquid effluents is given in Table 11.2-1. Using an annual dilution volume of 2.4×10^{13} cm³, the concentration of each nuclide in the discharge canal can be determined. This is shown in Table 11.2-4.

Estimated annual average doses to individuals exposed to radioactive liquid effluents were calculated using the methodology of Regulatory Guide 1.109 (Reference 3). Fish consumption, drinking water, and recreational exposure pathways were considered. Annual use factors for these pathways are given in Table 11.2-8.

In order to obtain a conservative estimate of the radiation doses, no radioactive decay or dilution by river water was taken into consideration.

Estimates of doses to the whole body and to different organs are submitted in Table 11.2-3. As explained in Subsection 11.2.1.4, these estimated doses are all within Appendix I to 10 CFR 50 guidelines. Actual release data are available in the effluent release reports, which are prepared in accordance with the ODCM.

11.2.4 References

1. Regulatory Guide 1.112, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light Water-Cooled Power Reactors," U.S. Nuclear Regulatory Commission, April 1976.
2. NUREG-0017, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluent from Pressurized Water Reactors (PWR-GALE Code)," Office of Standards Development, U.S. Nuclear Regulatory Commission, April 1976.
3. 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," U.S. Nuclear Regulatory Commission, Revision 1, October 1977.
4. ANSI Standard N199, "Liquid Radioactive Waste Processing System for Pressurized Water Reactor Plants," American National Standards Institute, Inc., 1976.
5. WASH-1258, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criteria 'Low as Practicable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," U.S. Atomic Energy Commission, 1973.

ATTACHMENT C

**RETDAS COMPUTER PROGRAM OUTPUT UNIT SPECIFIC OR SITE
SPECIFIC
BYRON STATION UNIT 1 AND UNIT 2**



Dose Reports

Golich, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com,
IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com

08/03/2016 03:02 PM

Hide Details

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>

To: "BARRY.C.SCHWARTZ@Sargentlundy.com"

<BARRY.C.SCHWARTZ@Sargentlundy.com>,

"IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com"

<IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com>,

History: This message has been forwarded.

6 Attachments



40CFR190.docx



Gaseous Instantaneous.docx



U1 Gaseous Annual.docx



U1 Liquid Annual.docx



U2 Gaseous Annual.docx



U2 Liquid Annual.docx

Barry/John,

The doubling of the liquid discharge flow rates did not change the liquid doses because the permits were based on average effluent concentrations, which did not change.

Attached are the dose reports that have been reviewed by my supervisor (Z. Cox). I only ran annual dose reports because the Appendix I annual dose limits are twice the quarterly limits. Since we are using average effluent concentrations, once we demonstrate compliance to annual limits we automatically demonstrate compliance to quarterly limits. RETDAS is very temperamental, so when you look at the reports, ignore the listed monthly and quarterly limits and focus only on the annual limits. The gaseous and liquid annual reports demonstrate 10CFR50 Appendix I (per unit) compliance, the 40CFR190 report demonstrates 40CFR190 (site) compliance, and the gaseous instantaneous report demonstrates 10CFR20 (site) compliance. Give me a call tomorrow and we can discuss them.

After tomorrow, I will be out of the office until Wednesday.

Jeff

From: BARRY.C.SCHWARTZ@Sargentlundy.com [<mailto:BARRY.C.SCHWARTZ@Sargentlundy.com>]**Sent:** Wednesday, August 03, 2016 12:53 PM**To:** Golich, Jeffrey M:(GenCo-Nuc)**Cc:** CM.LAUNI@sargentlundy.com; RICHARD.CHITTENDEN@sargentlundy.com;

ROBERT.L.MARSH@sargentlundy.com; ANTHONY.KLAZURA@sargentlundy.com;

IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com; Cox, Zoe L:(GenCo-Nuc); PAUL.A.MCGARY@sargentlundy.com;

Englert, Edward James:(GenCo-Nuc)

Subject: Byron UFSAR Annual Liquid Releases and Associated Concentrations

Jeff,

I have attached six PDFs, five related to the UFSAR and one from the Byron ODCM.

Placing UFSAR Table 11.2-1 on a station basis would double "Total" Ci/yr. However, the underlined text on page 6628 indicates that the PWR GALE parameters shown in UFSAR Table 11.2-2 (6649) are on a one unit basis. One a station basis, the gpm dilution flow in UFSAR Table 11.2-2 would also double, thus maintaining the same liquid effluent concentration into the discharge canal.

LIQUID RELEASES

The annual average radwaste dilution flow is 13000 gpm and is tabulated in UFSAR Table 11.2-2 (6649). The annual liquid releases for the unit are presented in UFSAR Table 11.2-1.

ANNUAL RELEASE: UNIT (ONE UNIT)

CR-51: $6.16\text{E-}05 \text{ Ci/yr} \times 1000000 \text{ uCi/Ci} \times (1/13000 \text{ gpm}) \times (0.264 \text{ gal/1000 ml}) / 60 \text{ min/24 hr/365 days} = 2.38\text{E-}12 \text{ uCi/ml}$

ANNUAL RELEASE STATION (TWO UNITS)

CR-51: $2 \times 6.16\text{E-}05 \text{ Ci/yr} \times 1000000 \text{ uCi/Ci} \times (1/26000 \text{ gpm}) \times (0.264 \text{ gal/1000 ml}) / 60 \text{ min/24 hr/365 days} = 2.38\text{E-}12 \text{ uCi/ml}$

ODCM Table 2-4

Cr-51: Liquid Effluent Concentration = $2.39\text{E-}12 \text{ uCi/ml}$

In summary, the liquid effluent concentration is the same for a one unit or two units due to the doubling of the dilution flow, but the curies released is dependent on the number of units.

Thank you for your support,
Barry

1-312-269-7296

----- Forwarded by BARRY C SCHWARTZ/Sargentlundy on 08/03/2016 07:51 AM -----

From: BARRY C SCHWARTZ/Sargentlundy
To: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>,
Cc: "CM.LAUNI@sargentlundy.com" <CM.LAUNI@sargentlundy.com>, "ANTHONY.KLAZURA@sargentlundy.com" <ANTHONY.KLAZURA@sargentlundy.com>, "PAUL.A.MCGARY@sargentlundy.com" <PAUL.A.MCGARY@sargentlundy.com>, "RICHARD.CHITTENDEN@sargentlundy.com" <RICHARD.CHITTENDEN@sargentlundy.com>, "IOANNIS.K.GASTOUNIOTIS@sargentlundy.com" <IOANNIS.K.GASTOUNIOTIS@sargentlundy.com>, "Cox, Zoe L:(GenCo-Nuc)" <zoe.cox@exeloncorp.com>, "Englert, Edward James:(GenCo-Nuc)" <Edward.Englert@exeloncorp.com>
Date: 08/02/2016 02:53 PM
Subject: RE: [EXTERNAL] Byron Liquid Releases and Airborne Releases- per Unit or per Station

Jeff,

Thank you for the clarification and correction. As far as doubling the annual release of UFSAR Table 11.2-1 is concerned, I am going to do some preliminary number crunching this evening with the "gpm" annual average dilution value in the UFSAR and compare some examples with ODCM Table 2-4, "Assumed Composition of the Byron Station Liquid Effluent", which is in units of uCi/ml. I will E-mail you tomorrow.

Thank you for your support,

Barry

1-312-269-7296

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>
To: "BARRY.C.SCHWARTZ@sargentlundy.com" <BARRY.C.SCHWARTZ@sargentlundy.com>,
Cc: "CM.LAUNI@sargentlundy.com" <CM.LAUNI@sargentlundy.com>, "ANTHONY.KLAZURA@sargentlundy.com" <ANTHONY.KLAZURA@sargentlundy.com>, "PAUL.A.MCGARY@sargentlundy.com" <PAUL.A.MCGARY@sargentlundy.com>, "RICHARD.CHITTENDEN@sargentlundy.com" <RICHARD.CHITTENDEN@sargentlundy.com>, "IOANNIS.K.GASTOUNIOTIS@sargentlundy.com" <IOANNIS.K.GASTOUNIOTIS@sargentlundy.com>, "Cox, Zoe L:(GenCo-Nuc)" <zoe.cox@exeloncorp.com>, "Englert, Edward James:(GenCo-Nuc)" <Edward.Englert@exeloncorp.com>
Date: 08/02/2016 01:32 PM
Subject: RE: [EXTERNAL] Byron Liquid Releases and Airborne Releases- per Unit or per Station

Barry,

I think there may have been a misunderstanding. I don't believe we concluded the liquid effluent concentrations listed in the UFSAR were on a station basis. But I believe that I stated the liquid effluent concentrations (uCi/ml) needed to be listed on a station basis because that is the way they are required to be input to RETDAS. When a liquid release permit is created, it is a single permit. RETDAS subsequently allocates the curies and dose evenly between units.

So it sounds like the values in Table 11.2-1 just need to be doubled.

Jeff

From: BARRY.C.SCHWARTZ@sargentlundy.com [<mailto:BARRY.C.SCHWARTZ@sargentlundy.com>]
Sent: Tuesday, August 02, 2016 12:38 PM
To: Golich, Jeffrey M:(GenCo-Nuc)
Cc: CM.LAUNI@sargentlundy.com; ANTHONY.KLAZURA@sargentlundy.com;
PAUL.A.MCGARY@sargentlundy.com; RICHARD.CHITTENDEN@sargentlundy.com;
IOANNIS.K.GASTOUNIOTIS@sargentlundy.com; Cox, Zoe L:(GenCo-Nuc); Englert, Edward James:(GenCo-Nuc)

Subject: [EXTERNAL] Byron Liquid Releases and Airborne Releases- per Unit or per Station

Jeff

In our conference call of 7/14/2016, we discussed UFSAR Table 11.2-1 for expected annual liquid releases into the discharge canal. UFSAR Table 11.3-6 is the expected annual airborne release per unit as indicated by the double asterisk in the table title. The point of this discussion was UFSAR Table 11.2-1, an expected annual release to discharge canal per unit or per station. Since UFSAR Table 11.3-6 is explicitly annual release per unit, we concluded that UFSAR Table 11.2-1 is per station due to the absence of the per unit designation.

However, during the preparation of the draft calculation I was preparing a section of the calculation on the power uprate impact on normal operation source terms, airborne and liquid, UFSAR Section 11.3.3.4 and UFSAR Table 11.3-7 and UFSAR Section 11.2.1.3 and UFSAR Table 11.2-4, respectively.

The following tables are extracted directly from the UFSAR for comparison purposes:

LIQUID RELEASES

Comparing the "Total" column of Table 11.2-1 with the "Expected Release" column of Table 11.2-4 shows that they tabulate the same annual releases, accounting for rounding. Note the units of release in the two tables, Ci/yr in Table 11.2-1 and Ci/yr/unit in Table 11.2-4. The conclusion previously drawn on liquid releases being on a station basis was not correct. Based on Table 11.2-4, the units of release are Ci/yr/unit not Ci/yr/station.

AIRBORNE RELEASES

Note the double asterisk in the title of Table 11.3-6 indicating that the table is on a per unit basis. In Table 11.3-7, the 2nd column is entitled "Annual Release From One Unit". Therefore, these two tables explicitly indicate the annual releases are on a per unit basis.

In summary, liquid releases and airborne releases are in terms of Ci.yr/unit in Chapter 11 of the UFSAR.

New PDFs for liquid releases are in preparation and are being reviewed..

Thank you for your support,
Barry
1-312 -269-7296

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ATTACHMENT D

THE UFSAR AND ODCM AS DESIGN INPUT DOCUMENTS
BYRON STATION UNIT 1 AND UNIT 2



**Re: FW: [EXTERNAL] Fw: B/B UFSAR/ODCM STATUS AS A DESIGN
REFERENCE-DRAFT**

IOANNIS K GASTOUNIOTIS to: Englert, Edward
James:(GenCo-Nuc)
Cc: BARRY C SCHWARTZ, RICHARD CHITTENDEN

08/01/2016 02:01 PM

Ed,

I appreciate the expedient response

Best Regards

John Gastouniotis
Nuclear Power Technologies.
Sargent & Lundy L.L.C.
4320 Winfield Road Suite 550
Warrenville, IL 60555
(630) 821-7463 (Office)
(630) 864-9784 (Cell)
email:John.Gastouniotis@SargentLundy.com

"Englert, Edward James:(GenCo-Nuc)"

Here you go From: Cunze...

08/01/2016 12:57:36 PM

From: "Englert, Edward James:(GenCo-Nuc)" <Edward.Englert@exeloncorp.com>
To: "IOANNIS.K.GASTOUNIOTIS@SargentLundy.com"
<IOANNIS.K.GASTOUNIOTIS@SargentLundy.com>,
Date: 08/01/2016 12:57 PM
Subject: FW: [EXTERNAL] Fw: B/B UFSAR/ODCM STATUS AS A DESIGN REFERENCE-DRAFT

Here you go

From: Cunzeman, Jonathan P.:(GenCo-Nuc)
Sent: Monday, August 01, 2016 12:56 PM
To: Englert, Edward James:(GenCo-Nuc)
Subject: RE: [EXTERNAL] Fw: B/B UFSAR/ODCM STATUS AS A DESIGN REFERENCE-DRAFT

Ed,

Since Change Control for the UFSAR is maintained via LS-AA-107 and the ODCM Change control is maintained by CY-AA-170-300/CY-AA-170-3100, I agree with you that there isn't necessarily a need to provide a TODI for sections referenced as long as the reference includes the date of record for the section they are referencing.

Jon

From: Englert, Edward James:(GenCo-Nuc)
Sent: Monday, August 01, 2016 12:35 PM
To: Cunzeman, Jonathan P.:(GenCo-Nuc)
Subject: FW: [EXTERNAL] Fw: B/B UFSAR/ODCM STATUS AS A DESIGN REFERENCE-DRAFT

Please provide S&L approval to reference the UFSAR in a calc.

See me if you need details.

From: IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com [<mailto:IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com>]
Sent: Monday, August 01, 2016 12:26 PM
To: Englert, Edward James:(GenCo-Nuc)
Cc: BARRY.C.SCHWARTZ@Sargentlundy.com; RICHARD.CHITTENDEN@sargentlundy.com
Subject: [EXTERNAL] Fw: B/B UFSAR/ODCM STATUS AS A DESIGN REFERENCE-DRAFT

Ed,

Is it possible to get Exelon's concurrence to use UFSAR and ODCM info without a TODI? (Email from a Design Manager etc.)

We will not be able to locate the source document for the values in these documents.

I understand that the UFSAR is not a Design Basis Document and the ODCM is probably in the same category. However, it is the only document available to reference in the Calc.

The Radiological Department at S&L has some previous EXELON experience that did not allow them to use the UFSAR without a TODI and they have some reservations.

If such concurrence from EXELON is inconvenient to obtain, S&L will ghost-prepare the TODI and send it for EXELON to issue so we can attach to the Calc.

Please let me know.

Best Regards

John Gastouniotis
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----- Forwarded by IOANNIS K GASTOUNIOTIS/Sargentlundy on 08/01/2016 12:14 PM -----

From: IOANNIS K GASTOUNIOTIS/Sargentlundy
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Cc: Edward.Englert@exeloncorp.com, ANTHONY KLAZURA/Sargentlundy@SARGENTLUNDY, CM
LAUNI/Sargentlundy@SARGENTLUNDY, RICHARD CHITTENDEN/Sargentlundy@SARGENTLUNDY, ROBERT L
MARSH/Sargentlundy@SARGENTLUNDY
Date: 07/29/2016 03:53 PM

Subject: Re: B/B UFSAR/ODCM STATUS AS A DESIGN REFERENCE-DRAFT

Barry,

From CC-AA-310

CC-AA-310 describes the requirements to prepare a Transmittal of Design Information (TODI) for those cases when a controlled record is necessary. This is typically required when design information is transmitted between the corporate office, sites, and vendors (e.g. manufacturer, Engineer of Choice (EOC)).

Transmittal of Design Information can be from the vendor to Exelon or from Exelon to the vendor. A TODI is available for use by anyone where the rigor of the process can be leveraged to ensure that precise design requirements are communicated.

The design information is not created or revised by this procedure. An individual who has knowledge of the design information being transmitted, and the intended use of the design information by the recipient prepares the TODI in order that the recipient can appropriately use the information.

Processes that share critical information between the corporate office, sites, and vendors require the use of the TODI *unless such information can be obtained from documented and controlled plant files not requiring further interpretation* . These processes are the configuration change process and troubleshooting process.

In my opinion, (also discussed with Ed Englert) a TODI is not required in our case. The UFSAR is a controlled document and I am assuming that the extracted information requires no interpretation or direction on how to be used. Therefore, the UFSAR data may be used by reference to the latest UFSAR Revision. If we feel further enhancement is necessary, we could make the specific UFSAR pages an attachment to the calculation. If my assumption is incorrect an guidance is needed, then we should proceed with the preparation of the TODI and have Byron sign it.

Best Regards

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Date: 07/28/2016 01:51 PM
Subject: B/B UFSAR/ODCM STATUS AS A DESIGN REFERENCE-DRAFT

John

Over the years, the position on using the Commonwealth Edison/Exelon UFSAR as a design input reference for use in design calculations has changed several times from no to yes and back. The current point in question is Byron Calculation BYR16-012 which analyzes the dose consequences of removing the steam jet air ejector process stream from filtration by the Offgas Filter Unit and releasing it to the environment via the station vent stack. Expected airborne releases (per unit) and expected liquid releases (per station) are tabulated in UFSAR Table 11.3-6 and UFSAR Table 11.-2-1, respectively. These tables are the output of NUREG-0017 (the PWR GALE Computer program). UFSAR Table 11.2-2 contains some PWR GALE input parameters and UFSAR Sections 11.2 and 11.3 contain supporting text and other parameters.

Attempts to resurrect the PWR GALE computer runs and any associated calculation write-ups proved futile. The text and data from UFSAR Chapter 11 now become the primary reference for Calculation BYR16-012 and the Byron ODCM computer program RETDAS, which generates the dose consequences and documents the regulatory comparisons. In a similar analysis for Clinton, Exelon provided UFSAR text, data and associated documentation with directives on how to use the information attached to a TODI. The TODI then became an attachment to the Clinton calculation.

Please clarify Exelon's position on the use of the UFSAR as a primary reference for Byron design calculations. For added flexibility, please do the same for the ODCM.

Thank you,
Barry
X-7296

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ATTACHMENT E

UFSAR TABLE 11.3-6 PROJECTED ANNUAL GASEOUS RELEASES BYRON STATION UNIT 1 OR UNIT 2

TABLE 11.3-6
EXPECTED ANNUAL AVERAGE RELEASE OF AIRBORNE RADIONUCLIDES*, **

NUCLIDE	PRIMARY COOLANT (μCi/g)	SECONDARY COOLANT (μCi/g)	GASEOUS RELEASE RATE - CURIES PER YEAR						
			GAS STRIPPING		BUILDING VENTILATION		BLOWDOWN		AIR EJECTOR EXHAUST
			SHUTDOWN	CONTINUOUS	REACTOR	AUXILIARY	TURBINE	VENT OFF-GAS	
KR 83M	2.265-02	6.255-09	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KR 85M	1.184-01	3.337-08	0.0	0.0	0.0	3.0+00	0.0	0.0	2.0+00
KR 85	1.051-01	2.944-08	5.1+01	5.7+02	7.4+01	2.0+00	0.0	0.0	1.0+00
KR 87	6.474-02	1.726-08	0.0	0.0	0.0	1.0+00	0.0	0.0	0.0
KR 88	2.156-01	5.928-08	0.0	0.0	0.0	5.0+00	0.0	0.0	3.0+00
KR 89	5.399-03	1.512-09	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XE131M	1.035-01	2.917-08	4.0+00	1.5+01	1.7+01	2.0+00	0.0	0.0	1.0+00
XE133M	2.293-01	6.461-08	0.0	0.0	7.0+00	5.0+00	0.0	0.0	3.0+00
XE133	1.804+01	5.010-06	2.4+01	4.7+01	1.3+03	3.8+02	0.0	0.0	2.4+02
XE135M	1.404-02	3.887-09	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XE135	3.755-01	1.041-07	0.0	0.0	2.0+00	8.0+00	0.0	0.0	5.0+00

* 0.0 appearing in the table indicates release is less than 1.0 Ci/yr for noble gas, 0.0001 Ci/yr for I.
.. For one unit.
KEY: 4.5-03 = 4.5 x 10⁻³

TABLE 11.3-6 (Cont'd)

NUCLIDE	PRIMARY COOLANT (μ Ci/g)	SECONDARY COOLANT (μ Ci/g)	GASEOUS RELEASE RATE - CURIES PER YEAR							
			GAS STRIPPING		REACTOR	BUILDING VENTILATION		BLOWDOWN		AIR EJECTOR EXHAUST
			SHUTDOWN	CONTINUOUS		AUXILIARY	TURBINE	VENT OFF-GAS		
XE137	9.719-03	2.700-09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XE138	4.751-02	1.296-08	0.0	0.0	0.0	1.0+00	0.0	0.0	0.0	1.0+00
TOTAL NOBLE GASES										
I 131	2.795-01	4.215-05	0.0	0.0	1.7-03	4.4-02	2.3-03	0.0	2.8-03	5.1-02
I 133	3.986-01	3.831-05	0.0	0.0	7.7-04	6.3-02	2.1-03	0.0	4.0-03	7.0-02
TRITIUM GASEOUS RELEASE			1000 CURIES/YR							

TABLE 11.3-6 (Cont'd)

AIRBORNE PARTICULATE RELEASE RATE - CURIES PER YEAR¹

NUCLIDE	WASTE GAS SYSTEM	BUILDING VENTILATION		TOTAL
		REACTOR	AUXILIARY	
MN 54	4.5-03	6.1-06	1.8-04	4.7-03
FE 59	1.5-03	2.1-06	6.0-05	1.6-03
CO 58	1.5-02	2.1-05	6.0-04	1.6-02
CO 60	7.0-03	9.5-06	2.7-04	7.3-03
SR 89	3.3-04	4.7-07	1.3-05	3.4-04
SR 90	6.0-05	8.4-08	2.4-06	6.2-05
CS134	4.5-03	6.1-06	1.8-04	4.7-03
CS137	7.5-03	1.1-05	3.0-04	7.8-03

*In addition to these releases, 25 Ci/yr of argon-41 are released from the containment and 8 Ci/yr of carbon-14 are released from the waste gas processing system. This table was developed taking into account both releases from normal operations and also operational occurrences.

KEY: 4.5-03 = 4.5×10^{-3}

TABLE 11.3-6 (Cont'd)

VOLUME REDUCTION SYSTEM* RELEASE RATE (Ci/yr)

Noble Gases:
Xe 131m 5.1-01
Xe 133m 1.2+00
Xe 133 2.1+01

Halogens:
I 131 2.8-03
I 132 3.7-03
I 133 2.1-03

Tritium:
H 3 2.6+01

Particulates:
Cr 51 5.3-08
Fe 55 7.0-07
Co 58 6.0-07
Co 60 9.2-08
Ni 63 7.0-07
Y 91 1.5-09
Mo 99 3.5-07
Tc 99m 2.1-09
Te 132 1.5-07
Cs 134 1.1-05
Cs 136 1.9-07
Cs 137 7.4-07

KEY: 5.1-01 = 5.1×10^{-1}

* The original estimate included release data for the volume reduction system. This system is no longer used.

ATTACHMENT F

**RETDAS COMPUTER PROGRAM U1 GASEOUS ANNUAL
(UNFILTERED) DOSE REPORT
BYRON STATION UNIT 1**

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== RELEASE DATA ===
 Total Release Duration (minutes)..... 5.256E+05
 Total Release Volume (cf)..... 7.726E+10
 Average Release Flowrate (cfm)..... 1.470E+05

Average Period Flowrate (cfm)..... 1.470E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	2.49E+07	1.14E-08	1.14E+00	1.00E-08
KR-85M	4.99E+06	2.28E-09	2.28E-02	1.00E-07
KR-85	7.00E+08	3.20E-07	4.57E-01	7.00E-07
KR-87	1.00E+06	4.57E-10	2.28E-02	2.00E-08
KR-88	7.99E+06	3.65E-09	4.06E-01	9.00E-09
XE-131M	3.89E+07	1.78E-08	8.90E-03	2.00E-06
XE-133M	1.50E+07	6.85E-09	1.14E-02	6.00E-07
XE-133	2.00E+09	9.13E-07	1.83E+00	5.00E-07
XE-135	1.50E+07	6.85E-09	9.79E-02	7.00E-08
XE-138	1.00E+06	4.57E-10	2.28E-02	2.00E-08
F&AG	2.81E+09	1.28E-06	4.02E+00	
I-131	7.59E+04	3.47E-11	1.73E-01	2.00E-10
I-133	1.10E+05	5.02E-11	5.02E-02	1.00E-09
Iodine	1.86E+05	8.49E-11	2.24E-01	
C-14	7.99E+06	3.65E-09	1.22E+00	3.00E-09
Other	7.99E+06	3.65E-09	1.22E+00	
H-3	1.00E+09	4.57E-07	4.57E+00	1.00E-07
H-3	1.00E+09	4.57E-07	4.57E+00	
MN-54	4.70E+03	2.15E-12	2.15E-03	1.00E-09
FE-59	1.60E+03	7.31E-13	1.46E-03	5.00E-10
CO-58	1.60E+04	7.31E-12	7.31E-03	1.00E-09
CO-60	7.29E+03	3.33E-12	6.66E-02	5.00E-11
SR-89	3.39E+02	1.55E-13	7.75E-04	2.00E-10
SR-90	6.19E+01	2.83E-14	4.72E-03	6.00E-12

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== NUCLIDE DATA =====

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
CS-134	4.70E+03	2.15E-12	1.07E-02	2.00E-10
CS-137	7.79E+03	3.56E-12	1.78E-02	2.00E-10
P>=8	4.25E+04	1.94E-11	1.12E-01	
Total	3.81E+09	1.74E-06	1.01E+01	

Verified By: _____ Date: _____

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	INFANT	THYROID	9.82E+00	31-day	2.25E-01	4.37E+03
					Quarter	5.63E+00	1.75E+02
					Annual	1.13E+01	8.73E+01
T.Spec	Any Organ	INFANT	THYROID	9.82E+00	31-day	3.00E-01	3.27E+03
					Quarter	7.50E+00	1.31E+02
					Annual	1.50E+01	6.55E+01

Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Critical Pathway.....: 5 Grs/Cow/Milk (CMILK)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	2.51E-01
C-14	8.05E-01
MN-54	7.90E-03
FE-59	5.29E-04
CO-58	7.37E-03
CO-60	1.90E-01
SR-89	8.89E-09
SR-90	0.00E+00
I-131	9.72E+01
I-133	1.34E+00
CS-134	3.96E-02
CS-137	1.66E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) =====								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
AINHL	2.22E-03	1.08E-02	2.69E-02	1.08E-02	1.16E-02	1.07E-02	0.00E+00	1.08E-02
AVEG	1.17E-01	5.46E-02	3.88E-01	4.54E-02	4.03E-02	4.42E-02	0.00E+00	5.04E-02
ACMEAT	3.94E-02	1.26E-02	5.58E-02	1.11E-02	1.05E-02	1.26E-02	0.00E+00	1.20E-02
ACMILK	5.45E-02	3.54E-02	1.28E+00	2.68E-02	1.63E-02	1.64E-02	0.00E+00	2.91E-02
TGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
TINHL	3.16E-03	1.11E-02	3.13E-02	1.11E-02	1.23E-02	1.10E-02	0.00E+00	1.10E-02
TVEG	1.87E-01	7.77E-02	3.44E-01	6.32E-02	5.70E-02	5.96E-02	0.00E+00	6.43E-02
TCMEAT	3.32E-02	9.85E-03	4.10E-02	8.69E-03	8.20E-03	9.28E-03	0.00E+00	8.88E-03
TCMILK	9.99E-02	5.99E-02	2.03E+00	4.51E-02	2.71E-02	2.58E-02	0.00E+00	3.89E-02
CGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
CINHL	4.35E-03	1.01E-02	3.35E-02	1.01E-02	1.11E-02	9.92E-03	0.00E+00	9.97E-03
CVEG	4.46E-01	1.51E-01	5.53E-01	1.26E-01	1.17E-01	1.16E-01	0.00E+00	1.21E-01
CCMEAT	6.23E-02	1.64E-02	6.38E-02	1.49E-02	1.42E-02	1.46E-02	0.00E+00	1.47E-02
CCMILK	2.44E-01	1.12E-01	4.02E+00	8.60E-02	5.59E-02	5.21E-02	0.00E+00	6.59E-02
IGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
IINHL	3.18E-03	6.05E-03	2.75E-02	5.98E-03	6.62E-03	5.86E-03	0.00E+00	5.90E-03
ICMILK	4.63E-01	2.22E-01	9.75E+00	1.57E-01	1.08E-01	9.96E-02	0.00E+00	1.19E-01
----- TOTALS -----								
ADULT	2.54E-01	1.54E-01	1.80E+00	1.35E-01	1.19E-01	1.25E-01	0.00E+00	1.43E-01
TEEN	3.63E-01	1.99E-01	2.49E+00	1.69E-01	1.45E-01	1.46E-01	0.00E+00	1.64E-01
CHILD	7.98E-01	3.30E-01	4.71E+00	2.78E-01	2.39E-01	2.33E-01	0.00E+00	2.53E-01
INFANT	5.07E-01	2.69E-01	9.82E+00	2.04E-01	1.55E-01	1.46E-01	0.00E+00	1.66E-01

=== AGE GROUP / PATHWAY DESCRIPTIONS =====		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== AGE GROUP / PATHWAY DESCRIPTIONS =====
Abbreviation Age Group Pathway

CVEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM NG DOSE FOR PERIOD =====

Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	6.57E-02	31-day	1.50E-01	4.38E+01
			Quarter	3.75E+00	1.75E+00
			Annual	7.50E+00	8.75E-01
Admin	Beta	5.27E-02	31-day	3.00E-01	1.76E+01
			Quarter	7.50E+00	7.02E-01
			Annual	1.50E+01	3.51E-01
T.Spec	Gamma	6.57E-02	31-day	2.00E-01	3.28E+01
			Quarter	5.00E+00	1.31E+00
			Annual	1.00E+01	6.57E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.05E+01
KR-85M	5.42E-01
KR-85	1.06E+00
KR-87	5.45E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133M	4.33E-01
XE-133	6.23E+01
XE-135	2.54E+00
XE-138	8.14E-01

T.Spec	Beta	5.27E-02	31-day	4.00E-01	1.32E+01
			Quarter	1.00E+01	5.27E-01
			Annual	2.00E+01	2.63E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
AR-41	2.21E+00
KR-85M	2.66E-01
KR-85	3.69E+01
KR-87	2.79E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133M	6.00E-01
XE-133	5.68E+01
XE-135	9.98E-01
XE-138	1.29E-01

ATTACHMENT G

**RETDAS COMPUTER PROGRAM U2 GASEOUS ANNUAL
(UNFILTERED) DOSE REPORT
BYRON STATION UNIT 2**

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== RELEASE DATA ===
 Total Release Duration (minutes)..... 5.256E+05
 Total Release Volume (cf)..... 7.726E+10
 Average Release Flowrate (cfm)..... 1.470E+05

Average Period Flowrate (cfm)..... 1.470E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	2.49E+07	1.14E-08	1.14E+00	1.00E-08
KR-85M	4.99E+06	2.28E-09	2.28E-02	1.00E-07
KR-85	7.00E+08	3.20E-07	4.57E-01	7.00E-07
KR-87	1.00E+06	4.57E-10	2.28E-02	2.00E-08
KR-88	7.99E+06	3.65E-09	4.06E-01	9.00E-09
XE-131M	3.89E+07	1.78E-08	8.90E-03	2.00E-06
XE-133M	1.50E+07	6.85E-09	1.14E-02	6.00E-07
XE-133	2.00E+09	9.13E-07	1.83E+00	5.00E-07
XE-135	1.50E+07	6.85E-09	9.79E-02	7.00E-08
XE-138	1.00E+06	4.57E-10	2.28E-02	2.00E-08
F&AG	2.81E+09	1.28E-06	4.02E+00	
I-131	7.59E+04	3.47E-11	1.73E-01	2.00E-10
I-133	1.10E+05	5.02E-11	5.02E-02	1.00E-09
Iodine	1.86E+05	8.49E-11	2.24E-01	
C-14	7.99E+06	3.65E-09	1.22E+00	3.00E-09
Other	7.99E+06	3.65E-09	1.22E+00	
H-3	1.00E+09	4.57E-07	4.57E+00	1.00E-07
H-3	1.00E+09	4.57E-07	4.57E+00	
MN-54	4.70E+03	2.15E-12	2.15E-03	1.00E-09
FE-59	1.60E+03	7.31E-13	1.46E-03	5.00E-10
CO-58	1.60E+04	7.31E-12	7.31E-03	1.00E-09
CO-60	7.29E+03	3.33E-12	6.66E-02	5.00E-11
SR-89	3.39E+02	1.55E-13	7.75E-04	2.00E-10
SR-90	6.19E+01	2.83E-14	4.72E-03	6.00E-12

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== NUCLIDE DATA =====

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
CS-134	4.70E+03	2.15E-12	1.07E-02	2.00E-10
CS-137	7.79E+03	3.56E-12	1.78E-02	2.00E-10
P>=8	4.25E+04	1.94E-11	1.12E-01	
Total	3.81E+09	1.74E-06	1.01E+01	

Verified By: _____ Date: _____

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	INFANT	THYROID	9.82E+00	31-day	2.25E-01	4.37E+03
					Quarter	5.63E+00	1.75E+02
					Annual	1.13E+01	8.73E+01
T.Spec	Any Organ	INFANT	THYROID	9.82E+00	31-day	3.00E-01	3.27E+03
					Quarter	7.50E+00	1.31E+02
					Annual	1.50E+01	6.55E+01

Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Critical Pathway.....: 5 Grs/Cow/Milk (CMILK)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	2.51E-01
C-14	8.05E-01
MN-54	7.90E-03
FE-59	5.29E-04
CO-58	7.37E-03
CO-60	1.90E-01
SR-89	8.89E-09
SR-90	0.00E+00
I-131	9.72E+01
I-133	1.34E+00
CS-134	3.96E-02
CS-137	1.66E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
AINHL	2.22E-03	1.08E-02	2.69E-02	1.08E-02	1.16E-02	1.07E-02	0.00E+00	1.08E-02
AVEG	1.17E-01	5.46E-02	3.88E-01	4.54E-02	4.03E-02	4.42E-02	0.00E+00	5.04E-02
ACMEAT	3.94E-02	1.26E-02	5.58E-02	1.11E-02	1.05E-02	1.26E-02	0.00E+00	1.20E-02
ACMILK	5.45E-02	3.54E-02	1.28E+00	2.68E-02	1.63E-02	1.64E-02	0.00E+00	2.91E-02
TGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
TINHL	3.16E-03	1.11E-02	3.13E-02	1.11E-02	1.23E-02	1.10E-02	0.00E+00	1.10E-02
TVEG	1.87E-01	7.77E-02	3.44E-01	6.32E-02	5.70E-02	5.96E-02	0.00E+00	6.43E-02
TCMEAT	3.32E-02	9.85E-03	4.10E-02	8.69E-03	8.20E-03	9.28E-03	0.00E+00	8.88E-03
TCMILK	9.99E-02	5.99E-02	2.03E+00	4.51E-02	2.71E-02	2.58E-02	0.00E+00	3.89E-02
CGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
CINHL	4.35E-03	1.01E-02	3.35E-02	1.01E-02	1.11E-02	9.92E-03	0.00E+00	9.97E-03
CVEG	4.46E-01	1.51E-01	5.53E-01	1.26E-01	1.17E-01	1.16E-01	0.00E+00	1.21E-01
CCMEAT	6.23E-02	1.64E-02	6.38E-02	1.49E-02	1.42E-02	1.46E-02	0.00E+00	1.47E-02
CCMILK	2.44E-01	1.12E-01	4.02E+00	8.60E-02	5.59E-02	5.21E-02	0.00E+00	6.59E-02
IGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
IINHL	3.18E-03	6.05E-03	2.75E-02	5.98E-03	6.62E-03	5.86E-03	0.00E+00	5.90E-03
ICMILK	4.63E-01	2.22E-01	9.75E+00	1.57E-01	1.08E-01	9.96E-02	0.00E+00	1.19E-01
----- TOTALS -----								
ADULT	2.54E-01	1.54E-01	1.80E+00	1.35E-01	1.19E-01	1.25E-01	0.00E+00	1.43E-01
TEEN	3.63E-01	1.99E-01	2.49E+00	1.69E-01	1.45E-01	1.46E-01	0.00E+00	1.64E-01
CHILD	7.98E-01	3.30E-01	4.71E+00	2.78E-01	2.39E-01	2.33E-01	0.00E+00	2.53E-01
INFANT	5.07E-01	2.69E-01	9.82E+00	2.04E-01	1.55E-01	1.46E-01	0.00E+00	1.66E-01

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== AGE GROUP / PATHWAY DESCRIPTIONS =====
Abbreviation Age Group Pathway

CVEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	6.57E-02	31-day	1.50E-01	4.38E+01
			Quarter	3.75E+00	1.75E+00
			Annual	7.50E+00	8.75E-01
Admin	Beta	5.27E-02	31-day	3.00E-01	1.76E+01
			Quarter	7.50E+00	7.02E-01
			Annual	1.50E+01	3.51E-01
T.Spec	Gamma	6.57E-02	31-day	2.00E-01	3.28E+01
			Quarter	5.00E+00	1.31E+00
			Annual	1.00E+01	6.57E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage				
AR-41	2.05E+01				
KR-85M	5.42E-01				
KR-85	1.06E+00				
KR-87	5.45E-01				
KR-88	1.07E+01				
XE-131M	5.37E-01				
XE-133M	4.33E-01				
XE-133	6.23E+01				
XE-135	2.54E+00				
XE-138	8.14E-01				
T.Spec	Beta	5.27E-02	31-day	4.00E-01	1.32E+01
			Quarter	1.00E+01	5.27E-01
			Annual	2.00E+01	2.63E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
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AR-41	2.21E+00
KR-85M	2.66E-01
KR-85	3.69E+01
KR-87	2.79E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133M	6.00E-01
XE-133	5.68E+01
XE-135	9.98E-01
XE-138	1.29E-01

ATTACHMENT H

RETDAS COMPUTER PROGRAM GASEOUS INSTANTANEOUS
(UNFILTERED) DOSE REPORT
BYRON STATION UNIT 1 AND UNIT 2

Release Point Description	Isotopic Start Date	End Date	Total Body (mrem/yr)	Skin (mrem/yr)	Organ (mrem/yr)
Unit 1 Stack	2016308 07/01/2017 00:00	12/31/2017 23:59	5.75E-02	1.51E-01	3.04E+01
Unit 2 Stack	2016310 07/01/2017 00:00	12/31/2017 23:59	5.75E-02	1.51E-01	3.04E+01
Maximum Possible Dose Rates.....			1.15E-01	3.01E-01	6.07E+01
Tech Spec Limit.....			5.00E+02	3.00E+03	1.50E+03
% of Tech. Spec Limit.....			2.30E-02	1.00E-02	4.05E+00

I&P
SITE PERIOD DOSE RATE REPORT

ATTACHMENT I

**RETDAS COMPUTER PROGRAM GASEOUS INSTANTANEOUS
(FILTERED) DOSE REPORT**

BYRON STATION UNIT 1 AND UNIT 2

SITE PERIOD DOSE RATE REPORT

Release Point Description	I&P	Isotopic Start Date	End Date	Total Body (mrem/yr)	Skin (mrem/yr)	Organ (mrem/yr)
Unit 1 Stack	2016308	07/01/2017 00:00	12/31/2017 23:59	5.75E-02	1.51E-01	2.04E+01
Unit 2 Stack	2016310	07/01/2017 00:00	12/31/2017 23:59	5.75E-02	1.51E-01	2.04E+01
Maximum Possible Dose Rates.....				1.15E-01	3.01E-01	4.09E+01
Tech Spec Limit.....				5.00E+02	3.00E+03	1.50E+03
% of Tech. Spec Limit.....				2.30E-02	1.00E-02	2.72E+00

ATTACHMENT J

**RETDAS COMPUTER PROGRAM U1 LIQUID ANNUAL DOSE REPORT
BYRON STATION UNIT 1**

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1

=== MULTIPLE RELEASE POINT MESSAGE =====
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA =====
Total Release Duration (minutes)..... 5.256E+05
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA =====
Nuclide uCi

BA-137M 1.01E+04
CR-51 6.16E+01
MN-54 1.01E+03
FE-59 3.47E+01
CO-58 4.53E+03
CO-60 8.77E+03
BR-83 1.76E+01
RB-86 4.68E+01
ZR-95 1.40E+03
NB-95 2.00E+03
MO-99 1.98E+03
TC-99M 2.31E+03
RU-103 1.41E+02
RU-106 2.40E+03
AG-110M 4.40E+02
TE-127 1.40E+01
TE-129 3.03E+01
TE-129M 4.58E+01
TE-131M 3.26E+01
TE-132 6.16E+02
I-130 1.09E+02
I-131 8.04E+04
I-132 1.79E+03
I-133 3.65E+04
I-135 4.35E+03
CS-134 2.79E+04
CS-136 6.88E+03
CS-137 3.47E+04
CE-144 5.20E+03
NP-239 2.32E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

=== NUCLIDE DATA =====

Nuclide	uCi
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Gamma	2.34E+05
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H-3	3.00E+08
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FE-55	5.41E+01
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SR-89	1.28E+01
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Beta	3.00E+08
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Total	3.00E+08
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Verified By: _____ Date: _____

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: 0 Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
APWtr	2.18E-05	1.17E-04	8.30E-04	9.57E-05	8.30E-05	8.92E-05	0.00E+00	1.07E-04
AFWFSp	1.15E-02	2.05E-02	3.26E-03	6.94E-03	2.26E-03	2.11E-03	0.00E+00	1.52E-02
TPWtr	2.11E-05	9.19E-05	7.02E-04	7.13E-05	6.00E-05	6.29E-05	0.00E+00	7.11E-05
TFWFSp	1.21E-02	2.11E-02	3.06E-03	7.06E-03	2.66E-03	1.51E-03	0.00E+00	8.73E-03
CPWtr	6.06E-05	1.80E-04	1.68E-03	1.38E-04	1.15E-04	1.14E-04	0.00E+00	1.23E-04
CFWFSp	1.50E-02	1.84E-02	3.21E-03	5.94E-03	2.09E-03	5.53E-04	0.00E+00	3.48E-03
IPWtr	6.46E-05	1.97E-04	2.58E-03	1.37E-04	1.14E-04	1.09E-04	0.00E+00	1.17E-04

----- TOTALS -----								
ADULT	1.15E-02	2.07E-02	4.09E-03	7.03E-03	2.34E-03	2.20E-03	0.00E+00	1.53E-02
TEEN	1.22E-02	2.12E-02	3.76E-03	7.13E-03	2.72E-03	1.57E-03	0.00E+00	8.80E-03
CHILD	1.51E-02	1.85E-02	4.89E-03	6.08E-03	2.21E-03	6.67E-04	0.00E+00	3.60E-03
INFANT	6.46E-05	1.97E-04	2.58E-03	1.37E-04	1.14E-04	1.09E-04	0.00E+00	1.17E-04

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
APWtr	ADULT	Potable Water (PWtr)
AFWFSp	ADULT	Fresh Water Fish - Sport (FFSP)
TPWtr	TEEN	Potable Water (PWtr)
TFWFSp	TEEN	Fresh Water Fish - Sport (FFSP)
CPWtr	CHILD	Potable Water (PWtr)
CFWFSp	CHILD	Fresh Water Fish - Sport (FFSP)
IPWtr	INFANT	Potable Water (PWtr)

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: 0 Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB

ADULT								
H-3	0.00E+00	9.96E-05	9.96E-05	9.96E-05	9.96E-05	9.96E-05	0.00E+00	9.96E-05
CR-51	0.00E+00	0.00E+00	2.52E-11	9.30E-12	5.60E-11	1.06E-08	0.00E+00	4.22E-11
MN-54	0.00E+00	2.36E-06	0.00E+00	7.01E-07	0.00E+00	7.22E-06	0.00E+00	4.50E-07
FE-55	1.95E-08	1.35E-08	0.00E+00	0.00E+00	7.51E-09	7.72E-09	0.00E+00	3.14E-09
FE-59	1.97E-08	4.63E-08	0.00E+00	0.00E+00	1.29E-08	1.54E-07	0.00E+00	1.78E-08
CO-58	0.00E+00	2.28E-07	0.00E+00	0.00E+00	0.00E+00	4.63E-06	0.00E+00	5.12E-07
CO-60	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00	2.39E-05	0.00E+00	2.80E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.46E-10	0.00E+00	3.79E-10
RB-86	0.00E+00	2.51E-06	0.00E+00	0.00E+00	0.00E+00	4.94E-07	0.00E+00	1.17E-06
SR-89	1.67E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E-08	0.00E+00	4.80E-09
ZR-95	3.65E-10	1.17E-10	0.00E+00	1.84E-10	0.00E+00	3.71E-07	0.00E+00	7.93E-11
NB-95	4.73E-07	2.63E-07	0.00E+00	2.60E-07	0.00E+00	1.60E-03	0.00E+00	1.41E-07
MO-99	0.00E+00	1.46E-07	0.00E+00	3.30E-07	0.00E+00	3.38E-07	0.00E+00	2.77E-08
TC-99M	1.34E-11	3.77E-11	0.00E+00	5.73E-10	1.85E-11	2.23E-08	0.00E+00	4.81E-10
RU-103	4.45E-10	0.00E+00	0.00E+00	1.70E-09	0.00E+00	5.20E-08	0.00E+00	1.92E-10
RU-106	1.13E-07	0.00E+00	0.00E+00	2.17E-07	0.00E+00	7.29E-06	0.00E+00	1.42E-08
AG-110M	5.15E-10	4.76E-10	0.00E+00	9.36E-10	0.00E+00	1.94E-07	0.00E+00	2.83E-10
TE-127	7.87E-10	2.83E-10	5.83E-10	3.20E-09	0.00E+00	6.21E-08	0.00E+00	1.70E-10
TE-129	4.86E-10	1.83E-10	3.73E-10	2.04E-09	0.00E+00	3.67E-10	0.00E+00	1.18E-10
TE-129M	2.69E-07	1.00E-07	9.24E-08	1.12E-06	0.00E+00	1.36E-06	0.00E+00	4.26E-08
TE-131M	2.88E-08	1.41E-08	2.23E-08	1.43E-07	0.00E+00	1.40E-06	0.00E+00	1.17E-08
TE-132	7.93E-07	5.13E-07	5.66E-07	4.94E-06	0.00E+00	2.43E-05	0.00E+00	4.81E-07
I-130	1.93E-09	5.68E-09	4.82E-07	8.87E-09	0.00E+00	4.89E-09	0.00E+00	2.24E-09
I-131	7.83E-06	1.12E-05	3.67E-03	1.92E-05	0.00E+00	2.96E-06	0.00E+00	6.42E-06
I-132	8.50E-09	2.28E-08	7.96E-07	3.62E-08	0.00E+00	4.27E-09	0.00E+00	7.96E-09
I-133	1.21E-06	2.11E-06	3.10E-04	3.68E-06	0.00E+00	1.90E-06	0.00E+00	6.43E-07
I-135	4.51E-08	1.18E-07	7.78E-06	1.89E-07	0.00E+00	1.33E-07	0.00E+00	4.35E-08
CS-134	4.41E-03	1.05E-02	0.00E+00	3.40E-03	1.13E-03	1.84E-04	0.00E+00	8.58E-03
CS-136	1.14E-04	4.49E-04	0.00E+00	2.50E-04	3.42E-05	5.10E-05	0.00E+00	3.23E-04
CS-137	7.01E-03	9.59E-03	0.00E+00	3.26E-03	1.08E-03	1.86E-04	0.00E+00	6.28E-03
CE-144	1.44E-08	6.02E-09	0.00E+00	3.57E-09	0.00E+00	4.86E-06	0.00E+00	7.72E-10
NP-239	4.71E-13	4.63E-14	0.00E+00	1.44E-13	0.00E+00	9.50E-09	0.00E+00	2.55E-14
TEEN								
H-3	0.00E+00	7.15E-05	7.15E-05	7.15E-05	7.15E-05	7.15E-05	0.00E+00	7.15E-05
CR-51	0.00E+00	0.00E+00	2.41E-11	9.52E-12	6.21E-11	7.30E-09	0.00E+00	4.35E-11
MN-54	0.00E+00	2.32E-06	0.00E+00	6.91E-07	0.00E+00	4.75E-06	0.00E+00	4.59E-07
FE-55	2.04E-08	1.44E-08	0.00E+00	0.00E+00	9.15E-09	6.25E-09	0.00E+00	3.37E-09
FE-59	2.03E-08	4.73E-08	0.00E+00	0.00E+00	1.49E-08	1.12E-07	0.00E+00	1.83E-08

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
CO-58	0.00E+00	2.26E-07	0.00E+00	0.00E+00	0.00E+00	3.11E-06	0.00E+00	5.21E-07
CO-60	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00	1.65E-05	0.00E+00	2.85E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-10
RB-86	0.00E+00	2.70E-06	0.00E+00	0.00E+00	0.00E+00	3.99E-07	0.00E+00	1.27E-06
SR-89	1.80E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E-08	0.00E+00	5.17E-09
ZR-95	3.61E-10	1.14E-10	0.00E+00	1.67E-10	0.00E+00	2.63E-07	0.00E+00	7.83E-11
NB-95	4.76E-07	2.64E-07	0.00E+00	2.56E-07	0.00E+00	1.13E-03	0.00E+00	1.45E-07
MO-99	0.00E+00	1.52E-07	0.00E+00	3.48E-07	0.00E+00	2.72E-07	0.00E+00	2.90E-08
TC-99M	1.35E-11	3.76E-11	0.00E+00	5.60E-10	2.08E-11	2.46E-08	0.00E+00	4.87E-10
RU-103	4.58E-10	0.00E+00	0.00E+00	1.61E-09	0.00E+00	3.82E-08	0.00E+00	1.96E-10
RU-106	1.20E-07	0.00E+00	0.00E+00	2.31E-07	0.00E+00	5.74E-06	0.00E+00	1.51E-08
AG-110M	4.77E-10	4.52E-10	0.00E+00	8.62E-10	0.00E+00	1.27E-07	0.00E+00	2.75E-10
TE-127	8.61E-10	3.05E-10	5.94E-10	3.48E-09	0.00E+00	6.64E-08	0.00E+00	1.85E-10
TE-129	5.28E-10	1.97E-10	3.77E-10	2.21E-09	0.00E+00	2.89E-09	0.00E+00	1.28E-10
TE-129M	2.90E-07	1.08E-07	9.37E-08	1.22E-06	0.00E+00	1.09E-06	0.00E+00	4.60E-08
TE-131M	3.09E-08	1.48E-08	2.23E-08	1.55E-07	0.00E+00	1.19E-06	0.00E+00	1.24E-08
TE-132	8.36E-07	5.29E-07	5.58E-07	5.08E-06	0.00E+00	1.68E-05	0.00E+00	4.98E-07
I-130	1.97E-09	5.70E-09	4.65E-07	8.78E-09	0.00E+00	4.38E-09	0.00E+00	2.27E-09
I-131	8.26E-06	1.16E-05	3.38E-03	1.99E-05	0.00E+00	2.29E-06	0.00E+00	6.21E-06
I-132	8.77E-09	2.29E-08	7.73E-07	3.61E-08	0.00E+00	9.99E-09	0.00E+00	8.23E-09
I-133	1.29E-06	2.18E-06	3.05E-04	3.83E-06	0.00E+00	1.65E-06	0.00E+00	6.66E-07
I-135	4.65E-08	1.20E-07	7.70E-06	1.89E-07	0.00E+00	1.33E-07	0.00E+00	4.44E-08
CS-134	4.52E-03	1.06E-02	0.00E+00	3.38E-03	1.29E-03	1.32E-04	0.00E+00	4.94E-03
CS-136	1.14E-04	4.50E-04	0.00E+00	2.45E-04	3.86E-05	3.62E-05	0.00E+00	3.02E-04
CS-137	7.51E-03	9.99E-03	0.00E+00	3.40E-03	1.32E-03	1.42E-04	0.00E+00	3.48E-03
CE-144	1.46E-08	6.05E-09	0.00E+00	3.61E-09	0.00E+00	3.68E-06	0.00E+00	7.86E-10
NP-239	5.19E-13	4.90E-14	0.00E+00	1.54E-13	0.00E+00	7.88E-09	0.00E+00	2.72E-14
CHILD								
H-3	0.00E+00	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	0.00E+00	1.20E-04
CR-51	0.00E+00	0.00E+00	2.63E-11	7.17E-12	4.79E-11	2.51E-09	0.00E+00	4.73E-11
MN-54	0.00E+00	1.83E-06	0.00E+00	5.13E-07	0.00E+00	1.54E-06	0.00E+00	4.88E-07
FE-55	2.78E-08	1.47E-08	0.00E+00	0.00E+00	8.34E-09	2.73E-09	0.00E+00	4.57E-09
FE-59	2.56E-08	4.14E-08	0.00E+00	0.00E+00	1.20E-08	4.31E-08	0.00E+00	2.06E-08
CO-58	0.00E+00	1.95E-07	0.00E+00	0.00E+00	0.00E+00	1.14E-06	0.00E+00	5.96E-07
CO-60	0.00E+00	1.11E-06	0.00E+00	0.00E+00	0.00E+00	6.14E-06	0.00E+00	3.27E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-10
RB-86	0.00E+00	2.62E-06	0.00E+00	0.00E+00	0.00E+00	1.69E-07	0.00E+00	1.61E-06
SR-89	2.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-08	0.00E+00	7.51E-09
ZR-95	7.22E-10	1.59E-10	0.00E+00	2.27E-10	0.00E+00	1.66E-07	0.00E+00	1.41E-10
NB-95	5.62E-07	2.19E-07	0.00E+00	2.06E-07	0.00E+00	4.05E-04	0.00E+00	1.56E-07

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB

MO-99	0.00E+00	1.90E-07	0.00E+00	4.07E-07	0.00E+00	1.58E-07	0.00E+00	4.71E-08
TC-99M	1.99E-11	3.90E-11	0.00E+00	5.66E-10	1.98E-11	2.22E-08	0.00E+00	6.46E-10
RU-103	7.46E-10	0.00E+00	0.00E+00	1.88E-09	0.00E+00	1.93E-08	0.00E+00	2.87E-10
RU-106	2.03E-07	0.00E+00	0.00E+00	2.74E-07	0.00E+00	3.16E-06	0.00E+00	2.53E-08
AG-110M	9.56E-10	6.46E-10	0.00E+00	1.20E-09	0.00E+00	7.68E-08	0.00E+00	5.16E-10
TE-127	1.12E-09	3.01E-10	7.74E-10	3.18E-09	0.00E+00	4.37E-08	0.00E+00	2.40E-10
TE-129	6.88E-10	1.92E-10	4.91E-10	2.01E-09	0.00E+00	4.28E-08	0.00E+00	1.63E-10
TE-129M	3.78E-07	1.06E-07	1.22E-07	1.11E-06	0.00E+00	4.61E-07	0.00E+00	5.87E-08
TE-131M	3.98E-08	1.38E-08	2.83E-08	1.33E-07	0.00E+00	5.58E-07	0.00E+00	1.46E-08
TE-132	1.05E-06	4.66E-07	6.79E-07	4.33E-06	0.00E+00	4.70E-06	0.00E+00	5.64E-07
I-130	2.96E-09	5.99E-09	6.60E-07	8.95E-09	0.00E+00	2.80E-09	0.00E+00	3.09E-09
I-131	1.29E-05	1.30E-05	4.29E-03	2.13E-05	0.00E+00	1.15E-06	0.00E+00	7.37E-06
I-132	1.33E-08	2.45E-08	1.14E-06	3.75E-08	0.00E+00	2.89E-08	0.00E+00	1.13E-08
I-133	2.01E-06	2.49E-06	4.62E-04	4.15E-06	0.00E+00	1.00E-06	0.00E+00	9.41E-07
I-135	7.09E-08	1.28E-07	1.13E-05	1.96E-07	0.00E+00	9.72E-08	0.00E+00	6.03E-08
CS-134	5.46E-03	8.96E-03	0.00E+00	2.78E-03	9.97E-04	4.83E-05	0.00E+00	1.89E-03
CS-136	1.35E-04	3.71E-04	0.00E+00	1.98E-04	2.95E-05	1.30E-05	0.00E+00	2.40E-04
CS-137	9.47E-03	9.06E-03	0.00E+00	2.95E-03	1.06E-03	5.68E-05	0.00E+00	1.34E-03
CE-144	3.78E-08	1.18E-08	0.00E+00	6.56E-09	0.00E+00	3.09E-06	0.00E+00	2.02E-09
NP-239	8.81E-13	6.32E-14	0.00E+00	1.83E-13	0.00E+00	4.68E-09	0.00E+00	4.45E-14
INFANT								
H-3	0.00E+00	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	0.00E+00	1.05E-04
CR-51	0.00E+00	0.00E+00	1.13E-12	2.46E-13	2.19E-12	5.04E-11	0.00E+00	1.73E-12
MN-54	0.00E+00	4.00E-08	0.00E+00	8.86E-09	0.00E+00	1.47E-08	0.00E+00	9.06E-09
FE-55	1.50E-09	9.66E-10	0.00E+00	0.00E+00	4.73E-10	1.23E-10	0.00E+00	2.58E-10
FE-59	2.13E-09	3.71E-09	0.00E+00	0.00E+00	1.10E-09	1.77E-09	0.00E+00	1.46E-09
CO-58	0.00E+00	3.24E-08	0.00E+00	0.00E+00	0.00E+00	8.08E-08	0.00E+00	8.09E-08
CO-60	0.00E+00	1.89E-07	0.00E+00	0.00E+00	0.00E+00	4.49E-07	0.00E+00	4.45E-07
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E-11
RB-86	0.00E+00	1.58E-08	0.00E+00	0.00E+00	0.00E+00	4.05E-10	0.00E+00	7.83E-09
SR-89	6.40E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-09	0.00E+00	1.84E-09
ZR-95	5.74E-10	1.40E-10	0.00E+00	1.51E-10	0.00E+00	6.96E-08	0.00E+00	9.92E-11
NB-95	1.67E-10	6.89E-11	0.00E+00	4.94E-11	0.00E+00	5.81E-08	0.00E+00	3.98E-11
MO-99	0.00E+00	1.34E-07	0.00E+00	2.00E-07	0.00E+00	4.41E-08	0.00E+00	2.61E-08
TC-99M	8.83E-12	1.82E-11	0.00E+00	1.96E-10	9.52E-12	5.29E-09	0.00E+00	2.35E-10
RU-103	4.15E-10	0.00E+00	0.00E+00	8.65E-10	0.00E+00	5.05E-09	0.00E+00	1.39E-10
RU-106	1.15E-07	0.00E+00	0.00E+00	1.36E-07	0.00E+00	8.73E-07	0.00E+00	1.44E-08
AG-110M	8.72E-10	6.36E-10	0.00E+00	9.10E-10	0.00E+00	3.30E-08	0.00E+00	4.21E-10
TE-127	2.79E-11	9.33E-12	2.27E-11	6.80E-11	0.00E+00	5.85E-10	0.00E+00	5.99E-12
TE-129	1.71E-11	5.90E-12	1.43E-11	4.26E-11	0.00E+00	1.37E-09	0.00E+00	3.99E-12

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
TE-129M	9.11E-09	3.13E-09	3.50E-09	2.28E-08	0.00E+00	5.44E-09	0.00E+00	1.40E-09
TE-131M	9.86E-10	3.97E-10	8.05E-10	2.73E-09	0.00E+00	6.68E-09	0.00E+00	3.28E-10
TE-132	2.55E-08	1.26E-08	1.86E-08	7.89E-08	0.00E+00	4.67E-08	0.00E+00	1.18E-08
I-130	1.30E-09	2.86E-09	3.21E-07	3.14E-09	0.00E+00	6.14E-10	0.00E+00	1.15E-09
I-131	5.75E-06	6.77E-06	2.23E-03	7.91E-06	0.00E+00	2.42E-07	0.00E+00	2.98E-06
I-132	5.92E-09	1.20E-08	5.63E-07	1.34E-08	0.00E+00	9.73E-09	0.00E+00	4.28E-09
I-133	9.08E-07	1.32E-06	2.40E-04	1.55E-06	0.00E+00	2.24E-07	0.00E+00	3.87E-07
I-135	3.15E-08	6.26E-08	5.62E-06	6.98E-08	0.00E+00	2.27E-08	0.00E+00	2.28E-08
CS-134	2.10E-05	3.91E-05	0.00E+00	1.01E-05	4.13E-06	1.06E-07	0.00E+00	3.95E-06
CS-136	6.29E-07	1.85E-06	0.00E+00	7.37E-07	1.51E-07	2.81E-08	0.00E+00	6.90E-07
CS-137	3.60E-05	4.22E-05	0.00E+00	1.13E-05	4.58E-06	1.32E-07	0.00E+00	2.99E-06
CE-144	3.08E-08	1.26E-08	0.00E+00	5.10E-09	0.00E+00	1.77E-06	0.00E+00	1.73E-09
NP-239	5.12E-13	4.58E-14	0.00E+00	9.14E-14	0.00E+00	1.32E-09	0.00E+00	2.59E-14

LIQUID RELEASE AND DOSE SUMMARY REPORT
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Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: 0 Liquid Receptor

=== MAXIMUM DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	TEEN	LIVER	2.12E-02	31-day	1.50E-01	1.41E+01
					Quarter	3.75E+00	5.65E-01
					Annual	7.50E+00	2.82E-01
Admin	Tot Body	ADULT	TBODY	1.53E-02	31-day	4.50E-02	3.40E+01
					Quarter	1.13E+00	1.36E+00
					Annual	2.25E+00	6.80E-01
T.Spec	Any Organ	TEEN	LIVER	2.12E-02	31-day	2.00E-01	1.06E+01
					Quarter	5.00E+00	4.23E-01
					Annual	1.00E+01	2.12E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.38E-01
MN-54	1.09E-02
FE-55	6.82E-05
FE-59	2.23E-04
CO-58	1.07E-03
CO-60	5.98E-03
RB-86	1.27E-02
ZR-95	5.38E-07
NB-95	1.25E-03
MO-99	7.17E-04
TC-99M	1.77E-07
AG-110M	2.13E-06
TE-129	9.29E-07
TE-127	1.44E-06
TE-129M	5.09E-04
TE-131M	7.01E-05
TE-132	2.50E-03
I-130	2.69E-05
I-131	5.46E-02
I-132	1.08E-04
I-133	1.03E-02
I-135	5.66E-04
CS-134	5.03E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
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Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
CS-136	2.12E+00
CS-137	4.72E+01
CE-144	2.86E-05
NP-239	2.31E-10

T.Spec	Tot Body	ADULT	TBODY	1.53E-02	31-day	6.00E-02	2.55E+01
					Quarter	1.50E+00	1.02E+00
					Annual	3.00E+00	5.10E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	6.51E-01
CR-51	2.76E-07
MN-54	2.94E-03
FE-55	2.05E-05
FE-59	1.16E-04
CO-58	3.35E-03
CO-60	1.83E-02
BR-83	2.48E-06
RB-86	7.64E-03
SR-89	3.14E-05
ZR-95	5.18E-07
NB-95	9.24E-04
MO-99	1.81E-04
TC-99M	3.14E-06
RU-103	1.25E-06
RU-106	9.31E-05
AG-110M	1.85E-06
TE-127	1.11E-06
TE-129	7.74E-07
TE-129M	2.78E-04
TE-131M	7.68E-05
TE-132	3.15E-03
I-130	1.47E-05
I-131	4.20E-02
I-132	5.20E-05
I-133	4.20E-03
I-135	2.85E-04
CS-134	5.61E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
CS-136	2.11E+00
CS-137	4.11E+01
CE-144	5.05E-06
NP-239	1.67E-10

ATTACHMENT K

**RETDAS COMPUTER PROGRAM U2 LIQUID ANNUAL DOSE REPORT
BYRON STATION UNIT 2**

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2

=== MULTIPLE RELEASE POINT MESSAGE =====
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA =====
Total Release Duration (minutes)..... 5.256E+05
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA =====
Nuclide uCi

BA-137M 1.01E+04
CR-51 6.16E+01
MN-54 1.01E+03
FE-59 3.47E+01
CO-58 4.53E+03
CO-60 8.77E+03
BR-83 1.76E+01
RB-86 4.68E+01
ZR-95 1.40E+03
NB-95 2.00E+03
MO-99 1.98E+03
TC-99M 2.31E+03
RU-103 1.41E+02
RU-106 2.40E+03
AG-110M 4.40E+02
TE-127 1.40E+01
TE-129 3.03E+01
TE-129M 4.58E+01
TE-131M 3.26E+01
TE-132 6.16E+02
I-130 1.09E+02
I-131 8.04E+04
I-132 1.79E+03
I-133 3.65E+04
I-135 4.35E+03
CS-134 2.79E+04
CS-136 6.88E+03
CS-137 3.47E+04
CE-144 5.20E+03
NP-239 2.32E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

=== NUCLIDE DATA =====
Nuclide uCi

Gamma 2.34E+05

H-3 3.00E+08
FE-55 5.41E+01
SR-89 1.28E+01

Beta 3.00E+08

Total 3.00E+08

Verified By: _____ Date: _____

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: 0 Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
APWtr	2.18E-05	1.17E-04	8.30E-04	9.57E-05	8.30E-05	8.92E-05	0.00E+00	1.07E-04
AFWFSp	1.15E-02	2.05E-02	3.26E-03	6.94E-03	2.26E-03	2.11E-03	0.00E+00	1.52E-02
TPWtr	2.11E-05	9.19E-05	7.02E-04	7.13E-05	6.00E-05	6.29E-05	0.00E+00	7.11E-05
TFWFSp	1.21E-02	2.11E-02	3.06E-03	7.06E-03	2.66E-03	1.51E-03	0.00E+00	8.73E-03
CPWtr	6.06E-05	1.80E-04	1.68E-03	1.38E-04	1.15E-04	1.14E-04	0.00E+00	1.23E-04
CFWFSp	1.50E-02	1.84E-02	3.21E-03	5.94E-03	2.09E-03	5.53E-04	0.00E+00	3.48E-03
IPWtr	6.46E-05	1.97E-04	2.58E-03	1.37E-04	1.14E-04	1.09E-04	0.00E+00	1.17E-04

----- TOTALS -----								
ADULT	1.15E-02	2.07E-02	4.09E-03	7.03E-03	2.34E-03	2.20E-03	0.00E+00	1.53E-02
TEEN	1.22E-02	2.12E-02	3.76E-03	7.13E-03	2.72E-03	1.57E-03	0.00E+00	8.80E-03
CHILD	1.51E-02	1.85E-02	4.89E-03	6.08E-03	2.21E-03	6.67E-04	0.00E+00	3.60E-03
INFANT	6.46E-05	1.97E-04	2.58E-03	1.37E-04	1.14E-04	1.09E-04	0.00E+00	1.17E-04

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
APWtr	ADULT	Potable Water (PWtr)
AFWFSp	ADULT	Fresh Water Fish - Sport (FFSP)
TPWtr	TEEN	Potable Water (PWtr)
TFWFSp	TEEN	Fresh Water Fish - Sport (FFSP)
CPWtr	CHILD	Potable Water (PWtr)
CFWFSp	CHILD	Fresh Water Fish - Sport (FFSP)
IPWtr	INFANT	Potable Water (PWtr)

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: 0 Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====
 Agegroup Bone Liver Thyroid Kidney Lung GI-Lli Skin TB

ADULT

H-3	0.00E+00	9.96E-05	9.96E-05	9.96E-05	9.96E-05	9.96E-05	0.00E+00	9.96E-05
CR-51	0.00E+00	0.00E+00	2.52E-11	9.30E-12	5.60E-11	1.06E-08	0.00E+00	4.22E-11
MN-54	0.00E+00	2.36E-06	0.00E+00	7.01E-07	0.00E+00	7.22E-06	0.00E+00	4.50E-07
FE-55	1.95E-08	1.35E-08	0.00E+00	0.00E+00	7.51E-09	7.72E-09	0.00E+00	3.14E-09
FE-59	1.97E-08	4.63E-08	0.00E+00	0.00E+00	1.29E-08	1.54E-07	0.00E+00	1.78E-08
CO-58	0.00E+00	2.28E-07	0.00E+00	0.00E+00	0.00E+00	4.63E-06	0.00E+00	5.12E-07
CO-60	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00	2.39E-05	0.00E+00	2.80E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.46E-10	0.00E+00	3.79E-10
RB-86	0.00E+00	2.51E-06	0.00E+00	0.00E+00	0.00E+00	4.94E-07	0.00E+00	1.17E-06
SR-89	1.67E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E-08	0.00E+00	4.80E-09
ZR-95	3.65E-10	1.17E-10	0.00E+00	1.84E-10	0.00E+00	3.71E-07	0.00E+00	7.93E-11
NB-95	4.73E-07	2.63E-07	0.00E+00	2.60E-07	0.00E+00	1.60E-03	0.00E+00	1.41E-07
MO-99	0.00E+00	1.46E-07	0.00E+00	3.30E-07	0.00E+00	3.38E-07	0.00E+00	2.77E-08
TC-99M	1.34E-11	3.77E-11	0.00E+00	5.73E-10	1.85E-11	2.23E-08	0.00E+00	4.81E-10
RU-103	4.45E-10	0.00E+00	0.00E+00	1.70E-09	0.00E+00	5.20E-08	0.00E+00	1.92E-10
RU-106	1.13E-07	0.00E+00	0.00E+00	2.17E-07	0.00E+00	7.29E-06	0.00E+00	1.42E-08
AG-110M	5.15E-10	4.76E-10	0.00E+00	9.36E-10	0.00E+00	1.94E-07	0.00E+00	2.83E-10
TE-127	7.87E-10	2.83E-10	5.83E-10	3.20E-09	0.00E+00	6.21E-08	0.00E+00	1.70E-10
TE-129	4.86E-10	1.83E-10	3.73E-10	2.04E-09	0.00E+00	3.67E-10	0.00E+00	1.18E-10
TE-129M	2.69E-07	1.00E-07	9.24E-08	1.12E-06	0.00E+00	1.36E-06	0.00E+00	4.26E-08
TE-131M	2.88E-08	1.41E-08	2.23E-08	1.43E-07	0.00E+00	1.40E-06	0.00E+00	1.17E-08
TE-132	7.93E-07	5.13E-07	5.66E-07	4.94E-06	0.00E+00	2.43E-05	0.00E+00	4.81E-07
I-130	1.93E-09	5.68E-09	4.82E-07	8.87E-09	0.00E+00	4.89E-09	0.00E+00	2.24E-09
I-131	7.83E-06	1.12E-05	3.67E-03	1.92E-05	0.00E+00	2.96E-06	0.00E+00	6.42E-06
I-132	8.50E-09	2.28E-08	7.96E-07	3.62E-08	0.00E+00	4.27E-09	0.00E+00	7.96E-09
I-133	1.21E-06	2.11E-06	3.10E-04	3.68E-06	0.00E+00	1.90E-06	0.00E+00	6.43E-07
I-135	4.51E-08	1.18E-07	7.78E-06	1.89E-07	0.00E+00	1.33E-07	0.00E+00	4.35E-08
CS-134	4.41E-03	1.05E-02	0.00E+00	3.40E-03	1.13E-03	1.84E-04	0.00E+00	8.58E-03
CS-136	1.14E-04	4.49E-04	0.00E+00	2.50E-04	3.42E-05	5.10E-05	0.00E+00	3.23E-04
CS-137	7.01E-03	9.59E-03	0.00E+00	3.26E-03	1.08E-03	1.86E-04	0.00E+00	6.28E-03
CE-144	1.44E-08	6.02E-09	0.00E+00	3.57E-09	0.00E+00	4.86E-06	0.00E+00	7.72E-10
NP-239	4.71E-13	4.63E-14	0.00E+00	1.44E-13	0.00E+00	9.50E-09	0.00E+00	2.55E-14

TEEN

H-3	0.00E+00	7.15E-05	7.15E-05	7.15E-05	7.15E-05	7.15E-05	0.00E+00	7.15E-05
CR-51	0.00E+00	0.00E+00	2.41E-11	9.52E-12	6.21E-11	7.30E-09	0.00E+00	4.35E-11
MN-54	0.00E+00	2.32E-06	0.00E+00	6.91E-07	0.00E+00	4.75E-06	0.00E+00	4.59E-07
FE-55	2.04E-08	1.44E-08	0.00E+00	0.00E+00	9.15E-09	6.25E-09	0.00E+00	3.37E-09
FE-59	2.03E-08	4.73E-08	0.00E+00	0.00E+00	1.49E-08	1.12E-07	0.00E+00	1.83E-08

LIQUID RELEASE AND DOSE SUMMARY REPORT

----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases

Period Start Date.....: 01/01/2017 00:00

Period End Date.....: 01/01/2018 00:00

Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
CO-58	0.00E+00	2.26E-07	0.00E+00	0.00E+00	0.00E+00	3.11E-06	0.00E+00	5.21E-07
CO-60	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00	1.65E-05	0.00E+00	2.85E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-10
RB-86	0.00E+00	2.70E-06	0.00E+00	0.00E+00	0.00E+00	3.99E-07	0.00E+00	1.27E-06
SR-89	1.80E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E-08	0.00E+00	5.17E-09
ZR-95	3.61E-10	1.14E-10	0.00E+00	1.67E-10	0.00E+00	2.63E-07	0.00E+00	7.83E-11
NB-95	4.76E-07	2.64E-07	0.00E+00	2.56E-07	0.00E+00	1.13E-03	0.00E+00	1.45E-07
MO-99	0.00E+00	1.52E-07	0.00E+00	3.48E-07	0.00E+00	2.72E-07	0.00E+00	2.90E-08
TC-99M	1.35E-11	3.76E-11	0.00E+00	5.60E-10	2.08E-11	2.46E-08	0.00E+00	4.87E-10
RU-103	4.58E-10	0.00E+00	0.00E+00	1.61E-09	0.00E+00	3.82E-08	0.00E+00	1.96E-10
RU-106	1.20E-07	0.00E+00	0.00E+00	2.31E-07	0.00E+00	5.74E-06	0.00E+00	1.51E-08
AG-110M	4.77E-10	4.52E-10	0.00E+00	8.62E-10	0.00E+00	1.27E-07	0.00E+00	2.75E-10
TE-127	8.61E-10	3.05E-10	5.94E-10	3.48E-09	0.00E+00	6.64E-08	0.00E+00	1.85E-10
TE-129	5.28E-10	1.97E-10	3.77E-10	2.21E-09	0.00E+00	2.89E-09	0.00E+00	1.28E-10
TE-129M	2.90E-07	1.08E-07	9.37E-08	1.22E-06	0.00E+00	1.09E-06	0.00E+00	4.60E-08
TE-131M	3.09E-08	1.48E-08	2.23E-08	1.55E-07	0.00E+00	1.19E-06	0.00E+00	1.24E-08
TE-132	8.36E-07	5.29E-07	5.58E-07	5.08E-06	0.00E+00	1.68E-05	0.00E+00	4.98E-07
I-130	1.97E-09	5.70E-09	4.65E-07	8.78E-09	0.00E+00	4.38E-09	0.00E+00	2.27E-09
I-131	8.26E-06	1.16E-05	3.38E-03	1.99E-05	0.00E+00	2.29E-06	0.00E+00	6.21E-06
I-132	8.77E-09	2.29E-08	7.73E-07	3.61E-08	0.00E+00	9.99E-09	0.00E+00	8.23E-09
I-133	1.29E-06	2.18E-06	3.05E-04	3.83E-06	0.00E+00	1.65E-06	0.00E+00	6.66E-07
I-135	4.65E-08	1.20E-07	7.70E-06	1.89E-07	0.00E+00	1.33E-07	0.00E+00	4.44E-08
CS-134	4.52E-03	1.06E-02	0.00E+00	3.38E-03	1.29E-03	1.32E-04	0.00E+00	4.94E-03
CS-136	1.14E-04	4.50E-04	0.00E+00	2.45E-04	3.86E-05	3.62E-05	0.00E+00	3.02E-04
CS-137	7.51E-03	9.99E-03	0.00E+00	3.40E-03	1.32E-03	1.42E-04	0.00E+00	3.48E-03
CE-144	1.46E-08	6.05E-09	0.00E+00	3.61E-09	0.00E+00	3.68E-06	0.00E+00	7.86E-10
NP-239	5.19E-13	4.90E-14	0.00E+00	1.54E-13	0.00E+00	7.88E-09	0.00E+00	2.72E-14
CHILD								
H-3	0.00E+00	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	0.00E+00	1.20E-04
CR-51	0.00E+00	0.00E+00	2.63E-11	7.17E-12	4.79E-11	2.51E-09	0.00E+00	4.73E-11
MN-54	0.00E+00	1.83E-06	0.00E+00	5.13E-07	0.00E+00	1.54E-06	0.00E+00	4.88E-07
FE-55	2.78E-08	1.47E-08	0.00E+00	0.00E+00	8.34E-09	2.73E-09	0.00E+00	4.57E-09
FE-59	2.56E-08	4.14E-08	0.00E+00	0.00E+00	1.20E-08	4.31E-08	0.00E+00	2.06E-08
CO-58	0.00E+00	1.95E-07	0.00E+00	0.00E+00	0.00E+00	1.14E-06	0.00E+00	5.96E-07
CO-60	0.00E+00	1.11E-06	0.00E+00	0.00E+00	0.00E+00	6.14E-06	0.00E+00	3.27E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-10
RB-86	0.00E+00	2.62E-06	0.00E+00	0.00E+00	0.00E+00	1.69E-07	0.00E+00	1.61E-06
SR-89	2.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-08	0.00E+00	7.51E-09
ZR-95	7.22E-10	1.59E-10	0.00E+00	2.27E-10	0.00E+00	1.66E-07	0.00E+00	1.41E-10
NB-95	5.62E-07	2.19E-07	0.00E+00	2.06E-07	0.00E+00	4.05E-04	0.00E+00	1.56E-07

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
MO-99	0.00E+00	1.90E-07	0.00E+00	4.07E-07	0.00E+00	1.58E-07	0.00E+00	4.71E-08
TC-99M	1.99E-11	3.90E-11	0.00E+00	5.66E-10	1.98E-11	2.22E-08	0.00E+00	6.46E-10
RU-103	7.46E-10	0.00E+00	0.00E+00	1.88E-09	0.00E+00	1.93E-08	0.00E+00	2.87E-10
RU-106	2.03E-07	0.00E+00	0.00E+00	2.74E-07	0.00E+00	3.16E-06	0.00E+00	2.53E-08
AG-110M	9.56E-10	6.46E-10	0.00E+00	1.20E-09	0.00E+00	7.68E-08	0.00E+00	5.16E-10
TE-127	1.12E-09	3.01E-10	7.74E-10	3.18E-09	0.00E+00	4.37E-08	0.00E+00	2.40E-10
TE-129	6.88E-10	1.92E-10	4.91E-10	2.01E-09	0.00E+00	4.28E-08	0.00E+00	1.63E-10
TE-129M	3.78E-07	1.06E-07	1.22E-07	1.11E-06	0.00E+00	4.61E-07	0.00E+00	5.87E-08
TE-131M	3.98E-08	1.38E-08	2.83E-08	1.33E-07	0.00E+00	5.58E-07	0.00E+00	1.46E-08
TE-132	1.05E-06	4.66E-07	6.79E-07	4.33E-06	0.00E+00	4.70E-06	0.00E+00	5.64E-07
I-130	2.96E-09	5.99E-09	6.60E-07	8.95E-09	0.00E+00	2.80E-09	0.00E+00	3.09E-09
I-131	1.29E-05	1.30E-05	4.29E-03	2.13E-05	0.00E+00	1.15E-06	0.00E+00	7.37E-06
I-132	1.33E-08	2.45E-08	1.14E-06	3.75E-08	0.00E+00	2.89E-08	0.00E+00	1.13E-08
I-133	2.01E-06	2.49E-06	4.62E-04	4.15E-06	0.00E+00	1.00E-06	0.00E+00	9.41E-07
I-135	7.09E-08	1.28E-07	1.13E-05	1.96E-07	0.00E+00	9.72E-08	0.00E+00	6.03E-08
CS-134	5.46E-03	8.96E-03	0.00E+00	2.78E-03	9.97E-04	4.83E-05	0.00E+00	1.89E-03
CS-136	1.35E-04	3.71E-04	0.00E+00	1.98E-04	2.95E-05	1.30E-05	0.00E+00	2.40E-04
CS-137	9.47E-03	9.06E-03	0.00E+00	2.95E-03	1.06E-03	5.68E-05	0.00E+00	1.34E-03
CE-144	3.78E-08	1.18E-08	0.00E+00	6.56E-09	0.00E+00	3.09E-06	0.00E+00	2.02E-09
NP-239	8.81E-13	6.32E-14	0.00E+00	1.83E-13	0.00E+00	4.68E-09	0.00E+00	4.45E-14

INFANT

H-3	0.00E+00	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	0.00E+00	1.05E-04
CR-51	0.00E+00	0.00E+00	1.13E-12	2.46E-13	2.19E-12	5.04E-11	0.00E+00	1.73E-12
MN-54	0.00E+00	4.00E-08	0.00E+00	8.86E-09	0.00E+00	1.47E-08	0.00E+00	9.06E-09
FE-55	1.50E-09	9.66E-10	0.00E+00	0.00E+00	4.73E-10	1.23E-10	0.00E+00	2.58E-10
FE-59	2.13E-09	3.71E-09	0.00E+00	0.00E+00	1.10E-09	1.77E-09	0.00E+00	1.46E-09
CO-58	0.00E+00	3.24E-08	0.00E+00	0.00E+00	0.00E+00	8.08E-08	0.00E+00	8.09E-08
CO-60	0.00E+00	1.89E-07	0.00E+00	0.00E+00	0.00E+00	4.49E-07	0.00E+00	4.45E-07
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E-11
RB-86	0.00E+00	1.58E-08	0.00E+00	0.00E+00	0.00E+00	4.05E-10	0.00E+00	7.83E-09
SR-89	6.40E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-09	0.00E+00	1.84E-09
ZR-95	5.74E-10	1.40E-10	0.00E+00	1.51E-10	0.00E+00	6.96E-08	0.00E+00	9.92E-11
NB-95	1.67E-10	6.89E-11	0.00E+00	4.94E-11	0.00E+00	5.81E-08	0.00E+00	3.98E-11
MO-99	0.00E+00	1.34E-07	0.00E+00	2.00E-07	0.00E+00	4.41E-08	0.00E+00	2.61E-08
TC-99M	8.83E-12	1.82E-11	0.00E+00	1.96E-10	9.52E-12	5.29E-09	0.00E+00	2.35E-10
RU-103	4.15E-10	0.00E+00	0.00E+00	8.65E-10	0.00E+00	5.05E-09	0.00E+00	1.39E-10
RU-106	1.15E-07	0.00E+00	0.00E+00	1.36E-07	0.00E+00	8.73E-07	0.00E+00	1.44E-08
AG-110M	8.72E-10	6.36E-10	0.00E+00	9.10E-10	0.00E+00	3.30E-08	0.00E+00	4.21E-10
TE-127	2.79E-11	9.33E-12	2.27E-11	6.80E-11	0.00E+00	5.85E-10	0.00E+00	5.99E-12
TE-129	1.71E-11	5.90E-12	1.43E-11	4.26E-11	0.00E+00	1.37E-09	0.00E+00	3.99E-12

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
-----	-----	-----	-----	-----	-----	-----	-----	-----
TE-129M	9.11E-09	3.13E-09	3.50E-09	2.28E-08	0.00E+00	5.44E-09	0.00E+00	1.40E-09
TE-131M	9.86E-10	3.97E-10	8.05E-10	2.73E-09	0.00E+00	6.68E-09	0.00E+00	3.28E-10
TE-132	2.55E-08	1.26E-08	1.86E-08	7.89E-08	0.00E+00	4.67E-08	0.00E+00	1.18E-08
I-130	1.30E-09	2.86E-09	3.21E-07	3.14E-09	0.00E+00	6.14E-10	0.00E+00	1.15E-09
I-131	5.75E-06	6.77E-06	2.23E-03	7.91E-06	0.00E+00	2.42E-07	0.00E+00	2.98E-06
I-132	5.92E-09	1.20E-08	5.63E-07	1.34E-08	0.00E+00	9.73E-09	0.00E+00	4.28E-09
I-133	9.08E-07	1.32E-06	2.40E-04	1.55E-06	0.00E+00	2.24E-07	0.00E+00	3.87E-07
I-135	3.15E-08	6.26E-08	5.62E-06	6.98E-08	0.00E+00	2.27E-08	0.00E+00	2.28E-08
CS-134	2.10E-05	3.91E-05	0.00E+00	1.01E-05	4.13E-06	1.06E-07	0.00E+00	3.95E-06
CS-136	6.29E-07	1.85E-06	0.00E+00	7.37E-07	1.51E-07	2.81E-08	0.00E+00	6.90E-07
CS-137	3.60E-05	4.22E-05	0.00E+00	1.13E-05	4.58E-06	1.32E-07	0.00E+00	2.99E-06
CE-144	3.08E-08	1.26E-08	0.00E+00	5.10E-09	0.00E+00	1.77E-06	0.00E+00	1.73E-09
NP-239	5.12E-13	4.58E-14	0.00E+00	9.14E-14	0.00E+00	1.32E-09	0.00E+00	2.59E-14

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: 0 Liquid Receptor

=== MAXIMUM DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	TEEN	LIVER	2.12E-02	31-day	1.50E-01	1.41E+01
					Quarter	3.75E+00	5.65E-01
					Annual	7.50E+00	2.82E-01
Admin	Tot Body	ADULT	TBODY	1.53E-02	31-day	4.50E-02	3.40E+01
					Quarter	1.13E+00	1.36E+00
					Annual	2.25E+00	6.80E-01
T.Spec	Any Organ	TEEN	LIVER	2.12E-02	31-day	2.00E-01	1.06E+01
					Quarter	5.00E+00	4.23E-01
					Annual	1.00E+01	2.12E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.38E-01
MN-54	1.09E-02
FE-55	6.82E-05
FE-59	2.23E-04
CO-58	1.07E-03
CO-60	5.98E-03
RB-86	1.27E-02
ZR-95	5.38E-07
NB-95	1.25E-03
MO-99	7.17E-04
TC-99M	1.77E-07
AG-110M	2.13E-06
TE-129	9.29E-07
TE-127	1.44E-06
TE-129M	5.09E-04
TE-131M	7.01E-05
TE-132	2.50E-03
I-130	2.69E-05
I-131	5.46E-02
I-132	1.08E-04
I-133	1.03E-02
I-135	5.66E-04
CS-134	5.03E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
CS-136	2.12E+00
CS-137	4.72E+01
CE-144	2.86E-05
NP-239	2.31E-10

T.Spec	Tot Body	ADULT	TBODY	1.53E-02	31-day	6.00E-02	2.55E+01
					Quarter	1.50E+00	1.02E+00
					Annual	3.00E+00	5.10E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	6.51E-01
CR-51	2.76E-07
MN-54	2.94E-03
FE-55	2.05E-05
FE-59	1.16E-04
CO-58	3.35E-03
CO-60	1.83E-02
BR-83	2.48E-06
RB-86	7.64E-03
SR-89	3.14E-05
ZR-95	5.18E-07
NB-95	9.24E-04
MO-99	1.81E-04
TC-99M	3.14E-06
RU-103	1.25E-06
RU-106	9.31E-05
AG-110M	1.85E-06
TE-127	1.11E-06
TE-129	7.74E-07
TE-129M	2.78E-04
TE-131M	7.68E-05
TE-132	3.15E-03
I-130	1.47E-05
I-131	4.20E-02
I-132	5.20E-05
I-133	4.20E-03
I-135	2.85E-04
CS-134	5.61E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
CS-136	2.11E+00
CS-137	4.11E+01
CE-144	5.05E-06
NP-239	1.67E-10

ATTACHMENT L

**RETDAS COMPUTER PROGRAM 40CFR190 (UNFILTERED) ANNUAL
DOSE REPORT
BYRON STATION UNIT 1 AND UNIT 2**

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === ANNUAL 2017 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	2.31E-02	4.13E-02	8.18E-03	1.41E-02	4.69E-03	4.39E-03	0.00E+00	3.06E-02
TEEN	2.43E-02	4.23E-02	7.52E-03	1.43E-02	5.44E-03	3.14E-03	0.00E+00	1.76E-02
CHILD	3.02E-02	3.71E-02	9.77E-03	1.22E-02	4.42E-03	1.33E-03	0.00E+00	7.21E-03
INFANT	1.29E-04	3.94E-04	5.16E-03	2.74E-04	2.28E-04	2.19E-04	0.00E+00	2.33E-04

=== SITE DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2017 - Admin. Any Organ	TEEN	LIVER	4.23E-02	7.50E+00	5.65E-01
2017 - Admin. Total Body	ADULT	TBODY	3.06E-02	2.25E+00	1.36E+00

2017 - T.Spc. Any Organ TEEN LIVER 4.23E-02 1.00E+01 4.23E-01

Critical Pathway: Freshwater fish

Major Contributors (0% or greater to total)

Nuclide Percentage

Nuclide	Percentage
H-3	3.38E-01
MN-54	1.09E-02
FE-55	6.82E-05
FE-59	2.23E-04
CO-58	1.07E-03
CO-60	5.98E-03
RB-86	1.27E-02
ZR-95	5.38E-07
NB-95	1.25E-03
MO-99	7.17E-04
TC-99M	1.77E-07
AG-110M	2.13E-06
TE-127	1.44E-06
TE-129	9.29E-07
TE-129M	5.09E-04
TE-131M	7.01E-05
TE-132	2.50E-03
I-130	2.69E-05
I-131	5.46E-02
I-132	1.08E-04
I-133	1.03E-02
I-135	5.66E-04
CS-134	5.03E+01
CS-136	2.12E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
CS-137	4.72E+01
CE-144	2.86E-05
NP-239	2.31E-10

2017 - T.Spc. Total Body ADULT TBody 3.06E-02 3.00E+00 1.02E+00

Critical Pathway: Freshwater fish

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	6.51E-01
CR-51	2.76E-07
MN-54	2.94E-03
FE-55	2.05E-05
FE-59	1.16E-04
CO-58	3.35E-03
CO-60	1.83E-02
BR-83	2.48E-06
RB-86	7.64E-03
SR-89	3.14E-05
ZR-95	5.18E-07
NB-95	9.24E-04
MO-99	1.81E-04
TC-99M	3.14E-06
RU-103	1.25E-06
RU-106	9.31E-05
AG-110M	1.85E-06
TE-127	1.11E-06
TE-129	7.74E-07
TE-129M	2.78E-04
TE-131M	7.68E-05
TE-132	3.15E-03
I-130	1.47E-05
I-131	4.20E-02
I-132	5.20E-05
I-133	4.20E-03
I-135	2.85E-04
CS-134	5.61E+01
CS-136	2.11E+00
CS-137	4.11E+01
CE-144	5.05E-06
NP-239	1.67E-10

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS ===== ANNUAL 2017 =====

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2017 - Admin. Any Organ	INFANT	THYROID	1.96E+01	1.13E+01	1.75E+02
2017 - Admin. Total Body	CHILD	TBODY	5.05E-01	1.05E+01	4.81E+00

2017 - T.Spc. Any Organ	INFANT	THYROID	1.96E+01	1.50E+01	1.31E+02
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Receptor: 5 Composite Crit. Receptor - IP

Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Grs/Cow/Milk

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	2.51E-01
C-14	8.05E-01
MN-54	7.90E-03
FE-59	5.29E-04
CO-58	7.37E-03
CO-60	1.90E-01
SR-89	8.89E-09
SR-90	0.00E+00
I-131	9.72E+01
I-133	1.34E+00
CS-134	3.96E-02
CS-137	1.66E-01

2017 - T.Spc. Total Body	CHILD	TBODY	5.05E-01	1.50E+01	3.37E+00
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Receptor: 5 Composite Crit. Receptor - IP

Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	2.24E+01
C-14	5.15E+01
MN-54	3.49E-01
FE-59	7.51E-02
CO-58	5.02E-01
CO-60	7.89E+00
SR-89	1.97E-02
SR-90	1.21E-01
I-131	3.07E+00
I-133	6.78E-02

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
-----	-----
CS-134	4.59E+00
CS-137	9.47E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
2017 - Admin. Gamma	1.31E-01	7.50E+00	1.75E+00
2017 - Admin. Beta	1.05E-01	1.50E+01	7.02E-01

2017 - T.Spc. Gamma	1.31E-01	1.00E+01	1.31E+00
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Receptor: 4 Composite Crit. Receptor - NG

Distance: 800 (meters) Compass Point: SSE

Nuclide Percentage

AR-41	2.05E+01
KR-85	1.06E+00
XE-138	8.14E-01
KR-87	5.45E-01
KR-85M	5.42E-01
XE-135	2.54E+00
XE-133M	4.33E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133	6.23E+01

2017 - T.Spc. Beta	1.05E-01	2.00E+01	5.27E-01
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Receptor: 4 Composite Crit. Receptor - NG

Distance: 800 (meters) Compass Point: SSE

Nuclide Percentage

AR-41	2.21E+00
KR-85	3.69E+01
XE-138	1.29E-01
KR-87	2.79E-01
KR-85M	2.66E-01
XE-135	9.98E-01
XE-133M	6.00E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133	5.68E+01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Units 1 & 2

Report for: 2017
 Unit Range - From: 1 To: 2

=== MAXIMUM DOSE ANALYSIS === ANNUAL 2017 ===

Dose Type	Age Group	Organ	Dose (mrem)
Any Organ	INFANT	THYROID	1.97E+01
Liquid Receptor: 0	Liquid Receptor		
Gaseous Receptor: 5	Composite Crit. Receptor - IP		
Distance: 800 (meters)	Compass Point: SSE		

Liquid Dose: 5.16E-03 % of Total: 2.62E-02

Critical Pathway: Potable Water (PWtr)

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	4.08E+00
CR-51	4.37E-08
MN-54	0.00E+00
FE-55	0.00E+00
FE-59	0.00E+00
CO-58	0.00E+00
CO-60	0.00E+00
BR-83	0.00E+00
RB-86	0.00E+00
SR-89	0.00E+00
ZR-95	0.00E+00
NB-95	0.00E+00
MO-99	0.00E+00
TC-99M	0.00E+00
RU-103	0.00E+00
RU-106	0.00E+00
AG-110M	0.00E+00
TE-127	8.80E-07
TE-129	5.56E-07
TE-129M	1.36E-04
TE-131M	3.12E-05
TE-132	7.23E-04
I-130	1.24E-02
I-131	8.63E+01
I-132	2.18E-02
I-133	9.32E+00
I-135	2.18E-01
CS-134	0.00E+00
CS-136	0.00E+00
CS-137	0.00E+00
CE-144	0.00E+00
NP-239	0.00E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

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Gaseous Dose:      1.96E+01      % of Total: 9.97E+01
Critical Pathway:  Grs/Cow/Milk (CMILK)
Major Contributors (0% or greater to total)
Nuclide            Percentage
-----
H-3                2.51E-01
C-14               8.05E-01
MN-54              7.90E-03
FE-59              5.29E-04
CO-58              7.37E-03
CO-60              1.90E-01
SR-89              8.89E-09
SR-90              0.00E+00
I-131              9.72E+01
I-133              1.34E+00
CS-134             3.96E-02
CS-137             1.66E-01

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=== MAXIMUM DOSE ANALYSIS ===== ANNUAL 2017 =====

Dose Type	Age Group	Organ	Dose (mrem)
Total Body	CHILD	TBODY	5.12E-01

Liquid Receptor: 0 Liquid Receptor
 Gaseous Receptor: 5 Composite Crit. Receptor - IP
 Distance: 800 (meters) Compass Point: SSE

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Liquid Dose:      7.21E-03      % of Total: 1.41E+00
Critical Pathway:  Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)
Nuclide            Percentage
-----
H-3                3.33E+00
CR-51              1.31E-06
MN-54              1.35E-02
FE-55              1.27E-04
FE-59              5.72E-04
CO-58              1.65E-02
CO-60              9.07E-02
BR-83              1.48E-05
RB-86              4.47E-02
SR-89              2.08E-04
ZR-95              3.92E-06
NB-95              4.34E-03
MO-99              1.31E-03
TC-99M             1.79E-05
RU-103             7.96E-06
RU-106             7.03E-04
AG-110M            1.43E-05
TE-127             6.65E-06

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40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
---------	------------

TE-129	4.53E-06
TE-129M	1.63E-03
TE-131M	4.06E-04
TE-132	1.56E-02
I-130	8.56E-05
I-131	2.05E-01
I-132	3.13E-04
I-133	2.61E-02
I-135	1.67E-03
CS-134	5.25E+01
CS-136	6.67E+00
CS-137	3.71E+01
CE-144	5.59E-05
NP-239	1.23E-09

Gaseous Dose: 5.05E-01 % of Total: 9.87E+01

Critical Pathway: Vegetation (VEG)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	2.24E+01
C-14	5.15E+01
MN-54	3.49E-01
FE-59	7.51E-02
CO-58	5.02E-01
CO-60	7.89E+00
SR-89	1.97E-02
SR-90	1.21E-01
I-131	3.07E+00
I-133	6.78E-02
CS-134	4.59E+00
CS-137	9.47E+00

ATTACHMENT M

**RETDAS COMPUTER PROGRAM 40CFR190 (FILTERED) ANNUAL
DOSE REPORT**

BYRON STATION UNIT 1 AND UNIT 2

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

								Liquid Receptor
=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === ANNUAL 2017 ===								
Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	2.31E-02	4.13E-02	8.18E-03	1.41E-02	4.69E-03	4.39E-03	0.00E+00	3.06E-02
TEEN	2.43E-02	4.23E-02	7.52E-03	1.43E-02	5.44E-03	3.14E-03	0.00E+00	1.76E-02
CHILD	3.02E-02	3.71E-02	9.77E-03	1.22E-02	4.42E-03	1.33E-03	0.00E+00	7.21E-03
INFANT	1.29E-04	3.94E-04	5.16E-03	2.74E-04	2.28E-04	2.19E-04	0.00E+00	2.33E-04

=== SITE DOSE LIMIT ANALYSIS === ANNUAL 2017 ===						
Annual - Limit		Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2017 - Admin. Any Organ		TEEN	LIVER	4.23E-02	7.50E+00	5.65E-01
2017 - Admin. Total Body		ADULT	TBODY	3.06E-02	2.25E+00	1.36E+00

2017 - T.Spc. Any Organ TEEN LIVER 4.23E-02 1.00E+01 4.23E-01

Critical Pathway: Freshwater fish

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	3.38E-01
MN-54	1.09E-02
FE-55	6.82E-05
FE-59	2.23E-04
CO-58	1.07E-03
CO-60	5.98E-03
RB-86	1.27E-02
ZR-95	5.38E-07
NB-95	1.25E-03
MO-99	7.17E-04
TC-99M	1.77E-07
AG-110M	2.13E-06
TE-127	1.44E-06
TE-129	9.29E-07
TE-129M	5.09E-04
TE-131M	7.01E-05
TE-132	2.50E-03
I-130	2.69E-05
I-131	5.46E-02
I-132	1.08E-04
I-133	1.03E-02
I-135	5.66E-04
CS-134	5.03E+01
CS-136	2.12E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
-----	-----
CS-137	4.72E+01
CE-144	2.86E-05
NP-239	2.31E-10

2017 - T.Spc. Total Body ADULT TBODY 3.06E-02 3.00E+00 1.02E+00

Critical Pathway: Freshwater fish

Major Contributors (0% or greater to total)

Nuclide	Percentage
-----	-----
H-3	6.51E-01
CR-51	2.76E-07
MN-54	2.94E-03
FE-55	2.05E-05
FE-59	1.16E-04
CO-58	3.35E-03
CO-60	1.83E-02
BR-83	2.48E-06
RB-86	7.64E-03
SR-89	3.14E-05
ZR-95	5.18E-07
NB-95	9.24E-04
MO-99	1.81E-04
TC-99M	3.14E-06
RU-103	1.25E-06
RU-106	9.31E-05
AG-110M	1.85E-06
TE-127	1.11E-06
TE-129	7.74E-07
TE-129M	2.78E-04
TE-131M	7.68E-05
TE-132	3.15E-03
I-130	1.47E-05
I-131	4.20E-02
I-132	5.20E-05
I-133	4.20E-03
I-135	2.85E-04
CS-134	5.61E+01
CS-136	2.11E+00
CS-137	4.11E+01
CE-144	5.05E-06
NP-239	1.67E-10

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2017 - Admin. Any Organ	INFANT	THYROID	1.33E+01	1.13E+01	1.18E+02
2017 - Admin. Total Body	CHILD	TBODY	5.00E-01	1.05E+01	4.76E+00

2017 - T.Spc. Any Organ	INFANT	THYROID	1.33E+01	1.50E+01	8.85E+01
-------------------------	--------	---------	----------	----------	----------

Receptor: 5 Composite Crit. Receptor - IP
 Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Grs/Cow/Milk

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	3.71E-01
C-14	1.19E+00
MN-54	1.17E-02
FE-59	7.83E-04
CO-58	1.09E-02
CO-60	2.81E-01
SR-89	1.32E-08
SR-90	0.00E+00
I-131	9.66E+01
I-133	1.26E+00
CS-134	5.86E-02
CS-137	2.46E-01

2017 - T.Spc. Total Body	CHILD	TBODY	5.00E-01	1.50E+01	3.33E+00
--------------------------	-------	-------	----------	----------	----------

Receptor: 5 Composite Crit. Receptor - IP
 Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	2.26E+01
C-14	5.20E+01
MN-54	3.52E-01
FE-59	7.58E-02
CO-58	5.07E-01
CO-60	7.98E+00
SR-89	1.99E-02
SR-90	1.22E-01
I-131	2.08E+00
I-133	4.36E-02

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide -----	Percentage -----
CS-134	4.64E+00
CS-137	9.56E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
2017 - Admin. Gamma	1.31E-01	7.50E+00	1.75E+00
2017 - Admin. Beta	1.05E-01	1.50E+01	7.02E-01

2017 - T.Spc. Gamma	1.31E-01	1.00E+01	1.31E+00
---------------------	----------	----------	----------

Receptor: 4 Composite Crit. Receptor - NG

Distance: 800 (meters) Compass Point: SSE

Nuclide Percentage

AR-41	2.05E+01
KR-85	1.06E+00
XE-138	8.14E-01
KR-87	5.45E-01
KR-85M	5.42E-01
XE-135	2.54E+00
XE-133M	4.33E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133	6.23E+01

2017 - T.Spc. Beta	1.05E-01	2.00E+01	5.27E-01
--------------------	----------	----------	----------

Receptor: 4 Composite Crit. Receptor - NG

Distance: 800 (meters) Compass Point: SSE

Nuclide Percentage

AR-41	2.21E+00
KR-85	3.69E+01
XE-138	1.29E-01
KR-87	2.79E-01
KR-85M	2.66E-01
XE-135	9.98E-01
XE-133M	6.00E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133	5.68E+01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== MAXIMUM DOSE ANALYSIS === ANNUAL 2017 ===

Dose Type	Age Group	Organ	Dose (mrem)
Any Organ	INFANT	THYROID	1.33E+01
Liquid Receptor: 0		Liquid Receptor	
Gaseous Receptor: 5		Composite Crit. Receptor - IP	
Distance: 800 (meters)		Compass Point: SSE	

Liquid Dose: 5.16E-03 % of Total: 3.88E-02

Critical Pathway: Potable Water (PWtr)

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	4.08E+00
CR-51	4.37E-08
MN-54	0.00E+00
FE-55	0.00E+00
FE-59	0.00E+00
CO-58	0.00E+00
CO-60	0.00E+00
BR-83	0.00E+00
RB-86	0.00E+00
SR-89	0.00E+00
ZR-95	0.00E+00
NB-95	0.00E+00
MO-99	0.00E+00
TC-99M	0.00E+00
RU-103	0.00E+00
RU-106	0.00E+00
AG-110M	0.00E+00
TE-127	8.80E-07
TE-129	5.56E-07
TE-129M	1.36E-04
TE-131M	3.12E-05
TE-132	7.23E-04
I-130	1.24E-02
I-131	8.63E+01
I-132	2.18E-02
I-133	9.32E+00
I-135	2.18E-01
CS-134	0.00E+00
CS-136	0.00E+00
CS-137	0.00E+00
CE-144	0.00E+00
NP-239	0.00E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Gaseous Dose: 1.33E+01 % of Total: 9.98E+01
 Critical Pathway: Grs/Cow/Milk (CMILK)
 Major Contributors (0% or greater to total)

Nuclide	Percentage
-----	-----
H-3	3.71E-01
C-14	1.19E+00
MN-54	1.17E-02
FE-59	7.83E-04
CO-58	1.09E-02
CO-60	2.81E-01
SR-89	1.32E-08
SR-90	0.00E+00
I-131	9.66E+01
I-133	1.26E+00
CS-134	5.86E-02
CS-137	2.46E-01

=== MAXIMUM DOSE ANALYSIS ===== ANNUAL 2017 =====

Dose Type	Age Group	Organ	Dose (mrem)
-----	-----	-----	-----
Total Body	CHILD	TBODY	5.07E-01
Liquid Receptor: 0	Liquid Receptor		
Gaseous Receptor: 5	Composite Crit. Receptor - IP		
Distance: 800 (meters)	Compass Point: SSE		

Liquid Dose: 7.21E-03 % of Total: 1.42E+00
 Critical Pathway: Fresh Water Fish - Sport (FFSP)
 Major Contributors (0% or greater to total)

Nuclide	Percentage
-----	-----
H-3	3.33E+00
CR-51	1.31E-06
MN-54	1.35E-02
FE-55	1.27E-04
FE-59	5.72E-04
CO-58	1.65E-02
CO-60	9.07E-02
BR-83	1.48E-05
RB-86	4.47E-02
SR-89	2.08E-04
ZR-95	3.92E-06
NB-95	4.34E-03
MO-99	1.31E-03
TC-99M	1.79E-05
RU-103	7.96E-06
RU-106	7.03E-04
AG-110M	1.43E-05
TE-127	6.65E-06

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
-----	-----

TE-129	4.53E-06
TE-129M	1.63E-03
TE-131M	4.06E-04
TE-132	1.56E-02
I-130	8.56E-05
I-131	2.05E-01
I-132	3.13E-04
I-133	2.61E-02
I-135	1.67E-03
CS-134	5.25E+01
CS-136	6.67E+00
CS-137	3.71E+01
CE-144	5.59E-05
NP-239	1.23E-09

Gaseous Dose: 5.00E-01 % of Total: 9.86E+01

Critical Pathway: Vegetation (VEG)

Major Contributors (0% or greater to total)

Nuclide	Percentage
-----	-----

H-3	2.26E+01
C-14	5.20E+01
MN-54	3.52E-01
FE-59	7.58E-02
CO-58	5.07E-01
CO-60	7.98E+00
SR-89	1.99E-02
SR-90	1.22E-01
I-131	2.08E+00
I-133	4.36E-02
CS-134	4.64E+00
CS-137	9.56E+00

ATTACHMENT N

BYRON ODCM TABLE 1-1 REGULATORY DOSE LIMIT
MATRIX BYRON STATION UNIT 1 AND UNIT 2

CY-BY-170-301

Revision 12

Page 33 of 188

Table 1 - 1
Regulatory Dose Limit Matrix

Regulatory Dose Limit Matrix					
REGULATION	DOSE TYPE		DOSE LIMIT(s)		TRM Section
Airborne Releases:			(quarterly)	(annual)	
10CFR50 App. I ³	Gamma Dose to Air due to Noble Gas Radionuclides (per reactor unit)		5 mrad	10 mrad	3.11.g
	Beta Dose to Air Due to Noble Gas Radionuclides (per reactor unit)		10 mrad	20 mrad	3.11.g
	Organ Dose Due to Specified Non-Noble Gas Radionuclides (per reactor unit)		7.5 mrem	15 mrem	3.11.h
	Total Body and Skin Dose (if air dose is exceeded)	Total Body	2.5 mrem	5 mrem	N/A
		Skin	7.5 mrem	15 mrem	N/A
Technical Specifications	Total Body Dose Rate Due to Noble Gas Radionuclides (instantaneous limit, per site)		500 mrem/yr		3.11.f
	Skin Dose Rate Due to Noble Gas Radionuclides (instantaneous limit, per site)		3,000 mrem/yr		3.11.f
	Organ Dose Rate Due to Specified Non-Noble Gas Radionuclides (instantaneous limit, per site)		1,500 mrem/yr		3.11.f
Liquid Releases:			(quarterly)	(annual)	
10CFR50 App. I ³	Whole (Total) Body Dose (per reactor unit)		1.5 mrem	3 mrem	3.11.d
	Organ Dose (per reactor unit)		5 mrem	10 mrem	3.11.d
Technical Specifications	The concentration of radioactivity in liquid effluents released to unrestricted areas		Ten times the values listed in 10CFR20 Appendix B; Table 2, Column 2, and note 5 below for Noble Gases		3.11.c
Total Doses ¹ :					ODCM PART 2
10 CFR 20.1301 (a)(1)	Total Effective Dose Equivalent ⁴		100 mrem/yr	5.5	
10CFR20.1301 (d) And 40CFR190	Total Body Dose		25 mrem/yr	5.5	
	Thyroid Dose		75 mrem/yr	5.5	
	Other Organ Dose		25 mrem/yr	5.5	
Other Limits ² :					
40CFR141	Total Body Dose Due to Drinking Water From Public Water Systems		4 mrem/yr	3.4	
	Organ Dose Due to Drinking Water From Public Water Systems		4 mrem/yr	3.4	

¹ These doses are calculated considering all sources of radiation and radioactivity in effluents.

² These limits are not directly applicable to nuclear power stations. They are applicable to the owners or operators of public water systems. However, the Byron RECS requires assessment of compliance with these limits.

³ Note that 10CFR50 provides design objectives, not limits.

⁴ Compliance with 10CFR20.1301(a)(1) is demonstrated by compliance with 40CFR190. Note that it may be necessary to address dose from on-site activity by members of the public as well.

⁵ Kr-85m, Kr-85, Kr-87, Kr-88, Ar-41, Xe-131m, Xe-133m, Xe-133, Xe-135m and Xe-135 allowable concentration is 2E-4 µCi/ml computed from Equation 17 of ICRP Publication 2 adjusted for infinite cloud submersion in water, and R = 0.01 rem/wk, $p_w = 1.0 \text{ g/cm}^3$, and $P_w/P_t = 1.0$.

ATTACHMENT O

BYRON STATION 2015 ANNUAL EFFLUENT REPORT
BYRON STATION UNIT 1 AND UNIT 2

**BYRON NUCLEAR POWER STATION
ANNUAL RADIOLOGICAL EFFLUENT RELEASE REPORT (ARERR)
2015**

BYRON NUCLEAR POWER STATION
UNIT 1/2 DOCKET NUMBER STN-50-454/455
RADIOACTIVE EFFLUENT RELEASE REPORT
January 2015 - December 2015
Supplemental Information

1. Regulatory Limits

a. Fission and activation products:

Tech Spec Whole Body = 500 mrem/year
Skin = 3000 mrem/year

10CFR50 Gamma = 5 mrad/quarter; 10 mrad/year
Beta = 10 mrad/quarter; 20 mrad/year

b. Iodine: (summed with particulate, see below)

c. Particulates with half-lives > 8 days:

Tech Spec Organ = 1500 mrem/year
10CFR50 Organ = 7.5 mrem/quarter; 15 mrem/year

d. Liquid Effluents:

10CFR50 Whole Body = 1.5 mrem/quarter; 3 mrem/year
Organ = 5 mrem/quarter; 10 mrem/year

2. Maximum Permissible Concentration

- a. Fission and Activation Products: 10CFR20 Appendix B Table 2
- b. Iodine: 10CFR20 Appendix B Table 2
- c. Particulates: 10CFR20 Appendix B Table 2
- d. Liquid Effluents: 10 X 10CFR20 Appendix B Table 2

3. Average Energy: This item is not applicable. The ODCM limits the dose equivalent rates due to the release of noble gases to less than or equal to 500 mrem/year to the total body and less than or equal to 3000 mrem/year to the skin.

4. Measurements and Approximations of Total Radioactivity

- a. Fission and activation products: Prior to release, the isotopic content is determined. Released activity is calculated using volume of release, which is determined by the change in tank level, containment pressure, or containment purge fan flow rates.
- b. Particulate and iodine sampling media for the plant vent stacks are continuously collected and analyzed weekly. Tritium and noble gas analysis for the plant vent stacks are obtained and analyzed weekly.

- c. Liquid effluents: Isotopic analysis is performed on each batch liquid release tank prior to its release. Total release activity is calculated using volume of release. Total tritium activity released is calculated from the highest of a monthly circulating water blowdown composite activity or a sum of the effluent input composite activities.
- d. All positive results (i.e. higher than the lower limit of detection (LLD)) are reported in units of uCi/cc or uCi/ml unless otherwise noted. All LLD values and the associated LLD requirements are listed in Attachment A.

5. Batch Releases:

a. Liquid:

- 1. Number of batch releases = 79
- 2. Total time period for batch releases = 17,902 minutes
- 3. Maximum time period for a batch release = 558 minutes
- 4. Average time period for a batch release = 227 minutes
- 5. Minimum time period for a batch release = 63 minutes
- 6. Average Rock River stream flow during periods of release of effluent into a flowing stream = 168 m³/sec, based on information from the U.S. Geological Survey Byron Gauging Station.

b. Gaseous:

- 1. Number of batch releases = 370
- 2. Total time period for batch releases = 35,241 minutes
- 3. Maximum time period for a batch release = 4,923 minutes
- 4. Average time period for batch releases = 95 minutes
- 5. Minimum time period for a batch release = 5 minutes

6. Abnormal Releases:

a. Liquid - None

b. Gaseous – None

7. There was one revision to the Off Site Dose Calculation Manual (ODCM), which was implemented in February 2015. The revision included updating the reference for a revised dose analysis report regarding the Independent Spent Fuel Storage Installation (ISFSI), adding a note specifying that dosimeters are present at each air sampling location, improvements to dosimeter maps, location changes for two Special Interest dosimeters, and several administrative changes.

8. Errata

No errata data to report.

9. 2015 Radiological Groundwater Protection Program (RGPP) Results Summary:

In 2015, fifteen (15) Radiological Groundwater Protection Program (RGPP) monitoring wells were sampled in total. Groundwater samples were obtained in March, May, August, and November and analyzed for tritium. In addition, a study of gamma, gross beta, and gross alpha radioisotopes was performed in accordance with Nuclear Energy Institute (NEI) 07-07, Groundwater Protection Initiative, for the samples obtained in May. None of the May samples showed concentrations of radionuclides above what is considered background levels. Three wells contained levels of tritium above the lower limit of detection (LLD) of 200 pCi/L. They were: AR-4 (493 pCi/L in March, 723 pCi/L in May, 417

pCi/L in August, 450 pCi/L in November) and AR-11 (945 pCi/L in March, 839 pCi/L in May, 422 pCi/L in August, 1040 pCi/L in November). Wells AR-4 and AR-11 are near the Circulating Water Blowdown piping, where historical leakage through vacuum breakers was known to have occurred. Tritium concentrations in these wells have gradually decreased since being first sampled in 2006. In 2015, tritium was measured in Well AR-7, located on-site, just west plant structures, at concentrations ranging between the lower limit of detection (200 pCi/L) and 508 pCi/L. Tritium has been measured in this well just above detectable limits on an intermittent basis since the well was first drilled in 2006. The tritium present in this well is at or below tritium levels that have been measured in rainwater as a result of precipitation recapture from permitted gaseous releases and it is not believed to be the result of new leak(s). In August 2014, a break in the well piping was discovered about six feet below the surface that could have served as the entry point for tritium in the recapture water. Should the water in these aquifers migrate to off-site wells used for drinking, the off-site dose consequence from tritium present in any of these three wells would be negligible. There are no existing or new leaks evident at the site and all groundwater well sample results are well below the drinking water standard of 20,000 pCi/L tritium.

SUMMARY

Calculations based on gaseous and liquid effluents and meteorological data indicate that public dose due to radioactive material attributable to Byron Station during the period did not exceed any regulatory or Offsite Dose Calculation Manual (ODCM) limits.

The Total Effective Dose Equivalent (TEDE) due to licensed activities at Byron Station calculated for the maximum exposed individual for the period is 2.66E-01 mrem. The annual limit on TEDE is 100 mrem.

The assessment of radiation doses to the public is performed in accordance with the ODCM. The results of these analyses confirm that the station is operating in compliance with 10CFR50 Appendix I, 10CFR20 and 40CFR190.

There were no additional operational controls implemented in 2015 that affected radiological effluents.

There were no measurements which exceeded the reporting levels, including any that would not have been attributable to station effluents.

The results of the current radiological environmental monitoring program are approximately the same as those found during the pre-operational studies conducted at Byron Station.

RELEASES

Gaseous Effluents to the Atmosphere

A total of 2.12E+01 curies of fission and activation gases were released with a maximum average quarterly release rate of 2.55E+00 μ Ci/sec.

A total of 4.45E-06 curies of 1-131 were released during the year with a maximum average quarterly release rate of 3.88E-07 μ Ci/sec.

A total of 1.01E-06 curies were released as airborne particulate matter with a maximum average quarterly release rate of 1.28E-07 μ Ci/sec.

A total of 8.85E+00 curies of other (C-14) radioisotopes were released with a maximum average quarterly release rate of 3.06E-01 μ Ci/sec.

A total of $8.05\text{E}+01$ curies of tritium were released with a maximum average quarterly release rate of $3.99\text{E}+00$ $\mu\text{Ci/sec}$.

Gross alpha-emitting radionuclides were below detectable limits.

Liquids Released to Rock River

A total of $2.86\text{E}+10$ liters of radioactive liquid wastes containing $8.48\text{E}-03$ curies of fission and activation products were discharged with a maximum quarterly average concentration of $4.71\text{E}-10$ $\mu\text{Ci/ml}$.

A total of $3.32\text{E}+03$ curies of tritium were discharged with a maximum quarterly average concentration of $1.56\text{E}-04$ uCi/ml .

A total of $5.08\text{E}-04$ curies of dissolved and entrained gases were discharged with a maximum quarterly average concentration of $5.56\text{E}-11$ uCi/ml .

Gross alpha-emitting radionuclides were below detectable limits.

DOSE TO MAN

GASEOUS EFFLUENT PATHWAYS

Noble Gas - Gamma Dose Rates

Offsite Gamma air and whole body dose rates for the period were calculated based on measured release rates, isotopic composition of the noble gases, and average meteorological data. The maximum gamma air dose was $1.76\text{E}-02$ mrad based on measured effluents and average meteorological data, and $3.19\text{E}-03$ mrad based on measured effluents and concurrent meteorological data.

Noble Gas - Beta Air and Skin Dose Rates

The range of beta particles in air is relatively small (on the order of a few meters or less). Consequently, plumes of gaseous effluents may be considered "semi-infinite" for the purpose of calculating the dose from beta radiation incident on the skin. However, the actual dose to sensitive skin tissues is difficult to calculate due to the effect of the beta particle energies, thickness of inert skin, and clothing covering sensitive tissues. For purposes of this report the skin is taken to have a thickness of 7.0 mg/cm^2 and an occupancy factor of 1.0 is used. The maximum skin dose was $2.84\text{E}-04$ mrem based on measured effluents and average meteorological data, and $2.97\text{E}-03$ mrem based on measured effluents and concurrent meteorological data.

The maximum offsite beta air dose for the year based on measured effluents and average meteorological data was $8.55\text{E}-04$ mrad, and $6.29\text{E}-04$ mrad based on measured effluents and concurrent meteorological data.

Radioactive Iodine & Particulate

The human thyroid exhibits a significant capacity to concentrate ingested or inhaled iodine. I-131 released during routine operation of the station may be made available to man resulting in dose to the thyroid. C-14 is also included in this category. C-14 exhibits a capacity to concentrate in bone. C-14 is released in gaseous form and is absorbed into vegetation through photosynthesis. The principal pathways of interest for C-14 are the consumption of vegetation by humans and milk from which animals have ingested C-14 through the consumption of vegetation. With the requirement to begin

reporting C-14 dose in 2011 and the addition of C-14 to plant effluents, human dose in this category is primarily driven by the release of C-14 from the plant.

The hypothetical dose to the maximum exposed individual living near the station via ingestion of milk and vegetation was calculated. The source of milk and vegetation was assumed to be at the nearest site boundary with the cows pastured and vegetation grown from May through October. The maximum organ dose from radioactive iodine and particulate (including C-14) to any organ was 7.22E-01 mrem (child/bone) based on measured effluents and average meteorological data, and 6.95E-01 mrem (child/bone) based on measured effluents and concurrent meteorological data. The maximum dose from radioactive iodine and particulate (including C-14) to the whole body was 1.49E-01 mrem (child) based on measured effluents and average meteorological data, and 1.46E-01 mrem (child) based on measured effluents and concurrent meteorological data.

Gaseous Total Dose

The maximum total dose from gaseous releases to any organ was 7.22E-01 mrem (child/bone) based on measured effluents and average meteorological data, and 6.95E-01 mrem (child/bone) based on measured effluents and concurrent meteorological data. The maximum total dose from gaseous releases to the whole body was 1.49E-01 mrem (child) based on measured effluents and average meteorological data, and 1.46E-01 mrem (child) based on measured effluents and concurrent meteorological data.

LIQUID EFFLUENT PATHWAYS

The principal pathways through the aquatic environment for potential doses to man from liquid waste are ingestion of potable water and eating aquatic foods. Liquid dose was calculated based on the ingestion of potable water and sport fish. It should be noted, however, there are currently no communities within 10 km downstream of the plant using the Rock River for drinking water. NRC-developed equations are used to calculate the doses to the whole body, bone, liver, thyroid, kidney, lung, lower GI tract, and skin. Specific parameters for use in the equations are given in the Exelon Offsite Dose Calculation Manual (ODCM).

The maximum dose from liquid releases to any organ was 1.58E-01 mrem (adult/gilli). The maximum dose from liquid releases to the whole body was 1.40E-01 mrem (adult).

GASEOUS + LIQUID TOTAL DOSE

The maximum total dose to any organ via both gaseous and liquid effluents is 7.22E-01 mrem (child/bone). The maximum dose to the whole body via both gaseous and liquid effluents is 2.66E-01 mrem (child).

Dose Limits to Members of the Public

Byron Station did not exceed any of the dose limits as shown below based on concurrent or historical meteorological data.

- The limits on dose or dose commitment to a member of the public due to radioactive materials in liquid effluents from each reactor is 1.5 mrem to the whole body or 5 mrem to any organ during any calendar quarter and 3 mrem to the whole body or 10 mrem to any organ during a calendar year.
- The limits on air dose due to noble gases released in gaseous effluents to a member of the public from each reactor is 5 mrad for gamma radiation or 10 mrad for beta radiation during any calendar quarter and 10 mrad for gamma radiation or 20 mrad for beta radiation during a calendar year.

- The limits on dose to a member of the public due to radioactive iodine & particulate with half-lives greater than eight days in gaseous effluents released from each reactor is 7.5 mrem to any organ during any calendar quarter and 15 mrem to any organ during a calendar year.
- The annual 10CFR20 limit on Total Effective Dose Equivalent to individual members of the public is 100 mrem.
- The 40CFR190 limits on individual members of the public is 25 mrem to the whole body, 25 mrem to any organ (except thyroid), and 75 mrem to the thyroid.

SITE METEOROLOGY

Detailed records of the site meteorological measurements taken during each calendar quarter of the year are maintained by the meteorological vendor, retained on site, and are available upon request. The data are presented as cumulative joint frequency distributions of the wind direction for the 250' level and wind speed class by atmospheric stability class determined from the temperature difference between the 250' and 30' levels. Data recovery for all measurements on the meteorological tower was 99.7% during 2015.

SOLID RADIOACTIVE WASTE FOR BURIAL 1ST QUARTER 2015No Shipments in 1st Quarter 2015SOLID RADIOACTIVE WASTE FOR BURIAL 2ND QUARTER 2015

DATE Shipment # Description	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT/ CARRIER	DESTINATION	VOLUME (m ³) PER SHIPMENT	CURIES* PER SHIPMENT
4/10/15 RWS 15-003 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.44E+01	4.16E-02
4/28/15 RWS 15-001 Bead Resin	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, FISSILE EXCEPTED, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.81E+00	3.51E+00
5/19/15 RWS 15-002 Bead Resin/Charcoal	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, FISSILE EXCEPTED, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.39E+00	7.57E+00
Quarterly Totals		Number of Shipments:	3	7.36E+01	1.11E+01
* Calculated using measured ratios				CUBIC M	CURIES

SOLID RADIOACTIVE WASTE FOR BURIAL 3RD QUARTER 2015

DATE Shipment # Description	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT/ CARRIER	DESTINATION	VOLUME (m ³) PER SHIPMENT	CURIES* PER SHIPMENT
7/7/15 RWS 15-004 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.44E+01	8.33E-03
8/3/15 RWS 15-005 Bead Resin	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.39E+00	7.08E+00
8/5/15 RWS 15-006 Bead Resin	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.39E+00	3.25E+00
9/2/15 RWS 15-007 Sludge/DAW	UN2910, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7, 20' METAL BOX(2), CLASS A, NONE UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	3.94E+01	3.26E-02
9/3/15 RWS 15-008 Sludge	UN2910, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7, 20' METAL BOX(6), CLASS A, NONE	Highway Hittman Transport	Gallaher Road Kingston, TN	1.61E+01	3.83E-02
9/21/15 RWS 15-009 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.44E+01	7.67E-02
9/25/15 RWS 15-010 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	3.13E+01	4.26E-02
9/25/15 RWS 15-011 Oil	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	1.10E+01	1.17E-02
9/25/15 RWS 15-012 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.26E+01	1.95E-01
Quarterly Totals		Number of Shipments:	9	2.98E+02	1.07E+01
* Calculated using measured ratios				CUBIC M	CURIES

SOLID RADIOACTIVE WASTE FOR BURIAL 4TH QUARTER 2015

DATE Shipment # Description	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT/ CARRIER	DESTINATION	VOLUME(m ³) PER SHIPMENT	CURIES* PER SHIPMENT
10/1/15 RWS 15-013 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.44E+01	2.84E-01
10/13/15 RWS 15-014 Bead Resin/Charcoal	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.53E+00	6.37E+00
Quarterly Totals		Number of Shipments:	2	6.89E+01	6.65E+00
* Calculated using measured ratios				CUBIC M	CURIES

Resins, Filters, Evap Bottoms			
2015			
Volume (m3)	2.25E+01		
Class	A		
Nuclide	% Abund	Curies	uCi/ml
H-3	41.60	1.16E+01	5.16E-01
Be-7	0.03	7.35E-03	3.27E-04
C-14	0.81	2.26E-01	1.00E-02
Cr-51	0.10	2.82E-02	1.25E-03
Mn-54	1.05	2.92E-01	1.30E-02
Fe-55	3.66	1.02E+00	4.53E-02
Fe-59	0.01	2.79E-03	1.24E-04
Co-57	0.27	7.54E-02	3.35E-03
Co-58	12.73	3.54E+00	1.57E-01
Co-60	9.63	2.68E+00	1.19E-01
Ni-59	0.05	1.37E-02	6.09E-04
Ni-63	22.40	6.22E+00	2.76E-01
Zn-65	0.24	6.65E-02	2.96E-03
Sr-90	0.00	8.10E-06	3.60E-07
Zr-95	0.01	3.13E-03	1.39E-04
Nb-95	0.28	7.92E-02	3.52E-03
Mo-99	0.00	7.31E-04	3.25E-05
Tc-99	0.04	1.09E-02	4.84E-04
Ru-103	0.00	5.27E-05	2.34E-06
Ag-110m	0.00	9.75E-05	4.33E-06
Sn-113	0.01	2.62E-03	1.16E-04
Sb-124	0.00	1.19E-03	5.29E-05
Sb-125	6.39	1.78E+00	7.91E-02
Te-125m	0.07	1.83E-02	8.13E-04
Te-132	0.00	3.20E-05	1.42E-06
I-129	0.01	1.49E-03	6.62E-05
I-131	0.01	1.58E-03	7.02E-05
Cs-134	0.01	2.06E-03	9.16E-05
Cs-137	0.55	1.52E-01	6.76E-03
Ce-144	0.05	1.44E-02	6.40E-04

Dry Active Waste			
2015			
Volume (m3)	4.07E+02		
Class	A		
Nuclide	% Abund	Curies	uCi/ml
H-3	11.11	8.00E-02	1.97E-04
C-14	0.03	2.14E-04	5.26E-07
Cr-51	0.19	1.36E-03	3.34E-06
Mn-54	0.85	6.11E-03	1.50E-05
Fe-55	48.44	3.49E-01	8.57E-04
Fe-59	0.01	4.24E-05	1.04E-07
Co-57	0.07	5.05E-04	1.24E-06
Co-58	2.80	2.02E-02	4.96E-05
Co-60	17.42	1.25E-01	3.07E-04
Ni-59	0.02	1.61E-04	3.96E-07
Ni-63	15.75	1.13E-01	2.78E-04
Zn-65	0.03	2.38E-04	5.85E-07
Zr-95	0.81	5.82E-03	1.43E-05
Nb-95	1.13	8.16E-03	2.00E-05
Tc-99	0.09	6.42E-04	1.58E-06
Ag-110m	0.01	5.11E-05	1.26E-07
Sn-113	0.02	1.47E-04	3.61E-07
Sb-125	1.17	8.40E-03	2.06E-05
I-129	0.00	2.23E-05	5.48E-08
Cs-137	0.04	2.85E-04	7.00E-07
Ce-144	0.01	6.37E-05	1.57E-07

Other Waste (Oil)			
2015			
Volume (m3)	1.10E+01		
Class	A		
Nuclide	% Abund	Curies	uCi/ml
H-3	0.20	2.31E-05	2.10E-06
C-14	0.03	4.07E-06	3.70E-07
Mn-54	0.88	1.03E-04	9.36E-06
Fe-55	56.59	6.65E-03	6.05E-04
Co-57	0.08	9.61E-06	8.74E-07
Co-58	3.03	3.56E-04	3.24E-05
Co-60	19.01	2.23E-03	2.03E-04
Ni-63	17.22	2.02E-03	1.84E-04
Zr-95	0.58	6.85E-05	6.23E-06
Nb-95	0.93	1.10E-04	1.00E-05
Tc-99	0.10	1.16E-05	1.05E-06
Sb-125	1.28	1.51E-04	1.37E-05
I-129	0.00	3.29E-07	2.99E-08
Cs-137	0.04	5.13E-06	4.66E-07
Ce-144	0.01	9.91E-07	9.01E-08

Irradiated Components	
2015	
Volume (m3)	0.00E+00
Class	N/A
No Shipments	

SOLID RADIOACTIVE WASTE FOR BURIAL
Estimated Solid Waste Composition
2015

Sum of All Categories			
2015			
Volume (m3) 4.41E+02			
Class A			
Nuclide	% Abund	Curies	uCi/ml
H-3	40.81	1.16E+01	2.63E-02
Be-7	0.03	7.35E-03	1.67E-05
C-14	0.79	2.27E-01	5.15E-04
Cr-51	0.10	2.95E-02	6.69E-05
Mn-54	1.04	2.98E-01	6.76E-04
Fe-55	4.81	1.37E+00	3.11E-03
Fe-59	0.01	2.83E-03	6.42E-06
Co-57	0.27	7.59E-02	1.72E-04
Co-58	12.48	3.56E+00	8.07E-03
Co-60	9.83	2.80E+00	6.35E-03
Ni-59	0.05	1.39E-02	3.15E-05
Ni-63	22.23	6.34E+00	1.44E-02
Zn-65	0.23	6.67E-02	1.51E-04
Sr-90	0.00	8.10E-06	1.84E-08
Zr-95	0.03	9.02E-03	2.05E-05
Nb-95	0.31	8.75E-02	1.98E-04
Mo-99	0.00	7.31E-04	1.66E-06
Tc-99	0.04	1.15E-02	2.61E-05
Ru-103	0.00	5.27E-05	1.20E-07
Ag-110m	0.00	1.49E-04	3.38E-07
Sn-113	0.01	2.77E-03	6.28E-06
Sb-124	0.00	1.19E-03	2.70E-06
Sb-125	6.25	1.78E+00	4.04E-03
Te-125m	0.06	1.83E-02	4.15E-05
Te-132	0.00	3.20E-05	7.26E-08
I-129	0.01	1.51E-03	3.42E-06
I-131	0.01	1.58E-03	3.58E-06
Cs-134	0.01	2.06E-03	4.67E-06
Cs-137	0.53	1.52E-01	3.45E-04
Ce-144	0.05	1.44E-02	3.27E-05

Process Control Program (PCP) for Radioactive Wastes

RW-AA-100, Process Control Program (PCP) for Radioactive Waste, Revision 11, was implemented in June, 2015. The revision incorporated the following changes:

The terms and definitions were alphabetized and some had updated definitions as follows:

2. TERMS AND DEFINITIONS

2.1. Blending: The mixing of LLRW with different concentrations of radionuclides, typically in an effort to create a relatively homogeneous mixture for disposal.

2.2. Classification Controlling Nuclides: One or more nuclides, listed in Table 1 or Table 2 of 10CFR61.55, whose concentration is the specific basis for the classification of the waste container. This could be a single nuclide or multiple nuclides that make up >50% of the sum of the fractions.

2.3. Compaction: When dry wastes such as paper, wood, plastic, cardboard, incinerator ash, and etc. are volume reduced through the use of a compactor.

2.4. Concentration Averaging: The averaging of the radionuclide concentrations for specific wastes or mixture of waste over the volume or weight of the waste.

2.5. Dewatering: The process of removing fluids from liquid waste streams to produce a waste form that meets the requirements of 10CFR Part 61 and applicable burial site criteria, <0.5% by volume when the waste is packaged to an "unstable" state, or <1% by volume when the waste is packaged to a "stable" form.

2.6. Encapsulation: Encapsulation is the surrounding of a radioactive source or component with a nonradioactive material. Encapsulation involves a radioactive core surrounded by a non-radioactive matrix.

2.7. High Integrity Container (HIC): A disposable container that is approved to the Requirements of 10CFR61. The use of HIC's is an alternative to solidification or encapsulation in a steel container to meet burial stability. HIC's are used to package dewatered liquid wastes, (e.g. filter cartridges, filter media, resin, sludges, etc), or dry active waste.

2.8. Homogeneous Waste: Waste in which concentrations of radionuclides of concern are likely to approach uniformity in the context of reasonable foreseeable intruder scenarios (This is because hot spots are a concern with respect to protection of an individual who may inadvertently intrude into the burial site).

2.9. Incineration, RVR, and/or Glass Vitrification of Liquid or Solid: Dry or wet waste processed via incineration and/or thermal processing where the volume is reduced by thermal means meets 10CFR61 requirements.

2.10. Liquid Waste Processing Systems: In-plant or vendor supplied processing systems consisting of equipment utilized for evaporation, filtration, demineralization, dewatering, compression dewatering, solidification, or reverse osmosis (RO) for the treatment of liquid wastes (such as Floor Drains, Chemical Drains and Equipment Drain inputs).

2.11. Mixable Waste: Waste that is amenable to physical mixing to create relatively uniform radionuclide concentrations.

2.12. Nuclides of Concern: A nuclide in the waste in concentrations greater than 1% of

the concentration of that nuclide listed in Table 1 of 10CFR61.55 or 1% of the applicable class-dependent concentration of that nuclide in Table 2 of 10CFR61.55, Column 2 or 3.

2.13. Process Control Program (PCP): The program which contains the current formulas, sampling, analysis, tests, and determinations to be made to ensure that processing and packaging of solid radioactive waste based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure the waste meets the stabilization criteria specified in 10CFR Parts 20, 61 and 71, state regulations, and burial site requirements.

2.14. Solidification: Liquid waste processed to either an unstable or stable form per 10CFR61 requirements. Waste solidified does not have to meet the 300-year free standing monolith criteria. Approved formulas, samples and tests do not have to meet NRC approval for wastes solidified in a container meeting stability criteria (e.g. High Integrity Container).

2.15. Solidification Media: An approved media (e.g. Barnwell - vinyl ester styrene, cement, bitumen) when waste containing nuclides with greater than 5-year half lives is solidified in a container with activity greater than 1 micro curie/cc. Waste solidified in a HIC is approved by the commission meeting the 10CFR61 stabilization criteria, including 1% free standing liquids by volume when the waste is packaged to a "stable" form and < 0.5% when waste is packaged to an "unstable" form. The formulas, sampling, analysis, and test do not require NRC approval, because the HIC meets the stability criteria.

2.15.1. Solidification to an unstable or stable state is performed by vendors, when applicable. Liquid waste solidified to meet stabilization criteria (10CFR61 and 01-91 Branch Technical Requirements) shall have documentation available that demonstrates that the process is approved by the NRC or disposal facility.

2.16. Stabilization: Liquid waste processed to a "stable state" per 10CFR61 Requirements. Established formulas, samples, and tests shall be approved by the NRC in order to meet solidification "stabilization" criteria. This processing method is currently not available, because the NRC recognizes that waste packed in a High Integrity Container meets the 300-year stabilization criteria. In the event that this processing method becomes an acceptable method, then the NRC shall approve the stabilization formulas, samples, tests, etc.

2.17. Waste Streams: Consist of but are not limited to

- Filter media (powdered, bead resin and fiber),
- Filter cartridges,
- Pre-coat body feed material,
- Contaminated charcoal,
- Fuel pool activated hardware,
- Oil Dry absorbent material added to a container to absorb liquids
- Fuel Pool Crud
- Sump and tank sludges,
- High activity filter cartridges,
- Concentrated liquids,
- Contaminated waste oil,
- Dried sewage or wastewater plant waste,
- Dry Active Waste (DAW): Waste such as filters, air filters, low activity cartridge filters, paper, wood, glass, plastic, cardboard, hoses, cloth, and metals, etc, which have become contaminated as a consequence of normal operating, housekeeping and maintenance activities.
- Other radioactive waste generated from cleanup of inadvertent contamination.

Section 4.2.13 was updated to include "NRC-2001-0022" as follows:

4.2.13. Concentration averaging may be **PERFORMED** to combine LLRW having different concentrations of radionuclides to form a homogeneous mixture in accordance with the guidance in the NRC's Branch Technical Position on Concentration Averaging and Encapsulation-1995, NRC-2011-0022:

– For homogeneous waste types such as resins...

The References in Section 6 were edited to include a portion for UFSAR and there was a reformatting of the Writers' References and Users' References as follows:

6.3. UFSAR

- 6.3.1. Braidwood UFSAR, Section 11.4, Solid Waste Management System
- 6.3.2. Byron UFSAR Section 11.4, Solid Waste Management System
- 6.3.3. Calvert Cliffs UFSAR Section 11.1.2.3 Solid Waste Processing System
- 6.3.4. Clinton USAR Table 11.4, Solid Waste Management System
- 6.3.5. Dresden UFSAR Section 11.4, Waste Management System
- 6.3.6. Ft. Calhoun USAR Section 11-03, Radiological Effluent Requirements
- 6.3.7. Ginna UFSAR Section 11.4, Solid Waste Management System
- 6.3.8. LaSalle UFSAR Section 11.4.2.7 Storage areas, Table 12.3.6- IRSF Storage Area
- 6.3.9. Limerick UFSAR Section 11.4, Solid Waste Management
- 6.3.10. Nine Mile Point Unit 1 UFSAR Section 2.3 Solid Waste System
- 6.3.11. Nine Mile Point Unit 2 UFSAR Section 11.4, Solid Waste Management System
- 6.3.12. Oyster Creek UFSAR Section 11.4, Solid Waste Management System
- 6.3.13. Peach Bottom UFSAR Section 9.0, Radioactive Waste Systems
- 6.3.14. Quad Cities UFSAR Section 11.4.4.5, Interim Radwaste Storage Facility
- 6.3.15. Three Mile Island UFSAR Section 11.2, Radioactive Waste Disposal Systems Summary

6.4. Writers' References:

- Amendment No. 202 to Facility Operating License No. NPF-11 and Amendment No. 189 to Facility Operating License (FOL) No. NPF-18 for the LaSalle County Station (LSCS), Units 1 and 2
- Code of Federal Regulations: 10 CFR Part 20, Part 61, Part 71, 49 CFR Parts 171-172
- I.E. Circular 80.18, 10CFR 50.59 Safety Evaluation for Changes to Radioactive Waste Treatment Systems
- Low Level Waste Licensing Branch Technical Position on Radioactive Waste Classification, May 1983
- NRC Branch Technical Position on Blending of Low-Level Radioactive Waste, SECY-10-0043
- NRC Concentration Averaging and Encapsulation Branch Technical Position, NRC-2011-0022
- Regulatory Guide 1.21, Measuring Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants
- Technical Position on Waste Form (Revision 1), January 1991

6.5. Users' References:

- CY-AA-170-2000, Annual Radioactive Effluent Release Report
- LS-AA-106, Plant Operations Review Committee
- Quality Assurance Program (QATR)
- RM-AA-101, Records Management Program
- RM-AA-102-1006, Processing Vendor Documents
- RP-AA-600 Series, Radioactive Material/Waste Shipments

Error Analysis

The following is an estimate of the errors associated with effluent monitoring and analysis. The estimate is calculated using the square root of the sum of the squares methodology.

1. Gaseous Effluents

Qme=3.33%
RM=N/A
ECe=5%
StdCse/SmplCse=5%
qme=N/A

Total error = 7.8%

2. Liquid Effluents

Qme=3.33%
RM=N/A
ECe=N/A
StdCse/SmplCse=5%
qme=2.22%

Total error = 6.4%

3. Waste Resin

Qme=10.0%
RM=N/A
ECe=5%
StdCse/SmplCse=5%
qme=1.0%

Total error = 12.3%

4. DAW, Mechanical Filters, and Contaminated Metal

Qme=10.0%
RM=N/A
ECe=N/A
StdCse/SmplCse=5%
qme=N/A

Instrument calibration error = 10%
Total error = 11.2%

Qme = the process quantity measurement error associated with the release point (e.g. flow, level measurements)

RM = error associated with the radiation monitor used in quantifying releases through the release point

ECe = error associated with the collection efficiency of the sample media

StdCse = one-sigma counting error associated with the counting instrument of interest

SmplCse = one-sigma counting error associated with a sample of a given geometry that is used for the release point of interest

qme = sample quantity measurement error associated with the sample of interest

Miscellaneous Information

- A. As required by Technical Specification 5.6.2, meteorological and environmental impact information is reported in the 2015 Annual Radiological Environmental Operating Report (AREOR) or is retained on file to be provided upon request.
- B. No limits were exceeded during the 2015 reporting period in liquid hold up tanks or waste gas decay tanks as stated in Technical Specification 5.5.12.
- C. There were no irradiated fuel shipments during the 2015 reporting period. An Independent Spent Fuel Storage Installation (ISFSI) campaign began in 2010 when used fuel was removed from the Spent Fuel Pool (SFP), placed into six (6) casks, each containing 32 fuel bundles, and transferred to an outdoor storage pad. No additional casks were placed on the pad in 2011. In 2012, eight (8) additional casks were placed on the pad for a total of fourteen (14) casks. No additional casks were placed on the pad in 2013 or 2014. In 2015, six (6) additional casks were placed on the pad for a total of twenty (20) casks. Prior to the ISFSI campaign, additional dosimeters were placed at the site boundary nearest to the storage pad (in between the pad and the nearest resident) for the purpose of measuring any potential offsite dose to the public from the storage pad. Since the dosimeters were placed, data from the dosimeters, when compared to the existing environmental dosimeters in the surrounding area, have shown no statistical difference. As a result, there is currently no offsite dose contribution from the ISFSI facility or any other on-site storage facility, including the Dry Active Waste (DAW) Building and the Old Steam Generator (OSG) Storage Building, as evidenced by dosimetry data that is indistinguishable from the existing environmental dosimeters.
- D. There were no REMP sample results that exceeded any technical specification limits or analytical results investigation levels during the 2015 reporting period. REMP composite surface water samples from point BY-12, Rock River downstream of the plant liquid effluent discharge, detected tritium results of 490 pCi/L in the second quarter and 748 pCi/L in the third quarter, against a lower detection limit of 200 pCi/L. The positive sample results can be attributed to one or more weekly samples being obtained shortly after permitted liquid discharges, and are not unexpected. The results are well below the Technical Requirements Manual (TRM) reportable limit of 30,000 pCi/L. There are no communities using the Rock River for drinking water within 10 km downstream of the station. No radionuclides that were a result of plant effluents were detected in any of the other REMP samples.
- E. There were no elevated releases during the 2015 reporting period. All planned gaseous releases were discharged by way of the plant vent stacks and are considered to be mixed mode releases.
- F. There was one liquid effluent flow loop that exceeded its inoperability time limit as stated in TRM TLCO 3.11.b. On 4/3/15 01:53, 0WX001, Liquid Radwaste Release High Flow Loop, entered OBOL 11.a due to calibration procedure OBISR 11.a.3-005. The procedure requires a channel check for operability following completion of the calibration. The channel check requires process flow through the loop and could not be completed within the required 30-day time frame because there were no liquid releases performed during this time utilizing the high flow loop. The flow loop (high/low) to be utilized during liquid releases is contingent upon the radioactivity (i.e. tritium) concentration present in the release tank. The condition was exited on 5/8/15 13:21, when a liquid release was able to be performed utilizing the high flow loop.
- G. There were no unplanned gaseous or liquid releases to unrestricted areas during the 2015 reporting period.
- H. All Rock River flow measurements during liquid effluent discharges were obtained from the U.S. Geological Survey Byron Gauging Station for the Rock River with the following exceptions. Due to icing

conditions near the Byron gauging station, flows were obtained from the Rockton flow gauge, located on the Rock River approximately 30 miles upstream of the Byron flow gauge, during the liquid effluent releases on 1/21/15 and 1/30/15. Due to icing conditions near the Byron and Rockton gauging stations, the Rock River flow measurement during the liquid effluent release on 1/9/15 was obtained from the Dixon flow gauge, located approximately 32 miles downstream of the Byron flow gauge.

- I. Attached are offsite dose calculation reports for January through December of 2015.

The following are the maximum annual calculated cumulative offsite doses resulting from Byron airborne releases in 2015 based on concurrent meteorological data:

Unit 1:

<u>Dose</u>	<u>Maximum Value</u>	<u>Sector Affected</u>
gamma air ⁽¹⁾	3.19 x10 ⁻³ mrad	North-Northwest
beta air ⁽²⁾	6.24 x10 ⁻⁴ mrad	North-Northwest
whole body ⁽³⁾	7.02 x10 ⁻² mrem	North-Northwest
skin ⁽⁴⁾	2.97 x10 ⁻³ mrem	North-Northwest
organ ⁽⁵⁾ (child-bone)	3.34 x10 ⁻¹ mrem	North-Northwest

Unit 1 Compliance Status

10 CFR 50 Appendix I	Yearly Objective	% of Appendix I
gamma air	10.0 mrad	0.03
beta air	20.0 mrad	0.00
whole body	5.0 mrem	1.40
skin	15.0 mrem	0.02
organ	15.0 mrem	2.23

Unit 2:

<u>Dose</u>	<u>Maximum Value</u>	<u>Sector Affected</u>
gamma air ⁽¹⁾	2.71 x10 ⁻⁶ mrad	North-Northwest
beta air ⁽²⁾	4.94 x10 ⁻⁶ mrad	North-Northwest
whole body ⁽³⁾	7.54 x10 ⁻² mrem	North-Northwest
skin ⁽⁴⁾	3.78 x10 ⁻⁶ mrem	North-Northwest
organ ⁽⁵⁾ (child-bone)	3.61 x10 ⁻¹ mrem	North-Northwest

Unit 2 Compliance Status

10 CFR 50 Appendix I	Yearly Objective	% of Appendix I
gamma air	10.0 mrad	0.00
beta air	20.0 mrad	0.00
whole body	5.0 mrem	1.51
skin	15.0 mrem	0.00
organ	15.0 mrem	2.41

-
- ⁽¹⁾ Gamma Air Dose - GASPAR II, NUREG-0597
⁽²⁾ Beta Air Dose - GASPAR II, NUREG-0597
⁽³⁾ Whole Body Dose - GASPAR II, NUREG-0597
⁽⁴⁾ Skin Dose - GASPAR II, NUREG-0597
⁽⁵⁾ Inhalation and Food Pathways Dose - GASPAR II, NUREG-0597

Data recovery: 99.7%

Attachment A, 2015 Radioactive Effluent Release Report
2015 Lower Limits of Detection (LLD's)

Nuclide	Gaseous LLD (uCi/cc)	Required Gaseous LLD (uCi/cc)	Nuclide	Liquid LLD (uCi/ml)	Required Liquid LLD (uCi/cc)
H3	4.52E-08	1.00E-07	H3	1.81E-06	1.00E-05
Ar41	5.72E-07		Na24	3.27E-08	
Cr51	2.99E-12		Cr51	2.65E-07	
Mn54	5.86E-13	1.00E-11	Mn54	4.29E-08	5.00E-07
Co58	7.39E-13	1.00E-11	Fe55	7.13E-07	1.00E-06
Fe59	1.66E-12	1.00E-11	Co57	2.68E-08	
Co60	1.19E-12	1.00E-11	Co58	3.68E-08	5.00E-07
Ni63	5.39E-15		Fe59	9.29E-08	5.00E-07
Zn65	1.36E-12	1.00E-11	Co60	6.94E-08	5.00E-07
Br82	6.63E-13		Ni63	4.24E-07	
Kr85m	2.25E-07		Zn65	9.78E-08	5.00E-07
Kr87	3.33E-07	1.00E-04	Sr85	3.80E-08	
Kr88	5.91E-07	1.00E-04	Kr85m	3.07E-08	1.00E-05
Sr89	1.83E-14	1.00E-11	Kr87	7.50E-08	1.00E-05
Sr-90	2.28E-15	1.00E-11	Kr88	9.12E-08	1.00E-05
Mo99	2.41E-13	1.00E-11	Sr89	3.40E-08	5.00E-08
I131	7.17E-13	1.00E-12	Sr90	8.59E-09	5.00E-08
Xe131m	8.10E-06		Sr92	7.57E-08	
I133	9.87E-13	1.00E-10	Nb95	4.20E-08	
Xe133	3.33E-07	1.00E-04	Zr95	8.31E-08	
Xe133m	1.91E-06	1.00E-04	Mo99	2.25E-08	5.00E-07
Cs134	6.61E-13	1.00E-11	Ag110m	5.10E-08	
I135	4.65E-12		Sb122	6.16E-08	
Xe135	1.91E-07	1.00E-04	Te123m	2.52E-08	
Cs137	5.53E-13	1.00E-11	Sb124	8.48E-08	
Xe138	8.70E-07	1.00E-04	Sb125	1.12E-07	
Ba140	1.75E-12		Te125m	7.26E-06	
La140	7.83E-13		Sb126	4.23E-08	
Ce141	4.40E-13	1.00E-11	Xe131m	1.03E-06	1.00E-05
Ce144	1.86E-12	1.00E-11	I131	3.18E-08	1.00E-06
Gross Alpha	2.84E-15	1.00E-11	I132	4.62E-08	
			Te132	2.31E-08	
			I133	3.75E-08	
			Xe133	6.42E-08	1.00E-05
			Xe133m	2.44E-07	1.00E-05
			Cs134	5.23E-08	5.00E-07
			Xe135	3.07E-08	1.00E-05
			Cs137	4.84E-08	5.00E-07
			Xe138	2.12E-07	1.00E-05
			Ba140	1.33E-07	
			La140	4.03E-08	
			Ce141	4.07E-08	5.00E-07
			Ce144	1.72E-07	5.00E-06
			Gross Alpha	6.40E-08	1.00E-07
			Gross Beta	1.72E-07	

EFFLUENT AND WASTE DISPOSAL REPORT

SUPPLEMENTAL INFORMATION

GASEOUS EFFLUENTS - BATCH MODE

Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		50	55	57	56	218
Total release time	minutes	2.61E+03	3.59E+03	1.58E+04	6.43E+03	2.85E+04
Maximum release time	minutes	2.17E+02	5.25E+02	4.92E+03	1.09E+03	4.92E+03
Average release time	minutes	5.23E+01	6.53E+01	2.78E+02	1.15E+02	1.31E+02
Minimum release time	minutes	5.00E+00	2.50E+01	3.80E+01	3.50E+01	5.00E+00

Note: Waste Gas Decay Tank releases are included with Unit 1 data

EFFLUENT AND WASTE DISPOSAL REPORT

SUPPLEMENTAL INFORMATION

GASEOUS EFFLUENTS - BATCH MODE

Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		37	41	40	34	152
Total release time	minutes	1.45E+03	1.66E+03	1.77E+03	1.90E+03	6.77E+03
Maximum release time	minutes	6.20E+01	5.80E+01	7.50E+01	8.40E+01	8.40E+01
Average release time	minutes	3.92E+01	4.04E+01	4.41E+01	5.59E+01	4.46E+01
Minimum release time	minutes	1.00E+01	1.40E+01	1.50E+01	3.10E+01	1.00E+01

EFFLUENT AND WASTE DISPOSAL REPORT

SUPPLEMENTAL INFORMATION

LIQUID EFFLUENTS - BATCH MODE

Unit 1 & Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		11	14	32	22	79
Total release time	minutes	2.51E+03	4.48E+03	5.66E+03	5.26E+03	1.79E+04
Maximum release time	minutes	5.58E+02	5.30E+02	4.43E+02	4.29E+02	5.58E+02
Average release time	minutes	2.28E+02	3.20E+02	1.77E+02	2.39E+02	2.27E+02
Minimum release time	minutes	6.60E+01	1.78E+02	6.30E+01	7.60E+01	6.30E+01
Average dilution flow	gpm	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Note: Liquid Releases are divided evenly between units

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1A
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
1. Total Release	Ci	4.97E-01	1.46E-01	1.10E-01	2.01E+01	2.08E+01
2. Avg. Release Rate	uCi/sec	6.39E-02	1.86E-02	1.38E-02	2.53E+00	6.60E-01
Iodine-131						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)
Others						
1. Total Release	Ci	1.12E+00	1.11E+00	9.79E-01	1.04E+00	4.24E+00
2. Avg. Release Rate	uCi/sec	1.44E-01	1.41E-01	1.23E-01	1.31E-01	1.35E-01
Tritium						
1. Total Release	Ci	1.38E+01	8.01E+00	1.49E+00	4.00E+00	2.73E+01
2. Avg. Release Rate	uCi/sec	1.77E+00	1.02E+00	1.87E-01	5.03E-01	8.64E-01
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1C
GASEOUS EFFLUENTS - MIXED MODE RELEASES - CONTINUOUS MODE
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
KR-88	Ci	(1)	(1)	(1)	1.99E+01	1.99E+01
XE-133	Ci	4.85E-01	1.22E-01	5.59E-02	1.34E-01	7.97E-01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	4.85E-01	1.22E-01	5.59E-02	2.01E+01	2.07E+01
Iodines						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Others						
C-14	Ci	1.12E+00	1.11E+00	9.79E-01	1.04E+00	4.24E+00
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.12E+00	1.11E+00	9.79E-01	1.04E+00	4.24E+00
Tritium						
H-3	Ci	1.36E+01	7.91E+00	1.26E+00	3.97E+00	2.68E+01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.36E+01	7.91E+00	1.26E+00	3.97E+00	2.68E+01
Gross Alpha Radioactivity						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1C
GASEOUS EFFLUENTS - MIXED MODE RELEASES - BATCH MODE
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
AR-41	Ci	8.58E-03	1.96E-02	1.91E-02	2.53E-03	4.99E-02
KR-85M	Ci	(1)	(1)	2.23E-05	1.59E-06	2.39E-05
XE-133	Ci	2.92E-03	4.13E-03	3.31E-02	2.54E-03	4.27E-02
XE-133M	Ci	(1)	(1)	1.80E-04	7.92E-06	1.88E-04
XE-135	Ci	3.91E-04	(1)	1.39E-03	3.28E-05	1.81E-03
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.19E-02	2.37E-02	5.38E-02	5.11E-03	9.46E-02
Iodines						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Others						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Tritium						
H-3	Ci	1.19E-01	9.96E-02	2.31E-01	3.00E-02	4.79E-01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.19E-01	9.96E-02	2.31E-01	3.00E-02	4.79E-01
Gross Alpha Radioactivity						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1A
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
1. Total Release	Ci	7.09E-02	1.26E-01	7.20E-02	1.42E-01	4.12E-01
2. Avg. Release Rate	uCi/sec	9.12E-03	1.61E-02	9.06E-03	1.79E-02	1.31E-02
Iodine-131						
1. Total Release	Ci	7.01E-07	(1)	3.08E-06	6.64E-07	4.45E-06
2. Avg. Release Rate	uCi/sec	9.01E-08	(1)	3.88E-07	8.36E-08	1.41E-07
Particulates Half Life >= 8 days						
1. Total Release	Ci	(1)	(1)	(1)	1.01E-06	1.01E-06
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	1.28E-07	3.21E-08
Others						
1. Total Release	Ci	1.26E+00	1.10E+00	1.20E+00	1.05E+00	4.61E+00
2. Avg. Release Rate	uCi/sec	1.62E-01	1.40E-01	1.51E-01	1.33E-01	1.46E-01
Tritium						
1. Total Release	Ci	1.72E+01	1.71E+01	1.05E+01	8.35E+00	5.32E+01
2. Avg. Release Rate	uCi/sec	2.22E+00	2.17E+00	1.32E+00	1.05E+00	1.69E+00
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1C
GASEOUS EFFLUENTS - MIXED MODE RELEASES - CONTINUOUS MODE
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
XE-133	Ci	6.92E-02	1.22E-01	5.59E-02	1.34E-01	3.81E-01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	6.92E-02	1.22E-01	5.59E-02	1.34E-01	3.81E-01
Iodines						
I-131	Ci	7.01E-07	(1)	3.08E-06	6.64E-07	4.45E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	7.01E-07	(1)	3.08E-06	6.64E-07	4.45E-06
Particulates Half Life >= 8 days						
CR-51	Ci	(1)	(1)	(1)	1.01E-06	1.01E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	1.01E-06	1.01E-06
Others						
C-14	Ci	1.26E+00	1.10E+00	1.20E+00	1.05E+00	4.61E+00
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.26E+00	1.10E+00	1.20E+00	1.05E+00	4.61E+00
Tritium						
H-3	Ci	1.72E+01	1.70E+01	1.04E+01	8.28E+00	5.30E+01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.72E+01	1.70E+01	1.04E+01	8.28E+00	5.30E+01
Gross Alpha Radioactivity						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1C
GASEOUS EFFLUENTS - MIXED MODE RELEASES - BATCH MODE
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
AR-41	Ci	1.68E-03	3.55E-03	2.54E-03	4.35E-03	1.21E-02
KR-85M	Ci	(1)	(1)	2.22E-05	1.60E-06	2.38E-05
XE-133M	Ci	(1)	(1)	1.80E-04	7.88E-06	1.88E-04
XE-133	Ci	2.71E-05	7.40E-04	1.20E-02	4.08E-03	1.68E-02
XE-135	Ci	(1)	(1)	1.38E-03	3.29E-05	1.41E-03
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.71E-03	4.29E-03	1.61E-02	8.47E-03	3.05E-02
Iodines						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Others						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Tritium						
H-3	Ci	3.56E-02	4.82E-02	5.94E-02	6.49E-02	2.08E-01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	3.56E-02	4.82E-02	5.94E-02	6.49E-02	2.08E-01
Gross Alpha Radioactivity						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2A
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	9.90E-04	7.13E-04	1.63E-03	1.33E-03	4.24E-03
2. Avg. Diluted Conc.	uCi/ml	2.89E-10	1.93E-10	4.71E-10	3.56E-10	2.96E-10
Tritium						
1. Total Release	Ci	2.47E+02	3.80E+02	4.48E+02	5.81E+02	1.66E+03
2. Avg. Diluted Conc.	uCi/ml	7.21E-05	1.03E-04	1.29E-04	1.56E-04	1.16E-04
Dissolved and Entrained Gases						
1. Total Release	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
2. Avg. Diluted Conc.	uCi/ml	1.51E-11	2.52E-12	5.56E-11	(1)	1.77E-11
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters		3.42E+09	3.70E+09	3.47E+09	3.73E+09	1.43E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
 TABLE 2A - Release Tank
 LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT
 Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	9.90E-04	7.13E-04	1.63E-03	1.33E-03	4.24E-03
2. Avg. Diluted Conc.	uCi/ml	2.13E-06	1.17E-06	1.22E-06	1.40E-06	1.26E-06
Tritium						
1. Total Release	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
2. Avg. Diluted Conc.	uCi/ml	4.36E-01	5.91E-01	3.08E-01	4.41E-01	4.15E-01
Dissolved and Entrained Gases						
1. Total Release	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
2. Avg. Diluted Conc.	uCi/ml	1.11E-07	1.53E-08	1.44E-07	(1)	7.56E-08
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste	liters	4.66E+05	6.09E+05	1.34E+06	9.46E+05	3.36E+06

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
 TABLE 2A - Circulating Water Blowdown
 LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT
 Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Tritium						
1. Total Release	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
2. Avg. Diluted Conc.	uCi/ml	1.28E-05	5.22E-06	1.03E-05	4.39E-05	1.83E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste	liters	3.42E+09	3.70E+09	3.47E+09	3.73E+09	1.43E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2B
LIQUID EFFLUENTS - CONTINUOUS MODE
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Tritium						
H-3	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
-----	-----	-----	-----	-----	-----	-----
Totals for Period...	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
-----	-----	-----	-----	-----	-----	-----
Dissolved and Entrained Gases						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Gross Alpha Radioactivity						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT

TABLE 2B

LIQUID EFFLUENTS - BATCH MODE

Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
CO-57	Ci	3.23E-06	4.19E-06	4.93E-06	1.60E-06	1.40E-05
CO-58	Ci	7.03E-04	4.73E-04	5.97E-04	9.86E-04	2.76E-03
CO-60	Ci	2.52E-04	1.49E-04	4.64E-04	2.24E-04	1.09E-03
CR-51	Ci	(1)	(1)	1.92E-04	(1)	1.92E-04
FE-59	Ci	4.47E-06	(1)	(1)	(1)	4.47E-06
I-132	Ci	(1)	(1)	1.95E-05	(1)	1.95E-05
I-133	Ci	(1)	1.93E-06	(1)	(1)	1.93E-06
MN-54	Ci	(1)	3.94E-06	(1)	(1)	3.94E-06
NB-95	Ci	3.08E-06	(1)	1.11E-05	(1)	1.42E-05
SB-122	Ci	(1)	(1)	5.08E-06	(1)	5.08E-06
SB-124	Ci	(1)	(1)	2.48E-05	2.14E-06	2.69E-05
SB-125	Ci	2.21E-05	5.52E-06	4.36E-05	(1)	7.12E-05
TE-123M	Ci	2.28E-06	(1)	1.82E-05	(1)	2.05E-05
TE-132	Ci	(1)	(1)	1.32E-05	(1)	1.32E-05
ZR-95	Ci	(1)	(1)	5.34E-06	(1)	5.34E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	9.90E-04	6.37E-04	1.40E-03	1.21E-03	4.24E-03
Tritium						
H-3	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
		-----	-----	-----	-----	-----
Totals for Period...	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
Dissolved and Entrained Gases						
XE-133	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
		-----	-----	-----	-----	-----
Totals for Period...	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
Gross Alpha Radioactivity						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2A
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	9.90E-04	7.13E-04	1.63E-03	1.33E-03	4.24E-03
2. Avg. Diluted Conc.	uCi/ml	2.89E-10	1.93E-10	4.71E-10	3.56E-10	2.96E-10
Tritium						
1. Total Release	Ci	2.47E+02	3.80E+02	4.48E+02	5.81E+02	1.66E+03
2. Avg. Diluted Conc.	uCi/ml	7.21E-05	1.03E-04	1.29E-04	1.56E-04	1.16E-04
Dissolved and Entrained Gases						
1. Total Release	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
2. Avg. Diluted Conc.	uCi/ml	1.51E-11	2.52E-12	5.56E-11	(1)	1.77E-11
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste	liters	3.42E+09	3.70E+09	3.47E+09	3.73E+09	1.43E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
 TABLE 2A - Release Tank
 LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT
 Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	9.90E-04	7.13E-04	1.63E-03	1.33E-03	4.24E-03
2. Avg. Diluted Conc.	uCi/ml	2.13E-06	1.17E-06	1.22E-06	1.40E-06	1.26E-06
Tritium						
1. Total Release	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
2. Avg. Diluted Conc.	uCi/ml	4.36E-01	5.91E-01	3.08E-01	4.41E-01	4.15E-01
Dissolved and Entrained Gases						
1. Total Release	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
2. Avg. Diluted Conc.	uCi/ml	1.11E-07	1.53E-08	1.44E-07	(1)	7.56E-08
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste	liters	4.66E+05	6.09E+05	1.34E+06	9.46E+05	3.36E+06

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
 TABLE 2A - Circulating Water Blowdown
 LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT
 Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc. uCi/ml		(1)	(1)	(1)	(1)	(1)
Tritium						
1. Total Release	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
2. Avg. Diluted Conc. uCi/ml		1.28E-05	5.22E-06	1.03E-05	4.39E-05	1.83E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc. uCi/ml		(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters		3.42E+09	3.70E+09	3.47E+09	3.73E+09	1.43E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2B
LIQUID EFFLUENTS - CONTINUOUS MODE
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
Tritium						
H-3	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
-----	-----	-----	-----	-----	-----	-----
Totals for Period...	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
Dissolved and Entrained Gases						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT

TABLE 2B

LIQUID EFFLUENTS - BATCH MODE

Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
CO-57	Ci	3.23E-06	4.19E-06	4.93E-06	1.60E-06	1.40E-05
CO-58	Ci	7.03E-04	4.73E-04	5.97E-04	9.86E-04	2.76E-03
CO-60	Ci	2.52E-04	1.49E-04	4.64E-04	2.24E-04	1.09E-03
CR-51	Ci	(1)	(1)	1.92E-04	(1)	1.92E-04
FE-59	Ci	4.47E-06	(1)	(1)	(1)	4.47E-06
I-132	Ci	(1)	(1)	1.95E-05	(1)	1.95E-05
I-133	Ci	(1)	1.93E-06	(1)	(1)	1.93E-06
MN-54	Ci	(1)	3.94E-06	(1)	(1)	3.94E-06
NB-95	Ci	3.08E-06	(1)	1.11E-05	(1)	1.42E-05
SB-122	Ci	(1)	(1)	5.08E-06	(1)	5.08E-06
SB-124	Ci	(1)	(1)	2.48E-05	2.14E-06	2.69E-05
SB-125	Ci	2.21E-05	5.52E-06	4.36E-05	(1)	7.12E-05
TE-123M	Ci	2.28E-06	(1)	1.82E-05	(1)	2.05E-05
TE-132	Ci	(1)	(1)	1.32E-05	(1)	1.32E-05
ZR-95	Ci	(1)	(1)	5.34E-06	(1)	5.34E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	9.90E-04	6.37E-04	1.40E-03	1.21E-03	4.24E-03
Tritium						
H-3	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
		-----	-----	-----	-----	-----
Totals for Period...	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
Dissolved and Entrained Gases						
XE-133	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
		-----	-----	-----	-----	-----
Totals for Period...	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
Gross Alpha Radioactivity						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 1 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	6.22E-06	3.69E-02	3.68E-02	3.68E-02	3.68E-02	4.40E-02	0.00E+00	3.71E-02
TEEN	6.38E-06	2.77E-02	2.76E-02	2.76E-02	2.76E-02	3.27E-02	0.00E+00	2.79E-02
CHILD	7.77E-06	3.09E-02	3.08E-02	3.08E-02	3.08E-02	3.26E-02	0.00E+00	3.11E-02
INFANT	1.56E-07	1.36E-02	1.36E-02	1.36E-02	1.36E-02	1.37E-02	0.00E+00	1.37E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 1 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 1 - Admin. Any Organ	ADULT	GILLI	4.40E-02	3.75E+00	1.17E+00
Qtr 1 - Admin. Total Body	ADULT	TBODY	3.71E-02	1.13E+00	3.30E+00

Qtr 1 - T.Spc. Any Organ	ADULT	GILLI	4.40E-02	5.00E+00	8.81E-01
--------------------------	-------	-------	----------	----------	----------

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	8.35E+01
FE-59	8.37E-02
CO-58	2.93E+00
CO-60	2.80E+00
NB-95	1.07E+01
SB-125	3.23E-03

Qtr 1 - T.Spc. Total Body	ADULT	TBODY	3.71E-02	1.50E+00	2.47E+00
---------------------------	-------	-------	----------	----------	----------

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	9.92E+01
FE-59	1.14E-02
CO-58	3.86E-01
CO-60	3.90E-01
NB-95	1.12E-03
SB-125	8.28E-05

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 2 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	4.24E-04	3.47E-02	3.47E-02	3.47E-02	3.47E-02	3.56E-02	0.00E+00	3.48E-02
TEEN	3.88E-04	2.61E-02	2.60E-02	2.60E-02	2.60E-02	2.66E-02	0.00E+00	2.61E-02
CHILD	4.38E-04	2.90E-02	2.90E-02	2.90E-02	2.90E-02	2.92E-02	0.00E+00	2.91E-02
INFANT	7.65E-06	1.28E-02	1.28E-02	1.28E-02	1.28E-02	1.28E-02	0.00E+00	1.28E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 2 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 2 - Admin. Any Organ	ADULT	GILLI	3.56E-02	3.75E+00	9.48E-01
Qtr 2 - Admin. Total Body	ADULT	TBODY	3.48E-02	1.13E+00	3.09E+00

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 2 - T.Spc. Any Organ	ADULT	GILLI	3.56E-02	5.00E+00	7.11E-01

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	9.75E+01
MN-54	7.98E-02
FE-55	2.86E-02
CO-58	1.30E+00
CO-60	1.09E+00
SR-89	1.28E-02
SR-90	2.62E-02
SB-125	5.30E-04
I-133	2.38E-04

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 2 - T.Spc. Total Body	ADULT	TBODY	3.48E-02	1.50E+00	2.32E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	9.97E+01
MN-54	5.08E-03
FE-55	1.19E-02
CO-58	1.47E-01
CO-60	1.31E-01
SR-89	2.34E-03
SR-90	2.14E-02
SB-125	1.17E-05
I-133	8.25E-05

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 3 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	1.15E-03	3.43E-02	3.41E-02	3.42E-02	3.41E-02	4.40E-02	0.00E+00	3.43E-02
TEEN	1.06E-03	2.57E-02	2.56E-02	2.57E-02	2.56E-02	3.25E-02	0.00E+00	2.58E-02
CHILD	1.19E-03	2.87E-02	2.86E-02	2.86E-02	2.86E-02	3.10E-02	0.00E+00	2.88E-02
INFANT	2.07E-05	1.27E-02	1.27E-02	1.27E-02	1.27E-02	1.27E-02	0.00E+00	1.27E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 3 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 3 - Admin. Any Organ	ADULT	GILLI	4.40E-02	3.75E+00	1.17E+00
Qtr 3 - Admin. Total Body	ADULT	TBODY	3.43E-02	1.13E+00	3.05E+00

Qtr 3 - T.Spc. Any Organ ADULT GILLI 4.40E-02 5.00E+00 8.79E-01

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	7.76E+01
CR-51	6.46E-02
FE-55	6.19E-02
CO-58	1.14E+00
CO-60	2.36E+00
SR-89	2.76E-02
SR-90	5.67E-02
ZR-95	1.51E-03
NB-95	1.76E+01
SB-124	6.69E-03
SB-125	2.91E-03
TE-132	1.02E+00
I-132	7.66E-05

Qtr 3 - T.Spc. Total Body ADULT TBODY 3.43E-02 1.50E+00 2.29E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	9.94E+01
CR-51	3.29E-04
FE-55	3.22E-02
CO-58	1.61E-01
CO-60	3.55E-01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
SR-89	6.33E-03
SR-90	5.80E-02
ZR-95	4.13E-07
NB-95	2.00E-03
SB-124	1.19E-04
SB-125	8.06E-05
TE-132	2.60E-02
I-132	1.83E-04

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 4 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	5.50E-04	3.49E-02	3.48E-02	3.48E-02	3.48E-02	3.61E-02	0.00E+00	3.49E-02
TEEN	5.03E-04	2.62E-02	2.61E-02	2.61E-02	2.61E-02	2.70E-02	0.00E+00	2.62E-02
CHILD	5.68E-04	2.92E-02	2.91E-02	2.91E-02	2.91E-02	2.95E-02	0.00E+00	2.93E-02
INFANT	9.90E-06	1.30E-02	1.30E-02	1.30E-02	1.30E-02	1.30E-02	0.00E+00	1.30E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 4 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 4 - Admin. Any Organ	ADULT	GILLI	3.61E-02	3.75E+00	9.63E-01
Qtr 4 - Admin. Total Body	ADULT	TBODY	3.49E-02	1.13E+00	3.11E+00

Qtr 4 - T.Spc. Any Organ	ADULT	GILLI	3.61E-02	5.00E+00	7.23E-01
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Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	9.62E+01
FE-55	3.65E-02
CO-58	2.30E+00
CO-60	1.39E+00
SR-89	1.63E-02
SR-90	3.34E-02
SB-124	7.05E-04

Qtr 4 - T.Spc. Total Body	ADULT	TBODY	3.49E-02	1.50E+00	2.33E+00
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Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	9.95E+01
FE-55	1.53E-02
CO-58	2.63E-01
CO-60	1.69E-01
SR-89	3.01E-03
SR-90	2.76E-02
SB-124	1.02E-05

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

```

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) ===== ANNUAL 2015 =====
Agegrp  Bone      Liver      Thyroid  Kidney   Lung      GI-LLI   Skin      TB
-----
ADULT    2.44E-05  1.40E-01  1.39E-01  1.39E-01  1.39E-01  1.58E-01  0.00E+00  1.40E-01
TEEN     2.55E-05  1.05E-01  1.04E-01  1.05E-01  1.04E-01  1.17E-01  0.00E+00  1.05E-01
CHILD    3.17E-05  1.17E-01  1.17E-01  1.17E-01  1.16E-01  1.21E-01  0.00E+00  1.17E-01
INFANT   4.03E-07  5.17E-02  5.17E-02  5.17E-02  5.17E-02  5.17E-02  0.00E+00  5.17E-02

```

```

=== SITE DOSE LIMIT ANALYSIS ===== ANNUAL 2015 =====
Annual - Limit                Age      Dose      Limit      Max % of
                              Group     (mrem)    (mrem)     Limit
-----
2015  - Admin. Any Organ      ADULT    GILLI      1.58E-01  7.50E+00  2.10E+00
2015  - Admin. Total Body     ADULT    TBODY      1.40E-01  2.25E+00  6.22E+00

```

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2015  - T.Spc. Any Organ      ADULT    GILLI      1.58E-01  1.00E+01  1.58E+00
Critical Pathway: Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)

```

```

Nuclide      Percentage
-----

```

```

H-3          8.84E+01
CR-51        2.18E-02
MN-54        1.87E-02
FE-59        1.29E-02
CO-58        1.77E+00
CO-60        1.87E+00
ZR-95        5.09E-04
NB-95        7.58E+00
SB-124       2.45E-03
SB-125       1.60E-03
TE-132       3.45E-01
I-132        2.58E-05
I-133        5.56E-05

```

```

2015  - T.Spc. Total Body     ADULT    TBODY      1.40E-01  3.00E+00  4.66E+00
Critical Pathway: Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)

```

```

Nuclide      Percentage
-----

```

```

H-3          9.95E+01
CR-51        9.74E-05
MN-54        1.31E-03
FE-59        1.67E-03
CO-58        2.21E-01

```

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
CO-60	2.47E-01
ZR-95	1.22E-07
NB-95	7.56E-04
SB-124	3.84E-05
SB-125	3.90E-05
TE-132	7.71E-03
I-132	5.41E-05
I-133	2.13E-05

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS ===== QUARTER 1 =====

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 1 - Admin. Any Organ	CHILD	BONE	1.94E-01	5.63E+00	3.45E+00
Qtr 1 - Admin. Total Body	CHILD	TBODY	4.06E-02	5.25E+00	7.73E-01

Qtr 1 - T.Spc. Any Organ	CHILD	BONE	1.94E-01	7.50E+00	2.59E+00
--------------------------	-------	------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
-----	----------

C-14	1.00E+02
------	----------

I-131	6.39E-05
-------	----------

Qtr 1 - T.Spc. Total Body	CHILD	TBODY	4.06E-02	7.50E+00	5.41E-01
---------------------------	-------	-------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	4.32E+00
-----	----------

C-14	9.57E+01
------	----------

I-131	1.76E-04
-------	----------

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

```

=== NG DOSE LIMIT ANALYSIS ===== QUARTER 1 =====
Quarter - Limit                               Dose      Limit      Max % of
(mrad)      (mrad)      Limit
-----
Qtr 1 - Admin. Gamma                         1.70E-05   3.75E+00   4.53E-04
Qtr 1 - Admin. Beta                          8.83E-06   7.50E+00   1.18E-04

Qtr 1 - T.Spc. Gamma                         1.70E-05   5.00E+00   3.40E-04
Receptor: Composite Crit. Receptor - NG
Distance: 800 meters      Compass Point: SSE
Nuclide      Percentage
-----
AR-41        3.26E+01
XE-135       2.56E-01
XE-133       6.72E+01

Qtr 1 - T.Spc. Beta                         8.83E-06   1.00E+01   8.83E-05
Receptor: Composite Crit. Receptor - NG
Distance: 800 meters      Compass Point: SSE
Nuclide      Percentage
-----
AR-41        5.43E+00
XE-135       1.55E-01
XE-133       9.44E+01

```


40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS === QUARTER 2 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 2 - Admin. Any Organ	CHILD	BONE	1.80E-01	5.63E+00	3.19E+00
Qtr 2 - Admin. Total Body	CHILD	TBODY	3.73E-02	5.25E+00	7.11E-01

Qtr 2 - T.Spc. Any Organ	CHILD	BONE	1.80E-01	7.50E+00	2.40E+00
--------------------------	-------	------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
-----	----------

C-14	1.00E+02
------	----------

Qtr 2 - T.Spc. Total Body	CHILD	TBODY	3.73E-02	7.50E+00	4.98E-01
---------------------------	-------	-------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	3.79E+00
-----	----------

C-14	9.62E+01
------	----------

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === QUARTER 2 ===

Quarter - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
-----	-----	-----	-----
Qtr 2 - Admin. Gamma	1.76E-05	3.75E+00	4.70E-04
Qtr 2 - Admin. Beta	4.81E-06	7.50E+00	6.42E-05
Qtr 2 - T.Spc. Gamma	1.76E-05	5.00E+00	3.52E-04
Receptor: Composite Crit. Receptor - NG			
Distance: 800 meters Compass Point: SSE			
Nuclide	Percentage		
-----	-----		
AR-41	7.10E+01		
XE-133	2.90E+01		
Qtr 2 - T.Spc. Beta	4.81E-06	1.00E+01	4.81E-05
Receptor: Composite Crit. Receptor - NG			
Distance: 800 meters Compass Point: SSE			
Nuclide	Percentage		
-----	-----		
AR-41	2.25E+01		
XE-133	7.75E+01		

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS ===== QUARTER 3 =====

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 3 - Admin. Any Organ	CHILD	BONE	1.78E-01	5.63E+00	3.16E+00
Qtr 3 - Admin. Total Body	CHILD	TBODY	3.62E-02	5.25E+00	6.89E-01

Qtr 3 - T.Spc. Any Organ	CHILD	BONE	1.78E-01	7.50E+00	2.37E+00
--------------------------	-------	------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
-----	----------

C-14	1.00E+02
------	----------

I-131	3.08E-04
-------	----------

Qtr 3 - T.Spc. Total Body	CHILD	TBODY	3.62E-02	7.50E+00	4.82E-01
---------------------------	-------	-------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	1.87E+00
-----	----------

C-14	9.81E+01
------	----------

I-131	8.70E-04
-------	----------

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === QUARTER 3 ===

Quarter - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
-----	-----	-----	-----
Qtr 3 - Admin. Gamma	1.52E-05	3.75E+00	4.06E-04
Qtr 3 - Admin. Beta	3.47E-06	7.50E+00	4.62E-05

Qtr 3 - T.Spc. Gamma	1.52E-05	5.00E+00	3.04E-04
----------------------	----------	----------	----------

Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide Percentage

AR-41 7.68E+01

KR-85M 2.09E-02

XE-135 2.03E+00

XE-133M 4.49E-02

XE-133 2.11E+01

Qtr 3 - T.Spc. Beta	3.47E-06	1.00E+01	3.47E-05
---------------------	----------	----------	----------

Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide Percentage

AR-41 2.92E+01

KR-85M 3.60E-02

XE-135 2.80E+00

XE-133M 2.19E-01

XE-133 6.78E+01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS ===== QUARTER 4 =====

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 4 - Admin. Any Organ	CHILD	BONE	1.70E-01	5.63E+00	3.03E+00
Qtr 4 - Admin. Total Body	CHILD	TBODY	3.48E-02	5.25E+00	6.62E-01

Qtr 4 - T.Spc. Any Organ	CHILD	BONE	1.70E-01	7.50E+00	2.27E+00
--------------------------	-------	------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
C-14	1.00E+02
CR-51	3.30E-07
I-131	6.90E-05

Qtr 4 - T.Spc. Total Body	CHILD	TBODY	3.48E-02	7.50E+00	4.64E-01
---------------------------	-------	-------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	2.00E+00
C-14	9.80E+01
CR-51	1.70E-06
I-131	1.95E-04

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS ===== QUARTER 4 =====

Quarter - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
Qtr 4 - Admin. Gamma	1.76E-02	3.75E+00	4.69E-01
Qtr 4 - Admin. Beta	8.38E-04	7.50E+00	1.12E-02

Qtr 4 - T.Spc. Gamma	1.76E-02	5.00E+00	3.52E-01
----------------------	----------	----------	----------

Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide Percentage

AR-41	2.11E-02
KR-85M	1.30E-06
XE-135	4.16E-05
XE-133M	1.70E-06
KR-88	9.99E+01
XE-133	3.20E-02

Qtr 4 - T.Spc. Beta	8.38E-04	1.00E+01	8.38E-03
---------------------	----------	----------	----------

Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide Percentage

AR-41	3.84E-02
KR-85M	1.07E-05
XE-135	2.75E-04
XE-133M	3.97E-05
KR-88	9.95E+01
XE-133	4.92E-01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS ===== ANNUAL 2015 =====

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2015 - Admin. Any Organ	CHILD	BONE	7.22E-01	1.13E+01	6.42E+00
2015 - Admin. Total Body	CHILD	TBODY	1.49E-01	1.05E+01	1.42E+00

2015 - T.Spc. Any Organ	CHILD	BONE	7.22E-01	1.50E+01	4.81E+00
-------------------------	-------	------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	0.00E+00
C-14	1.00E+02
CR-51	7.79E-08
I-131	1.09E-04

2015 - T.Spc. Total Body	CHILD	TBODY	1.49E-01	1.50E+01	9.92E-01
--------------------------	-------	-------	----------	----------	----------

Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	3.05E+00
C-14	9.69E+01
CR-51	3.98E-07
I-131	3.05E-04

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS ===== ANNUAL 2015 =====

Annual - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
2015 - Admin. Gamma	1.76E-02	7.50E+00	2.35E-01
2015 - Admin. Beta	8.55E-04	1.50E+01	5.70E-03

2015 - T.Spc. Gamma	1.76E-02	1.00E+01	1.76E-01
---------------------	----------	----------	----------

Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide	Percentage
AR-41	1.89E-01
KR-85M	1.93E-05
XE-135	2.03E-03
XE-133M	4.04E-05
KR-88	9.97E+01
XE-133	1.44E-01

2015 - T.Spc. Beta	8.55E-04	2.00E+01	4.27E-03
--------------------	----------	----------	----------

Receptor: Composite Crit. Receptor - NG

Distance: 800 (meters) Compass Point: SSE

Nuclide	Percentage
AR-41	3.39E-01
KR-85M	1.57E-04
XE-135	1.32E-02
XE-133M	9.29E-04
KR-88	9.75E+01
XE-133	2.17E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== MAXIMUM DOSE ANALYSIS ===== ANNUAL 2015 =====

Dose Type	Age Group	Organ	Dose (mrem)
Any Organ	CHILD	BONE	7.22E-01

Liquid Receptor: Liquid Receptor
 Gaseous Receptor: Composite Crit. Receptor - IP
 Distance: 800 meters Compass Point: SSE

Liquid Dose: 3.17E-05 % of Total: 4.39E-03

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
CR-51	0.00E+00
MN-54	0.00E+00
FE-59	1.03E+01
CO-58	0.00E+00
CO-60	0.00E+00
ZR-95	3.46E-03
NB-95	1.33E+01
SB-124	7.19E-01
SB-125	1.23E+00
TE-132	7.39E+01
I-132	3.39E-01
I-133	2.49E-01

Gaseous Dose: 7.22E-01 % of Total: 1.00E+02

Critical Pathway: Vegetation (VEG)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
C-14	1.00E+02
CR-51	7.79E-08
I-131	1.09E-04

=== MAXIMUM DOSE ANALYSIS ===== ANNUAL 2015 =====

Dose Type	Age Group	Organ	Dose (mrem)
Total Body	CHILD	TBODY	2.66E-01

Liquid Receptor: Liquid Receptor
 Gaseous Receptor: Composite Crit. Receptor - IP
 Distance: 800 meters Compass Point: SSE

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Liquid Dose: 1.17E-01 % of Total: 4.41E+01
Critical Pathway: Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)

Nuclide Percentage

H-3 9.94E+01
CR-51 1.28E-04
MN-54 1.68E-03
FE-59 2.24E-03
CO-58 2.88E-01
CO-60 3.22E-01
ZR-95 1.83E-07
NB-95 9.98E-04
SB-124 6.80E-05
SB-125 6.95E-05
TE-132 1.07E-02
I-132 7.75E-05
I-133 3.14E-05

Gaseous Dose: 1.49E-01 % of Total: 5.60E+01
Critical Pathway: Vegetation (VEG)
Major Contributors (0% or greater to total)

Nuclide Percentage

H-3 3.05E+00
C-14 9.69E+01
CR-51 3.98E-07
I-131 3.05E-04

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== RELEASE DATA ===
 Total Release Duration (minutes)..... 6.183E+05
 Total Release Volume (cf)..... 6.672E+10
 Average Release Flowrate (cfm)..... 1.079E+05
 Average Period Flowrate (cfm)..... 1.269E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	4.99E+04	2.64E-11	2.64E-03	1.00E-08
KR-85M	2.38E+01	1.26E-14	1.26E-07	1.00E-07
KR-88	1.99E+07	1.06E-08	1.17E+00	9.00E-09
XE-133M	1.88E+02	9.95E-14	1.66E-07	6.00E-07
XE-133	8.40E+05	4.45E-10	8.89E-04	5.00E-07
XE-135	1.81E+03	9.56E-13	1.37E-05	7.00E-08
F&AG	2.08E+07	1.10E-08	1.18E+00	
C-14	4.24E+06	2.25E-09	7.49E-01	3.00E-09
Other	4.24E+06	2.25E-09	7.49E-01	
H-3	2.73E+07	1.44E-08	1.44E-01	1.00E-07
H-3	2.73E+07	1.44E-08	1.44E-01	
Total	5.23E+07	2.77E-08	2.07E+00	

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	CHILD	BONE	3.46E-01	31-day	2.25E-01	1.54E+02
					Quarter	5.63E+00	6.15E+00
					Annual	1.13E+01	3.07E+00
T.Spec	Any Organ	CHILD	BONE	3.46E-01	31-day	3.00E-01	1.15E+02
					Quarter	7.50E+00	4.61E+00
					Annual	1.50E+01	2.31E+00

Receptor.....: Composite Crit. Receptor - IP
 Distance (meters).....: 800
 Compass Point.....: SSE
 Critical Pathway.....: Vegetation (VEG)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	0.00E+00
C-14	1.00E+02

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AINHL	1.10E-03	4.85E-04	4.85E-04	4.85E-04	4.85E-04	4.85E-04	0.00E+00	4.85E-04
AVEG	5.43E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02	0.00E+00	1.13E-02
ACMEAT	2.01E-02	4.10E-03	4.10E-03	4.10E-03	4.10E-03	4.10E-03	0.00E+00	4.10E-03
ACMILK	2.20E-02	4.56E-03	4.56E-03	4.56E-03	4.56E-03	4.56E-03	0.00E+00	4.56E-03
TINHL	1.57E-03	5.76E-04	5.76E-04	5.76E-04	5.76E-04	5.76E-04	0.00E+00	5.76E-04
TVEG	8.77E-02	1.82E-02	1.82E-02	1.82E-02	1.82E-02	1.82E-02	0.00E+00	1.82E-02
TCMEAT	1.70E-02	3.44E-03	3.44E-03	3.44E-03	3.44E-03	3.44E-03	0.00E+00	3.44E-03
TCMILK	4.05E-02	8.33E-03	8.33E-03	8.33E-03	8.33E-03	8.33E-03	0.00E+00	8.33E-03
CINHL	2.17E-03	6.56E-04	6.56E-04	6.56E-04	6.56E-04	6.56E-04	0.00E+00	6.56E-04
CVEG	2.12E-01	4.33E-02	4.33E-02	4.33E-02	4.33E-02	4.33E-02	0.00E+00	4.33E-02
CCMEAT	3.20E-02	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	0.00E+00	6.47E-03
CCMILK	9.98E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	0.00E+00	2.03E-02
IINHL	1.60E-03	4.64E-04	4.64E-04	4.64E-04	4.64E-04	4.64E-04	0.00E+00	4.64E-04
ICMILK	1.95E-01	4.22E-02	4.22E-02	4.22E-02	4.22E-02	4.22E-02	0.00E+00	4.22E-02
----- TOTALS -----								
ADULT	9.75E-02	2.05E-02	2.05E-02	2.05E-02	2.05E-02	2.05E-02	0.00E+00	2.05E-02
TEEN	1.47E-01	3.05E-02	3.05E-02	3.05E-02	3.05E-02	3.05E-02	0.00E+00	3.05E-02
CHILD	3.46E-01	7.07E-02	7.07E-02	7.07E-02	7.07E-02	7.07E-02	0.00E+00	7.07E-02
INFANT	1.97E-01	4.27E-02	4.27E-02	4.27E-02	4.27E-02	4.27E-02	0.00E+00	4.27E-02

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CINHL	CHILD	Inhalation (INHL)
CVEG	CHILD	Vegetation (VEG)
CCMEAT	CHILD	Grs/Cow/Meat (CMEAT)
CCMILK	CHILD	Grs/Cow/Milk (CMILK)
IINHL	INFANT	Inhalation (INHL)
ICMILK	INFANT	Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	1.76E-02	31-day	1.50E-01	1.18E+01
			Quarter	3.75E+00	4.70E-01
			Annual	7.50E+00	2.35E-01
Admin	Beta	8.48E-04	31-day	3.00E-01	2.83E-01
			Quarter	7.50E+00	1.13E-02
			Annual	1.50E+01	5.65E-03
T.Spec	Gamma	1.76E-02	31-day	2.00E-01	8.82E+00
			Quarter	5.00E+00	3.53E-01
			Annual	1.00E+01	1.76E-01

Receptor.....: Composite Crit. Receptor - NG
 Distance (meters).....: 800
 Compass Point.....: SSE
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage				
AR-41	1.53E-01				
KR-85M	9.64E-06				
KR-88	9.97E+01				
XE-133M	2.02E-05				
XE-133	9.75E-02				
XE-135	1.14E-03				
T.Spec	Beta	8.48E-04	31-day	4.00E-01	2.12E-01
			Quarter	1.00E+01	8.48E-03
			Annual	2.00E+01	4.24E-03

Receptor.....: Composite Crit. Receptor - NG
 Distance (meters).....: 800
 Compass Point.....: SSE
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.75E-01
KR-85M	7.89E-05
KR-88	9.82E+01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
XE-133M	4.68E-04
XE-133	1.48E+00
XE-135	7.47E-03

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== RELEASE DATA =====
 Total Release Duration (minutes)..... 6.107E+05
 Total Release Volume (cf)..... 8.233E+10
 Average Release Flowrate (cfm)..... 1.348E+05

Average Period Flowrate (cfm)..... 1.566E+05

=== NUCLIDE DATA =====

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	1.21E+04	5.20E-12	5.20E-04	1.00E-08
KR-85M	2.38E+01	1.02E-14	1.02E-07	1.00E-07
XE-133M	1.88E+02	8.07E-14	1.34E-07	6.00E-07
XE-133	3.98E+05	1.71E-10	3.42E-04	5.00E-07
XE-135	1.42E+03	6.07E-13	8.68E-06	7.00E-08
F&AG	4.12E+05	1.77E-10	8.71E-04	
I-131	4.45E+00	1.91E-15	9.54E-06	2.00E-10
Iodine	4.45E+00	1.91E-15	9.54E-06	
C-14	4.61E+06	1.98E-09	6.60E-01	3.00E-09
Other	4.61E+06	1.98E-09	6.60E-01	
H-3	5.32E+07	2.28E-08	2.28E-01	1.00E-07
H-3	5.32E+07	2.28E-08	2.28E-01	
CR-51	1.01E+00	4.35E-16	1.45E-08	3.00E-08
P>=8	1.01E+00	4.35E-16	1.45E-08	
Total	5.82E+07	2.50E-08	8.89E-01	

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	CHILD	BONE	3.76E-01	31-day	2.25E-01	1.67E+02
					Quarter	5.63E+00	6.68E+00
					Annual	1.13E+01	3.34E+00
T.Spec	Any Organ	CHILD	BONE	3.76E-01	31-day	3.00E-01	1.25E+02
					Quarter	7.50E+00	5.01E+00
					Annual	1.50E+01	2.51E+00

Receptor.....: Composite Crit. Receptor - IP
 Distance (meters).....: 800
 Compass Point.....: SSE
 Critical Pathway.....: Vegetation (VEG)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	0.00E+00
C-14	1.00E+02
CR-51	1.50E-07
I-131	2.10E-04

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) =====								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	0.00E+00	9.69E-09
AINHL	1.20E-03	7.69E-04	7.70E-04	7.69E-04	7.69E-04	7.69E-04	0.00E+00	7.69E-04
AVEG	5.90E-02	1.28E-02	1.28E-02	1.28E-02	1.28E-02	1.28E-02	0.00E+00	1.28E-02
ACMEAT	2.19E-02	4.52E-03	4.52E-03	4.52E-03	4.52E-03	4.52E-03	0.00E+00	4.52E-03
ACMILK	2.39E-02	5.11E-03	5.18E-03	5.11E-03	5.11E-03	5.11E-03	0.00E+00	5.11E-03
TGPD	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	0.00E+00	9.69E-09
TINHL	1.71E-03	8.70E-04	8.71E-04	8.70E-04	8.70E-04	8.70E-04	0.00E+00	8.70E-04
TVEG	9.54E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	0.00E+00	2.03E-02
TCMEAT	1.85E-02	3.78E-03	3.78E-03	3.78E-03	3.78E-03	3.78E-03	0.00E+00	3.78E-03
TCMILK	4.41E-02	9.24E-03	9.36E-03	9.24E-03	9.24E-03	9.24E-03	0.00E+00	9.24E-03
CGPD	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	0.00E+00	9.69E-09
CINHL	2.36E-03	9.28E-04	9.29E-04	9.28E-04	9.28E-04	9.28E-04	0.00E+00	9.28E-04
CVEG	2.30E-01	4.78E-02	4.79E-02	4.78E-02	4.78E-02	4.78E-02	0.00E+00	4.78E-02
CCMEAT	3.48E-02	7.07E-03	7.08E-03	7.07E-03	7.07E-03	7.07E-03	0.00E+00	7.07E-03
CCMILK	1.09E-01	2.23E-02	2.26E-02	2.23E-02	2.23E-02	2.23E-02	0.00E+00	2.23E-02
IGPD	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	0.00E+00	9.69E-09
IINHL	1.74E-03	6.28E-04	6.29E-04	6.28E-04	6.28E-04	6.28E-04	0.00E+00	6.28E-04
ICMILK	2.12E-01	4.64E-02	4.69E-02	4.64E-02	4.64E-02	4.64E-02	0.00E+00	4.64E-02

----- TOTALS -----								
ADULT	1.06E-01	2.31E-02	2.32E-02	2.31E-02	2.31E-02	2.31E-02	0.00E+00	2.31E-02
TEEN	1.60E-01	3.42E-02	3.43E-02	3.42E-02	3.42E-02	3.42E-02	0.00E+00	3.42E-02
CHILD	3.76E-01	7.82E-02	7.84E-02	7.82E-02	7.82E-02	7.82E-02	0.00E+00	7.82E-02
INFANT	2.14E-01	4.70E-02	4.75E-02	4.70E-02	4.70E-02	4.70E-02	0.00E+00	4.70E-02

=== AGE GROUP / PATHWAY DESCRIPTIONS =====		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== AGE GROUP / PATHWAY DESCRIPTIONS =====
Abbreviation Age Group Pathway

CVEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
-----	-----	-----	-----	-----	-----
Admin	Gamma	1.49E-05	31-day	1.50E-01	9.91E-03
			Quarter	3.75E+00	3.96E-04
			Annual	7.50E+00	1.98E-04
-----	-----	-----	-----	-----	-----
Admin	Beta	6.59E-06	31-day	3.00E-01	2.20E-03
			Quarter	7.50E+00	8.78E-05
			Annual	1.50E+01	4.39E-05
-----	-----	-----	-----	-----	-----
T.Spec	Gamma	1.49E-05	31-day	2.00E-01	7.43E-03
			Quarter	5.00E+00	2.97E-04
			Annual	1.00E+01	1.49E-04

Receptor.....: Composite Crit. Receptor - NG
 Distance (meters).....: 800
 Compass Point.....: SSE
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
AR-41	4.40E+01
KR-85M	1.14E-02
XE-133M	2.40E-02
XE-133	5.49E+01
XE-135	1.06E+00

-----	-----	-----	-----	-----
T.Spec	Beta	6.59E-06	31-day	4.00E-01
			Quarter	1.00E+01
			Annual	2.00E+01
				1.65E-03
				6.59E-05
				3.29E-05

Receptor.....: Composite Crit. Receptor - NG
 Distance (meters).....: 800
 Compass Point.....: SSE
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
AR-41	8.61E+00
KR-85M	1.02E-02
XE-133M	6.03E-02
XE-133	9.06E+01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

Major Contributors.....: 0.0 % or greater to total
Nuclide Percentage

XE-135 7.54E-01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1

=== MULTIPLE RELEASE POINT MESSAGE =====
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA =====
Total Release Duration (minutes)..... 5.435E+05
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA =====

Nuclide	uCi
CO-57	1.40E+01
SB-122	5.08E+00
SB-124	2.69E+01
SB-125	7.12E+01
TE-123M	2.05E+01
CR-51	1.92E+02
MN-54	3.94E+00
FE-59	4.47E+00
CO-58	2.76E+03
CO-60	1.09E+03
ZR-95	5.34E+00
NB-95	1.42E+01
TE-132	1.32E+01
I-132	1.95E+01
I-133	1.93E+00
Gamma	4.24E+03
XE-133	2.54E+02
D&EG	2.54E+02
H-3	1.66E+09
Beta	1.66E+09
Total	1.66E+09

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) =====								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB

APWtr	6.08E-08	1.95E-02	1.95E-02	1.95E-02	1.95E-02	1.95E-02	0.00E+00	1.95E-02
AFWFSp	1.21E-05	5.03E-02	5.02E-02	5.02E-02	5.01E-02	5.93E-02	0.00E+00	5.05E-02
TPWtr	5.87E-08	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	0.00E+00	1.37E-02
TFWFSp	1.27E-05	3.87E-02	3.85E-02	3.86E-02	3.85E-02	4.49E-02	0.00E+00	3.89E-02
CPWtr	1.69E-07	2.63E-02	2.63E-02	2.63E-02	2.63E-02	2.64E-02	0.00E+00	2.64E-02
CFWFSp	1.57E-05	3.20E-02	3.19E-02	3.19E-02	3.19E-02	3.41E-02	0.00E+00	3.23E-02
IPWtr	2.02E-07	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02

TOTALS -----								
ADULT	1.22E-05	6.98E-02	6.96E-02	6.97E-02	6.96E-02	7.88E-02	0.00E+00	7.00E-02
TEEN	1.27E-05	5.24E-02	5.22E-02	5.23E-02	5.22E-02	5.86E-02	0.00E+00	5.26E-02
CHILD	1.58E-05	5.84E-02	5.83E-02	5.83E-02	5.82E-02	6.05E-02	0.00E+00	5.86E-02
INFANT	2.02E-07	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02

=== AGE GROUP / PATHWAY DESCRIPTIONS =====		
Abbreviation	Age Group	Pathway

APWtr	ADULT	Potable Water (PWtr)
AFWFSp	ADULT	Fresh Water Fish - Sport (FFSP)
TPWtr	TEEN	Potable Water (PWtr)
TFWFSp	TEEN	Fresh Water Fish - Sport (FFSP)
CPWtr	CHILD	Potable Water (PWtr)
CFWFSp	CHILD	Fresh Water Fish - Sport (FFSP)
IPWtr	INFANT	Potable Water (PWtr)

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
-----	-----	-----	-----	-----	-----	-----	-----	-----
ADULT								
H-3	0.00E+00	6.96E-02	6.96E-02	6.96E-02	6.96E-02	6.96E-02	0.00E+00	6.96E-02
CR-51	0.00E+00	0.00E+00	4.07E-08	1.50E-08	9.04E-08	1.71E-05	0.00E+00	6.82E-08
MN-54	0.00E+00	4.80E-06	0.00E+00	1.43E-06	0.00E+00	1.47E-05	0.00E+00	9.16E-07
FE-59	1.30E-06	3.05E-06	0.00E+00	0.00E+00	8.52E-07	1.02E-05	0.00E+00	1.17E-06
CO-58	0.00E+00	6.90E-05	0.00E+00	0.00E+00	0.00E+00	1.40E-03	0.00E+00	1.55E-04
CO-60	0.00E+00	7.83E-05	0.00E+00	0.00E+00	0.00E+00	1.47E-03	0.00E+00	1.73E-04
ZR-95	3.95E-10	1.27E-10	0.00E+00	1.99E-10	0.00E+00	4.01E-07	0.00E+00	8.57E-11
NB-95	1.77E-06	9.84E-07	0.00E+00	9.73E-07	0.00E+00	5.97E-03	0.00E+00	5.29E-07
SB-124	6.77E-08	1.28E-09	1.65E-10	0.00E+00	5.28E-08	1.93E-06	0.00E+00	2.69E-08
SB-125	1.15E-07	1.28E-09	1.17E-10	0.00E+00	8.85E-08	1.26E-06	0.00E+00	2.73E-08
TE-132	8.88E-06	5.75E-06	6.35E-06	5.53E-05	0.00E+00	2.72E-04	0.00E+00	5.39E-06
I-132	4.05E-08	1.08E-07	3.79E-06	1.72E-07	0.00E+00	2.03E-08	0.00E+00	3.79E-08
I-133	2.80E-08	4.88E-08	7.17E-06	8.51E-08	0.00E+00	4.38E-08	0.00E+00	1.49E-08
TEEN								
H-3	0.00E+00	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	0.00E+00	5.22E-02
CR-51	0.00E+00	0.00E+00	3.90E-08	1.54E-08	1.00E-07	1.18E-05	0.00E+00	7.02E-08
MN-54	0.00E+00	4.72E-06	0.00E+00	1.41E-06	0.00E+00	9.69E-06	0.00E+00	9.37E-07
FE-59	1.34E-06	3.12E-06	0.00E+00	0.00E+00	9.83E-07	7.38E-06	0.00E+00	1.20E-06
CO-58	0.00E+00	6.86E-05	0.00E+00	0.00E+00	0.00E+00	9.45E-04	0.00E+00	1.58E-04
CO-60	0.00E+00	7.83E-05	0.00E+00	0.00E+00	0.00E+00	1.02E-03	0.00E+00	1.76E-04
ZR-95	4.04E-10	1.28E-10	0.00E+00	1.87E-10	0.00E+00	2.94E-07	0.00E+00	8.77E-11
NB-95	1.78E-06	9.88E-07	0.00E+00	9.58E-07	0.00E+00	4.23E-03	0.00E+00	5.44E-07
SB-124	6.98E-08	1.29E-09	3.83E-07	0.00E+00	6.10E-08	1.41E-06	0.00E+00	9.33E-09
SB-125	1.18E-07	1.30E-09	1.13E-10	0.00E+00	1.04E-07	9.23E-07	0.00E+00	2.77E-08
TE-132	9.37E-06	5.93E-06	6.26E-06	5.69E-05	0.00E+00	1.88E-04	0.00E+00	5.59E-06
I-132	4.23E-08	1.11E-07	3.73E-06	1.74E-07	0.00E+00	4.82E-08	0.00E+00	3.97E-08
I-133	3.02E-08	5.12E-08	7.15E-06	8.98E-08	0.00E+00	3.87E-08	0.00E+00	1.56E-08
CHILD								
H-3	0.00E+00	5.82E-02	5.82E-02	5.82E-02	5.82E-02	5.82E-02	0.00E+00	5.82E-02
CR-51	0.00E+00	0.00E+00	4.17E-08	1.14E-08	7.61E-08	3.98E-06	0.00E+00	7.50E-08
MN-54	0.00E+00	3.70E-06	0.00E+00	1.04E-06	0.00E+00	3.10E-06	0.00E+00	9.85E-07
FE-59	1.63E-06	2.63E-06	0.00E+00	0.00E+00	7.63E-07	2.74E-06	0.00E+00	1.31E-06
CO-58	0.00E+00	5.52E-05	0.00E+00	0.00E+00	0.00E+00	3.22E-04	0.00E+00	1.69E-04
CO-60	0.00E+00	6.41E-05	0.00E+00	0.00E+00	0.00E+00	3.55E-04	0.00E+00	1.89E-04
ZR-95	5.48E-10	1.20E-10	0.00E+00	1.72E-10	0.00E+00	1.26E-07	0.00E+00	1.07E-10
NB-95	2.10E-06	8.19E-07	0.00E+00	7.69E-07	0.00E+00	1.51E-03	0.00E+00	5.85E-07
SB-124	1.14E-07	1.47E-09	2.52E-10	0.00E+00	6.32E-08	7.13E-07	0.00E+00	3.99E-08

LIQUID RELEASE AND DOSE SUMMARY REPORT

----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05

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=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====
Agegroup Bone      Liver      Thyroid  Kidney   Lung      GI-Lli   Skin      TB
-----
SB-125   1.95E-07 1.50E-09 1.80E-10 0.00E+00 1.08E-07 4.65E-07 0.00E+00 4.07E-08
TE-132   1.17E-05 5.18E-06 7.55E-06 4.81E-05 0.00E+00 5.22E-05 0.00E+00 6.26E-06
I-132    5.37E-08 9.87E-08 4.58E-06 1.51E-07 0.00E+00 1.16E-07 0.00E+00 4.54E-08
I-133    3.94E-08 4.87E-08 9.05E-06 8.11E-08 0.00E+00 1.96E-08 0.00E+00 1.84E-08

INFANT
H-3      0.00E+00 2.59E-02 2.59E-02 2.59E-02 2.59E-02 2.59E-02 0.00E+00 2.59E-02
CR-51    0.00E+00 0.00E+00 1.85E-10 4.04E-11 3.60E-10 8.26E-09 0.00E+00 2.83E-10
MN-54    0.00E+00 8.21E-09 0.00E+00 1.82E-09 0.00E+00 3.02E-09 0.00E+00 1.86E-09
FE-59    1.44E-08 2.52E-08 0.00E+00 0.00E+00 7.44E-09 1.20E-08 0.00E+00 9.92E-09
CO-58    0.00E+00 1.04E-06 0.00E+00 0.00E+00 0.00E+00 2.59E-06 0.00E+00 2.60E-06
CO-60    0.00E+00 1.23E-06 0.00E+00 0.00E+00 0.00E+00 2.93E-06 0.00E+00 2.91E-06
ZR-95    1.15E-10 2.81E-11 0.00E+00 3.03E-11 0.00E+00 1.40E-08 0.00E+00 1.99E-11
NB-95    6.26E-11 2.58E-11 0.00E+00 1.85E-11 0.00E+00 2.18E-08 0.00E+00 1.49E-11
SB-124    6.04E-08 8.92E-10 1.60E-10 0.00E+00 3.78E-08 1.87E-07 0.00E+00 1.87E-08
SB-125    9.19E-08 8.89E-10 1.15E-10 0.00E+00 5.32E-08 1.23E-07 0.00E+00 1.89E-08
TE-132    2.88E-08 1.43E-08 2.10E-08 8.91E-08 0.00E+00 5.27E-08 0.00E+00 1.33E-08
I-132     3.39E-09 6.88E-09 3.22E-07 7.68E-09 0.00E+00 5.57E-09 0.00E+00 2.45E-09
I-133     2.53E-09 3.68E-09 6.69E-07 4.33E-09 0.00E+00 6.23E-10 0.00E+00 1.08E-09
  
```

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: Liquid Receptor

=== MAXIMUM DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	ADULT	GILLI	7.88E-02	31-day Quarter Annual	1.50E-01 3.75E+00 7.50E+00	5.25E+01 2.10E+00 1.05E+00
Admin	Tot Body	ADULT	TBODY	7.00E-02	31-day Quarter Annual	4.50E-02 1.13E+00 2.25E+00	1.55E+02 6.22E+00 3.11E+00
T.Spec	Any Organ	ADULT	GILLI	7.88E-02	31-day Quarter Annual	2.00E-01 5.00E+00 1.00E+01	3.94E+01 1.58E+00 7.88E-01

Critical Pathway.....: Fresh Water Fish - Sport (FFSP)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
SB-125	1.60E-03
SB-124	2.45E-03
H-3	8.84E+01
CR-51	2.18E-02
MN-54	1.87E-02
FE-59	1.29E-02
CO-58	1.77E+00
CO-60	1.87E+00
ZR-95	5.09E-04
NB-95	7.58E+00
TE-132	3.45E-01
I-132	2.58E-05
I-133	5.56E-05

T.Spec	Tot Body	ADULT	TBODY	7.00E-02	31-day Quarter Annual	6.00E-02 1.50E+00 3.00E+00	1.17E+02 4.66E+00 2.33E+00
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Critical Pathway.....: Fresh Water Fish - Sport (FFSP)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
SB-125	3.90E-05
SB-124	3.84E-05
H-3	9.95E+01
CR-51	9.74E-05
MN-54	1.31E-03
FE-59	1.67E-03
CO-58	2.21E-01
CO-60	2.47E-01
ZR-95	1.22E-07
NB-95	7.56E-04
TE-132	7.71E-03
I-132	5.41E-05
I-133	2.13E-05

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2

=== MULTIPLE RELEASE POINT MESSAGE =====
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA =====
Total Release Duration (minutes)..... 5.435E+05
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA =====

Nuclide	uCi
CO-57	1.40E+01
SB-122	5.08E+00
SB-124	2.69E+01
SB-125	7.12E+01
TE-123M	2.05E+01
CR-51	1.92E+02
MN-54	3.94E+00
FE-59	4.47E+00
CO-58	2.76E+03
CO-60	1.09E+03
ZR-95	5.34E+00
NB-95	1.42E+01
TE-132	1.32E+01
I-132	1.95E+01
I-133	1.93E+00
Gamma	4.24E+03
XE-133	2.54E+02
D&EG	2.54E+02
H-3	1.66E+09
Beta	1.66E+09
Total	1.66E+09

LIQUID RELEASE AND DOSE SUMMARY REPORT

----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: Liquid Receptor

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=== PERMIT ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) =====
Age/Path Bone      Liver      Thyroid  Kidney   Lung      GI-Lli    Skin      TB
-----
APWtr      6.08E-08 1.95E-02 1.95E-02 1.95E-02 1.95E-02 1.95E-02 0.00E+00 1.95E-02
AFWFSp     1.21E-05 5.03E-02 5.02E-02 5.02E-02 5.01E-02 5.93E-02 0.00E+00 5.05E-02
TPWtr      5.87E-08 1.37E-02 1.37E-02 1.37E-02 1.37E-02 1.37E-02 0.00E+00 1.37E-02
TFWFSp     1.27E-05 3.87E-02 3.85E-02 3.86E-02 3.85E-02 4.49E-02 0.00E+00 3.89E-02
CPWtr      1.69E-07 2.63E-02 2.63E-02 2.63E-02 2.63E-02 2.64E-02 0.00E+00 2.64E-02
CFWFSp     1.57E-05 3.20E-02 3.19E-02 3.19E-02 3.19E-02 3.41E-02 0.00E+00 3.23E-02
IPWtr      2.02E-07 2.59E-02 2.59E-02 2.59E-02 2.59E-02 2.59E-02 0.00E+00 2.59E-02
  
```

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----- TOTALS -----
ADULT      1.22E-05 6.98E-02 6.96E-02 6.97E-02 6.96E-02 7.88E-02 0.00E+00 7.00E-02
TEEN       1.27E-05 5.24E-02 5.22E-02 5.23E-02 5.22E-02 5.86E-02 0.00E+00 5.26E-02
CHILD      1.58E-05 5.84E-02 5.83E-02 5.83E-02 5.82E-02 6.05E-02 0.00E+00 5.86E-02
INFANT     2.02E-07 2.59E-02 2.59E-02 2.59E-02 2.59E-02 2.59E-02 0.00E+00 2.59E-02
  
```

=== AGE GROUP / PATHWAY DESCRIPTIONS =====

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Abbreviation  Age Group  Pathway
-----
APWtr         ADULT      Potable Water (PWtr)
AFWFSp        ADULT      Fresh Water Fish - Sport (FFSP)
TPWtr         TEEN       Potable Water (PWtr)
TFWFSp        TEEN       Fresh Water Fish - Sport (FFSP)
CPWtr         CHILD      Potable Water (PWtr)
CFWFSp        CHILD      Fresh Water Fish - Sport (FFSP)
IPWtr         INFANT     Potable Water (PWtr)
  
```

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
-----	-----	-----	-----	-----	-----	-----	-----	-----
ADULT								
H-3	0.00E+00	6.96E-02	6.96E-02	6.96E-02	6.96E-02	6.96E-02	0.00E+00	6.96E-02
CR-51	0.00E+00	0.00E+00	4.07E-08	1.50E-08	9.04E-08	1.71E-05	0.00E+00	6.82E-08
MN-54	0.00E+00	4.80E-06	0.00E+00	1.43E-06	0.00E+00	1.47E-05	0.00E+00	9.16E-07
FE-59	1.30E-06	3.05E-06	0.00E+00	0.00E+00	8.52E-07	1.02E-05	0.00E+00	1.17E-06
CO-58	0.00E+00	6.90E-05	0.00E+00	0.00E+00	0.00E+00	1.40E-03	0.00E+00	1.55E-04
CO-60	0.00E+00	7.83E-05	0.00E+00	0.00E+00	0.00E+00	1.47E-03	0.00E+00	1.73E-04
ZR-95	3.95E-10	1.27E-10	0.00E+00	1.99E-10	0.00E+00	4.01E-07	0.00E+00	8.57E-11
NB-95	1.77E-06	9.84E-07	0.00E+00	9.73E-07	0.00E+00	5.97E-03	0.00E+00	5.29E-07
SB-124	6.77E-08	1.28E-09	1.65E-10	0.00E+00	5.28E-08	1.93E-06	0.00E+00	2.69E-08
SB-125	1.15E-07	1.28E-09	1.17E-10	0.00E+00	8.85E-08	1.26E-06	0.00E+00	2.73E-08
TE-132	8.88E-06	5.75E-06	6.35E-06	5.53E-05	0.00E+00	2.72E-04	0.00E+00	5.39E-06
I-132	4.05E-08	1.08E-07	3.79E-06	1.72E-07	0.00E+00	2.03E-08	0.00E+00	3.79E-08
I-133	2.80E-08	4.88E-08	7.17E-06	8.51E-08	0.00E+00	4.38E-08	0.00E+00	1.49E-08
TEEN								
H-3	0.00E+00	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	0.00E+00	5.22E-02
CR-51	0.00E+00	0.00E+00	3.90E-08	1.54E-08	1.00E-07	1.18E-05	0.00E+00	7.02E-08
MN-54	0.00E+00	4.72E-06	0.00E+00	1.41E-06	0.00E+00	9.69E-06	0.00E+00	9.37E-07
FE-59	1.34E-06	3.12E-06	0.00E+00	0.00E+00	9.83E-07	7.38E-06	0.00E+00	1.20E-06
CO-58	0.00E+00	6.86E-05	0.00E+00	0.00E+00	0.00E+00	9.45E-04	0.00E+00	1.58E-04
CO-60	0.00E+00	7.83E-05	0.00E+00	0.00E+00	0.00E+00	1.02E-03	0.00E+00	1.76E-04
ZR-95	4.04E-10	1.28E-10	0.00E+00	1.87E-10	0.00E+00	2.94E-07	0.00E+00	8.77E-11
NB-95	1.78E-06	9.88E-07	0.00E+00	9.58E-07	0.00E+00	4.23E-03	0.00E+00	5.44E-07
SB-124	6.98E-08	1.29E-09	3.83E-07	0.00E+00	6.10E-08	1.41E-06	0.00E+00	9.33E-09
SB-125	1.18E-07	1.30E-09	1.13E-10	0.00E+00	1.04E-07	9.23E-07	0.00E+00	2.77E-08
TE-132	9.37E-06	5.93E-06	6.26E-06	5.69E-05	0.00E+00	1.88E-04	0.00E+00	5.59E-06
I-132	4.23E-08	1.11E-07	3.73E-06	1.74E-07	0.00E+00	4.82E-08	0.00E+00	3.97E-08
I-133	3.02E-08	5.12E-08	7.15E-06	8.98E-08	0.00E+00	3.87E-08	0.00E+00	1.56E-08
CHILD								
H-3	0.00E+00	5.82E-02	5.82E-02	5.82E-02	5.82E-02	5.82E-02	0.00E+00	5.82E-02
CR-51	0.00E+00	0.00E+00	4.17E-08	1.14E-08	7.61E-08	3.98E-06	0.00E+00	7.50E-08
MN-54	0.00E+00	3.70E-06	0.00E+00	1.04E-06	0.00E+00	3.10E-06	0.00E+00	9.85E-07
FE-59	1.63E-06	2.63E-06	0.00E+00	0.00E+00	7.63E-07	2.74E-06	0.00E+00	1.31E-06
CO-58	0.00E+00	5.52E-05	0.00E+00	0.00E+00	0.00E+00	3.22E-04	0.00E+00	1.69E-04
CO-60	0.00E+00	6.41E-05	0.00E+00	0.00E+00	0.00E+00	3.55E-04	0.00E+00	1.89E-04
ZR-95	5.48E-10	1.20E-10	0.00E+00	1.72E-10	0.00E+00	1.26E-07	0.00E+00	1.07E-10
NB-95	2.10E-06	8.19E-07	0.00E+00	7.69E-07	0.00E+00	1.51E-03	0.00E+00	5.85E-07
SB-124	1.14E-07	1.47E-09	2.52E-10	0.00E+00	6.32E-08	7.13E-07	0.00E+00	3.99E-08

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) ===									
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB	
SB-125	1.95E-07	1.50E-09	1.80E-10	0.00E+00	1.08E-07	4.65E-07	0.00E+00	4.07E-08	
TE-132	1.17E-05	5.18E-06	7.55E-06	4.81E-05	0.00E+00	5.22E-05	0.00E+00	6.26E-06	
I-132	5.37E-08	9.87E-08	4.58E-06	1.51E-07	0.00E+00	1.16E-07	0.00E+00	4.54E-08	
I-133	3.94E-08	4.87E-08	9.05E-06	8.11E-08	0.00E+00	1.96E-08	0.00E+00	1.84E-08	
INFANT									
H-3	0.00E+00	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02	
CR-51	0.00E+00	0.00E+00	1.85E-10	4.04E-11	3.60E-10	8.26E-09	0.00E+00	2.83E-10	
MN-54	0.00E+00	8.21E-09	0.00E+00	1.82E-09	0.00E+00	3.02E-09	0.00E+00	1.86E-09	
FE-59	1.44E-08	2.52E-08	0.00E+00	0.00E+00	7.44E-09	1.20E-08	0.00E+00	9.92E-09	
CO-58	0.00E+00	1.04E-06	0.00E+00	0.00E+00	0.00E+00	2.59E-06	0.00E+00	2.60E-06	
CO-60	0.00E+00	1.23E-06	0.00E+00	0.00E+00	0.00E+00	2.93E-06	0.00E+00	2.91E-06	
ZR-95	1.15E-10	2.81E-11	0.00E+00	3.03E-11	0.00E+00	1.40E-08	0.00E+00	1.99E-11	
NB-95	6.26E-11	2.58E-11	0.00E+00	1.85E-11	0.00E+00	2.18E-08	0.00E+00	1.49E-11	
SB-124	6.04E-08	8.92E-10	1.60E-10	0.00E+00	3.78E-08	1.87E-07	0.00E+00	1.87E-08	
SB-125	9.19E-08	8.89E-10	1.15E-10	0.00E+00	5.32E-08	1.23E-07	0.00E+00	1.89E-08	
TE-132	2.88E-08	1.43E-08	2.10E-08	8.91E-08	0.00E+00	5.27E-08	0.00E+00	1.33E-08	
I-132	3.39E-09	6.88E-09	3.22E-07	7.68E-09	0.00E+00	5.57E-09	0.00E+00	2.45E-09	
I-133	2.53E-09	3.68E-09	6.69E-07	4.33E-09	0.00E+00	6.23E-10	0.00E+00	1.08E-09	

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: Liquid Receptor

=== MAXIMUM DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	ADULT	GILLI	7.88E-02	31-day Quarter Annual	1.50E-01 3.75E+00 7.50E+00	5.25E+01 2.10E+00 1.05E+00
Admin	Tot Body	ADULT	TBODY	7.00E-02	31-day Quarter Annual	4.50E-02 1.13E+00 2.25E+00	1.55E+02 6.22E+00 3.11E+00
T.Spec	Any Organ	ADULT	GILLI	7.88E-02	31-day Quarter Annual	2.00E-01 5.00E+00 1.00E+01	3.94E+01 1.58E+00 7.88E-01

Critical Pathway.....: Fresh Water Fish - Sport (FFSP)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
SB-125	1.60E-03
SB-124	2.45E-03
H-3	8.84E+01
CR-51	2.18E-02
MN-54	1.87E-02
FE-59	1.29E-02
CO-58	1.77E+00
CO-60	1.87E+00
ZR-95	5.09E-04
NB-95	7.58E+00
TE-132	3.45E-01
I-132	2.58E-05
I-133	5.56E-05

T.Spec	Tot Body	ADULT	TBODY	7.00E-02	31-day Quarter Annual	6.00E-02 1.50E+00 3.00E+00	1.17E+02 4.66E+00 2.33E+00
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Critical Pathway.....: Fresh Water Fish - Sport (FFSP)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases

Period Start Date.....: 01/01/2015 00:00

Period End Date.....: 01/01/2016 00:00

Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
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SB-125	3.90E-05
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SB-124	3.84E-05
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H-3	9.95E+01
-----	----------

CR-51	9.74E-05
-------	----------

MN-54	1.31E-03
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FE-59	1.67E-03
-------	----------

CO-58	2.21E-01
-------	----------

CO-60	2.47E-01
-------	----------

ZR-95	1.22E-07
-------	----------

NB-95	7.56E-04
-------	----------

TE-132	7.71E-03
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I-132	5.41E-05
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I-133	2.13E-05
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ATTACHMENT P

RETDAS COMPUTER PROGRAM U1 GASEOUS ANNUAL (FILTERED)
DOSE REPORT

BYRON STATION UNIT 1

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== RELEASE DATA ===
 Total Release Duration (minutes)..... 5.256E+05
 Total Release Volume (cf)..... 7.726E+10
 Average Release Flowrate (cfm)..... 1.470E+05

Average Period Flowrate (cfm)..... 1.470E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	2.49E+07	1.14E-08	1.14E+00	1.00E-08
KR-85M	4.99E+06	2.28E-09	2.28E-02	1.00E-07
KR-85	7.00E+08	3.20E-07	4.57E-01	7.00E-07
KR-87	1.00E+06	4.57E-10	2.28E-02	2.00E-08
KR-88	7.99E+06	3.65E-09	4.06E-01	9.00E-09
XE-131M	3.89E+07	1.78E-08	8.90E-03	2.00E-06
XE-133M	1.50E+07	6.85E-09	1.14E-02	6.00E-07
XE-133	2.00E+09	9.13E-07	1.83E+00	5.00E-07
XE-135	1.50E+07	6.85E-09	9.79E-02	7.00E-08
XE-138	1.00E+06	4.57E-10	2.28E-02	2.00E-08
F&AG	2.81E+09	1.28E-06	4.02E+00	
I-131	5.10E+04	2.33E-11	1.16E-01	2.00E-10
I-133	7.00E+04	3.20E-11	3.20E-02	1.00E-09
Iodine	1.21E+05	5.53E-11	1.48E-01	
C-14	7.99E+06	3.65E-09	1.22E+00	3.00E-09
Other	7.99E+06	3.65E-09	1.22E+00	
H-3	1.00E+09	4.57E-07	4.57E+00	1.00E-07
H-3	1.00E+09	4.57E-07	4.57E+00	
MN-54	4.70E+03	2.15E-12	2.15E-03	1.00E-09
FE-59	1.60E+03	7.31E-13	1.46E-03	5.00E-10
CO-58	1.60E+04	7.31E-12	7.31E-03	1.00E-09
CO-60	7.29E+03	3.33E-12	6.66E-02	5.00E-11
SR-89	3.39E+02	1.55E-13	7.75E-04	2.00E-10
SR-90	6.19E+01	2.83E-14	4.72E-03	6.00E-12

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
CS-134	4.70E+03	2.15E-12	1.07E-02	2.00E-10
CS-137	7.79E+03	3.56E-12	1.78E-02	2.00E-10
P>=8	4.25E+04	1.94E-11	1.12E-01	
Total	3.81E+09	1.74E-06	1.01E+01	

Verified By: _____ Date: _____

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	INFANT	THYROID	6.64E+00	31-day	2.25E-01	2.95E+03
					Quarter	5.63E+00	1.18E+02
					Annual	1.13E+01	5.90E+01
T.Spec	Any Organ	INFANT	THYROID	6.64E+00	31-day	3.00E-01	2.21E+03
					Quarter	7.50E+00	8.85E+01
					Annual	1.50E+01	4.43E+01

Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Critical Pathway.....: 5 Grs/Cow/Milk (CMILK)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.71E-01
C-14	1.19E+00
MN-54	1.17E-02
FE-59	7.83E-04
CO-58	1.09E-02
CO-60	2.81E-01
SR-89	1.32E-08
SR-90	0.00E+00
I-131	9.66E+01
I-133	1.26E+00
CS-134	5.86E-02
CS-137	2.46E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) =====								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
AINHL	2.20E-03	1.08E-02	2.14E-02	1.07E-02	1.16E-02	1.07E-02	0.00E+00	1.07E-02
AVEG	1.17E-01	5.42E-02	2.73E-01	4.48E-02	4.03E-02	4.41E-02	0.00E+00	5.02E-02
ACMEAT	3.93E-02	1.25E-02	4.08E-02	1.10E-02	1.05E-02	1.26E-02	0.00E+00	1.20E-02
ACMILK	5.36E-02	3.41E-02	8.66E-01	2.46E-02	1.63E-02	1.60E-02	0.00E+00	2.83E-02
TGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
TINHL	3.14E-03	1.11E-02	2.44E-02	1.10E-02	1.23E-02	1.10E-02	0.00E+00	1.10E-02
TVEG	1.86E-01	7.74E-02	2.49E-01	6.26E-02	5.70E-02	5.95E-02	0.00E+00	6.41E-02
TCMEAT	3.31E-02	9.81E-03	3.01E-02	8.63E-03	8.20E-03	9.27E-03	0.00E+00	8.86E-03
TCMILK	9.82E-02	5.76E-02	1.37E+00	4.11E-02	2.71E-02	2.53E-02	0.00E+00	3.77E-02
CGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
CINHL	4.32E-03	1.01E-02	2.55E-02	1.00E-02	1.11E-02	9.92E-03	0.00E+00	9.95E-03
CVEG	4.46E-01	1.50E-01	4.08E-01	1.26E-01	1.17E-01	1.16E-01	0.00E+00	1.21E-01
CCMEAT	6.23E-02	1.63E-02	4.74E-02	1.48E-02	1.42E-02	1.46E-02	0.00E+00	1.47E-02
CCMILK	2.40E-01	1.08E-01	2.72E+00	7.94E-02	5.59E-02	5.17E-02	0.00E+00	6.37E-02
IGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
IINHL	3.16E-03	6.02E-03	2.02E-02	5.94E-03	6.62E-03	5.86E-03	0.00E+00	5.89E-03
ICMILK	4.55E-01	2.12E-01	6.58E+00	1.46E-01	1.08E-01	9.92E-02	0.00E+00	1.15E-01
----- TOTALS -----								
ADULT	2.52E-01	1.52E-01	1.24E+00	1.32E-01	1.19E-01	1.24E-01	0.00E+00	1.42E-01
TEEN	3.62E-01	1.96E-01	1.71E+00	1.64E-01	1.45E-01	1.46E-01	0.00E+00	1.62E-01
CHILD	7.93E-01	3.25E-01	3.24E+00	2.70E-01	2.38E-01	2.33E-01	0.00E+00	2.50E-01
INFANT	4.98E-01	2.59E-01	6.64E+00	1.92E-01	1.55E-01	1.46E-01	0.00E+00	1.61E-01

=== AGE GROUP / PATHWAY DESCRIPTIONS =====		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== AGE GROUP / PATHWAY DESCRIPTIONS ===
Abbreviation Age Group Pathway

CVEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	6.57E-02	31-day	1.50E-01	4.38E+01
			Quarter	3.75E+00	1.75E+00
			Annual	7.50E+00	8.75E-01
Admin	Beta	5.27E-02	31-day	3.00E-01	1.76E+01
			Quarter	7.50E+00	7.02E-01
			Annual	1.50E+01	3.51E-01
T.Spec	Gamma	6.57E-02	31-day	2.00E-01	3.28E+01
			Quarter	5.00E+00	1.31E+00
			Annual	1.00E+01	6.57E-01

Receptor.....: 4 Composite Crit. Receptor - NG
Distance (meters).....: 0.0
Compass Point.....: 0.0
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage				
AR-41	2.05E+01				
KR-85M	5.42E-01				
KR-85	1.06E+00				
KR-87	5.45E-01				
KR-88	1.07E+01				
XE-131M	5.37E-01				
XE-133M	4.33E-01				
XE-133	6.23E+01				
XE-135	2.54E+00				
XE-138	8.14E-01				
T.Spec	Beta	5.27E-02	31-day	4.00E-01	1.32E+01
			Quarter	1.00E+01	5.27E-01
			Annual	2.00E+01	2.63E-01

Receptor.....: 4 Composite Crit. Receptor - NG
Distance (meters).....: 0.0
Compass Point.....: 0.0

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
AR-41	2.21E+00
KR-85M	2.66E-01
KR-85	3.69E+01
KR-87	2.79E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133M	6.00E-01
XE-133	5.68E+01
XE-135	9.98E-01
XE-138	1.29E-01

ATTACHMENT Q

RETDAS COMPUTER PROGRAM U2 GASEOUS ANNUAL (FILTERED)
DOSE REPORT

BYRON STATION UNIT 2

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== RELEASE DATA ===
 Total Release Duration (minutes)..... 5.256E+05
 Total Release Volume (cf)..... 7.726E+10
 Average Release Flowrate (cfm)..... 1.470E+05

Average Period Flowrate (cfm)..... 1.470E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	2.49E+07	1.14E-08	1.14E+00	1.00E-08
KR-85M	4.99E+06	2.28E-09	2.28E-02	1.00E-07
KR-85	7.00E+08	3.20E-07	4.57E-01	7.00E-07
KR-87	1.00E+06	4.57E-10	2.28E-02	2.00E-08
KR-88	7.99E+06	3.65E-09	4.06E-01	9.00E-09
XE-131M	3.89E+07	1.78E-08	8.90E-03	2.00E-06
XE-133M	1.50E+07	6.85E-09	1.14E-02	6.00E-07
XE-133	2.00E+09	9.13E-07	1.83E+00	5.00E-07
XE-135	1.50E+07	6.85E-09	9.79E-02	7.00E-08
XE-138	1.00E+06	4.57E-10	2.28E-02	2.00E-08
F&AG	2.81E+09	1.28E-06	4.02E+00	
I-131	5.10E+04	2.33E-11	1.16E-01	2.00E-10
I-133	7.00E+04	3.20E-11	3.20E-02	1.00E-09
Iodine	1.21E+05	5.53E-11	1.48E-01	
C-14	7.99E+06	3.65E-09	1.22E+00	3.00E-09
Other	7.99E+06	3.65E-09	1.22E+00	
H-3	1.00E+09	4.57E-07	4.57E+00	1.00E-07
H-3	1.00E+09	4.57E-07	4.57E+00	
MN-54	4.70E+03	2.15E-12	2.15E-03	1.00E-09
FE-59	1.60E+03	7.31E-13	1.46E-03	5.00E-10
CO-58	1.60E+04	7.31E-12	7.31E-03	1.00E-09
CO-60	7.29E+03	3.33E-12	6.66E-02	5.00E-11
SR-89	3.39E+02	1.55E-13	7.75E-04	2.00E-10
SR-90	6.19E+01	2.83E-14	4.72E-03	6.00E-12

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
CS-134	4.70E+03	2.15E-12	1.07E-02	2.00E-10
CS-137	7.79E+03	3.56E-12	1.78E-02	2.00E-10
P>=8	4.25E+04	1.94E-11	1.12E-01	
Total	3.81E+09	1.74E-06	1.01E+01	

Verified By: _____ Date: _____

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	INFANT	THYROID	6.64E+00	31-day	2.25E-01	2.95E+03
					Quarter	5.63E+00	1.18E+02
					Annual	1.13E+01	5.90E+01
T.Spec	Any Organ	INFANT	THYROID	6.64E+00	31-day	3.00E-01	2.21E+03
					Quarter	7.50E+00	8.85E+01
					Annual	1.50E+01	4.43E+01

Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Critical Pathway.....: 5 Grs/Cow/Milk (CMILK)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.71E-01
C-14	1.19E+00
MN-54	1.17E-02
FE-59	7.83E-04
CO-58	1.09E-02
CO-60	2.81E-01
SR-89	1.32E-08
SR-90	0.00E+00
I-131	9.66E+01
I-133	1.26E+00
CS-134	5.86E-02
CS-137	2.46E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) =====								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
AINHL	2.20E-03	1.08E-02	2.14E-02	1.07E-02	1.16E-02	1.07E-02	0.00E+00	1.07E-02
AVEG	1.17E-01	5.42E-02	2.73E-01	4.48E-02	4.03E-02	4.41E-02	0.00E+00	5.02E-02
ACMEAT	3.93E-02	1.25E-02	4.08E-02	1.10E-02	1.05E-02	1.26E-02	0.00E+00	1.20E-02
ACMILK	5.36E-02	3.41E-02	8.66E-01	2.46E-02	1.63E-02	1.60E-02	0.00E+00	2.83E-02
TGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
TINHL	3.14E-03	1.11E-02	2.44E-02	1.10E-02	1.23E-02	1.10E-02	0.00E+00	1.10E-02
TVEG	1.86E-01	7.74E-02	2.49E-01	6.26E-02	5.70E-02	5.95E-02	0.00E+00	6.41E-02
TCMEAT	3.31E-02	9.81E-03	3.01E-02	8.63E-03	8.20E-03	9.27E-03	0.00E+00	8.86E-03
TCMILK	9.82E-02	5.76E-02	1.37E+00	4.11E-02	2.71E-02	2.53E-02	0.00E+00	3.77E-02
CGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
CINHL	4.32E-03	1.01E-02	2.55E-02	1.00E-02	1.11E-02	9.92E-03	0.00E+00	9.95E-03
CVEG	4.46E-01	1.50E-01	4.08E-01	1.26E-01	1.17E-01	1.16E-01	0.00E+00	1.21E-01
CCMEAT	6.23E-02	1.63E-02	4.74E-02	1.48E-02	1.42E-02	1.46E-02	0.00E+00	1.47E-02
CCMILK	2.40E-01	1.08E-01	2.72E+00	7.94E-02	5.59E-02	5.17E-02	0.00E+00	6.37E-02
IGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
IINHL	3.16E-03	6.02E-03	2.02E-02	5.94E-03	6.62E-03	5.86E-03	0.00E+00	5.89E-03
ICMILK	4.55E-01	2.12E-01	6.58E+00	1.46E-01	1.08E-01	9.92E-02	0.00E+00	1.15E-01
----- TOTALS -----								
ADULT	2.52E-01	1.52E-01	1.24E+00	1.32E-01	1.19E-01	1.24E-01	0.00E+00	1.42E-01
TEEN	3.62E-01	1.96E-01	1.71E+00	1.64E-01	1.45E-01	1.46E-01	0.00E+00	1.62E-01
CHILD	7.93E-01	3.25E-01	3.24E+00	2.70E-01	2.38E-01	2.33E-01	0.00E+00	2.50E-01
INFANT	4.98E-01	2.59E-01	6.64E+00	1.92E-01	1.55E-01	1.46E-01	0.00E+00	1.61E-01

=== AGE GROUP / PATHWAY DESCRIPTIONS =====		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== AGE GROUP / PATHWAY DESCRIPTIONS =====
Abbreviation Age Group Pathway

CVEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	6.57E-02	31-day	1.50E-01	4.38E+01
			Quarter	3.75E+00	1.75E+00
			Annual	7.50E+00	8.75E-01
Admin	Beta	5.27E-02	31-day	3.00E-01	1.76E+01
			Quarter	7.50E+00	7.02E-01
			Annual	1.50E+01	3.51E-01
T.Spec	Gamma	6.57E-02	31-day	2.00E-01	3.28E+01
			Quarter	5.00E+00	1.31E+00
			Annual	1.00E+01	6.57E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage				
AR-41	2.05E+01				
KR-85M	5.42E-01				
KR-85	1.06E+00				
KR-87	5.45E-01				
KR-88	1.07E+01				
XE-131M	5.37E-01				
XE-133M	4.33E-01				
XE-133	6.23E+01				
XE-135	2.54E+00				
XE-138	8.14E-01				
T.Spec	Beta	5.27E-02	31-day	4.00E-01	1.32E+01
			Quarter	1.00E+01	5.27E-01
			Annual	2.00E+01	2.63E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
AR-41	2.21E+00
KR-85M	2.66E-01
KR-85	3.69E+01
KR-87	2.79E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133M	6.00E-01
XE-133	5.68E+01
XE-135	9.98E-01
XE-138	1.29E-01

ATTACHMENT R

GUIDANCE ON MAXIMUM UNRESTRICTED AREA BOUNDARY AND
RESTRICTED AREA BOUNDARY χ/Q_s , RETDAS 40CFR190 DOSE
REPORTS AND LIQUID RELEASE DOSE CALCULATIONS

BYRON STATION UNIT 1 AND UNIT 2



RE: [EXTERNAL] Byron Offgas Filter Project-Dose Report Guidance Refresher
Golic, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com

08/10/2016 03:03 PM

Cc:

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"ROBERT.L.MARSH@sargentlundy.com", "Cox, Zoe L:(GenCo-Nuc)", "Englert, Edward James:(GenCo-Nuc)"

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Sorry, I missed an important word, "not" – denoted in RED.

From: Golic, Jeffrey M:(GenCo-Nuc)

Sent: Wednesday, August 10, 2016 2:57 PM

To: 'BARRY.C.SCHWARTZ@Sargentlundy.com'

Cc: CM.LAUNI@sargentlundy.com; ANTHONY.KLAZURA@sargentlundy.com;

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IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com; ROBERT.L.MARSH@sargentlundy.com; Cox, Zoe L:(GenCo-Nuc);

Englert, Edward James:(GenCo-Nuc)

Subject: RE: [EXTERNAL] Byron Offgas Filter Project-Dose Report Guidance Refresher

Barry,

See responses below.

Jeff

From: BARRY.C.SCHWARTZ@Sargentlundy.com [mailto:BARRY.C.SCHWARTZ@Sargentlundy.com]

Sent: Wednesday, August 10, 2016 12:45 PM

To: Golic, Jeffrey M:(GenCo-Nuc)

Cc: CM.LAUNI@sargentlundy.com; ANTHONY.KLAZURA@sargentlundy.com;

RICHARD.CHITTENDEN@sargentlundy.com; PAUL.A.MCGARY@sargentlundy.com;

IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com; ROBERT.L.MARSH@sargentlundy.com; Cox, Zoe L:(GenCo-Nuc);

Englert, Edward James:(GenCo-Nuc)

Subject: [EXTERNAL] Byron Offgas Filter Project-Dose Report Guidance Refresher

Jeff,

I need a Dose Report refresher on a few points.

1. I did find Item "Charlie" on Page 17 of the Byron 2015 Annual Report. The last few sentences will provide the justification for using zero for the contained source contribution in the 40CFR190 summation. OK

2. For gaseous releases via the vent stack, the instantaneous and annual doses in RETDAS are calculated at the location of maximum mixed mode X/Q at the Unrestricted Area Boundary. From Table 4-1 of the Byron ODCM, that would be the SSE sector. TRUE? Correct

3. The maximum mix mode X/Q for the Restricted Area Boundary is in the S sector as I read Table 4-2 of the Byron ODCM. True? Correct

4. Doses associated with liquid releases are calculated where? What would be the ODCM reference? I did a ODCM search using the key words "Mixing" and "Zone" I did not have a relevant hit. The following foot note is from UFSAR Table 11.2-3

"All activities are assumed to take place in the discharge canal. No credit is taken for dilution of effluents in the Rock River"

Does the foot note extracted from the UFSAR mean the same thing as the "Mixing Zone" or is there a different receptor location that needs to be referenced in the ODCM.

Liquid doses are not calculated at a specific location like gaseous effluents but are based on the concentration of radioactivity in liquid effluents released to unrestricted areas as defined in ODCM Table 1-1. The dose from radioactive materials in liquid effluents is calculated from the consumption of fish and potable water as defined in ODCM Section 3.4.1. There is a potable intake water near-field dilution factor defined in section 3.4.2. which assumes the potable water intake is at least ¼ mile downstream. Fish intake is assumed to occur at the discharge structure after a mixing factor is applied as defined in Section 3.5.5.

5. I know that for 40CFR190, the dose points are at different locations. Byron ODCM Table 1-1 tabulates the 40CFR 190 dose limits as follows:

Total Body Dose 25 mrem/yr
Thyroid Dose 75 mrem/yr
Other Organ Dose 25 mrem/yr

From our 40CFR190 word file:

Total Body: Liquid +Gaseous = $5.12\text{E-}02$ mrem + $1.86\text{E-}01$ = $2.37\text{E-}01$ mrem (WORD FILE PAGE 27 + WORD FILE PAGE 25 (BETA + GAMMA))

Thyroid Dose Liquid + Gaseous = $9.77\text{E-}03$ + $1.96\text{E+}01$ = $1.96\text{E+}01$ mrem (WORD FILE PAGE 9 + WORD FILE PAGE 23)

Other Organ Dose: Liquid + Gaseous = $4.23\text{E-}02$ mrem + $1.97\text{E+}01$ mrem = $1.97\text{E+}01$ (WORD FILE PAGE 9 + WORD FILE PAGE 26)

Did I make the proper interpretation of the RETDAS results? Is it legitimate to count an Infant any organ thyroid in two dose categories or does other organ mean any organ but thyroid?

The 40CFR190 doses are already summed. The total organ dose of $1.97\text{E+}01$ mrem on page 26 is the

sum of $5.16\text{E-}03$ mrem liquid dose and $1.96\text{E+}01$ gaseous dose. The total body dose of $5.12\text{E-}01$ mrem on page 27 is the sum of $7.21\text{E-}03$ mrem liquid dose and $5.05\text{E-}01$ gaseous dose. As you can see, the total dose is dominated by the gaseous dose. When calculating dose due to non-noble gases, the age group and organ with the highest dose from non-noble gases is used.

Thank you for your support,
Barry
1-312-269-7296

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RE: [EXTERNAL] BYR16-012-Comment Issue related to 40CFR190 Compliance
Golich, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com

11/04/2016 09:11 AM

Cc:

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<zoe.cox@exeloncorp.com>

History: This message has been replied to and forwarded.

Barry,

Yes, I would agree that is a reasonable approach. Remember that the 10CFR50 Appendix I dose is more restrictive than 40CFR190 doses, so compliance with 40CFR190 is demonstrated by compliance with Appendix I. The only thing 40CFR190 adds is direct radiation dose from plant structures and on-site storage facilities. There is no additional dose from plant structures and on-site storage facilities as we state each year in the Miscellaneous Info section of the ARERR.

So I'm thinking that the 40CFR190 dose reports may not even be necessary if you would prefer to leave them out.

Jeff

From: BARRY.C.SCHWARTZ@Sargentlundy.com [<mailto:BARRY.C.SCHWARTZ@Sargentlundy.com>]

Sent: Friday, November 04, 2016 8:47 AM

To: Golich, Jeffrey M:(GenCo-Nuc)

Cc: CM.LAUNI@sargentlundy.com; ANTHONY.KLAZURA@sargentlundy.com;

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IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com; Cox, Zoe L:(GenCo-Nuc)

Subject: Fw: [EXTERNAL] BYR16-012-Comment Issue related to 40CFR190 Compliance

Jeff,

There appears to be confusion below on when and how a thyroid dose and an Other Organ/
Any Organ dose is used to determine 40CFR190 compliance.

The following text is extracted from the 2015 Byron ARERR:

"The 40CFR190 limits on individual members of the public is 25 mrem to the whole body, 25 mrem to any organ (except thyroid), and 75 mrem to the thyroid."

From the 40CFR190 RETDAS word file above, the logic of the program allows "Any Organ" to include a thyroid, in this case an Infant Thyroid. The program prints out the age group/organ dose (for all ages) for the liquid releases, but only prints the maximum dose limit age group/organ dose results for Iodine and Particulate gaseous releases (I & P, Non-noble gas). Thus the teen liver liquid doses cannot be used for "Other/Any Organ" comparison to 25 mrem, since I & P gaseous results for the various organ/age groups are not printed out and therefore cannot be added to the organ liquid doses to obtain the maximum organ dose.

In our particular scenario for Calculation BYR16-012, the calculated result of 1.97E+01 mrem meets both criteria of 25 mrem and 75 mrem. I propose eliminating the "Other/Any Organ" row from the table below and adding a footnote that states since the calculated value of 1.97E+01 for the infant thyroid is less than 25 mrem and since the thyroid dose is the limiting organ dose, then the "Any Organ" criteria is also met.

Do you agree that this is workable path forward?

Thank you for your support.

Barry Schwartz

1-312-269-7296

----- Forwarded by BARRY C SCHWARTZ/Sargentlundy on 11/01/2016 11:58 AM -----

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>
To: "BARRY.C.SCHWARTZ@Sargentlundy.com" <BARRY.C.SCHWARTZ@Sargentlundy.com>
Cc: "IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com" <IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com>, "RICHARD.CHITTENDEN@Sargentlundy.com" <RICHARD.CHITTENDEN@Sargentlundy.com>, "ANTHONY.KLAZURA@Sargentlundy.com" <ANTHONY.KLAZURA@Sargentlundy.com>, "ROBERT.L.MARSH@Sargentlundy.com" <ROBERT.L.MARSH@Sargentlundy.com>, "WILLIAM.B.MCCUE@Sargentlundy.com" <WILLIAM.B.MCCUE@Sargentlundy.com>, "kevin.dhasese@exeloncorp.com" <kevin.dhasese@exeloncorp.com>, "Cox, Zoe L:(GenCo-Nuc)" <zoe.cox@exeloncorp.com>, "Englert, Edward James:(GenCo-Nuc)" <Edward.Englert@exeloncorp.com>
Date: 10/28/2016 01:38 PM
Subject: RE: [EXTERNAL] BYR16-012-Comment Issue related to 40CFR190 Compliance

See comments in red below.

Jeff

From: BARRY.C.SCHWARTZ@Sargentlundy.com [<mailto:BARRY.C.SCHWARTZ@Sargentlundy.com>]
Sent: Friday, October 28, 2016 12:56 PM
To: Golich, Jeffrey M:(GenCo-Nuc)
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Subject: [EXTERNAL] BYR16-012-Comment Issue related to 40CFR190 Compliance

Jeff

We are currently resolving comments on Calculation BYR16-012. I have attached two files related to 40CFR190 RETDAS output and your guidance on the use of that output.

Extracted OAR Comment:

"I do not see this tabulated in Attachments L or M. I see the values duplicate those for Infant thyroid. Is infant thyroid assumed to be the same dose as other organ? If that is the answer, can you add an explanation and basis?"

See below

Extracted table from OAR evolution of Calculation of BYR16-012:

Table 2.13-1
40CFR190 UNFILTERED ANNUAL DOSE BY ORGAN AND AGE GROUP (mrem)

Age Group	Organ	Liquid Dose Component (mrem/yr)	Gaseous Dose Component (mrem/yr)	Total Dose (mrem/yr)	ODCM Regulatory Dose Limit Matrix (mrem/yr)
Child	Total Body	7.21E-03	5.05E-01	5.12E-01	25
Infant	Thyroid	5.16E-03	1.96E+01	1.97E+01	75
Infant	Other Organ	5.16E-03	1.96E+01	1.97E+01	25

The yellow-highlighted text is not quite correct. The thyroid dose is the highest organ dose, so meeting 25 mrem for the thyroid dose meets the 25 mrem limit for "other organ."

The 40CFR190 refresher file contains the following as a last sentence: "When calculating dose due to non-noble gases, the age group and organ with the highest dose from non-noble gases is used."

The word file is a RETDAS report UNFILTERED. 40CFR190 compliance is defined in Table 1-1 of the Byron ODCM on Page 33:

Total Body Dose -25 mrem/year
Thyroid Dose - 75 mrem/year
Other Organ Dose - 25 mrem/year

"Non-noble gas" means iodines and particulates in the gaseous and liquid effluent. Correct? "Non-noble gas" means iodines, particulates, tritium, and carbon-14 in gaseous effluents only. Noble gases are not taken into consideration in liquid releases under Appendix I but there is a total noble gas effluent concentration limit under 10CFR20.

"Age age group and organ with the highest dose from non-noble gases". RETDAS uses the term "Any Organ". In the OAR evolution of this calculation, I placed "Infant Thyroid" dose results in both classifications, "Thyroid Dose" and "Other Organ Dose". See above comment. The age group and organ with the highest dose is infant thyroid.

Combining the above thoughts, Other Organ/Any Organ means the age group and organ with the highest dose from non-noble gases, excluding the thyroid organ. Correct? Correct

Thank you for your support,

Barry Schwartz
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ATTACHMENT S
UFSAR SECTION 11.2 TABLES
BYRON STATION UNIT 1 AND UNIT 2

TABLE 11.2-1

EXPECTED ANNUAL AVERAGE RELEASES OF RADIONUCLIDES IN LIQUID EFFLUENTS

NUCLIDE	HALF-LIFE (DAYS)	COOLANT CONCENTRATIONS										ANNUAL RELEASES TO DISCHARGE CANAL										TOTAL (CI/YR)
		PRIMARY (MICRO CI/ML)		SECONDARY (MICRO CI/ML)		BORON RS (CURIES)	MISC. WASTES (CURIES)	SECONDARY (CURIES)	TURB BLDG (CURIES)	TOTAL LWS (CURIES)	ADJUSTED TOTAL (CI/YR)	DETERGENT WASTES (CI/YR)										
CORROSION AND ACTIVATION PRODUCTS																						
CR 51	2.78+01	1.90-03	2.51-07	5.36-06	6.13-09	0.00	2.48-06	7.85-06	6.16-05	0.00	6.16-05	0.00	6.16-05	0.00	6.16-05	6.16-05						
MN 54	3.03+02	3.10-04	6.08-08	9.21-07	1.05-09	0.00	6.05-07	1.53-06	1.00-03	0.00	1.00-03	0.00	1.00-03	0.00	1.00-03	1.01-03						
FE 55	9.50+02	1.60-03	2.12-07	4.77-06	5.44-09	0.00	2.11-06	6.89-06	5.40-05	0.00	5.40-05	0.00	5.40-05	0.00	5.40-05	5.40-05						
FE 59	4.50+01	1.00-03	1.55-07	2.88-06	3.29-09	0.00	1.54-06	4.42-06	3.47-05	0.00	3.47-05	0.00	3.47-05	0.00	3.47-05	3.47-05						
CO 58	7.13+01	1.60-02	2.15-06	4.67-05	5.34-08	0.00	2.14-05	6.81-05	5.35-04	0.00	5.35-04	0.00	5.35-04	0.00	5.35-04	4.53-03						
CO 60	1.92+03	2.00-03	2.73-07	5.97-06	6.81-09	0.00	2.72-06	8.69-06	6.82-05	0.00	6.82-05	0.00	6.82-05	0.00	6.82-05	8.77-03						
ZR 95	6.50+01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40-03						
NB 95	3.50+01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00-03						
NP 239	2.35+00	1.20-03	1.23-07	1.82-06	2.32-09	0.00	1.14-06	2.96-06	2.32-05	0.00	2.32-05	0.00	2.32-05	0.00	2.32-05	2.32-05						
FISSION PRODUCTS																						
BR 83	1.00-01	4.80-03	1.26-07	2.11-09	2.69-09	0.00	2.24-06	2.24-06	1.76-05	0.00	1.76-05	0.00	1.76-05	0.00	1.76-05	1.76-05						
RB 86	1.87+01	8.50-05	1.40-08	5.83-06	1.34-08	0.00	1.38-07	5.98-06	4.69-05	0.00	4.69-05	0.00	4.69-05	0.00	4.69-05	4.69-05						
SR 89	5.20+01	3.50-04	6.17-08	1.01-06	1.16-09	0.00	6.13-07	1.63-06	1.28-05	0.00	1.28-05	0.00	1.28-05	0.00	1.28-05	1.28-05						
MO 99	2.79+00	8.40-02	1.19-05	1.42-04	1.76-07	0.00	1.11-04	2.53-04	1.98-03	0.00	1.98-03	0.00	1.98-03	0.00	1.98-03	1.98-03						
TC 99M	2.50-01	4.80-02	2.18-05	1.35-04	1.65-07	0.00	1.58-04	2.94-04	2.31-03	0.00	2.31-03	0.00	2.31-03	0.00	2.31-03	2.31-03						
RU 103	3.96+01	4.50-05	6.21-09	1.29-07	1.48-10	0.00	6.16-08	1.91-07	1.50-06	0.00	1.50-06	0.00	1.50-06	0.00	1.50-06	1.41-04						
RU 106	3.67+02	1.00-05	1.52-09	2.97-08	3.39-11	0.00	1.51-08	4.49-08	3.52-07	0.00	3.52-07	0.00	3.52-07	0.00	3.52-07	2.40-03						
AG 110M	2.53+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40-04						
TE 127	3.92-01	8.50-04	1.31-07	8.46-07	1.24-09	0.00	9.37-07	1.78-06	1.40-05	0.00	1.40-05	0.00	1.40-05	0.00	1.40-05	1.40-05						
TE 129M	3.40+01	1.40-03	1.87-07	3.99-06	4.56-09	0.00	1.85-06	5.85-06	4.59-05	0.00	4.59-05	0.00	4.59-05	0.00	4.59-05	4.59-05						
TE 129	4.79-02	2.50-03	5.39-07	2.94-09	2.94-09	0.00	1.30-06	3.86-06	3.03-05	0.00	3.03-05	0.00	3.03-05	0.00	3.03-05	3.03-05						
I 130	5.17-01	2.10-03	1.53-07	2.95-06	1.18-08	0.00	1.09-05	1.38-05	1.09-04	0.00	1.09-04	0.00	1.09-04	0.00	1.09-04	1.09-04						
TE 131M	1.25+00	2.50-03	2.39-07	3.24-09	3.24-09	0.00	2.07-06	4.17-06	3.27-05	0.00	3.27-05	0.00	3.27-05	0.00	3.27-05	3.27-05						
I 131	8.05+00	2.70-01	3.72-05	6.62-03	7.69-06	0.00	3.63-03	1.03-02	8.04-02	6.20-05	8.04-02	6.20-05	8.04-02	6.20-05	8.04-02	8.05-02						
TE 132	3.25+00	2.70-02	3.07-06	4.94-05	6.02-08	0.00	2.90-05	7.85-05	6.16-04	0.00	6.16-04	0.00	6.16-04	0.00	6.16-04	6.16-04						
I 132	9.58-02	1.00-01	9.32-06	5.11-05	3.47-07	0.00	1.77-04	2.28-04	1.79-03	0.00	1.79-03	0.00	1.79-03	0.00	1.79-03	1.79-03						
I 133	8.75-01	3.80-01	3.43-05	1.85-03	3.65-06	0.00	2.80-03	4.66-03	3.66-02	0.00	3.66-02	0.00	3.66-02	0.00	3.66-02	3.66-02						
CS 134	7.49+02	2.50-02	4.01-06	1.86-03	4.25-06	0.00	3.99-05	1.91-03	1.50-02	1.30-02	1.50-02	1.30-02	1.50-02	1.30-02	1.50-02	2.80-02						
I 135	2.79-01	1.90-01	9.96-06	2.10-05	5.10-07	0.00	5.33-04	5.54-04	4.35-03	0.00	4.35-03	0.00	4.35-03	0.00	4.35-03	4.35-03						
CS 136	1.30+01	1.30-02	1.78-06	8.59-04	1.98-06	0.00	1.75-05	8.79-04	6.89-03	0.00	6.89-03	0.00	6.89-03	0.00	6.89-03	6.89-03						
CS 137	1.10+04	1.80-02	2.67-06	1.34-03	3.06-06	0.00	2.65-05	1.37-03	1.08-02	0.00	1.08-02	0.00	1.08-02	0.00	1.08-02	3.48-02						
BA 137M	1.77-03	1.60-02	7.67-06	1.26-03	2.87-06	0.00	2.48-05	1.29-03	1.01-02	0.00	1.01-02	0.00	1.01-02	0.00	1.01-02	1.01-02						
CE 144	2.84+02	3.30-05	6.08-09	9.80-08	1.12-10	0.00	6.08-08	1.59-07	1.24-06	5.20-03	1.24-06	5.20-03	1.24-06	5.20-03	5.20-03	5.20-03						
ALL OTHERS		2.53-01	2.02-06	3.69-06	7.27-09	0.00	2.84-06	6.54-06	5.13-05	0.0	5.13-05	0.0	5.13-05	0.0	5.13-05	5.13-05						
TOTAL (EXCEPT TRITIUM)		1.46+00	1.50-04	1.43-02	2.49-05	0.00	7.60-03	2.19-02	1.72-01	6.23-02	1.72-01	6.23-02	1.72-01	6.23-02	6.23-02	2.34-01						

TRITIUM RELEASE 300 CURIES PER YEAR (BYRON), 750 CURIES PER YEAR (BRAIDWOOD)

11.2-18

REVISION 12 - DECEMBER 2008

TABLE 11.2-2

PARAMETERS USED IN THE GALE-PWR COMPUTER PROGRAM
(ORIGINAL & UPDATED) - NOTE 1

1) Reactor type	PWR
2) Thermal power level (MWt)	3565.0 (3586.6)
3) Mass of coolant in the primary system (10^6 gms)	242 (247.7)
4) Primary system letdown rate (gpm)	75.0
5) Letdown cation demineralizer flow (gpm)	7.5
6) Number of steam generators	4.0
7) Total steam flow (10^6 lb/hr)	15.0 (16.04)
8) Mass of steam in each steam generator (10^3 lb)	9.1 (6.039)
9) Mass of liquid in each steam generator (10^3 lb)	117.0 (114.465)
10) Total mass of secondary coolant (10^3 lb)	2023.0
11) Steam generator blowdown rate (10^3 lb/hr)	30.0

The steam generator blowdown is recycled to the condensate system after treatment in the blowdown system. Condensate demineralizers are not used.

12) Condensate demineralizer regeneration time (days)	0.0
13) Fraction of feedwater through the condensate demineralizers	0.0
14) Annual average liquid radwaste dilution flow (10^3 gpm)	
Cooling tower blowdown, Byron	13.0
Cooling lake blowdown, Braidwood	12.0*
15) Shim bleed rate (gpd)	2160.0
16) Decontamination Factors for the shim bleed system:	

Iodine - 10^3 , Cesium - 2×10^3 , Others - 10^4

TABLE 11.2-2 (Cont'd)

17)	Shim bleed system - Collection time (days)	0.60
	Processing time (days)	2.00
	Fraction discharged	0.10
18)	Equipment drains input (gpd)	2800.0
	Fraction of primary coolant activity	0.005
19)	Decontamination Factors for Equipment Drains Processing:	
	Iodine - 10^5 , Cesium - 2×10^4 , Others - 10^6	
20)	Equipment drains - Collection time (days)	2.30
	Processing time (days)	0.15
	Fraction discharged	0.10
21)	Clean waste input (gpd)	2800.0
	Fraction of primary coolant activity	0.002
22)	Decontamination Factors for Clean Waste Processing:	
	Iodine - 10^5 , Cesium - 2×10^4 , Others - 10^6	
23)	Clean waste - Collection time (days)	2.30
	Processing time (days)	0.15
	Fraction discharged	0.10
24)	Dirty wastes input (gpd)	2800.0
	Fraction of primary coolant activity	0.0068
25)	Decontamination Factors for Dirty Waste Processing:	
	Iodine - 10^5 , Cesium - 2×10^4 , Others - 10^6	
26)	Dirty wastes - Collection time (days)	4.60
	Processing time (days)	0.11
	Fraction discharged	0.10
27)	Blowdown fraction processed	1.00
28)	Decontamination Factors for Blowdown Processing:	
	Iodine - 10^2 , Cesium - 10, Others - 10^2	
29)	Blowdown - Collection time (days)	0.03
	Processing time (days)	0.03
	Fraction discharged	0.10

TABLE 11.2-2 (Cont'd)

30)	Condensate demineralizer regenerant flow (gpd)	0.00
31)	Decontamination Factors for Regenerant Processing: Iodine - 1.0, Cesium - 1.0, Others - 1.0	
32)	Regenerant - Collection time (days)	0.00
	Processing time (days)	0.00
	Fraction discharged	0.00
33)	There is not continuous stripping of full letdown flow.	
34)	Holdup time for xenon (days)	45.0
35)	Holdup time for krypton (days)	45.0
36)	Fill time for gas decay tanks (days)	43.0
37)	The waste gas system does not have a HEPA filter.	
38)	The auxiliary building vent system does have a HEPA filter, but it does not have a charcoal filter.	
39)	Containment volume (10^6 ft ³)	2.9
40)	Containment atmosphere cleanup rate (10^3 cfm)	16.0
41)	The containment shutdown purge line has a HEPA filter, but it does not have a charcoal filter.	
42)	There is no continuous low volume purge of the containment.	
43)	There is no blowdown tank vent.	
44)	Fraction of iodine released from the main condenser air ejector **	0.10**
45)	Reciprocal of the detergent waste processing decontamination factor	1.00

TABLE 11.2-2 (Cont'd)

-
- * Original design and without the use of CW blowdown booster pumps installed at Braidwood.
- ** The Off-Gas filter unit does not provide an Iodine removal mechanism for Braidwood. The iodine removal capability of the Off-Gas system has been evaluated for this condition and the off gas flow bypassing charcoal filter found acceptable, per calculation BRW-99-0468-M revision 0.

Note 1: Parameters that changed due to uprate are presented in ().

TABLE 11.2-3

PATHWAYS DOSES FROM LIQUID EFFLUENTS

(BYRON)

EXPOSURE PATHWAY	ORGAN	DOSE (mrem/yr/unit) ¹
Drinking Water	Whole Body	7.36×10^{-1}
	GI-LLI	6.87×10^{-1}
	Thyroid	$3.49 \times 10^{+0}$
	Bone	7.03×10^{-2}
Fish Consumption	Whole Body	4.54×10^{-1}
	GI-LLI	7.43×10^{-2}
	Thyroid	1.03×10^{-1}
	Bone	3.4×10^{-1}
Shoreline Recreation	Skin	9.15×10^{-3}
	Whole Body	7.83×10^{-3}
Swimming & Boating	Skin	3.38×10^{-4}
	Whole Body	2.56×10^{-4}

¹All activities are assumed to take place in the discharge canal.
No credit is taken for dilution of effluents in the Rock River.

TABLE 11.2-3

PATHWAYS DOSES FROM LIQUID EFFLUENTS

(BRAIDWOOD)

EXPOSURE PATHWAY	ORGAN	DOSE (mrem/yr/unit) ²
Drinking Water	Whole Body	9.88×10^{-1}
	GI-LLI	9.22×10^{-1}
	Thyroid	$4.69 \times 10^{+0}$
	Bone	9.44×10^{-2}
Fish Consumption	Whole Body	6.09×10^{-1}
	GI-LLI	9.97×10^{-2}
	Thyroid	1.38×10^{-1}
	Bone	4.67×10^{-1}
Shoreline Recreation	Skin	1.23×10^{-2}
	Whole Body	1.05×10^{-2}
Swimming and Boating	Skin	4.53×10^{-4}
	Whole Body	3.42×10^{-4}

² All activities are assumed to take place in the discharge canal. No credit is taken for dilution of effluents in the Kankakee River.

TABLE 11.2-4

COMPARISON OF EXPECTED LIQUID EFFLUENT CONCENTRATIONS
TO 10 CFR 20 LIMITS

ISOTOPE		EXPECTED* RELEASE (Ci/yr/unit)	BLOWDOWN** CONCENTRATION (μ ci/ml)	10 CFR 20 LIMIT*** (μ Ci/ml)
H	3	3.00+02	1.16-05	3.00-03
Cr	51	6.20-05	2.39-12	2.00-03
Mn	54	1.00-03	3.86-11	1.00-04
Fe	55	5.40-05	2.08-12	8.00-04
Fe	59	3.50-05	1.35-12	5.00-05
Co	58	4.50-03	1.74-10	9.00-05
Co	60	8.80-03	3.40-10	3.00-05
Br	83	1.80-05	6.59-13	3.00-06
Rb	86	4.70-05	1.81-12	2.00-05
Sr	89	1.30-05	5.02-13	3.00-06
Zr	95	1.40-03	5.40-11	6.00-05
Nb	95	2.00-03	7.72-11	1.00-04
Mo	99	2.00-03	7.72-11	4.00-05
Tc	99m	2.30-03	8.88-11	3.00-03
Ru	103	1.40-04	5.40-12	8.00-05
Ru	106	2.40-03	9.26-11	1.00-05
Ag	110m	4.40-04	1.70-11	3.00-05
Te	127	1.40-05	5.40-13	2.00-04
Te	129m	4.60-05	1.78-12	2.00-05
Te	129	3.00-05	1.16-12	8.00-04
Te	131m	3.30-05	1.27-12	4.00-05
Te	132	6.20-04	2.39-11	2.00-05
I	130	1.10-04	4.24-12	3.00-06
I	131	8.00-02	3.09-09	3.00-07
I	132	1.80-03	6.95-11	8.00-06
I	133	3.70-02	1.43-09	1.00-06
I	135	4.30-03	1.66-10	4.00-06
Cs	134	2.80-02	1.08-09	9.00-06
Cs	136	6.90-03	2.66-10	9.00-05
Cs	137	3.50-02	1.35-09	2.00-05
Ce	144	5.20-03	2.01-10	1.00-05
Np	239	2.30-05	8.88-13	1.00-04

* Calculated using the PWR-GALE computer program described in NUREG-0017. The actual data are available in the effluent release reports, which are prepared in accordance with the ODCM.

** Annual average cooling tower blowdown = 29.0 cfs.

*** Limits used in the comparison are those that were in effect at the time of the analysis.

TABLE 11.2-4

COMPARISON OF EXPECTED LIQUID EFFLUENT CONCENTRATIONS
TO 10 CFR 20 LIMITS

ISOTOPE		EXPECTED* RELEASE (Ci/yr/unit)	BLOWDOWN** CONCENTRATION (μ Ci/ml)	10 CFR 20 LIMIT*** (μ Ci/ml)
H	3	7.50+02	3.88-05	3.00-03
Cr	51	6.20-05	3.21-12	2.00-03
Mn	54	1.00-03	5.18-11	1.00-04
Fe	55	5.40-05	2.80-12	8.00-04
Fe	59	3.50-05	1.81-12	5.00-05
Co	58	4.50-03	2.33-10	9.00-05
Co	60	8.80-03	4.56-10	3.00-05
Br	83	1.80-05	9.33-13	3.00-06
Rb	86	4.70-05	2.44-12	2.00-05
Sr	89	1.30-05	6.74-13	3.00-06
Zr	95	1.40-03	7.25-11	6.00-05
Nb	95	2.00-03	1.04-10	1.00-04
Mo	99	2.00-03	1.04-10	4.00-05
Tc	99m	2.30-03	1.19-10	3.00-03
Ru	103	1.40-04	7.25-12	8.00-05
Ru	106	2.40-03	1.24-10	1.00-05
Ag	110m	4.40-04	2.28-11	3.00-05
Te	127	1.40-05	7.25-13	2.00-04
Te	129m	4.60-05	2.38-12	2.00-05
Te	129	3.00-05	1.55-12	8.00-04
Te	131m	3.30-05	1.71-12	4.00-05
Te	132	6.20-04	3.21-11	2.00-05
I	130	1.10-04	5.70-12	3.00-06
I	131	8.00-02	4.14-09	3.00-07
I	132	1.80-03	9.33-11	8.00-06
I	133	3.70-02	1.92-09	1.00-06
I	135	4.30-03	2.23-10	4.00-06
Cs	134	2.80-02	1.45-09	9.00-06
Cs	136	6.90-03	3.57-10	9.00-05
Cs	137	3.50-02	1.81-09	2.00-05
Ce	144	5.20-03	2.69-10	1.00-05
Np	239	2.30-05	1.19-12	1.00-04

* Calculated using the PWR-GALE computer program described in NUREG-0017 (Except H-3. Tritium value is based on actual data.) The actual data are available in the effluent release reports, which are prepared in accordance with the ODCM.

** Annual average cooling lake blowdown = 13.4 cfs per unit. Original design and without the use of CW blowdown booster pumps installed at Braidwood.

*** Limits used in the comparison are those that were in effect at the time of the analysis.

TABLE 11.2-5

LIQUID RADWASTE SYSTEM COMPONENTS AND DESIGN PARAMETERS PER STATION

EQUIPMENT	DESIGN		CAPACITY	NUMBER	MATERIALS OF CONSTRUCTION
	DESIGN PRESSURE (psig)	DESIGN TEMP (°F)			
I. Blowdown mixed bed demineralizers	150	110	283 gpm*	4	316-SS
II. Radwaste mixed bed demineralizers	150	110	45 gpm	3	316-SS
III. Cartridge filters:					
1. Chemical drain	150	140	130 gpm	1	316-SS
2. Regeneration waste drain	150	140	130 gpm	1	316-SS

* Hydraulic limit. The kinetic limit will vary based on resin types and water chemistry.

TABLE 11.2-5 (Cont'd)

EQUIPMENT	DESIGN		CAPACITY	NUMBER	MATERIALS OF CONSTRUCTION
	PRESSURE (psig)	TEMP (°F)			
3. Blowdown prefilters (Byron)	250	120	360 gpm	4	Housing shell - 304-SS internal components - 316-SS
Blowdown prefilters (Braidwood)	150	250	250 gpm	4	Housing shell - carbon steel internal components - 304-SS
4. Blowdown after-filters	150	140	250 gpm	4	304-SS
5. Auxiliary Bldg. floor drains	150	180	250 gpm	1	304-SS
6. Auxiliary Bldg. equipment drain	150	180	250 gpm	1	304-SS
7. Turbine Bldg. floor drains	150	140	130 gpm	1	304-SS
8. Turbine Bldg. equipment drains	150	180	130 gpm	1	304-SS
9. Laundry drain	150	180	130 gpm	1	304-SS
10. Radwaste demineralizer afterfilter	150	180	250 gpm	3	304-SS

TABLE 11.2-5 (Cont'd)

EQUIPMENT	DESIGN		CAPACITY	NUMBER	MATERIALS OF CONSTRUCTION
	PRESSURE (psig)	DESIGN TEMP (°F)			
VI. Tanks:					
1. Chemical drain	Atmos.	200	6,000 gal	1	304-SS
2. Dual Purpose Chemical/Regeneration waste Drain	Atmos.	200	10,000 gal	1	304-SS

TABLE 11.2-5 (Cont'd)

EQUIPMENT	DESIGN PRESSURE (psig)	DESIGN TEMP (°F)	CAPACITY	NUMBER	MATERIALS OF CONSTRUCTION
3. Regeneration waste Drain	Atmos.	200	30,000 gal (Byron) 20,000 gal (Braidwood)	1	304-SS
4. Auxiliary Bldg. equipment drain	50	200	8,000 gal	2	304-SS
5. Auxiliary Bldg. floor drain	Atmos.	150	8,000 gal	2	304-SS
6. Turbine Bldg. equipment drain	Atmos.	130	12,000 gal	2	C.S.
7. Turbine Bldg. floor drain	Atmos.	150	12,000 gal	2	C.S.
8. Laundry drain	Atmos.	200	4,000 gal	1	C.S.
9. Laundry drain storage	Atmos.	130	2,000 gal	2	C.S.
10. Blowdown monitor	Atmos.	150	20,000 gal	3	304-SS
11. Radwaste monitor	Atmos.	150	20,000 gal	2	304-SS
12. Release	Atmos.	150	30,000 gal	2	304-SS

TABLE 11.2-5 (Cont'd)

EQUIPMENT	DESIGN		CAPACITY	NUMBER	MATERIALS OF CONSTRUCTION
	DESIGN PRESSURE (psig)	DESIGN TEMP (°F)			
13. Concentrates (Byron) holding	Atmos.	250	6,400 gal	1	316L-SS
14. Spent Resin (Byron)	125	120	5,000 gal	1	304-SS
15. Low Activity Spent Resin (Braidwood)	15	120	6,400 gal	1	316L-SS
16. High Activity Spent Resin (Braidwood)	125	120	5,000 gal	1	304-SS
17. Radwaste Storage Tank (Braidwood)	Atmos.	120	500,000 gal	1	304L-SS

TABLE 11.2-5 (Cont'd)

EQUIPMENT	CAPACITY	DISCHARGE HEAD (ft)	NUMBER	MATERIALS OF CONSTRUCTION
VII. Pumps:				
1. Chemical drain tank	60 gpm	235	2	316-SS
2. Dual purpose chemical/ Regeneration waste drain tank	60 gpm	235	2	316-SS
3. Regeneration waste drain tank	60 gpm	235	2	316-SS
4. Auxiliary Bldg. equip. drain tank	60 gpm	235	2	304-SS
5. Auxiliary Bldg. floor drain tank	60 gpm	235	2	304-SS
6. Turbine Bldg. equip. drain tank	90 gpm	235	2	304-SS
7. Turbine Bldg. floor drain tank	90 gpm	235	2	304-SS
8. Laundry drain tank	30 gpm	200	1	C.S.
9. Laundry drain storage tank	25 gpm	150	2	C.S.
10. Blowdown monitor tank	350 gpm	175	3	304-SS
11. Radwaste monitor tank	350 gpm	175	2	304-SS

11.2-30

TABLE 11.2-5 (Cont'd)

EQUIPMENT	CAPACITY	DISCHARGE HEAD (ft)	NUMBER	MATERIALS OF CONSTRUCTION
12. Release tank	500 gpm	100	2	304-SS
13. Blowdown condenser	180 gpm	1050	4	304-SS
14. Spent resin (Byron)	120 gpm	115	2	ACI CD4MCu-SS
15. Spent resin (Braidwood)	65 gpm	175	2	BUNA N, 316-SS
16. Radwaste Storage Recirculating Pump (Braidwood)	150 gpm	65	1	316-SS
17. Brine Tank Transfer Pump (Braidwood)	200 gpm	100	1	316-SS

NOTE: Radwaste Evaporator Components have been intentionally deleted from this table. Braidwood and Byron stations do not intend to use this equipment.

TABLE 11.2-6

DESIGN-BASIS ANNUAL AVERAGE AND MAXIMUM WASTE STREAM FLOWS

(Two Units)

WASTE INPUT SOURCES	AVERAGE DAILY FLOW (gpd)	MAXIMUM DAILY FLOW (gpd)
Steam generator blowdown	259,200*	604,800**
Auxiliary building equipment drain	5,600	16,000
Auxiliary building floor drain	5,600	16,000
Chemical waste drain	2,100	6,000
Laundry drain	1,400	4,000
Turbine building equipment drain	4,200	12,000
Turbine building floor drain	4,200	12,000
Condensate polisher	25,300	90,700
Turbine building fire and oil sump	62,000	150,000
Waste treatment system	36,300	56,900

* Based on average of 28 days primary to secondary leakage (1956 gpm/two units), 28 days condenser to secondary leakage (420 gpm/two units) and 309 days of normal operation (120 gpm/two units).

** Based on condenser to secondary leakage of 420 gpm/two units.

TABLE 11.2-7

DESIGN-BASIS PROCESS DECONTAMINATION FACTORS

ELEMENT	FILTERS		CLEAN WASTE DEMINER- ALIZERS	BLOWDOWN DEMINER- ALIZERS	EVAPORATORS	EVAPORATORS DISTILLATE DEMINER- ALIZERS
	(A)	(B)				
H	1	1	1	1	1	1
Cr	10	1	100	100	10^4	10
Mn	10	1	100	100	10^4	10
Fe	10	1	100	100	10^4	10
Co	10	1	100	100	10^4	10
Br	1.0	1	100	100	10^4	10
Kr	1	1	1	1	1	1
Rb	1.0	1	2	10	10^4	10
Sr	1.0	1	100	100	10^4	10
Y	1.0	1	100	100	10^4	10
Zr	10	1	100	100	10^4	10
Nb	10	1	100	100	10^4	10
Mo*	10	1	100	100	10^4	10
Tc*	1.0	1	100	100	10^4	10
Ru	1.0	1	100	100	10^4	10
Rh	1.0	1	100	100	10^4	10
Te	1.0	1	100	100	10^4	10
I	1.0	1	100	100	10^3	10
Xe	1	1	1	1	1	1
Cs	1.0	1	2	10	10^4	10
Ba	1.0	1	100	100	10^4	10

TABLE 11.2-7 (Cont'd)

ELEMENT	FILTERS		CLEAN WASTE	BLOWDOWN	EVAPORATORS	EVAPORATORS
	(A)	(B)	DEMINER- ALIZERS	DEMINER- ALIZERS		DISTILLATE DEMINER- ALIZERS
La	1.0	1	100	100	10^4	10
Ce	1.0	1	100	100	10^4	10
Pr	1.0	1	100	100	10^4	10
Np	1.0	1	100	100	10^4	10

Basis for Decontamination Factors:

1. Filters:
 - (A) Is used for filter source term calculations only.
 - (B) Is used for other calculations. (Table 1-3, NUREG-0017, PWR GALE)
2. (A) Radwaste Demineralizers:
 - (Table 1-3, NUREG-0017, PWR GALE and Table 1 ANSI N199-1976)
 - (B) Blowdown Demineralizers
 - (Table 1-3, NUREG-0017, PWR GALE)
3. Evaporators:
 - (Table 1-3, NUREG-0017, PWR GALE and Table 1 ANSI N199-1976)
4. Evaporator Distillate Demineralizers:
 - (Table 1-3, NUREG-0017, PWR GALE)

TABLE 11.2-8

CONSUMPTION FACTORS FOR THE MAXIMUM EXPOSED INDIVIDUAL

PATHWAY	CHILD	TEEN	ADULT	UNITS
Fruits, vegetables and grains*	520.0	630.0	520.0	kg/yr
Leafy vegetables**	26	42	64	kg/yr
Milk**	330	400	310	l/yr
Meat and poultry**	41	65	110	kg/yr
Sport fish**	6.9	15.8	21	kg/yr
Drinking water**	508	508	728	l/yr
Shoreline activities***	-	-	15.0	hr/yr
Boating/swimming***	-	-	29.0/6.0	hr/yr
Inhalation*,**	3700.0	8000.0	8000.0	m ³ /yr
	1400.0	(Infant)		

* From Regulatory Guide 1.109, Table E-5 (Reference 3).

** From Offsite Dose Calculation Manual, Revision 1.2, Table D-10.

*** From HERMES as used in Zion Station annual and semiannual reports on station radioactive waste, environmental monitoring, and occupational personnel radiation exposure.

TABLE 11.2-9

SUMMARY OF TANK LEVEL INDICATION, ANNUNCIATORS, AND OVERFLOWS
FOR TANKS OUTSIDE OF CONTAINMENT POTENTIALLY CONTAINING RADIOACTIVE LIQUIDS

TANK	LEVEL INDICATOR AND/OR RECORDER LOCATION	ANNUNCIATOR	OVERFLOW TO
Primary Water Storage	Main Control Room* Radwaste Control Panel	AL, AH, AHH None	Turbine Building Equipment Drains Sump
Condensate Storage	Main Control Room* Radwaste Control Panel Makeup Demineralizer Panel	AL, AH None AL, AH	Turbine Building Equipment Drains Sump
Turbine Building Equipment Drain	Radwaste Control Panel	AL, AH	None
Turbine Building Floor Drain	Radwaste Control Panel	AL, AH	None
Chemical Drain	Radwaste Control Panel	AL, AH	None
Chemical/Regeneration Waste Drain	Radwaste Control Panel	AL, AH	None
Regeneration Waste Drain	Radwaste Control Panel	AL, AH	Auxiliary Building Floor Drain System*
Auxiliary Building Equipment Drain	Radwaste Control Panel	AL, AH	None
Auxiliary Building Floor Drain	Radwaste Control Panel	AL, AH	None

TABLE 11.2-9 (Cont'd)

TANK	LEVEL INDICATOR AND/OR RECORDER LOCATION	ANNUNCIATOR	OVERFLOW TO
Laundry Drain	Radwaste Control Panel	AL, AH	None
Laundry Waste Storage	Radwaste Control Panel	AL, AH	Auxiliary Building Equipment Drains Sump
Blowdown Monitor	Radwaste Control Panel	AL, AH	Turbine Building Equipment Drains Sump
Radwaste Monitor	Radwaste Control Panel	AL, AH	Auxiliary Building Equipment Drains Sump
Release	Radwaste Control Panel	AL, AH	Regeneration Waste Drain Tank or Auxiliary Building Floor Drain System*
Concentrates Holding (Byron)	Radwaste Control Panel	AL, AH	None
Spent Resin (Byron)	Radwaste Control Panel	AL, AH	None
Decant (Byron)	Solid Radwaste Panel	AL, AH	Regeneration Waste Drain Tank
Vacuum Deaerator Catch	Radwaste Control Panel	AL, AH	None
High Activity Spent Resin (Braidwood)	Radwaste Control Panel	AHH	None

TABLE 11.2-9 (Cont'd)

TANK	LEVEL INDICATOR AND/OR RECORDER LOCATION	ANNUNCIATOR	OVERFLOW TO
Low Activity Spent Resin (Braidwood)	Radwaste Control Panel	AHH	None
Auxiliary Building Borated Equipment Drain	Radwaste Control Panel	AL, AH	None
Auxiliary Building Waste Oil Collection	Local	AH (Radwaste Panel)	None
Refueling Water Storage	Main Control Room*	AH, AL, ALL, ALLL	Recycle Holdup Tank
Volume Control	Main Control Room* Local	AH, AL None	None
Recycle Holdup	Main Recycle Panel Local	AH, AL None	None
Boric Acid	Main Control Room* Local	AH, AL None	Auxiliary Building Equipment Drains
Boric Acid Batching	Local	AH, AL (Main Control Room)	Recycle Holdup Tank
Radwaste Storage (Braidwood)	Radwaste Control Panel	AL, ALL, AH, AHH	3000 gal overflow tank

TABLE 11.2-9 (Cont'd)

TANK	LEVEL INDICATOR AND/OR RECORDER LOCATION	ANNUNCIATOR	OVERFLOW TO
Boric Acid Monitor	Boron Recovery Panel Local	AH, AL None	Auxiliary Building Equipment Drains

NOTES:

AL - Alarm Low
ALL - Alarm Low Low
ALLL - Alarm Low Low Low

AH - Alarm High
AHH - Alarm High High
*General Services Panel

ATTACHMENT T

BYRON STATION E-MAIL TRANSMITTAL OF RETDAS DOSE REPORTS



Corrected Filtered Dose Reports

Golich, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com, Gastouniotis, Ioannis K:(Contractor - GenCo-Nuc)

08/29/2016 11:35 AM

Hide Details

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>

To: "BARRY.C.SCHWARTZ@Sargentlundy.com"

<BARRY.C.SCHWARTZ@Sargentlundy.com>, "Gastouniotis, Ioannis K:(Contractor - GenCo-Nuc)" <john.gastouniotis@exeloncorp.com>,

History: This message has been forwarded.

3 Attachments



Gaseous Instantaneous (Filtered).docx U1 Gaseous Annual (Filtered).docx U2 Gaseous Annual (Filtered).docx

Barry/John,

Attached are the corrected filtered dose reports. Please discard the previous reports.

Jeff

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Unfiltered Dose Reports

Golich, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com, Gastouniotis, Ioannis K:(Contractor - GenCo-Nuc)

08/29/2016 11:34 AM

Hide Details

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>

To: "BARRY.C.SCHWARTZ@Sargentlundy.com"

<BARRY.C.SCHWARTZ@Sargentlundy.com>, "Gastouniotis, Ioannis K:(Contractor - GenCo-Nuc)" <john.gastouniotis@exeloncorp.com>,

History: This message has been forwarded.

3 Attachments



Gaseous Instantaneous (Unfiltered).docx



U1 Gaseous Annual (Unfiltered).docx



U2 Gaseous Annual (Unfiltered).docx

Barry/John,

Attached are the corrected unfiltered dose reports. Please discard the previous reports.

Jeff

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RE: Filtered Reports

Golich, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com

08/29/2016 06:50 AM

Hide Details

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>

To: "BARRY.C.SCHWARTZ@Sargentlundy.com"

<BARRY.C.SCHWARTZ@Sargentlundy.com>,

History: This message has been forwarded.

1 Attachment



40CFR190 (Filtered).docx

Sorry, here it is.

Jeff

From: BARRY.C.SCHWARTZ@Sargentlundy.com [mailto:BARRY.C.SCHWARTZ@Sargentlundy.com]

Sent: Monday, August 29, 2016 5:46 AM

To: Golich, Jeffrey M:(GenCo-Nuc)

Cc: RICHARD.CHITTENDEN@sargentlundy.com; IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com;
CM.LAUNI@sargentlundy.com; ANTHONY.KLAZURA@sargentlundy.com

Subject: Fw: Filtered Reports

JEFF,

FROM THE TEXT, THERE SHOULD BE FOUR WORD FILES. PLEASE RETRANSMIT THE 40CFR190 WORD FILE.

THANKS AGAIN,

BARRY

1-312-269-7296

----- Forwarded by BARRY C SCHWARTZ/Sargentlundy on 08/29/2016 05:38 AM -----

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>

To: "BARRY.C.SCHWARTZ@Sargentlundy.com" <BARRY.C.SCHWARTZ@Sargentlundy.com>,

Cc: "Gastouniotis, Ioannis K:(Contractor - GenCo-Nuc)" <john.gastouniotis@exeloncorp.com>, "Cox, Zoe L:(GenCo-Nuc)"

<zoe.cox@exeloncorp.com>

Date: 08/25/2016 02:31 PM

Subject: Filtered Reports

Barry,

Attached are copies of the filtered Unit 1 and Unit 2 Gaseous dose reports, along with the filtered 40CFR190 dose report.

These reports would represent the off-site dose prior to the engineering change. The filtered dose reports assume 5.1E-02 Ci/yr of I-131 and 7.0E-02 Ci/yr of I-133. The liquid dose reports would, obviously, remain unchanged.

You will notice the organ dose rates on the Instantaneous Filtered report were unchanged. This is because the limiting receptor in calculating instantaneous dose rates to organs is due to inhalation of non-noble gas (i.e. iodine). Ingestion dose

factors are not used in the calculation of instantaneous organ dose rates. The inhalation dose factors for iodine are much lower than the ingestion dose factors.

As we discussed on the phone, I am currently looking into a potential issue with the instantaneous dose report. Before we use the results from that report, I need to better understand what that report is actually telling us. I am awaiting response from Canberra. The rep is out of town this week.

Also, I will need an AT, due 4/15/17, cut from the EC to include a summary of the engineering change in the 2016 Annual Radiological Effluent Release Report (ARERR).

Jeff

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Dose Reports

Golich, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com,

IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com

08/03/2016 03:02 PM

Hide Details

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>

To: "BARRY.C.SCHWARTZ@Sargentlundy.com"

<BARRY.C.SCHWARTZ@Sargentlundy.com>,

"IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com"

<IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com>,

History: This message has been forwarded.

6 Attachments



40CFR190.docx



Gaseous Instantaneous.docx



U1 Gaseous Annual.docx



U1 Liquid Annual.docx



U2 Gaseous Annual.docx



U2 Liquid Annual.docx

Barry/John,

The doubling of the liquid discharge flow rates did not change the liquid doses because the permits were based on average effluent concentrations, which did not change.

Attached are the dose reports that have been reviewed by my supervisor (Z. Cox). I only ran annual dose reports because the Appendix I annual dose limits are twice the quarterly limits. Since we are using average effluent concentrations, once we demonstrate compliance to annual limits we automatically demonstrate compliance to quarterly limits. RETDAS is very temperamental, so when you look at the reports, ignore the listed monthly and quarterly limits and focus only on the annual limits. The gaseous and liquid annual reports demonstrate 10CFR50 Appendix I (per unit) compliance, the 40CFR190 report demonstrates 40CFR190 (site) compliance, and the gaseous instantaneous report demonstrates 10CFR20 (site) compliance. Give me a call tomorrow and we can discuss them.

After tomorrow, I will be out of the office until Wednesday.

Jeff

From: BARRY.C.SCHWARTZ@Sargentlundy.com [<mailto:BARRY.C.SCHWARTZ@Sargentlundy.com>]**Sent:** Wednesday, August 03, 2016 12:53 PM**To:** Golich, Jeffrey M:(GenCo-Nuc)**Cc:** CM.LAUNI@sargentlundy.com; RICHARD.CHITTENDEN@sargentlundy.com;

ROBERT.L.MARSH@sargentlundy.com; ANTHONY.KLAZURA@sargentlundy.com;

IOANNIS.K.GASTOUNIOTIS@Sargentlundy.com; Cox, Zoe L:(GenCo-Nuc); PAUL.A.MCGARY@sargentlundy.com;

Englert, Edward James:(GenCo-Nuc)

Subject: Byron UFSAR Annual Liquid Releases and Associated Concentrations

Jeff,

I have attached six PDFs, five related to the UFSAR and one from the Byron ODCM.

Placing UFSAR Table 11.2-1 on a station basis would double "Total" Ci/yr. However, the underlined text on page 6628 indicates that the PWR GALE parameters shown in UFSAR Table 11.2-2 (6649) are on a one unit basis. One a station basis, the gpm dilution flow in UFSAR Table 11.2-2 would also double, thus maintaining the same liquid effluent concentration into the discharge canal.

LIQUID RELEASES

The annual average radwaste dilution flow is 13000 gpm and is tabulated in UFSAR Table 11.2-2 (6649). The annual liquid releases for the unit are presented in UFSAR Table 11.2-1.

ANNUAL RELEASE: UNIT (ONE UNIT)

CR-51: $6.16\text{E-}05 \text{ Ci/yr} \times 1000000 \text{ uCi/Ci} \times (1/13000 \text{ gpm}) \times (0.264 \text{ gal/1000 ml})/60 \text{ min/24 hr/365 days} = 2.38\text{E-}12 \text{ uCi/ml}$

ANNUAL RELEASE STATION (TWO UNITS)

CR-51: $2 \times 6.16\text{E-}05 \text{ Ci/yr} \times 1000000 \text{ uCi/Ci} \times (1/26000 \text{ gpm}) \times (0.264 \text{ gal/1000 ml})/60 \text{ min/24 hr/365 days} = 2.38\text{E-}12 \text{ uCi/ml}$

ODCM Table 2-4

Cr-51: Liquid Effluent Concentration = $2.39\text{E-}12 \text{ uCi/ml}$

In summary, the liquid effluent concentration is the same for a one unit or two units due to the doubling of the dilution flow, but the curies released is dependent on the number of units.

Thank you for your support,
Barry

1-312-269-7296

----- Forwarded by BARRY C SCHWARTZ/Sargentlundy on 08/03/2016 07:51 AM -----

From: BARRY C SCHWARTZ/Sargentlundy
To: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>,
Cc: "CM.LAUNI@sargentlundy.com" <CM.LAUNI@sargentlundy.com>, "ANTHONY.KLAZURA@sargentlundy.com" <ANTHONY.KLAZURA@sargentlundy.com>, "PAUL.A.MCGARY@sargentlundy.com" <PAUL.A.MCGARY@sargentlundy.com>, "RICHARD.CHITTENDEN@sargentlundy.com" <RICHARD.CHITTENDEN@sargentlundy.com>, "IOANNIS.K.GASTOUNIOTIS@sargentlundy.com" <IOANNIS.K.GASTOUNIOTIS@sargentlundy.com>, "Cox, Zoe L:(GenCo-Nuc)" <zoe.cox@exeloncorp.com>, "Englert, Edward James:(GenCo-Nuc)" <Edward.Englert@exeloncorp.com>
Date: 08/02/2016 02:53 PM
Subject: RE: [EXTERNAL] Byron Liquid Releases and Airborne Releases- per Unit or per Station

Jeff,

Thank you for the clarification and correction. As far as doubling the annual release of UFSAR Table 11.2-1 is concerned, I am going to do some preliminary number crunching this evening with the "gpm" annual average dilution value in the UFSAR and compare some examples with ODCM Table 2-4, "Assumed Composition of the Byron Station Liquid Effluent", which is in units of uCi/ml. I will E-mail you tomorrow.

Thank you for your support,

Barry

1-312-269-7296

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>
To: "BARRY.C.SCHWARTZ@Sargentlundy.com" <BARRY.C.SCHWARTZ@Sargentlundy.com>,
Cc: "CM.LAUNI@sargentlundy.com" <CM.LAUNI@sargentlundy.com>, "ANTHONY.KLAZURA@sargentlundy.com" <ANTHONY.KLAZURA@sargentlundy.com>, "PAUL.A.MCGARY@sargentlundy.com" <PAUL.A.MCGARY@sargentlundy.com>, "RICHARD.CHITTENDEN@sargentlundy.com" <RICHARD.CHITTENDEN@sargentlundy.com>, "IOANNIS.K.GASTOUNIOTIS@sargentlundy.com" <IOANNIS.K.GASTOUNIOTIS@sargentlundy.com>, "Cox, Zoe L:(GenCo-Nuc)" <zoe.cox@exeloncorp.com>, "Englert, Edward James:(GenCo-Nuc)" <Edward.Englert@exeloncorp.com>
Date: 08/02/2016 01:32 PM
Subject: RE: [EXTERNAL] Byron Liquid Releases and Airborne Releases- per Unit or per Station

Barry,

I think there may have been a misunderstanding. I don't believe we concluded the liquid effluent concentrations listed in the UFSAR were on a station basis. But I believe that I stated the liquid effluent concentrations (uCi/ml) needed to be listed on a station basis because that is the way they are required to be input to RETDAS. When a liquid release permit is created, it is a single permit. RETDAS subsequently allocates the curies and dose evenly between units.

So it sounds like the values in Table 11.2-1 just need to be doubled.

Jeff

From: BARRY.C.SCHWARTZ@Sargentlundy.com [mailto:BARRY.C.SCHWARTZ@Sargentlundy.com]
Sent: Tuesday, August 02, 2016 12:38 PM
To: Golich, Jeffrey M:(GenCo-Nuc)
Cc: CM.LAUNI@sargentlundy.com; ANTHONY.KLAZURA@sargentlundy.com;
PAUL.A.MCGARY@sargentlundy.com; RICHARD.CHITTENDEN@sargentlundy.com;
IOANNIS.K.GASTOUNIOTIS@sargentlundy.com; Cox, Zoe L:(GenCo-Nuc); Englert, Edward James:(GenCo-Nuc)

Subject: [EXTERNAL] Byron Liquid Releases and Airborne Releases- per Unit or per Station

Jeff

In our conference call of 7/14/2016, we discussed UFSAR Table 11.2-1 for expected annual liquid releases into the discharge canal. UFSAR Table 11.3-6 is the expected annual airborne release per unit as indicated by the double asterisk in the table title. The point of this discussion was UFSAR Table 11.2-1, an expected annual release to discharge canal per unit or per station. Since UFSAR Table 11.3-6 is explicitly annual release per unit, we concluded that UFSAR Table 11.2-1 is per station due to the absence of the per unit designation.

However, during the preparation of the draft calculation I was preparing a section of the calculation on the power uprate impact on normal operation source terms, airborne and liquid, UFSAR Section 11.3.3.4 and UFSAR Table 11.3-7 and UFSAR Section 11.2.1.3 and UFSAR Table 11.2-4, respectively.

The following tables are extracted directly from the UFSAR for comparison purposes:

LIQUID RELEASES

Comparing the "Total" column of Table 11.2-1 with the "Expected Release" column of Table 11.2-4 shows that they tabulate the same annual releases, accounting for rounding. Note the units of release in the two tables, Ci/yr in Table 11.2-1 and Ci/yr/unit in Table 11.2-4. The conclusion previously drawn on liquid releases being on a station basis was not correct. Based on Table 11.2-4, the units of release are Ci/yr/unit not Ci/yr/station.

AIRBORNE RELEASES

Note the double asterisk in the title of Table 11.3-6 indicating that the table is on a per unit basis. In Table 11.3-7, the 2nd column is entitled "Annual Release From One Unit". Therefore, these two tables explicitly indicate the annual releases are on a per unit basis.

In summary, liquid releases and airborne releases are in terms of Ci.yr/unit in Chapter 11 of the UFSAR.

New PDFs for liquid releases are in preparation and are being reviewed..

Thank you for your support,

Barry

1-312 -269-7296

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Permits Attached

Golich, Jeffrey M:(GenCo-Nuc)

to:

BARRY.C.SCHWARTZ@Sargentlundy.com

09/15/2016 03:54 PM

Hide Details

From: "Golich, Jeffrey M:(GenCo-Nuc)" <jeffrey.golich@exeloncorp.com>

To: "BARRY.C.SCHWARTZ@Sargentlundy.com"

<BARRY.C.SCHWARTZ@Sargentlundy.com>,

History: This message has been forwarded.

6 Attachments



Liquid Permit 2016064.docx



Liquid Permit 2016065.docx



U1 Vent Stack Permit 2016307.docx



U1 Vent Stack Permit 2016308.docx



U2 Vent Stack Permit 2016309.docx



U2 Vent Stack Permit 2016310.docx

Barry,

Attached are copies of all the permits that were created for this project.

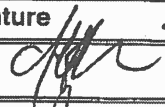
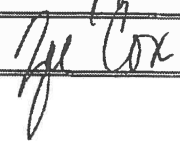
RETDAS was updated from v3.6.4.8 to v3.6.4.9. The update was to correct the error in the instantaneous Site Period Dose Rate report module only and did not involve a change in the source code. Therefore the V&V testing, which was performed on Version 3, still remains valid. The RETDAS reports only display v3.6.4 so there is no need to run another instantaneous Site Period Dose Rate Report.

Jeff

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ATTACHMENT U
BYRON TODI BYR-16-044 REVISION 0
TRANSMITTAL OF DATA ASSOCIATED WITH BYR16-012

Byron Station Transmittal of Design Information

To: Barry Schwartz	Location: Sargent & Lundy	Record ID Number: BYR-16-044, Rev. 0	
Subject: Transmittal of data associated with BYR16-012			
Reference System(s): OG			
Description of Information: This TODI transmits RETDAS data associated with BYR16-012, Rev. 0, Off Gas Filter Analysis. This analysis supports EC 402667, Off Gas Vent Stack Isolation Valve Single Point Vulnerability Elimination. This data has already been compiled and labeled for use in BYR16-012. To avoid relabeling every page, the attachment labels employed by BYR16-012 will be used in this transmittal. There are no attachments labeled as A, B, C, D, E, or N. Attachment F - 8 pages Attachment G - 8 pages Attachment H - 2 pages Attachment I - 2 pages Attachment J - 11 pages Attachment K - 11 pages Attachment L - 9 pages Attachment M - 9 pages Attachment O - 80 pages Attachment P - 8 pages Attachment Q - 8 pages			
State Intended Use of Information: This value is an input to BYR16-012			
Limitations (if any): None			
Source of Information/Reference Documents: This data is supplied by Chemistry Department.			
Is there any unverified Information <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, Enter Action Tracking Item to track verification of Unverified Information <u>NA</u>			
	Print	Signature	Date
Prepared by:	Jeff Golich		12-7-16
Approved by:	Zoe Cox		12-7-16

ATTACHMENT F

RETDAS COMPUTER PROGRAM U1 GASEOUS ANNUAL (UNFILTERED) DOSE REPORT BYRON STATION UNIT 1

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== RELEASE DATA ===
 Total Release Duration (minutes)..... 5.256E+05
 Total Release Volume (cf)..... 7.726E+10
 Average Release Flowrate (cfm)..... 1.470E+05

Average Period Flowrate (cfm)..... 1.470E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	2.49E+07	1.14E-08	1.14E+00	1.00E-08
KR-85M	4.99E+06	2.28E-09	2.28E-02	1.00E-07
KR-85	7.00E+08	3.20E-07	4.57E-01	7.00E-07
KR-87	1.00E+06	4.57E-10	2.28E-02	2.00E-08
KR-88	7.99E+06	3.65E-09	4.06E-01	9.00E-09
XE-131M	3.89E+07	1.78E-08	8.90E-03	2.00E-06
XE-133M	1.50E+07	6.85E-09	1.14E-02	6.00E-07
XE-133	2.00E+09	9.13E-07	1.83E+00	5.00E-07
XE-135	1.50E+07	6.85E-09	9.79E-02	7.00E-08
XE-138	1.00E+06	4.57E-10	2.28E-02	2.00E-08
F&AG	2.81E+09	1.28E-06	4.02E+00	
I-131	7.59E+04	3.47E-11	1.73E-01	2.00E-10
I-133	1.10E+05	5.02E-11	5.02E-02	1.00E-09
Iodine	1.86E+05	8.49E-11	2.24E-01	
C-14	7.99E+06	3.65E-09	1.22E+00	3.00E-09
Other	7.99E+06	3.65E-09	1.22E+00	
H-3	1.00E+09	4.57E-07	4.57E+00	1.00E-07
H-3	1.00E+09	4.57E-07	4.57E+00	
MN-54	4.70E+03	2.15E-12	2.15E-03	1.00E-09
FE-59	1.60E+03	7.31E-13	1.46E-03	5.00E-10
CO-58	1.60E+04	7.31E-12	7.31E-03	1.00E-09
CO-60	7.29E+03	3.33E-12	6.66E-02	5.00E-11
SR-89	3.39E+02	1.55E-13	7.75E-04	2.00E-10
SR-90	6.19E+01	2.83E-14	4.72E-03	6.00E-12

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== NUCLIDE DATA =====

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
CS-134	4.70E+03	2.15E-12	1.07E-02	2.00E-10
CS-137	7.79E+03	3.56E-12	1.78E-02	2.00E-10
P>=8	4.25E+04	1.94E-11	1.12E-01	
Total	3.81E+09	1.74E-06	1.01E+01	

Verified By: _____ Date: _____

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	INFANT	THYROID	9.82E+00	31-day	2.25E-01	4.37E+03
					Quarter	5.63E+00	1.75E+02
					Annual	1.13E+01	8.73E+01
T.Spec	Any Organ	INFANT	THYROID	9.82E+00	31-day	3.00E-01	3.27E+03
					Quarter	7.50E+00	1.31E+02
					Annual	1.50E+01	6.55E+01

Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Critical Pathway.....: 5 Grs/Cow/Milk (CMILK)
 Major Contributors.....: 0.0 % or greater to total
 Nuclide Percentage

H-3	2.51E-01
C-14	8.05E-01
MN-54	7.90E-03
FE-59	5.29E-04
CO-58	7.37E-03
CO-60	1.90E-01
SR-89	8.89E-09
SR-90	0.00E+00
I-131	9.72E+01
I-133	1.34E+00
CS-134	3.96E-02
CS-137	1.66E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
AINHL	2.22E-03	1.08E-02	2.69E-02	1.08E-02	1.16E-02	1.07E-02	0.00E+00	1.08E-02
AVEG	1.17E-01	5.46E-02	3.88E-01	4.54E-02	4.03E-02	4.42E-02	0.00E+00	5.04E-02
ACMEAT	3.94E-02	1.26E-02	5.58E-02	1.11E-02	1.05E-02	1.26E-02	0.00E+00	1.20E-02
ACMILK	5.45E-02	3.54E-02	1.28E+00	2.68E-02	1.63E-02	1.64E-02	0.00E+00	2.91E-02
TGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
TINHL	3.16E-03	1.11E-02	3.13E-02	1.11E-02	1.23E-02	1.10E-02	0.00E+00	1.10E-02
TVEG	1.87E-01	7.77E-02	3.44E-01	6.32E-02	5.70E-02	5.96E-02	0.00E+00	6.43E-02
TCMEAT	3.32E-02	9.85E-03	4.10E-02	8.69E-03	8.20E-03	9.28E-03	0.00E+00	8.88E-03
TCMILK	9.99E-02	5.99E-02	2.03E+00	4.51E-02	2.71E-02	2.58E-02	0.00E+00	3.89E-02
CGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
CINHL	4.35E-03	1.01E-02	3.35E-02	1.01E-02	1.11E-02	9.92E-03	0.00E+00	9.97E-03
CVEG	4.46E-01	1.51E-01	5.53E-01	1.26E-01	1.17E-01	1.16E-01	0.00E+00	1.21E-01
CCMEAT	6.23E-02	1.64E-02	6.38E-02	1.49E-02	1.42E-02	1.46E-02	0.00E+00	1.47E-02
CCMILK	2.44E-01	1.12E-01	4.02E+00	8.60E-02	5.59E-02	5.21E-02	0.00E+00	6.59E-02
IGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
IINHL	3.18E-03	6.05E-03	2.75E-02	5.98E-03	6.62E-03	5.86E-03	0.00E+00	5.90E-03
ICMILK	4.63E-01	2.22E-01	9.75E+00	1.57E-01	1.08E-01	9.96E-02	0.00E+00	1.19E-01
----- TOTALS -----								
ADULT	2.54E-01	1.54E-01	1.80E+00	1.35E-01	1.19E-01	1.25E-01	0.00E+00	1.43E-01
TEEN	3.63E-01	1.99E-01	2.49E+00	1.69E-01	1.45E-01	1.46E-01	0.00E+00	1.64E-01
CHILD	7.98E-01	3.30E-01	4.71E+00	2.78E-01	2.39E-01	2.33E-01	0.00E+00	2.53E-01
INFANT	5.07E-01	2.69E-01	9.82E+00	2.04E-01	1.55E-01	1.46E-01	0.00E+00	1.66E-01

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== AGE GROUP / PATHWAY DESCRIPTIONS =====
Abbreviation Age Group Pathway

CPEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM NG DOSE FOR PERIOD =====

Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	6.57E-02	31-day	1.50E-01	4.38E+01
			Quarter	3.75E+00	1.75E+00
			Annual	7.50E+00	8.75E-01
Admin	Beta	5.27E-02	31-day	3.00E-01	1.76E+01
			Quarter	7.50E+00	7.02E-01
			Annual	1.50E+01	3.51E-01
T.Spec	Gamma	6.57E-02	31-day	2.00E-01	3.28E+01
			Quarter	5.00E+00	1.31E+00
			Annual	1.00E+01	6.57E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.05E+01
KR-85M	5.42E-01
KR-85	1.06E+00
KR-87	5.45E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133M	4.33E-01
XE-133	6.23E+01
XE-135	2.54E+00
XE-138	8.14E-01

Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
T.Spec	Beta	5.27E-02	31-day	4.00E-01	1.32E+01
			Quarter	1.00E+01	5.27E-01
			Annual	2.00E+01	2.63E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.21E+00
KR-85M	2.66E-01
KR-85	3.69E+01
KR-87	2.79E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133M	6.00E-01
XE-133	5.68E+01
XE-135	9.98E-01
XE-138	1.29E-01

ATTACHMENT G

RETDAS COMPUTER PROGRAM U2 GASEOUS ANNUAL (UNFILTERED) DOSE REPORT BYRON STATION UNIT 2

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== RELEASE DATA ===
 Total Release Duration (minutes)..... 5.256E+05
 Total Release Volume (cf)..... 7.726E+10
 Average Release Flowrate (cfm)..... 1.470E+05

Average Period Flowrate (cfm)..... 1.470E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	2.49E+07	1.14E-08	1.14E+00	1.00E-08
KR-85M	4.99E+06	2.28E-09	2.28E-02	1.00E-07
KR-85	7.00E+08	3.20E-07	4.57E-01	7.00E-07
KR-87	1.00E+06	4.57E-10	2.28E-02	2.00E-08
KR-88	7.99E+06	3.65E-09	4.06E-01	9.00E-09
XE-131M	3.89E+07	1.78E-08	8.90E-03	2.00E-06
XE-133M	1.50E+07	6.85E-09	1.14E-02	6.00E-07
XE-133	2.00E+09	9.13E-07	1.83E+00	5.00E-07
XE-135	1.50E+07	6.85E-09	9.79E-02	7.00E-08
XE-138	1.00E+06	4.57E-10	2.28E-02	2.00E-08
F&AG	2.81E+09	1.28E-06	4.02E+00	
I-131	7.59E+04	3.47E-11	1.73E-01	2.00E-10
I-133	1.10E+05	5.02E-11	5.02E-02	1.00E-09
Iodine	1.86E+05	8.49E-11	2.24E-01	
C-14	7.99E+06	3.65E-09	1.22E+00	3.00E-09
Other	7.99E+06	3.65E-09	1.22E+00	
H-3	1.00E+09	4.57E-07	4.57E+00	1.00E-07
H-3	1.00E+09	4.57E-07	4.57E+00	
MN-54	4.70E+03	2.15E-12	2.15E-03	1.00E-09
FE-59	1.60E+03	7.31E-13	1.46E-03	5.00E-10
CO-58	1.60E+04	7.31E-12	7.31E-03	1.00E-09
CO-60	7.29E+03	3.33E-12	6.66E-02	5.00E-11
SR-89	3.39E+02	1.55E-13	7.75E-04	2.00E-10
SR-90	6.19E+01	2.83E-14	4.72E-03	6.00E-12

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== NUCLIDE DATA =====

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
CS-134	4.70E+03	2.15E-12	1.07E-02	2.00E-10
CS-137	7.79E+03	3.56E-12	1.78E-02	2.00E-10
P>=8	4.25E+04	1.94E-11	1.12E-01	
Total	3.81E+09	1.74E-06	1.01E+01	

Verified By: _____ Date: _____

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	INFANT	THYROID	9.82E+00	31-day	2.25E-01	4.37E+03
					Quarter	5.63E+00	1.75E+02
					Annual	1.13E+01	8.73E+01
T.Spec	Any Organ	INFANT	THYROID	9.82E+00	31-day	3.00E-01	3.27E+03
					Quarter	7.50E+00	1.31E+02
					Annual	1.50E+01	6.55E+01

Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Critical Pathway.....: 5 Grs/Cow/Milk (CMILK)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	2.51E-01
C-14	8.05E-01
MN-54	7.90E-03
FE-59	5.29E-04
CO-58	7.37E-03
CO-60	1.90E-01
SR-89	8.89E-09
SR-90	0.00E+00
I-131	9.72E+01
I-133	1.34E+00
CS-134	3.96E-02
CS-137	1.66E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
AINHL	2.22E-03	1.08E-02	2.69E-02	1.08E-02	1.16E-02	1.07E-02	0.00E+00	1.08E-02
AVEG	1.17E-01	5.46E-02	3.88E-01	4.54E-02	4.03E-02	4.42E-02	0.00E+00	5.04E-02
ACMEAT	3.94E-02	1.26E-02	5.58E-02	1.11E-02	1.05E-02	1.26E-02	0.00E+00	1.20E-02
ACMILK	5.45E-02	3.54E-02	1.28E+00	2.68E-02	1.63E-02	1.64E-02	0.00E+00	2.91E-02
TGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
TINHL	3.16E-03	1.11E-02	3.13E-02	1.11E-02	1.23E-02	1.10E-02	0.00E+00	1.10E-02
TVEG	1.87E-01	7.77E-02	3.44E-01	6.32E-02	5.70E-02	5.96E-02	0.00E+00	6.43E-02
TCMEAT	3.32E-02	9.85E-03	4.10E-02	8.69E-03	8.20E-03	9.28E-03	0.00E+00	8.88E-03
TCMILK	9.99E-02	5.99E-02	2.03E+00	4.51E-02	2.71E-02	2.58E-02	0.00E+00	3.89E-02
CGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
CINHL	4.35E-03	1.01E-02	3.35E-02	1.01E-02	1.11E-02	9.92E-03	0.00E+00	9.97E-03
CVEG	4.46E-01	1.51E-01	5.53E-01	1.26E-01	1.17E-01	1.16E-01	0.00E+00	1.21E-01
CCMEAT	6.23E-02	1.64E-02	6.38E-02	1.49E-02	1.42E-02	1.46E-02	0.00E+00	1.47E-02
CCMILK	2.44E-01	1.12E-01	4.02E+00	8.60E-02	5.59E-02	5.21E-02	0.00E+00	6.59E-02
IGPD	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	4.07E-02	0.00E+00	4.07E-02
IINHL	3.18E-03	6.05E-03	2.75E-02	5.98E-03	6.62E-03	5.86E-03	0.00E+00	5.90E-03
ICMILK	4.63E-01	2.22E-01	9.75E+00	1.57E-01	1.08E-01	9.96E-02	0.00E+00	1.19E-01
----- TOTALS -----								
ADULT	2.54E-01	1.54E-01	1.80E+00	1.35E-01	1.19E-01	1.25E-01	0.00E+00	1.43E-01
TEEN	3.63E-01	1.99E-01	2.49E+00	1.69E-01	1.45E-01	1.46E-01	0.00E+00	1.64E-01
CHILD	7.98E-01	3.30E-01	4.71E+00	2.78E-01	2.39E-01	2.33E-01	0.00E+00	2.53E-01
INFANT	5.07E-01	2.69E-01	9.82E+00	2.04E-01	1.55E-01	1.46E-01	0.00E+00	1.66E-01

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== AGE GROUP / PATHWAY DESCRIPTIONS =====
Abbreviation Age Group Pathway

CVEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	6.57E-02	31-day	1.50E-01	4.38E+01
			Quarter	3.75E+00	1.75E+00
			Annual	7.50E+00	8.75E-01
Admin	Beta	5.27E-02	31-day	3.00E-01	1.76E+01
			Quarter	7.50E+00	7.02E-01
			Annual	1.50E+01	3.51E-01
T.Spec	Gamma	6.57E-02	31-day	2.00E-01	3.28E+01
			Quarter	5.00E+00	1.31E+00
			Annual	1.00E+01	6.57E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.05E+01
KR-85M	5.42E-01
KR-85	1.06E+00
KR-87	5.45E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133M	4.33E-01
XE-133	6.23E+01
XE-135	2.54E+00
XE-138	8.14E-01

T.Spec	Beta	5.27E-02	31-day	4.00E-01	1.32E+01
			Quarter	1.00E+01	5.27E-01
			Annual	2.00E+01	2.63E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.21E+00
KR-85M	2.66E-01
KR-85	3.69E+01
KR-87	2.79E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133M	6.00E-01
XE-133	5.68E+01
XE-135	9.98E-01
XE-138	1.29E-01

ATTACHMENT H

RETDAS COMPUTER PROGRAM GASEOUS INSTANTANEOUS (UNFILTERED) DOSE REPORT BYRON STATION UNIT 1 AND UNIT 2

ANALYSIS NO. BYR16-012
RETDas v3.6.4 <BYR>

REVISION 0

PAGE 2H of 2H

VSSI

SITE PERIOD DOSE RATE REPORT

Release Point Description	I&P	Isotopic Start Date	End Date	Total Body (mrem/yr)	Skin (mrem/yr)	Organ (mrem/yr)
Unit 1 Stack	2016308	07/01/2017 00:00	12/31/2017 23:59	5.75E-02	1.51E-01	3.04E+01
Unit 2 Stack	2016310	07/01/2017 00:00	12/31/2017 23:59	5.75E-02	1.51E-01	3.04E+01
Maximum Possible Dose Rates.....				1.15E-01	3.01E-01	6.07E+01
Tech Spec Limit.....				5.00E+02	3.00E+03	1.50E+03
% of Tech. Spec Limit.....				2.30E-02	1.00E-02	4.05E+00

Date/Time: 08/29/2016 11:04 retDasID: RetDas

Page - 1

ATTACHMENT I

RETDAS COMPUTER PROGRAM GASEOUS INSTANTANEOUS (FILTERED) DOSE REPORT

BYRON STATION UNIT 1 AND UNIT 2

SITE PERIOD DOSE RATE REPORT

Release Point Description	I&P	Isotopic	Start Date	End Date	Total Body (mrem/yr)	Skin (mrem/yr)	Organ (mrem/yr)
Unit 1 Stack	2016308	07/01/2017	00:00	12/31/2017	23:59	1.51E-01	2.04E+01
Unit 2 Stack	2016310	07/01/2017	00:00	12/31/2017	23:59	1.51E-01	2.04E+01
Maximum Possible Dose Rates.....							
Tech Spec Limit.....					1.15E-01	3.01E-01	4.09E+01
% of Tech. Spec Limit.....					5.00E+02	3.00E+03	1.50E+03
					2.30E-02	1.00E-02	2.72E+00

ATTACHMENT J

RETDAS COMPUTER PROGRAM U1 LIQUID ANNUAL DOSE REPORT BYRON STATION UNIT 1

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1

=== MULTIPLE RELEASE POINT MESSAGE =====
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA =====
Total Release Duration (minutes)..... 5.256E+05
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA =====
Nuclide uCi

BA-137M 1.01E+04
CR-51 6.16E+01
MN-54 1.01E+03
FE-59 3.47E+01
CO-58 4.53E+03
CO-60 8.77E+03
BR-83 1.76E+01
RB-86 4.68E+01
ZR-95 1.40E+03
NB-95 2.00E+03
MO-99 1.98E+03
TC-99M 2.31E+03
RU-103 1.41E+02
RU-106 2.40E+03
AG-110M 4.40E+02
TE-127 1.40E+01
TE-129 3.03E+01
TE-129M 4.58E+01
TE-131M 3.26E+01
TE-132 6.16E+02
I-130 1.09E+02
I-131 8.04E+04
I-132 1.79E+03
I-133 3.65E+04
I-135 4.35E+03
CS-134 2.79E+04
CS-136 6.88E+03
CS-137 3.47E+04
CE-144 5.20E+03
NP-239 2.32E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

=== NUCLIDE DATA =====

Nuclide	uCi
-----	-----
Gamma	2.34E+05
H-3	3.00E+08
FE-55	5.41E+01
SR-89	1.28E+01
-----	-----
Beta	3.00E+08
-----	-----
Total	3.00E+08

Verified By: _____ Date: _____

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: 0 Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
APWtr	2.18E-05	1.17E-04	8.30E-04	9.57E-05	8.30E-05	8.92E-05	0.00E+00	1.07E-04
AFWFSp	1.15E-02	2.05E-02	3.26E-03	6.94E-03	2.26E-03	2.11E-03	0.00E+00	1.52E-02
TPWtr	2.11E-05	9.19E-05	7.02E-04	7.13E-05	6.00E-05	6.29E-05	0.00E+00	7.11E-05
TFWFSp	1.21E-02	2.11E-02	3.06E-03	7.06E-03	2.66E-03	1.51E-03	0.00E+00	8.73E-03
CPWtr	6.06E-05	1.80E-04	1.68E-03	1.38E-04	1.15E-04	1.14E-04	0.00E+00	1.23E-04
CFWFSp	1.50E-02	1.84E-02	3.21E-03	5.94E-03	2.09E-03	5.53E-04	0.00E+00	3.48E-03
IPWtr	6.46E-05	1.97E-04	2.58E-03	1.37E-04	1.14E-04	1.09E-04	0.00E+00	1.17E-04

----- TOTALS -----								
ADULT	1.15E-02	2.07E-02	4.09E-03	7.03E-03	2.34E-03	2.20E-03	0.00E+00	1.53E-02
TEEN	1.22E-02	2.12E-02	3.76E-03	7.13E-03	2.72E-03	1.57E-03	0.00E+00	8.80E-03
CHILD	1.51E-02	1.85E-02	4.89E-03	6.08E-03	2.21E-03	6.67E-04	0.00E+00	3.60E-03
INFANT	6.46E-05	1.97E-04	2.58E-03	1.37E-04	1.14E-04	1.09E-04	0.00E+00	1.17E-04

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
APWtr	ADULT	Potable Water (PWtr)
AFWFSp	ADULT	Fresh Water Fish - Sport (FFSP)
TPWtr	TEEN	Potable Water (PWtr)
TFWFSp	TEEN	Fresh Water Fish - Sport (FFSP)
CPWtr	CHILD	Potable Water (PWtr)
CFWFSp	CHILD	Fresh Water Fish - Sport (FFSP)
IPWtr	INFANT	Potable Water (PWtr)

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: 0 Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) ===								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
ADULT								
H-3	0.00E+00	9.96E-05	9.96E-05	9.96E-05	9.96E-05	9.96E-05	0.00E+00	9.96E-05
CR-51	0.00E+00	0.00E+00	2.52E-11	9.30E-12	5.60E-11	1.06E-08	0.00E+00	4.22E-11
MN-54	0.00E+00	2.36E-06	0.00E+00	7.01E-07	0.00E+00	7.22E-06	0.00E+00	4.50E-07
FE-55	1.95E-08	1.35E-08	0.00E+00	0.00E+00	7.51E-09	7.72E-09	0.00E+00	3.14E-09
FE-59	1.97E-08	4.63E-08	0.00E+00	0.00E+00	1.29E-08	1.54E-07	0.00E+00	1.78E-08
CO-58	0.00E+00	2.28E-07	0.00E+00	0.00E+00	0.00E+00	4.63E-06	0.00E+00	5.12E-07
CO-60	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00	2.39E-05	0.00E+00	2.80E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.46E-10	0.00E+00	3.79E-10
RB-86	0.00E+00	2.51E-06	0.00E+00	0.00E+00	0.00E+00	4.94E-07	0.00E+00	1.17E-06
SR-89	1.67E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E-08	0.00E+00	4.80E-09
ZR-95	3.65E-10	1.17E-10	0.00E+00	1.84E-10	0.00E+00	3.71E-07	0.00E+00	7.93E-11
NB-95	4.73E-07	2.63E-07	0.00E+00	2.60E-07	0.00E+00	1.60E-03	0.00E+00	1.41E-07
MO-99	0.00E+00	1.46E-07	0.00E+00	3.30E-07	0.00E+00	3.38E-07	0.00E+00	2.77E-08
TC-99M	1.34E-11	3.77E-11	0.00E+00	5.73E-10	1.85E-11	2.23E-08	0.00E+00	4.81E-10
RU-103	4.45E-10	0.00E+00	0.00E+00	1.70E-09	0.00E+00	5.20E-08	0.00E+00	1.92E-10
RU-106	1.13E-07	0.00E+00	0.00E+00	2.17E-07	0.00E+00	7.29E-06	0.00E+00	1.42E-08
AG-110M	5.15E-10	4.76E-10	0.00E+00	9.36E-10	0.00E+00	1.94E-07	0.00E+00	2.83E-10
TE-127	7.87E-10	2.83E-10	5.83E-10	3.20E-09	0.00E+00	6.21E-08	0.00E+00	1.70E-10
TE-129	4.86E-10	1.83E-10	3.73E-10	2.04E-09	0.00E+00	3.67E-10	0.00E+00	1.18E-10
TE-129M	2.69E-07	1.00E-07	9.24E-08	1.12E-06	0.00E+00	1.36E-06	0.00E+00	4.26E-08
TE-131M	2.88E-08	1.41E-08	2.23E-08	1.43E-07	0.00E+00	1.40E-06	0.00E+00	1.17E-08
TE-132	7.93E-07	5.13E-07	5.66E-07	4.94E-06	0.00E+00	2.43E-05	0.00E+00	4.81E-07
I-130	1.93E-09	5.68E-09	4.82E-07	8.87E-09	0.00E+00	4.89E-09	0.00E+00	2.24E-09
I-131	7.83E-06	1.12E-05	3.67E-03	1.92E-05	0.00E+00	2.96E-06	0.00E+00	6.42E-06
I-132	8.50E-09	2.28E-08	7.96E-07	3.62E-08	0.00E+00	4.27E-09	0.00E+00	7.96E-09
I-133	1.21E-06	2.11E-06	3.10E-04	3.68E-06	0.00E+00	1.90E-06	0.00E+00	6.43E-07
I-135	4.51E-08	1.18E-07	7.78E-06	1.89E-07	0.00E+00	1.33E-07	0.00E+00	4.35E-08
CS-134	4.41E-03	1.05E-02	0.00E+00	3.40E-03	1.13E-03	1.84E-04	0.00E+00	8.58E-03
CS-136	1.14E-04	4.49E-04	0.00E+00	2.50E-04	3.42E-05	5.10E-05	0.00E+00	3.23E-04
CS-137	7.01E-03	9.59E-03	0.00E+00	3.26E-03	1.08E-03	1.86E-04	0.00E+00	6.28E-03
CE-144	1.44E-08	6.02E-09	0.00E+00	3.57E-09	0.00E+00	4.86E-06	0.00E+00	7.72E-10
NP-239	4.71E-13	4.63E-14	0.00E+00	1.44E-13	0.00E+00	9.50E-09	0.00E+00	2.55E-14
TEEN								
H-3	0.00E+00	7.15E-05	7.15E-05	7.15E-05	7.15E-05	7.15E-05	0.00E+00	7.15E-05
CR-51	0.00E+00	0.00E+00	2.41E-11	9.52E-12	6.21E-11	7.30E-09	0.00E+00	4.35E-11
MN-54	0.00E+00	2.32E-06	0.00E+00	6.91E-07	0.00E+00	4.75E-06	0.00E+00	4.59E-07
FE-55	2.04E-08	1.44E-08	0.00E+00	0.00E+00	9.15E-09	6.25E-09	0.00E+00	3.37E-09
FE-59	2.03E-08	4.73E-08	0.00E+00	0.00E+00	1.49E-08	1.12E-07	0.00E+00	1.83E-08

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) ===								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
CO-58	0.00E+00	2.26E-07	0.00E+00	0.00E+00	0.00E+00	3.11E-06	0.00E+00	5.21E-07
CO-60	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00	1.65E-05	0.00E+00	2.85E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-10
RB-86	0.00E+00	2.70E-06	0.00E+00	0.00E+00	0.00E+00	3.99E-07	0.00E+00	1.27E-06
SR-89	1.80E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E-08	0.00E+00	5.17E-09
ZR-95	3.61E-10	1.14E-10	0.00E+00	1.67E-10	0.00E+00	2.63E-07	0.00E+00	7.83E-11
NB-95	4.76E-07	2.64E-07	0.00E+00	2.56E-07	0.00E+00	1.13E-03	0.00E+00	1.45E-07
MO-99	0.00E+00	1.52E-07	0.00E+00	3.48E-07	0.00E+00	2.72E-07	0.00E+00	2.90E-08
TC-99M	1.35E-11	3.76E-11	0.00E+00	5.60E-10	2.08E-11	2.46E-08	0.00E+00	4.87E-10
RU-103	4.58E-10	0.00E+00	0.00E+00	1.61E-09	0.00E+00	3.82E-08	0.00E+00	1.96E-10
RU-106	1.20E-07	0.00E+00	0.00E+00	2.31E-07	0.00E+00	5.74E-06	0.00E+00	1.51E-08
AG-110M	4.77E-10	4.52E-10	0.00E+00	8.62E-10	0.00E+00	1.27E-07	0.00E+00	2.75E-10
TE-127	8.61E-10	3.05E-10	5.94E-10	3.48E-09	0.00E+00	6.64E-08	0.00E+00	1.85E-10
TE-129	5.28E-10	1.97E-10	3.77E-10	2.21E-09	0.00E+00	2.89E-09	0.00E+00	1.28E-10
TE-129M	2.90E-07	1.08E-07	9.37E-08	1.22E-06	0.00E+00	1.09E-06	0.00E+00	4.60E-08
TE-131M	3.09E-08	1.48E-08	2.23E-08	1.55E-07	0.00E+00	1.19E-06	0.00E+00	1.24E-08
TE-132	8.36E-07	5.29E-07	5.58E-07	5.08E-06	0.00E+00	1.68E-05	0.00E+00	4.98E-07
I-130	1.97E-09	5.70E-09	4.65E-07	8.78E-09	0.00E+00	4.38E-09	0.00E+00	2.27E-09
I-131	8.26E-06	1.16E-05	3.38E-03	1.99E-05	0.00E+00	2.29E-06	0.00E+00	6.21E-06
I-132	8.77E-09	2.29E-08	7.73E-07	3.61E-08	0.00E+00	9.99E-09	0.00E+00	8.23E-09
I-133	1.29E-06	2.18E-06	3.05E-04	3.83E-06	0.00E+00	1.65E-06	0.00E+00	6.66E-07
I-135	4.65E-08	1.20E-07	7.70E-06	1.89E-07	0.00E+00	1.33E-07	0.00E+00	4.44E-08
CS-134	4.52E-03	1.06E-02	0.00E+00	3.38E-03	1.29E-03	1.32E-04	0.00E+00	4.94E-03
CS-136	1.14E-04	4.50E-04	0.00E+00	2.45E-04	3.86E-05	3.62E-05	0.00E+00	3.02E-04
CS-137	7.51E-03	9.99E-03	0.00E+00	3.40E-03	1.32E-03	1.42E-04	0.00E+00	3.48E-03
CE-144	1.46E-08	6.05E-09	0.00E+00	3.61E-09	0.00E+00	3.68E-06	0.00E+00	7.86E-10
NP-239	5.19E-13	4.90E-14	0.00E+00	1.54E-13	0.00E+00	7.88E-09	0.00E+00	2.72E-14
CHILD								
H-3	0.00E+00	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	0.00E+00	1.20E-04
CR-51	0.00E+00	0.00E+00	2.63E-11	7.17E-12	4.79E-11	2.51E-09	0.00E+00	4.73E-11
MN-54	0.00E+00	1.83E-06	0.00E+00	5.13E-07	0.00E+00	1.54E-06	0.00E+00	4.88E-07
FE-55	2.78E-08	1.47E-08	0.00E+00	0.00E+00	8.34E-09	2.73E-09	0.00E+00	4.57E-09
FE-59	2.56E-08	4.14E-08	0.00E+00	0.00E+00	1.20E-08	4.31E-08	0.00E+00	2.06E-08
CO-58	0.00E+00	1.95E-07	0.00E+00	0.00E+00	0.00E+00	1.14E-06	0.00E+00	5.96E-07
CO-60	0.00E+00	1.11E-06	0.00E+00	0.00E+00	0.00E+00	6.14E-06	0.00E+00	3.27E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-10
RB-86	0.00E+00	2.62E-06	0.00E+00	0.00E+00	0.00E+00	1.69E-07	0.00E+00	1.61E-06
SR-89	2.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-08	0.00E+00	7.51E-09
ZR-95	7.22E-10	1.59E-10	0.00E+00	2.27E-10	0.00E+00	1.66E-07	0.00E+00	1.41E-10
NB-95	5.62E-07	2.19E-07	0.00E+00	2.06E-07	0.00E+00	4.05E-04	0.00E+00	1.56E-07

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) ===								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
MO-99	0.00E+00	1.90E-07	0.00E+00	4.07E-07	0.00E+00	1.58E-07	0.00E+00	4.71E-08
TC-99M	1.99E-11	3.90E-11	0.00E+00	5.66E-10	1.98E-11	2.22E-08	0.00E+00	6.46E-10
RU-103	7.46E-10	0.00E+00	0.00E+00	1.88E-09	0.00E+00	1.93E-08	0.00E+00	2.87E-10
RU-106	2.03E-07	0.00E+00	0.00E+00	2.74E-07	0.00E+00	3.16E-06	0.00E+00	2.53E-08
AG-110M	9.56E-10	6.46E-10	0.00E+00	1.20E-09	0.00E+00	7.68E-08	0.00E+00	5.16E-10
TE-127	1.12E-09	3.01E-10	7.74E-10	3.18E-09	0.00E+00	4.37E-08	0.00E+00	2.40E-10
TE-129	6.88E-10	1.92E-10	4.91E-10	2.01E-09	0.00E+00	4.28E-08	0.00E+00	1.63E-10
TE-129M	3.78E-07	1.06E-07	1.22E-07	1.11E-06	0.00E+00	4.61E-07	0.00E+00	5.87E-08
TE-131M	3.98E-08	1.38E-08	2.83E-08	1.33E-07	0.00E+00	5.58E-07	0.00E+00	1.46E-08
TE-132	1.05E-06	4.66E-07	6.79E-07	4.33E-06	0.00E+00	4.70E-06	0.00E+00	5.64E-07
I-130	2.96E-09	5.99E-09	6.60E-07	8.95E-09	0.00E+00	2.80E-09	0.00E+00	3.09E-09
I-131	1.29E-05	1.30E-05	4.29E-03	2.13E-05	0.00E+00	1.15E-06	0.00E+00	7.37E-06
I-132	1.33E-08	2.45E-08	1.14E-06	3.75E-08	0.00E+00	2.89E-08	0.00E+00	1.13E-08
I-133	2.01E-06	2.49E-06	4.62E-04	4.15E-06	0.00E+00	1.00E-06	0.00E+00	9.41E-07
I-135	7.09E-08	1.28E-07	1.13E-05	1.96E-07	0.00E+00	9.72E-08	0.00E+00	6.03E-08
CS-134	5.46E-03	8.96E-03	0.00E+00	2.78E-03	9.97E-04	4.83E-05	0.00E+00	1.89E-03
CS-136	1.35E-04	3.71E-04	0.00E+00	1.98E-04	2.95E-05	1.30E-05	0.00E+00	2.40E-04
CS-137	9.47E-03	9.06E-03	0.00E+00	2.95E-03	1.06E-03	5.68E-05	0.00E+00	1.34E-03
CE-144	3.78E-08	1.18E-08	0.00E+00	6.56E-09	0.00E+00	3.09E-06	0.00E+00	2.02E-09
NP-239	8.81E-13	6.32E-14	0.00E+00	1.83E-13	0.00E+00	4.68E-09	0.00E+00	4.45E-14
INFANT								
H-3	0.00E+00	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	0.00E+00	1.05E-04
CR-51	0.00E+00	0.00E+00	1.13E-12	2.46E-13	2.19E-12	5.04E-11	0.00E+00	1.73E-12
MN-54	0.00E+00	4.00E-08	0.00E+00	8.86E-09	0.00E+00	1.47E-08	0.00E+00	9.06E-09
FE-55	1.50E-09	9.66E-10	0.00E+00	0.00E+00	4.73E-10	1.23E-10	0.00E+00	2.58E-10
FE-59	2.13E-09	3.71E-09	0.00E+00	0.00E+00	1.10E-09	1.77E-09	0.00E+00	1.46E-09
CO-58	0.00E+00	3.24E-08	0.00E+00	0.00E+00	0.00E+00	8.08E-08	0.00E+00	8.09E-08
CO-60	0.00E+00	1.89E-07	0.00E+00	0.00E+00	0.00E+00	4.49E-07	0.00E+00	4.45E-07
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E-11
RB-86	0.00E+00	1.58E-08	0.00E+00	0.00E+00	0.00E+00	4.05E-10	0.00E+00	7.83E-09
SR-89	6.40E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-09	0.00E+00	1.84E-09
ZR-95	5.74E-10	1.40E-10	0.00E+00	1.51E-10	0.00E+00	6.96E-08	0.00E+00	9.92E-11
NB-95	1.67E-10	6.89E-11	0.00E+00	4.94E-11	0.00E+00	5.81E-08	0.00E+00	3.98E-11
MO-99	0.00E+00	1.34E-07	0.00E+00	2.00E-07	0.00E+00	4.41E-08	0.00E+00	2.61E-08
TC-99M	8.83E-12	1.82E-11	0.00E+00	1.96E-10	9.52E-12	5.29E-09	0.00E+00	2.35E-10
RU-103	4.15E-10	0.00E+00	0.00E+00	8.65E-10	0.00E+00	5.05E-09	0.00E+00	1.39E-10
RU-106	1.15E-07	0.00E+00	0.00E+00	1.36E-07	0.00E+00	8.73E-07	0.00E+00	1.44E-08
AG-110M	8.72E-10	6.36E-10	0.00E+00	9.10E-10	0.00E+00	3.30E-08	0.00E+00	4.21E-10
TE-127	2.79E-11	9.33E-12	2.27E-11	6.80E-11	0.00E+00	5.85E-10	0.00E+00	5.99E-12
TE-129	1.71E-11	5.90E-12	1.43E-11	4.26E-11	0.00E+00	1.37E-09	0.00E+00	3.99E-12

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

```
=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====
Agegroup Bone      Liver      Thyroid  Kidney   Lung     GI-Lli   Skin     TB
-----
TE-129M  9.11E-09  3.13E-09  3.50E-09  2.28E-08  0.00E+00  5.44E-09  0.00E+00  1.40E-09
TE-131M  9.86E-10  3.97E-10  8.05E-10  2.73E-09  0.00E+00  6.68E-09  0.00E+00  3.28E-10
TE-132   2.55E-08  1.26E-08  1.86E-08  7.89E-08  0.00E+00  4.67E-08  0.00E+00  1.18E-08
I-130    1.30E-09  2.86E-09  3.21E-07  3.14E-09  0.00E+00  6.14E-10  0.00E+00  1.15E-09
I-131    5.75E-06  6.77E-06  2.23E-03  7.91E-06  0.00E+00  2.42E-07  0.00E+00  2.98E-06
I-132    5.92E-09  1.20E-08  5.63E-07  1.34E-08  0.00E+00  9.73E-09  0.00E+00  4.28E-09
I-133    9.08E-07  1.32E-06  2.40E-04  1.55E-06  0.00E+00  2.24E-07  0.00E+00  3.87E-07
I-135    3.15E-08  6.26E-08  5.62E-06  6.98E-08  0.00E+00  2.27E-08  0.00E+00  2.28E-08
CS-134   2.10E-05  3.91E-05  0.00E+00  1.01E-05  4.13E-06  1.06E-07  0.00E+00  3.95E-06
CS-136   6.29E-07  1.85E-06  0.00E+00  7.37E-07  1.51E-07  2.81E-08  0.00E+00  6.90E-07
CS-137   3.60E-05  4.22E-05  0.00E+00  1.13E-05  4.58E-06  1.32E-07  0.00E+00  2.99E-06
CE-144   3.08E-08  1.26E-08  0.00E+00  5.10E-09  0.00E+00  1.77E-06  0.00E+00  1.73E-09
NP-239   5.12E-13  4.58E-14  0.00E+00  9.14E-14  0.00E+00  1.32E-09  0.00E+00  2.59E-14
```

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: 0 Liquid Receptor

=== MAXIMUM DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	TEEN	LIVER	2.12E-02	31-day Quarter Annual	1.50E-01 3.75E+00 7.50E+00	1.41E+01 5.65E-01 2.82E-01
Admin	Tot Body	ADULT	TBODY	1.53E-02	31-day Quarter Annual	4.50E-02 1.13E+00 2.25E+00	3.40E+01 1.36E+00 6.80E-01
T.Spec	Any Organ	TEEN	LIVER	2.12E-02	31-day Quarter Annual	2.00E-01 5.00E+00 1.00E+01	1.06E+01 4.23E-01 2.12E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.38E-01
MN-54	1.09E-02
FE-55	6.82E-05
FE-59	2.23E-04
CO-58	1.07E-03
CO-60	5.98E-03
RB-86	1.27E-02
ZR-95	5.38E-07
NB-95	1.25E-03
MO-99	7.17E-04
TC-99M	1.77E-07
AG-110M	2.13E-06
TE-129	9.29E-07
TE-127	1.44E-06
TE-129M	5.09E-04
TE-131M	7.01E-05
TE-132	2.50E-03
I-130	2.69E-05
I-131	5.46E-02
I-132	1.08E-04
I-133	1.03E-02
I-135	5.66E-04
CS-134	5.03E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
CS-136	2.12E+00
CS-137	4.72E+01
CE-144	2.86E-05
NP-239	2.31E-10

T.Spec	Tot Body	ADULT	TBODY	1.53E-02	31-day	6.00E-02	2.55E+01
					Quarter	1.50E+00	1.02E+00
					Annual	3.00E+00	5.10E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	6.51E-01
CR-51	2.76E-07
MN-54	2.94E-03
FE-55	2.05E-05
FE-59	1.16E-04
CO-58	3.35E-03
CO-60	1.83E-02
BR-83	2.48E-06
RB-86	7.64E-03
SR-89	3.14E-05
ZR-95	5.18E-07
NB-95	9.24E-04
MO-99	1.81E-04
TC-99M	3.14E-06
RU-103	1.25E-06
RU-106	9.31E-05
AG-110M	1.85E-06
TE-127	1.11E-06
TE-129	7.74E-07
TE-129M	2.78E-04
TE-131M	7.68E-05
TE-132	3.15E-03
I-130	1.47E-05
I-131	4.20E-02
I-132	5.20E-05
I-133	4.20E-03
I-135	2.85E-04
CS-134	5.61E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
CS-136	2.11E+00
CS-137	4.11E+01
CE-144	5.05E-06
NP-239	1.67E-10

ATTACHMENT K

RETDAS COMPUTER PROGRAM U2 LIQUID ANNUAL DOSE REPORT BYRON STATION UNIT 2

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2

=== MULTIPLE RELEASE POINT MESSAGE =====
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA =====
Total Release Duration (minutes)..... 5.256E+05
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA =====
Nuclide uCi

BA-137M 1.01E+04
CR-51 6.16E+01
MN-54 1.01E+03
FE-59 3.47E+01
CO-58 4.53E+03
CO-60 8.77E+03
BR-83 1.76E+01
RB-86 4.68E+01
ZR-95 1.40E+03
NB-95 2.00E+03
MO-99 1.98E+03
TC-99M 2.31E+03
RU-103 1.41E+02
RU-106 2.40E+03
AG-110M 4.40E+02
TE-127 1.40E+01
TE-129 3.03E+01
TE-129M 4.58E+01
TE-131M 3.26E+01
TE-132 6.16E+02
I-130 1.09E+02
I-131 8.04E+04
I-132 1.79E+03
I-133 3.65E+04
I-135 4.35E+03
CS-134 2.79E+04
CS-136 6.88E+03
CS-137 3.47E+04
CE-144 5.20E+03
NP-239 2.32E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

=== NUCLIDE DATA =====

Nuclide	uCi
-----	-----
Gamma	2.34E+05
H-3	3.00E+08
FE-55	5.41E+01
SR-89	1.28E+01
-----	-----
Beta	3.00E+08
-----	-----
Total	3.00E+08

Verified By: _____ Date: _____

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: 0 Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
APWtr	2.18E-05	1.17E-04	8.30E-04	9.57E-05	8.30E-05	8.92E-05	0.00E+00	1.07E-04
AFWFSp	1.15E-02	2.05E-02	3.26E-03	6.94E-03	2.26E-03	2.11E-03	0.00E+00	1.52E-02
TPWtr	2.11E-05	9.19E-05	7.02E-04	7.13E-05	6.00E-05	6.29E-05	0.00E+00	7.11E-05
TFWFSp	1.21E-02	2.11E-02	3.06E-03	7.06E-03	2.66E-03	1.51E-03	0.00E+00	8.73E-03
CPWtr	6.06E-05	1.80E-04	1.68E-03	1.38E-04	1.15E-04	1.14E-04	0.00E+00	1.23E-04
CFWFSp	1.50E-02	1.84E-02	3.21E-03	5.94E-03	2.09E-03	5.53E-04	0.00E+00	3.48E-03
IPWtr	6.46E-05	1.97E-04	2.58E-03	1.37E-04	1.14E-04	1.09E-04	0.00E+00	1.17E-04

----- TOTALS -----								
ADULT	1.15E-02	2.07E-02	4.09E-03	7.03E-03	2.34E-03	2.20E-03	0.00E+00	1.53E-02
TEEN	1.22E-02	2.12E-02	3.76E-03	7.13E-03	2.72E-03	1.57E-03	0.00E+00	8.80E-03
CHILD	1.51E-02	1.85E-02	4.89E-03	6.08E-03	2.21E-03	6.67E-04	0.00E+00	3.60E-03
INFANT	6.46E-05	1.97E-04	2.58E-03	1.37E-04	1.14E-04	1.09E-04	0.00E+00	1.17E-04

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
APWtr	ADULT	Potable Water (PWtr)
AFWFSp	ADULT	Fresh Water Fish - Sport (FFSP)
TPWtr	TEEN	Potable Water (PWtr)
TFWFSp	TEEN	Fresh Water Fish - Sport (FFSP)
CPWtr	CHILD	Potable Water (PWtr)
CFWFSp	CHILD	Fresh Water Fish - Sport (FFSP)
IPWtr	INFANT	Potable Water (PWtr)

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: 0 Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB

ADULT								
H-3	0.00E+00	9.96E-05	9.96E-05	9.96E-05	9.96E-05	9.96E-05	0.00E+00	9.96E-05
CR-51	0.00E+00	0.00E+00	2.52E-11	9.30E-12	5.60E-11	1.06E-08	0.00E+00	4.22E-11
MN-54	0.00E+00	2.36E-06	0.00E+00	7.01E-07	0.00E+00	7.22E-06	0.00E+00	4.50E-07
FE-55	1.95E-08	1.35E-08	0.00E+00	0.00E+00	7.51E-09	7.72E-09	0.00E+00	3.14E-09
FE-59	1.97E-08	4.63E-08	0.00E+00	0.00E+00	1.29E-08	1.54E-07	0.00E+00	1.78E-08
CO-58	0.00E+00	2.28E-07	0.00E+00	0.00E+00	0.00E+00	4.63E-06	0.00E+00	5.12E-07
CO-60	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00	2.39E-05	0.00E+00	2.80E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.46E-10	0.00E+00	3.79E-10
RB-86	0.00E+00	2.51E-06	0.00E+00	0.00E+00	0.00E+00	4.94E-07	0.00E+00	1.17E-06
SR-89	1.67E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E-08	0.00E+00	4.80E-09
ZR-95	3.65E-10	1.17E-10	0.00E+00	1.84E-10	0.00E+00	3.71E-07	0.00E+00	7.93E-11
NB-95	4.73E-07	2.63E-07	0.00E+00	2.60E-07	0.00E+00	1.60E-03	0.00E+00	1.41E-07
MO-99	0.00E+00	1.46E-07	0.00E+00	3.30E-07	0.00E+00	3.38E-07	0.00E+00	2.77E-08
TC-99M	1.34E-11	3.77E-11	0.00E+00	5.73E-10	1.85E-11	2.23E-08	0.00E+00	4.81E-10
RU-103	4.45E-10	0.00E+00	0.00E+00	1.70E-09	0.00E+00	5.20E-08	0.00E+00	1.92E-10
RU-106	1.13E-07	0.00E+00	0.00E+00	2.17E-07	0.00E+00	7.29E-06	0.00E+00	1.42E-08
AG-110M	5.15E-10	4.76E-10	0.00E+00	9.36E-10	0.00E+00	1.94E-07	0.00E+00	2.83E-10
TE-127	7.87E-10	2.83E-10	5.83E-10	3.20E-09	0.00E+00	6.21E-08	0.00E+00	1.70E-10
TE-129	4.86E-10	1.83E-10	3.73E-10	2.04E-09	0.00E+00	3.67E-10	0.00E+00	1.18E-10
TE-129M	2.69E-07	1.00E-07	9.24E-08	1.12E-06	0.00E+00	1.36E-06	0.00E+00	4.26E-08
TE-131M	2.88E-08	1.41E-08	2.23E-08	1.43E-07	0.00E+00	1.40E-06	0.00E+00	1.17E-08
TE-132	7.93E-07	5.13E-07	5.66E-07	4.94E-06	0.00E+00	2.43E-05	0.00E+00	4.81E-07
I-130	1.93E-09	5.68E-09	4.82E-07	8.87E-09	0.00E+00	4.89E-09	0.00E+00	2.24E-09
I-131	7.83E-06	1.12E-05	3.67E-03	1.92E-05	0.00E+00	2.96E-06	0.00E+00	6.42E-06
I-132	8.50E-09	2.28E-08	7.96E-07	3.62E-08	0.00E+00	4.27E-09	0.00E+00	7.96E-09
I-133	1.21E-06	2.11E-06	3.10E-04	3.68E-06	0.00E+00	1.90E-06	0.00E+00	6.43E-07
I-135	4.51E-08	1.18E-07	7.78E-06	1.89E-07	0.00E+00	1.33E-07	0.00E+00	4.35E-08
CS-134	4.41E-03	1.05E-02	0.00E+00	3.40E-03	1.13E-03	1.84E-04	0.00E+00	8.58E-03
CS-136	1.14E-04	4.49E-04	0.00E+00	2.50E-04	3.42E-05	5.10E-05	0.00E+00	3.23E-04
CS-137	7.01E-03	9.59E-03	0.00E+00	3.26E-03	1.08E-03	1.86E-04	0.00E+00	6.28E-03
CE-144	1.44E-08	6.02E-09	0.00E+00	3.57E-09	0.00E+00	4.86E-06	0.00E+00	7.72E-10
NP-239	4.71E-13	4.63E-14	0.00E+00	1.44E-13	0.00E+00	9.50E-09	0.00E+00	2.55E-14
TEEN								
H-3	0.00E+00	7.15E-05	7.15E-05	7.15E-05	7.15E-05	7.15E-05	0.00E+00	7.15E-05
CR-51	0.00E+00	0.00E+00	2.41E-11	9.52E-12	6.21E-11	7.30E-09	0.00E+00	4.35E-11
MN-54	0.00E+00	2.32E-06	0.00E+00	6.91E-07	0.00E+00	4.75E-06	0.00E+00	4.59E-07
FE-55	2.04E-08	1.44E-08	0.00E+00	0.00E+00	9.15E-09	6.25E-09	0.00E+00	3.37E-09
FE-59	2.03E-08	4.73E-08	0.00E+00	0.00E+00	1.49E-08	1.12E-07	0.00E+00	1.83E-08

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====

Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
CO-58	0.00E+00	2.26E-07	0.00E+00	0.00E+00	0.00E+00	3.11E-06	0.00E+00	5.21E-07
CO-60	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00	1.65E-05	0.00E+00	2.85E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-10
RB-86	0.00E+00	2.70E-06	0.00E+00	0.00E+00	0.00E+00	3.99E-07	0.00E+00	1.27E-06
SR-89	1.80E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E-08	0.00E+00	5.17E-09
ZR-95	3.61E-10	1.14E-10	0.00E+00	1.67E-10	0.00E+00	2.63E-07	0.00E+00	7.83E-11
NB-95	4.76E-07	2.64E-07	0.00E+00	3.48E-07	0.00E+00	1.13E-03	0.00E+00	1.45E-07
MO-99	0.00E+00	1.52E-07	0.00E+00	3.48E-07	0.00E+00	2.72E-07	0.00E+00	2.90E-08
TC-99M	1.35E-11	3.76E-11	0.00E+00	5.60E-10	2.08E-11	2.46E-08	0.00E+00	4.87E-10
RU-103	4.58E-10	0.00E+00	0.00E+00	1.61E-09	0.00E+00	3.82E-08	0.00E+00	1.96E-10
RU-106	1.20E-07	0.00E+00	0.00E+00	2.31E-07	0.00E+00	5.74E-06	0.00E+00	1.51E-08
AG-110M	4.77E-10	4.52E-10	0.00E+00	8.62E-10	0.00E+00	1.27E-07	0.00E+00	2.75E-10
TE-127	8.61E-10	3.05E-10	5.94E-10	3.48E-09	0.00E+00	6.64E-08	0.00E+00	1.85E-10
TE-129	5.28E-10	1.97E-10	3.77E-10	2.21E-09	0.00E+00	2.89E-09	0.00E+00	1.28E-10
TE-129M	2.90E-07	1.08E-07	9.37E-08	1.22E-06	0.00E+00	1.09E-06	0.00E+00	4.60E-08
TE-131M	3.09E-08	1.48E-08	2.23E-08	1.55E-07	0.00E+00	1.19E-06	0.00E+00	1.24E-08
TE-132	8.36E-07	5.29E-07	5.58E-07	5.08E-06	0.00E+00	1.68E-05	0.00E+00	4.98E-07
I-130	1.97E-09	5.70E-09	4.65E-07	8.78E-09	0.00E+00	4.38E-09	0.00E+00	2.27E-09
I-131	8.26E-06	1.16E-05	3.38E-03	1.99E-05	0.00E+00	2.29E-06	0.00E+00	6.21E-06
I-132	8.77E-09	2.29E-08	7.73E-07	3.61E-08	0.00E+00	9.99E-09	0.00E+00	8.23E-09
I-133	1.29E-06	2.18E-06	3.05E-04	3.83E-06	0.00E+00	1.65E-06	0.00E+00	6.66E-07
I-135	4.65E-08	1.20E-07	7.70E-06	1.89E-07	0.00E+00	1.33E-07	0.00E+00	4.44E-08
CS-134	4.52E-03	1.06E-02	0.00E+00	3.38E-03	1.29E-03	1.32E-04	0.00E+00	4.94E-03
CS-136	1.14E-04	4.50E-04	0.00E+00	2.45E-04	3.86E-05	3.62E-05	0.00E+00	3.02E-04
CS-137	7.51E-03	9.99E-03	0.00E+00	3.40E-03	1.32E-03	1.42E-04	0.00E+00	3.48E-03
CE-144	1.46E-08	6.05E-09	0.00E+00	3.61E-09	0.00E+00	3.68E-06	0.00E+00	7.86E-10
NP-239	5.19E-13	4.90E-14	0.00E+00	1.54E-13	0.00E+00	7.88E-09	0.00E+00	2.72E-14
CHILD								
H-3	0.00E+00	1.20E-04	1.20E-04	1.20E-04	1.20E-04	1.20E-04	0.00E+00	1.20E-04
CR-51	0.00E+00	0.00E+00	2.63E-11	7.17E-12	4.79E-11	2.51E-09	0.00E+00	4.73E-11
MN-54	0.00E+00	1.83E-06	0.00E+00	5.13E-07	0.00E+00	1.54E-06	0.00E+00	4.88E-07
FE-55	2.78E-08	1.47E-08	0.00E+00	0.00E+00	8.34E-09	2.73E-09	0.00E+00	4.57E-09
FE-59	2.56E-08	4.14E-08	0.00E+00	0.00E+00	1.20E-08	4.31E-08	0.00E+00	2.06E-08
CO-58	0.00E+00	1.95E-07	0.00E+00	0.00E+00	0.00E+00	1.14E-06	0.00E+00	5.96E-07
CO-60	0.00E+00	1.11E-06	0.00E+00	0.00E+00	0.00E+00	6.14E-06	0.00E+00	3.27E-06
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-10
RB-86	0.00E+00	2.62E-06	0.00E+00	0.00E+00	0.00E+00	1.69E-07	0.00E+00	1.61E-06
SR-89	2.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-08	0.00E+00	7.51E-09
ZR-95	7.22E-10	1.59E-10	0.00E+00	2.27E-10	0.00E+00	1.66E-07	0.00E+00	1.41E-10
NB-95	5.62E-07	2.19E-07	0.00E+00	2.06E-07	0.00E+00	4.05E-04	0.00E+00	1.56E-07

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
MO-99	0.00E+00	1.90E-07	0.00E+00	4.07E-07	0.00E+00	1.58E-07	0.00E+00	4.71E-08
TC-99M	1.99E-11	3.90E-11	0.00E+00	5.66E-10	1.98E-11	2.22E-08	0.00E+00	6.46E-10
RU-103	7.46E-10	0.00E+00	0.00E+00	1.88E-09	0.00E+00	1.93E-08	0.00E+00	2.87E-10
RU-106	2.03E-07	0.00E+00	0.00E+00	2.74E-07	0.00E+00	3.16E-06	0.00E+00	2.53E-08
AG-110M	9.56E-10	6.46E-10	0.00E+00	1.20E-09	0.00E+00	7.68E-08	0.00E+00	5.16E-10
TE-127	1.12E-09	3.01E-10	7.74E-10	3.18E-09	0.00E+00	4.37E-08	0.00E+00	2.40E-10
TE-129	6.88E-10	1.92E-10	4.91E-10	2.01E-09	0.00E+00	4.28E-08	0.00E+00	1.63E-10
TE-129M	3.78E-07	1.06E-07	1.22E-07	1.11E-06	0.00E+00	4.61E-07	0.00E+00	5.87E-08
TE-131M	3.98E-08	1.38E-08	2.83E-08	1.33E-07	0.00E+00	5.58E-07	0.00E+00	1.46E-08
TE-132	1.05E-06	4.66E-07	6.79E-07	4.33E-06	0.00E+00	4.70E-06	0.00E+00	5.64E-07
I-130	2.96E-09	5.99E-09	6.60E-07	8.95E-09	0.00E+00	2.80E-09	0.00E+00	3.09E-09
I-131	1.29E-05	1.30E-05	4.29E-03	2.13E-05	0.00E+00	1.15E-06	0.00E+00	7.37E-06
I-132	1.33E-08	2.45E-08	1.14E-06	3.75E-08	0.00E+00	2.89E-08	0.00E+00	1.13E-08
I-133	2.01E-06	2.49E-06	4.62E-04	4.15E-06	0.00E+00	1.00E-06	0.00E+00	9.41E-07
I-135	7.09E-08	1.28E-07	1.13E-05	1.96E-07	0.00E+00	9.72E-08	0.00E+00	6.03E-08
CS-134	5.46E-03	8.96E-03	0.00E+00	2.78E-03	9.97E-04	4.83E-05	0.00E+00	1.89E-03
CS-136	1.35E-04	3.71E-04	0.00E+00	1.98E-04	2.95E-05	1.30E-05	0.00E+00	2.40E-04
CS-137	9.47E-03	9.06E-03	0.00E+00	2.95E-03	1.06E-03	5.68E-05	0.00E+00	1.34E-03
CE-144	3.78E-08	1.18E-08	0.00E+00	6.56E-09	0.00E+00	3.09E-06	0.00E+00	2.02E-09
NP-239	8.81E-13	6.32E-14	0.00E+00	1.83E-13	0.00E+00	4.68E-09	0.00E+00	4.45E-14
INFANT								
H-3	0.00E+00	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	0.00E+00	1.05E-04
CR-51	0.00E+00	0.00E+00	1.13E-12	2.46E-13	2.19E-12	5.04E-11	0.00E+00	1.73E-12
MN-54	0.00E+00	4.00E-08	0.00E+00	8.86E-09	0.00E+00	1.47E-08	0.00E+00	9.06E-09
FE-55	1.50E-09	9.66E-10	0.00E+00	0.00E+00	4.73E-10	1.23E-10	0.00E+00	2.58E-10
FE-59	2.13E-09	3.71E-09	0.00E+00	0.00E+00	1.10E-09	1.77E-09	0.00E+00	1.46E-09
CO-58	0.00E+00	3.24E-08	0.00E+00	0.00E+00	0.00E+00	8.08E-08	0.00E+00	8.09E-08
CO-60	0.00E+00	1.89E-07	0.00E+00	0.00E+00	0.00E+00	4.49E-07	0.00E+00	4.45E-07
BR-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E-11
RB-86	0.00E+00	1.58E-08	0.00E+00	0.00E+00	0.00E+00	4.05E-10	0.00E+00	7.83E-09
SR-89	6.40E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-09	0.00E+00	1.84E-09
ZR-95	5.74E-10	1.40E-10	0.00E+00	1.51E-10	0.00E+00	6.96E-08	0.00E+00	9.92E-11
NB-95	1.67E-10	6.89E-11	0.00E+00	4.94E-11	0.00E+00	5.81E-08	0.00E+00	3.98E-11
MO-99	0.00E+00	1.34E-07	0.00E+00	2.00E-07	0.00E+00	4.41E-08	0.00E+00	2.61E-08
TC-99M	8.83E-12	1.82E-11	0.00E+00	1.96E-10	9.52E-12	5.29E-09	0.00E+00	2.35E-10
RU-103	4.15E-10	0.00E+00	0.00E+00	8.65E-10	0.00E+00	5.05E-09	0.00E+00	1.39E-10
RU-106	1.15E-07	0.00E+00	0.00E+00	1.36E-07	0.00E+00	8.73E-07	0.00E+00	1.44E-08
AG-110M	8.72E-10	6.36E-10	0.00E+00	9.10E-10	0.00E+00	3.30E-08	0.00E+00	4.21E-10
TE-127	2.79E-11	9.33E-12	2.27E-11	6.80E-11	0.00E+00	5.85E-10	0.00E+00	5.99E-12
TE-129	1.71E-11	5.90E-12	1.43E-11	4.26E-11	0.00E+00	1.37E-09	0.00E+00	3.99E-12

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) ===								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
TE-129M	9.11E-09	3.13E-09	3.50E-09	2.28E-08	0.00E+00	5.44E-09	0.00E+00	1.40E-09
TE-131M	9.86E-10	3.97E-10	8.05E-10	2.73E-09	0.00E+00	6.68E-09	0.00E+00	3.28E-10
TE-132	2.55E-08	1.26E-08	1.86E-08	7.89E-08	0.00E+00	4.67E-08	0.00E+00	1.18E-08
I-130	1.30E-09	2.86E-09	3.21E-07	3.14E-09	0.00E+00	6.14E-10	0.00E+00	1.15E-09
I-131	5.75E-06	6.77E-06	2.23E-03	7.91E-06	0.00E+00	2.42E-07	0.00E+00	2.98E-06
I-132	5.92E-09	1.20E-08	5.63E-07	1.34E-08	0.00E+00	9.73E-09	0.00E+00	4.28E-09
I-133	9.08E-07	1.32E-06	2.40E-04	1.55E-06	0.00E+00	2.24E-07	0.00E+00	3.87E-07
I-135	3.15E-08	6.26E-08	5.62E-06	6.98E-08	0.00E+00	2.27E-08	0.00E+00	2.28E-08
CS-134	2.10E-05	3.91E-05	0.00E+00	1.01E-05	4.13E-06	1.06E-07	0.00E+00	3.95E-06
CS-136	6.29E-07	1.85E-06	0.00E+00	7.37E-07	1.51E-07	2.81E-08	0.00E+00	6.90E-07
CS-137	3.60E-05	4.22E-05	0.00E+00	1.13E-05	4.58E-06	1.32E-07	0.00E+00	2.99E-06
CE-144	3.08E-08	1.26E-08	0.00E+00	5.10E-09	0.00E+00	1.77E-06	0.00E+00	1.73E-09
NP-239	5.12E-13	4.58E-14	0.00E+00	9.14E-14	0.00E+00	1.32E-09	0.00E+00	2.59E-14

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 2
 Receptor.....: 0 Liquid Receptor

=== MAXIMUM DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	TEEN	LIVER	2.12E-02	31-day	1.50E-01	1.41E+01
					Quarter	3.75E+00	5.65E-01
					Annual	7.50E+00	2.82E-01
Admin	Tot Body	ADULT	TBODY	1.53E-02	31-day	4.50E-02	3.40E+01
					Quarter	1.13E+00	1.36E+00
					Annual	2.25E+00	6.80E-01
T.Spec	Any Organ	TEEN	LIVER	2.12E-02	31-day	2.00E-01	1.06E+01
					Quarter	5.00E+00	4.23E-01
					Annual	1.00E+01	2.12E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.38E-01
MN-54	1.09E-02
FE-55	6.82E-05
FE-59	2.23E-04
CO-58	1.07E-03
CO-60	5.98E-03
RB-86	1.27E-02
ZR-95	5.38E-07
NB-95	1.25E-03
MO-99	7.17E-04
TC-99M	1.77E-07
AG-110M	2.13E-06
TE-129	9.29E-07
TE-127	1.44E-06
TE-129M	5.09E-04
TE-131M	7.01E-05
TE-132	2.50E-03
I-130	2.69E-05
I-131	5.46E-02
I-132	1.08E-04
I-133	1.03E-02
I-135	5.66E-04
CS-134	5.03E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
 ----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
CS-136	2.12E+00
CS-137	4.72E+01
CE-144	2.86E-05
NP-239	2.31E-10

T.Spec	Tot Body	ADULT	TBODY	1.53E-02	31-day	6.00E-02	2.55E+01
					Quarter	1.50E+00	1.02E+00
					Annual	3.00E+00	5.10E-01

Critical Pathway.....: 1 Fresh Water Fish - Sport (FFSP)

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	6.51E-01
CR-51	2.76E-07
MN-54	2.94E-03
FE-55	2.05E-05
FE-59	1.16E-04
CO-58	3.35E-03
CO-60	1.83E-02
BR-83	2.48E-06
RB-86	7.64E-03
SR-89	3.14E-05
ZR-95	5.18E-07
NB-95	9.24E-04
MO-99	1.81E-04
TC-99M	3.14E-06
RU-103	1.25E-06
RU-106	9.31E-05
AG-110M	1.85E-06
TE-127	1.11E-06
TE-129	7.74E-07
TE-129M	2.78E-04
TE-131M	7.68E-05
TE-132	3.15E-03
I-130	1.47E-05
I-131	4.20E-02
I-132	5.20E-05
I-133	4.20E-03
I-135	2.85E-04
CS-134	5.61E+01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: 1 All Liquid Releases
Period Start Date.....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
CS-136	2.11E+00
CS-137	4.11E+01
CE-144	5.05E-06
NP-239	1.67E-10

ATTACHMENT L

RETDAS COMPUTER PROGRAM 40CFR190 (UNFILTERED) ANNUAL DOSE REPORT BYRON STATION UNIT 1 AND UNIT 2

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === ANNUAL 2017 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	2.31E-02	4.13E-02	8.18E-03	1.41E-02	4.69E-03	4.39E-03	0.00E+00	3.06E-02
TEEN	2.43E-02	4.23E-02	7.52E-03	1.43E-02	5.44E-03	3.14E-03	0.00E+00	1.76E-02
CHILD	3.02E-02	3.71E-02	9.77E-03	1.22E-02	4.42E-03	1.33E-03	0.00E+00	7.21E-03
INFANT	1.29E-04	3.94E-04	5.16E-03	2.74E-04	2.28E-04	2.19E-04	0.00E+00	2.33E-04

=== SITE DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2017 - Admin. Any Organ	TEEN	LIVER	4.23E-02	7.50E+00	5.65E-01
2017 - Admin. Total Body	ADULT	TBODY	3.06E-02	2.25E+00	1.36E+00
2017 - T.Spc. Any Organ	TEEN	LIVER	4.23E-02	1.00E+01	4.23E-01

Critical Pathway: Freshwater fish

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	3.38E-01
MN-54	1.09E-02
FE-55	6.82E-05
FE-59	2.23E-04
CO-58	1.07E-03
CO-60	5.98E-03
RB-86	1.27E-02
ZR-95	5.38E-07
NB-95	1.25E-03
MO-99	7.17E-04
TC-99M	1.77E-07
AG-110M	2.13E-06
TE-127	1.44E-06
TE-129	9.29E-07
TE-129M	5.09E-04
TE-131M	7.01E-05
TE-132	2.50E-03
I-130	2.69E-05
I-131	5.46E-02
I-132	1.08E-04
I-133	1.03E-02
I-135	5.66E-04
CS-134	5.03E+01
CS-136	2.12E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
CS-137	4.72E+01
CE-144	2.86E-05
NP-239	2.31E-10

2017 - T.Spc. Total Body ADULT TBODY 3.06E-02 3.00E+00 1.02E+00

Critical Pathway: Freshwater fish

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	6.51E-01
CR-51	2.76E-07
MN-54	2.94E-03
FE-55	2.05E-05
FE-59	1.16E-04
CO-58	3.35E-03
CO-60	1.83E-02
BR-83	2.48E-06
RB-86	7.64E-03
SR-89	3.14E-05
ZR-95	5.18E-07
NB-95	9.24E-04
MO-99	1.81E-04
TC-99M	3.14E-06
RU-103	1.25E-06
RU-106	9.31E-05
AG-110M	1.85E-06
TE-127	1.11E-06
TE-129	7.74E-07
TE-129M	2.78E-04
TE-131M	7.68E-05
TE-132	3.15E-03
I-130	1.47E-05
I-131	4.20E-02
I-132	5.20E-05
I-133	4.20E-03
I-135	2.85E-04
CS-134	5.61E+01
CS-136	2.11E+00
CS-137	4.11E+01
CE-144	5.05E-06
NP-239	1.67E-10

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2017 - Admin. Any Organ	INFANT	THYROID	1.96E+01	1.13E+01	1.75E+02
2017 - Admin. Total Body	CHILD	TBODY	5.05E-01	1.05E+01	4.81E+00

2017 - T.Spc. Any Organ	INFANT	THYROID	1.96E+01	1.50E+01	1.31E+02
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Receptor: 5 Composite Crit. Receptor - IP
 Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Grs/Cow/Milk

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	2.51E-01
C-14	8.05E-01
MN-54	7.90E-03
FE-59	5.29E-04
CO-58	7.37E-03
CO-60	1.90E-01
SR-89	8.89E-09
SR-90	0.00E+00
I-131	9.72E+01
I-133	1.34E+00
CS-134	3.96E-02
CS-137	1.66E-01

2017 - T.Spc. Total Body	CHILD	TBODY	5.05E-01	1.50E+01	3.37E+00
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Receptor: 5 Composite Crit. Receptor - IP
 Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	2.24E+01
C-14	5.15E+01
MN-54	3.49E-01
FE-59	7.51E-02
CO-58	5.02E-01
CO-60	7.89E+00
SR-89	1.97E-02
SR-90	1.21E-01
I-131	3.07E+00
I-133	6.78E-02

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
-----	-----
CS-134	4.59E+00
CS-137	9.47E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
2017 - Admin. Gamma	1.31E-01	7.50E+00	1.75E+00
2017 - Admin. Beta	1.05E-01	1.50E+01	7.02E-01
2017 - T.Spc. Gamma	1.31E-01	1.00E+01	1.31E+00

Receptor: 4 Composite Crit. Receptor - NG
Distance: 800 (meters) Compass Point: SSE

Nuclide	Percentage
AR-41	2.05E+01
KR-85	1.06E+00
XE-138	8.14E-01
KR-87	5.45E-01
KR-85M	5.42E-01
XE-135	2.54E+00
XE-133M	4.33E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133	6.23E+01

2017 - T.Spc. Beta	1.05E-01	2.00E+01	5.27E-01
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Receptor: 4 Composite Crit. Receptor - NG
Distance: 800 (meters) Compass Point: SSE

Nuclide	Percentage
AR-41	2.21E+00
KR-85	3.69E+01
XE-138	1.29E-01
KR-87	2.79E-01
KR-85M	2.66E-01
XE-135	9.98E-01
XE-133M	6.00E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133	5.68E+01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== MAXIMUM DOSE ANALYSIS === ANNUAL 2017 ===

Dose Type	Age Group	Organ	Dose (mrem)
Any Organ	INFANT	THYROID	1.97E+01
Liquid Receptor: 0		Liquid Receptor	
Gaseous Receptor: 5		Composite Crit. Receptor - IP	
Distance: 800 (meters)		Compass Point: SSE	

Liquid Dose: 5.16E-03 % of Total: 2.62E-02

Critical Pathway: Potable Water (PWtr)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	4.08E+00
CR-51	4.37E-08
MN-54	0.00E+00
FE-55	0.00E+00
FE-59	0.00E+00
CO-58	0.00E+00
CO-60	0.00E+00
BR-83	0.00E+00
RB-86	0.00E+00
SR-89	0.00E+00
ZR-95	0.00E+00
NB-95	0.00E+00
MO-99	0.00E+00
TC-99M	0.00E+00
RU-103	0.00E+00
RU-106	0.00E+00
AG-110M	0.00E+00
TE-127	8.80E-07
TE-129	5.56E-07
TE-129M	1.36E-04
TE-131M	3.12E-05
TE-132	7.23E-04
I-130	1.24E-02
I-131	8.63E+01
I-132	2.18E-02
I-133	9.32E+00
I-135	2.18E-01
CS-134	0.00E+00
CS-136	0.00E+00
CS-137	0.00E+00
CE-144	0.00E+00
NP-239	0.00E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Gaseous Dose: 1.96E+01 % of Total: 9.97E+01
 Critical Pathway: Grs/Cow/Milk (CMILK)
 Major Contributors (0% or greater to total)
 Nuclide Percentage

 H-3 2.51E-01
 C-14 8.05E-01
 MN-54 7.90E-03
 FE-59 5.29E-04
 CO-58 7.37E-03
 CO-60 1.90E-01
 SR-89 8.89E-09
 SR-90 0.00E+00
 I-131 9.72E+01
 I-133 1.34E+00
 CS-134 3.96E-02
 CS-137 1.66E-01

=== MAXIMUM DOSE ANALYSIS ===== ANNUAL 2017 =====

Dose Type	Age Group	Organ	Dose (mrem)
Total Body	CHILD	TBODY	5.12E-01

Liquid Receptor: 0 Liquid Receptor
 Gaseous Receptor: 5 Composite Crit. Receptor - IP
 Distance: 800 (meters) Compass Point: SSE

Liquid Dose: 7.21E-03 % of Total: 1.41E+00
 Critical Pathway: Fresh Water Fish - Sport (FFSP)
 Major Contributors (0% or greater to total)
 Nuclide Percentage

 H-3 3.33E+00
 CR-51 1.31E-06
 MN-54 1.35E-02
 FE-55 1.27E-04
 FE-59 5.72E-04
 CO-58 1.65E-02
 CO-60 9.07E-02
 BR-83 1.48E-05
 RB-86 4.47E-02
 SR-89 2.08E-04
 ZR-95 3.92E-06
 NB-95 4.34E-03
 MO-99 1.31E-03
 TC-99M 1.79E-05
 RU-103 7.96E-06
 RU-106 7.03E-04
 AG-110M 1.43E-05
 TE-127 6.65E-06

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
TE-129	4.53E-06
TE-129M	1.63E-03
TE-131M	4.06E-04
TE-132	1.56E-02
I-130	8.56E-05
I-131	2.05E-01
I-132	3.13E-04
I-133	2.61E-02
I-135	1.67E-03
CS-134	5.25E+01
CS-136	6.67E+00
CS-137	3.71E+01
CE-144	5.59E-05
NP-239	1.23E-09

Gaseous Dose: 5.05E-01 % of Total: 9.87E+01

Critical Pathway: Vegetation (VEG)

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	2.24E+01
C-14	5.15E+01
MN-54	3.49E-01
FE-59	7.51E-02
CO-58	5.02E-01
CO-60	7.89E+00
SR-89	1.97E-02
SR-90	1.21E-01
I-131	3.07E+00
I-133	6.78E-02
CS-134	4.59E+00
CS-137	9.47E+00

ATTACHMENT M

RETDAS COMPUTER PROGRAM 40CFR190 (FILTERED) ANNUAL DOSE REPORT

BYRON STATION UNIT 1 AND UNIT 2

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

							Liquid Receptor	
=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) ===							ANNUAL 2017	
Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	2.31E-02	4.13E-02	8.18E-03	1.41E-02	4.69E-03	4.39E-03	0.00E+00	3.06E-02
TEEN	2.43E-02	4.23E-02	7.52E-03	1.43E-02	5.44E-03	3.14E-03	0.00E+00	1.76E-02
CHILD	3.02E-02	3.71E-02	9.77E-03	1.22E-02	4.42E-03	1.33E-03	0.00E+00	7.21E-03
INFANT	1.29E-04	3.94E-04	5.16E-03	2.74E-04	2.28E-04	2.19E-04	0.00E+00	2.33E-04

=== SITE DOSE LIMIT ANALYSIS === ANNUAL 2017

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2017 - Admin. Any Organ	TEEN	LIVER	4.23E-02	7.50E+00	5.65E-01
2017 - Admin. Total Body	ADULT	TBODY	3.06E-02	2.25E+00	1.36E+00
2017 - T.Spc. Any Organ	TEEN	LIVER	4.23E-02	1.00E+01	4.23E-01

Critical Pathway: Freshwater fish

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	3.38E-01
MN-54	1.09E-02
FE-55	6.82E-05
FE-59	2.23E-04
CO-58	1.07E-03
CO-60	5.98E-03
RB-86	1.27E-02
ZR-95	5.38E-07
NB-95	1.25E-03
MO-99	7.17E-04
TC-99M	1.77E-07
AG-110M	2.13E-06
TE-127	1.44E-06
TE-129	9.29E-07
TE-129M	5.09E-04
TE-131M	7.01E-05
TE-132	2.50E-03
I-130	2.69E-05
I-131	5.46E-02
I-132	1.08E-04
I-133	1.03E-02
I-135	5.66E-04
CS-134	5.03E+01
CS-136	2.12E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
CS-137	4.72E+01
CE-144	2.86E-05
NP-239	2.31E-10

2017 - T.Spc. Total Body ADULT TBODY 3.06E-02 3.00E+00 1.02E+00

Critical Pathway: Freshwater fish

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	6.51E-01
CR-51	2.76E-07
MN-54	2.94E-03
FE-55	2.05E-05
FE-59	1.16E-04
CO-58	3.35E-03
CO-60	1.83E-02
BR-83	2.48E-06
RB-86	7.64E-03
SR-89	3.14E-05
ZR-95	5.18E-07
NB-95	9.24E-04
MO-99	1.81E-04
TC-99M	3.14E-06
RU-103	1.25E-06
RU-106	9.31E-05
AG-110M	1.85E-06
TE-127	1.11E-06
TE-129	7.74E-07
TE-129M	2.78E-04
TE-131M	7.68E-05
TE-132	3.15E-03
I-130	1.47E-05
I-131	4.20E-02
I-132	5.20E-05
I-133	4.20E-03
I-135	2.85E-04
CS-134	5.61E+01
CS-136	2.11E+00
CS-137	4.11E+01
CE-144	5.05E-06
NP-239	1.67E-10

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2017 - Admin. Any Organ	INFANT	THYROID	1.33E+01	1.13E+01	1.18E+02
2017 - Admin. Total Body	CHILD	TBODY	5.00E-01	1.05E+01	4.76E+00

2017 - T.Spc. Any Organ	INFANT	THYROID	1.33E+01	1.50E+01	8.85E+01
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Receptor: 5 Composite Crit. Receptor - IP

Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Grs/Cow/Milk

Major Contributors (0% or greater to total)

Nuclide	Percentage
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H-3	3.71E-01
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C-14	1.19E+00
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MN-54	1.17E-02
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FE-59	7.83E-04
-------	----------

CO-58	1.09E-02
-------	----------

CO-60	2.81E-01
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SR-89	1.32E-08
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SR-90	0.00E+00
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I-131	9.66E+01
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I-133	1.26E+00
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CS-134	5.86E-02
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CS-137	2.46E-01
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2017 - T.Spc. Total Body	CHILD	TBODY	5.00E-01	1.50E+01	3.33E+00
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Receptor: 5 Composite Crit. Receptor - IP

Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
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H-3	2.26E+01
-----	----------

C-14	5.20E+01
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MN-54	3.52E-01
-------	----------

FE-59	7.58E-02
-------	----------

CO-58	5.07E-01
-------	----------

CO-60	7.98E+00
-------	----------

SR-89	1.99E-02
-------	----------

SR-90	1.22E-01
-------	----------

I-131	2.08E+00
-------	----------

I-133	4.36E-02
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40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
-----	-----
CS-134	4.64E+00
CS-137	9.56E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === ANNUAL 2017 ===

Annual - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
2017 - Admin. Gamma	1.31E-01	7.50E+00	1.75E+00
2017 - Admin. Beta	1.05E-01	1.50E+01	7.02E-01

2017 - T.Spc. Gamma	1.31E-01	1.00E+01	1.31E+00
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Receptor: 4 Composite Crit. Receptor - NG
 Distance: 800 (meters) Compass Point: SSE

Nuclide	Percentage
AR-41	2.05E+01
KR-85	1.06E+00
XE-138	8.14E-01
KR-87	5.45E-01
KR-85M	5.42E-01
XE-135	2.54E+00
XE-133M	4.33E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133	6.23E+01

2017 - T.Spc. Beta	1.05E-01	2.00E+01	5.27E-01
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Receptor: 4 Composite Crit. Receptor - NG
 Distance: 800 (meters) Compass Point: SSE

Nuclide	Percentage
AR-41	2.21E+00
KR-85	3.69E+01
XE-138	1.29E-01
KR-87	2.79E-01
KR-85M	2.66E-01
XE-135	9.98E-01
XE-133M	6.00E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133	5.68E+01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Units 1 & 2

Report for: 2017

Unit Range - From: 1 To: 2

=== MAXIMUM DOSE ANALYSIS === ANNUAL 2017 ===

Dose Type	Age Group	Organ	Dose (mrem)
Any Organ	INFANT	THYROID	1.33E+01
Liquid Receptor: 0	Liquid Receptor		
Gaseous Receptor: 5	Composite Crit. Receptor - IP		
Distance: 800 (meters)	Compass Point: SSE		

Liquid Dose: 5.16E-03 % of Total: 3.88E-02

Critical Pathway: Potable Water (PWtr)

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	4.08E+00
CR-51	4.37E-08
MN-54	0.00E+00
FE-55	0.00E+00
FE-59	0.00E+00
CO-58	0.00E+00
CO-60	0.00E+00
BR-83	0.00E+00
RB-86	0.00E+00
SR-89	0.00E+00
ZR-95	0.00E+00
NB-95	0.00E+00
MO-99	0.00E+00
TC-99M	0.00E+00
RU-103	0.00E+00
RU-106	0.00E+00
AG-110M	0.00E+00
TE-127	8.80E-07
TE-129	5.56E-07
TE-129M	1.36E-04
TE-131M	3.12E-05
TE-132	7.23E-04
I-130	1.24E-02
I-131	8.63E+01
I-132	2.18E-02
I-133	9.32E+00
I-135	2.18E-01
CS-134	0.00E+00
CS-136	0.00E+00
CS-137	0.00E+00
CE-144	0.00E+00
NP-239	0.00E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Gaseous Dose: 1.33E+01 % of Total: 9.98E+01
 Critical Pathway: Grs/Cow/Milk (CMILK)
 Major Contributors (0% or greater to total)
 Nuclide Percentage

 H-3 3.71E-01
 C-14 1.19E+00
 MN-54 1.17E-02
 FE-59 7.83E-04
 CO-58 1.09E-02
 CO-60 2.81E-01
 SR-89 1.32E-08
 SR-90 0.00E+00
 I-131 9.66E+01
 I-133 1.26E+00
 CS-134 5.86E-02
 CS-137 2.46E-01

=== MAXIMUM DOSE ANALYSIS ===== ANNUAL 2017 =====

Dose Type	Age Group	Organ	Dose (mrem)
Total Body	CHILD	TBODY	5.07E-01

Liquid Receptor: 0 Liquid Receptor
 Gaseous Receptor: 5 Composite Crit. Receptor - IP
 Distance: 800 (meters) Compass Point: SSE

Liquid Dose: 7.21E-03 % of Total: 1.42E+00
 Critical Pathway: Fresh Water Fish - Sport (FFSP)
 Major Contributors (0% or greater to total)
 Nuclide Percentage

 H-3 3.33E+00
 CR-51 1.31E-06
 MN-54 1.35E-02
 FE-55 1.27E-04
 FE-59 5.72E-04
 CO-58 1.65E-02
 CO-60 9.07E-02
 BR-83 1.48E-05
 RB-86 4.47E-02
 SR-89 2.08E-04
 ZR-95 3.92E-06
 NB-95 4.34E-03
 MO-99 1.31E-03
 TC-99M 1.79E-05
 RU-103 7.96E-06
 RU-106 7.03E-04
 AG-110M 1.43E-05
 TE-127 6.65E-06

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
-----	-----
TE-129	4.53E-06
TE-129M	1.63E-03
TE-131M	4.06E-04
TE-132	1.56E-02
I-130	8.56E-05
I-131	2.05E-01
I-132	3.13E-04
I-133	2.61E-02
I-135	1.67E-03
CS-134	5.25E+01
CS-136	6.67E+00
CS-137	3.71E+01
CE-144	5.59E-05
NP-239	1.23E-09

Gaseous Dose: 5.00E-01 % of Total: 9.86E+01

Critical Pathway: Vegetation (VEG)

Major Contributors (0% or greater to total)

Nuclide	Percentage
-----	-----
H-3	2.26E+01
C-14	5.20E+01
MN-54	3.52E-01
FE-59	7.58E-02
CO-58	5.07E-01
CO-60	7.98E+00
SR-89	1.99E-02
SR-90	1.22E-01
I-131	2.08E+00
I-133	4.36E-02
CS-134	4.64E+00
CS-137	9.56E+00

ATTACHMENT O

BYRON STATION 2015 ANNUAL EFFLUENT REPORT BYRON STATION UNIT 1 AND UNIT 2

BYRON NUCLEAR POWER STATION
ANNUAL RADIOLOGICAL EFFLUENT RELEASE REPORT (ARERR)
2015

BYRON NUCLEAR POWER STATION
UNIT 1/2 DOCKET NUMBER STN-50-454/455
RADIOACTIVE EFFLUENT RELEASE REPORT
January 2015 - December 2015
Supplemental Information

1. Regulatory Limits

a. Fission and activation products:

Tech Spec Whole Body = 500 mrem/year
Skin = 3000 mrem/year

10CFR50 Gamma = 5 mrad/quarter; 10 mrad/year
Beta = 10 mrad/quarter; 20 mrad/year

b. Iodine: (summed with particulate, see below)

c. Particulates with half-lives > 8 days:

Tech Spec Organ = 1500 mrem/year
10CFR50 Organ = 7.5 mrem/quarter; 15 mrem/year

d. Liquid Effluents:

10CFR50 Whole Body = 1.5 mrem/quarter; 3 mrem/year
Organ = 5 mrem/quarter; 10 mrem/year

2. Maximum Permissible Concentration

- a. Fission and Activation Products: 10CFR20 Appendix B Table 2
- b. Iodine: 10CFR20 Appendix B Table 2
- c. Particulates: 10CFR20 Appendix B Table 2
- d. Liquid Effluents: 10 X 10CFR20 Appendix B Table 2

3. Average Energy: This item is not applicable. The ODCM limits the dose equivalent rates due to the release of noble gases to less than or equal to 500 mrem/year to the total body and less than or equal to 3000 mrem/year to the skin.

4. Measurements and Approximations of Total Radioactivity

- a. Fission and activation products: Prior to release, the isotopic content is determined. Released activity is calculated using volume of release, which is determined by the change in tank level, containment pressure, or containment purge fan flow rates.
- b. Particulate and iodine sampling media for the plant vent stacks are continuously collected and analyzed weekly. Tritium and noble gas analysis for the plant vent stacks are obtained and analyzed weekly.

- c. Liquid effluents: Isotopic analysis is performed on each batch liquid release tank prior to its release. Total release activity is calculated using volume of release. Total tritium activity released is calculated from the highest of a monthly circulating water blowdown composite activity or a sum of the effluent input composite activities.
- d. All positive results (i.e. higher than the lower limit of detection (LLD)) are reported in units of uCi/cc or uCi/ml unless otherwise noted. All LLD values and the associated LLD requirements are listed in Attachment A.

5. Batch Releases:

a. Liquid:

- 1. Number of batch releases = 79
- 2. Total time period for batch releases = 17,902 minutes
- 3. Maximum time period for a batch release = 558 minutes
- 4. Average time period for a batch release = 227 minutes
- 5. Minimum time period for a batch release = 63 minutes
- 6. Average Rock River stream flow during periods of release of effluent into a flowing stream = 168 m³/sec, based on information from the U.S. Geological Survey Byron Gauging Station.

b. Gaseous:

- 1. Number of batch releases = 370
- 2. Total time period for batch releases = 35,241 minutes
- 3. Maximum time period for a batch release = 4,923 minutes
- 4. Average time period for batch releases = 95 minutes
- 5. Minimum time period for a batch release = 5 minutes

6. Abnormal Releases:

a. Liquid - None

b. Gaseous – None

7. There was one revision to the Off Site Dose Calculation Manual (ODCM), which was implemented in February 2015. The revision included updating the reference for a revised dose analysis report regarding the Independent Spent Fuel Storage Installation (ISFSI), adding a note specifying that dosimeters are present at each air sampling location, improvements to dosimeter maps, location changes for two Special Interest dosimeters, and several administrative changes.

8. Errata

No errata data to report.

9. 2015 Radiological Groundwater Protection Program (RGPP) Results Summary:

In 2015, fifteen (15) Radiological Groundwater Protection Program (RGPP) monitoring wells were sampled in total. Groundwater samples were obtained in March, May, August, and November and analyzed for tritium. In addition, a study of gamma, gross beta, and gross alpha radioisotopes was performed in accordance with Nuclear Energy Institute (NEI) 07-07, Groundwater Protection Initiative, for the samples obtained in May. None of the May samples showed concentrations of radionuclides above what is considered background levels. Three wells contained levels of tritium above the lower limit of detection (LLD) of 200 pCi/L. They were: AR-4 (493 pCi/L in March, 723 pCi/L in May, 417

pCi/L in August, 450 pCi/L in November) and AR-11 (945 pCi/L in March, 839 pCi/L in May, 422 pCi/L in August, 1040 pCi/L in November). Wells AR-4 and AR-11 are near the Circulating Water Blowdown piping, where historical leakage through vacuum breakers was known to have occurred. Tritium concentrations in these wells have gradually decreased since being first sampled in 2006. In 2015, tritium was measured in Well AR-7, located on-site, just west plant structures, at concentrations ranging between the lower limit of detection (200 pCi/L) and 508 pCi/L. Tritium has been measured in this well just above detectable limits on an intermittent basis since the well was first drilled in 2006. The tritium present in this well is at or below tritium levels that have been measured in rainwater as a result of precipitation recapture from permitted gaseous releases and it is not believed to be the result of new leak(s). In August 2014, a break in the well piping was discovered about six feet below the surface that could have served as the entry point for tritium in the recapture water. Should the water in these aquifers migrate to off-site wells used for drinking, the off-site dose consequence from tritium present in any of these three wells would be negligible. There are no existing or new leaks evident at the site and all groundwater well sample results are well below the drinking water standard of 20,000 pCi/L tritium.

SUMMARY

Calculations based on gaseous and liquid effluents and meteorological data indicate that public dose due to radioactive material attributable to Byron Station during the period did not exceed any regulatory or Offsite Dose Calculation Manual (ODCM) limits.

The Total Effective Dose Equivalent (TEDE) due to licensed activities at Byron Station calculated for the maximum exposed individual for the period is 2.66E-01 mrem. The annual limit on TEDE is 100 mrem.

The assessment of radiation doses to the public is performed in accordance with the ODCM. The results of these analyses confirm that the station is operating in compliance with 10CFR50 Appendix I, 10CFR20 and 40CFR190.

There were no additional operational controls implemented in 2015 that affected radiological effluents.

There were no measurements which exceeded the reporting levels, including any that would not have been attributable to station effluents.

The results of the current radiological environmental monitoring program are approximately the same as those found during the pre-operational studies conducted at Byron Station.

RELEASES

Gaseous Effluents to the Atmosphere

A total of 2.12E+01 curies of fission and activation gases were released with a maximum average quarterly release rate of 2.55E+00 μ Ci/sec.

A total of 4.45E-06 curies of 1-131 were released during the year with a maximum average quarterly release rate of 3.88E-07 μ Ci/sec.

A total of 1.01E-06 curies were released as airborne particulate matter with a maximum average quarterly release rate of 1.28E-07 μ Ci/sec.

A total of 8.85E+00 curies of other (C-14) radioisotopes were released with a maximum average quarterly release rate of 3.06E-01 μ Ci/sec.

A total of $8.05\text{E}+01$ curies of tritium were released with a maximum average quarterly release rate of $3.99\text{E}+00$ $\mu\text{Ci/sec}$.

Gross alpha-emitting radionuclides were below detectable limits.

Liquids Released to Rock River

A total of $2.86\text{E}+10$ liters of radioactive liquid wastes containing $8.48\text{E}-03$ curies of fission and activation products were discharged with a maximum quarterly average concentration of $4.71\text{E}-10$ $\mu\text{Ci/ml}$.

A total of $3.32\text{E}+03$ curies of tritium were discharged with a maximum quarterly average concentration of $1.56\text{E}-04$ uCi/ml .

A total of $5.08\text{E}-04$ curies of dissolved and entrained gases were discharged with a maximum quarterly average concentration of $5.56\text{E}-11$ uCi/ml .

Gross alpha-emitting radionuclides were below detectable limits.

DOSE TO MAN

GASEOUS EFFLUENT PATHWAYS

Noble Gas - Gamma Dose Rates

Offsite Gamma air and whole body dose rates for the period were calculated based on measured release rates, isotopic composition of the noble gases, and average meteorological data. The maximum gamma air dose was $1.76\text{E}-02$ mrad based on measured effluents and average meteorological data, and $3.19\text{E}-03$ mrad based on measured effluents and concurrent meteorological data.

Noble Gas - Beta Air and Skin Dose Rates

The range of beta particles in air is relatively small (on the order of a few meters or less). Consequently, plumes of gaseous effluents may be considered "semi-infinite" for the purpose of calculating the dose from beta radiation incident on the skin. However, the actual dose to sensitive skin tissues is difficult to calculate due to the effect of the beta particle energies, thickness of inert skin, and clothing covering sensitive tissues. For purposes of this report the skin is taken to have a thickness of 7.0 mg/cm^2 and an occupancy factor of 1.0 is used. The maximum skin dose was $2.84\text{E}-04$ mrem based on measured effluents and average meteorological data, and $2.97\text{E}-03$ mrem based on measured effluents and concurrent meteorological data.

The maximum offsite beta air dose for the year based on measured effluents and average meteorological data was $8.55\text{E}-04$ mrad, and $6.29\text{E}-04$ mrad based on measured effluents and concurrent meteorological data.

Radioactive Iodine & Particulate

The human thyroid exhibits a significant capacity to concentrate ingested or inhaled iodine. I-131 released during routine operation of the station may be made available to man resulting in dose to the thyroid. C-14 is also included in this category. C-14 exhibits a capacity to concentrate in bone. C-14 is released in gaseous form and is absorbed into vegetation through photosynthesis. The principal pathways of interest for C-14 are the consumption of vegetation by humans and milk from which animals have ingested C-14 through the consumption of vegetation. With the requirement to begin

reporting C-14 dose in 2011 and the addition of C-14 to plant effluents, human dose in this category is primarily driven by the release of C-14 from the plant.

The hypothetical dose to the maximum exposed individual living near the station via ingestion of milk and vegetation was calculated. The source of milk and vegetation was assumed to be at the nearest site boundary with the cows pastured and vegetation grown from May through October. The maximum organ dose from radioactive iodine and particulate (including C-14) to any organ was 7.22E-01 mrem (child/bone) based on measured effluents and average meteorological data, and 6.95E-01 mrem (child/bone) based on measured effluents and concurrent meteorological data. The maximum dose from radioactive iodine and particulate (including C-14) to the whole body was 1.49E-01 mrem (child) based on measured effluents and average meteorological data, and 1.46E-01 mrem (child) based on measured effluents and concurrent meteorological data.

Gaseous Total Dose

The maximum total dose from gaseous releases to any organ was 7.22E-01 mrem (child/bone) based on measured effluents and average meteorological data, and 6.95E-01 mrem (child/bone) based on measured effluents and concurrent meteorological data. The maximum total dose from gaseous releases to the whole body was 1.49E-01 mrem (child) based on measured effluents and average meteorological data, and 1.46E-01 mrem (child) based on measured effluents and concurrent meteorological data.

LIQUID EFFLUENT PATHWAYS

The principal pathways through the aquatic environment for potential doses to man from liquid waste are ingestion of potable water and eating aquatic foods. Liquid dose was calculated based on the ingestion of potable water and sport fish. It should be noted, however, there are currently no communities within 10 km downstream of the plant using the Rock River for drinking water. NRC-developed equations are used to calculate the doses to the whole body, bone, liver, thyroid, kidney, lung, lower GI tract, and skin. Specific parameters for use in the equations are given in the Exelon Offsite Dose Calculation Manual (ODCM).

The maximum dose from liquid releases to any organ was 1.58E-01 mrem (adult/gilli). The maximum dose from liquid releases to the whole body was 1.40E-01 mrem (adult).

GASEOUS + LIQUID TOTAL DOSE

The maximum total dose to any organ via both gaseous and liquid effluents is 7.22E-01 mrem (child/bone). The maximum dose to the whole body via both gaseous and liquid effluents is 2.66E-01 mrem (child).

Dose Limits to Members of the Public

Byron Station did not exceed any of the dose limits as shown below based on concurrent or historical meteorological data.

- The limits on dose or dose commitment to a member of the public due to radioactive materials in liquid effluents from each reactor is 1.5 mrem to the whole body or 5 mrem to any organ during any calendar quarter and 3 mrem to the whole body or 10 mrem to any organ during a calendar year.
- The limits on air dose due to noble gases released in gaseous effluents to a member of the public from each reactor is 5 mrad for gamma radiation or 10 mrad for beta radiation during any calendar quarter and 10 mrad for gamma radiation or 20 mrad for beta radiation during a calendar year.

- The limits on dose to a member of the public due to radioactive iodine & particulate with half-lives greater than eight days in gaseous effluents released from each reactor is 7.5 mrem to any organ during any calendar quarter and 15 mrem to any organ during a calendar year.
- The annual 10CFR20 limit on Total Effective Dose Equivalent to individual members of the public is 100 mrem.
- The 40CFR190 limits on individual members of the public is 25 mrem to the whole body, 25 mrem to any organ (except thyroid), and 75 mrem to the thyroid.

SITE METEOROLOGY

Detailed records of the site meteorological measurements taken during each calendar quarter of the year are maintained by the meteorological vendor, retained on site, and are available upon request. The data are presented as cumulative joint frequency distributions of the wind direction for the 250' level and wind speed class by atmospheric stability class determined from the temperature difference between the 250' and 30' levels. Data recovery for all measurements on the meteorological tower was 99.7% during 2015.

SOLID RADIOACTIVE WASTE FOR BURIAL 1ST QUARTER 2015No Shipments in 1st Quarter 2015SOLID RADIOACTIVE WASTE FOR BURIAL 2ND QUARTER 2015

DATE Shipment # Description	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT/ CARRIER	DESTINATION	VOLUME (m ³) PER SHIPMENT	CURIES* PER SHIPMENT
4/10/15 RWS 15-003 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.44E+01	4.16E-02
4/28/15 RWS 15-001 Bead Resin	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, FISSILE EXCEPTED, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.81E+00	3.51E+00
5/19/15 RWS 15-002 Bead Resin/Charcoal	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, FISSILE EXCEPTED, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.39E+00	7.57E+00
Quarterly Totals		Number of Shipments:	3	7.36E+01	1.11E+01
* Calculated using measured ratios				CUBIC M	CURIES

SOLID RADIOACTIVE WASTE FOR BURIAL 3RD QUARTER 2015

DATE Shipment # Description	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT/ CARRIER	DESTINATION	VOLUME (m ³) PER SHIPMENT	CURIES* PER SHIPMENT
7/7/15 RWS 15-004 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.44E+01	8.33E-03
8/3/15 RWS 15-005 Bead Resin	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.39E+00	7.08E+00
8/5/15 RWS 15-006 Bead Resin	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.39E+00	3.25E+00
9/2/15 RWS 15-007 Sludge/DAW	UN2910, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7, 20' METAL BOX(2), CLASS A, NONE UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	3.94E+01	3.26E-02
9/3/15 RWS 15-008 Sludge	UN2910, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE-LIMITED QUANTITY OF MATERIAL, 7, 20' METAL BOX(8), CLASS A, NONE	Highway Hittman Transport	Gallaher Road Kingston, TN	1.61E+01	3.83E-02
9/21/15 RWS 15-009 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.44E+01	7.67E-02
9/25/15 RWS 15-010 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	3.13E+01	4.26E-02
9/25/15 RWS 15-011 Oil	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	1.10E+01	1.17E-02
9/25/15 RWS 15-012 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.26E+01	1.95E-01
Quarterly Totals		Number of Shipments:	9	2.98E+02	1.07E+01
* Calculated using measured ratios				CUBIC M	CURIES

SOLID RADIOACTIVE WASTE FOR BURIAL 4TH QUARTER 2015

DATE Shipment # Description	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT/ CARRIER	DESTINATION	VOLUME(m ³) PER SHIPMENT	CURIES* PER SHIPMENT
10/1/15 RWS 15-013 DAW	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, 20' METAL BOX(2), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Bear Creek Oak Ridge, TN	6.44E+01	2.84E-01
10/13/15 RWS 15-014 Bead Resin/Charcoal	UN3321, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, CASK(1), CLASS A, NONE	Highway Hittman Transport EXCLUSIVE-USE	Energy Solutions Clive, UT	4.53E+00	6.37E+00
Quarterly Totals		Number of Shipments:	2	6.89E+01	6.65E+00
* Calculated using measured ratios				CUBIC M	CURIES

Resins, Filters, Evap Bottoms			
2015			
Volume (m3) 2.25E+01			
Class A			
Nuclide	% Abund	Curies	uCi/ml
H-3	41.60	1.16E+01	5.16E-01
Be-7	0.03	7.35E-03	3.27E-04
C-14	0.81	2.26E-01	1.00E-02
Cr-51	0.10	2.82E-02	1.25E-03
Mn-54	1.05	2.92E-01	1.30E-02
Fe-55	3.66	1.02E+00	4.53E-02
Fe-59	0.01	2.79E-03	1.24E-04
Co-57	0.27	7.54E-02	3.35E-03
Co-58	12.73	3.54E+00	1.57E-01
Co-60	9.63	2.68E+00	1.19E-01
Ni-59	0.05	1.37E-02	6.09E-04
Ni-63	22.40	6.22E+00	2.76E-01
Zn-65	0.24	6.65E-02	2.96E-03
Sr-90	0.00	8.10E-06	3.60E-07
Zr-95	0.01	3.13E-03	1.39E-04
Nb-95	0.28	7.92E-02	3.52E-03
Mo-99	0.00	7.31E-04	3.25E-05
Tc-99	0.04	1.09E-02	4.84E-04
Ru-103	0.00	5.27E-05	2.34E-06
Ag-110m	0.00	9.75E-05	4.33E-06
Sn-113	0.01	2.62E-03	1.16E-04
Sb-124	0.00	1.19E-03	5.29E-05
Sb-125	6.39	1.78E+00	7.91E-02
Te-125m	0.07	1.83E-02	8.13E-04
Te-132	0.00	3.20E-05	1.42E-06
I-129	0.01	1.49E-03	6.62E-05
I-131	0.01	1.58E-03	7.02E-05
Cs-134	0.01	2.06E-03	9.16E-05
Cs-137	0.55	1.52E-01	6.76E-03
Ce-144	0.05	1.44E-02	6.40E-04

Dry Active Waste			
2015			
Volume (m3) 4.07E+02			
Class A			
Nuclide	% Abund	Curies	uCi/ml
H-3	11.11	8.00E-02	1.97E-04
C-14	0.03	2.14E-04	5.26E-07
Cr-51	0.19	1.36E-03	3.34E-06
Mn-54	0.85	6.11E-03	1.50E-05
Fe-55	48.44	3.49E-01	8.57E-04
Fe-59	0.01	4.24E-05	1.04E-07
Co-57	0.07	5.05E-04	1.24E-06
Co-58	2.80	2.02E-02	4.96E-05
Co-60	17.42	1.25E-01	3.07E-04
Ni-59	0.02	1.61E-04	3.96E-07
Ni-63	15.75	1.13E-01	2.78E-04
Zn-65	0.03	2.38E-04	5.85E-07
Zr-95	0.81	5.82E-03	1.43E-05
Nb-95	1.13	8.16E-03	2.00E-05
Tc-99	0.09	6.42E-04	1.58E-06
Ag-110m	0.01	5.11E-05	1.26E-07
Sn-113	0.02	1.47E-04	3.61E-07
Sb-125	1.17	8.40E-03	2.06E-05
I-129	0.00	2.23E-05	5.48E-08
Cs-137	0.04	2.85E-04	7.00E-07
Ce-144	0.01	6.37E-05	1.57E-07

Other Waste (Oil)			
2015			
Volume (m3) 1.10E+01			
Class A			
Nuclide	% Abund	Curies	uCi/ml
H-3	0.20	2.31E-05	2.10E-06
C-14	0.03	4.07E-06	3.70E-07
Mn-54	0.88	1.03E-04	9.36E-06
Fe-55	56.59	6.65E-03	6.05E-04
Co-57	0.08	9.61E-06	8.74E-07
Co-58	3.03	3.56E-04	3.24E-05
Co-60	19.01	2.23E-03	2.03E-04
Ni-63	17.22	2.02E-03	1.84E-04
Zr-95	0.58	6.85E-05	6.23E-06
Nb-95	0.93	1.10E-04	1.00E-05
Tc-99	0.10	1.16E-05	1.05E-06
Sb-125	1.28	1.51E-04	1.37E-05
I-129	0.00	3.29E-07	2.99E-08
Cs-137	0.04	5.13E-06	4.66E-07
Ce-144	0.01	9.91E-07	9.01E-08

Irradiated Components	
2015	
Volume (m3) 0.00E+00	
Class N/A	
No Shipments	

SOLID RADIOACTIVE WASTE FOR BURIAL
Estimated Solid Waste Composition
2015

Sum of All Categories			
2015			
Volume (m3) 4.41E+02			
Class A			
Nuclide	% Abund	Curies	uCi/ml
H-3	40.81	1.16E+01	2.63E-02
Be-7	0.03	7.35E-03	1.67E-05
C-14	0.79	2.27E-01	5.15E-04
Cr-51	0.10	2.95E-02	6.69E-05
Mn-54	1.04	2.98E-01	6.76E-04
Fe-55	4.81	1.37E+00	3.11E-03
Fe-59	0.01	2.83E-03	6.42E-06
Co-57	0.27	7.59E-02	1.72E-04
Co-58	12.48	3.56E+00	8.07E-03
Co-60	9.83	2.80E+00	6.35E-03
Ni-59	0.05	1.39E-02	3.15E-05
Ni-63	22.23	6.34E+00	1.44E-02
Zn-65	0.23	6.67E-02	1.51E-04
Sr-90	0.00	8.10E-06	1.84E-08
Zr-95	0.03	9.02E-03	2.05E-05
Nb-95	0.31	8.75E-02	1.98E-04
Mo-99	0.00	7.31E-04	1.66E-06
Tc-99	0.04	1.15E-02	2.61E-05
Ru-103	0.00	5.27E-05	1.20E-07
Ag-110m	0.00	1.49E-04	3.38E-07
Sn-113	0.01	2.77E-03	6.28E-06
Sb-124	0.00	1.19E-03	2.70E-06
Sb-125	6.25	1.78E+00	4.04E-03
Te-125m	0.06	1.83E-02	4.15E-05
Te-132	0.00	3.20E-05	7.26E-08
I-129	0.01	1.51E-03	3.42E-06
I-131	0.01	1.58E-03	3.58E-06
Cs-134	0.01	2.06E-03	4.67E-06
Cs-137	0.53	1.52E-01	3.45E-04
Ce-144	0.05	1.44E-02	3.27E-05

Process Control Program (PCP) for Radioactive Wastes

RW-AA-100, Process Control Program (PCP) for Radioactive Waste, Revision 11, was implemented in June, 2015. The revision incorporated the following changes:

The terms and definitions were alphabetized and some had updated definitions as follows:

2. TERMS AND DEFINITIONS

2.1. Blending: The mixing of LLRW with different concentrations of radionuclides, typically in an effort to create a relatively homogeneous mixture for disposal.

2.2. Classification Controlling Nuclides: One or more nuclides, listed in Table 1 or Table 2 of 10CFR61.55, whose concentration is the specific basis for the classification of the waste container. This could be a single nuclide or multiple nuclides that make up >50% of the sum of the fractions.

2.3. Compaction: When dry wastes such as paper, wood, plastic, cardboard, incinerator ash, and etc. are volume reduced through the use of a compactor.

2.4. Concentration Averaging: The averaging of the radionuclide concentrations for specific wastes or mixture of waste over the volume or weight of the waste.

2.5. Dewatering: The process of removing fluids from liquid waste streams to produce a waste form that meets the requirements of 10CFR Part 61 and applicable burial site criteria, <0.5% by volume when the waste is packaged to an "unstable" state, or <1% by volume when the waste is packaged to a "stable" form.

2.6. Encapsulation: Encapsulation is the surrounding of a radioactive source or component with a nonradioactive material. Encapsulation involves a radioactive core surrounded by a non-radioactive matrix.

2.7. High Integrity Container (HIC): A disposable container that is approved to the Requirements of 10CFR61. The use of HIC's is an alternative to solidification or encapsulation in a steel container to meet burial stability. HIC's are used to package dewatered liquid wastes, (e.g. filter cartridges, filter media, resin, sludges, etc), or dry active waste.

2.8. Homogeneous Waste: Waste in which concentrations of radionuclides of concern are likely to approach uniformity in the context of reasonable foreseeable intruder scenarios (This is because hot spots are a concern with respect to protection of an individual who may inadvertently intrude into the burial site).

2.9. Incineration, RVR, and/or Glass Vitrification of Liquid or Solid: Dry or wet waste processed via incineration and/or thermal processing where the volume is reduced by thermal means meets 10CFR61 requirements.

2.10. Liquid Waste Processing Systems: In-plant or vendor supplied processing systems consisting of equipment utilized for evaporation, filtration, demineralization, dewatering, compression dewatering, solidification, or reverse osmosis (RO) for the treatment of liquid wastes (such as Floor Drains, Chemical Drains and Equipment Drain inputs).

2.11. Mixable Waste: Waste that is amenable to physical mixing to create relatively uniform radionuclide concentrations.

2.12. Nuclides of Concern: A nuclide in the waste in concentrations greater than 1% of

the concentration of that nuclide listed in Table 1 of 10CFR61.55 or 1% of the applicable class-dependent concentration of that nuclide in Table 2 of 10CFR61.55, Column 2 or 3.

2.13. Process Control Program (PCP): The program which contains the current formulas, sampling, analysis, tests, and determinations to be made to ensure that processing and packaging of solid radioactive waste based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure the waste meets the stabilization criteria specified in 10CFR Parts 20, 61 and 71, state regulations, and burial site requirements.

2.14. Solidification: Liquid waste processed to either an unstable or stable form per 10CFR61 requirements. Waste solidified does not have to meet the 300-year free standing monolith criteria. Approved formulas, samples and tests do not have to meet NRC approval for wastes solidified in a container meeting stability criteria (e.g. High Integrity Container).

2.15. Solidification Media: An approved media (e.g. Barnwell - vinyl ester styrene, cement, bitumen) when waste containing nuclides with greater than 5-year half lives is solidified in a container with activity greater than 1 micro curie/cc. Waste solidified in a HIC is approved by the commission meeting the 10CFR61 stabilization criteria, including 1% free standing liquids by volume when the waste is packaged to a "stable" form and < 0.5% when waste is packaged to an "unstable" form. The formulas, sampling, analysis, and test do not require NRC approval, because the HIC meets the stability criteria.

2.15.1. Solidification to an unstable or stable state is performed by vendors, when applicable. Liquid waste solidified to meet stabilization criteria (10CFR61 and 01-91 Branch Technical Requirements) shall have documentation available that demonstrates that the process is approved by the NRC or disposal facility.

2.16. Stabilization: Liquid waste processed to a "stable state" per 10CFR61 Requirements. Established formulas, samples, and tests shall be approved by the NRC in order to meet solidification "stabilization" criteria. This processing method is currently not available, because the NRC recognizes that waste packed in a High Integrity Container meets the 300-year stabilization criteria. In the event that this processing method becomes an acceptable method, then the NRC shall approve the stabilization formulas, samples, tests, etc.

2.17. Waste Streams: Consist of but are not limited to

- Filter media (powdered, bead resin and fiber),
- Filter cartridges,
- Pre-coat body feed material,
- Contaminated charcoal,
- Fuel pool activated hardware,
- Oil Dry absorbent material added to a container to absorb liquids
- Fuel Pool Crud
- Sump and tank sludges,
- High activity filter cartridges,
- Concentrated liquids,
- Contaminated waste oil,
- Dried sewage or wastewater plant waste,
- Dry Active Waste (DAW): Waste such as filters, air filters, low activity cartridge filters, paper, wood, glass, plastic, cardboard, hoses, cloth, and metals, etc, which have become contaminated as a consequence of normal operating, housekeeping and maintenance activities.
- Other radioactive waste generated from cleanup of inadvertent contamination.

Section 4.2.13 was updated to include "NRC-2001-0022" as follows:

4.2.13. Concentration averaging may be **PERFORMED** to combine LLRW having different concentrations of radionuclides to form a homogeneous mixture in accordance with the guidance in the NRC's Branch Technical Position on Concentration Averaging and Encapsulation-1995, NRC-2011-0022:

- For homogeneous waste types such as resins...

The References in Section 6 were edited to include a portion for UFSAR and there was a reformatting of the Writers' References and Users' References as follows:

6.3. UFSAR

- 6.3.1. Braidwood UFSAR, Section 11.4, Solid Waste Management System
- 6.3.2. Byron UFSAR Section 11.4, Solid Waste Management System
- 6.3.3. Calvert Cliffs UFSAR Section 11.1.2.3 Solid Waste Processing System
- 6.3.4. Clinton USAR Table 11.4, Solid Waste Management System
- 6.3.5. Dresden UFSAR Section 11.4, Waste Management System
- 6.3.6. Ft. Calhoun USAR Section 11-03, Radiological Effluent Requirements
- 6.3.7. Ginna UFSAR Section 11.4, Solid Waste Management System
- 6.3.8. LaSalle UFSAR Section 11.4.2.7 Storage areas, Table 12.3.6- IRSF Storage Area
- 6.3.9. Limerick UFSAR Section 11.4, Solid Waste Management
- 6.3.10. Nine Mile Point Unit 1 UFSAR Section 2.3 Solid Waste System
- 6.3.11. Nine Mile Point Unit 2 UFSAR Section 11.4, Solid Waste Management System
- 6.3.12. Oyster Creek UFSAR Section 11.4, Solid Waste Management System
- 6.3.13. Peach Bottom UFSAR Section 9.0, Radioactive Waste Systems
- 6.3.14. Quad Cities UFSAR Section 11.4.4.5, Interim Radwaste Storage Facility
- 6.3.15. Three Mile Island UFSAR Section 11.2, Radioactive Waste Disposal Systems Summary

6.4. Writers' References:

- Amendment No. 202 to Facility Operating License No. NPF-11 and Amendment No. 189 to Facility Operating License (FOL) No. NPF-18 for the LaSalle County Station (LSCS), Units 1 and 2
- Code of Federal Regulations: 10 CFR Part 20, Part 61, Part 71, 49 CFR Parts 171-172
- I.E. Circular 80.18, 10CFR 50.59 Safety Evaluation for Changes to Radioactive Waste Treatment Systems
- Low Level Waste Licensing Branch Technical Position on Radioactive Waste Classification, May 1983
- NRC Branch Technical Position on Blending of Low-Level Radioactive Waste, SECY-10-0043
- NRC Concentration Averaging and Encapsulation Branch Technical Position, NRC-2011-0022
- Regulatory Guide 1.21, Measuring Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants
- Technical Position on Waste Form (Revision 1), January 1991

6.5. Users' References:

- CY-AA-170-2000, Annual Radioactive Effluent Release Report
- LS-AA-106, Plant Operations Review Committee
- Quality Assurance Program (QATR)
- RM-AA-101, Records Management Program
- RM-AA-102-1006, Processing Vendor Documents
- RP-AA-600 Series, Radioactive Material/Waste Shipments

Error Analysis

The following is an estimate of the errors associated with effluent monitoring and analysis. The estimate is calculated using the square root of the sum of the squares methodology.

1. Gaseous Effluents

Qme=3.33%
RM=N/A
ECe=5%
Stdce/Smpcse=5%
qme=N/A

Total error = 7.8%

2. Liquid Effluents

Qme=3.33%
RM=N/A
ECe=N/A
Stdce/Smpcse=5%
qme=2.22%

Total error = 6.4%

3. Waste Resin

Qme=10.0%
RM=N/A
ECe=5%
Stdce/Smpcse=5%
qme=1.0%

Total error = 12.3%

4. DAW, Mechanical Filters, and Contaminated Metal

Qme=10.0%
RM=N/A
ECe=N/A
Stdce/Smpcse=5%
qme=N/A

Instrument calibration error = 10%

Total error = 11.2%

Qme = the process quantity measurement error associated with the release point (e.g. flow, level measurements)

RM = error associated with the radiation monitor used in quantifying releases through the release point

ECe = error associated with the collection efficiency of the sample media

Stdce = one-sigma counting error associated with the counting instrument of interest

Smpcse = one-sigma counting error associated with a sample of a given geometry that is used for the release point of interest

qme = sample quantity measurement error associated with the sample of interest

Miscellaneous Information

- A. As required by Technical Specification 5.6.2, meteorological and environmental impact information is reported in the 2015 Annual Radiological Environmental Operating Report (AREOR) or is retained on file to be provided upon request.
- B. No limits were exceeded during the 2015 reporting period in liquid hold up tanks or waste gas decay tanks as stated in Technical Specification 5.5.12.
- C. There were no irradiated fuel shipments during the 2015 reporting period. An Independent Spent Fuel Storage Installation (ISFSI) campaign began in 2010 when used fuel was removed from the Spent Fuel Pool (SFP), placed into six (6) casks, each containing 32 fuel bundles, and transferred to an outdoor storage pad. No additional casks were placed on the pad in 2011. In 2012, eight (8) additional casks were placed on the pad for a total of fourteen (14) casks. No additional casks were placed on the pad in 2013 or 2014. In 2015, six (6) additional casks were placed on the pad for a total of twenty (20) casks. Prior to the ISFSI campaign, additional dosimeters were placed at the site boundary nearest to the storage pad (in between the pad and the nearest resident) for the purpose of measuring any potential offsite dose to the public from the storage pad. Since the dosimeters were placed, data from the dosimeters, when compared to the existing environmental dosimeters in the surrounding area, have shown no statistical difference. As a result, there is currently no offsite dose contribution from the ISFSI facility or any other on-site storage facility, including the Dry Active Waste (DAW) Building and the Old Steam Generator (OSG) Storage Building, as evidenced by dosimetry data that is indistinguishable from the existing environmental dosimeters.
- D. There were no REMP sample results that exceeded any technical specification limits or analytical results investigation levels during the 2015 reporting period. REMP composite surface water samples from point BY-12, Rock River downstream of the plant liquid effluent discharge, detected tritium results of 490 pCi/L in the second quarter and 748 pCi/L in the third quarter, against a lower detection limit of 200 pCi/L. The positive sample results can be attributed to one or more weekly samples being obtained shortly after permitted liquid discharges, and are not unexpected. The results are well below the Technical Requirements Manual (TRM) reportable limit of 30,000 pCi/L. There are no communities using the Rock River for drinking water within 10 km downstream of the station. No radionuclides that were a result of plant effluents were detected in any of the other REMP samples.
- E. There were no elevated releases during the 2015 reporting period. All planned gaseous releases were discharged by way of the plant vent stacks and are considered to be mixed mode releases.
- F. There was one liquid effluent flow loop that exceeded its inoperability time limit as stated in TRM TLCO 3.11.b. On 4/3/15 01:53, 0WX001, Liquid Radwaste Release High Flow Loop, entered 0BOL 11.a due to calibration procedure 0BISR 11.a.3-005. The procedure requires a channel check for operability following completion of the calibration. The channel check requires process flow through the loop and could not be completed within the required 30-day time frame because there were no liquid releases performed during this time utilizing the high flow loop. The flow loop (high/low) to be utilized during liquid releases is contingent upon the radioactivity (i.e. tritium) concentration present in the release tank. The condition was exited on 5/8/15 13:21, when a liquid release was able to be performed utilizing the high flow loop.
- G. There were no unplanned gaseous or liquid releases to unrestricted areas during the 2015 reporting period.
- H. All Rock River flow measurements during liquid effluent discharges were obtained from the U.S. Geological Survey Byron Gauging Station for the Rock River with the following exceptions. Due to icing

conditions near the Byron gauging station, flows were obtained from the Rockton flow gauge, located on the Rock River approximately 30 miles upstream of the Byron flow gauge, during the liquid effluent releases on 1/21/15 and 1/30/15. Due to icing conditions near the Byron and Rockton gauging stations, the Rock River flow measurement during the liquid effluent release on 1/9/15 was obtained from the Dixon flow gauge, located approximately 32 miles downstream of the Byron flow gauge.

- I. Attached are offsite dose calculation reports for January through December of 2015.

The following are the maximum annual calculated cumulative offsite doses resulting from Byron airborne releases in 2015 based on concurrent meteorological data:

Unit 1:

<u>Dose</u>	<u>Maximum Value</u>	<u>Sector Affected</u>
gamma air ⁽¹⁾	3.19 x10 ⁻³ mrad	North-Northwest
beta air ⁽²⁾	6.24 x10 ⁻⁴ mrad	North-Northwest
whole body ⁽³⁾	7.02 x10 ⁻² mrem	North-Northwest
skin ⁽⁴⁾	2.97 x10 ⁻³ mrem	North-Northwest
organ ⁽⁵⁾ (child-bone)	3.34 x10 ⁻¹ mrem	North-Northwest

Unit 1 Compliance Status

10 CFR 50 Appendix I	Yearly Objective	% of Appendix I
gamma air	10.0 mrad	0.03
beta air	20.0 mrad	0.00
whole body	5.0 mrem	1.40
skin	15.0 mrem	0.02
organ	15.0 mrem	2.23

Unit 2:

<u>Dose</u>	<u>Maximum Value</u>	<u>Sector Affected</u>
gamma air ⁽¹⁾	2.71 x10 ⁻⁶ mrad	North-Northwest
beta air ⁽²⁾	4.94 x10 ⁻⁶ mrad	North-Northwest
whole body ⁽³⁾	7.54 x10 ⁻² mrem	North-Northwest
skin ⁽⁴⁾	3.78 x10 ⁻⁶ mrem	North-Northwest
organ ⁽⁵⁾ (child-bone)	3.61 x10 ⁻¹ mrem	North-Northwest

Unit 2 Compliance Status

10 CFR 50 Appendix I	Yearly Objective	% of Appendix I
gamma air	10.0 mrad	0.00
beta air	20.0 mrad	0.00
whole body	5.0 mrem	1.51
skin	15.0 mrem	0.00
organ	15.0 mrem	2.41

-
- (1) Gamma Air Dose - GASPAR II, NUREG-0597
 (2) Beta Air Dose - GASPAR II, NUREG-0597
 (3) Whole Body Dose - GASPAR II, NUREG-0597
 (4) Skin Dose - GASPAR II, NUREG-0597
 (5) Inhalation and Food Pathways Dose - GASPAR II, NUREG-0597

Data recovery: 99.7%

Attachment A, 2015 Radioactive Effluent Release Report
2015 Lower Limits of Detection (LLD's)

Nuclide	Gaseous LLD (uCi/cc)	Required Gaseous LLD (uCi/cc)	Nuclide	Liquid LLD (uCi/ml)	Required Liquid LLD (uCi/cc)
H3	4.52E-08	1.00E-07	H3	1.81E-06	1.00E-05
Ar41	5.72E-07		Na24	3.27E-08	
Cr51	2.99E-12		Cr51	2.65E-07	
Mn54	5.86E-13	1.00E-11	Mn54	4.29E-08	5.00E-07
Co58	7.39E-13	1.00E-11	Fe55	7.13E-07	1.00E-06
Fe59	1.66E-12	1.00E-11	Co57	2.68E-08	
Co60	1.19E-12	1.00E-11	Co58	3.68E-08	5.00E-07
Ni63	5.39E-15		Fe59	9.29E-08	5.00E-07
Zn65	1.36E-12	1.00E-11	Co60	6.94E-08	5.00E-07
Br82	6.63E-13		Ni63	4.24E-07	
Kr85m	2.25E-07		Zn65	9.78E-08	5.00E-07
Kr87	3.33E-07	1.00E-04	Sr85	3.80E-08	
Kr88	5.91E-07	1.00E-04	Kr85m	3.07E-08	1.00E-05
Sr89	1.83E-14	1.00E-11	Kr87	7.50E-08	1.00E-05
Sr90	2.28E-15	1.00E-11	Kr88	9.12E-08	1.00E-05
Mo99	2.41E-13	1.00E-11	Sr89	3.40E-08	5.00E-08
I131	7.17E-13	1.00E-12	Sr90	8.59E-09	5.00E-08
Xe131m	8.10E-06		Sr92	7.57E-08	
I133	9.87E-13	1.00E-10	Nb95	4.20E-08	
Xe133	3.33E-07	1.00E-04	Zr95	8.31E-08	
Xe133m	1.91E-06	1.00E-04	Mo99	2.25E-08	5.00E-07
Cs134	6.61E-13	1.00E-11	Ag110m	5.10E-08	
I135	4.65E-12		Sb122	6.16E-08	
Xe135	1.91E-07	1.00E-04	Te123m	2.52E-08	
Cs137	5.53E-13	1.00E-11	Sb124	8.48E-08	
Xe138	8.70E-07	1.00E-04	Sb125	1.12E-07	
Ba140	1.75E-12		Te125m	7.26E-06	
La140	7.83E-13		Sb126	4.23E-08	
Ce141	4.40E-13	1.00E-11	Xe131m	1.03E-06	1.00E-05
Ce144	1.86E-12	1.00E-11	I131	3.18E-08	1.00E-06
Gross Alpha	2.84E-15	1.00E-11	I132	4.62E-08	
			Te132	2.31E-08	
			I133	3.75E-08	
			Xe133	6.42E-08	1.00E-05
			Xe133m	2.44E-07	1.00E-05
			Cs134	5.23E-08	5.00E-07
			Xe135	3.07E-08	1.00E-05
			Cs137	4.84E-08	5.00E-07
			Xe138	2.12E-07	1.00E-05
			Ba140	1.33E-07	
			La140	4.03E-08	
			Ce141	4.07E-08	5.00E-07
			Ce144	1.72E-07	5.00E-06
			Gross Alpha	6.40E-08	1.00E-07
			Gross Beta	1.72E-07	

EFFLUENT AND WASTE DISPOSAL REPORT
SUPPLEMENTAL INFORMATION
GASEOUS EFFLUENTS - BATCH MODE
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		50	55	57	56	218
Total release time	minutes	2.61E+03	3.59E+03	1.58E+04	6.43E+03	2.85E+04
Maximum release time	minutes	2.17E+02	5.25E+02	4.92E+03	1.09E+03	4.92E+03
Average release time	minutes	5.23E+01	6.53E+01	2.78E+02	1.15E+02	1.31E+02
Minimum release time	minutes	5.00E+00	2.50E+01	3.80E+01	3.50E+01	5.00E+00

Note: Waste Gas Decay Tank releases are included with Unit 1 data

EFFLUENT AND WASTE DISPOSAL REPORT
SUPPLEMENTAL INFORMATION
GASEOUS EFFLUENTS - BATCH MODE
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		37	41	40	34	152
Total release time	minutes	1.45E+03	1.66E+03	1.77E+03	1.90E+03	6.77E+03
Maximum release time	minutes	6.20E+01	5.80E+01	7.50E+01	8.40E+01	8.40E+01
Average release time	minutes	3.92E+01	4.04E+01	4.41E+01	5.59E+01	4.46E+01
Minimum release time	minutes	1.00E+01	1.40E+01	1.50E+01	3.10E+01	1.00E+01

EFFLUENT AND WASTE DISPOSAL REPORT
SUPPLEMENTAL INFORMATION
LIQUID EFFLUENTS - BATCH MODE
Unit 1 & Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		11	14	32	22	79
Total release time	minutes	2.51E+03	4.48E+03	5.66E+03	5.26E+03	1.79E+04
Maximum release time	minutes	5.58E+02	5.30E+02	4.43E+02	4.29E+02	5.58E+02
Average release time	minutes	2.28E+02	3.20E+02	1.77E+02	2.39E+02	2.27E+02
Minimum release time	minutes	6.60E+01	1.78E+02	6.30E+01	7.60E+01	6.30E+01
Average dilution flow	gpm	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Note: Liquid Releases are divided evenly between units

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT

TABLE 1A

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
1. Total Release	Ci	4.97E-01	1.46E-01	1.10E-01	2.01E+01	2.08E+01
2. Avg. Release Rate	uCi/sec	6.39E-02	1.86E-02	1.38E-02	2.53E+00	6.60E-01
Iodine-131						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)
Others						
1. Total Release	Ci	1.12E+00	1.11E+00	9.79E-01	1.04E+00	4.24E+00
2. Avg. Release Rate	uCi/sec	1.44E-01	1.41E-01	1.23E-01	1.31E-01	1.35E-01
Tritium						
1. Total Release	Ci	1.38E+01	8.01E+00	1.49E+00	4.00E+00	2.73E+01
2. Avg. Release Rate	uCi/sec	1.77E+00	1.02E+00	1.87E-01	5.03E-01	8.64E-01
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1C
GASEOUS EFFLUENTS - MIXED MODE RELEASES - CONTINUOUS MODE
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
KR-88	Ci	(1)	(1)	(1)	1.99E+01	1.99E+01
XE-133	Ci	4.85E-01	1.22E-01	5.59E-02	1.34E-01	7.97E-01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	4.85E-01	1.22E-01	5.59E-02	2.01E+01	2.07E+01
Iodines						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Others						
C-14	Ci	1.12E+00	1.11E+00	9.79E-01	1.04E+00	4.24E+00
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.12E+00	1.11E+00	9.79E-01	1.04E+00	4.24E+00
Tritium						
H-3	Ci	1.36E+01	7.91E+00	1.26E+00	3.97E+00	2.68E+01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.36E+01	7.91E+00	1.26E+00	3.97E+00	2.68E+01
Gross Alpha Radioactivity						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1C
GASEOUS EFFLUENTS - MIXED MODE RELEASES - BATCH MODE
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
AR-41	Ci	8.58E-03	1.96E-02	1.91E-02	2.53E-03	4.99E-02
KR-85M	Ci	(1)	(1)	2.23E-05	1.59E-06	2.39E-05
XE-133	Ci	2.92E-03	4.13E-03	3.31E-02	2.54E-03	4.27E-02
XE-133M	Ci	(1)	(1)	1.80E-04	7.92E-06	1.88E-04
XE-135	Ci	3.91E-04	(1)	1.39E-03	3.28E-05	1.81E-03
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.19E-02	2.37E-02	5.38E-02	5.11E-03	9.46E-02
Iodines						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Others						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Tritium						
H-3	Ci	1.19E-01	9.96E-02	2.31E-01	3.00E-02	4.79E-01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.19E-01	9.96E-02	2.31E-01	3.00E-02	4.79E-01
Gross Alpha Radioactivity						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1A
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
1. Total Release	Ci	7.09E-02	1.26E-01	7.20E-02	1.42E-01	4.12E-01
2. Avg. Release Rate	uCi/sec	9.12E-03	1.61E-02	9.06E-03	1.79E-02	1.31E-02
Iodine-131						
1. Total Release	Ci	7.01E-07	(1)	3.08E-06	6.64E-07	4.45E-06
2. Avg. Release Rate	uCi/sec	9.01E-08	(1)	3.88E-07	8.36E-08	1.41E-07
Particulates Half Life >= 8 days						
1. Total Release	Ci	(1)	(1)	(1)	1.01E-06	1.01E-06
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	1.28E-07	3.21E-08
Others						
1. Total Release	Ci	1.26E+00	1.10E+00	1.20E+00	1.05E+00	4.61E+00
2. Avg. Release Rate	uCi/sec	1.62E-01	1.40E-01	1.51E-01	1.33E-01	1.46E-01
Tritium						
1. Total Release	Ci	1.72E+01	1.71E+01	1.05E+01	8.35E+00	5.32E+01
2. Avg. Release Rate	uCi/sec	2.22E+00	2.17E+00	1.32E+00	1.05E+00	1.69E+00
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1C
GASEOUS EFFLUENTS - MIXED MODE RELEASES - CONTINUOUS MODE
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
XE-133	Ci	6.92E-02	1.22E-01	5.59E-02	1.34E-01	3.81E-01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	6.92E-02	1.22E-01	5.59E-02	1.34E-01	3.81E-01
		-----	-----	-----	-----	-----
Iodines						
I-131	Ci	7.01E-07	(1)	3.08E-06	6.64E-07	4.45E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	7.01E-07	(1)	3.08E-06	6.64E-07	4.45E-06
		-----	-----	-----	-----	-----
Particulates Half Life >= 8 days						
CR-51	Ci	(1)	(1)	(1)	1.01E-06	1.01E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	1.01E-06	1.01E-06
		-----	-----	-----	-----	-----
Others						
C-14	Ci	1.26E+00	1.10E+00	1.20E+00	1.05E+00	4.61E+00
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.26E+00	1.10E+00	1.20E+00	1.05E+00	4.61E+00
		-----	-----	-----	-----	-----
Tritium						
H-3	Ci	1.72E+01	1.70E+01	1.04E+01	8.28E+00	5.30E+01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.72E+01	1.70E+01	1.04E+01	8.28E+00	5.30E+01
		-----	-----	-----	-----	-----
Gross Alpha Radioactivity						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 1C
GASEOUS EFFLUENTS - MIXED MODE RELEASES - BATCH MODE
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Gases						
AR-41	Ci	1.68E-03	3.55E-03	2.54E-03	4.35E-03	1.21E-02
KR-85M	Ci	(1)	(1)	2.22E-05	1.60E-06	2.38E-05
XE-133M	Ci	(1)	(1)	1.80E-04	7.88E-06	1.88E-04
XE-133	Ci	2.71E-05	7.40E-04	1.20E-02	4.08E-03	1.68E-02
XE-135	Ci	(1)	(1)	1.38E-03	3.29E-05	1.41E-03

Totals for Period...	Ci	1.71E-03	4.29E-03	1.61E-02	8.47E-03	3.05E-02

Iodines						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Particulates Half Life >= 8 days						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Others						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)
Tritium						
H-3	Ci	3.56E-02	4.82E-02	5.94E-02	6.49E-02	2.08E-01

Totals for Period...	Ci	3.56E-02	4.82E-02	5.94E-02	6.49E-02	2.08E-01

Gross Alpha Radioactivity						
** No Nuclide Activities **		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2A
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	9.90E-04	7.13E-04	1.63E-03	1.33E-03	4.24E-03
2. Avg. Diluted Conc.	uCi/ml	2.89E-10	1.93E-10	4.71E-10	3.56E-10	2.96E-10
Tritium						
1. Total Release	Ci	2.47E+02	3.80E+02	4.48E+02	5.81E+02	1.66E+03
2. Avg. Diluted Conc.	uCi/ml	7.21E-05	1.03E-04	1.29E-04	1.56E-04	1.16E-04
Dissolved and Entrained Gases						
1. Total Release	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
2. Avg. Diluted Conc.	uCi/ml	1.51E-11	2.52E-12	5.56E-11	(1)	1.77E-11
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters		3.42E+09	3.70E+09	3.47E+09	3.73E+09	1.43E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2A - Release Tank
LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	9.90E-04	7.13E-04	1.63E-03	1.33E-03	4.24E-03
2. Avg. Diluted Conc.	uCi/ml	2.13E-06	1.17E-06	1.22E-06	1.40E-06	1.26E-06
Tritium						
1. Total Release	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
2. Avg. Diluted Conc.	uCi/ml	4.36E-01	5.91E-01	3.08E-01	4.41E-01	4.15E-01
Dissolved and Entrained Gases						
1. Total Release	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
2. Avg. Diluted Conc.	uCi/ml	1.11E-07	1.53E-08	1.44E-07	(1)	7.56E-08
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters		4.66E+05	6.09E+05	1.34E+06	9.46E+05	3.36E+06

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2A - Circulating Water Blowdown
LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Tritium						
1. Total Release	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
2. Avg. Diluted Conc.	uCi/ml	1.28E-05	5.22E-06	1.03E-05	4.39E-05	1.83E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters		3.42E+09	3.70E+09	3.47E+09	3.73E+09	1.43E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2B
LIQUID EFFLUENTS - CONTINUOUS MODE
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
Tritium						
H-3	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
		-----	-----	-----	-----	-----
Totals for Period...	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
Dissolved and Entrained Gases						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2B
LIQUID EFFLUENTS - BATCH MODE
Unit 1

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
CO-57	Ci	3.23E-06	4.19E-06	4.93E-06	1.60E-06	1.40E-05
CO-58	Ci	7.03E-04	4.73E-04	5.97E-04	9.86E-04	2.76E-03
CO-60	Ci	2.52E-04	1.49E-04	4.64E-04	2.24E-04	1.09E-03
CR-51	Ci	(1)	(1)	1.92E-04	(1)	1.92E-04
FE-59	Ci	4.47E-06	(1)	(1)	(1)	4.47E-06
I-132	Ci	(1)	(1)	1.95E-05	(1)	1.95E-05
I-133	Ci	(1)	1.93E-06	(1)	(1)	1.93E-06
MN-54	Ci	(1)	3.94E-06	(1)	(1)	3.94E-06
NB-95	Ci	3.08E-06	(1)	1.11E-05	(1)	1.42E-05
SB-122	Ci	(1)	(1)	5.08E-06	(1)	5.08E-06
SB-124	Ci	(1)	(1)	2.48E-05	2.14E-06	2.69E-05
SB-125	Ci	2.21E-05	5.52E-06	4.36E-05	(1)	7.12E-05
TE-123M	Ci	2.28E-06	(1)	1.82E-05	(1)	2.05E-05
TE-132	Ci	(1)	(1)	1.32E-05	(1)	1.32E-05
ZR-95	Ci	(1)	(1)	5.34E-06	(1)	5.34E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	9.90E-04	6.37E-04	1.40E-03	1.21E-03	4.24E-03
		-----	-----	-----	-----	-----
Tritium						
H-3	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
		-----	-----	-----	-----	-----
Totals for Period...	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
		-----	-----	-----	-----	-----
Dissolved and Entrained Gases						
XE-133	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
		-----	-----	-----	-----	-----
Totals for Period...	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
		-----	-----	-----	-----	-----
Gross Alpha Radioactivity						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2A
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Products						
1. Total Release	Ci	9.90E-04	7.13E-04	1.63E-03	1.33E-03	4.24E-03
2. Avg. Diluted Conc.	uCi/ml	2.89E-10	1.93E-10	4.71E-10	3.56E-10	2.96E-10
Tritium						
1. Total Release	Ci	2.47E+02	3.80E+02	4.48E+02	5.81E+02	1.66E+03
2. Avg. Diluted Conc.	uCi/ml	7.21E-05	1.03E-04	1.29E-04	1.56E-04	1.16E-04
Dissolved and Entrained Gases						
1. Total Release	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
2. Avg. Diluted Conc.	uCi/ml	1.51E-11	2.52E-12	5.56E-11	(1)	1.77E-11
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters						
		3.42E+09	3.70E+09	3.47E+09	3.73E+09	1.43E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2A - Release Tank
LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
1. Total Release	Ci	9.90E-04	7.13E-04	1.63E-03	1.33E-03	4.24E-03
2. Avg. Diluted Conc.	uCi/ml	2.13E-06	1.17E-06	1.22E-06	1.40E-06	1.26E-06
Tritium						
1. Total Release	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03
2. Avg. Diluted Conc.	uCi/ml	4.36E-01	5.91E-01	3.08E-01	4.41E-01	4.15E-01
Dissolved and Entrained Gases						
1. Total Release	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04
2. Avg. Diluted Conc.	uCi/ml	1.11E-07	1.53E-08	1.44E-07	(1)	7.56E-08
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters		4.66E+05	6.09E+05	1.34E+06	9.46E+05	3.36E+06

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2A - Circulating Water Blowdown
LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Products						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Tritium						
1. Total Release	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
2. Avg. Diluted Conc.	uCi/ml	1.28E-05	5.22E-06	1.03E-05	4.39E-05	1.83E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters						
		3.42E+09	3.70E+09	3.47E+09	3.73E+09	1.43E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2B
LIQUID EFFLUENTS - CONTINUOUS MODE
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
Tritium						
H-3	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
		-----	-----	-----	-----	-----
Totals for Period...	Ci	4.39E+01	1.93E+01	3.58E+01	1.64E+02	2.63E+02
Dissolved and Entrained Gases						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

RG 1.21 EFFLUENT AND WASTE DISPOSAL REPORT
TABLE 2B
LIQUID EFFLUENTS - BATCH MODE
Unit 2

REPORT FOR 2015	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Products						
CO-57	Ci	3.23E-06	4.19E-06	4.93E-06	1.60E-06	1.40E-05
CO-58	Ci	7.03E-04	4.73E-04	5.97E-04	9.86E-04	2.76E-03
CO-60	Ci	2.52E-04	1.49E-04	4.64E-04	2.24E-04	1.09E-03
CR-51	Ci	(1)	(1)	1.92E-04	(1)	1.92E-04
FE-59	Ci	4.47E-06	(1)	(1)	(1)	4.47E-06
I-132	Ci	(1)	(1)	1.95E-05	(1)	1.95E-05
I-133	Ci	(1)	1.93E-06	(1)	(1)	1.93E-06
MN-54	Ci	(1)	3.94E-06	(1)	(1)	3.94E-06
NB-95	Ci	3.08E-06	(1)	1.11E-05	(1)	1.42E-05
SB-122	Ci	(1)	(1)	5.08E-06	(1)	5.08E-06
SB-124	Ci	(1)	(1)	2.48E-05	2.14E-06	2.69E-05
SB-125	Ci	2.21E-05	5.52E-06	4.36E-05	(1)	7.12E-05
TE-123M	Ci	2.28E-06	(1)	1.82E-05	(1)	2.05E-05
TE-132	Ci	(1)	(1)	1.32E-05	(1)	1.32E-05
ZR-95	Ci	(1)	(1)	5.34E-06	(1)	5.34E-06

Totals for Period...	Ci	9.90E-04	6.37E-04	1.40E-03	1.21E-03	4.24E-03

Tritium						
H-3	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03

Totals for Period...	Ci	2.03E+02	3.60E+02	4.13E+02	4.17E+02	1.39E+03

Dissolved and Entrained Gases						
XE-133	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04

Totals for Period...	Ci	5.16E-05	9.32E-06	1.93E-04	(1)	2.54E-04

Gross Alpha Radioactivity						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)

Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 1 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	6.22E-06	3.69E-02	3.68E-02	3.68E-02	3.68E-02	4.40E-02	0.00E+00	3.71E-02
TEEN	6.38E-06	2.77E-02	2.76E-02	2.76E-02	2.76E-02	3.27E-02	0.00E+00	2.79E-02
CHILD	7.77E-06	3.09E-02	3.08E-02	3.08E-02	3.08E-02	3.26E-02	0.00E+00	3.11E-02
INFANT	1.56E-07	1.36E-02	1.36E-02	1.36E-02	1.36E-02	1.37E-02	0.00E+00	1.37E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 1 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 1 - Admin. Any Organ	ADULT	GILLI	4.40E-02	3.75E+00	1.17E+00
Qtr 1 - Admin. Total Body	ADULT	TBODY	3.71E-02	1.13E+00	3.30E+00

Qtr 1 - T.Spc. Any Organ ADULT GILLI 4.40E-02 5.00E+00 8.81E-01

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	8.35E+01
FE-59	8.37E-02
CO-58	2.93E+00
CO-60	2.80E+00
NB-95	1.07E+01
SB-125	3.23E-03

Qtr 1 - T.Spc. Total Body ADULT TBODY 3.71E-02 1.50E+00 2.47E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	9.92E+01
FE-59	1.14E-02
CO-58	3.86E-01
CO-60	3.90E-01
NB-95	1.12E-03
SB-125	8.28E-05

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 2 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	4.24E-04	3.47E-02	3.47E-02	3.47E-02	3.47E-02	3.56E-02	0.00E+00	3.48E-02
TEEN	3.88E-04	2.61E-02	2.60E-02	2.60E-02	2.60E-02	2.66E-02	0.00E+00	2.61E-02
CHILD	4.38E-04	2.90E-02	2.90E-02	2.90E-02	2.90E-02	2.92E-02	0.00E+00	2.91E-02
INFANT	7.65E-06	1.28E-02	1.28E-02	1.28E-02	1.28E-02	1.28E-02	0.00E+00	1.28E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 2 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 2 - Admin. Any Organ	ADULT	GILLI	3.56E-02	3.75E+00	9.48E-01
Qtr 2 - Admin. Total Body	ADULT	TBODY	3.48E-02	1.13E+00	3.09E+00

Qtr 2 - T.Spc. Any Organ ADULT GILLI 3.56E-02 5.00E+00 7.11E-01

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	9.75E+01
MN-54	7.98E-02
FE-55	2.86E-02
CO-58	1.30E+00
CO-60	1.09E+00
SR-89	1.28E-02
SR-90	2.62E-02
SB-125	5.30E-04
I-133	2.38E-04

Qtr 2 - T.Spc. Total Body ADULT TBODY 3.48E-02 1.50E+00 2.32E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	9.97E+01
MN-54	5.08E-03
FE-55	1.19E-02
CO-58	1.47E-01
CO-60	1.31E-01
SR-89	2.34E-03
SR-90	2.14E-02
SB-125	1.17E-05
I-133	8.25E-05

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 3 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	1.15E-03	3.43E-02	3.41E-02	3.42E-02	3.41E-02	4.40E-02	0.00E+00	3.43E-02
TEEN	1.06E-03	2.57E-02	2.56E-02	2.57E-02	2.56E-02	3.25E-02	0.00E+00	2.58E-02
CHILD	1.19E-03	2.87E-02	2.86E-02	2.86E-02	2.86E-02	3.10E-02	0.00E+00	2.88E-02
INFANT	2.07E-05	1.27E-02	1.27E-02	1.27E-02	1.27E-02	1.27E-02	0.00E+00	1.27E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 3 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 3 - Admin. Any Organ	ADULT	GILLI	4.40E-02	3.75E+00	1.17E+00
Qtr 3 - Admin. Total Body	ADULT	TBODY	3.43E-02	1.13E+00	3.05E+00
Qtr 3 - T.Spc. Any Organ	ADULT	GILLI	4.40E-02	5.00E+00	8.79E-01

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	7.76E+01
CR-51	6.46E-02
FE-55	6.19E-02
CO-58	1.14E+00
CO-60	2.36E+00
SR-89	2.76E-02
SR-90	5.67E-02
ZR-95	1.51E-03
NB-95	1.76E+01
SB-124	6.69E-03
SB-125	2.91E-03
TE-132	1.02E+00
I-132	7.66E-05

Qtr 3 - T.Spc. Total Body	ADULT	TBODY	3.43E-02	1.50E+00	2.29E+00
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Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
H-3	9.94E+01
CR-51	3.29E-04
FE-55	3.22E-02
CO-58	1.61E-01
CO-60	3.55E-01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
-----	-----
SR-89	6.33E-03
SR-90	5.80E-02
ZR-95	4.13E-07
NB-95	2.00E-03
SB-124	1.19E-04
SB-125	8.06E-05
TE-132	2.60E-02
I-132	1.83E-04

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 4 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	5.50E-04	3.49E-02	3.48E-02	3.48E-02	3.48E-02	3.61E-02	0.00E+00	3.49E-02
TEEN	5.03E-04	2.62E-02	2.61E-02	2.61E-02	2.61E-02	2.70E-02	0.00E+00	2.62E-02
CHILD	5.68E-04	2.92E-02	2.91E-02	2.91E-02	2.91E-02	2.95E-02	0.00E+00	2.93E-02
INFANT	9.90E-06	1.30E-02	1.30E-02	1.30E-02	1.30E-02	1.30E-02	0.00E+00	1.30E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 4 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 4 - Admin. Any Organ	ADULT	GILLI	3.61E-02	3.75E+00	9.63E-01
Qtr 4 - Admin. Total Body	ADULT	TBODY	3.49E-02	1.13E+00	3.11E+00

Qtr 4 - T.Spc. Any Organ ADULT GILLI 3.61E-02 5.00E+00 7.23E-01

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	9.62E+01
FE-55	3.65E-02
CO-58	2.30E+00
CO-60	1.39E+00
SR-89	1.63E-02
SR-90	3.34E-02
SB-124	7.05E-04

Qtr 4 - T.Spc. Total Body ADULT TBODY 3.49E-02 1.50E+00 2.33E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	9.95E+01
FE-55	1.53E-02
CO-58	2.63E-01
CO-60	1.69E-01
SR-89	3.01E-03
SR-90	2.76E-02
SB-124	1.02E-05

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === ANNUAL 2015 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	2.44E-05	1.40E-01	1.39E-01	1.39E-01	1.39E-01	1.58E-01	0.00E+00	1.40E-01
TEEN	2.55E-05	1.05E-01	1.04E-01	1.05E-01	1.04E-01	1.17E-01	0.00E+00	1.05E-01
CHILD	3.17E-05	1.17E-01	1.17E-01	1.17E-01	1.16E-01	1.21E-01	0.00E+00	1.17E-01
INFANT	4.03E-07	5.17E-02	5.17E-02	5.17E-02	5.17E-02	5.17E-02	0.00E+00	5.17E-02

=== SITE DOSE LIMIT ANALYSIS === ANNUAL 2015 ===

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2015 - Admin. Any Organ	ADULT	GILLI	1.58E-01	7.50E+00	2.10E+00
2015 - Admin. Total Body	ADULT	TBODY	1.40E-01	2.25E+00	6.22E+00

2015 - T.Spc. Any Organ ADULT GILLI 1.58E-01 1.00E+01 1.58E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	8.84E+01
CR-51	2.18E-02
MN-54	1.87E-02
FE-59	1.29E-02
CO-58	1.77E+00
CO-60	1.87E+00
ZR-95	5.09E-04
NB-95	7.58E+00
SB-124	2.45E-03
SB-125	1.60E-03
TE-132	3.45E-01
I-132	2.58E-05
I-133	5.56E-05

2015 - T.Spc. Total Body ADULT TBODY 1.40E-01 3.00E+00 4.66E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	9.95E+01
CR-51	9.74E-05
MN-54	1.31E-03
FE-59	1.67E-03
CO-58	2.21E-01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Nuclide	Percentage
-----	-----
CO-60	2.47E-01
ZR-95	1.22E-07
NB-95	7.56E-04
SB-124	3.84E-05
SB-125	3.90E-05
TE-132	7.71E-03
I-132	5.41E-05
I-133	2.13E-05

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS === QUARTER 1 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 1 - Admin. Any Organ	CHILD	BONE	1.94E-01	5.63E+00	3.45E+00
Qtr 1 - Admin. Total Body	CHILD	TBODY	4.06E-02	5.25E+00	7.73E-01

Qtr 1 - T.Spc. Any Organ	CHILD	BONE	1.94E-01	7.50E+00	2.59E+00
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
C-14	1.00E+02
I-131	6.39E-05

Qtr 1 - T.Spc. Total Body	CHILD	TBODY	4.06E-02	7.50E+00	5.41E-01
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	4.32E+00
C-14	9.57E+01
I-131	1.76E-04

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === QUARTER 1 ===

Quarter - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
Qtr 1 - Admin. Gamma	1.70E-05	3.75E+00	4.53E-04
Qtr 1 - Admin. Beta	8.83E-06	7.50E+00	1.18E-04

Qtr 1 - T.Spc. Gamma	1.70E-05	5.00E+00	3.40E-04
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Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide	Percentage
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AR-41	3.26E+01
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XE-135	2.56E-01
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XE-133	6.72E+01
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Qtr 1 - T.Spc. Beta	8.83E-06	1.00E+01	8.83E-05
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Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide	Percentage
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AR-41	5.43E+00
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XE-135	1.55E-01
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XE-133	9.44E+01
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40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS === QUARTER 2 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 2 - Admin. Any Organ	CHILD	BONE	1.80E-01	5.63E+00	3.19E+00
Qtr 2 - Admin. Total Body	CHILD	TBODY	3.73E-02	5.25E+00	7.11E-01

Qtr 2 - T.Spc. Any Organ	CHILD	BONE	1.80E-01	7.50E+00	2.40E+00
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
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C-14	1.00E+02
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Qtr 2 - T.Spc. Total Body	CHILD	TBODY	3.73E-02	7.50E+00	4.98E-01
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Receptor: Composite Crit. Receptor - IP

Distance: 800 (meters) Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
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H-3	3.79E+00
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C-14	9.62E+01
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40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === QUARTER 2 ===

Quarter - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
Qtr 2 - Admin. Gamma	1.76E-05	3.75E+00	4.70E-04
Qtr 2 - Admin. Beta	4.81E-06	7.50E+00	6.42E-05

Qtr 2 - T.Spc. Gamma	1.76E-05	5.00E+00	3.52E-04
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Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide	Percentage
---------	------------

AR-41	7.10E+01
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XE-133	2.90E+01
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Qtr 2 - T.Spc. Beta	4.81E-06	1.00E+01	4.81E-05
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Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide	Percentage
---------	------------

AR-41	2.25E+01
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XE-133	7.75E+01
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40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS === QUARTER 3 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 3 - Admin. Any Organ	CHILD	BONE	1.78E-01	5.63E+00	3.16E+00
Qtr 3 - Admin. Total Body	CHILD	TBODY	3.62E-02	5.25E+00	6.89E-01

Qtr 3 - T.Spc. Any Organ	CHILD	BONE	1.78E-01	7.50E+00	2.37E+00
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
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C-14	1.00E+02
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I-131	3.08E-04
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Qtr 3 - T.Spc. Total Body	CHILD	TBODY	3.62E-02	7.50E+00	4.82E-01
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
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H-3	1.87E+00
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C-14	9.81E+01
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I-131	8.70E-04
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40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS ===== QUARTER 3 =====

Quarter - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
Qtr 3 - Admin. Gamma	1.52E-05	3.75E+00	4.06E-04
Qtr 3 - Admin. Beta	3.47E-06	7.50E+00	4.62E-05

Qtr 3 - T.Spc. Gamma	1.52E-05	5.00E+00	3.04E-04
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Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide Percentage

AR-41	7.68E+01
KR-85M	2.09E-02
XE-135	2.03E+00
XE-133M	4.49E-02
XE-133	2.11E+01

Qtr 3 - T.Spc. Beta	3.47E-06	1.00E+01	3.47E-05
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Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide Percentage

AR-41	2.92E+01
KR-85M	3.60E-02
XE-135	2.80E+00
XE-133M	2.19E-01
XE-133	6.78E+01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS === QUARTER 4 ===

Quarter - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 4 - Admin. Any Organ	CHILD	BONE	1.70E-01	5.63E+00	3.03E+00
Qtr 4 - Admin. Total Body	CHILD	TBODY	3.48E-02	5.25E+00	6.62E-01

Qtr 4 - T.Spc. Any Organ	CHILD	BONE	1.70E-01	7.50E+00	2.27E+00
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
-----	----------

C-14	1.00E+02
------	----------

CR-51	3.30E-07
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I-131	6.90E-05
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Qtr 4 - T.Spc. Total Body	CHILD	TBODY	3.48E-02	7.50E+00	4.64E-01
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	2.00E+00
-----	----------

C-14	9.80E+01
------	----------

CR-51	1.70E-06
-------	----------

I-131	1.95E-04
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40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === QUARTER 4 ===

Quarter - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
Qtr 4 - Admin. Gamma	1.76E-02	3.75E+00	4.69E-01
Qtr 4 - Admin. Beta	8.38E-04	7.50E+00	1.12E-02

Qtr 4 - T.Spc. Gamma	1.76E-02	5.00E+00	3.52E-01
----------------------	----------	----------	----------

Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide	Percentage
AR-41	2.11E-02
KR-85M	1.30E-06
XE-135	4.16E-05
XE-133M	1.70E-06
KR-88	9.99E+01
XE-133	3.20E-02

Qtr 4 - T.Spc. Beta	8.38E-04	1.00E+01	8.38E-03
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Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide	Percentage
AR-41	3.84E-02
KR-85M	1.07E-05
XE-135	2.75E-04
XE-133M	3.97E-05
KR-88	9.95E+01
XE-133	4.92E-01

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS ===== ANNUAL 2015 =====

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2015 - Admin. Any Organ	CHILD	BONE	7.22E-01	1.13E+01	6.42E+00
2015 - Admin. Total Body	CHILD	TBODY	1.49E-01	1.05E+01	1.42E+00

2015 - T.Spc. Any Organ	CHILD	BONE	7.22E-01	1.50E+01	4.81E+00
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	0.00E+00
-----	----------

C-14	1.00E+02
------	----------

CR-51	7.79E-08
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I-131	1.09E-04
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2015 - T.Spc. Total Body	CHILD	TBODY	1.49E-01	1.50E+01	9.92E-01
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Receptor: Composite Crit. Receptor - IP

Distance: 800 meters Compass Point: SSE

Critical Pathway: Vegetation

Major Contributors (0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	3.05E+00
-----	----------

C-14	9.69E+01
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CR-51	3.98E-07
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I-131	3.05E-04
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40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS === ANNUAL 2015 ===

Annual - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
2015 - Admin. Gamma	1.76E-02	7.50E+00	2.35E-01
2015 - Admin. Beta	8.55E-04	1.50E+01	5.70E-03

2015 - T.Spc. Gamma	1.76E-02	1.00E+01	1.76E-01
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Receptor: Composite Crit. Receptor - NG

Distance: 800 meters Compass Point: SSE

Nuclide	Percentage
---------	------------

AR-41	1.89E-01
KR-85M	1.93E-05
XE-135	2.03E-03
XE-133M	4.04E-05
KR-88	9.97E+01
XE-133	1.44E-01

2015 - T.Spc. Beta	8.55E-04	2.00E+01	4.27E-03
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Receptor: Composite Crit. Receptor - NG

Distance: 800 (meters) Compass Point: SSE

Nuclide	Percentage
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AR-41	3.39E-01
KR-85M	1.57E-04
XE-135	1.32E-02
XE-133M	9.29E-04
KR-88	9.75E+01
XE-133	2.17E+00

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Units 1 & 2

Report for: 2015

Unit Range - From: 1 To: 2

=== MAXIMUM DOSE ANALYSIS ===== ANNUAL 2015 =====

Dose Type	Age Group	Organ	Dose (mrem)
Any Organ	CHILD	BONE	7.22E-01

Liquid Receptor: Liquid Receptor
Gaseous Receptor: Composite Crit. Receptor - IP
Distance: 800 meters Compass Point: SSE

Liquid Dose: 3.17E-05 % of Total: 4.39E-03
Critical Pathway: Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)
Nuclide Percentage

H-3 0.00E+00
CR-51 0.00E+00
MN-54 0.00E+00
FE-59 1.03E+01
CO-58 0.00E+00
CO-60 0.00E+00
ZR-95 3.46E-03
NB-95 1.33E+01
SB-124 7.19E-01
SB-125 1.23E+00
TE-132 7.39E+01
I-132 3.39E-01
I-133 2.49E-01

Gaseous Dose: 7.22E-01 % of Total: 1.00E+02
Critical Pathway: Vegetation (VEG)
Major Contributors (0% or greater to total)
Nuclide Percentage

H-3 0.00E+00
C-14 1.00E+02
CR-51 7.79E-08
I-131 1.09E-04

=== MAXIMUM DOSE ANALYSIS ===== ANNUAL 2015 =====

Dose Type	Age Group	Organ	Dose (mrem)
Total Body	CHILD	TBODY	2.66E-01

Liquid Receptor: Liquid Receptor
Gaseous Receptor: Composite Crit. Receptor - IP
Distance: 800 meters Compass Point: SSE

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

Liquid Dose: 1.17E-01 % of Total: 4.41E+01
Critical Pathway: Fresh Water Fish - Sport (FFSP)
Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	9.94E+01
CR-51	1.28E-04
MN-54	1.68E-03
FE-59	2.24E-03
CO-58	2.88E-01
CO-60	3.22E-01
ZR-95	1.83E-07
NB-95	9.98E-04
SB-124	6.80E-05
SB-125	6.95E-05
TE-132	1.07E-02
I-132	7.75E-05
I-133	3.14E-05

Gaseous Dose: 1.49E-01 % of Total: 5.60E+01
Critical Pathway: Vegetation (VEG)
Major Contributors (0% or greater to total)

Nuclide Percentage

H-3	3.05E+00
C-14	9.69E+01
CR-51	3.98E-07
I-131	3.05E-04

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== RELEASE DATA ===
Total Release Duration (minutes)..... 6.183E+05
Total Release Volume (cf)..... 6.672E+10
Average Release Flowrate (cfm)..... 1.079E+05

Average Period Flowrate (cfm)..... 1.269E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	4.99E+04	2.64E-11	2.64E-03	1.00E-08
KR-85M	2.38E+01	1.26E-14	1.26E-07	1.00E-07
KR-88	1.99E+07	1.06E-08	1.17E+00	9.00E-09
XE-133M	1.88E+02	9.95E-14	1.66E-07	6.00E-07
XE-133	8.40E+05	4.45E-10	8.89E-04	5.00E-07
XE-135	1.81E+03	9.56E-13	1.37E-05	7.00E-08
F&AG	2.08E+07	1.10E-08	1.18E+00	
C-14	4.24E+06	2.25E-09	7.49E-01	3.00E-09
Other	4.24E+06	2.25E-09	7.49E-01	
H-3	2.73E+07	1.44E-08	1.44E-01	1.00E-07
H-3	2.73E+07	1.44E-08	1.44E-01	
Total	5.23E+07	2.77E-08	2.07E+00	

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	CHILD	BONE	3.46E-01	31-day	2.25E-01	1.54E+02
					Quarter	5.63E+00	6.15E+00
					Annual	1.13E+01	3.07E+00
T.Spec	Any Organ	CHILD	BONE	3.46E-01	31-day	3.00E-01	1.15E+02
					Quarter	7.50E+00	4.61E+00
					Annual	1.50E+01	2.31E+00

Receptor.....: Composite Crit. Receptor - IP
Distance (meters).....: 800
Compass Point.....: SSE
Critical Pathway.....: Vegetation (VEG)
Major Contributors.....: 0.0 % or greater to total
Nuclide Percentage

H-3	0.00E+00
C-14	1.00E+02

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AINHL	1.10E-03	4.85E-04	4.85E-04	4.85E-04	4.85E-04	4.85E-04	0.00E+00	4.85E-04
AVEG	5.43E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02	0.00E+00	1.13E-02
ACMEAT	2.01E-02	4.10E-03	4.10E-03	4.10E-03	4.10E-03	4.10E-03	0.00E+00	4.10E-03
ACMILK	2.20E-02	4.56E-03	4.56E-03	4.56E-03	4.56E-03	4.56E-03	0.00E+00	4.56E-03
TINHL	1.57E-03	5.76E-04	5.76E-04	5.76E-04	5.76E-04	5.76E-04	0.00E+00	5.76E-04
TVEG	8.77E-02	1.82E-02	1.82E-02	1.82E-02	1.82E-02	1.82E-02	0.00E+00	1.82E-02
TCMEAT	1.70E-02	3.44E-03	3.44E-03	3.44E-03	3.44E-03	3.44E-03	0.00E+00	3.44E-03
TCMILK	4.05E-02	8.33E-03	8.33E-03	8.33E-03	8.33E-03	8.33E-03	0.00E+00	8.33E-03
CINHL	2.17E-03	6.56E-04	6.56E-04	6.56E-04	6.56E-04	6.56E-04	0.00E+00	6.56E-04
CVEG	2.12E-01	4.33E-02	4.33E-02	4.33E-02	4.33E-02	4.33E-02	0.00E+00	4.33E-02
CCMEAT	3.20E-02	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	0.00E+00	6.47E-03
CCMILK	9.98E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	0.00E+00	2.03E-02
IINHL	1.60E-03	4.64E-04	4.64E-04	4.64E-04	4.64E-04	4.64E-04	0.00E+00	4.64E-04
ICMILK	1.95E-01	4.22E-02	4.22E-02	4.22E-02	4.22E-02	4.22E-02	0.00E+00	4.22E-02
----- TOTALS -----								
ADULT	9.75E-02	2.05E-02	2.05E-02	2.05E-02	2.05E-02	2.05E-02	0.00E+00	2.05E-02
TEEN	1.47E-01	3.05E-02	3.05E-02	3.05E-02	3.05E-02	3.05E-02	0.00E+00	3.05E-02
CHILD	3.46E-01	7.07E-02	7.07E-02	7.07E-02	7.07E-02	7.07E-02	0.00E+00	7.07E-02
INFANT	1.97E-01	4.27E-02	4.27E-02	4.27E-02	4.27E-02	4.27E-02	0.00E+00	4.27E-02

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CINHL	CHILD	Inhalation (INHL)
CVEG	CHILD	Vegetation (VEG)
CCMEAT	CHILD	Grs/Cow/Meat (CMEAT)
CCMILK	CHILD	Grs/Cow/Milk (CMILK)
IINHL	INFANT	Inhalation (INHL)
ICMILK	INFANT	Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	1.76E-02	31-day Quarter Annual	1.50E-01 3.75E+00 7.50E+00	1.18E+01 4.70E-01 2.35E-01
Admin	Beta	8.48E-04	31-day Quarter Annual	3.00E-01 7.50E+00 1.50E+01	2.83E-01 1.13E-02 5.65E-03
T.Spec	Gamma	1.76E-02	31-day Quarter Annual	2.00E-01 5.00E+00 1.00E+01	8.82E+00 3.53E-01 1.76E-01

Receptor.....: Composite Crit. Receptor - NG
Distance (meters).....: 800
Compass Point.....: SSE
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	1.53E-01
KR-85M	9.64E-06
KR-88	9.97E+01
XE-133M	2.02E-05
XE-133	9.75E-02
XE-135	1.14E-03

T.Spec	Beta	8.48E-04	31-day Quarter Annual	4.00E-01 1.00E+01 2.00E+01	2.12E-01 8.48E-03 4.24E-03
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Receptor.....: Composite Crit. Receptor - NG
Distance (meters).....: 800
Compass Point.....: SSE
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.75E-01
KR-85M	7.89E-05
KR-88	9.82E+01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
XE-133M	4.68E-04
XE-133	1.48E+00
XE-135	7.47E-03

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== RELEASE DATA ===
Total Release Duration (minutes)..... 6.107E+05
Total Release Volume (cf)..... 8.233E+10
Average Release Flowrate (cfm)..... 1.348E+05

Average Period Flowrate (cfm)..... 1.566E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	1.21E+04	5.20E-12	5.20E-04	1.00E-08
KR-85M	2.38E+01	1.02E-14	1.02E-07	1.00E-07
XE-133M	1.88E+02	8.07E-14	1.34E-07	6.00E-07
XE-133	3.98E+05	1.71E-10	3.42E-04	5.00E-07
XE-135	1.42E+03	6.07E-13	8.68E-06	7.00E-08
F&AG	4.12E+05	1.77E-10	8.71E-04	
I-131	4.45E+00	1.91E-15	9.54E-06	2.00E-10
Iodine	4.45E+00	1.91E-15	9.54E-06	
C-14	4.61E+06	1.98E-09	6.60E-01	3.00E-09
Other	4.61E+06	1.98E-09	6.60E-01	
H-3	5.32E+07	2.28E-08	2.28E-01	1.00E-07
H-3	5.32E+07	2.28E-08	2.28E-01	
CR-51	1.01E+00	4.35E-16	1.45E-08	3.00E-08
P>=8	1.01E+00	4.35E-16	1.45E-08	
Total	5.82E+07	2.50E-08	8.89E-01	

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	CHILD	BONE	3.76E-01	31-day	2.25E-01	1.67E+02
					Quarter	5.63E+00	6.68E+00
					Annual	1.13E+01	3.34E+00
T.Spec	Any Organ	CHILD	BONE	3.76E-01	31-day	3.00E-01	1.25E+02
					Quarter	7.50E+00	5.01E+00
					Annual	1.50E+01	2.51E+00

Receptor.....: Composite Crit. Receptor - IP
Distance (meters).....: 800
Compass Point.....: SSE
Critical Pathway.....: Vegetation (VEG)
Major Contributors.....: 0.0 % or greater to total
Nuclide Percentage

H-3	0.00E+00
C-14	1.00E+02
CR-51	1.50E-07
I-131	2.10E-04

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	0.00E+00	9.69E-09
AINHL	1.20E-03	7.69E-04	7.70E-04	7.69E-04	7.69E-04	7.69E-04	0.00E+00	7.69E-04
AVEG	5.90E-02	1.28E-02	1.28E-02	1.28E-02	1.28E-02	1.28E-02	0.00E+00	1.28E-02
ACMEAT	2.19E-02	4.52E-03	4.52E-03	4.52E-03	4.52E-03	4.52E-03	0.00E+00	4.52E-03
ACMILK	2.39E-02	5.11E-03	5.18E-03	5.11E-03	5.11E-03	5.11E-03	0.00E+00	5.11E-03
TGPD	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	0.00E+00	9.69E-09
TINHL	1.71E-03	8.70E-04	8.71E-04	8.70E-04	8.70E-04	8.70E-04	0.00E+00	8.70E-04
TVEG	9.54E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	0.00E+00	2.03E-02
TCMEAT	1.85E-02	3.78E-03	3.78E-03	3.78E-03	3.78E-03	3.78E-03	0.00E+00	3.78E-03
TCMILK	4.41E-02	9.24E-03	9.36E-03	9.24E-03	9.24E-03	9.24E-03	0.00E+00	9.24E-03
CGPD	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	0.00E+00	9.69E-09
CINHL	2.36E-03	9.28E-04	9.29E-04	9.28E-04	9.28E-04	9.28E-04	0.00E+00	9.28E-04
CVEG	2.30E-01	4.78E-02	4.79E-02	4.78E-02	4.78E-02	4.78E-02	0.00E+00	4.78E-02
CCMEAT	3.48E-02	7.07E-03	7.08E-03	7.07E-03	7.07E-03	7.07E-03	0.00E+00	7.07E-03
CCMILK	1.09E-01	2.23E-02	2.26E-02	2.23E-02	2.23E-02	2.23E-02	0.00E+00	2.23E-02
IGPD	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	9.69E-09	0.00E+00	9.69E-09
IINHL	1.74E-03	6.28E-04	6.29E-04	6.28E-04	6.28E-04	6.28E-04	0.00E+00	6.28E-04
ICMILK	2.12E-01	4.64E-02	4.69E-02	4.64E-02	4.64E-02	4.64E-02	0.00E+00	4.64E-02
----- TOTALS -----								
ADULT	1.06E-01	2.31E-02	2.32E-02	2.31E-02	2.31E-02	2.31E-02	0.00E+00	2.31E-02
TEEN	1.60E-01	3.42E-02	3.43E-02	3.42E-02	3.42E-02	3.42E-02	0.00E+00	3.42E-02
CHILD	3.76E-01	7.82E-02	7.84E-02	7.82E-02	7.82E-02	7.82E-02	0.00E+00	7.82E-02
INFANT	2.14E-01	4.70E-02	4.75E-02	4.70E-02	4.70E-02	4.70E-02	0.00E+00	4.70E-02

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
 Period Start Date....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
CVEG	CHILD	Vegetation (VEG)
CCMEAT	CHILD	Grs/Cow/Meat (CMEAT)
CCMILK	CHILD	Grs/Cow/Milk (CMILK)
IGPD	INFANT	Ground Plane Deposition (GPD)
IINHL	INFANT	Inhalation (INHL)
ICMILK	INFANT	Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	1.49E-05	31-day	1.50E-01	9.91E-03
			Quarter	3.75E+00	3.96E-04
			Annual	7.50E+00	1.98E-04
Admin	Beta	6.59E-06	31-day	3.00E-01	2.20E-03
			Quarter	7.50E+00	8.78E-05
			Annual	1.50E+01	4.39E-05
T.Spec	Gamma	1.49E-05	31-day	2.00E-01	7.43E-03
			Quarter	5.00E+00	2.97E-04
			Annual	1.00E+01	1.49E-04

Receptor.....: Composite Crit. Receptor - NG
Distance (meters).....: 800
Compass Point.....: SSE
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	4.40E+01
KR-85M	1.14E-02
XE-133M	2.40E-02
XE-133	5.49E+01
XE-135	1.06E+00

T.Spec	Beta	6.59E-06	31-day	4.00E-01	1.65E-03
			Quarter	1.00E+01	6.59E-05
			Annual	2.00E+01	3.29E-05

Receptor.....: Composite Crit. Receptor - NG
Distance (meters).....: 800
Compass Point.....: SSE
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	8.61E+00
KR-85M	1.02E-02
XE-133M	6.03E-02
XE-133	9.06E+01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: All Gas Release Types
Period Start Date....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

Major Contributors.....: 0.0 % or greater to total
Nuclide Percentage

XE-135 7.54E-01

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1

=== MULTIPLE RELEASE POINT MESSAGE =====
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA =====
Total Release Duration (minutes)..... 5.435E+05
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA =====
Nuclide uCi

CO-57 1.40E+01
SB-122 5.08E+00
SB-124 2.69E+01
SB-125 7.12E+01
TE-123M 2.05E+01
CR-51 1.92E+02
MN-54 3.94E+00
FE-59 4.47E+00
CO-58 2.76E+03
CO-60 1.09E+03
ZR-95 5.34E+00
NB-95 1.42E+01
TE-132 1.32E+01
I-132 1.95E+01
I-133 1.93E+00

Gamma 4.24E+03

XE-133 2.54E+02

D&EG 2.54E+02

H-3 1.66E+09

Beta 1.66E+09

Total 1.66E+09

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
 Period Start Date.....: 01/01/2015 00:00
 Period End Date.....: 01/01/2016 00:00
 Period Duration (mins): 5.256E+05
 Unit.....: 1
 Receptor.....: Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
APWtr	6.08E-08	1.95E-02	1.95E-02	1.95E-02	1.95E-02	1.95E-02	0.00E+00	1.95E-02
AFWFSp	1.21E-05	5.03E-02	5.02E-02	5.02E-02	5.01E-02	5.93E-02	0.00E+00	5.05E-02
TPWtr	5.87E-08	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	0.00E+00	1.37E-02
TFWFSp	1.27E-05	3.87E-02	3.85E-02	3.86E-02	3.85E-02	4.49E-02	0.00E+00	3.89E-02
CPWtr	1.69E-07	2.63E-02	2.63E-02	2.63E-02	2.63E-02	2.64E-02	0.00E+00	2.64E-02
CFWFSp	1.57E-05	3.20E-02	3.19E-02	3.19E-02	3.19E-02	3.41E-02	0.00E+00	3.23E-02
IPWtr	2.02E-07	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02
----- TOTALS -----								
ADULT	1.22E-05	6.98E-02	6.96E-02	6.97E-02	6.96E-02	7.88E-02	0.00E+00	7.00E-02
TEEN	1.27E-05	5.24E-02	5.22E-02	5.23E-02	5.22E-02	5.86E-02	0.00E+00	5.26E-02
CHILD	1.58E-05	5.84E-02	5.83E-02	5.83E-02	5.82E-02	6.05E-02	0.00E+00	5.86E-02
INFANT	2.02E-07	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
APWtr	ADULT	Potable Water (PWtr)
AFWFSp	ADULT	Fresh Water Fish - Sport (FFSP)
TPWtr	TEEN	Potable Water (PWtr)
TFWFSp	TEEN	Fresh Water Fish - Sport (FFSP)
CPWtr	CHILD	Potable Water (PWtr)
CFWFSp	CHILD	Fresh Water Fish - Sport (FFSP)
IPWtr	INFANT	Potable Water (PWtr)

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1
Receptor.....: Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB

ADULT								
H-3	0.00E+00	6.96E-02	6.96E-02	6.96E-02	6.96E-02	6.96E-02	0.00E+00	6.96E-02
CR-51	0.00E+00	0.00E+00	4.07E-08	1.50E-08	9.04E-08	1.71E-05	0.00E+00	6.82E-08
MN-54	0.00E+00	4.80E-06	0.00E+00	1.43E-06	0.00E+00	1.47E-05	0.00E+00	9.16E-07
FE-59	1.30E-06	3.05E-06	0.00E+00	0.00E+00	8.52E-07	1.02E-05	0.00E+00	1.17E-06
CO-58	0.00E+00	6.90E-05	0.00E+00	0.00E+00	0.00E+00	1.40E-03	0.00E+00	1.55E-04
CO-60	0.00E+00	7.83E-05	0.00E+00	0.00E+00	0.00E+00	1.47E-03	0.00E+00	1.73E-04
ZR-95	3.95E-10	1.27E-10	0.00E+00	1.99E-10	0.00E+00	4.01E-07	0.00E+00	8.57E-11
NB-95	1.77E-06	9.84E-07	0.00E+00	9.73E-07	0.00E+00	5.97E-03	0.00E+00	5.29E-07
SB-124	6.77E-08	1.28E-09	1.65E-10	0.00E+00	5.28E-08	1.93E-06	0.00E+00	2.69E-08
SB-125	1.15E-07	1.28E-09	1.17E-10	0.00E+00	8.85E-08	1.26E-06	0.00E+00	2.73E-08
TE-132	8.88E-06	5.75E-06	6.35E-06	5.53E-05	0.00E+00	2.72E-04	0.00E+00	5.39E-06
I-132	4.05E-08	1.08E-07	3.79E-06	1.72E-07	0.00E+00	2.03E-08	0.00E+00	3.79E-08
I-133	2.80E-08	4.88E-08	7.17E-06	8.51E-08	0.00E+00	4.38E-08	0.00E+00	1.49E-08
TEEN								
H-3	0.00E+00	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	0.00E+00	5.22E-02
CR-51	0.00E+00	0.00E+00	3.90E-08	1.54E-08	1.00E-07	1.18E-05	0.00E+00	7.02E-08
MN-54	0.00E+00	4.72E-06	0.00E+00	1.41E-06	0.00E+00	9.69E-06	0.00E+00	9.37E-07
FE-59	1.34E-06	3.12E-06	0.00E+00	0.00E+00	9.83E-07	7.38E-06	0.00E+00	1.20E-06
CO-58	0.00E+00	6.86E-05	0.00E+00	0.00E+00	0.00E+00	9.45E-04	0.00E+00	1.58E-04
CO-60	0.00E+00	7.83E-05	0.00E+00	0.00E+00	0.00E+00	1.02E-03	0.00E+00	1.76E-04
ZR-95	4.04E-10	1.28E-10	0.00E+00	1.87E-10	0.00E+00	2.94E-07	0.00E+00	8.77E-11
NB-95	1.78E-06	9.88E-07	0.00E+00	9.58E-07	0.00E+00	4.23E-03	0.00E+00	5.44E-07
SB-124	6.98E-08	1.29E-09	3.83E-07	0.00E+00	6.10E-08	1.41E-06	0.00E+00	9.33E-09
SB-125	1.18E-07	1.30E-09	1.13E-10	0.00E+00	1.04E-07	9.23E-07	0.00E+00	2.77E-08
TE-132	9.37E-06	5.93E-06	6.26E-06	5.69E-05	0.00E+00	1.88E-04	0.00E+00	5.59E-06
I-132	4.23E-08	1.11E-07	3.73E-06	1.74E-07	0.00E+00	4.82E-08	0.00E+00	3.97E-08
I-133	3.02E-08	5.12E-08	7.15E-06	8.98E-08	0.00E+00	3.87E-08	0.00E+00	1.56E-08
CHILD								
H-3	0.00E+00	5.82E-02	5.82E-02	5.82E-02	5.82E-02	5.82E-02	0.00E+00	5.82E-02
CR-51	0.00E+00	0.00E+00	4.17E-08	1.14E-08	7.61E-08	3.98E-06	0.00E+00	7.50E-08
MN-54	0.00E+00	3.70E-06	0.00E+00	1.04E-06	0.00E+00	3.10E-06	0.00E+00	9.85E-07
FE-59	1.63E-06	2.63E-06	0.00E+00	0.00E+00	7.63E-07	2.74E-06	0.00E+00	1.31E-06
CO-58	0.00E+00	5.52E-05	0.00E+00	0.00E+00	0.00E+00	3.22E-04	0.00E+00	1.69E-04
CO-60	0.00E+00	6.41E-05	0.00E+00	0.00E+00	0.00E+00	3.55E-04	0.00E+00	1.89E-04
ZR-95	5.48E-10	1.20E-10	0.00E+00	1.72E-10	0.00E+00	1.26E-07	0.00E+00	1.07E-10
NB-95	2.10E-06	8.19E-07	0.00E+00	7.69E-07	0.00E+00	1.51E-03	0.00E+00	5.85E-07
SB-124	1.14E-07	1.47E-09	2.52E-10	0.00E+00	6.32E-08	7.13E-07	0.00E+00	3.99E-08

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) ===

Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
SB-125	1.95E-07	1.50E-09	1.80E-10	0.00E+00	1.08E-07	4.65E-07	0.00E+00	4.07E-08
TE-132	1.17E-05	5.18E-06	7.55E-06	4.81E-05	0.00E+00	5.22E-05	0.00E+00	6.26E-06
I-132	5.37E-08	9.87E-08	4.58E-06	1.51E-07	0.00E+00	1.16E-07	0.00E+00	4.54E-08
I-133	3.94E-08	4.87E-08	9.05E-06	8.11E-08	0.00E+00	1.96E-08	0.00E+00	1.84E-08
INFANT								
H-3	0.00E+00	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02
CR-51	0.00E+00	0.00E+00	1.85E-10	4.04E-11	3.60E-10	8.26E-09	0.00E+00	2.83E-10
MN-54	0.00E+00	8.21E-09	0.00E+00	1.82E-09	0.00E+00	3.02E-09	0.00E+00	1.86E-09
FE-59	1.44E-08	2.52E-08	0.00E+00	0.00E+00	7.44E-09	1.20E-08	0.00E+00	9.92E-09
CO-58	0.00E+00	1.04E-06	0.00E+00	0.00E+00	0.00E+00	2.59E-06	0.00E+00	2.60E-06
CO-60	0.00E+00	1.23E-06	0.00E+00	0.00E+00	0.00E+00	2.93E-06	0.00E+00	2.91E-06
ZR-95	1.15E-10	2.81E-11	0.00E+00	3.03E-11	0.00E+00	1.40E-08	0.00E+00	1.99E-11
NB-95	6.26E-11	2.58E-11	0.00E+00	1.85E-11	0.00E+00	2.18E-08	0.00E+00	1.49E-11
SB-124	6.04E-08	8.92E-10	1.60E-10	0.00E+00	3.78E-08	1.87E-07	0.00E+00	1.87E-08
SB-125	9.19E-08	8.89E-10	1.15E-10	0.00E+00	5.32E-08	1.23E-07	0.00E+00	1.89E-08
TE-132	2.88E-08	1.43E-08	2.10E-08	8.91E-08	0.00E+00	5.27E-08	0.00E+00	1.33E-08
I-132	3.39E-09	6.88E-09	3.22E-07	7.68E-09	0.00E+00	5.57E-09	0.00E+00	2.45E-09
I-133	2.53E-09	3.68E-09	6.69E-07	4.33E-09	0.00E+00	6.23E-10	0.00E+00	1.08E-09

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05
Unit.....: 1
Receptor.....: Liquid Receptor

=== MAXIMUM DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	ADULT	GILLI	7.88E-02	31-day Quarter Annual	1.50E-01 3.75E+00 7.50E+00	5.25E+01 2.10E+00 1.05E+00
Admin	Tot Body	ADULT	TBODY	7.00E-02	31-day Quarter Annual	4.50E-02 1.13E+00 2.25E+00	1.55E+02 6.22E+00 3.11E+00
T.Spec	Any Organ	ADULT	GILLI	7.88E-02	31-day Quarter Annual	2.00E-01 5.00E+00 1.00E+01	3.94E+01 1.58E+00 7.88E-01

Critical Pathway.....: Fresh Water Fish - Sport (FFSP)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
SB-125	1.60E-03
SB-124	2.45E-03
H-3	8.84E+01
CR-51	2.18E-02
MN-54	1.87E-02
FE-59	1.29E-02
CO-58	1.77E+00
CO-60	1.87E+00
ZR-95	5.09E-04
NB-95	7.58E+00
TE-132	3.45E-01
I-132	2.58E-05
I-133	5.56E-05

T.Spec	Tot Body	ADULT	TBODY	7.00E-02	31-day Quarter Annual	6.00E-02 1.50E+00 3.00E+00	1.17E+02 4.66E+00 2.33E+00
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Critical Pathway.....: Fresh Water Fish - Sport (FFSP)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
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LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
SB-125	3.90E-05
SB-124	3.84E-05
H-3	9.95E+01
CR-51	9.74E-05
MN-54	1.31E-03
FE-59	1.67E-03
CO-58	2.21E-01
CO-60	2.47E-01
ZR-95	1.22E-07
NB-95	7.56E-04
TE-132	7.71E-03
I-132	5.41E-05
I-133	2.13E-05

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2

=== MULTIPLE RELEASE POINT MESSAGE =====
Undiluted and Diluted Flowrate(s) and Concentration(s) cannot be combined.

=== RELEASE DATA =====
Total Release Duration (minutes)..... 5.435E+05
Total Undiluted Volume Released (gallons)..... NA
Average Undiluted Flowrate (gpm)..... NA

Total Dilution Volume (gallons)..... NA
Average Dilution Flowrate (gpm)..... NA

=== NUCLIDE DATA =====
Nuclide uCi

CO-57 1.40E+01
SB-122 5.08E+00
SB-124 2.69E+01
SB-125 7.12E+01
TE-123M 2.05E+01
CR-51 1.92E+02
MN-54 3.94E+00
FE-59 4.47E+00
CO-58 2.76E+03
CO-60 1.09E+03
ZR-95 5.34E+00
NB-95 1.42E+01
TE-132 1.32E+01
I-132 1.95E+01
I-133 1.93E+00

Gamma 4.24E+03

XE-133 2.54E+02

D&EG 2.54E+02

H-3 1.66E+09

Beta 1.66E+09

Total 1.66E+09

LIQUID RELEASE AND DOSE SUMMARY REPORT

----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases

Period Start Date.....: 01/01/2015 00:00

Period End Date.....: 01/01/2016 00:00

Period Duration (mins): 5.256E+05

Unit.....: 2

Receptor.....: Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===

Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
APWtr	6.08E-08	1.95E-02	1.95E-02	1.95E-02	1.95E-02	1.95E-02	0.00E+00	1.95E-02
AFWFSp	1.21E-05	5.03E-02	5.02E-02	5.02E-02	5.01E-02	5.93E-02	0.00E+00	5.05E-02
TPWtr	5.87E-08	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	0.00E+00	1.37E-02
TFWFSp	1.27E-05	3.87E-02	3.85E-02	3.86E-02	3.85E-02	4.49E-02	0.00E+00	3.89E-02
CPWtr	1.69E-07	2.63E-02	2.63E-02	2.63E-02	2.63E-02	2.64E-02	0.00E+00	2.64E-02
CFWFSp	1.57E-05	3.20E-02	3.19E-02	3.19E-02	3.19E-02	3.41E-02	0.00E+00	3.23E-02
IPWtr	2.02E-07	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02

----- TOTALS -----								
ADULT	1.22E-05	6.98E-02	6.96E-02	6.97E-02	6.96E-02	7.88E-02	0.00E+00	7.00E-02
TEEN	1.27E-05	5.24E-02	5.22E-02	5.23E-02	5.22E-02	5.86E-02	0.00E+00	5.26E-02
CHILD	1.58E-05	5.84E-02	5.83E-02	5.83E-02	5.82E-02	6.05E-02	0.00E+00	5.86E-02
INFANT	2.02E-07	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02

=== AGE GROUP / PATHWAY DESCRIPTIONS ===

Abbreviation	Age Group	Pathway
APWtr	ADULT	Potable Water (PWtr)
AFWFSp	ADULT	Fresh Water Fish - Sport (FFSP)
TPWtr	TEEN	Potable Water (PWtr)
TFWFSp	TEEN	Fresh Water Fish - Sport (FFSP)
CPWtr	CHILD	Potable Water (PWtr)
CFWFSp	CHILD	Fresh Water Fish - Sport (FFSP)
IPWtr	INFANT	Potable Water (PWtr)

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2
Receptor.....: Liquid Receptor

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) =====								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB

ADULT								
H-3	0.00E+00	6.96E-02	6.96E-02	6.96E-02	6.96E-02	6.96E-02	0.00E+00	6.96E-02
CR-51	0.00E+00	0.00E+00	4.07E-08	1.50E-08	9.04E-08	1.71E-05	0.00E+00	6.82E-08
MN-54	0.00E+00	4.80E-06	0.00E+00	1.43E-06	0.00E+00	1.47E-05	0.00E+00	9.16E-07
FE-59	1.30E-06	3.05E-06	0.00E+00	0.00E+00	8.52E-07	1.02E-05	0.00E+00	1.17E-06
CO-58	0.00E+00	6.90E-05	0.00E+00	0.00E+00	0.00E+00	1.40E-03	0.00E+00	1.55E-04
CO-60	0.00E+00	7.83E-05	0.00E+00	0.00E+00	0.00E+00	1.47E-03	0.00E+00	1.73E-04
ZR-95	3.95E-10	1.27E-10	0.00E+00	1.99E-10	0.00E+00	4.01E-07	0.00E+00	8.57E-11
NB-95	1.77E-06	9.84E-07	0.00E+00	9.73E-07	0.00E+00	5.97E-03	0.00E+00	5.29E-07
SB-124	6.77E-08	1.28E-09	1.65E-10	0.00E+00	5.28E-08	1.93E-06	0.00E+00	2.69E-08
SB-125	1.15E-07	1.28E-09	1.17E-10	0.00E+00	8.85E-08	1.26E-06	0.00E+00	2.73E-08
TE-132	8.88E-06	5.75E-06	6.35E-06	5.53E-05	0.00E+00	2.72E-04	0.00E+00	5.39E-06
I-132	4.05E-08	1.08E-07	3.79E-06	1.72E-07	0.00E+00	2.03E-08	0.00E+00	3.79E-08
I-133	2.80E-08	4.88E-08	7.17E-06	8.51E-08	0.00E+00	4.38E-08	0.00E+00	1.49E-08
TEEN								
H-3	0.00E+00	5.22E-02	5.22E-02	5.22E-02	5.22E-02	5.22E-02	0.00E+00	5.22E-02
CR-51	0.00E+00	0.00E+00	3.90E-08	1.54E-08	1.00E-07	1.18E-05	0.00E+00	7.02E-08
MN-54	0.00E+00	4.72E-06	0.00E+00	1.41E-06	0.00E+00	9.69E-06	0.00E+00	9.37E-07
FE-59	1.34E-06	3.12E-06	0.00E+00	0.00E+00	9.83E-07	7.38E-06	0.00E+00	1.20E-06
CO-58	0.00E+00	6.86E-05	0.00E+00	0.00E+00	0.00E+00	9.45E-04	0.00E+00	1.58E-04
CO-60	0.00E+00	7.83E-05	0.00E+00	0.00E+00	0.00E+00	1.02E-03	0.00E+00	1.76E-04
ZR-95	4.04E-10	1.28E-10	0.00E+00	1.87E-10	0.00E+00	2.94E-07	0.00E+00	8.77E-11
NB-95	1.78E-06	9.88E-07	0.00E+00	9.58E-07	0.00E+00	4.23E-03	0.00E+00	5.44E-07
SB-124	6.98E-08	1.29E-09	3.83E-07	0.00E+00	6.10E-08	1.41E-06	0.00E+00	9.33E-09
SB-125	1.18E-07	1.30E-09	1.13E-10	0.00E+00	1.04E-07	9.23E-07	0.00E+00	2.77E-08
TE-132	9.37E-06	5.93E-06	6.26E-06	5.69E-05	0.00E+00	1.88E-04	0.00E+00	5.59E-06
I-132	4.23E-08	1.11E-07	3.73E-06	1.74E-07	0.00E+00	4.82E-08	0.00E+00	3.97E-08
I-133	3.02E-08	5.12E-08	7.15E-06	8.98E-08	0.00E+00	3.87E-08	0.00E+00	1.56E-08
CHILD								
H-3	0.00E+00	5.82E-02	5.82E-02	5.82E-02	5.82E-02	5.82E-02	0.00E+00	5.82E-02
CR-51	0.00E+00	0.00E+00	4.17E-08	1.14E-08	7.61E-08	3.98E-06	0.00E+00	7.50E-08
MN-54	0.00E+00	3.70E-06	0.00E+00	1.04E-06	0.00E+00	3.10E-06	0.00E+00	9.85E-07
FE-59	1.63E-06	2.63E-06	0.00E+00	0.00E+00	7.63E-07	2.74E-06	0.00E+00	1.31E-06
CO-58	0.00E+00	5.52E-05	0.00E+00	0.00E+00	0.00E+00	3.22E-04	0.00E+00	1.69E-04
CO-60	0.00E+00	6.41E-05	0.00E+00	0.00E+00	0.00E+00	3.55E-04	0.00E+00	1.89E-04
ZR-95	5.48E-10	1.20E-10	0.00E+00	1.72E-10	0.00E+00	1.26E-07	0.00E+00	1.07E-10
NB-95	2.10E-06	8.19E-07	0.00E+00	7.69E-07	0.00E+00	1.51E-03	0.00E+00	5.85E-07
SB-124	1.14E-07	1.47E-09	2.52E-10	0.00E+00	6.32E-08	7.13E-07	0.00E+00	3.99E-08

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05

=== PERMIT ORGAN DOSE BY AGE GROUP AND NUCLIDE (mrem) ===								
Agegroup	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
SB-125	1.95E-07	1.50E-09	1.80E-10	0.00E+00	1.08E-07	4.65E-07	0.00E+00	4.07E-08
TE-132	1.17E-05	5.18E-06	7.55E-06	4.81E-05	0.00E+00	5.22E-05	0.00E+00	6.26E-06
I-132	5.37E-08	9.87E-08	4.58E-06	1.51E-07	0.00E+00	1.16E-07	0.00E+00	4.54E-08
I-133	3.94E-08	4.87E-08	9.05E-06	8.11E-08	0.00E+00	1.96E-08	0.00E+00	1.84E-08

INFANT

H-3	0.00E+00	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02	0.00E+00	2.59E-02
CR-51	0.00E+00	0.00E+00	1.85E-10	4.04E-11	3.60E-10	8.26E-09	0.00E+00	2.83E-10
MN-54	0.00E+00	8.21E-09	0.00E+00	1.82E-09	0.00E+00	3.02E-09	0.00E+00	1.86E-09
FE-59	1.44E-08	2.52E-08	0.00E+00	0.00E+00	7.44E-09	1.20E-08	0.00E+00	9.92E-09
CO-58	0.00E+00	1.04E-06	0.00E+00	0.00E+00	0.00E+00	2.59E-06	0.00E+00	2.60E-06
CO-60	0.00E+00	1.23E-06	0.00E+00	0.00E+00	0.00E+00	2.93E-06	0.00E+00	2.91E-06
ZR-95	1.15E-10	2.81E-11	0.00E+00	3.03E-11	0.00E+00	1.40E-08	0.00E+00	1.99E-11
NB-95	6.26E-11	2.58E-11	0.00E+00	1.85E-11	0.00E+00	2.18E-08	0.00E+00	1.49E-11
SB-124	6.04E-08	8.92E-10	1.60E-10	0.00E+00	3.78E-08	1.87E-07	0.00E+00	1.87E-08
SB-125	9.19E-08	8.89E-10	1.15E-10	0.00E+00	5.32E-08	1.23E-07	0.00E+00	1.89E-08
TE-132	2.88E-08	1.43E-08	2.10E-08	8.91E-08	0.00E+00	5.27E-08	0.00E+00	1.33E-08
I-132	3.39E-09	6.88E-09	3.22E-07	7.68E-09	0.00E+00	5.57E-09	0.00E+00	2.45E-09
I-133	2.53E-09	3.68E-09	6.69E-07	4.33E-09	0.00E+00	6.23E-10	0.00E+00	1.08E-09

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05
Unit.....: 2
Receptor.....: Liquid Receptor

=== MAXIMUM DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	ADULT	GILLI	7.88E-02	31-day Quarter Annual	1.50E-01 3.75E+00 7.50E+00	5.25E+01 2.10E+00 1.05E+00
Admin	Tot Body	ADULT	TBODY	7.00E-02	31-day Quarter Annual	4.50E-02 1.13E+00 2.25E+00	1.55E+02 6.22E+00 3.11E+00
T.Spec	Any Organ	ADULT	GILLI	7.88E-02	31-day Quarter Annual	2.00E-01 5.00E+00 1.00E+01	3.94E+01 1.58E+00 7.88E-01

Critical Pathway.....: Fresh Water Fish - Sport (FFSP)
Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
SB-125	1.60E-03
SB-124	2.45E-03
H-3	8.84E+01
CR-51	2.18E-02
MN-54	1.87E-02
FE-59	1.29E-02
CO-58	1.77E+00
CO-60	1.87E+00
ZR-95	5.09E-04
NB-95	7.58E+00
TE-132	3.45E-01
I-132	2.58E-05
I-133	5.56E-05

T.Spec	Tot Body	ADULT	TBODY	7.00E-02	31-day Quarter Annual	6.00E-02 1.50E+00 3.00E+00	1.17E+02 4.66E+00 2.33E+00
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Critical Pathway.....: Fresh Water Fish - Sport (FFSP)
Major Contributors.....: 0.0 % or greater to total
Nuclide Percentage

LIQUID RELEASE AND DOSE SUMMARY REPORT
----- (PERIOD BASIS - BY UNIT) -----

Release ID.....: All Liquid Releases
Period Start Date.....: 01/01/2015 00:00
Period End Date.....: 01/01/2016 00:00
Period Duration (mins): 5.256E+05

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
SB-125	3.90E-05
SB-124	3.84E-05
H-3	9.95E+01
CR-51	9.74E-05
MN-54	1.31E-03
FE-59	1.67E-03
CO-58	2.21E-01
CO-60	2.47E-01
ZR-95	1.22E-07
NB-95	7.56E-04
TE-132	7.71E-03
I-132	5.41E-05
I-133	2.13E-05

ATTACHMENT P

RETDAS COMPUTER PROGRAM U1 GASEOUS ANNUAL (FILTERED)
DOSE REPORT

BYRON STATION UNIT 1

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== RELEASE DATA ===
Total Release Duration (minutes)..... 5.256E+05
Total Release Volume (cf)..... 7.726E+10
Average Release Flowrate (cfm)..... 1.470E+05

Average Period Flowrate (cfm)..... 1.470E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	2.49E+07	1.14E-08	1.14E+00	1.00E-08
KR-85M	4.99E+06	2.28E-09	2.28E-02	1.00E-07
KR-85	7.00E+08	3.20E-07	4.57E-01	7.00E-07
KR-87	1.00E+06	4.57E-10	2.28E-02	2.00E-08
KR-88	7.99E+06	3.65E-09	4.06E-01	9.00E-09
XE-131M	3.89E+07	1.78E-08	8.90E-03	2.00E-06
XE-133M	1.50E+07	6.85E-09	1.14E-02	6.00E-07
XE-133	2.00E+09	9.13E-07	1.83E+00	5.00E-07
XE-135	1.50E+07	6.85E-09	9.79E-02	7.00E-08
XE-138	1.00E+06	4.57E-10	2.28E-02	2.00E-08
F&AG	2.81E+09	1.28E-06	4.02E+00	
I-131	5.10E+04	2.33E-11	1.16E-01	2.00E-10
I-133	7.00E+04	3.20E-11	3.20E-02	1.00E-09
Iodine	1.21E+05	5.53E-11	1.48E-01	
C-14	7.99E+06	3.65E-09	1.22E+00	3.00E-09
Other	7.99E+06	3.65E-09	1.22E+00	
H-3	1.00E+09	4.57E-07	4.57E+00	1.00E-07
H-3	1.00E+09	4.57E-07	4.57E+00	
MN-54	4.70E+03	2.15E-12	2.15E-03	1.00E-09
FE-59	1.60E+03	7.31E-13	1.46E-03	5.00E-10
CO-58	1.60E+04	7.31E-12	7.31E-03	1.00E-09
CO-60	7.29E+03	3.33E-12	6.66E-02	5.00E-11
SR-89	3.39E+02	1.55E-13	7.75E-04	2.00E-10
SR-90	6.19E+01	2.83E-14	4.72E-03	6.00E-12

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== NUCLIDE DATA =====

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
CS-134	4.70E+03	2.15E-12	1.07E-02	2.00E-10
CS-137	7.79E+03	3.56E-12	1.78E-02	2.00E-10
P>=8	4.25E+04	1.94E-11	1.12E-01	
Total	3.81E+09	1.74E-06	1.01E+01	

Verified By: _____ Date: _____

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	INFANT	THYROID	6.64E+00	31-day Quarter Annual	2.25E-01 5.63E+00 1.13E+01	2.95E+03 1.18E+02 5.90E+01
T.Spec	Any Organ	INFANT	THYROID	6.64E+00	31-day Quarter Annual	3.00E-01 7.50E+00 1.50E+01	2.21E+03 8.85E+01 4.43E+01

Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Critical Pathway.....: 5 Grs/Cow/Milk (CMILK)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.71E-01
C-14	1.19E+00
MN-54	1.17E-02
FE-59	7.83E-04
CO-58	1.09E-02
CO-60	2.81E-01
SR-89	1.32E-08
SR-90	0.00E+00
I-131	9.66E+01
I-133	1.26E+00
CS-134	5.86E-02
CS-137	2.46E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
AINHL	2.20E-03	1.08E-02	2.14E-02	1.07E-02	1.16E-02	1.07E-02	0.00E+00	1.07E-02
AVEG	1.17E-01	5.42E-02	2.73E-01	4.48E-02	4.03E-02	4.41E-02	0.00E+00	5.02E-02
ACMEAT	3.93E-02	1.25E-02	4.08E-02	1.10E-02	1.05E-02	1.26E-02	0.00E+00	1.20E-02
ACMILK	5.36E-02	3.41E-02	8.66E-01	2.46E-02	1.63E-02	1.60E-02	0.00E+00	2.83E-02
TGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
TINHL	3.14E-03	1.11E-02	2.44E-02	1.10E-02	1.23E-02	1.10E-02	0.00E+00	1.10E-02
TVEG	1.86E-01	7.74E-02	2.49E-01	6.26E-02	5.70E-02	5.95E-02	0.00E+00	6.41E-02
TCMEAT	3.31E-02	9.81E-03	3.01E-02	8.63E-03	8.20E-03	9.27E-03	0.00E+00	8.86E-03
TCMILK	9.82E-02	5.76E-02	1.37E+00	4.11E-02	2.71E-02	2.53E-02	0.00E+00	3.77E-02
CGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
CINHL	4.32E-03	1.01E-02	2.55E-02	1.00E-02	1.11E-02	9.92E-03	0.00E+00	9.95E-03
CVEG	4.46E-01	1.50E-01	4.08E-01	1.26E-01	1.17E-01	1.16E-01	0.00E+00	1.21E-01
CCMEAT	6.23E-02	1.63E-02	4.74E-02	1.48E-02	1.42E-02	1.46E-02	0.00E+00	1.47E-02
CCMILK	2.40E-01	1.08E-01	2.72E+00	7.94E-02	5.59E-02	5.17E-02	0.00E+00	6.37E-02
IGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
IINHL	3.16E-03	6.02E-03	2.02E-02	5.94E-03	6.62E-03	5.86E-03	0.00E+00	5.89E-03
ICMILK	4.55E-01	2.12E-01	6.58E+00	1.46E-01	1.08E-01	9.92E-02	0.00E+00	1.15E-01
----- TOTALS -----								
ADULT	2.52E-01	1.52E-01	1.24E+00	1.32E-01	1.19E-01	1.24E-01	0.00E+00	1.42E-01
TEEN	3.62E-01	1.96E-01	1.71E+00	1.64E-01	1.45E-01	1.46E-01	0.00E+00	1.62E-01
CHILD	7.93E-01	3.25E-01	3.24E+00	2.70E-01	2.38E-01	2.33E-01	0.00E+00	2.50E-01
INFANT	4.98E-01	2.59E-01	6.64E+00	1.92E-01	1.55E-01	1.46E-01	0.00E+00	1.61E-01

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

=== AGE GROUP / PATHWAY DESCRIPTIONS ===
Abbreviation Age Group Pathway

CVEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 1

=== MAXIMUM NG DOSE FOR PERIOD =====					
Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	6.57E-02	31-day	1.50E-01	4.38E+01
			Quarter	3.75E+00	1.75E+00
			Annual	7.50E+00	8.75E-01
Admin	Beta	5.27E-02	31-day	3.00E-01	1.76E+01
			Quarter	7.50E+00	7.02E-01
			Annual	1.50E+01	3.51E-01
T.Spec	Gamma	6.57E-02	31-day	2.00E-01	3.28E+01
			Quarter	5.00E+00	1.31E+00
			Annual	1.00E+01	6.57E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.05E+01
KR-85M	5.42E-01
KR-85	1.06E+00
KR-87	5.45E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133M	4.33E-01
XE-133	6.23E+01
XE-135	2.54E+00
XE-138	8.14E-01

T.Spec	Beta	5.27E-02	31-day	4.00E-01	1.32E+01
			Quarter	1.00E+01	5.27E-01
			Annual	2.00E+01	2.63E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 1

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.21E+00
KR-85M	2.66E-01
KR-85	3.69E+01
KR-87	2.79E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133M	6.00E-01
XE-133	5.68E+01
XE-135	9.98E-01
XE-138	1.29E-01

ATTACHMENT Q

RETDAS COMPUTER PROGRAM U2 GASEOUS ANNUAL (FILTERED)
DOSE REPORT

BYRON STATION UNIT 2

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== RELEASE DATA ===
 Total Release Duration (minutes)..... 5.256E+05
 Total Release Volume (cf)..... 7.726E+10
 Average Release Flowrate (cfm)..... 1.470E+05

Average Period Flowrate (cfm)..... 1.470E+05

=== NUCLIDE DATA ===

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
AR-41	2.49E+07	1.14E-08	1.14E+00	1.00E-08
KR-85M	4.99E+06	2.28E-09	2.28E-02	1.00E-07
KR-85	7.00E+08	3.20E-07	4.57E-01	7.00E-07
KR-87	1.00E+06	4.57E-10	2.28E-02	2.00E-08
KR-88	7.99E+06	3.65E-09	4.06E-01	9.00E-09
XE-131M	3.89E+07	1.78E-08	8.90E-03	2.00E-06
XE-133M	1.50E+07	6.85E-09	1.14E-02	6.00E-07
XE-133	2.00E+09	9.13E-07	1.83E+00	5.00E-07
XE-135	1.50E+07	6.85E-09	9.79E-02	7.00E-08
XE-138	1.00E+06	4.57E-10	2.28E-02	2.00E-08
F&AG	2.81E+09	1.28E-06	4.02E+00	
I-131	5.10E+04	2.33E-11	1.16E-01	2.00E-10
I-133	7.00E+04	3.20E-11	3.20E-02	1.00E-09
Iodine	1.21E+05	5.53E-11	1.48E-01	
C-14	7.99E+06	3.65E-09	1.22E+00	3.00E-09
Other	7.99E+06	3.65E-09	1.22E+00	
H-3	1.00E+09	4.57E-07	4.57E+00	1.00E-07
H-3	1.00E+09	4.57E-07	4.57E+00	
MN-54	4.70E+03	2.15E-12	2.15E-03	1.00E-09
FE-59	1.60E+03	7.31E-13	1.46E-03	5.00E-10
CO-58	1.60E+04	7.31E-12	7.31E-03	1.00E-09
CO-60	7.29E+03	3.33E-12	6.66E-02	5.00E-11
SR-89	3.39E+02	1.55E-13	7.75E-04	2.00E-10
SR-90	6.19E+01	2.83E-14	4.72E-03	6.00E-12

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== NUCLIDE DATA =====

Nuclide	uCi	Average uCi/cc	EC Ratio	EC
CS-134	4.70E+03	2.15E-12	1.07E-02	2.00E-10
CS-137	7.79E+03	3.56E-12	1.78E-02	2.00E-10
P>=8	4.25E+04	1.94E-11	1.12E-01	
Total	3.81E+09	1.74E-06	1.01E+01	

Verified By: _____ Date: _____

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM I&P DOSE FOR PERIOD =====							
Limit Type	Organ Type	Age Group	Organ	Dose (mrem)	Limit Period	Limit (mrem)	Percent of Limit
Admin	Any Organ	INFANT	THYROID	6.64E+00	31-day	2.25E-01	2.95E+03
					Quarter	5.63E+00	1.18E+02
					Annual	1.13E+01	5.90E+01
T.Spec	Any Organ	INFANT	THYROID	6.64E+00	31-day	3.00E-01	2.21E+03
					Quarter	7.50E+00	8.85E+01
					Annual	1.50E+01	4.43E+01

Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Critical Pathway.....: 5 Grs/Cow/Milk (CMILK)
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
H-3	3.71E-01
C-14	1.19E+00
MN-54	1.17E-02
FE-59	7.83E-04
CO-58	1.09E-02
CO-60	2.81E-01
SR-89	1.32E-08
SR-90	0.00E+00
I-131	9.66E+01
I-133	1.26E+00
CS-134	5.86E-02
CS-137	2.46E-01

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== PERIOD ORGAN DOSE BY AGE GROUP AND PATHWAY (mrem) ===								
Age/Path	Bone	Liver	Thyroid	Kidney	Lung	GI-Lli	Skin	TB
AGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
AINHL	2.20E-03	1.08E-02	2.14E-02	1.07E-02	1.16E-02	1.07E-02	0.00E+00	1.07E-02
AVEG	1.17E-01	5.42E-02	2.73E-01	4.48E-02	4.03E-02	4.41E-02	0.00E+00	5.02E-02
ACMEAT	3.93E-02	1.25E-02	4.08E-02	1.10E-02	1.05E-02	1.26E-02	0.00E+00	1.20E-02
ACMILK	5.36E-02	3.41E-02	8.66E-01	2.46E-02	1.63E-02	1.60E-02	0.00E+00	2.83E-02
TGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
TINHL	3.14E-03	1.11E-02	2.44E-02	1.10E-02	1.23E-02	1.10E-02	0.00E+00	1.10E-02
TVEG	1.86E-01	7.74E-02	2.49E-01	6.26E-02	5.70E-02	5.95E-02	0.00E+00	6.41E-02
TCMEAT	3.31E-02	9.81E-03	3.01E-02	8.63E-03	8.20E-03	9.27E-03	0.00E+00	8.86E-03
TCMILK	9.82E-02	5.76E-02	1.37E+00	4.11E-02	2.71E-02	2.53E-02	0.00E+00	3.77E-02
CGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
CINHL	4.32E-03	1.01E-02	2.55E-02	1.00E-02	1.11E-02	9.92E-03	0.00E+00	9.95E-03
CVEG	4.46E-01	1.50E-01	4.08E-01	1.26E-01	1.17E-01	1.16E-01	0.00E+00	1.21E-01
CCMEAT	6.23E-02	1.63E-02	4.74E-02	1.48E-02	1.42E-02	1.46E-02	0.00E+00	1.47E-02
CCMILK	2.40E-01	1.08E-01	2.72E+00	7.94E-02	5.59E-02	5.17E-02	0.00E+00	6.37E-02
IGPD	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	4.06E-02	0.00E+00	4.06E-02
IINHL	3.16E-03	6.02E-03	2.02E-02	5.94E-03	6.62E-03	5.86E-03	0.00E+00	5.89E-03
ICMILK	4.55E-01	2.12E-01	6.58E+00	1.46E-01	1.08E-01	9.92E-02	0.00E+00	1.15E-01
----- TOTALS -----								
ADULT	2.52E-01	1.52E-01	1.24E+00	1.32E-01	1.19E-01	1.24E-01	0.00E+00	1.42E-01
TEEN	3.62E-01	1.96E-01	1.71E+00	1.64E-01	1.45E-01	1.46E-01	0.00E+00	1.62E-01
CHILD	7.93E-01	3.25E-01	3.24E+00	2.70E-01	2.38E-01	2.33E-01	0.00E+00	2.50E-01
INFANT	4.98E-01	2.59E-01	6.64E+00	1.92E-01	1.55E-01	1.46E-01	0.00E+00	1.61E-01

=== AGE GROUP / PATHWAY DESCRIPTIONS ===		
Abbreviation	Age Group	Pathway
AGPD	ADULT	Ground Plane Deposition (GPD)
AINHL	ADULT	Inhalation (INHL)
AVEG	ADULT	Vegetation (VEG)
ACMEAT	ADULT	Grs/Cow/Meat (CMEAT)
ACMILK	ADULT	Grs/Cow/Milk (CMILK)
TGPD	TEEN	Ground Plane Deposition (GPD)
TINHL	TEEN	Inhalation (INHL)
TVEG	TEEN	Vegetation (VEG)
TCMEAT	TEEN	Grs/Cow/Meat (CMEAT)
TCMILK	TEEN	Grs/Cow/Milk (CMILK)
CGPD	CHILD	Ground Plane Deposition (GPD)
CINHL	CHILD	Inhalation (INHL)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

=== AGE GROUP / PATHWAY DESCRIPTIONS =====
Abbreviation Age Group Pathway

CPEG CHILD Vegetation (VEG)
CCMEAT CHILD Grs/Cow/Meat (CMEAT)
CCMILK CHILD Grs/Cow/Milk (CMILK)
IGPD INFANT Ground Plane Deposition (GPD)
IINHL INFANT Inhalation (INHL)
ICMILK INFANT Grs/Cow/Milk (CMILK)

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
 (Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
 Period Start Date.....: 01/01/2017 00:00
 Period End Date.....: 01/01/2018 00:00
 Period Duration (min): 5.256E+05
 Coefficient Type.....: Historical
 Unit.....: 2

=== MAXIMUM NG DOSE FOR PERIOD =====

Limit Type	Dose Type	Dose (mrad)	Limit Period	Limit (mrad)	Percent of Limit
Admin	Gamma	6.57E-02	31-day	1.50E-01	4.38E+01
			Quarter	3.75E+00	1.75E+00
			Annual	7.50E+00	8.75E-01
Admin	Beta	5.27E-02	31-day	3.00E-01	1.76E+01
			Quarter	7.50E+00	7.02E-01
			Annual	1.50E+01	3.51E-01
T.Spec	Gamma	6.57E-02	31-day	2.00E-01	3.28E+01
			Quarter	5.00E+00	1.31E+00
			Annual	1.00E+01	6.57E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0
 Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
AR-41	2.05E+01
KR-85M	5.42E-01
KR-85	1.06E+00
KR-87	5.45E-01
KR-88	1.07E+01
XE-131M	5.37E-01
XE-133M	4.33E-01
XE-133	6.23E+01
XE-135	2.54E+00
XE-138	8.14E-01

T.Spec	Beta	5.27E-02	31-day	4.00E-01	1.32E+01
			Quarter	1.00E+01	5.27E-01
			Annual	2.00E+01	2.63E-01

Receptor.....: 4 Composite Crit. Receptor - NG
 Distance (meters).....: 0.0
 Compass Point.....: 0.0

GASEOUS RELEASE AND DOSE SUMMARY REPORT - BY UNIT
(Composite Critical Receptor - Limited Analysis)

Release ID.....: 1 All Gas Release Types
Period Start Date....: 01/01/2017 00:00
Period End Date.....: 01/01/2018 00:00
Period Duration (min): 5.256E+05
Coefficient Type.....: Historical
Unit.....: 2

Major Contributors.....: 0.0 % or greater to total

Nuclide	Percentage
-----	-----
AR-41	2.21E+00
KR-85M	2.66E-01
KR-85	3.69E+01
KR-87	2.79E-01
KR-88	6.33E-01
XE-131M	1.17E+00
XE-133M	6.00E-01
XE-133	5.68E+01
XE-135	9.98E-01
XE-138	1.29E-01

Licensed Engineer Certification Page
Page 1 of 1

CERTIFICATION OF CALCULATION NUMBER(s): BYR16-012, Rev. 0

I certify that the Calculation(s) listed above was prepared by me or under my personal supervision or developed in conjunction with the use of accepted engineering standards and that I am a Licensed Professional Engineer under the laws of the State of Illinois.

Certified by: *Richard M. Chittenden* Date: 12/14/2016

Seal Below



Expires: 11/30/2017