UNIVERSITY *of* MISSOURI

RESEARCH REACTOR CENTER

April 15, 2016

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

REFERENCE: Docket 50-186
University of Missouri-Columbia Research Reactor
Amended Facility Operating License No. R-103

SUBJECT: Written communication as specified by 10 CFR 50.4(b)(1) regarding responses to the "University of Missouri at Columbia – Clarifications Needed to Nuclear Regulatory Commission Staff Request for Additional Information Regarding the Renewal of Facility Operating License No. R-103 for the University of Missouri at Columbia Research Reactor (TAC No. ME1580)," dated March 23, 2016

On August 31, 2006, the University of Missouri-Columbia Research Reactor (MURR) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) to renew Amended Facility Operating License No. R-103.

By letter dated May 6, 2010, the NRC requested additional information and clarification regarding the renewal request in the form of nineteen (19) Complex Questions. By letter dated September 3, 2010, MURR responded to seven (7) of those Complex Questions.

By letter dated June 1, 2010, the NRC requested additional information and clarification regarding the renewal request in the form of one hundred and sixty-seven (167) 45-Day Response Questions. By letter dated July 16, 2010, MURR responded to forty-seven (47) of those 45-Day Response Questions.

On July 14, 2010, via electronic mail (email), MURR requested additional time to respond to the remaining one hundred and twenty (120) 45-Day Response Questions. By letter dated August 4, 2010, the NRC granted the request. By letter dated August 31, 2010, MURR responded to fifty-three (53) of the 45-Day Response Questions.

On September 1, 2010, via email, MURR requested additional time to respond to the remaining twelve (12) Complex Questions. By letter dated September 27, 2010, the NRC granted the request.

1513 Research Park Drive Columbia, MO 65211 Phone: 573-882-4211 Fax: 573-882-6360 Web: www.murr.missouri.edu

On September 29, 2010, via email, MURR requested additional time to respond to the remaining sixty-seven (67) 45-Day Response Questions. On September 30, 2010, MURR responded to sixteen (16) of the remaining 45-Day Questions. By letter dated October 13, 2010, the NRC granted the extension request.

By letter dated October 29, 2010, MURR responded to sixteen (16) of the remaining 45-Day Response Questions and two (2) of the remaining Complex Questions.

By letter dated November 30, 2010, MURR responded to twelve (12) of the remaining 45-Day Response Questions.

On December 1, 2010, via email, MURR requested additional time to respond to the remaining 45-Day Response and Complex Questions. By letter dated December 13, 2010, the NRC granted the extension request.

On January 14, 2011, via email, MURR requested additional time to respond to the remaining 45-Day Response and Complex Questions. By letter dated February 1, 2011, the NRC granted the extension request.

By letter dated March 11, 2011, MURR responded to twenty-one (21) of the remaining 45-Day Response Questions.

On May 27, 2011, via email, MURR requested additional time to respond to the remaining 45-Day Response and Complex Questions. By letter dated July 5, 2011, the NRC granted the request.

By letter dated September 8, 2011, MURR responded to six (6) of the remaining 45-Day Response and Complex Questions.

On September 30, 2011, via email, MURR requested additional time to respond to the remaining the remaining 45-Day Response and Complex Questions. By letter dated November 10, 2011, the NRC granted the request.

By letter dated January 6, 2012, MURR responded to four (4) of the remaining 45-Day Response and Complex Questions. Also submitted was an updated version of the MURR Technical Specifications.

On January 23, 2012, via email, MURR requested additional time to respond to the remaining the remaining 45-Day Response and Complex Questions. By letter dated January 26, 2012, the NRC granted the request.

On April 12, 2012, via email, MURR requested additional time to respond to the remaining the remaining 45-Day Response and Complex Questions.

By letter dated June 28, 2012, MURR responded to the remaining six (6) 45-Day Response and Complex Questions. With that set of responses, all 45-Day Response and Complex Questions had been addressed.

By letter dated December 20, 2012, the NRC requested a copy of the current Physical Security Plan (PSP) and Operator Requalification Program.

By letter dated January 4, 2013, MURR provided the NRC a copy of the current PSP and Operator Requalification Program.

By letter dated February 11, 2013, the NRC requested updated financial information in the form of four (4) questions because the information provided by the September 14, 2009 response had become outdated.

By letter dated March 12, 2013, MURR responded to the four (4) questions.

By letter dated December 3, 2014, the NRC requested additional information in the form of two (2) questions regarding significant changes to the MURR facility since submittal of the licensing renewal application in August 2006.

By letter dated January 28, 2015, MURR responded to the two (2) questions.

By letter dated April 17, 2015, the NRC requested additional information in the form of ten (10) questions.

On May 29, 2015, via email, MURR requested additional time to respond to the ten (10) questions.

By letter dated June 18, 2015, the NRC requested additional information in the form of two (2) questions.

By letter dated July 31, 2015, MURR responded to the two (2) questions from the June 18, 2015 request.

On September 14, 2015, via telephone, the NRC requested a copy of the Emergency Plan (EP).

By letter dated September 14, 2015, the NRC requested additional information in the form of fifteen (15) questions regarding the PSP.

By letter dated September 15, 2015, MURR provided the NRC a copy of the current EP.

By letter dated October 1, 2015, MURR responded to the ten (10) questions from the April 17, 2015 request.

By letter dated December 2, 2015, MURR responded to the fifteen (15) questions from the September 14, 2015 request regarding the PSP.

By letter dated December 17, 2015, the NRC requested additional information in the form of thirteen (13) questions regarding follow-up information from MURR's October 1, 2015 responses to the NRC's April 17, 2015 request for additional information.

By letter dated February 8, 2016, MURR responded to the thirteen (13) questions from the December 17, 2015 request.

By letter dated February 8, 2016, the NRC requested updated financial information in the form of four (4) questions because the information provided by the March 12, 2013 response had become outdated.

By letter dated March 23, 2016, the NRC requested additional information in the form of twenty-one (21) questions regarding follow-up information from MURR's February 8, 2016 responses to the NRC's April 17, 2015 request for additional information.

By letter dated April 8, 2016, MURR responded to the four (4) financial information questions.

The March 23, 2016 questions, and MURR's responses to those questions, are attached.

If there are any questions regarding this response, please contact me at (573) 882-5319 or FruitsJ@missouri.edu. I declare under penalty of perjury that the foregoing is true and correct.

Sincerely,

John L. Fruits
Reactor Manager

ENDORSEMENT:
Reviewed and Approved,

Ralph A. Butler, P.E.
Director

State of Missouri
County of Boone
Subscribed and sworn to before me this 15 day of April, 2016
Jacqueline L. Bohm, Notary Public
My Commission Expires: March 26, 2019

JACQUELINE L. BOHM
Notary Public-Notary Seal
STATE OF MISSOURI
Commissioned for Howard County
My Commission Expires: March 26, 2019
Commission # 15634308

xc: Reactor Advisory Committee
Reactor Safety Subcommittee
Dr. Garnett S. Stokes, Provost
Dr. Mark McIntosh, Vice Chancellor for Research, Graduate Studies and Economic Development
Mr. Alexander Adams Jr., U.S. Nuclear Regulatory Commission
Mr. Geoffrey Wertz, U.S. Nuclear Regulatory Commission
Mr. Johnny Eads, U.S. Nuclear Regulatory Commission

Attachments:

1. Fuel Failure during Reactor Operation and Fuel Handling Accident Source Terms – MONTEBURNS Output File
2. Fuel Failure during Reactor Operation – Excel Spreadsheet Dose Calculations – Restricted Area
3. Fuel Failure during Reactor Operation – Excel Spreadsheet Dose Calculations – Unrestricted Area
4. Calculated Derived Air Concentration Values for Kr-89, Kr-90, Xe-137 and Xe-139
5. Containment Building – Excel Spreadsheet Leakage Rate

6. Fuel Failure during Reactor Operation – MicroShield 8.02 Dose Calculations
7. Fuel Handling Accident – Excel Spreadsheet Dose Calculations – Restricted Area
8. Fuel Handling Accident – Excel Spreadsheet Dose Calculations – Unrestricted Area
9. Fuel Handling Accident – MicroShield 8.02 Dose Calculations
10. Fueled Experiment Failure – Excel Spreadsheet Dose Calculations – Restricted Area
11. Fueled Experiment Failure – Excel Spreadsheet Dose Calculations – Unrestricted Area
12. Fueled Experiment Failure – MicroShield 8.02 Dose Calculations

Note: The numbering in the column labeled "RAI No." corresponds to the RAIs issued by NRC letter dated April 17, 2015. The brackets [page] at the end of each item indicate the page number on the RAI response provided by MURR letter dated February 8, 2016.

RAI No. 3.c. – Information/Clarification Needed

- *Provide control blade D total reactivity worth – measured and calculated in numerical form (not graphical) [page 9].*

  In order to benchmark the MCNP core and control blade model, the measured total control blade worth for control blade 'D' was compared against the MCNP calculated total control blade worth. The results are shown in the Table below.

Control Blade	Total Reactivity Worth – Measured ($\Delta k/k$)	Total Reactivity Worth - Calculated ($\Delta k/k$)
D	-0.0355	-0.0364

RAI No. 7.g. – Information/Clarification Needed

- *Explain origin of source term data provided in RAI response [page 19].*

  For operation at 10 MW for 1,200 MWd in twelve 10-day cycles over a 300-day period with 6.2 Kg of ^{235}U (normal operating cycle is 6.5 days with a total of less than 700 MWd on the core), the radioiodine, krypton and xenon activities listed in the "Fuel Failure during Reactor Operation" accident analysis will conservatively be present in the core.

  Due to the complex nature of the MURR mixed core fuel cycle, the source term was determined using the computer program MONTEBURNS instead of simplistic ORIGEN runs. MONTEBURNS is a coupled MCNP-ORIGEN code system developed by Los Alamos National Laboratory (LANL). Within the MONTEBURNS program, MCNP calculations are used to obtain accurate one-group fluxes and one-group cross sections that are then utilized by ORIGEN for fuel depletion and fission product activity calculations. The use of MONTEBURNS and the flow diagram utilized for various neutronic computations at MURR were described in detail in the response to Request for Additional Information (RAI) Question 3.a (MURR letter dated October 1, 2015).

  Using MONTEBURNS to simulate the burnup of all eight (8) fuel elements for the core configuration beginning with an all-fresh core for the aforementioned hypothetical operational cycle, the source term for the "Fuel Failure during Reactor Operation" analysis was derived from summing the noble gases and iodine fission products inventories from all eight (8) fuel elements at the end of 300 days (i.e., at the End-of-Irradiation of cycle 12). The source term for the "Fuel Handling Accident (FHA)" analysis was similarly derived using the same radionuclides by extending the previous 300-day

MONTEBURNS simulation and decaying it for 30 minutes (i.e., 0.0208 days after the End-of-Irradiation of cycle 12).

- *Provide Attachment 4 in landscape mode to eliminate data wrapping around the next line, remove transport edits, and provide an explanation to translate calculated radioisotope inventories into the RAI response inventory.*

  Attached is the MONTEBURNS output file (Attachment 1) which provides the sources terms for both the "Fuel Failure during Reactor Operation" and "Fuel Handling Accident (FHA)" analyses.

- *Provide the equations (or spreadsheets) for calculations from Attachments 5 and 6.*

  Attached are the new spreadsheets (Attachments 2 and 3) for the "Fuel Failure during Reactor Operation" restricted and unrestricted area doses. Additionally, the equations are better defined in the revised accident analysis, which is attached at the end of the Fuel Failure during Reactor Operation section.

RAI No. 7.g.iv. – Information/Clarification Needed

- *Correct Kr-90 dose by eliminating the negative dose contribution from the curve fit [page 20].*

  The negative dose contribution from the curve fit has been eliminated; therefore, the new Kr-90 Derived Air Concentration value is 2.8 x 10^{-06} µCi/ml (see Attachment 4). This value now reflects that the whole body is the limiting organ and not the skin as in the previous analysis.

- *Review/correct the gamma source terms.*

  The gamma source terms have been corrected (see Attachment 4).

- *Correct reference to Attachment 7 (not Attachment 5 as indicated).*

  Attachment 5 was improperly referenced in the previous MURR response, by letter dated February 8, 2016. It should have referenced Attachment 7 in the "Fuel Failure during Reactor Operation" accident analysis. The revised "Calculated Derived Air Concentration Values for Kr-89, Kr-90, Xe-137 and Xe-139" is now Attachment 4 to this response.

- *Provide an updated Attachment 7.*

  Attachment 7 has been updated; it is now labeled Attachment 4 in this response.

RAI No. 9.b.ii. – Information/Clarification Needed

- *Explain the source term for the 30 minutes decay [page 38].*

As described in the response to RAI No. 7.g. above, for operation at 10 MW for 1,200 MWd in twelve 10-day cycles over a 300-day period with 6.2 Kg of ^{235}U (normal operating cycle is 6.5 days with a total of less than 700 MWd on the core), the radioiodine, krypton and xenon activities listed in the "Fuel Failure during Reactor Operation" accident analysis will conservatively be present in the core.

Due to the complex nature of the MURR mixed core fuel cycle, the source term was determined using the computer program MONTEBURNS instead of simplistic ORIGEN runs. MONTEBURNS is a coupled MCNP-ORIGEN code system developed by Los Alamos National Laboratory (LANL). Within the MONTEBURNS program, MCNP calculations are used to obtain accurate one-group fluxes and one-group cross sections that are then utilized by ORIGEN for fuel depletion and fission product activity calculations. The use of MONTEBURNS and the flow diagram utilized for various neutronic computations at MURR were described in detail in the response to Request for Additional Information (RAI) Question 3.a (MURR letter dated October 1, 2015).

Using MONTEBURNS to simulate the burnup of all eight (8) fuel elements for the core configuration beginning with an all-fresh core for the aforementioned hypothetical operational cycle, the source term for the "Fuel Failure during Reactor Operation" analysis was derived from summing the noble gases and iodine fission products inventories from all eight (8) fuel elements at the end of 300 days (i.e., at the End-of-Irradiation of cycle 12). The source term for the "Fuel Handling Accident (FHA)" analysis was similarly derived using the same radionuclides by extending the previous 300-day MONTEBURNS simulation and decaying it for 30 minutes (i.e., 0.0208 days after the End-of-Irradiation of cycle 12).

Attachment 1 is the MONTEBURNS output which provides the sources terms for both the "Fuel Failure during Reactor Operation" and "Fuel Handling Accident (FHA)" analyses.

Fuel Failure During Reactor Operation Analysis [page 22] – Information/Clarification Needed

- *Explain the origin of core inventory of isotopes (which we now understand is not from Attachment 2) [page 24].*

  As described in the response to RAI No. 7.g. above, for operation at 10 MW for 1,200 MWd in twelve 10-day cycles over a 300-day period with 6.2 Kg of ^{235}U (normal operating cycle is 6.5 days with a total of less than 700 MWd on the core), the radioiodine, krypton and xenon activities listed in the "Fuel Failure during Reactor Operation" accident analysis will conservatively be present in the core.

  Due to the complex nature of the MURR mixed core fuel cycle, the source term was determined using the computer program MONTEBURNS instead of simplistic ORIGEN runs. MONTEBURNS is a coupled MCNP-ORIGEN code system developed by Los Alamos National Laboratory (LANL). Within the MONTEBURNS program, MCNP calculations are used to obtain accurate one-group fluxes and one-group cross sections that are then utilized by ORIGEN for fuel depletion and fission product activity calculations. The use of MONTEBURNS and the flow diagram utilized for various neutronic computations at MURR were described in detail in the response to Request for Additional Information (RAI) Question 3.a (MURR letter dated October 1, 2015).

  Using MONTEBURNS to simulate the burnup of all eight (8) fuel elements for the core configuration beginning with an all-fresh core for the aforementioned hypothetical operational cycle, the source term for the "Fuel Failure during Reactor Operation" analysis was derived from summing the noble gases and iodine fission products inventories from all eight (8) fuel elements at the end of 300 days (i.e., at the End-of-Irradiation of cycle 12). The source term for the "Fuel Handling Accident (FHA)" analysis was similarly derived using the same radionuclides by extending the previous 300-day MONTEBURNS simulation and decaying it for 30 minutes (i.e., 0.0208 days after the End-of-Irradiation of cycle 12).

  Attachment 1 is the MONTEBURNS output which provides the sources terms for both the "Fuel Failure during Reactor Operation" and "Fuel Handling Accident (FHA)" analyses.

- *The mass transport equation is not clear, bracketing appears inconsistent – provide step-by-step description of the transport process with supporting equations for clarity [page 26].*

  The "Fuel Failure during Reactor Operation" analysis has been revised to provide a step-by-step description of the transport process with supporting equations.

- *Clarify how the current MURR TS 4.2.c containment building leakage rate is being used as the assumption for the leakage in the analysis [page 30].*

  As described in detail in the revised "Fuel Failure during Reactor Operation" accident analysis, the containment building ventilation system will shut down and the building itself will be isolated from the surrounding areas. Fuel failure will not cause an increase in pressure inside the reactor

containment structure; therefore, any air leakage from the building will occur as a result of normal changes in atmospheric pressure and pressure equilibrium between the inside of the containment structure and the outside atmosphere. It is highly probable that there will be no pressure differential between the inside of the containment building and the outside atmosphere, and consequently there will be no air leakage from the building and no radiation dose to members of the public in the unrestricted area. However, to develop what would clearly be a worst-case scenario, this analysis assumes that a barometric pressure drop has occurred in conjunction with fuel failure. An extreme assumption would be a pressure change on the order of 0.7 inches of Hg (25.4 mm of Hg at 22 °C) from an initial atmospheric pressure of 15.0333 psia. This would then create a pressure differential of about 1/3 psig (2.28 kPa above atmosphere) higher on the inside of the isolated containment building than on the inside of the adjacent laboratory building, which surrounds most of the containment structure. With an initial internal pressure in the containment building of 15.0333 psia, it would contain 230,102 standard cubic feet (scf) of air. The conservative assumption is made that the containment building will leak at a rate slightly greater than the Technical Specification (TS) leakage rate limit. The TS leakage rate limit shall not exceed either 16.3 ft^3/min (STP) with an overpressure of one pound per square inch gauge or 10% of the contained volume over a 24-hour period from an initial overpressure of two pounds per square inch gauge. Additionally, the minimum TS free volume of the containment building is 225,000-ft^3 at standard pressure and temperature.

The following equation represents the air leakage rate from the containment building in standard cubic feet per minute (scfm) as a function of containment pressure which at 1 psi over pressure would corresponds to 17.68 ft^3/minute. This would correspond to a leakage rate 8.4 % greater than the TS limit of 16.3 ft^3/minute at 1.0 psig.

$$LR = 17.68 \times (CP-14.7)^{1/2}$$

where:

LR = leakage rate from containment (scfm); and
CP = containment pressure (psia).

Using this equation for the assumed initial overpressure condition of 0.333 psig (2.28 kPa above atmosphere), it would take approximately 16.5 hours for the leakage rate to decrease to zero from an initial leakage rate of approximately 10.25 scfm, which would occur at the start of the event. The average leakage rate over the 16.5-hour period would be approximately 5.15 scfm.

Attached is an Excel spreadsheet (Attachment 5) that provides the leakage rates from the point of when the accident occurs (t = 0) to the point when the isolated containment building has equalized in pressure with the adjacent laboratory building (t = 16.5 hrs).

- *The analysis uses an iodine reduction factor of 75 percent. The NRC staff noted (from Attachment 13) that MURR previously used an iodine reduction factor of 50 percent in accordance with the guidance in Regulatory Guide 1.3 in support of MURR License Amendment No. 8. The NRC staff needs additional information to understand the technical basis for use of an iodine reduction factor of 75 percent in the current fuel failure analyses [page 31].*

  The analysis has been revised using the guidance of Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors," which employs a 50% reduction of radioiodines from plate-out and deposition.

- *The analysis indicates that there was no decay applied to the isotopes, but it appears that the decay of source isotopes was performed. Explain [page 32].*

  No decay is applied to the isotopes from the time they exit the ventilation exhaust stack to when they reach the receptor point in the unrestricted area. Decay is only calculated for the time the isotopes are in the isolated containment building, not after they leak out of the containment structure due to an assumed worst-case pressure differential.

- *Derived Air Concentration values for Kr-89, Kr-90, Xe-137, and Xe-139 were divided by 300. Title 10 of the Code of Federal Regulations Part 20, Appendix B, uses a factor of 219, which the NRC staff will also use. Consider revision using a factor of 219 [page 35].*

  The "Fuel Failure during Reactor Operation" accident analysis has been revised using the 10 CFR 20 Appendix B factor of 219, instead of 300.

Revised "Fuel Failure during Reactor Operation"

(Formerly the MHA)

13.2.1 Fuel Failure during Reactor Operation

13.2.1.1 Accident-Initiating Events and Scenarios

Many types of accidents have been considered in conjunction with the operation of the MURR. In all cases, safety systems have been designed such that the likelihood of an accident involving the release of a significant amount of fission products has essentially been eliminated. The safety systems take the form of automatic reactor shutdown circuits and process systems designed to ensure, through redundancy, that the reactor will shut down upon a significant deviation from normal operating conditions. In addition, the reactor is housed within a containment building, thus providing further protection against a significant release of radioactive material to the environment.

In the "Fuel Failure during Reactor Operation" accident for the MURR, it is assumed that an accident condition has caused the melting of the number-1 fuel plate in four (4) separate fuel elements (Ref. 13.11). It is further assumed that the four (4) number-1 fuel plates are in the peak power region of the core.

While one might postulate that this accident could result from a partial flow blockage to the fuel, mitigating features such as the primary coolant system strainer, the fuel element end-fittings, and the pre-operational visual inspection of the reactor pressure vessels and core region following any fuel handling evolution, all prevent an accident of this type from occurring. In addition, it has been shown that a 75% blockage of coolant flow to the hot channel is insufficient to cause cladding failure (Ref. 13.2).

13.2.1.2 Accident Analysis and Consequences

The fuel failure during reactor operation accident postulates partial fuel melting with an associated release of fission products into the primary coolant system. The accident is assumed to occur with the primary coolant system operating, resulting in a quick dispersal of the fission products throughout the system. With the design of the primary coolant system and its associated systems, particulate activity will remain in the coolant, and the gaseous activity that comes out of solution will collect in the reactor loop vent system and be retained there. Therefore, the primary coolant system relief valves and pressurizer are the only paths for a release of significant quantities of fission products to the environment.

The potential energy release from the melting of four (4) number-1 fuel plates could occur as a possible metal-water reaction (Ref. 13.3). While hydrogen would be formed, it is highly unlikely that in a water environment a hydrogen deflagration reaction would occur. The amount of material which would be involved in a metal-water reaction under the conditions of four (4) number-1 fuel plates melting is not predictable as the amount is dependent upon many conditions. For purposes of calculation, it is conservatively assumed that all the fuel plate aluminum cladding exposed in the area

is involved in the reaction. The reactor core contains a total of 33.56 Kg of aluminum. Of this, 1.3% or 436 grams is assumed to react according to the following equation:

$$Al + nH_2O \rightarrow AlO_n + nH_2 + heat.$$

The energy release per Kg of aluminum is 18 MW-sec, for a total energy release of:

$$7.9 \text{ MW-sec} = 7.5 \times 10^3 \text{ BTU}.$$

This amount of heat would easily be transferred to the adjacent fuel elements and primary coolant in the reactor core. Additionally, any steam that would form in the vicinity of the molten area would also assist in dissipating the heat. Since the fuel failure would result in a negligible release of energy to the primary coolant system, the introduction of pressure surges, which could lift the primary relief valves, are not considered credible. The pressurizer is an isolated system, and since no significant pressure surges are anticipated, it will not be subject to mixing with the primary coolant system.

Any significant gaseous radioactivity entrapped in the reactor loop vent tank will cause a reactor scram and actuation of the containment building isolation system by action of the pool surface radiation monitor. Additionally, following actuation of the anti-siphon system when the primary coolant system is secured, gases could also collect in the anti-siphon pressure tank. The location of these tanks under the pool surface, and the shielding provided by the water and the biological shield, will significantly reduce any radiation exposure to the reactor staff, visitors, or researchers.

Fission products entrapped in the primary coolant system can be removed by the reactor coolant cleanup system. This cleanup procedure would be undertaken under closely monitored and controlled conditions.

The primary coolant system does experience some coolant leakage into the reactor pool through the pressure vessel head packing and flange gasket. This leakage is typically less than 40 gallons (151 l) per week; an almost imperceptible leakage rate of approximately 4×10^{-3} gallons of primary coolant per minute into the pool. However, for purposes of calculation, a leakage rate of 80 gallons (303 l) per week is used. Based on this assumed conservative leakage rate, the radiation exposure to personnel in the containment building following fuel failure is calculated below.

Due to the complex nature of the MURR mixed core fuel cycle, the source terms for the "Fuel Failure during Reactor Operation" and "Fuel Handling Accident" were determined using the computer program MONTEBURNS instead of simplistic ORIGEN runs (Attachment 1). MONTEBURNS is a coupled MCNP-ORIGEN code system developed by Los Alamos National Laboratory (LANL). Within the MONTEBURNS program, MCNP calculations are used to obtain accurate one-group fluxes and one-group cross sections that are then utilized by ORIGEN for fuel depletion and fission product activity calculations. The use of MONTEBURNS and the flow diagram utilized for various neutronic computations at MURR were described in detail in the response to Request for Additional Information (RAI) Question 3.a (MURR letter dated October 1, 2015).

Radioiodine and Noble Gas Activities in the Core

^{131}I – 2.20 x 10^{+05} Ci	^{85}Kr – 4.63 x 10^{+02} Ci	^{133}Xe – 3.85 x 10^{+05} Ci
^{132}I – 3.08 x 10^{+05} Ci	^{85m}Kr – 1.31 x 10^{+05} Ci	^{135}Xe – 7.56 x 10^{+04} Ci
^{133}I – 5.42 x 10^{+05} Ci	^{87}Kr – 2.05 x 10^{+05} Ci	^{135m}Xe – 3.62 x 10^{+04} Ci
^{134}I – 6.11 x 10^{+05} Ci	^{88}Kr – 2.91 x 10^{+05} Ci	^{137}Xe – 4.81 x 10^{+05} Ci
^{135}I – 5.06 x 10^{+05} Ci	^{89}Kr – 3.69 x 10^{+05} Ci	^{138}Xe – 5.01 x 10^{+05} Ci
	^{90}Kr – 3.68 x 10^{+05} Ci	^{139}Xe – 4.07 x 10^{+05} Ci

An unirradiated fuel plate number-1 contains, on average, 19.26 grams of ^{235}U, so four (4) unirradiated number-1 fuel plates contain 77.04 grams of ^{235}U instead of the 78.58 grams assumed in the 2006 Safety Analysis Report analysis. These four number-1 fuel plates that melt correspond to 1.41% of the total ^{235}U in the Week 58 Core that was used to determine the high power peaking factor for the revised Safety Limits. The Week 58 Core has a total power history of 576 MWd. This power history results in a total reduced core mass of 5,474 grams of ^{235}U due to the previous fuel consumption. This 1.41% of ^{235}U melting releases 3.42% of the core fission products due to the highest power density fuel plate number-1 overall power peaking factor of 2.423, which is conservatively assumed to apply to all four (4) number-1 fuel plates (1.41% x 2.423 = 3.42%).

A very conservative value of a 100% release of the radioiodine and noble gas fission products from the fuel is assumed in calculating the fission product inventory in the primary coolant system. It is also assumed that fission products released into the primary coolant are quickly and uniformly dispersed within the 2,000-gallon (7,571 l) primary coolant system volume and, during a normal week's operation, 80 gallons (7.9 x 10^{-3} gpm) of coolant leaks from the primary coolant system into the pool water. Therefore, the radioactivity released into the reactor pool in 10 minutes – determined to be the maximum personnel occupancy time in the containment building after the accident for necessary operational personnel – is as follows:

(Note: It would take approximately five (5) minutes for Operations personnel to secure the primary coolant system and verify that the containment building has been evacuated following a containment building isolation. For the purposes of the fuel failure calculations, a conservative assumption of 10 minutes is used.)

Example calculation of ^{131}I released into the reactor pool during the 10-minute leakage period:

= ^{131}I in fuel x 0.0342 x 1/2,000 gal x (7.9 x 10^{-03} gpm) x 10 min
= 2.20 x 10^{+05} Ci x 0.0342 x 1/2000 gal x 0.079 gal
= 0.297 Ci
= 2.97 x 10^{+05} μCi

Note: Same calculation is used for the other isotopes listed below.

Radioiodine and Noble Gas Activities Released Into the Pool after 10 Minutes

^{131}I – $2.97 \times 10^{+05}$ μCi	^{85}Kr – $6.25 \times 10^{+02}$ μCi	^{133}Xe – $5.20 \times 10^{+05}$ μCi
^{132}I – $4.16 \times 10^{+05}$ μCi	^{85m}Kr – $1.77 \times 10^{+05}$ μCi	^{135}Xe – $1.02 \times 10^{+05}$ μCi
^{133}I – $7.32 \times 10^{+05}$ μCi	^{87}Kr – $2.77 \times 10^{+05}$ μCi	^{135m}Xe – $4.89 \times 10^{+04}$ μCi
^{134}I – $8.25 \times 10^{+05}$ μCi	^{88}Kr – $3.93 \times 10^{+05}$ μCi	^{137}Xe – $6.50 \times 10^{+05}$ μCi
^{135}I – $6.84 \times 10^{+05}$ μCi	^{89}Kr – $4.98 \times 10^{+05}$ μCi	^{138}Xe – $6.77 \times 10^{+05}$ μCi
	^{90}Kr – $4.97 \times 10^{+05}$ μCi	^{139}Xe – $5.50 \times 10^{+05}$ μCi

Fission products released into the reactor pool will be detected by the pool surface and ventilation system exhaust plenum radiation monitors. For the purposes of this analysis, it is assumed that a reactor scram and actuation of the containment building isolation system occurs by action of the pool surface radiation monitor.

The radioiodine released into the reactor pool over a 10-minute interval is conservatively assumed to be instantly and uniformly mixed into the 20,000 gallons (75,708 l) of bulk pool water, which then results in the following pool water concentrations for the radioiodine isotopes. The water solubility of the krypton and xenon noble gases released into the pool over this same time period are ignored and they are assumed to pass immediately through the pool water and evolve directly into the containment building air volume where they instantaneously form a uniform concentration in the isolated structure.

Radioiodine Concentrations in the Pool Water at 10 Minutes

^{131}I – $1.49 \times 10^{+01}$ μCi/gal	^{133}I – $3.66 \times 10^{+01}$ μCi/gal	^{135}I – $3.42 \times 10^{+01}$ μCi/gal
^{132}I – $2.08 \times 10^{+01}$ μCi/gal	^{134}I – $4.13 \times 10^{+01}$ μCi/gal	

When the reactor is at 10 MW and the containment building ventilation system is in operation, the evaporation rate from the reactor pool is approximately 80 gallons (302.8 L) of water per day. For the purposes of this calculation, it is assumed that a total of 40 gallons (151.4 L) of pool water containing the previously listed radioiodine concentrations evaporates into the containment building over the 10-minute period. This assumption results in about seventy times more radioiodine in the containment building air than would be present at the end of the 10 minutes of evaporation. In addition, air with a temperature of 75 °F (23.9 °C) and 100% relative humidity contains H_2O vapor equal to 40 gallons (151.4 L) of water. Since the air in containment is normally at about 50% relative humidity, thus containing approximately 20 gallons (75.7 L) of water vapor, the assumed addition of 40 gallons (151.4 L) of water vapor over estimates by a factor of two the amount of water that would make the containment air saturated. It is also conservatively assumed that all of the radioiodine activity in the 40 gallons (151.4 L) of pool water that evaporates instantaneously forms a uniform concentration in the containment building air. When distributed into the containment building, this would result in the following radioiodine concentrations in the 225,000 ft^3 (6,371.3 m^3) air volume:

Example calculation of average ^{131}I in containment air during the tenth minute:

= ^{131}I concentration in pool water at 10 min x (9.5 min/10 min) x 40 gal x (9.5 min/10 min) x 1/225,000 ft^3 x 1 ft^3/28,317 cc x EXP[(-0.693 x 9.5 min) / (8.02 day x 1440 min/day)]
= (1.49 x 10^{+01} μCi/gal) x 0.95 x 38 gal x 1/225,000 ft^3 x 1 ft^3/28,317 ml x 0.9994
= 8.41 x 10^{-08} μCi/ml

The average radioiodine concentrations are determined for the first and last minute and four 2-minute concentrations for the other eight (8) minutes. The overall average concentration is then calculated.

Average Radioiodine Concentrations in the Containment Building Air during the 10 Minutes

^{131}I – 3.08 x 10^{-08} μCi/ml	^{133}I – 7.56 x 10^{-08} μCi/ml	^{135}I – 7.00 x 10^{-08} μCi/ml
^{132}I – 4.16 x 10^{-08} μCi/ml	^{134}I – 7.77 x 10^{-08} μCi/ml	

As noted previously, the krypton and xenon noble gases released into the reactor pool from the primary coolant system during the assumed 10-minute interval following fuel failure are assumed to pass immediately through the pool water (ignoring their solubility in water) and enter the containment building air volume where they instantaneously form a uniform concentration in the isolated structure. (Note: Within 10 minutes the primary coolant system is shut down and secured; therefore, the leakage driving force is stopped.) Based on the 225,000-ft^3 (6,371.3 m^3) volume of containment building air and the previously listed Curie quantities of these gases released into the reactor pool, the average noble gas concentrations in the containment building for each time interval of the 10 minutes would be as follows:

Example calculation of average ^{85}Kr released into containment air during the 2-minute time interval between three (3) to five (5) minutes:

= Total ^{85}Kr activity x (4 min/10 min) x 1/ (225,000 ft^3 x 28,317 cc/ft^3) x EXP[(-0.693 x 4 min) / (10.76 yr x 365.25 days/yr x 1,440 min/day)]
= 6.25 x 10^{+02} uCi x 0.4 / (6.371 x 10^{+09} ml) x 1.0
= 3.93 x 10^{-08} μCi/ml

The 10-minute average noble gas concentrations are calculated from the average of the first and last 1-minute time intervals and the other four (4) 2-minute time intervals.

Average Noble Gas Concentrations in the Containment Building Air during the 10 Minutes

^{85}Kr – 4.91 x 10^{-08} μCi/ml	^{133}Xe – 4.08 x 10^{-05} μCi/ml
^{85m}Kr – 1.37 x 10^{-05} μCi/ml	^{135}Xe – 7.95 x 10^{-06} μCi/ml
^{87}Kr – 2.05 x 10^{-05} μCi/ml	^{135m}Xe – 2.86 x 10^{-06} μCi/ml
^{88}Kr – 3.00 x 10^{-05} μCi/ml	^{137}Xe – 1.69 x 10^{-05} μCi/ml
^{89}Kr – 1.05 x 10^{-05} μCi/ml	^{138}Xe – 3.86 x 10^{-05} μCi/ml
^{90}Kr – 4.84 x 10^{-07} μCi/ml	^{139}Xe – 8.08 x 10^{-07} μCi/ml

The objective of this calculation is to present a worst-case dose assessment for an individual who remains in the containment building for 10 minutes following fuel failure. Therefore, as noted previously, the radioactivity in the evaporated pool water is assumed to be instantaneously and uniformly distributed into the building once released into the air.

Based on the source term data provided, it is possible to determine the radiation dose to the thyroid from radioiodine and the dose to the whole body resulting from submersion in the airborne noble gases and radioiodine inside the containment building. As previously noted, the exposure time for this dose assessment is 10 minutes.

Because the airborne radioiodine source is composed of five (5) different iodine isotopes, it will be necessary to determine the dose contribution from each individual isotope and then sum the results. Dose Multiplication Factors were established using the Derived Air Concentrations (DACs) for the "listed" isotopes in Appendix B of 10 CFR 20 and calculated values for the four (4) "unlisted" submersion isotopes (Kr-89, Kr- 90, Xe-137 and Xe-139). The submersion DAC values that were calculated were done in accordance with the data and methodology as supplied in Federal Guidance Report (FGR) No.12 (Attachment 4).

Example calculation of thyroid dose due to ^{131}I:

The DAC can also be defined as 50,000 mrem (thyroid target organ limit)/2,000 hrs, or 25 mrem/DAC-hr. Additionally, 10 minutes of one (1) DAC-hr is 1.67 x 10^{-01} DAC-hr.

^{131}I concentration in containment	=	3.08 x 10^{-08} µCi/ml
^{131}I DAC (10 CFR 20)	=	2.00 x 10^{-08} µCi/ml
Dose Multiplication Factor	=	(^{131}I concentration) / (^{131}I DAC)
	=	(3.08 x 10^{-08} µCi/ml) / (2.00 x 10^{-08} µCi/ml)
	=	1.54

Therefore, a 10-minute thyroid exposure from ^{131}I is:

= Dose Multiplication Factor x DAC Dose Rate x 10 minutes
= 1.54 x (25 mrem/DAC-hr) x (1.67 x 10^{-01} DAC-hr)
= 6.42 mrem

Note: Same calculation is used for the other radioiodines listed below.

Derived Air Concentration Values and 10-Minute Exposures – Radioiodine

Radionuclide	Derived Air Concentration	10-Minute Exposure
^{131}I	2.00×10^{-08} µCi/ml	$6.42 \times 10^{+00}$ mrem
^{132}I	3.00×10^{-06} µCi/ml	5.78×10^{-02} mrem
^{133}I	1.00×10^{-07} µCi/ml	$3.15 \times 10^{+00}$ mrem
^{134}I	2.00×10^{-05} µCi/ml	1.62×10^{-02} mrem
^{135}I	7.00×10^{-07} µCi/ml	4.17×10^{-01} mrem
		Total = 10.07 mrem

Doses from the kryptons and xenons present in the containment building are assessed in much the same manner as the radioiodines, and the dose contribution from each individual radionuclide must be calculated and then added together to arrive at the final noble gas dose. Because the dose from the noble gases is only an external dose due to submersion, and because the DACs for these radionuclides are based on this type of exposure, the individual noble gas doses for 10 minutes in containment were based on their average concentration in the containment air and the corresponding DAC.

Example calculation of whole body dose due to ^{85}Kr:

The DAC can also be defined as 5,000 mrem / 2,000 hrs, or 2.5 mrem/DAC-hr. Additionally, 10 minutes of one (1) DAC-hr is 1.67×10^{-01} DAC-hr.

^{85}Kr concentration in containment	=	4.91×10^{-08} µCi/ml
^{85}Kr DAC (10 CFR 20)	=	1.00×10^{-04} µCi/ml
Dose Multiplication Factor	=	(^{85}Kr concentration) / (^{85}Kr DAC)
	=	(4.91×10^{-08} µCi/ml) / (1.00×10^{-04} µCi/ml)
	=	4.91×10^{-04}

Therefore, a 10-minute whole body exposure from ^{85}Kr is:

= Dose Multiplication Factor x DAC Dose Rate x 10 minutes
= 4.91×10^{-04} x (2.5 mrem/DAC-hr) x (1.67×10^{-01} DAC-hr)
= 2.05×10^{-04} mrem

Note: Same calculation is used for the other noble gases listed below.

Derived Air Concentration Values and 10-Minute Exposures – Noble Gases

Radionuclide	Derived Air Concentration	10-Minute Exposure
^{85}Kr	1.00×10^{-04} µCi/ml	2.05×10^{-04} mrem
^{85m}Kr	2.00×10^{-05} µCi/ml	2.85×10^{-01} mrem
^{87}Kr	5.00×10^{-06} µCi/ml	$1.71 \times 10^{+00}$ mrem
^{88}Kr	2.00×10^{-06} µCi/ml	$6.26 \times 10^{+00}$ mrem
^{89}Kr	1.90×10^{-06} µCi/ml	$2.31 \times 10^{+00}$ mrem
^{90}Kr	2.80×10^{-06} µCi/ml	7.20×10^{-01} mrem
^{133}Xe	1.00×10^{-04} µCi/ml	1.70×10^{-01} mrem
^{135}Xe	1.00×10^{-05} µCi/ml	3.31×10^{-01} mrem
^{135m}Xe	9.00×10^{-06} µCi/ml	1.32×10^{-01} mrem
^{137}Xe	2.00×10^{-05} µCi/ml	3.53×10^{-01} mrem
^{138}Xe	4.00×10^{-06} µCi/ml	$4.03 \times 10^{+00}$ mrem
^{139}Xe	3.70×10^{-06} µCi/ml	9.10×10^{-02} mrem
		Total = 16.38 mrem

To finalize the occupational dose in terms of Total Effective Dose Equivalent (TEDE) for a 10-minute exposure in the containment building after fuel failure, the doses from the radioiodines and noble gases must be added together, and result in the following values:

10-Minute Dose from Radioiodines and Noble Gases in the Containment Building

Total Iodine – Committed Dose Equivalent (CDE)	**10.07 mrem**
Iodine – Committed Effective Dose Equivalent (CEDE) (CEDE = CDE x 0.03)	**0.302 mrem**
Noble Gas – Committed Effective Dose Equivalent (CEDE)	**16.38 mrem**
Total Dose – Total Effective Dose Equivalent (TEDE)	**16.69 mrem**

By comparison of the maximum TEDE and CDE for those occupationally-exposed during fuel failure to applicable NRC dose limits in 10 CFR 20, the final values are shown to be well within the published regulatory limits and, in fact, lower than 1% of any occupational limit.

Radiation shine through the containment structure was also evaluated when considering accident conditions and dose consequences to the public and MURR staff. Calculation of exposure rate from a fuel failure was performed using the computer program MicroShield 8.02 with a Rectangular Volume – External Dose Point geometry for the representation of the containment structure (Attachment 6). MicroShield 8.02 is a product of Grove Software and is a comprehensive photon/gamma ray shielding and dose assessment program that is widely used by industry for designing radiation shields.

The exposure rate values provided below represents the radiation fields at 1 foot (30.5 cm) from a 12-inch (30.5 cm) thick ordinary concrete containment wall and at the Emergency Planning Zone (EPZ) boundary of 150 meters (492.1 ft). The airborne concentration source terms used to develop the exposure rate values are similar to those used for determining the dose to a worker within

containment from noble gases. For radioiodine, the total iodine activity that leaked to the pool system in the 10-minute period was used for the dose calculations. The source term also assumes a homogenous mixture of nuclides within the containment free volume.

Radiation Shine through the Containment Building

Exposure Rate at 1-Foot from Containment Building Wall:	**1.374 mrem/hr**
Exposure Rate at Emergency Planning Zone Boundary (150 meters):	**0.0094 mrem/hr**

As noted earlier in this analysis, the containment building ventilation system will shut down and the building itself will be isolated from the surrounding areas. Fuel failure will not cause an increase in pressure inside the reactor containment structure; therefore, any air leakage from the building will occur as a result of normal changes in atmospheric pressure and pressure equilibrium between the inside of the containment structure and the outside atmosphere. It is highly probable that there will be no pressure differential between the inside of the containment building and the outside atmosphere, and consequently there will be no air leakage from the building and no radiation dose to members of the public in the unrestricted area. However, to develop what would clearly be a worst-case scenario, this analysis assumes that a barometric pressure drop has occurred in conjunction with fuel failure. An extreme assumption would be a pressure change on the order of 0.7 inches of Hg (25.4 mm of Hg at 22 °C) from an initial atmospheric pressure of 15.0333 psia. This would then create a pressure differential of about 1/3 psig (2.28 kPa above atmosphere) higher on the inside of the isolated containment building than on the inside of the adjacent laboratory building, which surrounds most of the containment structure. With an initial internal pressure in the containment building of 15.0333 psia, it would contain 230,102 standard cubic feet (scf) of air. The conservative assumption is made that the containment building will leak at a rate slightly greater than the Technical Specification (TS) leakage rate limit. The TS leakage rate limit shall not exceed either 16.3 ft^3/min (STP) with an overpressure of one pound per square inch gauge or 10% of the contained volume over a 24-hour period from an initial overpressure of two pounds per square inch gauge. Additionally, the minimum TS free volume of the containment building is 225,000-ft^3 at standard pressure and temperature.

The following equation represents the air leakage rate from the containment building in standard cubic feet per minute (scfm) as a function of containment pressure which at 1 psi over pressure would corresponds to 17.68 ft^3/minute. This would correspond to a leakage rate 8.4% greater than the TS limit of 16.3 ft^3/minute at 1.0 psig.

$$LR = 17.68 \times (CP-14.7)^{1/2};$$

where:

LR = leakage rate from containment (scfm); and
CP = containment pressure (psia).

Using this equation for the assumed initial overpressure condition of 0.333 psig (2.28 kPa above atmosphere), it would take approximately 16.5 hours for the leakage rate to decrease to zero from an initial leakage rate of approximately 10.25 scfm, which would occur at the start of the event. The average leakage rate over the 16.5-hour period would be approximately 5.15 scfm. This conservatively over calculates the actual amount of activity that would leak out of the containment building and potentially expose someone in this assumed accident.

Several factors exist that will mitigate the radiological impact of any air leakage from the containment building following fuel failure. First of all, most leakage pathways from containment discharge into the laboratory building, which surrounds the containment structure. Since the laboratory building ventilation system continues to operate during fuel failure, leakage air captured by the ventilation exhaust system is mixed with other building air, and then discharged from the facility through the exhaust stack at a rate of approximately 30,500 scfm. Mixing of containment air leakage with the laboratory building ventilation flow, followed by discharge out the exhaust stack and subsequent atmospheric dispersion, results in extremely low radionuclide concentrations and very small radiation doses in the unrestricted area. A tabulation of these concentrations and doses is given below.

A second factor which helps to reduce the potential radiation dose in the unrestricted area relates to the behavior of radioiodine, which has been studied extensively in the containment mockup facility at Oak Ridge National Laboratory (ORNL). From these experiments, it was shown that up to 75% of the iodine released will be deposited in the containment vessel. For the purposes of this analysis, MURR used the more conservative NRC-accepted value of 50% reduction of radioiodines from plate-out and deposition (Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors"). Thus, if due to this 50% iodine deposition in the containment building, each cubic foot of air released from the containment structure has a radioiodine concentration that is 50% of each cubic foot within the containment building air, then the radioiodine concentrations leaking from the containment structure into the laboratory building, in microcuries per milliliter, will be:

Example calculation of the average ^{131}I released through the exhaust stack during the first hour:

Note: The average cubic foot per hour leakage rate can be calculated for each time interval.

= (^{131}I activity in containment x leakage rate in scf/hr x 0.50) / (30,500 ft^3/min x 60 min/hr x 28,317 cc/ft^3)
= (2.58 x 10^{-03} μCi/ft^3 x 595.6 scf/hr x 0.50) / (5.18 x 10^{+10} ml)
= 1.48 x 10^{-11} μCi/ml

Note: Same calculation is used for the other radioiodines listed below.

<u>Radioiodine Concentrations in Air Leaking from Containment and Exiting the Exhaust Stack during the First Hour</u>

^{131}I – 1.48 x 10^{-11} μCi/ml	^{133}I – 3.60 x 10^{-11} μCi/ml	^{135}I – 3.24 x 10^{-11} μCi/ml
^{132}I – 1.79 x 10^{-11} μCi/ml	^{134}I – 2.78 x 10^{-11} μCi/ml	

Example calculation of ^{85}Kr released through the exhaust stack in the first hour:

= (^{85}Kr activity in containment x leakage rate in scf/hr) / (30,500 ft^3/min x 60 min/hr x 28,317 cc/ft^3)
= (2.72 x 10^{-03} μCi/scf x 595.6 scf/hr) / (5.18 x 10^{+10} ml)
= 3.13 x 10^{-11} μCi/ml

Note: Same calculation is used for the other noble gases listed below.

Noble Gas Concentrations in Air Leaking from Containment and Exiting the Exhaust Stack in the First Hour

^{85}Kr – 3.13 x 10^{-11} μCi/ml	^{87}Kr – 1.05 x 10^{-08} μCi/ml	^{89}Kr – 3.39 x 10^{-11} μCi/ml
^{85m}Kr – 8.19 x 10^{-09} μCi/ml	^{88}Kr – 1.74 x 10^{-08} μCi/ml	^{90}Kr – 4.20 x 10^{-25} μCi/ml
^{133}Xe – 2.59 x 10^{-08} μCi/ml	^{135m}Xe – 6.29 x 10^{-10} μCi/ml	^{138}Xe – 7.75 x 10^{-09} μCi/ml
^{135}Xe – 4.92 x 10^{-09} μCi/ml	^{137}Xe – 1.41 x 10^{-10} μCi/ml	^{139}Xe – 6.22 x 10^{-22} μCi/ml

The same type of calculation is used for all the radioiodines during the five (5) 1-hour intervals, the two (2) 4-hour intervals, and the one (1) 3.5-hour interval to determine the average concentration in the exhaust stack, which is listed below.

Average Radioiodine Concentrations in Air Leaking from Containment and Exiting the Exhaust Stack

^{131}I – 7.56 x 10^{-12} μCi/ml	^{133}I – 1.59 x 10^{-11} μCi/ml	^{135}I – 1.06 x 10^{-11} μCi/ml
^{132}I – 3.37 x 10^{-12} μCi/ml	^{134}I – 2.91 x 10^{-12} μCi/ml	

Note: Same calculation is used for the noble gases listed below.

Noble Gas Concentrations in Air Leaking from Containment and Exiting the Exhaust Stack

^{85}Kr – 1.62 x 10^{-11} μCi/ml	^{87}Kr – 1.38 x 10^{-09} μCi/ml	^{89}Kr – 2.06 x 10^{-12} μCi/ml
^{85m}Kr – 2.26 x 10^{-09} μCi/ml	^{88}Kr – 3.75 x 10^{-09} μCi/ml	^{90}Kr – 2.55 x 10^{-26} μCi/ml
^{133}Xe – 1.31 x 10^{-08} μCi/ml	^{135m}Xe – 4.06 x 10^{-11} μCi/ml	^{138}Xe – 4.94 x 10^{-10} μCi/ml
^{135}Xe – 1.80 x 10^{-09} μCi/ml	^{137}Xe – 8.53 x 10^{-12} μCi/ml	^{139}Xe – 3.77 x 10^{-23} μCi/ml

Assuming, as stated earlier, that (1) the average exhaust gas concentration due to the containment leakage rate applies for the 16.5-hour period in order to equalize the containment building pressure with atmospheric pressure, (2) the flow rate through the facility's ventilation exhaust stack is 30,500 scfm, (3) the reduction in concentration from the point of discharge at the exhaust stack to the point of maximum concentration in the unrestricted area is a factor of 292, and (4) after exiting the ventilation exhaust stack, conservatively there is assumed no decay of any radioiodines or noble gases. The following concentrations of radioiodines and noble gases with their corresponding radiation doses are calculated to occur in the unrestricted area. The values listed are for the point of maximum concentration in the unrestricted area assuming a uniform, semi-spherical cloud geometry

for noble gas submersion and further assuming that the most conservative (worst-case) meteorological conditions exist for the entire 16.5-hour period of containment leakage following fuel failure. Radiation doses are calculated for the entire 16.5-hour period. Dose values for the unrestricted area were obtained using the same methodology that was used to determine doses inside the containment building, and it was assumed that an individual was present at the point of maximum concentration for the full 16.5 hours that the containment building was leaking.

A worst-case scenario effluent dilution factor of 292 using the Pasquill-Guifford Model for atmospheric dilution is used in this analysis. It is assumed that all offsite (public) dose occurs under these atmospheric conditions at the site of interest, i.e. 760 meters north of MURR. In our case, at 760 meters, it occurs only during Stability Class 'F' conditions, which normally only occurs 11.4% of the time when the wind blows from the south. Thus this calculation is conservative.

10 CFR 20 Appendix B Effluent Concentration Limits are used for the "listed" isotopes. Effluent Concentration Limits were calculated for each of the four (4) "unlisted" noble gases (Kr-89, Kr-90, Xe-137 and Xe-139) using the data and methodology contained in FGR No. 12 for submersion isotopes. The DAC value was first calculated and then a factor of 219 was applied using 10 CFR 20, Appendix B, as a reference point for DAC values from submersion isotopes. Exposure at 1 DAC equates to 5000 mrem per year whereas at the Effluent Concentration Limit it is 50 mrem per year. Thus, there is a factor of 100 times lower allowable dose for the Effluent Concentration Limit as compared to the DAC. Exposure at the Effluent Concentration Limit assumes you are in that effluent concentration for 8760 hours per year. Therefore, the time assumed to be exposed to the Effluent Concentration Limit is a factor of 4.38 times longer than the 2000 hours per year that defines a DAC. No credit is taken for transit time from the exhaust stack to the receptor point nor is credit taken for decay inside the containment building until release. In the case of Kr-89 and Xe-137, the transit time alone would be approximately one (1) half-life while the transit time for Kr-90 and Xe-139 would be at least four (4) half-lives. The DAC values were then divided by 219 to arrive at the effluent concentration limits for the calculated isotope limits, consistent with the methodology used in Appendix B of 10 CFR 20.

Example calculation of whole body dose in the unrestricted area due to ^{131}I:

Conversion Factor: (Public dose limit of 50 mrem/yr) x (1 yr/8760 hrs) = 5.71×10^{-03} mrem/hr

^{131}I concentration	=	7.56×10^{-12} μCi/ml
^{131}I effluent concentration limit	=	2.00×10^{-10} μCi/ml
^{131}I Conversion Factor	=	5.71×10^{-03} mrem/hr

Therefore, a 16.5-hour whole body exposure from ^{131}I is:

= ^{131}I concentration / (^{131}I Effluent Concentration Limit x Conversion Factor x 16.5 hrs)
= 7.56×10^{-12} μCi/ml / (2.00×10^{-10} μCi/ml x 5.71×10^{-03} mrem/hr x 16.5 hrs/292)
= 1.22×10^{-05} mrem

Note: Same calculation is used for the other isotopes (radioiodines and noble gases) listed below.

Effluent Concentration Limits, Concentrations at Point of Maximum Concentration and Radiation Doses in the Unrestricted Area – Radioiodine

Radionuclide	Effluent Limit	Maximum Concentration[1]	Radiation Dose
^{131}I	2.00×10^{-10} µCi/ml	2.59×10^{-14} µCi/ml	1.22×10^{-05} mrem
^{132}I	2.00×10^{-08} µCi/ml	1.16×10^{-14} µCi/ml	5.44×10^{-08} mrem
^{133}I	1.00×10^{-09} µCi/ml	5.44×10^{-14} µCi/ml	5.13×10^{-06} mrem
^{134}I	6.00×10^{-08} µCi/ml	9.97×10^{-15} µCi/ml	1.57×10^{-08} mrem
^{135}I	6.00×10^{-09} µCi/ml	3.63×10^{-14} µCi/ml	5.70×10^{-07} mrem
			Total = 1.80E-05 mrem

Note 1: Maximum Concentrations are radioiodine and noble gas concentrations leaking from the containment building and exiting the exhaust stack reduced by a dilution factor of 292.

Effluent Concentration Limits, Concentrations at Point of Maximum Concentration and Radiation Doses in the Unrestricted Area – Noble Gases

Radionuclide	Effluent Limit	Maximum Concentration[1]	Radiation Dose
^{85}Kr	7.00×10^{-07} µCi/ml	5.56×10^{-14} µCi/ml	2.19×10^{-06} mrem
^{85m}Kr	1.00×10^{-07} µCi/ml	7.75×10^{-12} µCi/ml	2.13×10^{-03} mrem
^{87}Kr	2.00×10^{-08} µCi/ml	4.71×10^{-12} µCi/ml	6.49×10^{-03} mrem
^{88}Kr	9.00×10^{-09} µCi/ml	1.28×10^{-11} µCi/ml	3.93×10^{-02} mrem
^{89}Kr	8.60×10^{-09} µCi/ml	7.04×10^{-15} µCi/ml	2.25×10^{-05} mrem
^{90}Kr	1.20×10^{-08} µCi/ml	8.72×10^{-29} µCi/ml	2.00×10^{-19} mrem
^{133}Xe	5.00×10^{-07} µCi/ml	4.48×10^{-11} µCi/ml	2.47×10^{-03} mrem
^{135}Xe	7.00×10^{-08} µCi/ml	6.17×10^{-12} µCi/ml	2.42×10^{-03} mrem
^{135m}Xe	4.00×10^{-08} µCi/ml	1.39×10^{-13} µCi/ml	9.56×10^{-05} mrem
^{137}Xe	9.10×10^{-08} µCi/ml	2.92×10^{-14} µCi/ml	8.83×10^{-06} mrem
^{138}Xe	2.00×10^{-08} µCi/ml	1.69×10^{-12} µCi/ml	2.33×10^{-03} mrem
^{139}Xe	1.60×10^{-08} µCi/ml	1.29×10^{-25} µCi/ml	2.22×10^{-16} mrem
			Total = 5.52E-02 mrem

Note 1: Maximum Concentrations are radioiodine and noble gas concentrations leaking from the containment building and exiting the exhaust stack reduced by a dilution factor of 292.

To finalize the unrestricted dose in terms of Total Effective Dose Equivalent (TEDE), the doses from the radioiodines and noble gases must be added together, and result in the following values:

Dose from Radioiodines and Noble Gases in the Unrestricted Area

Total Iodine – Committed Effective Dose Equivalent (CEDE)	**1.80E-05 mrem**
Noble Gas – Committed Effective Dose Equivalent (CEDE)	**5.52E-02 mrem**
Total Dose – Total Effective Dose Equivalent (TEDE)	**5.53E-02 mrem**

Summing the doses from the noble gases and the radioiodines simply substantiates earlier statements regarding the very low levels in the unrestricted area should a fuel failure occur, and should the containment building leak following such an event. As can be seen in the above analysis, the doses are extremely low; less than 0.1% of the Part 20 limits for allowable dose to the general public. Additionally, leakage in mechanical equipment room 114 from such items as valve packing, flange gaskets, pump mechanical seals, etc. was also considered in the fuel failure analysis. A realistic leakage rate of 60 milliliters within the 10-minute time interval was used – after 10 minutes the primary coolant system would be shutdown, isolated and depressurized as part of the control room operator's actions. The additional contaminated water vapor and associated isotopes added to the facility ventilation exhaust system made a minimal (<1%) contribution to the total dose of an individual located in the facility. Therefore, the dose contribution to the unrestricted area would be expected to be approaching zero.

13.2.1.3 Conclusions

Generally, the most severe condition which is analyzed with regard to reactor accidents is either a loss of primary coolant or a loss of primary coolant flow during reactor operation. Both of these accidents are analyzed in this chapter and the results show no core damage. In addition, there are no other accidents that will result in a release of fission products from the reactor fuel, which is assumed in the fuel failure analysis. Even if such an event were to occur, the anti-siphon and reactor loop vent systems are designed such that any released radioactivity would be contained in the primary coolant system.

System design and operational procedures reduce the likelihood of any foreign material being introduced into the reactor core that could cause a partial flow blockage. Calculations have been performed which indicate that even partial flow blockage to a fuel element will not result in cladding failure (Ref. 13.2). A considerable margin of safety has been designed into the system in this regard. Also, considering the results of the analyses which show no core damage in the event of a loss of primary coolant or a loss of primary coolant flow accident (See Sections 13.2.3 and 13.2.4), and in view of the design of the anti-siphon and reactor loop vent systems, it is concluded that there is no radiation risk to personnel in the reactor containment building or in the unrestricted area should one of these events occur.

References:

Same as those stated on pages v through vii of Chapter 13 of the SAR.

Fuel Handling Accident Analysis [page 39] – Information/Clarification Needed

- *Origin of core inventory not clear (similar to comment on page 24 above) [page 40].*

  As described in the response to RAI No. 7.g. above, for operation at 10 MW for 1,200 MWd in twelve 10-day cycles over a 300-day period with 6.2 Kg of ^{235}U (normal operating cycle is 6.5 days with a total of less than 700 MWd on the core), the radioiodine, krypton and xenon activities listed in the "Fuel Failure during Reactor Operation" accident analysis will conservatively be present in the core.

  Due to the complex nature of the MURR mixed core fuel cycle, the source term was determined using the computer program MONTEBURNS instead of simplistic ORIGEN runs. MONTEBURNS is a coupled MCNP-ORIGEN code system developed by Los Alamos National Laboratory (LANL). Within the MONTEBURNS program, MCNP calculations are used to obtain accurate one-group fluxes and one-group cross sections that are then utilized by ORIGEN for fuel depletion and fission product activity calculations. The use of MONTEBURNS and the flow diagram utilized for various neutronic computations at MURR were described in detail in the response to Request for Additional Information (RAI) Question 3.a (MURR letter dated October 1, 2015).

  Using MONTEBURNS to simulate the burnup of all eight (8) fuel elements for the core configuration beginning with an all-fresh core for the aforementioned hypothetical operational cycle, the source term for the "Fuel Failure during Reactor Operation" analysis was derived from summing the noble gases and iodine fission products inventories from all eight (8) fuel elements at the end of 300 days (i.e., at the End-of-Irradiation of cycle 12). The source term for the "Fuel Handling Accident (FHA)" analysis was similarly derived using the same radionuclides by extending the previous 300-day MONTEBURNS simulation and decaying it for 30 minutes (i.e., 0.0208 days after the End-of-Irradiation of cycle 12).

  Attachment 1 is the MONTEBURNS output which provides the sources terms for both the "Fuel Failure during Reactor Operation" and "Fuel Handling Accident (FHA)" analyses.

- *The bracketing in several equations appears inconsistent (similar to comment on page 26 above, and again on page 47) [page 41].*

  The "Fuel Handling Accident" analysis has been revised to correct for any bracketing inaccuracies in the equations.

- *Units used are non-standard (micro-Curies per cubic foot versus micro-Curies per cubic milliliter, similar comment on pages 47 and 48). Verify units [page 41].*

  The "Fuel Handling Accident" analysis has been revised to correct for any non-standard units.

- *The value of 229,801 cubic feet was used versus the Technical Specification value of 225,000 cubic feet (similar comment on pages 47 and 63). Explain [page 41].*

  For all three (3) radiological accident analyses the barometric pressure is assumed to be 15.0333 psia at the start of the accident. At that pressure, the containment building would contain 230,102 scf of air [see "Containment Building – Excel Spreadsheet Leakage Rate" (Attachment 5)]. Assuming the slightly greater than Technical Specification allowed leakage on the table, the average volume of air in the containment structure during the first hour after a drop of 1/3 psi would be 229,801 scf.

“Fuel Handling Accident (FHA)”

All fuel handling is performed in accordance with Special Nuclear Material (SNM) Control and Accounting Procedures and as outlined in the Operations Procedures. Irradiated fuel is handled with a specially designed remote tool. The fuel handling tool is designed to provide a positive indication of latching prior to movement of a fuel element. This feature is tested prior to any fuel handling sequence. Fuel elements are always handled one at a time so that they are maintained in a criticality-safe configuration. New or irradiated fuel may be stored in any one of the 88 in-pool fuel storage locations (not including the core). These storage locations are designed to (1) ensure a geometry such that the calculated K_{eff} is less than 0.9 under all conditions of moderation, (2) allow sufficient convection cooling, and (3) provide sufficient radiation shielding. Therefore, the fuel handling system provides a safe, effective and reliable means of transporting and handling reactor fuel from the time it enters the facility until it leaves.

All cask lifting equipment, including the 15-ton capacity overhead rectilinear crane, is rigorously maintained, including preventive maintenance and testing, as appropriate. Hence, no specific accidents regarding the handling of fuel have been identified for the MURR. However, the probability of dropping a fuel element while underwater and damaging it severely enough to breach the fuel cladding was considered. A conservative potential radionuclide release and calculation of the occupational and public exposures from a Fuel Handling Accident (FHA) are included below.

The following calculations determining the postulated dose from a potential release of radioactivity from a fuel element during a handling accident closely follow the “Fuel Failure during Reactor Operation” calculations and methodology for personal exposure due to a release of fission products. The objective of these calculations is to present a worst-case dose assessment for a person who remains in the containment building for five (5) minutes following the release from a breached fuel element. MURR’s fuel cycle averages having approximately 40 fuel elements in the cycle – divided into 20 pairs of elements. Paired elements are always loaded opposite each other in the core. All eight (8) fuel elements are replaced every refueling. MURR has averaged refueling the core more than 52 times a year since 1977. This type of accident has never occurred at MURR during any of these fuel handlings.

The two outer fuel plates of a fuel element, number-1 and -24, are the plates most likely to be damaged during fuel handling. The number-1 fuel plate contains 19.26 grams of ^{235}U before irradiation. The highest peak power density in the various MURR core configurations occurs in fuel plate number-1 of a fresh fuel element, which has a power peaking factor of 4.116 – located between 13.75 to 14.75 inches down from the top of the fuel plate. Fuel plate number-24 has the most surface area to be damaged; however, it has a lower peak power density and contains 45.32 grams of ^{235}U. To be conservative, the analysis assumes that 0.125 grams of ^{235}U is exposed from plate number-1 during the FHA, which corresponds to removing a section of fuel meat from a plate that is 1-inch square and 5 mils thick. A power peaking factor of 4.116 is also applied.

Due to the complex nature of the MURR mixed core fuel cycle, the source terms for the “Fuel Failure during Reactor Operation” and “Fuel Handling Accident” were determined using the computer

program MONTEBURNS instead of simplistic ORIGEN runs (Attachment 1). MONTEBURNS is a coupled MCNP-ORIGEN code system developed by Los Alamos National Laboratory (LANL). Within the MONTEBURNS program, MCNP calculations are used to obtain accurate one-group fluxes and one-group cross sections that are then utilized by ORIGEN for fuel depletion and fission product activity calculations. The use of MONTEBURNS and the flow diagram utilized for various neutronic computations at MURR were described in detail in the response to Request for Additional Information (RAI) Question 3.a (MURR letter dated October 1, 2015).

The following radioiodine, krypton and xenon activities will be present in the MURR core 30 minutes after shutdown from 10 MW full power operation. Refueling typically occurs no sooner than one (1) hour after shutdown. This takes into account the time required to shut down the reactor, to secure the primary coolant system (required to stay in operation a minimum of 15 minutes after the control blades are fully inserted), and to remove the reactor pressure vessel head. For the purposes of the FHA calculations, a conservative assumption of 30 minutes is used.

<u>Radioiodine and Noble Gas Activities in the Core after 30-Minute Decay</u>

^{131}I – 2.20 x 10^{+05} Ci	^{85}Kr – 4.63 x 10^{+02} Ci	^{133}Xe – 3.85 x 10^{+05} Ci
^{132}I – 3.07 x 10^{+05} Ci	^{85m}Kr – 1.23 x 10^{+05} Ci	^{135}Xe – 9.11 x 10^{+04} Ci
^{133}I – 5.39 x 10^{+05} Ci	^{87}Kr – 1.58 x 10^{+05} Ci	^{135m}Xe – 3.62 x 10^{+04} Ci
^{134}I – 5.49 x 10^{+05} Ci	^{88}Kr – 2.58 x 10^{+05} Ci	^{137}Xe – 2.24 x 10^{+03} Ci
^{135}I – 4.80 x 10^{+05} Ci	^{89}Kr – 5.28 x 10^{+02} Ci	^{138}Xe – 1.16 x 10^{+05} Ci
	^{90}Kr – 6.31 x 10^{-12} Ci	^{139}Xe – 7.89 x 10^{-09} Ci

Fission products released into the reactor pool will be detected by the pool surface and ventilation system exhaust plenum radiation monitors. For the purposes of this analysis, it is assumed that an actuation of the containment building isolation system occurs by action of the pool surface radiation monitor. Actuation of the isolation system will prompt Operations personnel to ensure that a total evacuation of the containment building is accomplished promptly, usually within two (2) to two and a half (2.5) minutes. A conservative 5-minute evacuation time is used as the basis for the stay time in the dose calculations for personnel that are in containment during the FHA.

The following radioiodine and noble gas activities from 0.125 grams of ^{235}U from the peak power position of fuel plate number-1 in the peak power density fuel element are assumed to instantaneously and homogenously distribute in the reactor pool.

Example calculation of ^{131}I released into the reactor pool:

= (^{131}I in fuel / ^{235}U in core) x ^{235}U exposed x Power Peaking Factor x (1 x 10^{+06} μCi/Ci)
= (2.20 x 10^{+05} Ci / 5,474 grams) x 0.125 grams x 4.116 x (1 x 10^{+06} μCi/Ci)
= 2.07 x 10^{+07} μCi

Example calculation of ^{85}Kr released into the reactor pool:

= (^{85}Kr in fuel / ^{235}U in core) x ^{235}U exposed x Power Peaking Factor x (1 x 10^{+06} µCi/Ci)
= (4.63 x 10^{+02} Ci / 5,474 grams) x 0.125 grams x 4.116 x (1 x 10^{+06} µCi/Ci)
= 4.35 x 10^{+04} µCi

Note: Same calculations are used for the other isotopes listed below.

Radioiodine and Noble Gas Activities Released into the Pool

^{131}I – 2.07 x 10^{+07} µCi	^{85}Kr – 4.35 x 10^{+04} µCi	^{133}Xe – 3.62 x 10^{+07} µCi
^{132}I – 2.89 x 10^{+07} µCi	^{85m}Kr – 1.16 x 10^{+07} µCi	^{135}Xe – 8.56 x 10^{+06} µCi
^{133}I – 5.07 x 10^{+07} µCi	^{87}Kr – 1.49 x 10^{+07} µCi	^{135m}Xe – 3.40 x 10^{+06} µCi
^{134}I – 5.16 x 10^{+07} µCi	^{88}Kr – 2.42 x 10^{+07} µCi	^{137}Xe – 2.11 x 10^{+05} µCi
^{135}I – 4.51 x 10^{+07} µCi	^{89}Kr – 4.96 x 10^{+04} µCi	^{138}Xe – 1.09 x 10^{+07} µCi
	^{90}Kr – 5.93 x 10^{-10} µCi	^{139}Xe – 7.42 x 10^{-07} µCi

The radioiodine released into the reactor pool over a 5-minute interval is conservatively assumed to be instantly and uniformly mixed into the 20,000 gallons (75,708 l) of bulk pool water, which then results in the following pool water concentrations for the radioiodine isotopes. The water solubility of the krypton and xenon noble gases released into the pool over this same time period are ignored and they are assumed to pass immediately through the pool water and evolve directly into the containment building air volume where they instantaneously form a uniform concentration in the isolated structure.

Radioiodine Concentrations in the Pool Water

^{131}I – 1.03 x 10^{+03} µCi/gal	^{133}I – 2.53 x 10^{+03} µCi/gal	^{135}I – 2.26 x 10^{+03} µCi/gal
^{132}I – 1.44 x 10^{+03} µCi/gal	^{134}I – 2.58 x 10^{+03} µCi/gal	

When the reactor is at 10 MW and the containment building ventilation system is in operation, the evaporation rate from the reactor pool surface is approximately 80 gallons (302.8 L) of water per day. For the purposes of this calculation, it is assumed that a total of 20 gallons (75.7 L) of pool water containing the previously listed radioiodine concentrations evaporates into the containment building over the 5-minute period. Containment air with a temperature of 75 °F (23.9 °C) and 100% relative humidity contains H_2O vapor equal to 40 gallons (151.4 L) of water. Since the air in containment is normally at about 50% relative humidity, thus containing 20 gallons (75.7 L) of water vapor, the assumed addition of 20 gallons (75.7 L) of water vapor over five (5) minutes will not cause the containment air to be supersaturated. It is also conservatively assumed that all of the radioiodine activity in the 20 gallons (75.7 L) of pool water that evaporates instantaneously forms a uniform concentration in the containment building air. When distributed into the containment building, this would result in the following radioiodine concentrations in the 225,000 ft^3 (6,371.3 m^3) air volume:

Example calculation of ^{131}I released into containment air to determine the average concentration during the first minute:

= (^{131}I concentration in pool x 4 gal/min x 0.5 min) x EXP[(-0.693 x 0.5 min) / (8.02 day x 1440 min/day)] / (225,000 ft^3 x 28,317 ml/ft^3)
= (1.03 x 10^{+03} µCi/gal x 2 gal) x 0.9997 / (6.371 x 10^{+09} ml)
= 3.25 x 10^{-07} µCi/ml

The same calculation is used for the other isotopes listed below and was performed for each one (1) minute interval. The average radioiodine concentration over the 5-minute interval is the average of the five (5) 1-minute intervals.

Average Radioiodine Concentrations in the Containment Building Air during the 5-Minute Period

^{131}I – 1.62 x 10^{-06} µCi/ml	^{133}I – 3.97 x 10^{-06} µCi/ml	^{135}I – 3.52 x 10^{-06} µCi/ml
^{132}I – 2.23 x 10^{-06} µCi/ml	^{134}I – 3.88 x 10^{-06} µCi/ml	

As noted previously, the krypton and xenon noble gases released into the reactor pool during the 5-minute interval following the FHA are assumed to pass immediately through the pool water and enter the containment building air volume where they instantaneously form a uniform concentration in the isolated structure. This assumption is extremely conservative since it ignores the known solubility of krypton and xenon noble gases in the 100 °F (37.8 °C) pool water, which would reduce their release into the containment building. Based on the 225,000-ft^3 (6,371.3 m^3) volume of containment building air, and the previously listed Curie quantities of these gases released into the reactor pool, the maximum noble gas concentrations in the containment structure at the end of five (5) minutes would be as follows:

Example calculation of ^{85}Kr average concentration in containment air during the first minute:

= ^{85}Kr activity x EXP[(-0.693 x 0.5 min) / ^{85}Kr $T_{1/2}$] / (225,000 ft^3 x 28,317 ml/ft^3)
= (4.35 x 10^{+04} µCi x EXP[(-0.693 x 0.5 min) / (10.76 yr x 365.25 day/yr x 1440 min/day)] / 6.371 x 10^{+09} ml)
= 6.83 x 10^{-06} µCi/ml

Likewise, the average noble gas concentration of the five (5) 1-minute interval concentrations is the average concentration of the five (5) minute interval.

Average Noble Gas Concentrations in the Containment Building Air during the 5-Minute Period

^{85}Kr – 6.83 x 10^{-06} µCi/ml	^{133}Xe – 5.68 x 10^{-03} µCi/ml
^{85m}Kr – 1.80 x 10^{-03} µCi/ml	^{135}Xe – 1.34 x 10^{-03} µCi/ml
^{87}Kr – 2.28 x 10^{-03} µCi/ml	^{135m}Xe – 4.78 x 10^{-04} µCi/ml
^{88}Kr – 3.77 x 10^{-03} µCi/ml	^{137}Xe – 2.17 x 10^{-05} µCi/ml
^{89}Kr – 4.71 x 10^{-06} µCi/ml	^{138}Xe – 1.52 x 10^{-03} µCi/ml
^{90}Kr – 1.35 x 10^{-20} µCi/ml	^{139}Xe – 2.11 x 10^{-17} µCi/ml

The objective of this calculation is to present a worst-case dose assessment for an individual who remains in the containment building for five (5) minutes following the FHA. Therefore, as noted previously, the radioactivity in the evaporated pool water is assumed to be instantaneously and uniformly distributed into the containment building once released into the air.

Based on the source term data provided, it is possible to determine the radiation dose to the thyroid [Committed Dose Equivalent (CDE)] from radioiodine and the dose to the whole body [Committed Effective Dose Equivalent (CEDE)] resulting from submersion in the airborne noble gases and radioiodine inside the containment building.

Because the airborne radioiodine source is composed of five (5) different iodine isotopes, it will be necessary to determine the dose contribution from each individual isotope and then sum the results. Dose Multiplication Factors were established using the Derived Air Concentrations (DACs) for the "listed" isotopes in Appendix B of 10 CFR 20 and calculated values for the four (4) "unlisted" submersion isotopes (Kr-89, Kr- 90, Xe-137 and Xe-139). The submersion DAC values that were calculated were done in accordance with the data and methodology as supplied in Federal Guidance Report (FGR) No.12 (Attachment 4).

Example calculation of thyroid dose due to ^{131}I:

The DAC can also be defined as 50,000 mrem [thyroid target organ limit-(CDE)]/2,000 hrs, or 25 mrem/DAC-hr. Additionally, five (5) minutes of one (1) DAC-hr is 8.33 x 10^{-02} DAC-hr.

^{131}I concentration in containment	=	1.62 x 10^{-06} µCi/ml
^{131}I DAC (10 CFR 20)	=	2.00 x 10^{-08} µCi/ml
Dose Multiplication Factor	=	(^{131}I concentration) / (^{131}I DAC)
	=	(1.62 x 10^{-06} µCi/ml) / (2.00 x 10^{-08} µCi/ml)
	=	81.0

Therefore, a 5-minute thyroid exposure from ^{131}I is:

= Dose Multiplication Factor x DAC Dose Rate x 5 minutes
= 81.0 x (25 mrem/DAC-hr) x (8.33 x 10^{-02} DAC-hr)
= 169 mrem

Note: Same calculation is used for the other radioiodines listed below.

Derived Air Concentration Values and 5-Minute Exposures – Radioiodine

Radionuclide	Derived Air Concentration	5-Minute Exposure
^{131}I	2.00×10^{-08} µCi/ml	$1.69 \times 10^{+02}$ mrem
^{132}I	3.00×10^{-06} µCi/ml	$1.55 \times 10^{+00}$ mrem
^{133}I	1.00×10^{-07} µCi/ml	$8.26 \times 10^{+01}$ mrem
^{134}I	2.00×10^{-05} µCi/ml	4.04×10^{-01} mrem
^{135}I	7.00×10^{-07} µCi/ml	$1.05 \times 10^{+01}$ mrem
		Total = 264.00 mrem

Doses from the kryptons and xenons present in the containment building are assessed in much the same manner as the radioiodines, and the dose contribution from each individual radionuclide must be calculated and then added together to arrive at the final noble gas dose. Because the dose from the noble gases is only an external dose due to submersion, and because the DACs for these radionuclides are based on this type of exposure, the individual noble gas doses for five (5) minutes in containment were based on their average concentration in the containment air and the corresponding DAC.

Example calculation of whole body dose (CEDE) due to ^{85}Kr:

The DAC can also be defined as 5,000 mrem/2,000 hrs, or 2.5 mrem/DAC-hr. Additionally, five (5) minutes of one (1) DAC-hr is 8.33×10^{-02} DAC-hr.

^{85}Kr concentration in containment	=	6.83×10^{-06} µCi/ml
^{85}Kr DAC (10 CFR 20)	=	1.00×10^{-04} µCi/ml
Dose Multiplication Factor	=	(^{85}Kr concentration) / (^{85}Kr DAC)
	=	(6.83×10^{-06} µCi/ml) / (1.00×10^{-04} µCi/ml)
	=	0.0683

Therefore, a 5-minute whole body exposure from ^{85}Kr is:

= Dose Multiplication Factor x DAC Dose Rate x 5 min
= 0.0683 x (2.5 mrem/DAC-hr) x (8.33×10^{-02} DAC-hr)
= 1.42×10^{-02} mrem

Note: Same calculation is used for the other noble gases listed below.

Derived Air Concentration Values and 5-Minute Exposures – Noble Gases

Radionuclide	Derived Air Concentration	5-Minute Exposure
^{85}Kr	1.00×10^{-04} μCi/ml	1.42×10^{-02} mrem
^{85m}Kr	2.00×10^{-05} μCi/ml	$1.88 \times 10^{+01}$ mrem
^{87}Kr	5.00×10^{-06} μCi/ml	$9.49 \times 10^{+01}$ mrem
^{88}Kr	2.00×10^{-06} μCi/ml	$3.92 \times 10^{+02}$ mrem
^{89}Kr	1.90×10^{-06} μCi/ml	5.17×10^{-01} mrem
^{90}Kr	2.80×10^{-06} μCi/ml	1.00×10^{-14} mrem
^{133}Xe	1.00×10^{-04} μCi/ml	$1.18 \times 10^{+01}$ mrem
^{135}Xe	1.00×10^{-05} μCi/ml	$2.79 \times 10^{+01}$ mrem
^{135m}Xe	9.00×10^{-06} μCi/ml	$1.11 \times 10^{+01}$ mrem
^{137}Xe	2.00×10^{-05} μCi/ml	2.26×10^{-01} mrem
^{138}Xe	4.00×10^{-06} μCi/ml	$7.90 \times 10^{+01}$ mrem
^{139}Xe	3.70×10^{-06} μCi/ml	1.19×10^{-12} mrem
		Total = 636.49 mrem

To finalize the occupational dose in terms of Total Effective Dose Equivalent (TEDE) for a 5-minute exposure in the containment building after a FHA, the doses from the radioiodines and noble gases must be added together, and result in the following values:

5-Minute Dose from Radioiodines and Noble Gases in the Containment Building

Total Iodine – Committed Dose Equivalent (CDE)	**264.00 mrem**
Iodine – Committed Effective Dose Equivalent (CEDE) (CEDE = CDE x 0.03)	**7.92 mrem**
Noble Gas – Committed Effective Dose Equivalent (CEDE)	**636.49 mrem**
Total Dose – Total Effective Dose Equivalent (TEDE)	**644.41 mrem**

By comparison of the maximum TEDE and CDE for those occupationally-exposed during a FHA to applicable dose limits in 10 CFR 20, the final values are shown to be well within the published regulatory limits and, in fact, lower than 15% of any occupational limit.

Radiation shine through the containment structure was also evaluated when considering accident conditions and dose consequences to the public and MURR staff. Calculation of exposure rate from a FHA was performed using the computer program MicroShield 8.02 with a Rectangular Volume – External Dose Point geometry for the representation of the containment structure (Attachment 9). MicroShield 8.02 is a product of Grove Software and is a comprehensive photon/gamma ray shielding and dose assessment program that is widely used by industry for designing radiation shields.

The exposure rate values provided below represents the radiation fields at 1 foot (30.5 cm) from a 12-inch (30.5 cm) thick ordinary concrete containment wall and at the Emergency Planning Zone (EPZ) boundary of 150 meters (492.1 ft). The airborne concentration source terms used to develop the exposure rate values are identical to those used for determining the dose to a worker within

containment from noble gases. For radioiodine, the total iodine activity from the FHA was used for the dose calculations, not the amount that evaporated in five (5) minutes. The source term also assumes a homogenous mixture of nuclides within the containment free volume.

<u>Radiation Shine through the Containment Building</u>

Exposure Rate at 1-Foot from Containment Building Wall:	**59.77 mrem/hr**
Exposure Rate at Emergency Planning Zone Boundary (150 meters):	**0.41 mrem/hr**

As noted earlier in this analysis, the containment building ventilation system will shut down and the building itself will be isolated from the surrounding areas. The FHA will not cause an increase in pressure inside the reactor containment structure; therefore, any air leakage from the building will occur as a result of normal changes in atmospheric pressure and pressure equilibrium between the inside of the containment structure and the outside atmosphere. It is highly probable that there will be no pressure differential between the inside of the containment building and the outside atmosphere, and consequently there will be no air leakage from the building and no radiation dose to members of the public in the unrestricted area. However, to develop what would clearly be a worst-case scenario, this analysis assumes that a barometric pressure drop has occurred in conjunction with the FHA. An extreme assumption would be a pressure change on the order of 0.7 inches of Hg (25.4 mm of Hg at 22 °C) from an initial atmospheric pressure of 15.0333 psia. This would then create a pressure differential of about 1/3 psig (2.28 kPa above atmosphere) higher on the inside of the isolated containment building than on the inside of the adjacent laboratory building, which surrounds most of the containment structure. With an initial internal pressure in the containment building of 15.0333 psia, it would contain 230,102 standard cubic feet (scf) of air. The conservative assumption is made that the containment building will leak at a rate slightly greater than the Technical Specification (TS) leakage rate limit. The TS leakage rate limit shall not exceed either 16.3 ft^3/min (STP) with an overpressure of one pound per square inch gauge or 10% of the contained volume over a 24-hour period from an initial overpressure of two pounds per square inch gauge. Additionally, the minimum TS free volume of the containment building is 225,000-ft^3 at standard pressure and temperature.

The following equation represents the air leakage rate from the containment building in standard cubic feet per minute (scfm) as a function of containment pressure which at 1 psi over pressure would corresponds to 17.68 ft^3/minute. This would correspond to a leakage rate 8.4% greater than the TS limit of 16.3 ft^3/minute at 1.0 psig.

$$LR = 17.68 \times (CP-14.7)^{1/2};$$

where:

LR = leakage rate from containment (scfm); and
CP = containment pressure (psia).

Using this equation for the assumed initial overpressure condition of 0.333 psig (2.28 kPa above atmosphere), it would take approximately 16.5 hours for the leakage rate to decrease to zero from an initial leakage rate of approximately 10.25 scfm, which would occur at the start of the event. The average leakage rate over the 16.5-hour period would be approximately 5.15 scfm. This conservatively over calculates the actual amount of activity that would leak out of the containment building and potentially expose someone in this assumed accident.

Several factors exist that will mitigate the radiological impact of any air leakage from the containment building following a FHA. First of all, most leakage pathways from containment discharge into the reactor laboratory building, which surrounds the containment structure. Since the laboratory building ventilation system continues to operate during a FHA, leakage air captured by the ventilation exhaust system is mixed with other building air, and then discharged from the facility through the exhaust stack at a rate of approximately 30,500 scfm. Mixing of containment air leakage with the laboratory building ventilation flow, followed by discharge out the exhaust stack and subsequent atmospheric dispersion, results in extremely low radionuclide concentrations and very small radiation doses in the unrestricted area. A tabulation of these concentrations and doses is given below.

A second factor which helps to reduce the potential radiation dose in the unrestricted area relates to the behavior of radioiodine, which has been studied extensively in the containment mockup facility at Oak Ridge National Laboratory (ORNL). From these experiments, it was shown that up to 75% of the iodine released will be deposited in the containment vessel. For the purposes of this analysis, MURR used the more conservative NRC-accepted value of 50% reduction of radioiodines from plate-out and deposition (Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors"). Thus, if due to this 50% iodine deposition in the containment building, each cubic foot of air released from the containment structure has a radioiodine concentration that is 50% of each cubic foot within the containment building air, then the radioiodine concentrations leaking from the containment structure into the laboratory building, in microcuries per standard cubic foot (scf), will be:

Example calculation of average ^{131}I concentration in containment during the first hour:

= (^{131}I concentration in pool x 20 gal) x EXP[(-0.693 x 0.5 hr) / ^{131}I $T_{1/2}$] / (scf in containment building)
= ($1.03 \times 10^{+03}$ µCi/gal x 20 gal) x EXP[(-0.693 x 0.5 hr) / (8.02 days x 24 hr/day)] / (229,801 scf)
= ($1.03 \times 10^{+03}$ µCi/gal x 20 gal) x 0.9982 / (229,801 scf)
= 8.98×10^{-02} µCi/scf

Note: Same calculation is used for the other radioiodines listed below.

<u>Radioiodine Concentrations in Containment Air during the First Hour</u>

^{131}I – 8.98×10^{-02} µCi/scf
^{133}I – 2.17×10^{-01} µCi/scf
^{135}I – 1.86×10^{-01} µCi/scf
^{132}I – 1.08×10^{-01} µCi/scf
^{134}I – 1.51×10^{-01} µCi/scf

Example calculation of the ^{85}Kr concentration released into containment:

= ^{85}Kr activity x EXP[(-0.693 x 0.5 hr) / (10.76 yr x 365.25 days/yr x 24 hr/day)] / 229,801 ft^3
= 4.35 x 10^{+04} µCi x 0.999996 / 229,801 ft^3
= 1.89 x 10^{-01} µCi/scf

Note: Same calculation is used for the other noble gases listed below.

Average Noble Gas Concentrations in the Containment Air during the First Hour

^{85}Kr – 1.89 x 10^{-01} µCi/scf	^{133}Xe – 1.57 x 10^{+02} µCi/scf
^{85m}Kr – 4.66 x 10^{+01} µCi/scf	^{135}Xe – 3.59 x 10^{+01} µCi/scf
^{87}Kr – 4.92 x 10^{+01} µCi/scf	^{135m}Xe – 3.80 x 10^{+00} µCi/scf
^{88}Kr – 9.34 x 10^{+01} µCi/scf	^{137}Xe – 3.97 x 10^{-03} µCi/scf
^{89}Kr – 2.94 x 10^{-04} µCi/scf	^{138}Xe – 1.09 x 10^{+01} µCi/scf
^{90}Kr – 4.36 x 10^{-32} µCi/scf	^{139}Xe – 7.29 x 10^{-26} µCi/scf

The average containment building leakage rate was calculated for each of the first five (5) hours and for the following three (3) 4-hour intervals:

Hours:	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 9	9 - 13	13 - 16.5
scf/hr:	595.6	558.7	521.8	485.0	448.1	355.8	207.9	67.9

The average concentration of the radioactive iodine's and noble gases in the facility's exhaust stack was calculated based on the average isotope concentration in containment during each of the time periods and the average leakage rate for the time interval. The iodine activities are reduced to 50% due to the previous stated 50% deposition in the containment structure in their leakage path. This leakage of activity out of containment is drawn into the facility exhaust ventilation system. The facility exhaust ventilation system has a flow rate of 30,500 scfm and results in the following average exhaust activities:

Example calculation of the average concentration of ^{131}I released through the exhaust stack during the first hour:

= (^{131}I activity concentration in containment µCi/scf x scf leakage rate x 0.5) / (30,500 scfm x 60 min/hr x 1 hr x 28,317 ml/ft^3)
= (8.98 x 10^{-02} µCi/scf x 595.6 scf x 0.5) / 5.18 x 10^{+10} ml
= 5.16 x 10^{-10} µCi/ml

Note: Same calculation is used for the other radioiodines listed below.

Average Radioiodine Concentrations in Air Leaking from Containment and Exiting the Exhaust Stack during the First Hour

^{131}I – 5.16 x 10^{-10} μCi/ml	^{133}I – 1.25 x 10^{-09} μCi/ml	^{135}I – 1.07 x 10^{-09} μCi/ml
^{132}I – 6.20 x 10^{-10} μCi/ml	^{134}I – 8.69 x 10^{-10} μCi/ml	

Example calculation of the average concentration of ^{85}Kr released through the exhaust stack during the first hour:

= (^{85}Kr activity concentration in containment μCi/scf x scf leakage rate) / (30,500 scfm x 60 min/hr x 1 hr x 28,317 ml/ft^3)
= (1.89 x 10^{-01} μCi/scf x 595.6 scf/hr) / (30,500 scfm x 60 min/hr x 1 hr x 28,317 ml/ft^3)
= 2.18 x 10^{-09} μCi/ml

Note: Same calculation is used for the other noble gases listed below.

Average Noble Gas Concentrations in Air Leaking from Containment and Exiting the Exhaust Stack during the First Hour

^{85}Kr – 2.18 x 10^{-09} μCi/ml	^{87}Kr – 5.65 x 10^{-07} μCi/ml	^{89}Kr – 3.38 x 10^{-12} μCi/ml
^{85m}Kr – 5.35 x 10^{-07} μCi/ml	^{88}Kr – 1.07 x 10^{-06} μCi/ml	^{90}Kr – 5.01 x 10^{-40} μCi/ml
^{133}Xe – 1.80 x 10^{-06} μCi/ml	^{135m}Xe – 4.37 x 10^{-08} μCi/ml	^{138}Xe – 1.25 x 10^{-07} μCi/ml
^{135}Xe – 4.12 x 10^{-07} μCi/ml	^{137}Xe – 4.56 x 10^{-11} μCi/ml	^{139}Xe – 8.38 x 10^{-34} μCi/ml

Assuming, as stated earlier, that (1) the average leakage rate from the containment building is 5.2 scfm, (2) the leak continues for about 16.5 hours in order to equalize the containment building pressure with atmospheric pressure, (3) the flow rate through the facility's ventilation exhaust stack is 30,500 scfm, (4) the reduction in concentration from the point of discharge at the exhaust stack to the point of maximum concentration in the unrestricted area is a factor of 292, and (5) there is no decay of any radioiodines or noble gases following release from the exhaust stack, then the following concentrations of radioiodines and noble gases with their corresponding radiation doses will occur in the unrestricted area. The values listed are for the point of maximum concentration in the unrestricted area assuming uniform, semi-spherical cloud geometry for noble gas submersion and further assuming that the most conservative (worst-case) meteorological conditions exist for the entire 16.5-hour period of containment leakage following a FHA. Radiation doses are calculated for the entire 16.5-hour period. Dose values for the unrestricted area were obtained using the same methodology that was used to determine doses inside the containment building, and it was assumed that an individual was present at the point of maximum concentration for the full 16.5 hours that the containment building was leaking.

A worst-case scenario effluent dilution factor of 292 using the Pasquill-Guifford Model for atmospheric dilution is used in this analysis. It is assumed that all offsite (public) dose occurs under these atmospheric conditions at the site of interest, i.e. 760 meters north of MURR. In our case, at 760 meters, it occurs only during Stability Class 'F' conditions, which normally only occurs 11.4% of the time when the wind blows from the south. Thus this calculation is conservative.

10 CFR 20 Appendix B Effluent Concentration Limits are used for the "listed" isotopes. Effluent Concentration Limits were calculated for each of the four (4) "unlisted" noble gases (Kr-89, Kr-90, Xe-137 and Xe-139) using the data and methodology contained in FGR No. 12 for submersion isotopes. The DAC value was first calculated and then a factor of 219 was applied using 10 CFR 20, Appendix B, as a reference point for DAC values from submersion isotopes. Exposure at 1 DAC equates to 5000 mrem per year whereas at the Effluent Concentration Limit it is 50 mrem per year. Thus, there is a factor of 100 times lower allowable dose for the Effluent Concentration Limit as compared to the DAC. Exposure at the Effluent Concentration Limit assumes you are in that effluent concentration for 8760 hours per year. Therefore, the time assumed to be exposed to the Effluent Concentration Limit is a factor of 4.38 times longer than the 2000 hours per year that defines a DAC. No credit is taken for transit time from the exhaust stack to the receptor point nor is credit taken for decay inside the containment building until release. In the case of Kr-89 and Xe-137, the transit time alone would be approximately one (1) half-life while the transit time for Kr-90 and Xe-139 would be at least four (4) half-lives.

Example calculation of whole body dose in the unrestricted area due to ^{131}I:

Conversion Factor: (Public dose limit of 50 mrem/yr) x (1 yr/8760 hrs) = 5.71 x 10^{-03} mrem/hr

^{131}I concentration	=	2.63 x 10^{-10} µCi/ml
^{131}I effluent concentration limit	=	2.00 x 10^{-10} µCi/ml
^{131}I Conversion Factor	=	1.325 mrem/hr

Therefore, a 16.5-hour whole body exposure from ^{131}I is:

= [(^{131}I concentration / ^{131}I Effluent Concentration Limit) x Conversion Factor x 16.5 hrs] / Dilution Factor

= [[(2.63 x 10^{-10} µCi/ml) / (2.00 x 10^{-10} µCi/ml)] x 1.325 mrem/hr x 16.5 hrs] / 292

= 4.24 x 10^{-04} mrem

Note: Same calculation is used for the other isotopes (radioiodines and noble gases) listed below.

Effluent Concentration Limits, Concentrations at Point of Maximum Concentration and Radiation Doses in the Unrestricted Area – Radioiodine

Radionuclide	Effluent Limit	Maximum Concentration[1]	Radiation Dose
^{131}I	2.00×10^{-10} µCi/ml	9.01×10^{-13} µCi/ml	4.24×10^{-04} mrem
^{132}I	2.00×10^{-08} µCi/ml	4.01×10^{-13} µCi/ml	1.89×10^{-06} mrem
^{133}I	1.00×10^{-09} µCi/ml	1.88×10^{-12} µCi/ml	1.77×10^{-04} mrem
^{134}I	6.00×10^{-08} µCi/ml	3.12×10^{-13} µCi/ml	4.89×10^{-07} mrem
^{135}I	6.00×10^{-09} µCi/ml	1.20×10^{-12} µCi/ml	1.88×10^{-05} mrem
			Total = 6.23E-04 mrem

Note 1: Maximum Concentrations are radioiodine and noble gas concentrations leaking from the containment building and exiting the exhaust stack reduced by a dilution factor of 292.

Effluent Concentration Limits, Concentrations at Point of Maximum Concentration and Radiation Doses in the Unrestricted Area – Noble Gases

Radionuclide	Effluent Limit	Maximum Concentration[1]	Radiation Dose
^{85}Kr	7.00×10^{-07} µCi/ml	3.87×10^{-12} µCi/ml	5.21×10^{-07} mrem
^{85m}Kr	1.00×10^{-07} µCi/ml	5.06×10^{-10} µCi/ml	4.77×10^{-04} mrem
^{87}Kr	2.00×10^{-08} µCi/ml	2.53×10^{-10} µCi/ml	1.19×10^{-03} mrem
^{88}Kr	9.00×10^{-09} µCi/ml	7.93×10^{-10} µCi/ml	8.30×10^{-03} mrem
^{89}Kr	8.60×10^{-09} µCi/ml	7.01×10^{-16} µCi/ml	7.68×10^{-09} mrem
^{90}Kr	1.20×10^{-08} µCi/ml	1.04×10^{-43} µCi/ml	8.17×10^{-37} mrem
^{133}Xe	5.00×10^{-07} µCi/ml	3.12×10^{-09} µCi/ml	5.88×10^{-04} mrem
^{135}Xe	7.00×10^{-08} µCi/ml	5.17×10^{-10} µCi/ml	6.96×10^{-04} mrem
^{135m}Xe	4.00×10^{-08} µCi/ml	9.68×10^{-12} µCi/ml	2.28×10^{-05} mrem
^{137}Xe	9.10×10^{-08} µCi/ml	9.46×10^{-15} µCi/ml	9.80×10^{-09} mrem
^{138}Xe	2.00×10^{-08} µCi/ml	2.72×10^{-11} µCi/ml	1.28×10^{-04} mrem
^{139}Xe	1.60×10^{-08} µCi/ml	1.74×10^{-37} µCi/ml	1.02×10^{-30} mrem
			Total = 1.14E-02 mrem

Note 1: Maximum Concentrations are radioiodine and noble gas concentrations leaking from the containment building and exiting the exhaust stack reduced by a dilution factor of 292.

To finalize the unrestricted dose in terms of Total Effective Dose Equivalent (TEDE), the doses from the radioiodines and noble gases must be added together, and result in the following values:

Dose from Radioiodines and Noble Gases in the Unrestricted Area

Total Iodine – Committed Effective Dose Equivalent (CEDE)	**6.23E-04 mrem**
Noble Gas – Committed Effective Dose Equivalent (CEDE)	**1.14E-02 mrem**
Total Dose – Total Effective Dose Equivalent (TEDE)	**1.20E-02 mrem**

Summing the doses from the noble gases and the radioiodines simply substantiates earlier statements regarding the very low levels in the unrestricted area should a FHA occur, and should the containment building leak following such an event. Because the dose values are so low, a value far below the applicable 10 CFR 20 regulatory limit for the unrestricted area, MURR does not anticipate any issues regarding offsite dose during a FHA scenario.

Fueled Experiment Failure [page 56] – Information/Clarification Needed

- *Several equations do not appear to have been bracketed correctly. Explain.*

  The "Fueled Experiment Failure" accident analysis has been revised to correct for any bracketing inaccuracies in the equations.

- *Units used are non-standard (micro-Curies per cubic foot versus micro-Curies per cubic milliliter, similar comment on pages 47 and 48). Verify.*

  The "Fueled Experiment Failure" accident analysis has been revised to correct for any non-standard units.

Revised **"Fueled Experiment Failure"**
(MURR's new Maximum Hypothetical Accident)

The release of the radioisotopes of krypton, xenon and radioiodine from a 5-gram, low-enriched uranium (LEU) target is the major source of radiation exposure to an individual and will, therefore, serve as the basis for the source term for the dose calculations of a Fueled Experiment Failure. A 5-gram LEU target irradiated for 150 hours (normal weekly operating cycle) at a thermal neutron flux of 1.5 x 10^{+13} n/cm^2-sec will produce the following radioiodine, krypton and xenon activities (additionally, approximately 1.40 x 10^{+04} µCi of ^{90}Sr will be produced):

Radioiodine and Noble Gas Activities in a 5-Gram LEU Target

^{131}I – 6.755 Ci	^{85}Kr – 0.0020 Ci	^{133}Xe – 18.925 Ci
^{132}I – 18.635 Ci	^{85m}Kr – 7.580 Ci	^{135}Xe – 13.630 Ci
^{133}I – 39.875 Ci	^{87}Kr – 15.405 Ci	^{135m}Xe – 6.760 Ci
^{134}I – 45.405 Ci	^{88}Kr – 21.660 Ci	^{137}Xe – 35.800 Ci
^{135}I – 37.695 Ci	^{89}Kr – 27.740 Ci	^{138}Xe – 37.380 Ci
	^{90}Kr – 27.410 Ci	^{139}Xe – 30.675 Ci
Total Iodine – 148.365 Ci	**Total Krypton – 99.797 Ci**	**Total Xenon – 143.170 Ci**

The source term for the Fueled Experiment Failure accident analysis [the new Maximum Hypothetical Accident (MHA)] was determined using the ORIGEN program. The fueled experiment target was irradiated for 150 hours at the peak flux level it is exposed to during full power reactor operation and the resulting activities were calculated using ORIGEN 2.2.

A complete failure of the fueled target is unrealistic for many reasons. The worst that can be expected is partial melting; however, in order to present a worst-case dose assessment for an individual that remains in the containment building following target failure, 100% of the total activity of the target is assumed to be released into the reactor pool.

Fission products released into the reactor pool will be detected by the pool surface and ventilation system exhaust plenum radiation monitors. However, for the purposes of this analysis, it is assumed that a reactor scram and actuation of the containment building isolation system occurs by action of the pool surface radiation monitor. Actuation of the isolation system will prompt Operations personnel to ensure that a total evacuation of the containment building is accomplished promptly, usually within two (2) to two and a half (2.5) minutes. A conservative 5-minute evacuation time is used as the basis for the stay time in the dose calculations for personnel that are in containment during target failure.

The radioiodine released into the reactor pool over a 5-minute interval is conservatively assumed to be instantly and uniformly mixed into the 20,000 gallons (75,708 l) of bulk pool water, which then results in the following pool water concentrations for the radioiodine isotopes. The water solubility of the krypton and xenon noble gases released into the pool over this same time period is conservatively ignored. The gas bubble rise time in the reactor pool from where the target is situated in the graphite reflector region to the pool surface has been measured at 17 seconds, so it is assumed

the earliest any of the radioisotopes from the fueled experiment enters into the containment building air volume is after 17 seconds. It is also assumed when the radioactivity enters the containment air volume it instantaneously forms a uniform concentration in the isolated containment structure.

Radioiodine Concentrations in the Pool Water

^{131}I – 3.38 x 10^{+02} µCi/gal	^{133}I – 1.99 x 10^{+03} µCi/gal	^{135}I – 1.88 x 10^{+03} µCi/gal
^{132}I – 9.32 x 10^{+02} µCi/gal	^{134}I – 2.27 x 10^{+03} µCi/gal	

When the reactor is at 10 MW and the containment building ventilation system is in operation, the evaporation rate from the reactor pool surface is approximately 80 gallons (302.8 L) of water per day. For the purposes of this calculation, it is assumed that a total of 20 gallons (75.7 L) of pool water containing the previously listed radioiodine concentrations evaporates into the containment building over the 5-minute period. Containment air with a temperature of 75 °F (23.9 °C) and 100% relative humidity contains H_2O vapor equal to 40 gallons (151.4 L) of water. Since the air in containment is normally at about 50% relative humidity, thus containing 20 gallons (75.7 L) of water vapor, the assumed addition of 20 gallons (75.7 L) of water vapor over five (5) minutes will not cause the containment air to be supersaturated. It is also conservatively assumed that all of the radioiodine activity in the 20 gallons (75.7 L) of evaporated pool water instantaneously forms a uniform concentration in the containment building air. When distributed into the containment building, this would result in the following radioiodine concentrations in the 225,000 ft^3 (6,371.3 m^3) air volume:

Example calculation of the average ^{131}I concentration released into containment air during the first minute:

= ^{131}I concentration in pool water/gal x 20 gal/5 min x 0.5 min x EXP[(-0.693 x (17 + 30 sec)) / (8.02 day x 8.64 x 10^{+04} sec/day)] /(225,000 ft^3 x 28317 ml/ft^3)
= (3.38 x 10^{+02} µCi/gal) x 2 gal x 0.99995 / (6.317 x 10^{+09} ml)
= 1.06 x 10^{-07} µCi/ml

Same calculation is used for the other isotopes listed below and was performed for each one minute interval. The average radioiodine concentration over the 5-minute interval is the average of the five (5) 1-minute intervals.

Average Radioiodine Concentrations in the Containment Building Air during the 5 Minutes

^{131}I – 5.30 x 10^{-07} µCi/ml	^{133}I – 3.12 x 10^{-06} µCi/ml	^{135}I – 2.96 x 10^{-06} µCi/ml
^{132}I – 1.44 x 10^{-06} µCi/ml	^{134}I – 3.40 x 10^{-06} µCi/ml	

As noted previously, the krypton and xenon noble gases released into the reactor pool from the 5-gram LEU target during the 5-minute interval following failure are assumed to have no absorption in the pool water, rise through the pool in 17 seconds (thus slightly decaying) and enter the containment building air volume where they are assumed to instantaneously form a uniform concentration in the isolated structure. Based on the 225,000-ft^3 volume of containment building air, and the previously

listed Curie quantities of these gases released into the reactor pool, the maximum noble gas concentrations in the containment structure at the end of five (5) minutes would be as follows:

Example calculation of the average ^{85}Kr released into containment air during the first minute after the gas enters the containment air:

$$= {}^{85}\text{Kr activity} \times \text{EXP}[(-0.693 \times (17 + 30\ \text{sec})) / (10.76\ \text{yrs} \times 3.156 \times 10^{+07}\ \text{sec/yr})] / (225{,}000\ \text{ft}^3 \times 28317\ \text{ml/ft}^3)$$
$$= 2.00 \times 10^{+03}\ \mu\text{Ci} \times 1.000 / (6.371 \times 10^{+09}\ \text{ml})$$
$$= 3.14 \times 10^{-07}\ \mu\text{Ci/ml}$$

Note: Same calculation is used for the other isotopes listed below.

The average noble gas concentrations are the average of the five (5) 1-minute decay corrected concentrations.

Average Noble Gas Concentrations in the Containment Building Air during the 5 Minutes

^{85}Kr – 3.14×10^{-07} μCi/ml	^{133}Xe – 2.97×10^{-03} μCi/ml
^{85m}Kr – 1.18×10^{-03} μCi/ml	^{135}Xe – 2.13×10^{-03} μCi/ml
^{87}Kr – 2.36×10^{-03} μCi/ml	^{135m}Xe – 9.37×10^{-04} μCi/ml
^{88}Kr – 3.36×10^{-03} μCi/ml	^{137}Xe – 3.50×10^{-03} μCi/ml
^{89}Kr – 2.48×10^{-03} μCi/ml	^{138}Xe – 5.13×10^{-03} μCi/ml
^{90}Kr – 4.33×10^{-04} μCi/ml	^{139}Xe – 6.50×10^{-04} μCi/ml

The objective of this calculation is to present a worst-case dose assessment for an individual who remains in the containment building for five (5) minutes following target failure. Therefore, as noted previously, the radioactivity in the evaporated pool water is assumed to be instantaneously and uniformly distributed into the building once released into the air. Based on the source term data provided, it is possible to determine the radiation dose to the thyroid from radioiodine and the dose to the whole body resulting from submersion in the airborne noble gases and radioiodine inside the containment building.

Because the airborne radioiodine source is composed of five (5) different iodine isotopes, it will be necessary to determine the dose contribution from each individual isotope and to then sum the results before calculating an effective dose equivalent for the radioiodines. These results were then added to the submersion doses calculated for the noble gases. Dose multiplication factors were established using the Derived Air Concentrations (DACs) for the "listed" isotopes in Appendix B of 10 CFR 20 and were calculated using the methodology presented in Federal Guidance Report (FGR) No. 12 for those isotopes that are "unlisted" submersion isotopes, and the radionuclide concentrations in the containment building (Attachment 4).

Example calculation of thyroid dose due to ^{131}I:

The DAC can also be defined as 50,000 mrem (thyroid target organ limit)/2,000 hrs, or 25 mrem/DAC-hr. Additionally, five (5) minutes of one DAC-hr is 8.33×10^{-02} DAC-hr.

^{131}I concentration in containment	=	5.30×10^{-07} µCi/ml
^{131}I DAC (10 CFR 20)	=	2.00×10^{-08} µCi/ml
Dose Multiplication Factor	=	(^{131}I concentration) / (^{131}I DAC)
	=	(5.30×10^{-07} µCi/ml) / (2.00×10^{-08} µCi/ml)
	=	26.5

Therefore, a 5-minute thyroid exposure from ^{131}I is:

= Dose Multiplication Factor x DAC Dose Rate x 5 minutes of a DAC-hr
= 26.5 x (25 mrem/DAC-hr) x (8.33×10^{-02} DAC-hr)
= 55.2 mrem

Note: Same calculation is used for the other radioiodines listed below.

Derived Air Concentration Values and 5-Minute Exposures – Radioiodine

Radionuclide	Derived Air Concentration	5-Minute Exposure
^{131}I	2.00×10^{-08} µCi/ml	55.2 mrem
^{132}I	3.00×10^{-06} µCi/ml	0.997 mrem
^{133}I	1.00×10^{-07} µCi/ml	65.0 mrem
^{134}I	2.00×10^{-05} µCi/ml	0.354 mrem
^{135}I	7.00×10^{-07} µCi/ml	8.80 mrem
		Total = 130.4 mrem

Doses from the kryptons and xenons present in the containment building are assessed in much the same manner as the radioiodines, and the dose contribution from each individual radionuclide must be calculated and then added together to arrive at the final noble gas dose. Because the dose from the noble gases is only an external dose due to submersion, and because the DACs for these radionuclides are based on this type of exposure, the individual noble gas doses for five (5) minutes in containment were based on their average concentration in the containment air and the corresponding DAC.

Example calculation of whole body dose (CEDE) due to ^{85}Kr:

The DAC can also be defined as 5,000 mrem/2,000 hrs, or 2.5 mrem/DAC-hr. Additionally, five (5) minutes of one DAC-hr is 8.33×10^{-02} DAC-hr.

^{85}Kr concentration in containment	=	3.14×10^{-07} µCi/ml
^{85}Kr DAC (10 CFR 20)	=	1.00×10^{-04} µCi/ml
Dose Multiplication Factor	=	(^{85}Kr concentration) / (^{85}Kr DAC)
	=	(3.14×10^{-07} µCi/ml) / (1.00×10^{-04} µCi/ml)
	=	0.00314

Therefore, a 5-minute whole body exposure from ^{85}Kr is:

= Dose Multiplication Factor x DAC Dose Rate x 5 minutes of a DAC-hr
= 0.00314 x (2.5 mrem/DAC-hr) x (8.33×10^{-02} DAC-hr)
= 6.54×10^{-04} mrem

Note: Same calculation is used for the other noble gases listed below.

Derived Air Concentration Values and 5-Minute Exposures – Noble Gases

Radionuclide	Derived Air Concentration	5-Minute Exposure
^{85}Kr	1.00×10^{-04} µCi/ml	6.54×10^{-04} mrem
^{85m}Kr	2.00×10^{-05} µCi/ml	$1.23 \times 10^{+01}$ mrem
^{87}Kr	5.00×10^{-06} µCi/ml	$9.82 \times 10^{+01}$ mrem
^{88}Kr	2.00×10^{-06} µCi/ml	$3.50 \times 10^{+02}$ mrem
^{89}Kr	1.90×10^{-06} µCi/ml	$2.71 \times 10^{+02}$ mrem
^{90}Kr	2.80×10^{-06} µCi/ml	$3.22 \times 10^{+01}$ mrem
^{133}Xe	1.00×10^{-04} µCi/ml	$6.18 \times 10^{+00}$ mrem
^{135}Xe	1.00×10^{-05} µCi/ml	$4.44 \times 10^{+01}$ mrem
^{135m}Xe	9.00×10^{-06} µCi/ml	$2.17 \times 10^{+01}$ mrem
^{137}Xe	2.00×10^{-05} µCi/ml	$3.65 \times 10^{+01}$ mrem
^{138}Xe	4.00×10^{-06} µCi/ml	$2.67 \times 10^{+02}$ mrem
^{139}Xe	3.70×10^{-06} µCi/ml	$3.66 \times 10^{+01}$ mrem
		Total = 1176.42 mrem

To finalize the occupational dose in terms of Total Effective Dose Equivalent (TEDE) for a 5-minute exposure in the containment building after target failure, the doses from the radioiodines and noble gases must be added together, and result in the following values:

5-Minute Dose from Radioiodines and Noble Gases in the Containment Building

Total Iodine – Committed Dose Equivalent (CDE)	**130.36 mrem**
Iodine – Committed Effective Dose Equivalent (CEDE) (CEDE = CDE x 0.03)	**3.91 mrem**
Noble Gas – Committed Effective Dose Equivalent (CEDE)	**1176.42 mrem**
Total Dose – Total Effective Dose Equivalent (TEDE)	**1180.33 mrem**

Note: The addition of ^{90}Sr will increase the above stated TEDE (whole body) by <1%. However, due to the chemical form of the strontium, which would not be prone to evaporation from the pool into the containment atmosphere, it would remain as a residue or concentrate in the unevaporated pool water and its contribution to dose would essentially be zero.

By comparison of the maximum TEDE and CDE for those occupationally-exposed during target failure to applicable NRC dose limits in 10 CFR 20, the final values are shown to be well within the published regulatory limits and, in fact, lower than 25% of any occupational limit.

Radiation shine through the containment structure was also evaluated when considering accident conditions and dose consequences to the public and MURR staff. Calculation of exposure rate from the target failure was performed using the computer program MicroShield 8.02 with a Rectangular Volume – External Dose Point geometry for the representation of the containment structure (Attachment 12). MicroShield 8.02 is a product of Grove Software and is a comprehensive photon/gamma ray shielding and dose assessment program that is widely used by industry for designing radiation shields.

The exposure rate values provided below represents the radiation fields at 1 foot (30.5 cm) from a 12-inch (30.5 cm) thick ordinary concrete containment wall and at the Emergency Planning Zone (EPZ) boundary of 150 meters (492.1 ft). The airborne concentration source terms used to develop the exposure rate values are identical to those used for determining the dose to a worker within containment from noble gases. For radioiodine, the total iodine activity of the target was used for the dose calculations, not the amount that evaporated in five (5) minutes. The source term also assumes a homogenous mixture of nuclides within the containment free volume.

Radiation Shine through the Containment Building

Exposure Rate at 1-Foot from Containment Building Wall:	**74.69 mrem/hr**
Exposure Rate at Emergency Planning Zone Boundary (150 meters):	**0.514 mrem/hr**

As noted earlier in this analysis, the containment building ventilation system will shut down and the building itself will be isolated from the surrounding areas. Target failure will not cause an increase in pressure inside the reactor containment structure; therefore, any air leakage from the building will occur as a result of normal changes in atmospheric pressure and pressure equilibrium between the inside of the containment structure and the outside atmosphere. It is highly probable that there will be no pressure differential between the inside of the containment building and the outside atmosphere, and consequently there will be no air leakage from the building and no radiation dose to members of the public in the unrestricted area. However, to develop what would clearly be a worst-case scenario, this analysis assumes that a barometric pressure drop had occurred in conjunction with target failure. An extreme worst-case assumption would be a pressure change on the order of 0.7 inches of Hg (25.4 mm of Hg at 60 °C), which would then create a pressure differential of about 0.33 psig (2.28 kPa above atmosphere) between the inside of the isolated containment building and the inside of the adjacent laboratory building, which surrounds most of the containment building.

The conservative assumption is made that the containment building will leak at a rate slightly greater than the Technical Specification (TS) leakage rate limit. The TS leakage rate limit shall not exceed either 16.3 ft^3/min (STP) with an overpressure of one pound per square inch gauge or 10% of the contained volume over a 24-hour period from an initial overpressure of two pounds per square inch gauge. Additionally, the minimum TS free volume of the containment building is 225,000-ft^3 at standard pressure and temperature.

The following equation represents the air leakage rate from the containment building in standard cubic feet per minute (scfm) as a function of containment pressure which at 1 psi over pressure would corresponds to 17.68 ft^3/minute. This would correspond to a leakage rate 8.4% greater than the TS limit of 16.3 ft^3/minute at 1.0 psig.

$$LR = 17.68 \times (CP-14.7)^{1/2};$$

where:

LR = leakage rate from containment (scfm); and
CP = containment pressure (psia).

Using this equation for the assumed initial overpressure condition of 0.33 psig (2.28 kPa above atmosphere), it would take approximately 16.5 hours for the leakage rate to decrease to zero from an initial leakage rate of approximately 10.25 scfm, which would occur at the start of the event. The average leakage rate over the 16.5-hour period would be approximately 5.15 scfm. This conservatively over calculates the actual amount of activity that would leak out of the containment building and potentially expose someone in this assumed accident.

Several factors exist that will mitigate the radiological impact of any air leakage from the containment building following target failure. First of all, most leakage pathways from containment discharge into the laboratory building, which surrounds the containment structure. Since the laboratory building ventilation system continues to operate during target failure, leakage air captured by the ventilation exhaust system is mixed with other building air, and then discharged from the facility through the exhaust stack at a rate of approximately 30,500 scfm. Mixing of containment air leakage with the laboratory building ventilation flow, followed by discharge out the exhaust stack and subsequent atmospheric dispersion, results in extremely low radionuclide concentrations and very small radiation doses in the unrestricted area. A tabulation of these concentrations and doses is given below.

A second factor which helps to reduce the potential radiation dose in the unrestricted area relates to the behavior of radioiodine, which has been studied extensively in the containment mockup facility at Oak Ridge National Laboratory (ORNL). From these experiments, it was shown that up to 75% of the iodine released will be deposited in the containment vessel. For the purposes of this analysis, MURR used the more conservative NRC-accepted value of 50% reduction of radioiodines from plate-out and deposition (Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors"). Thus, due to this 50% iodine deposition in the containment building, each cubic foot of air released from

containment has a radioiodine concentration that is 50% of each cubic foot within containment building air, then the radioiodine concentrations leaking from the containment structure into the laboratory building, in microcuries per standard cubic foot (scf), during the first hour will be (average ^{131}I concentration in containment):

Example calculation of average ^{131}I concentration in containment during the first hour:

= (^{131}I activity in pool water x 20 gal) x EXP[(-0.693 x 0.5 hr) / ^{131}I $T_{1/2}$]) / (scf in containment)
= (3.38 x 10^{+02} μCi/gal x 20 gal) x 0.9982 / (229,800 scf)
= 2.94 x 10^{-02} μCi/scf

Note: Same calculation is used for the other radioiodines listed below.

Radioiodine Concentrations in Containment Air during the First Hour

^{131}I – 2.94 x 10^{-02} μCi/scf	^{133}I – 1.70 x 10^{-01} μCi/scf	^{135}I – 1.55 x 10^{-01} μCi/scf
^{132}I – 6.97 x 10^{-02} μCi/scf	^{134}I – 1.33 x 10^{-01} μCi/scf	

Example calculation of the ^{85}Kr concentration released into containment during the First Hour:

= ^{85}Kr activity x EXP[(-0.693 x 0.5 hr) / (10.76 yr x 365.25 days/yr x 24 hr/day)] / 229,801 ft^3
= 2.00 x 10^{+03} μCi x 0.999996 / 229,801 ft^3
= 8.70 x 10^{-03} μCi/scf

Note: Same calculation is used for the other noble gases listed below.

Average Noble Gas Concentrations in the Containment Air during the First Hour

^{85}Kr – 8.70 x 10^{-03} μCi/scf	^{133}Xe – 8.21 x 10^{+01} μCi/scf
^{85m}Kr – 3.05 x 10^{+01} μCi/scf	^{135}Xe – 5.71 x 10^{+01} μCi/scf
^{87}Kr – 5.10 x 10^{+01} μCi/scf	^{135m}Xe – 7.56 x 10^{+00} μCi/scf
^{88}Kr – 8.34 x 10^{+01} μCi/scf	^{137}Xe – 6.74 x 10^{-01} μCi/scf
^{89}Kr – 1.64 x 10^{-01} μCi/scf	^{138}Xe – 3.72 x 10^{+01} μCi/scf
^{90}Kr – 2.02 x 10^{-15} μCi/scf	^{139}Xe – 3.02 x 10^{-12} μCi/scf

The average containment building leakage rate was calculated for each of the first five (5) hours and for the following three (3) 4-hour intervals:

Hours:	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 9	9 - 12	12 - 16.5
scf/hr:	595.6	558.7	521.8	485.0	448.1	355.8	207.9	67.9

The average concentration of the radioactive iodine's and noble gasses in the facility's exhaust stack was calculated based on the average isotope concentration in containment during each of the time

periods and the average leak rate for the time interval. The iodine activities are reduced to 50% due to the previous stated 50% deposition in the containment structure in their leakage path. This leakage of activity out of containment is drawn into the facility exhaust ventilation system. The facility exhaust ventilation system has a flow rate of 30,500 scfm and results in the following average exhaust ventilation system activities:

Example calculation of the average concentration of ^{131}I released through the exhaust stack during the first hour:

= (^{131}I activity in containment in µCi/scf x scf leakage rate x 0.5) / (30,500 ft^3/min x 60 min/hr x 28,317 ml/ft^3)
= (2.94 x 10^{-02} µCi/scf x 595.6 scf/hr x 1 hr x 0.5) / 5.182 x 10^{+10} ml/hr
= 1.69 x 10^{-10} µCi/ml

Note: A similar, but longer, calculation is used to determine the average concentration in air exiting the exhaust stack over the full 16.5 hours for the radioiodines listed below.

<u>Average Radioiodine Concentrations in Air Leaking from Containment and Exiting the Exhaust Stack Over the 16.5 Hour Period</u>

^{131}I – 8.60 x 10^{-11} µCi/ml	^{133}I – 4.32 x 10^{-10} µCi/ml	^{135}I – 2.92 x 10^{-10} µCi/ml
^{132}I – 7.56 x 10^{-11} µCi/ml	^{134}I – 8.01 x 10^{-11} µCi/ml	

Example calculation of ^{85}Kr released through the exhaust stack during the first hour:

= (^{85}Kr activity/scf x 595.6 scf/hr x 1 hr) / (30,500 ft^3/min x 60 min/hr x 1 hr x 28,317 ml/ft^3)
= (8.70 x 10^{-03} µCi/scf x 595.6 scf) / 5.182 x 10^{+10} ml
= 1.00 x 10^{-10} µCi/ml

Note: Same calculation is used for the other noble gases listed below.

<u>Average Noble Gas Concentrations in Air Leaking from Containment and Exiting the Exhaust Stack Over the 16.5 Hour Period</u>

^{85}Kr – 5.19 x 10^{-11} µCi/ml	^{87}Kr – 7.66 x 10^{-08} µCi/ml	^{89}Kr – 1.14 x 10^{-10} µCi/ml
^{85m}Kr – 9.69 x 10^{-08} µCi/ml	^{88}Kr – 2.07 x 10^{-07} µCi/ml	^{90}Kr – 1.40 x 10^{-24} µCi/ml
^{133}Xe – 4.76 x 10^{-07} µCi/ml	^{135m}Xe – 5.61 x 10^{-09} µCi/ml	^{138}Xe – 2.73 x 10^{-08} µCi/ml
^{135}Xe – 2.40 x 10^{-07} µCi/ml	^{137}Xe – 4.70 x 10^{-10} µCi/ml	^{139}Xe – 2.10 x 10^{-21} µCi/ml

Assuming, as stated earlier, that (1) the average leakage rate from the containment building is 5.2 scfm, (2) the leak continues for about 16.5 hours in order to equalize the containment building pressure with atmospheric pressure, (3) the flow rate through the facility's ventilation exhaust stack is 30,500 scfm, (4) the reduction in concentration from the point of discharge at the exhaust stack to the point of maximum concentration in the unrestricted area is a factor of 292, and (5) there is no decay of any radioiodines or noble gases following release from the stack, then the following

concentrations of radioiodines and noble gases with their corresponding radiation doses will occur in the unrestricted area. The values listed are for the point of maximum concentration in the unrestricted area assuming a uniform, semi-spherical cloud geometry for noble gas submersion and further assuming that the most conservative (worst-case) meteorological conditions exist for the entire 16.5-hour period of containment leakage following target failure. Radiation doses are calculated based on a 16.5-hour exposure period. Dose values for the unrestricted area were obtained using the same methodology that was used to determine doses inside the containment building, and it was assumed that an individual was present at the point of maximum concentration for the full 16.5 hours that the containment building was leaking.

A worst-case scenario dilution factor of 292 for effluent dilution using the Pasquill-Guifford Model for atmospheric dilution is used in this analysis. We assume that all offsite (public) dose occurs under these atmospheric conditions at the site of interest, i.e. 760 meters North of MURR. In our case at 760 meters, it occurs only during Stability Class 'F' conditions, which normally only occurs 11.4% of the time when the wind blows from the south. Thus this calculation is conservative.

10 CFR 20 Appendix B Effluent Concentration Limits are used for the "listed" isotopes. Effluent Concentration Limits were calculated for each of the four (4) "unlisted" noble gases (Kr-89, Kr-90, Xe-137 and Xe-139) using the data and methodology contained in FGR No. 12 for submersion isotopes. The DAC value was first calculated and then a factor of 219 was applied using 10 CFR 20, Appendix B, as a reference point for DAC values from submersion isotopes. Exposure at 1 DAC equates to 5000 mrem per year whereas at the Effluent Concentration Limit it is 50 mrem per year. Thus, there is a factor of 100 times lower allowable dose for the Effluent Concentration Limit as compared to the DAC. Exposure at the Effluent Concentration Limit assumes you are in that effluent concentration for 8760 hours per year. Therefore, the time assumed to be exposed to the Effluent Concentration Limit is a factor of 4.38 times longer than the 2000 hours per year that defines a DAC. No credit is taken for transit time from the exhaust stack to the receptor point nor is credit taken for decay inside the containment building until release. In the case of Kr-89 and Xe-137, the transit time alone would be approximately one (1) half-life while the transit time for Kr-90 and Xe-139 would be at least four (4) half-lives.

Example calculation of whole body dose in the unrestricted area due to ^{131}I:

Conversion Factor: (Public dose limit of 50 mrem/yr) x (1 yr/8760 hrs) = 5.71×10^{-03} mrem/hr

^{131}I concentration	=	8.60×10^{-11} µCi/ml
^{131}I effluent concentration limit	=	2.00×10^{-10} µCi/ml
^{131}I Conversion Factor	=	5.71×10^{-03} mrem/hr

Therefore, a 16.5-hour whole body exposure from ^{131}I is:

= ^{131}I concentration / (^{131}I effluent concentration limit x Conversion Factor x 16.5 hrs)

= (8.60×10^{-11} µCi/ml / 2.00×10^{-10} µCi/ml) x 5.71×10^{-03} mrem/hr x 16.5 hrs/292

= 1.39×10^{-04} mrem

Note: Same calculation is used for the other isotopes (radioiodines and noble gases) listed below.

Effluent Concentration Limits, Concentrations at Point of Maximum Concentration and Radiation Doses in the Unrestricted Area – Radioiodine

Radionuclide	Effluent Limit	Maximum Concentration[1]	Radiation Dose
^{131}I	2.00×10^{-10} µCi/ml	2.95×10^{-13} µCi/ml	1.39×10^{-04} mrem
^{132}I	2.00×10^{-08} µCi/ml	2.59×10^{-13} µCi/ml	1.22×10^{-06} mrem
^{133}I	1.00×10^{-09} µCi/ml	1.48×10^{-12} µCi/ml	1.39×10^{-04} mrem
^{134}I	6.00×10^{-08} µCi/ml	2.74×10^{-13} µCi/ml	4.31×10^{-07} mrem
^{135}I	6.00×10^{-09} µCi/ml	9.99×10^{-13} µCi/ml	1.57×10^{-05} mrem
		Total	**= 2.95E-04 mrem**

Note 1: Maximum Concentrations are radioiodine and noble gas concentrations leaking from the containment building and exiting the exhaust stack reduced by a dilution factor of 292.

Effluent Concentration Limits, Concentrations at Point of Maximum Concentration and Radiation Doses in the Unrestricted Area – Noble Gases

Radionuclide	Effluent Limit	Maximum Concentration[1]	Radiation Dose
^{85}Kr	7.00×10^{-07} µCi/ml	1.78×10^{-13} µCi/ml	2.39×10^{-08} mrem
^{85m}Kr	1.00×10^{-07} µCi/ml	3.32×10^{-10} µCi/ml	3.13×10^{-04} mrem
^{87}Kr	2.00×10^{-08} µCi/ml	2.62×10^{-10} µCi/ml	1.24×10^{-03} mrem
^{88}Kr	9.00×10^{-09} µCi/ml	7.08×10^{-10} µCi/ml	7.41×10^{-03} mrem
^{89}Kr	8.60×10^{-09} µCi/ml	3.92×10^{-13} µCi/ml	4.29×10^{-06} mrem
^{90}Kr	1.20×10^{-08} µCi/ml	4.81×10^{-27} µCi/ml	3.78×10^{-20} mrem
^{133}Xe	5.00×10^{-07} µCi/ml	1.63×10^{-09} µCi/ml	3.07×10^{-04} mrem
^{135}Xe	7.00×10^{-08} µCi/ml	8.23×10^{-10} µCi/ml	1.11×10^{-03} mrem
^{135m}Xe	4.00×10^{-08} µCi/ml	1.92×10^{-11} µCi/ml	4.53×10^{-05} mrem
^{137}Xe	9.10×10^{-08} µCi/ml	1.61×10^{-12} µCi/ml	1.67×10^{-06} mrem
^{138}Xe	2.00×10^{-08} µCi/ml	9.34×10^{-11} µCi/ml	4.40×10^{-04} mrem
^{139}Xe	1.60×10^{-08} µCi/ml	7.20×10^{-24} µCi/ml	4.24×10^{-17} mrem
		Total	**= 1.09E-02 mrem**

Note 1: Maximum Concentrations are radioiodine and noble gas concentrations leaking from the containment building and exiting the exhaust stack reduced by a dilution factor of 292.

To finalize the unrestricted dose in terms of Total Effective Dose Equivalent (TEDE), the doses from the radioiodines and noble gases must be added together, and result in the following values:

Dose from Radioiodines and Noble Gases in the Unrestricted Area

Total Iodine – Committed Effective Dose Equivalent (CEDE)	**2.95E-04 mrem**
Noble Gas – Committed Effective Dose Equivalent (CEDE)	**1.09E-02 mrem**
Total Dose – Total Effective Dose Equivalent (TEDE)	**1.12E-02 mrem**

Summing the doses from the noble gases and the radioiodines simply substantiates earlier statements regarding the very low levels in the unrestricted area should a failure of a fueled experiment occur, and should the containment building leak following such an event. Due to low concentrations present at the modeled site of interest, dose to the public is low with the noble gases and iodines each contributing about equally. The overall TEDE is much less than 1 mrem, a value far below the applicable 10 CFR 20 regulatory limit for dose to the public in an unrestricted area.

ATTACHMENT 1

Burning of typical HEU fuel assembly at HURR for 12 10-day cycle for 300.0208 days
Total Power (MW) = 9.50E+00, Days = 3.00E+02
outer steps = 24, # inner steps = 60, # predictor steps = 1.
Importance Fraction = 0.0000

Monteburns HOIP k-eff Versus Time

	days	k-eff	rel err	nu	avQfis	k-inf
0m	0.00	1.09093	0.00096	2.433		
1e	10.00	1.03282	0.00099	2.434		
2e	26.36	1.07423	0.00097	2.433		
3e	36.36	1.02762	0.00098	2.435		
4e	52.73	1.06644	0.00101	2.434		
5e	62.73	1.02250	0.00093	2.433		
6e	79.09	1.06010	0.00100	2.436		
7e	89.09	1.01731	0.00100	2.436		
8e	105.46	1.05375	0.00100	2.434		
9e	115.46	1.01177	0.00098	2.432		
10e	131.82	1.04795	0.00101	2.436		
11e	141.82	1.00640	0.00101	2.438		
12e	158.18	1.04252	0.00098	2.437		
13e	168.18	1.00060	0.00098	2.436		
14e	184.55	1.03845	0.00098	2.435		
15e	194.55	0.99391	0.00096	2.439		
16e	210.91	1.03157	0.00097	2.433		
17e	220.91	0.98837	0.00098	2.435		
18e	237.28	1.02511	0.00103	2.436		
19e	247.28	0.98599	0.00096	2.435		
20e	263.64	1.01887	0.00097	2.437		
21e	273.64	0.97770	0.00100	2.438		
22e	290.00	1.01257	0.00105	2.436		
23e	300.00	0.97280	0.00098	2.435 (Step 23: EOI for FP inventory for FFA)		
24e	300.02	0.96435	0.00092	2.438 (Step 24: 1/2 hour decay for FP inventory for FHA)		

Monteburns Activity (Ci) of Fuel Assembly at End of Steps

Monteburns Activities (Ci) for Fuel in Core Position F1

	92234.60c	92235.72c	92238.72c	92236.60c	94238.60c	94239.72c	94240.60c	94241.60c	94242.60c	93237.60c	95241.60c	36085.70c	36485.00c	36086.70c	36087.00c	36088.00c	36089.00c	36090.00c
0	5.31E-02	1.68E-03	1.54E-05	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1	5.27E-02	1.65E-03	1.54E-05	3.56E-04	1.47E-04	4.08E-03	1.40E-04	1.58E-03	1.89E-10	3.07E-06	1.62E-08	4.81E+00	1.67E+04	0.00E+00	2.62E+04	3.71E+04	4.71E+04	4.69E+04
2	5.27E-02	1.65E-03	1.54E-05	3.56E-04	3.06E-04	6.04E-03	1.40E-04	1.58E-03	1.89E-10	7.93E-06	1.30E-07	4.93E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3	5.24E-02	1.61E-03	1.53E-05	5.28E-04	2.26E-03	9.79E-03	6.58E-04	1.42E-02	3.50E-09	1.36E-05	4.05E-07	9.65E+00	1.66E+04	0.00E+00	2.60E+04	3.69E+04	4.68E+04	4.66E+04
4	5.24E-02	1.61E-03	1.53E-05	5.28E-04	3.25E-03	1.18E-02	6.59E-04	1.42E-02	3.50E-09	2.15E-05	1.42E-06	9.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5	5.20E-02	1.58E-03	1.53E-05	6.98E-04	8.09E-03	1.52E-02	1.51E-03	4.97E-02	1.87E-08	2.90E-05	2.65E-06	1.45E+01	1.64E+04	0.00E+00	2.57E+04	3.65E+04	4.63E+04	4.61E+04
6	5.20E-02	1.58E-03	1.53E-05	6.98E-04	1.03E-02	1.72E-02	1.51E-03	4.96E-02	1.87E-08	3.91E-05	6.22E-06	1.46E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7	5.16E-02	1.55E-03	1.53E-05	8.68E-04	1.91E-02	2.03E-02	2.67E-03	1.29E-01	6.18E-08	4.89E-05	9.51E-06	1.93E+01	1.65E+04	0.00E+00	2.58E+04	3.66E+04	4.65E+04	4.63E+04
8	5.16E-02	1.55E-03	1.53E-05	8.68E-04	2.31E-02	2.23E-02	2.67E-03	1.29E-01	6.18E-08	6.22E-05	1.81E-05	1.94E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9	5.12E-02	1.51E-03	1.52E-05	1.04E-03	3.66E-02	2.52E-02	4.08E-03	2.34E-01	1.53E-07	7.40E-05	2.49E-05	2.40E+01	1.63E+04	0.00E+00	2.56E+04	3.62E+04	4.60E+04	4.58E+04
10	5.12E-02	1.51E-03	1.52E-05	1.04E-03	4.28E-02	2.71E-02	4.08E-03	2.33E-01	1.53E-07	9.01E-05	4.16E-05	2.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
11	5.08E-02	1.48E-03	1.52E-05	1.20E-03	6.21E-02	2.97E-02	5.74E-03	3.95E-01	3.20E-07	1.04E-04	5.34E-05	2.87E+01	1.62E+04	0.00E+00	2.55E+04	3.61E+04	4.59E+04	4.56E+04
12	5.08E-02	1.48E-03	1.52E-05	1.20E-03	7.07E-02	3.17E-02	5.74E-03	3.95E-01	3.20E-07	1.22E-04	8.17E-05	2.88E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
13	5.04E-02	1.45E-03	1.52E-05	1.37E-03	9.75E-02	3.42E-02	7.65E-03	6.21E-01	6.02E-07	1.37E-04	1.00E-04	3.35E+01	1.66E+04	0.00E+00	2.61E+04	3.70E+04	4.65E+04	4.67E+04
14	5.04E-02	1.45E-03	1.52E-05	1.37E-03	1.10E-01	3.62E-02	7.65E-03	6.19E-01	6.02E-07	1.59E-04	1.45E-04	3.36E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
15	4.99E-02	1.42E-03	1.51E-05	1.54E-03	1.45E-01	3.82E-02	9.75E-03	9.02E-01	1.03E-06	1.77E-04	1.71E-04	3.82E+01	1.64E+04	0.00E+00	2.57E+04	3.64E+04	4.62E+04	4.60E+04
16	4.99E-02	1.42E-03	1.51E-05	1.54E-03	1.60E-01	4.02E-02	9.75E-03	9.00E-01	1.03E-06	2.02E-04	2.36E-04	3.83E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
17	4.95E-02	1.38E-03	1.51E-05	1.70E-03	2.04E-01	4.21E-02	1.20E-02	1.26E+00	1.64E-06	2.20E-04	2.73E-04	4.29E+01	1.63E+04	0.00E+00	2.56E+04	3.62E+04	4.60E+04	4.58E+04
18	4.95E-02	1.38E-03	1.51E-05	1.70E-03	2.24E-01	4.41E-02	1.20E-02	1.26E+00	1.64E-06	2.46E-04	3.63E-04	4.29E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
19	4.91E-02	1.35E-03	1.51E-05	1.86E-03	2.77E-01	4.58E-02	1.43E-02	1.67E+00	2.48E-06	2.65E-04	4.11E-04	4.75E+01	1.62E+04	0.00E+00	2.54E+04	3.60E+04	4.56E+04	4.54E+04
20	4.91E-02	1.35E-03	1.51E-05	1.86E-03	3.01E-01	4.79E-02	1.43E-02	1.66E+00	2.48E-06	2.92E-04	5.30E-04	4.75E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
21	4.87E-02	1.32E-03	1.50E-05	2.02E-03	3.65E-01	4.93E-02	1.68E-02	2.14E+00	3.59E-06	3.14E-04	5.90E-04	5.21E+01	1.62E+04	0.00E+00	2.54E+04	3.60E+04	4.57E+04	4.55E+04
22	4.87E-02	1.32E-03	1.50E-05	2.02E-03	3.94E-01	5.13E-02	1.68E-02	2.14E+00	3.59E-06	3.45E-04	7.43E-04	5.20E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
23	4.83E-02	1.29E-03	1.50E-05	2.18E-03	4.65E-01	5.25E-02	1.94E-02	2.71E+00	5.02E-06	3.68E-04	8.16E-04	5.66E+01	1.60E+04	0.00E+00	2.51E+04	3.56E+04	4.52E+04	4.50E+04
24	4.83E-02	1.29E-03	1.50E-05	2.18E-03	4.70E-01	5.25E-02	1.94E-02	2.71E+00	5.02E-06	3.68E-04	8.16E-04	5.66E+01	1.51E+04	0.00E+00	1.93E+04	3.15E+04	6.46E+01	7.72E-13

	53131.70c	53132.00c	53133.00c	53134.00c	53135.70c	54133.70c	54135.70c	54535.00c	54137.00c	54138.00c	54139.00c	61149.50c	62149.50c	45117.91d	13027.70c	actinide	total
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.59E-02	
1	2.59E+04	3.89E+04	6.90E+04	7.78E+04	6.44E+04	4.78E+04	1.20E+04	6.04E+03	6.12E+04	6.38E+04	5.19E+04	1.06E+04	6.58E-15	0.00E+00	0.00E+00	7.02E+05	5.36E+06
2	6.28E+03	1.23E+03	1.47E-01	0.00E+00	8.44E-14	7.19E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.49E+01	1.36E-14	0.00E+00	0.00E+00	1.48E+04	9.55E+04
3	2.74E+04	3.88E+04	6.86E+04	7.72E+04	6.40E+04	4.86E+04	1.17E+04	5.86E+03	6.08E+04	6.33E+04	5.15E+04	1.06E+04	8.36E-15	0.00E+00	0.00E+00	7.01E+05	5.40E+06
4	6.89E+03	1.23E+03	1.46E-01	0.00E+00	8.38E-14	7.36E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.51E+01	1.59E-14	0.00E+00	0.00E+00	1.55E+04	1.33E+05
5	2.74E+04	3.84E+04	6.78E+04	7.64E+04	6.33E+04	4.81E+04	1.15E+04	5.72E+03	6.01E+04	6.27E+04	5.09E+04	1.07E+04	8.47E-15	0.00E+00	0.00E+00	6.94E+05	5.39E+06
6	6.82E+03	1.21E+03	1.44E-01	0.00E+00	8.29E-14	7.29E+03	1.78E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.54E+01	1.51E-14	0.00E+00	0.00E+00	1.55E+04	1.55E+05
7	2.75E+04	3.86E+04	6.81E+04	7.67E+04	6.36E+04	4.83E+04	1.13E+04	5.59E+03	6.04E+04	6.29E+04	5.12E+04	1.09E+04	8.42E-15	0.00E+00	0.00E+00	6.97E+05	5.46E+06
8	6.51E+03	1.22E+03	1.45E-01	0.00E+00	8.33E-14	7.32E+03	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.67E+01	1.52E-14	0.00E+00	0.00E+00	1.55E+04	1.71E+05
9	2.73E+04	3.82E+04	6.75E+04	7.60E+04	6.29E+04	4.78E+04	1.11E+04	5.47E+03	5.98E+04	6.23E+04	5.07E+04	1.09E+04	8.35E-15	0.00E+00	0.00E+00	6.90E+05	5.44E+06
10	6.85E+03	1.21E+03	1.43E-01	0.00E+00	8.24E-14	7.25E+03	1.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.71E+01	1.52E-14	0.00E+00	0.00E+00	1.54E+04	1.82E+05
11	2.72E+04	3.81E+04	6.72E+04	7.57E+04	6.27E+04	4.77E+04	1.08E+04	5.33E+03	5.96E+04	6.21E+04	5.05E+04	1.11E+04	8.27E-15	0.00E+00	0.00E+00	6.87E+05	5.45E+06
12	6.83E+03	1.20E+03	1.43E-01	0.00E+00	8.22E-14	7.23E+03	1.76E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.72E+01	1.52E-14	0.00E+00	0.00E+00	1.54E+04	1.91E+05
13	2.78E+04	3.90E+04	6.89E+04	7.75E+04	6.42E+04	4.88E+04	1.07E+04	5.20E+03	6.10E+04	6.36E+04	5.17E+04	1.15E+04	8.21E-15	0.00E+00	0.00E+00	7.03E+05	5.61E+06
14	6.97E+03	1.23E+03	1.46E-01	0.00E+00	8.42E-14	7.40E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.04E+01	1.54E-14	0.00E+00	0.00E+00	1.57E+04	2.00E+05
15	2.75E+04	3.84E+04	6.78E+04	7.64E+04	6.33E+04	4.81E+04	1.04E+04	5.08E+03	6.01E+04	6.26E+04	5.09E+04	1.15E+04	8.13E-15	0.00E+00	0.00E+00	6.93E+05	5.56E+06
16	6.90E+03	1.21E+03	1.44E-01	0.00E+00	8.29E-14	7.30E+03	1.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E+01	1.53E-14	0.00E+00	0.00E+00	1.55E+04	2.05E+05
17	2.73E+04	3.82E+04	6.75E+04	7.60E+04	6.30E+04	4.79E+04	1.02E+04	4.95E+03	5.98E+04	6.23E+04	5.06E+04	1.16E+04	8.05E-15	0.00E+00	0.00E+00	6.89E+05	5.56E+06
18	6.86E+03	1.21E+03	1.43E-01	0.00E+00	8.25E-14	7.26E+03	1.76E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.10E+01	1.53E-14	0.00E+00	0.00E+00	1.54E+04	2.09E+05
19	2.71E+04	3.80E+04	6.70E+04	7.54E+04	6.25E+04	4.75E+04	9.94E+03	4.82E+03	5.94E+04	6.18E+04	5.03E+04	1.17E+04	7.58E-15	0.00E+00	0.00E+00	6.84E+05	5.55E+06
20	6.81E+03	1.20E+03	1.42E-01	0.00E+00	8.18E-14	7.21E+03	1.74E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.13E+01	1.52E-14	0.00E+00	0.00E+00	1.53E+04	2.12E+05
21	2.72E+04	3.80E+04	6.71E+04	7.55E+04	6.26E+04	4.76E+04	9.73E+03	4.69E+03	5.94E+04	6.19E+04	5.03E+04	1.19E+04	7.85E-15	0.00E+00	0.00E+00	6.85E+05	5.59E+06
22	6.81E+03	1.20E+03	1.43E-01	0.00E+00	8.19E-14	7.21E+03	1.74E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.25E+01	1.52E-14	0.00E+00	0.00E+00	1.54E+04	2.15E+05
23	2.69E+04	3.76E+04	6.63E+04	7.47E+04	6.19E+04	4.71E+04	9.45E+03	4.57E+03	5.88E+04	6.12E+04	4.98E+04	1.19E+04	7.74E-15	0.00E+00	0.00E+00	6.77E+05	5.55E+06
24	2.69E+04	3.76E+04	6.59E+04	6.72E+04	5.87E+04	4.71E+04	1.14E+04	4.57E+03	2.74E+02	1.41E+04	9.66E-10	1.15E+04	7.79E-15	0.00E+00	0.00E+00	4.12E+05	2.07E+06

Monteburns Activities (Ci) for Fuel in Core Position F5

	92234.60c	92235.72c	92238.72c	92236.60c	94238.60c	94239.72c	94240.60c	94241.60c	94242.60c	93237.60c	95241.60c	36085.70c	36485.00c	36086.70c	36087.00c	36088.00c	36089.00c	36090.00c
0	5.31E-02	1.68E-03	1.54E-05	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1	5.27E-02	1.65E-03	1.54E-05	3.58E-04	1.51E-04	4.39E-03	1.52E-04	1.71E-03	2.06E-10	3.10E-06	1.75E-08	4.84E+00	1.68E+04	0.00E+00	2.64E+04	3.74E+04	4.75E+04	4.72E+04
2	5.27E-02	1.65E-03	1.54E-05	3.58E-04	3.13E-04	6.50E-03	1.53E-04	1.71E-03	2.06E-10	8.01E-06	1.40E-07	4.59E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3	5.23E-02	1.61E-03	1.53E-05	5.31E-04	2.27E-03	1.03E-02	7.03E-04	1.58E-02	3.89E-09	1.35E-05	4.47E-07	9.74E+00	1.66E+04	0.00E+00	2.61E+04	3.69E+04	4.65E+04	4.67E+04
4	5.23E-02	1.61E-03	1.53E-05	5.31E-04	3.25E-03	1.23E-02	7.03E-04	1.58E-02	3.89E-09	2.10E-05	1.58E-06	9.84E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5	5.19E-02	1.58E-03	1.53E-05	7.03E-04	8.11E-03	1.59E-02	1.60E-03	5.56E-02	2.12E-08	2.90E-05	2.96E-06	1.46E+01	1.66E+04	0.00E+00	2.60E+04	3.68E+04	4.62E+04	4.66E+04
6	5.19E-02	1.58E-03	1.53E-05	7.03E-04	1.04E-02	1.79E-02	1.60E-03	5.55E-02	2.12E-08	3.97E-05	6.94E-06	1.47E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7	5.15E-02	1.55E-03	1.53E-05	8.74E-04	1.93E-02	2.12E-02	2.83E-03	1.29E-01	6.83E-08	4.97E-05	1.05E-05	1.94E+01	1.65E+04	0.00E+00	2.55E+04	3.67E+04	4.66E+04	4.64E+04
8	5.15E-02	1.55E-03	1.53E-05	8.74E-04	2.34E-02	2.33E-02	2.83E-03	1.29E-01	6.83E-08	6.32E-05	1.98E-05	1.95E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9	5.11E-02	1.51E-03	1.52E-05	1.05E-03	3.75E-02	2.62E-02	4.36E-03	2.46E-01	1.68E-07	7.52E-05	2.69E-05	2.43E+01	1.67E+04	0.00E+00	2.61E+04	3.70E+04	4.70E+04	4.68E+04
10	5.11E-02	1.51E-03	1.52E-05	1.05E-03	4.35E-02	2.83E-02	4.36E-03	2.45E-01	1.68E-07	9.16E-05	4.45E-05	2.43E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
11	5.07E-02	1.48E-03	1.52E-05	1.21E-03	6.43E-02	3.09E-02	6.09E-03	4.39E-01	3.50E-07	1.06E-04	5.71E-05	2.90E+01	1.65E+04	0.00E+00	2.59E+04	3.67E+04	4.66E+04	4.64E+04
12	5.07E-02	1.48E-03	1.52E-05	1.21E-03	7.34E-02	3.38E-02	6.05E-03	4.29E-01	3.50E-07	1.26E-04	8.80E-05	2.91E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
13	5.03E-02	1.45E-03	1.52E-05	1.38E-03	1.01E-01	3.53E-02	8.03E-03	6.65E-01	6.46E-07	1.41E-04	1.08E-04	3.37E+01	1.61E+04	0.00E+00	2.53E+04	3.59E+04	4.56E+04	4.54E+04
14	5.03E-02	1.45E-03	1.52E-05	1.38E-03	1.13E-01	3.74E-02	8.03E-03	6.64E-01	6.46E-07	1.62E-04	1.56E-04	3.37E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
15	4.99E-02	1.42E-03	1.51E-05	1.54E-03	1.48E-01	3.95E-02	1.01E-02	9.60E-01	1.09E-06	1.80E-04	1.84E-04	3.83E+01	1.62E+04	0.00E+00	2.54E+04	3.59E+04	4.56E+04	4.54E+04
16	4.99E-02	1.42E-03	1.51E-05	1.54E-03	1.64E-01	4.16E-02	1.01E-02	9.58E-01	1.09E-06	2.04E-04	2.53E-04	3.83E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
17	4.95E-02	1.38E-03	1.51E-05	1.71E-03	2.05E-01	4.35E-02	1.25E-02	1.31E+00	1.73E-06	2.24E-04	2.51E-04	4.25E+01	1.62E+04	0.00E+00	2.54E+04	3.60E+04	4.56E+04	4.54E+04
18	4.95E-02	1.38E-03	1.51E-05	1.71E-03	2.29E-01	4.56E-02	1.25E-02	1.30E+00	1.73E-06	2.51E-04	3.85E-04	4.29E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
19	4.91E-02	1.35E-03	1.51E-05	1.87E-03	2.85E-01	4.72E-02	1.49E-02	1.73E+00	2.61E-06	2.71E-04	4.34E-04	4.75E+01	1.62E+04	0.00E+00	2.54E+04	3.60E+04	4.58E+04	4.55E+04
20	4.91E-02	1.35E-03	1.51E-05	1.87E-03	3.10E-01	4.92E-02	1.49E-02	1.73E+00	2.61E-06	3.00E-04	5.58E-04	4.75E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
21	4.87E-02	1.32E-03	1.50E-05	2.03E-03	3.75E-01	5.07E-02	1.75E-02	2.22E+00	3.75E-06	3.21E-04	6.19E-04	5.20E+01	1.59E+04	0.00E+00	2.50E+04	3.54E+04	4.49E+04	4.47E+04
22	4.87E-02	1.32E-03	1.50E-05	2.03E-03	4.05E-01	5.29E-02	1.75E-02	2.21E+00	3.75E-06	3.51E-04	7.79E-04	5.20E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
23	4.83E-02	1.29E-03	1.50E-05	2.19E-03	4.82E-01	5.39E-02	2.02E-02	2.78E+00	5.24E-06	3.75E-04	8.53E-04	5.66E+01	1.61E+04	0.00E+00	2.53E+04	3.59E+04	4.55E+04	4.53E+04
24	4.83E-02	1.29E-03	1.50E-05	2.19E-03	4.82E-01	5.39E-02	2.02E-02	2.78E+00	5.24E-06	3.75E-04	8.53E-04	5.66E+01	1.52E+04	0.00E+00	1.95E+04	3.18E+04	6.51E+01	7.78E-13

	53131.70c	53132.00c	53133.00c	53134.00c	53135.70c	54133.70c	54135.70c	54535.00c	54137.00c	54138.00c	54139.00c	61149.50c	62149.50c	45117.91d	13027.70c	actinide	total
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.59E-02	
1	2.51E+04	3.92E+04	6.96E+04	7.83E+04	6.49E+04	4.73E+04	1.21E+04	6.07E+03	6.16E+04	6.42E+04	5.22E+04	1.06E+04	7.03E-15	0.00E+00	0.00E+00	7.06E+05	5.39E+06
2	6.33E+03	1.24E+03	1.48E-01	0.00E+00	8.50E-14	7.24E+03	1.83E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.53E+01	1.37E-14	0.00E+00	0.00E+00	1.45E+04	9.62E+04
3	2.75E+04	3.85E+04	6.87E+04	7.74E+04	6.41E+04	4.87E+04	1.17E+04	5.86E+03	6.05E+04	6.35E+04	5.16E+04	1.06E+04	8.39E-15	0.00E+00	0.00E+00	7.03E+05	5.41E+06
4	6.90E+03	1.23E+03	1.46E-01	0.00E+00	8.40E-14	7.38E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.52E+01	1.59E-14	0.00E+00	0.00E+00	1.56E+04	1.34E+05
5	2.77E+04	3.88E+04	6.85E+04	7.72E+04	6.40E+04	4.86E+04	1.16E+04	5.75E+03	6.07E+04	6.33E+04	5.15E+04	1.08E+04	8.50E-15	0.00E+00	0.00E+00	7.01E+05	5.45E+06
6	6.95E+03	1.23E+03	1.46E-01	0.00E+00	8.38E-14	7.37E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.61E+01	1.52E-14	0.00E+00	0.00E+00	1.56E+04	1.56E+05
7	2.76E+04	3.87E+04	6.83E+04	7.69E+04	6.37E+04	4.84E+04	1.13E+04	5.61E+03	6.06E+04	6.31E+04	5.13E+04	1.09E+04	8.46E-15	0.00E+00	0.00E+00	6.98E+05	5.47E+06
8	6.93E+03	1.22E+03	1.45E-01	0.00E+00	8.35E-14	7.34E+03	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E+01	1.53E-14	0.00E+00	0.00E+00	1.56E+04	1.72E+05
9	2.79E+04	3.90E+04	6.89E+04	7.76E+04	6.43E+04	4.89E+04	1.11E+04	5.47E+03	6.11E+04	6.37E+04	5.18E+04	1.12E+04	8.33E-15	0.00E+00	0.00E+00	7.05E+05	5.56E+06
10	6.99E+03	1.23E+03	1.47E-01	0.00E+00	8.43E-14	7.41E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.85E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	1.85E+05
11	2.77E+04	3.87E+04	6.83E+04	7.70E+04	6.38E+04	4.85E+04	1.09E+04	5.35E+03	6.06E+04	6.31E+04	5.13E+04	1.13E+04	8.31E-15	0.00E+00	0.00E+00	6.98E+05	5.54E+06
12	6.94E+03	1.22E+03	1.45E-01	0.00E+00	8.35E-14	7.35E+03	1.75E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.91E+01	1.53E-14	0.00E+00	0.00E+00	1.56E+04	1.93E+05
13	2.71E+04	3.79E+04	6.68E+04	7.53E+04	6.24E+04	4.74E+04	1.06E+04	5.23E+03	5.92E+04	6.17E+04	5.02E+04	1.12E+04	8.23E-15	0.00E+00	0.00E+00	6.83E+05	5.46E+06
14	6.80E+03	1.20E+03	1.42E-01	0.00E+00	8.17E-14	7.19E+03	1.75E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.85E+01	1.52E-14	0.00E+00	0.00E+00	1.53E+04	1.98E+05
15	2.71E+04	3.79E+04	6.69E+04	7.54E+04	6.24E+04	4.75E+04	1.04E+04	5.09E+03	5.93E+04	6.18E+04	5.02E+04	1.14E+04	8.16E-15	0.00E+00	0.00E+00	6.84E+05	5.49E+06
16	6.75E+03	1.20E+03	1.42E-01	0.00E+00	8.18E-14	7.20E+03	1.75E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.95E+01	1.52E-14	0.00E+00	0.00E+00	1.53E+04	2.04E+05
17	2.71E+04	3.79E+04	6.70E+04	7.54E+04	6.25E+04	4.75E+04	1.02E+04	4.97E+03	5.93E+04	6.18E+04	5.03E+04	1.16E+04	8.05E-15	0.00E+00	0.00E+00	6.84E+05	5.52E+06
18	6.80E+03	1.20E+03	1.42E-01	0.00E+00	8.18E-14	7.20E+03	1.74E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.07E+01	1.52E-14	0.00E+00	0.00E+00	1.53E+04	2.08E+05
19	2.72E+04	3.81E+04	6.72E+04	7.56E+04	6.27E+04	4.77E+04	9.96E+03	4.84E+03	5.95E+04	6.20E+04	5.04E+04	1.17E+04	7.93E-15	0.00E+00	0.00E+00	6.86E+05	5.57E+06
20	6.82E+03	1.20E+03	1.43E-01	0.00E+00	8.21E-14	7.22E+03	1.75E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.17E+01	1.52E-14	0.00E+00	0.00E+00	1.54E+04	2.12E+05
21	2.67E+04	3.74E+04	6.59E+04	7.42E+04	6.15E+04	4.68E+04	9.76E+03	4.72E+03	5.84E+04	6.08E+04	4.95E+04	1.17E+04	7.91E-15	0.00E+00	0.00E+00	6.73E+05	5.50E+06
22	6.71E+03	1.18E+03	1.40E-01	0.00E+00	8.05E-14	7.09E+03	1.71E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.13E+01	1.51E-14	0.00E+00	0.00E+00	1.51E+04	2.12E+05
23	2.70E+04	3.79E+04	6.68E+04	7.52E+04	6.24E+04	4.74E+04	9.52E+03	4.59E+03	5.92E+04	6.17E+04	5.01E+04	1.20E+04	7.76E-15	0.00E+00	0.00E+00	6.82E+05	5.60E+06
24	2.70E+04	3.79E+04	6.65E+04	6.77E+04	5.92E+04	4.75E+04	1.14E+04	4.59E+03	2.76E+02	1.43E+04	9.74E-10	1.20E+04	7.80E-15	0.00E+00	0.00E+00	4.15E+05	2.09E+06

Monteburns Activities (Ci) for Fuel in Core Position F2

	92234.60c	92235.72c	92238.72c	92236.60c	94238.60c	94239.72c	94240.60c	94241.60c	94242.60c	93237.60c	95241.60c	36085.70c	36485.00c	36086.70c	36087.00c	36088.00c	36089.00c	36090.00c
0	5.31E-02	1.68E-03	1.54E-05	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1	5.27E-02	1.65E-03	1.54E-05	3.61E-04	1.54E-04	4.21E-03	1.49E-04	1.62E-03	2.01E-10	3.12E-06	1.66E-08	4.97E+00	1.73E+04	0.00E+00	2.71E+04	3.84E+04	4.87E+04	4.85E+04
2	5.27E-02	1.65E-03	1.54E-05	3.61E-04	3.15E-04	6.25E-03	1.49E-04	1.62E-03	2.01E-10	8.07E-06	1.33E-07	5.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3	5.23E-02	1.61E-03	1.53E-05	5.38E-04	2.35E-03	1.02E-02	7.02E-04	1.57E-02	3.94E-09	1.41E-05	4.34E-07	1.00E+01	1.71E+04	0.00E+00	2.68E+04	3.80E+04	4.82E+04	4.80E+04
4	5.23E-02	1.61E-03	1.53E-05	5.38E-04	3.35E-03	1.23E-02	7.02E-04	1.56E-02	3.94E-09	2.26E-05	1.56E-06	1.01E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5	5.19E-02	1.58E-03	1.53E-05	7.15E-04	8.67E-03	1.57E-02	1.62E-03	5.57E-02	2.18E-08	3.05E-05	2.93E-06	1.51E+01	1.72E+04	0.00E+00	2.70E+04	3.83E+04	4.86E+04	4.84E+04
6	5.19E-02	1.58E-03	1.53E-05	7.15E-04	1.11E-02	1.77E-02	1.62E-03	5.55E-02	2.18E-08	4.11E-05	6.92E-06	1.52E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7	5.15E-02	1.54E-03	1.53E-05	8.91E-04	2.05E-02	2.11E-02	2.85E-03	1.33E-01	7.12E-08	5.12E-05	1.06E-05	2.00E+01	1.70E+04	0.00E+00	2.67E+04	3.78E+04	4.79E+04	4.77E+04
8	5.15E-02	1.54E-03	1.53E-05	8.91E-04	2.48E-02	2.32E-02	2.85E-03	1.33E-01	7.12E-08	6.45E-05	2.01E-05	2.01E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9	5.11E-02	1.51E-03	1.52E-05	1.06E-03	3.94E-02	2.61E-02	4.37E-03	2.56E-01	1.76E-07	7.77E-05	2.76E-05	2.49E+01	1.68E+04	0.00E+00	2.64E+04	3.75E+04	4.75E+04	4.73E+04
10	5.11E-02	1.51E-03	1.52E-05	1.06E-03	4.60E-02	2.81E-02	4.37E-03	2.56E-01	1.76E-07	9.51E-05	4.60E-05	2.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
11	5.07E-02	1.47E-03	1.52E-05	1.24E-03	6.74E-02	3.07E-02	6.16E-03	4.33E-01	3.68E-07	1.09E-04	5.88E-05	2.98E+01	1.70E+04	0.00E+00	2.67E+04	3.79E+04	4.81E+04	4.79E+04
12	5.07E-02	1.47E-03	1.52E-05	1.24E-03	7.70E-02	3.27E-02	6.16E-03	4.32E-01	3.68E-07	1.28E-04	8.99E-05	2.99E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
13	5.03E-02	1.44E-03	1.52E-05	1.40E-03	1.05E-01	3.49E-02	8.09E-03	6.66E-01	6.73E-07	1.44E-04	1.10E-04	3.46E+01	1.66E+04	0.00E+00	2.61E+04	3.69E+04	4.69E+04	4.67E+04
14	5.03E-02	1.44E-03	1.52E-05	1.40E-03	1.18E-01	3.69E-02	8.09E-03	6.64E-01	6.73E-07	1.66E-04	1.57E-04	3.47E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
15	4.99E-02	1.41E-03	1.51E-05	1.57E-03	1.54E-01	3.88E-02	1.03E-02	9.55E-01	1.14E-06	1.84E-04	1.86E-04	3.95E+01	1.68E+04	0.00E+00	2.64E+04	3.74E+04	4.75E+04	4.73E+04
16	4.99E-02	1.41E-03	1.51E-05	1.57E-03	1.71E-01	4.08E-02	1.03E-02	9.53E-01	1.14E-06	2.05E-04	2.54E-04	3.95E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
17	4.95E-02	1.37E-03	1.51E-05	1.74E-03	2.17E-01	4.25E-02	1.25E-02	1.32E+00	1.79E-06	2.27E-04	2.92E-04	4.42E+01	1.65E+04	0.00E+00	2.59E+04	3.68E+04	4.67E+04	4.64E+04
18	4.95E-02	1.37E-03	1.51E-05	1.74E-03	2.37E-01	4.45E-02	1.25E-02	1.32E+00	1.79E-06	2.54E-04	3.87E-04	4.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
19	4.91E-02	1.34E-03	1.51E-05	1.91E-03	2.93E-01	4.61E-02	1.49E-02	1.75E+00	2.70E-06	2.75E-04	4.37E-04	4.89E+01	1.66E+04	0.00E+00	2.60E+04	3.69E+04	4.68E+04	4.66E+04
20	4.91E-02	1.34E-03	1.51E-05	1.91E-03	3.15E-01	4.82E-02	1.49E-02	1.75E+00	2.70E-06	3.06E-04	5.62E-04	4.89E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
21	4.87E-02	1.31E-03	1.50E-05	2.07E-03	3.86E-01	4.96E-02	1.74E-02	2.26E+00	3.89E-06	3.28E-04	6.24E-04	5.35E+01	1.64E+04	0.00E+00	2.58E+04	3.66E+04	4.64E+04	4.62E+04
22	4.87E-02	1.31E-03	1.50E-05	2.07E-03	4.17E-01	5.17E-02	1.74E-02	2.25E+00	3.89E-06	3.61E-04	7.86E-04	5.35E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
23	4.82E-02	1.28E-03	1.50E-05	2.23E-03	4.96E-01	5.27E-02	2.01E-02	2.82E+00	5.43E-06	3.84E-04	8.61E-04	5.82E+01	1.64E+04	0.00E+00	2.57E+04	3.65E+04	4.62E+04	4.61E+04
24	4.82E-02	1.28E-03	1.50E-05	2.23E-03	4.96E-01	5.27E-02	2.01E-02	2.82E+00	5.43E-06	3.84E-04	8.61E-04	5.82E+01	1.54E+04	0.00E+00	1.98E+04	3.23E+04	6.63E+01	7.51E-13

	53131.70c	53132.00c	53133.00c	53134.00c	53135.70c	54133.70c	54135.70c	54535.00c	54137.00c	54138.00c	54139.00c	61149.50c	62149.50c	45117.91d	13027.70c	actinide	total
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.58E-02	
1	2.58E+04	4.02E+04	7.14E+04	8.04E+04	6.66E+04	4.86E+04	1.21E+04	6.01E+03	6.33E+04	6.60E+04	5.36E+04	1.09E+04	7.07E-15	0.00E+00	0.00E+00	7.25E+05	5.54E+06
2	6.50E+03	1.27E+03	1.52E-01	0.00E+00	8.73E-14	7.44E+03	1.87E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E+01	1.39E-14	0.00E+00	0.00E+00	1.53E+04	9.88E+04
3	2.83E+04	4.00E+04	7.07E+04	7.96E+04	6.59E+04	5.01E+04	1.17E+04	5.81E+03	6.26E+04	6.53E+04	5.31E+04	1.09E+04	8.28E-15	0.00E+00	0.00E+00	7.22E+05	5.57E+06
4	7.10E+03	1.26E+03	1.50E-01	0.00E+00	8.64E-14	7.59E+03	1.85E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.71E+01	1.52E-14	0.00E+00	0.00E+00	1.60E+04	1.37E+05
5	2.87E+04	4.03E+04	7.12E+04	8.02E+04	6.64E+04	5.05E+04	1.15E+04	5.67E+03	6.31E+04	6.58E+04	5.35E+04	1.12E+04	8.42E-15	0.00E+00	0.00E+00	7.27E+05	5.66E+06
6	7.21E+03	1.27E+03	1.51E-01	0.00E+00	8.70E-14	7.65E+03	1.86E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E+01	1.54E-14	0.00E+00	0.00E+00	1.62E+04	1.62E+05
7	2.85E+04	3.98E+04	7.03E+04	7.91E+04	6.56E+04	4.99E+04	1.13E+04	5.55E+03	6.23E+04	6.49E+04	5.28E+04	1.12E+04	8.37E-15	0.00E+00	0.00E+00	7.18E+05	5.63E+06
8	7.14E+03	1.26E+03	1.49E-01	0.00E+00	8.59E-14	7.56E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.85E+01	1.54E-14	0.00E+00	0.00E+00	1.60E+04	1.77E+05
9	2.82E+04	3.95E+04	6.97E+04	7.85E+04	6.50E+04	4.95E+04	1.10E+04	5.42E+03	6.18E+04	6.44E+04	5.23E+04	1.13E+04	8.32E-15	0.00E+00	0.00E+00	7.12E+05	5.62E+06
10	7.08E+03	1.25E+03	1.48E-01	0.00E+00	8.52E-14	7.50E+03	1.82E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.94E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	1.89E+05
11	2.85E+04	3.99E+04	7.05E+04	7.94E+04	6.58E+04	5.00E+04	1.08E+04	5.29E+03	6.25E+04	6.51E+04	5.29E+04	1.16E+04	8.25E-15	0.00E+00	0.00E+00	7.20E+05	5.72E+06
12	7.15E+03	1.26E+03	1.50E-01	0.00E+00	8.62E-14	7.58E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.13E+01	1.55E-14	0.00E+00	0.00E+00	1.61E+04	1.99E+05
13	2.79E+04	3.90E+04	6.88E+04	7.74E+04	6.42E+04	4.88E+04	1.06E+04	5.15E+03	6.09E+04	6.35E+04	5.16E+04	1.15E+04	8.16E-15	0.00E+00	0.00E+00	7.02E+05	5.61E+06
14	7.00E+03	1.23E+03	1.46E-01	0.00E+00	8.40E-14	7.40E+03	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.07E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	2.04E+05
15	2.82E+04	3.95E+04	6.97E+04	7.85E+04	6.50E+04	4.94E+04	1.03E+04	5.01E+03	6.18E+04	6.43E+04	5.23E+04	1.19E+04	8.07E-15	0.00E+00	0.00E+00	7.11E+05	5.72E+06
16	7.07E+03	1.25E+03	1.48E-01	0.00E+00	8.52E-14	7.49E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.27E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.10E+05
17	2.78E+04	3.88E+04	6.85E+04	7.71E+04	6.39E+04	4.86E+04	1.01E+04	4.89E+03	6.07E+04	6.32E+04	5.14E+04	1.18E+04	7.97E-15	0.00E+00	0.00E+00	6.98E+05	5.65E+06
18	6.97E+03	1.23E+03	1.46E-01	0.00E+00	8.37E-14	7.37E+03	1.78E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.22E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	2.14E+05
19	2.78E+04	3.89E+04	6.87E+04	7.73E+04	6.41E+04	4.87E+04	9.88E+03	4.76E+03	6.09E+04	6.34E+04	5.15E+04	1.20E+04	7.87E-15	0.00E+00	0.00E+00	7.01E+05	5.70E+06
20	6.98E+03	1.23E+03	1.46E-01	0.00E+00	8.39E-14	7.39E+03	1.78E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.35E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	2.17E+05
21	2.76E+04	3.86E+04	6.81E+04	7.67E+04	6.36E+04	4.84E+04	9.66E+03	4.64E+03	6.04E+04	6.29E+04	5.11E+04	1.21E+04	7.81E-15	0.00E+00	0.00E+00	6.95E+05	5.68E+06
22	6.93E+03	1.22E+03	1.45E-01	0.00E+00	8.33E-14	7.33E+03	1.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.39E+01	1.53E-14	0.00E+00	0.00E+00	1.56E+04	2.20E+05
23	2.76E+04	3.86E+04	6.80E+04	7.66E+04	6.34E+04	4.83E+04	9.42E+03	4.51E+03	6.02E+04	6.28E+04	5.10E+04	1.22E+04	7.67E-15	0.00E+00	0.00E+00	6.94E+05	5.70E+06
24	2.75E+04	3.85E+04	6.76E+04	6.85E+04	6.02E+04	4.83E+04	1.14E+04	4.51E+03	2.81E+02	1.45E+04	9.51E-10	1.22E+04	7.72E-15	0.00E+00	0.00E+00	4.22E+05	2.13E+06

Monteburns Activities (Ci) for Fuel in Core Position F6

	92234.60c	92235.72c	92238.72c	92236.60c	94238.60c	94239.72c	94240.60c	94241.60c	94242.60c	93237.60c	95241.60c	36085.70c	36485.00c	36086.70c	36087.00c	36088.00c	36089.00c	36090.00c
0	5.31E-02	1.68E-03	1.54E-05	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1	5.27E-02	1.65E-03	1.54E-05	3.61E-04	1.63E-04	4.34E-03	1.54E-04	1.68E-03	2.08E-10	3.32E-06	1.72E-08	4.97E+00	1.73E+04	0.00E+00	2.71E+04	3.84E+04	4.87E+04	4.85E+04
2	5.27E-02	1.65E-03	1.54E-05	3.61E-04	3.35E-04	6.43E-03	1.54E-04	1.68E-03	2.08E-10	8.61E-06	1.38E-07	5.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3	5.23E-02	1.61E-03	1.53E-05	5.41E-04	2.54E-03	1.03E-02	7.25E-04	1.64E-02	4.19E-09	1.48E-05	4.53E-07	1.01E+01	1.74E+04	0.00E+00	2.73E+04	3.87E+04	4.91E+04	4.89E+04
4	5.23E-02	1.61E-03	1.53E-05	5.41E-04	3.66E-03	1.23E-02	7.25E-04	1.64E-02	4.19E-09	2.34E-05	1.63E-06	1.02E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5	5.19E-02	1.58E-03	1.53E-05	7.17E-04	9.10E-03	1.59E-02	1.64E-03	5.54E-02	2.20E-08	3.13E-05	3.01E-06	1.51E+01	1.70E+04	0.00E+00	2.67E+04	3.78E+04	4.80E+04	4.78E+04
6	5.19E-02	1.58E-03	1.53E-05	7.17E-04	1.16E-02	1.79E-02	1.64E-03	5.53E-02	2.20E-08	4.20E-05	6.59E-06	1.52E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7	5.15E-02	1.54E-03	1.53E-05	8.94E-04	2.13E-02	2.10E-02	2.90E-03	1.33E-01	7.21E-08	5.34E-05	1.06E-05	2.01E+01	1.72E+04	0.00E+00	2.65E+04	3.82E+04	4.84E+04	4.82E+04
8	5.15E-02	1.54E-03	1.53E-05	8.94E-04	2.59E-02	2.30E-02	2.90E-03	1.33E-01	7.21E-08	6.90E-05	2.02E-05	2.02E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9	5.11E-02	1.51E-03	1.52E-05	1.07E-03	4.14E-02	2.61E-02	4.41E-03	2.62E-01	1.79E-07	8.15E-05	2.77E-05	2.51E+01	1.70E+04	0.00E+00	2.67E+04	3.79E+04	4.81E+04	4.79E+04
10	5.11E-02	1.51E-03	1.52E-05	1.07E-03	4.85E-02	2.82E-02	4.41E-03	2.61E-01	1.79E-07	9.84E-05	4.65E-05	2.51E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
11	5.07E-02	1.47E-03	1.52E-05	1.24E-03	7.02E-02	3.07E-02	6.16E-03	4.37E-01	3.70E-07	1.12E-04	5.95E-05	2.99E+01	1.68E+04	0.00E+00	2.63E+04	3.73E+04	4.73E+04	4.71E+04
12	5.07E-02	1.47E-03	1.52E-05	1.24E-03	8.00E-02	3.27E-02	6.16E-03	4.36E-01	3.70E-07	1.31E-04	9.09E-05	3.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
13	5.02E-02	1.44E-03	1.52E-05	1.41E-03	1.09E-01	3.51E-02	8.17E-03	6.74E-01	6.87E-07	1.47E-04	1.11E-04	3.49E+01	1.71E+04	0.00E+00	2.68E+04	3.79E+04	4.81E+04	4.79E+04
14	5.02E-02	1.44E-03	1.52E-05	1.41E-03	1.23E-01	3.72E-02	8.17E-03	6.72E-01	6.87E-07	1.69E-04	1.59E-04	3.49E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
15	4.98E-02	1.41E-03	1.51E-05	1.58E-03	1.60E-01	3.93E-02	1.03E-02	9.76E-01	1.16E-06	1.87E-04	1.88E-04	3.96E+01	1.67E+04	0.00E+00	2.62E+04	3.71E+04	4.72E+04	4.69E+04
16	4.98E-02	1.41E-03	1.51E-05	1.58E-03	1.77E-01	4.13E-02	1.03E-02	9.73E-01	1.16E-06	2.12E-04	2.59E-04	3.96E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
17	4.94E-02	1.37E-03	1.51E-05	1.75E-03	2.24E-01	4.29E-02	1.26E-02	1.34E+00	1.83E-06	2.31E-04	2.97E-04	4.44E+01	1.66E+04	0.00E+00	2.61E+04	3.70E+04	4.70E+04	4.67E+04
18	4.94E-02	1.37E-03	1.51E-05	1.75E-03	2.45E-01	4.49E-02	1.26E-02	1.34E+00	1.83E-06	2.59E-04	3.93E-04	4.44E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
19	4.90E-02	1.34E-03	1.51E-05	1.92E-03	3.03E-01	4.63E-02	1.51E-02	1.79E+00	2.77E-06	2.80E-04	4.44E-04	4.91E+01	1.68E+04	0.00E+00	2.64E+04	3.74E+04	4.74E+04	4.72E+04
20	4.90E-02	1.34E-03	1.51E-05	1.92E-03	3.29E-01	4.83E-02	1.51E-02	1.79E+00	2.77E-06	3.12E-04	5.72E-04	4.91E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
21	4.86E-02	1.31E-03	1.50E-05	2.08E-03	3.95E-01	4.96E-02	1.77E-02	2.30E+00	4.01E-06	3.33E-04	6.35E-04	5.39E+01	1.67E+04	0.00E+00	2.62E+04	3.71E+04	4.71E+04	4.68E+04
22	4.86E-02	1.31E-03	1.50E-05	2.08E-03	4.30E-01	5.17E-02	1.77E-02	2.29E+00	4.01E-06	3.64E-04	8.00E-04	5.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
23	4.82E-02	1.27E-03	1.50E-05	2.24E-03	5.10E-01	5.27E-02	2.03E-02	2.88E+00	5.57E-06	3.87E-04	8.76E-04	5.85E+01	1.63E+04	0.00E+00	2.55E+04	3.62E+04	4.55E+04	4.57E+04

	53131.70c	53132.00c	53133.00c	53134.00c	53135.70c	54133.70c	54135.70c	54535.00c	54137.00c	54138.00c	54139.00c	61149.50c	62149.50c	45117.91d	13027.70c	actinide	total
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.58E-02	
1	2.58E+04	4.02E+04	7.14E+04	8.04E+04	6.66E+04	4.25E+04	1.20E+04	6.01E+03	6.33E+04	6.59E+04	5.36E+04	1.03E+04	7.06E-15	0.00E+00	0.00E+00	7.25E+05	5.54E+06
2	6.49E+03	1.27E+03	1.52E-01	0.00E+00	8.72E-14	7.43E+03	1.87E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E+01	1.39E-14	0.00E+00	0.00E+00	1.53E+04	9.87E+04
3	2.88E+04	4.07E+04	7.20E+04	8.11E+04	6.72E+04	5.09E+04	1.18E+04	5.82E+03	6.39E+04	6.65E+04	5.41E+04	1.11E+04	8.37E-15	0.00E+00	0.00E+00	7.35E+05	5.67E+06
4	7.27E+03	1.29E+03	1.53E-01	0.00E+00	8.80E-14	7.73E+03	1.88E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.84E+01	1.53E-14	0.00E+00	0.00E+00	1.63E+04	1.39E+05
5	2.85E+04	3.95E+04	7.04E+04	7.93E+04	6.57E+04	5.00E+04	1.15E+04	5.69E+03	6.24E+04	6.50E+04	5.29E+04	1.11E+04	8.45E-15	0.00E+00	0.00E+00	7.20E+05	5.60E+06
6	7.15E+03	1.26E+03	1.50E-01	0.00E+00	8.61E-14	7.57E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.79E+01	1.53E-14	0.00E+00	0.00E+00	1.61E+04	1.61E+05
7	2.87E+04	4.02E+04	7.10E+04	8.00E+04	6.62E+04	5.03E+04	1.13E+04	5.55E+03	6.29E+04	6.56E+04	5.33E+04	1.14E+04	8.48E-15	0.00E+00	0.00E+00	7.25E+05	5.65E+06
8	7.20E+03	1.27E+03	1.51E-01	0.00E+00	8.63E-14	7.63E+03	1.85E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.97E+01	1.55E-14	0.00E+00	0.00E+00	1.62E+04	1.78E+05
9	2.86E+04	3.99E+04	7.05E+04	7.94E+04	6.58E+04	5.00E+04	1.11E+04	5.41E+03	6.25E+04	6.51E+04	5.29E+04	1.15E+04	8.32E-15	0.00E+00	0.00E+00	7.20E+05	5.65E+06
10	7.16E+03	1.26E+03	1.50E-01	0.00E+00	8.62E-14	7.58E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.04E+01	1.55E-14	0.00E+00	0.00E+00	1.61E+04	1.90E+05
11	2.81E+04	3.93E+04	6.94E+04	7.81E+04	6.47E+04	4.92E+04	1.08E+04	5.28E+03	6.15E+04	6.41E+04	5.21E+04	1.14E+04	8.26E-15	0.00E+00	0.00E+00	7.09E+05	5.63E+06
12	7.05E+03	1.24E+03	1.47E-01	0.00E+00	8.48E-14	7.46E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.01E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	1.98E+05
13	2.85E+04	4.00E+04	7.06E+04	7.95E+04	6.59E+04	5.01E+04	1.06E+04	5.15E+03	6.26E+04	6.52E+04	5.30E+04	1.18E+04	8.14E-15	0.00E+00	0.00E+00	7.21E+05	5.70E+06
14	7.16E+03	1.26E+03	1.50E-01	0.00E+00	8.63E-14	7.59E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.24E+01	1.55E-14	0.00E+00	0.00E+00	1.61E+04	2.06E+05
15	2.81E+04	3.92E+04	6.92E+04	7.79E+04	6.45E+04	4.91E+04	1.04E+04	5.02E+03	6.13E+04	6.39E+04	5.19E+04	1.18E+04	8.09E-15	0.00E+00	0.00E+00	7.07E+05	5.68E+06
16	7.04E+03	1.24E+03	1.47E-01	0.00E+00	8.46E-14	7.44E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.21E+01	1.54E-14	0.00E+00	0.00E+00	1.58E+04	2.11E+05
17	2.79E+04	3.91E+04	6.89E+04	7.76E+04	6.43E+04	4.89E+04	1.01E+04	4.90E+03	6.11E+04	6.36E+04	5.17E+04	1.19E+04	7.97E-15	0.00E+00	0.00E+00	7.03E+05	5.69E+06
18	7.00E+03	1.23E+03	1.46E-01	0.00E+00	8.42E-14	7.41E+03	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.30E+01	1.54E-14	0.00E+00	0.00E+00	1.58E+04	2.14E+05
19	2.82E+04	3.95E+04	6.96E+04	7.84E+04	6.49E+04	4.94E+04	9.88E+03	4.75E+03	6.17E+04	6.43E+04	5.22E+04	1.22E+04	7.86E-15	0.00E+00	0.00E+00	7.10E+05	5.77E+06
20	7.06E+03	1.25E+03	1.48E-01	0.00E+00	8.51E-14	7.49E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.44E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.19E+05
21	2.80E+04	3.92E+04	6.91E+04	7.78E+04	6.45E+04	4.91E+04	9.67E+03	4.63E+03	6.12E+04	6.38E+04	5.18E+04	1.23E+04	7.79E-15	0.00E+00	0.00E+00	7.05E+05	5.76E+06
22	7.03E+03	1.24E+03	1.47E-01	0.00E+00	8.44E-14	7.44E+03	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.49E+01	1.54E-14	0.00E+00	0.00E+00	1.58E+04	2.22E+05
23	2.74E+04	3.83E+04	6.75E+04	7.59E+04	6.29E+04	4.79E+04	9.41E+03	4.51E+03	5.98E+04	6.23E+04	5.06E+04	1.22E+04	7.71E-15	0.00E+00	0.00E+00	6.88E+05	5.60E+06

ATTACHMENT 1

24	4.82E-02	1.27E-03	1.50E-05	2.24E-03	5.10E-01	5.27E-02	2.03E-02	2.88E+00	5.57E-06	3.87E-04	8.77E-04	5.85E+01	1.53E+04	0.00E+00	1.97E+04	3.21E+04	6.57E+01	7.86E-13	2.74E+04	3.82E+04	6.71E+04	6.83E+04	5.57E+04	4.89E+04	1.12E+04	4.51E+03	2.79E+02	1.44E+04	9.83E-10	1.21E+04	7.76E-15	0.00E+00	0.00E+00	4.19E+05	2.11E+06

Monteburns Activities (Ci) for Fuel in Core Position F3

	92234.69c	92235.72c	92238.72c	92236.69c	94238.69c	94239.72c	94240.69c	94241.69c	94242.69c	93237.69c	95241.69c	36085.70c	36485.00c	36086.70c	36087.00c	36088.00c	36089.00c	36090.00c	53131.70c	53132.00c	53133.00c	53134.00c	53135.70c	54133.70c	54135.70c	54535.00c	54137.00c	54138.00c	54139.00c	61149.50c	62149.50c	45117.91d	13027.70c	actinide	total
0	5.31E-02	1.68E-03	1.54E-05	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-02	
1	5.27E-02	1.64E-03	1.54E-05	3.63E-04	1.50E-04	4.41E-03	1.58E-04	1.83E-03	2.28E-10	3.03E-06	1.86E-08	5.04E+00	1.75E+04	0.00E+00	2.75E+04	3.89E+04	4.94E+04	4.52E+04	2.62E+04	4.08E+04	7.24E+04	8.15E+04	6.75E+04	4.92E+04	1.21E+04	5.59E+03	6.42E+04	6.69E+04	5.44E+04	1.11E+04	7.10E-15	0.00E+00	0.00E+00	7.35E+05	5.62E+06
2	5.27E-02	1.64E-03	1.54E-05	3.63E-04	3.11E-04	6.54E-03	1.58E-04	1.82E-03	2.28E-10	7.84E-06	1.50E-07	5.17E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.59E+03	1.29E+03	1.54E-01	0.00E+00	8.85E-14	7.54E+03	1.90E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.20E+01	1.40E-14	0.00E+00	0.00E+00	1.55E+04	1.00E+05
3	5.23E-02	1.61E-03	1.53E-05	5.40E-04	2.28E-03	1.02E-02	7.14E-04	1.67E-02	4.23E-09	1.37E-05	4.74E-07	1.01E+01	1.70E+04	0.00E+00	2.67E+04	3.79E+04	4.81E+04	4.79E+04	2.83E+04	3.95E+04	7.05E+04	7.94E+04	6.58E+04	5.00E+04	1.17E+04	5.81E+03	6.25E+04	6.51E+04	5.29E+04	1.09E+04	8.39E-15	0.00E+00	0.00E+00	7.21E+05	5.55E+06
4	5.23E-02	1.61E-03	1.53E-05	5.40E-04	3.29E-03	1.21E-02	7.14E-04	1.86E-02	4.23E-09	2.15E-05	1.67E-06	1.02E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.09E+03	1.28E+03	1.50E-01	0.00E+00	8.62E-14	7.58E+03	1.85E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E+01	1.52E-14	0.00E+00	0.00E+00	1.60E+04	1.38E+05
5	5.19E-02	1.58E-03	1.53E-05	7.19E-04	8.48E-03	1.57E-02	1.62E-03	5.90E-02	2.33E-08	3.04E-05	3.12E-06	1.52E+01	1.73E+04	0.00E+00	2.72E+04	3.86E+04	4.90E+04	4.87E+04	2.89E+04	4.06E+04	7.17E+04	8.08E+04	6.69E+04	5.08E+04	1.15E+04	5.66E+03	6.36E+04	6.63E+04	5.39E+04	1.13E+04	8.39E-15	0.00E+00	0.00E+00	7.33E+05	5.70E+06
6	5.19E-02	1.58E-03	1.53E-05	7.19E-04	1.09E-02	1.77E-02	1.62E-03	5.89E-02	2.33E-08	4.20E-05	7.36E-06	1.52E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.26E+03	1.28E+03	1.52E-01	0.00E+00	8.77E-14	7.71E+03	1.87E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.92E+01	1.54E-14	0.00E+00	0.00E+00	1.63E+04	1.63E+05
7	5.15E-02	1.54E-03	1.53E-05	8.96E-04	2.06E-02	2.09E-02	2.86E-03	1.36E-01	7.52E-08	5.25E-05	1.11E-05	2.02E+01	1.72E+04	0.00E+00	2.71E+04	3.83E+04	4.87E+04	4.85E+04	2.89E+04	4.04E+04	7.14E+04	8.04E+04	6.66E+04	5.06E+04	1.13E+04	5.52E+03	6.33E+04	6.59E+04	5.36E+04	1.14E+04	8.40E-15	0.00E+00	0.00E+00	7.29E+05	5.72E+06
8	5.15E-02	1.54E-03	1.53E-05	8.96E-04	2.50E-02	2.29E-02	2.86E-03	1.36E-01	7.53E-08	6.68E-05	2.09E-05	2.03E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.24E+03	1.28E+03	1.52E-01	0.00E+00	8.72E-14	7.67E+03	1.86E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.00E+01	1.55E-14	0.00E+00	0.00E+00	1.63E+04	1.79E+05
9	5.11E-02	1.51E-03	1.52E-05	1.07E-03	3.99E-02	2.59E-02	4.37E-03	2.60E-01	1.83E-07	7.91E-05	2.84E-05	2.52E+01	1.71E+04	0.00E+00	2.68E+04	3.80E+04	4.82E+04	4.80E+04	2.86E+04	4.00E+04	7.07E+04	7.96E+04	6.59E+04	5.01E+04	1.10E+04	5.29E+03	6.26E+04	6.53E+04	5.31E+04	1.15E+04	8.27E-15	0.00E+00	0.00E+00	7.22E+05	5.70E+06
10	5.11E-02	1.51E-03	1.52E-05	1.07E-03	4.67E-02	2.79E-02	4.37E-03	2.59E-01	1.83E-07	9.59E-05	4.71E-05	2.52E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E+03	1.26E+03	1.50E-01	0.00E+00	8.64E-14	7.60E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.04E+01	1.54E-14	0.00E+00	0.00E+00	1.61E+04	1.91E+05
11	5.07E-02	1.47E-03	1.52E-05	1.25E-03	6.85E-02	3.08E-02	6.18E-03	4.41E-01	3.81E-07	1.11E-04	6.00E-05	3.02E+01	1.73E+04	0.00E+00	2.72E+04	3.85E+04	4.85E+04	4.87E+04	2.90E+04	4.06E+04	7.17E+04	8.07E+04	6.69E+04	5.08E+04	1.08E+04	5.25E+03	6.35E+04	6.62E+04	5.38E+04	1.18E+04	8.22E-15	0.00E+00	0.00E+00	7.32E+05	5.82E+06
12	5.07E-02	1.47E-03	1.52E-05	1.25E-03	7.83E-02	3.29E-02	6.18E-03	4.40E-01	3.81E-07	1.31E-04	9.16E-05	3.02E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.27E+03	1.28E+03	1.52E-01	0.00E+00	8.76E-14	7.70E+03	1.87E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.25E+01	1.56E-14	0.00E+00	0.00E+00	1.64E+04	2.02E+05
13	5.03E-02	1.44E-03	1.52E-05	1.42E-03	1.07E-01	3.53E-02	8.17E-03	6.73E-01	6.93E-07	1.47E-04	1.12E-04	3.50E+01	1.67E+04	0.00E+00	2.62E+04	3.72E+04	4.72E+04	4.70E+04	2.81E+04	3.92E+04	6.93E+04	7.80E+04	6.46E+04	4.92E+04	1.06E+04	5.13E+03	6.14E+04	6.40E+04	5.20E+04	1.16E+04	8.19E-15	0.00E+00	0.00E+00	7.08E+05	5.66E+06
14	5.03E-02	1.44E-03	1.52E-05	1.42E-03	1.20E-01	3.74E-02	8.17E-03	6.71E-01	6.93E-07	1.65E-04	1.60E-04	3.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.06E+03	1.24E+03	1.47E-01	0.00E+00	8.47E-14	7.46E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.12E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.06E+05
15	4.99E-02	1.41E-03	1.51E-05	1.59E-03	1.58E-01	3.95E-02	1.04E-02	9.67E-01	1.16E-06	1.86E-04	1.88E-04	3.98E+01	1.68E+04	0.00E+00	2.63E+04	3.73E+04	4.74E+04	4.71E+04	2.81E+04	3.94E+04	6.95E+04	7.82E+04	6.48E+04	4.93E+04	1.03E+04	5.00E+03	6.16E+04	6.41E+04	5.21E+04	1.18E+04	8.09E-15	0.00E+00	0.00E+00	7.09E+05	5.70E+06
16	4.99E-02	1.41E-03	1.51E-05	1.59E-03	1.75E-01	4.15E-02	1.04E-02	9.65E-01	1.16E-06	2.10E-04	2.58E-04	3.98E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E+03	1.24E+03	1.48E-01	0.00E+00	8.49E-14	7.47E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.24E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.11E+05
17	4.95E-02	1.37E-03	1.51E-05	1.75E-03	2.21E-01	4.34E-02	1.27E-02	1.34E+00	1.84E-06	2.30E-04	2.56E-04	4.46E+01	1.68E+04	0.00E+00	2.64E+04	3.73E+04	4.74E+04	4.72E+04	2.82E+04	3.94E+04	6.96E+04	7.83E+04	6.49E+04	4.94E+04	1.01E+04	4.87E+03	6.17E+04	6.42E+04	5.22E+04	1.20E+04	7.97E-15	0.00E+00	0.00E+00	7.10E+05	5.74E+06
18	4.95E-02	1.37E-03	1.51E-05	1.75E-03	2.42E-01	4.56E-02	1.27E-02	1.34E+00	1.84E-06	2.57E-04	3.92E-04	4.46E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.07E+03	1.24E+03	1.48E-01	0.00E+00	8.50E-14	7.48E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.33E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.16E+05
19	4.90E-02	1.34E-03	1.51E-05	1.92E-03	3.00E-01	4.71E-02	1.52E-02	1.78E+00	2.77E-06	2.77E-04	4.43E-04	4.94E+01	1.67E+04	0.00E+00	2.62E+04	3.72E+04	4.72E+04	4.70E+04	2.81E+04	3.93E+04	6.93E+04	7.80E+04	6.46E+04	4.92E+04	9.86E+03	4.74E+03	6.14E+04	6.39E+04	5.20E+04	1.21E+04	7.84E-15	0.00E+00	0.00E+00	7.07E+05	5.75E+06
20	4.90E-02	1.34E-03	1.51E-05	1.92E-03	3.26E-01	4.91E-02	1.52E-02	1.78E+00	2.77E-06	3.07E-04	5.71E-04	4.93E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.04E+03	1.24E+03	1.47E-01	0.00E+00	8.47E-14	7.45E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.40E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.15E+05
21	4.86E-02	1.31E-03	1.50E-05	2.08E-03	3.93E-01	5.05E-02	1.78E-02	2.29E+00	3.59E-06	3.28E-04	6.33E-04	5.40E+01	1.65E+04	0.00E+00	2.59E+04	3.67E+04	4.66E+04	4.64E+04	2.77E+04	3.88E+04	6.84E+04	7.70E+04	6.38E+04	4.86E+04	9.63E+03	4.61E+03	6.06E+04	6.31E+04	5.13E+04	1.21E+04	7.79E-15	0.00E+00	0.00E+00	6.98E+05	5.70E+06
22	4.86E-02	1.31E-03	1.50E-05	2.08E-03	4.24E-01	5.26E-02	1.78E-02	2.29E+00	3.59E-06	3.60E-04	7.58E-04	5.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.96E+03	1.22E+03	1.45E-01	0.00E+00	8.36E-14	7.36E+03	1.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.41E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	2.21E+05
23	4.82E-02	1.27E-03	1.50E-05	2.25E-03	5.05E-01	5.35E-02	2.06E-02	2.85E+00	5.59E-06	3.83E-04	8.73E-04	5.88E+01	1.68E+04	0.00E+00	2.63E+04	3.73E+04	4.73E+04	4.71E+04	2.81E+04	3.94E+04	6.95E+04	7.83E+04	6.49E+04	4.93E+04	9.41E+03	4.48E+03	6.16E+04	6.42E+04	5.22E+04	1.25E+04	7.66E-15	0.00E+00	0.00E+00	7.09E+05	5.83E+06
24	4.82E-02	1.27E-03	1.50E-05	2.25E-03	5.06E-01	5.35E-02	2.06E-02	2.85E+00	5.59E-06	3.83E-04	8.73E-04	5.88E+01	1.58E+04	0.00E+00	2.03E+04	3.30E+04	6.77E+01	8.08E-13	2.81E+04	3.94E+04	6.51E+04	7.04E+04	6.16E+04	4.94E+04	1.14E+04	4.48E+03	2.87E+02	1.48E+04	1.01E-09	1.25E+04	7.71E-15	0.00E+00	0.00E+00	4.31E+05	2.17E+06

Monteburns Activities (Ci) for Fuel in Core Position F7

	92234.69c	92235.72c	92238.72c	92236.69c	94238.69c	94239.72c	94240.69c	94241.69c	94242.69c	93237.69c	95241.69c	36085.70c	36485.00c	36086.70c	36087.00c	36088.00c	36089.00c	36090.00c	53131.70c	53132.00c	53133.00c	53134.00c	53135.70c	54133.70c	54135.70c	54535.00c	54137.00c	54138.00c	54139.00c	61149.50c	62149.50c	45117.91d	13027.70c	actinide	total
0	5.31E-02	1.68E-03	1.54E-05	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-02	
1	5.27E-02	1.65E-03	1.54E-05	3.59E-04	1.50E-04	4.19E-03	1.47E-04	1.59E-03	1.94E-10	3.09E-06	1.62E-08	4.93E+00	1.71E+04	0.00E+00	2.68E+04	3.80E+04	4.83E+04	4.81E+04	2.56E+04	3.99E+04	7.07E+04	7.96E+04	6.60E+04	4.81E+04	1.20E+04	6.00E+03	6.27E+04	6.53E+04	5.31E+04	1.02E+04	7.04E-15	0.00E+00	0.00E+00	7.18E+05	5.49E+06
2	5.27E-02	1.65E-03	1.54E-05	3.59E-04	3.11E-04	6.22E-03	1.48E-04	1.58E-03	1.94E-10	7.92E-06	1.30E-07	5.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.44E+03	1.26E+03	1.50E-01	0.00E+00	8.65E-14	7.37E+03	1.86E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.64E+01	1.38E-14	0.00E+00	0.00E+00	1.51E+04	9.78E+04
3	5.23E-02	1.61E-03	1.53E-05	5.36E-04	2.30E-03	9.57E-03	6.84E-04	1.52E-02	3.89E-09	1.36E-05	4.24E-07	9.94E+00	1.70E+04	0.00E+00	2.67E+04	3.78E+04	4.80E+04	4.78E+04	2.81E+04	3.92E+04	7.03E+04	7.92E+04	6.56E+04	4.98E+04	1.17E+04	5.81E+03	6.23E+04	6.50E+04	5.28E+04	1.09E+04	8.36E-15	0.00E+00	0.00E+00	7.19E+05	5.54E+06
4	5.23E-02	1.61E-03	1.53E-05	5.36E-04	3.31E-03	1.19E-02	6.84E-04	1.52E-02	3.89E-09	2.14E-05	1.52E-06	1.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.06E+03	1.26E+03	1.49E-01	0.00E+00	8.60E-14	7.55E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.60E+01	1.51E-14	0.00E+00	0.00E+00	1.59E+04	1.36E+05
5	5.19E-02	1.58E-03	1.53E-05	7.11E-04	8.25E-03	1.53E-02	1.56E-03	5.47E-02	2.11E-08	2.91E-05	2.86E-06	1.49E+01	1.69E+04	0.00E+00	2.66E+04	3.76E+04	4.78E+04	4.76E+04	2.83E+04	3.96E+04	7.00E+04	7.89E+04	6.54E+04	4.97E+04	1.15E+04	5.69E+03	6.21E+04	6.47E+04	5.26E+04	1.10E+04	8.42E-15	0.00E+00	0.00E+00	7.16E+05	5.57E+06
6	5.19E-02	1.58E-03	1.53E-05	7.11E-04	1.06E-02	1.73E-02	1.57E-03	5.46E-02	2.11E-08	3.97E-05	6.79E-06	1.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.10E+03	1.25E+03	1.49E-01	0.00E+00	8.56E-14	7.53E+03	1.83E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.76E+01	1.53E-14	0.00E+00	0.00E+00	1.60E+04	1.60E+05
7	5.15E-02	1.54E-03	1.53E-05	8.85E-04	1.95E-02	2.05E-02	2.76E-03	1.28E-01	6.88E-08	4.95E-05	1.03E-05	1.99E+01	1.69E+04	0.00E+00	2.66E+04	3.77E+04	4.79E+04	4.76E+04	2.83E+04	3.97E+04	7.01E+04	7.89E+04	6.54E+04	4.57E+04	1.13E+04	5.54E+03	6.21E+04	6.47E+04	5.26E+04	1.12E+04	8.39E-15	0.00E+00	0.00E+00	7.16E+05	5.61E+06
8	5.15E-02	1.54E-03	1.53E-05	8.85E-04	2.36E-02	2.25E-02	2.76E-03	1.28E-01	6.88E-08	6.29E-05	1.95E-05	1.99E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.11E+03	1.25E+03	1.49E-01	0.00E+00	8.57E-14	7.53E+03	1.83E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E+01	1.54E-14	0.00E+00	0.00E+00	1.60E+04	1.76E+05
9	5.11E-02	1.51E-03	1.52E-05	1.06E-03	3.76E-02	2.54E-02	4.24E-03	2.46E-01	1.70E-07	7.54E-05	2.67E-05	2.48E+01	1.69E+04	0.00E+00	2.65E+04	3.75E+04	4.76E+04	4.74E+04	2.83E+04	3.95E+04	6.98E+04	7.86E+04	6.52E+04	4.95E+04	1.11E+04	5.42E+03	6.19E+04	6.45E+04	5.24E+04	1.14E+04	8.33E-15	0.00E+00	0.00E+00	7.14E+05	5.63E+06
10	5.11E-02	1.51E-03	1.52E-05	1.06E-03	4.40E-02	2.73E-02	4.24E-03	2.46E-01	1.70E-07	9.24E-05	4.44E-05	2.48E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.09E+03	1.25E+03	1.48E-01	0.00E+00	8.54E-14	7.51E+03	1.82E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.96E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	1.88E+05
11	5.07E-02	1.48E-03	1.52E-05	1.23E-03	6.43E-02	2.99E-02	5.93E-03	4.12E-01	3.47E-07	1.06E-04	5.66E-05	2.95E+01	1.65E+04	0.00E+00	2.58E+04	3.66E+04	4.64E+04	4.62E+04	2.76E+04	3.86E+04	6.81E+04	7.67E+04	6.35E+04	4.83E+04	1.08E+04	5.30E+03	6.03E+04	6.29E+04	5.11E+04	1.12E+04	8.29E-15	0.00E+00	0.00E+00	6.96E+05	5.53E+06
12	5.07E-02	1.48E-03	1.52E-05	1.23E-03	7.34E-02	3.19E-02	5.93E-03	4.11E-01	3.47E-07	1.25E-04	8.62E-05	2.96E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.93E+03	1.22E+03	1.45E-01	0.00E+00	8.32E-14	7.33E+03	1.78E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.85E+01	1.53E-14	0.00E+00	0.00E+00	1.56E+04	1.95E+05
13	5.03E-02	1.44E-03	1.52E-05	1.40E-03	1.01E-01	3.43E-02	7.90E-03	6.32E-01	6.42E-07	1.41E-04	1.05E-04	3.44E+01	1.70E+04	0.00E+00	2.66E+04	3.77E+04	4.75E+04	4.77E+04	2.84E+04	3.98E+04	7.03E+04	7.91E+04	6.56E+04	4.98E+04	1.06E+04	5.15E+03	6.23E+04	6.49E+04	5.28E+04	1.18E+04	8.15E-15	0.00E+00	0.00E+00	7.18E+05	5.73E+06
14	5.03E-02	1.44E-03	1.52E-05	1.40E-03	1.14E-01	3.63E-02	7.90E-03	6.31E-01	6.42E-07	1.63E-04	1.50E-04	3.44E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.12E+03	1.26E+03	1.49E-01	0.00E+00	8.59E-14	7.55E+03	1.83E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.22E+01	1.55E-14	0.00E+00	0.00E+00	1.60E+04	2.04E+05
15	4.99E-02	1.41E-03	1.51E-05	1.57E-03	1.50E-01	3.84E-02	1.00E-02	9.33E-01	1.09E-06	1.81E-04	1.78E-04	3.92E+01	1.68E+04	0.00E+00	2.64E+04	3.74E+04	4.75E+04	4.73E+04	2.82E+04	3.95E+04	6.97E+04	7.84E+04	6.50E+04	4.94E+04	1.04E+04	5.02E+03	6.17E+04	6.43E+04	5.23E+04	1.18E+04	8.10E-15	0.00E+00	0.00E+00	7.11E+05	5.71E+06
16	4.99E-02	1.41E-03	1.51E-05	1.57E-03	1.67E-01	4.04E-02	1.00E-02	9.31E-01	1.09E-06	2.06E-04	2.44E-04	3.93E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.08E+03	1.25E+03	1.48E-01	0.00E+00	8.51E-14	7.49E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.25E+01	1.55E-14	0.00E+00	0.00E+00	1.59E+04	2.10E+05
17	4.95E-02	1.38E-03	1.51E-05	1.74E-03	2.12E-01	4.23E-02	1.23E-02	1.30E+00	1.74E-06	2.25E-04	2.82E-04	4.40E+01	1.68E+04	0.00E+00	2.63E+04	3.72E+04	4.73E+04	4.71E+04	2.81E+04	3.93E+04	6.94E+04	7.81E+04	6.47E+04	4.92E+04	1.01E+04	4.89E+03	6.15E+04	6.41E+04	5.21E+04	1.20E+04	7.99E-15	0.00E+00	0.00E+00	7.08E+05	5.72E+06
18	4.95E-02	1.38E-03	1.51E-05	1.74E-03	2.33E-01	4.43E-02	1.23E-02	1.30E+00	1.74E-06	2.53E-04	3.75E-04	4.40E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E+03	1.24E+03	1.48E-01	0.00E+00	8.48E-14	7.46E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.32E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.15E+05
19	4.91E-02	1.34E-03	1.51E-05	1.90E-03	2.85E-01	4.60E-02	1.47E-02	1.72E+00	2.63E-06	2.73E-04	4.24E-04	4.87E+01	1.66E+04	0.00E+00	2.60E+04	3.69E+04	4.68E+04	4.66E+04	2.79E+04	3.90E+04	6.87E+04	7.74E+04	6.41E+04	4.88E+04	9.87E+03	4.76E+03	6.09E+04	6.34E+04	5.16E+04	1.20E+04	7.86E-15	0.00E+00	0.00E+00	7.01E+05	5.70E+06
20	4.91E-02	1.34E-03	1.51E-05	1.90E-03	3.15E-01	4.81E-02	1.47E-02	1.72E+00	2.63E-06	3.02E-04	5.48E-04	4.87E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.99E+03	1.23E+03	1.46E-01	0.00E+00	8.40E-14	7.39E+03	1.78E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.36E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	2.18E+05
21	4.87E-02	1.31E-03	1.50E-05	2.07E-03	3.81E-01	4.95E-02	1.73E-02	2.21E+00	3.81E-06	3.24E-04	6.09E-04	5.34E+01	1.65E+04	0.00E+00	2.60E+04	3.68E+04	4.67E+04	4.65E+04	2.78E+04	3.89E+04	6.85E+04	7.72E+04	6.39E+04	4.87E+04	9.67E+03	4.64E+03	6.07E+04	6.32E+04	5.14E+04	1.22E+04	7.81E-15	0.00E+00	0.00E+00	6.99E+05	5.71E+06
22	4.87E-02	1.31E-03	1.50E-05	2.07E-03	4.12E-01	5.17E-02	1.73E-02	2.20E+00	3.81E-06	3.56E-04	7.67E-04	5.34E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.97E+03	1.23E+03	1.46E-01	0.00E+00	8.38E-14	7.37E+03	1.78E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.44E+01	1.54E-14	0.00E+00	0.00E+00	1.57E+04	2.20E+05
23	4.82E-02	1.28E-03	1.50E-05	2.23E-03	4.90E-01	5.30E-02	2.00E-02	2.75E+00	5.32E-06	3.80E-04	8.40E-04	5.80E+01	1.64E+04	0.00E+00	2.57E+04	3.64E+04	4.63E+04	4.67E+04	2.75E+04	3.85E+04	6.79E+04	7.65E+04	6.34E+04	4.82E+04	9.44E+03	4.51E+03	6.02E+04	6.27E+04	5.10E+04	1.22E+04	7.73E-15	0.00E+00	0.00E+00	6.93E+05	5.69E+06
24	4.82E-02	1.28E-03	1.50E-05	2.23E-03	4.90E-01	5.30E-02	2.00E-02	2.75E+00	5.32E-06	3.80E-04	8.40E-04	5.81E+01	1.54E+04	0.00E+00	1.98E+04	3.23E+04	6.62E+01	7.89E-13	2.75E+04	3.85E+04	6.75E+04	6.88E+04	6.01E+04	4.83E+04	1.14E+04	4.51E+03	2.81E+02	1.45E+04	9.29E-10	1.22E+04	7.77E-15	0.00E+00	0.00E+00	4.21E+05	2.13E+06

Monteburns Activities (Ci) for Fuel in Core Position F4

	92234.69c	92235.72c	92238.72c	92236.69c	94238.69c	94239.72c	94240.69c	94241.69c	94242.69c	93237.69c	95241.69c	36085.70c	36485.00c	36086.70c	36087.00c	36088.00c	36089.00c	36090.00c	53131.70c	53132.00c	53133.00c	53134.00c	53135.70c	54133.70c	54135.70c	54535.00c	54137.00c	54138.00c	54139.00c	61149.50c	62149.50c	45117.91d	13027.70c	actinide	total
0	5.31E-02	1.68E-03	1.54E-05	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-02	
1	5.27E-02	1.65E-03	1.54E-05	3.60E-04	1.58E-04	4.10E-03	1.44E-04	1.61E-03	1.58E-10	3.26E-06	1.65E-08	4.95E+00	1.72E+04	0.00E+00	2.69E+04	3.82E+04	4.85E+04	4.82E+04	2.57E+04	4.00E+04	7.10E+04	7.99E+04	6.62E+04	4.83E+04	1.21E+04	6.01E+03	6.29E+04	6.56E+04	5.33E+04	1.09E+04	7.07E-15	0.00E+00	0.00E+00	7.21E+05	5.51E+06
2	5.27E-02	1.65E-03	1.54E-05	3.60E-04	3.29E-04	6.08E-03	1.45E-04	1.61E-03	1.58E-10	8.42E-06	1.32E-07	5.07E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.46E+03	1.26E+03	1.51E-01	0.00E+00	8.68E-14	7.39E+03	1.86E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.67E+01	1.38E-14	0.00E+00	0.00E+00	1.52E+04	9.82E+04
3	5.23E-02	1.61E-03	1.53E-05	5.36E-04	2.40E-03	9.98E-03	6.76E-04	1.48E-02	3.70E-09	1.41E-05	4.18E-07	9.95E+00	1.70E+04	0.00E+00	2.67E+04	3.79E+04	4.80E+04	4.77E+04	2.81E+04	3.98E+04	7.03E+04	7.91E+04	6.56E+04	4.98E+04	1.17E+04	5.80E+03	6.23E+04	6.49E+04	5.28E+04	1.09E+04	8.37E-15	0.00E+00	0.00E+00	7.18E+05	5.53E+06
4	5.23E-02	1.61E-03	1.53E-05	5.36E-04	3.44E-03	1.20E-02	6.76E-04	1.47E-02	3.70E-09	2.15E-05	1.48E-06	1.01E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.06E+03	1.26E+03	1.49E-01	0.00E+00	8.59E-14	7.55E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.67E+01	1.51E-14	0.00E+00	0.00E+00	1.59E+04	1.36E+05
5	5.19E-02	1.58E-03	1.53E-05	7.10E-04	8.45E-03	1.55E-02	1.57E-03	5.31E-02	2.03E-08	2.97E-05	2.78E-06	1.49E+01	1.68E+04	0.00E+00	2.64E+04	3.74E+04	4.75E+04	4.73E+04	2.81E+04	3.94E+04	6.96E+04	7.84E+04	6.49E+04	4.93E+04	1.15E+04	5.70E+03	6.17E+04	6.43E+04	5.23E+04	1.09E+04	8.44E-15	0.00E+00	0.00E+00	7.12E+05	5.53E+06
6	5.19E-02	1.58E-03	1.53E-05	7.10E-04	1.08E-02	1.75E-02	1.57E-03	5.29E-02	2.03E-08	4.03E-05	6.59E-06	1.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.06E+03	1.24E+03	1.48E-01	0.00E+00	8.51E-14	7.48E+03	1.82E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.71E+01	1.52E-14	0.00E+00	0.00E+00	1.59E+04	1.59E+05
7	5.15E-02	1.54E-03	1.53E-05	8.81E-04	1.98E-02	2.10E-02	2.77E-03	1.26E-01	6.61E-08	5.02E-05	1.01E-05	1.98E+01	1.67E+04	0.00E+00	2.61E+04	3.70E+04	4.70E+04	4.68E+04	2.79E+04	3.90E+04	6.89E+04	7.76E+04	6.43E+04	4.89E+04	1.13E+04	5.56E+03	6.11E+04	6.36E+04	5.17E+04	1.10E+04	8.41E-15	0.00E+00	0.00E+00	7.04E+05	5.52E+06
8	5.15E-02	1.54E-03	1.53E-05	8.81E-04	2.39E-02	2.31E-02	2.77E-03	1.26E-01	6.61E-08	6.35E-05	1.51E-05	1.98E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.00E+03	1.23E+03	1.46E-01	0.00E+00	8.42E-14	7.41E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	1.74E+05
9	5.11E-02	1.51E-03	1.52E-05	1.05E-03	3.79E-02	2.60E-02	4.27E-03	2.42E-01	1.63E-07	7.54E-05	2.61E-05	2.46E+01	1.66E+04	0.00E+00	2.61E+04	3.69E+04	4.69E+04	4.67E+04	2.78E+04	3.89E+04	6.87E+04	7.74E+04	6.41E+04	4.87E+04	1.11E+04	5.43E+03	6.09E+04	6.35E+04	5.16E+04	1.12E+04	8.33E-15	0.00E+00	0.00E+00	7.02E+05	5.54E+06
10	5.11E-02	1.51E-03	1.52E-05	1.05E-03	4.42E-02	2.79E-02	4.27E-03	2.41E-01	1.63E-07	9.15E-05	4.35E-05	2.46E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.98E+03	1.22E+03	1.46E-01	0.00E+00	8.40E-14	7.39E+03	1.80E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.83E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	1.86E+05
11	5.07E-02	1.48E-03	1.52E-05	1.22E-03	6.44E-02	3.06E-02	6.02E-03	4.14E-01	3.43E-07	1.05E-04	5.57E-05	2.94E+01	1.67E+04	0.00E+00	2.62E+04	3.72E+04	4.72E+04	4.70E+04	2.80E+04	3.92E+04	6.92E+04	7.79E+04	6.46E+04	4.91E+04	1.08E+04	5.30E+03	6.13E+04	6.39E+04	5.19E+04	1.14E+04	8.25E-15	0.00E+00	0.00E+00	7.07E+05	5.61E+06
12	5.07E-02	1.48E-03	1.52E-05	1.22E-03	7.35E-02	3.26E-02	6.02E-03	4.13E-01	3.43E-07	1.23E-04	8.54E-05	2.95E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.02E+03	1.24E+03	1.47E-01	0.00E+00	8.46E-14	7.44E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.98E+01	1.53E-14	0.00E+00	0.00E+00	1.58E+04	1.95E+05
13	5.03E-02	1.44E-03	1.52E-05	1.39E-03	1.00E-01	3.49E-02	7.96E-03	6.44E-01	6.34E-07	1.39E-04	1.05E-04	3.42E+01	1.66E+04	0.00E+00	2.60E+04	3.68E+04	4.67E+04	4.65E+04	2.78E+04	3.88E+04	6.86E+04	7.72E+04	6.40E+04	4.86E+04	1.06E+04	5.17E+03	6.08E+04	6.33E+04	5.15E+04	1.15E+04	8.16E-15	0.00E+00	0.00E+00	7.00E+05	5.59E+06
14	5.03E-02	1.44E-03	1.52E-05	1.39E-03	1.12E-01	3.69E-02	7.96E-03	6.43E-01	6.34E-07	1.60E-04	1.51E-04	3.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.97E+03	1.23E+03	1.46E-01	0.00E+00	8.38E-14	7.37E+03	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.03E+01	1.53E-14	0.00E+00	0.00E+00	1.57E+04	2.02E+05
15	4.99E-02	1.41E-03	1.51E-05	1.56E-03	1.47E-01	3.90E-02	1.01E-02	9.36E-01	1.08E-06	1.77E-04	1.79E-04	3.89E+01	1.64E+04	0.00E+00	2.57E+04	3.64E+04	4.62E+04	4.60E+04	2.75E+04	3.84E+04	6.79E+04	7.64E+04	6.33E+04	4.82E+04	1.04E+04	5.05E+03	6.01E+04	6.26E+04	5.09E+04	1.15E+04	8.13E-15	0.00E+00	0.00E+00	6.93E+05	5.57E+06
16	4.99E-02	1.41E-03	1.51E-05	1.56E-03	1.63E-01	4.10E-02	1.01E-02	9.34E-01	1.08E-06	2.00E-04	2.46E-04	3.89E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.90E+03	1.21E+03	1.44E-01	0.00E+00	8.29E-14	7.30E+03	1.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E+01	1.53E-14	0.00E+00	0.00E+00	1.55E+04	2.06E+05
17	4.95E-02	1.38E-03	1.51E-05	1.72E-03	2.07E-01	4.29E-02	1.24E-02	1.29E+00	1.71E-06	2.15E-04	2.83E-04	4.36E+01	1.64E+04	0.00E+00	2.58E+04	3.65E+04	4.64E+04	4.61E+04	2.75E+04	3.85E+04	6.80E+04	7.66E+04	6.35E+04	4.83E+04	1.02E+04	4.92E+03	6.03E+04	6.28E+04	5.10E+04	1.17E+04	8.03E-15	0.00E+00	0.00E+00	6.95E+05	5.61E+06
18	4.95E-02	1.38E-03	1.51E-05	1.72E-03	2.27E-01	4.50E-02	1.24E-02	1.29E+00	1.71E-06	2.46E-04	3.76E-04	4.36E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.91E+03	1.22E+03	1.45E-01	0.00E+00	8.31E-14	7.31E+03	1.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.17E+01	1.53E-14	0.00E+00	0.00E+00	1.56E+04	2.11E+05
19	4.91E-02	1.35E-03	1.51E-05	1.89E-03	2.81E-01	4.66E-02	1.48E-02	1.71E+00	2.59E-06	2.69E-04	4.25E-04	4.82E+01	1.65E+04	0.00E+00	2.58E+04	3.66E+04	4.65E+04	4.62E+04	2.76E+04	3.86E+04	6.82E+04	7.68E+04	6.36E+04	4.84E+04	9.92E+03	4.78E+03	6.04E+04	6.29E+04	5.12E+04	1.19E+04	7.91E-15	0.00E+00	0.00E+00	6.96E+05	5.65E+06
20	4.91E-02	1.35E-03	1.51E-05	1.89E-03	3.05E-01	4.87E-02	1.48E-02	1.70E+00	2.59E-06	2.96E-04	5.47E-04	4.82E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.92E+03	1.22E+03	1.45E-01	0.00E+00	8.33E-14	7.33E+03	1.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.30E+01	1.53E-14	0.00E+00	0.00E+00	1.56E+04	2.15E+05
21	4.87E-02	1.31E-03	1.50E-05	2.05E-03	3.71E-01	5.00E-02	1.74E-02	2.21E+00	3.75E-06	3.17E-04	6.08E-04	5.29E+01	1.64E+04	0.00E+00	2.58E+04	3.65E+04	4.64E+04	4.62E+04	2.76E+04	3.86E+04	6.81E+04	7.66E+04	6.35E+04	4.83E+04	9.69E+03	4.65E+03	6.03E+04	6.28E+04	5.11E+04	1.20E+04	7.89E-15	0.00E+00	0.00E+00	6.95E+05	5.67E+06
22	4.87E-02	1.31E-03	1.50E-05	2.05E-03	4.01E-01	5.22E-02	1.74E-02	2.21E+00	3.75E-06	3.47E-04	7.67E-04	5.29E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.92E+03	1.22E+03	1.45E-01	0.00E+00	8.32E-14	7.32E+03	1.77E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.39E+01	1.53E-14	0.00E+00	0.00E+00	1.56E+04	2.18E+05
23	4.82E-02	1.28E-03	1.50E-05	2.21E-03	4.76E-01	5.31E-02	2.00E-02	2.77E+00	5.25E-06	3.69E-04	8.41E-04	5.75E+01	1.62E+04	0.00E+00	2.55E+04	3.61E+04	4.58E+04	4.56E+04	2.73E+04	3.82E+04	6.73E+04	7.57E+04	6.28E+04	4.78E+04	9.44E+03	4.52E+03	5.96E+04	6.21E+04	5.05E+04	1.21E+04	7.70E-15	0.00E+00	0.00E+00	6.87E+05	5.64E+06
24	4.82E-02	1.28E-03	1.50E-05	2.21E-03	4.77E-01	5.32E-02	2.00E-02	2.77E+00	5.25E-06	3.69E-04	8.41E-04	5.75E+01	1.53E+04	0.00E+00	1.96E+04	3.20E+04	6.59E+01	7.83E-13	2.73E+04	3.81E+04	6.69E+04	6.81E+04	5.96E+04	4.78E+04	1.14E+04	4.52E+03	2.78E+02	1.43E+04	9.80E-10	1.21E+04	7.75E-15	0.00E+00	0.00E+00	4.17E+05	2.10E+06

Monteburns Activities (Ci) for Fuel in Core Position F2

	92234.69c	92235.72c	92238.72c	92236.69c	94238.69c	94239.72c	94240.69c	94241.69c	94242.69c	93237.69c	95241.69c	36085.70c	36485.00c	36086.70c	36087.00c	36088.00c	36089.00c	36090.00c	53131.70c	53132.00c	53133.00c	53134.00c	53135.70c	54133.70c	54135.70c	54535.00c	54137.00c	54138.00c	54139.00c	61149.50c	62149.50c	45117.91d	13027.70c	actinide	total
0	5.31E-02	1.68E-03	1.54E-05	1.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-02	
1	5.27E-02	1.64E-03	1.54E-05	3.65E-04	1.68E-04	4.26E-03	1.54E-04	1.76E-03	2.22E-10	3.38E-06	1.80E-08	5.09E+00	1.77E+04	0.00E+00	2.77E+04	3.93E+04	4.95E+04	4.97E+04	2.64E+04	4.12E+04	7.21E+04	8.22E+04	6.82E+04	4.97E+04	1.21E+04	5.59E+03	6.48E+04	6.75E+04	5.49E+04	1.12E+04	7.12E-15	0.00E+00	0.00E+00	7.42E+05	5.67E+06
2	5.27E-02	1.64E-03	1.54E-05	3.65E-04	3.50E-04	6.32E-03	1.54E-04	1.76E-03	2.22E-10	8.75E-06	1.44E-07	5.22E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.65E+03	1.30E+03	1.55E-01	0.00E+00	8.93E-14	7.61E+03	1.91E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E+01	1.41E-14	0.00E+00	0.00E+00	1.56E+04	1.01E+05
3	5.23E-02	1.61E-03	1.53E-05	5.44E-04	2.54E-03	1.00E-02	7.08E-04	1.61E-02	4.15E-09	1.45E-05	4.57E-07	1.02E+01	1.72E+04	0.00E+00	2.70E+04	3.83E+04	4.87E+04	4.84E+04	2.86E+04	4.04E+04	7.13E+04	8.03E+04	6.65E+04	5.05E+04	1.17E+04	5.82E+03	6.32E+04	6.58E+04	5.35E+04	1.10E+04	8.36E-15	0.00E+00	0.00E+00	7.28E+05	5.62E+06
4	5.23E-02	1.61E-03	1.53E-05	5.44E-04	3.64E-03	1.20E-02	7.05E-04	1.61E-02	4.15E-09	2.24E-05	1.61E-06	1.03E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.17E+03	1.27E+03	1.52E-01	0.00E+00	8.71E-14	7.66E+03	1.87E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.77E+01	1.52E-14	0.00E+00	0.00E+00	1.62E+04	1.39E+05
5	5.19E-02	1.58E-03	1.53E-05	7.21E-04	8.85E-03	1.55E-02	1.61E-03	5.55E-02	2.21E-08	3.05E-05	2.90E-06	1.52E+01	1.72E+04	0.00E+00	2.70E+04	3.82E+04	4.85E+04	4.83E+04	2.87E+04	4.02E+04	7.11E+04	8.00E+04	6.63E+04	5.04E+04	1.15E+04	5.67E+03	6.30E+04	6.56E+04	5.34E+04	1.12E+04	8.45E-15	0.00E+00	0.00E+00	7.26E+05	5.65E+06
6	5.19E-02	1.58E-03	1.53E-05	7.21E-04	1.13E-02	1.75E-02	1.61E-03	5.54E-02	2.21E-08	4.15E-05	6.97E-06	1.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.21E+03	1.27E+03	1.51E-01	0.00E+00	8.69E-14	7.64E+03	1.86E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E+01	1.54E-14	0.00E+00	0.00E+00	1.62E+04	1.62E+05
7	5.15E-02	1.54E-03	1.53E-05	8.96E-04	2.07E-02	2.08E-02	2.81E-03	1.35E-01	7.21E-08	5.19E-05	1.07E-05	2.02E+01	1.70E+04	0.00E+00	2.67E+04	3.78E+04	4.80E+04	4.78E+04	2.85E+04	3.99E+04	7.04E+04	7.93E+04	6.57E+04	4.99E+04	1.13E+04	5.54E+03	6.24E+04	6.50E+04	5.29E+04	1.12E+04	8.41E-15	0.00E+00	0.00E+00	7.20E+05	5.64E+06
8	5.15E-02	1.54E-03	1.53E-05	8.96E-04	2.50E-02	2.28E-02	2.81E-03	1.35E-01	7.21E-08	6.58E-05	2.04E-05	2.03E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.15E+03	1.26E+03	1.50E-01	0.00E+00	8.61E-14	7.57E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.90E+01	1.54E-14	0.00E+00	0.00E+00	1.61E+04	1.78E+05
9	5.11E-02	1.51E-03	1.52E-05	1.07E-03	4.02E-02	2.59E-02	4.34E-03	2.57E-01	1.80E-07	7.82E-05	2.78E-05	2.52E+01	1.72E+04	0.00E+00	2.70E+04	3.83E+04	4.87E+04	4.84E+04	2.88E+04	4.04E+04	7.13E+04	8.03E+04	6.66E+04	5.06E+04	1.11E+04	5.41E+03	6.32E+04	6.59E+04	5.36E+04	1.16E+04	8.39E-15	0.00E+00	0.00E+00	7.29E+05	5.75E+06
10	5.11E-02	1.51E-03	1.52E-05	1.07E-03	4.70E-02	2.79E-02	4.34E-03	2.57E-01	1.80E-07	9.52E-05	4.63E-05	2.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.23E+03	1.28E+03	1.52E-01	0.00E+00	8.72E-14	7.67E+03	1.86E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.11E+01	1.55E-14	0.00E+00	0.00E+00	1.63E+04	1.91E+05
11	5.07E-02	1.47E-03	1.52E-05	1.25E-03	6.85E-02	3.06E-02	6.13E-03	4.37E-01	3.74E-07	1.10E-04	5.92E-05	3.02E+01	1.71E+04	0.00E+00	2.69E+04	3.81E+04	4.84E+04	4.82E+04	2.87E+04	4.02E+04	7.10E+04	7.99E+04	6.62E+04	5.03E+04	1.09E+04	5.26E+03	6.29E+04	6.55E+04	5.33E+04	1.17E+04	8.23E-15	0.00E+00	0.00E+00	7.25E+05	5.76E+06
12	5.07E-02	1.47E-03	1.52E-05	1.25E-03	7.81E-02	3.26E-02	6.13E-03	4.36E-01	3.74E-07	1.31E-04	9.06E-05	3.02E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.21E+03	1.27E+03	1.51E-01	0.00E+00	8.67E-14	7.63E+03	1.85E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E+01	1.55E-14	0.00E+00	0.00E+00	1.62E+04	2.01E+05
13	5.03E-02	1.44E-03	1.52E-05	1.42E-03	1.08E-01	3.50E-02	8.14E-03	6.73E-01	6.90E-07	1.47E-04	1.11E-04	3.51E+01	1.70E+04	0.00E+00	2.67E+04	3.79E+04	4.81E+04	4.79E+04	2.86E+04	4.00E+04	7.05E+04	7.94E+04	6.58E+04	5.00E+04	1.06E+04	5.14E+03	6.25E+04	6.51E+04	5.29E+04	1.18E+04	8.15E-15	0.00E+00	0.00E+00	7.20E+05	5.76E+06
14	5.03E-02	1.44E-03	1.52E-05	1.42E-03	1.21E-01	3.71E-02	8.14E-03	6.72E-01	6.90E-07	1.69E-04	1.59E-04	3.51E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.17E+03	1.26E+03	1.50E-01	0.00E+00	8.62E-14	7.59E+03	1.84E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.23E+01	1.55E-14	0.00E+00	0.00E+00	1.61E+04	2.08E+05
15	4.98E-02	1.40E-03	1.51E-05	1.59E-03	1.59E-01	3.91E-02	1.03E-02	9.78E-01	1.16E-06	1.87E-04	1.88E-04	3.99E+01	1.68E+04	0.00E+00	2.64E+04	3.74E+04	4.75E+04	4.72E+04	2.82E+04	3.95E+04	6.96E+04	7.84E+04	6.50E+04	4.94E+04	1.03E+04	5.00E+03	6.17E+04	6.43E+04	5.23E+04	1.18E+04	8.07E-15	0.00E+00	0.00E+00	7.11E+05	5.72E+06
16	4.98E-02	1.40E-03	1.51E-05	1.59E-03	1.76E-01	4.12E-02	1.03E-02	9.76E-01	1.16E-06	2.12E-04	2.58E-04	3.99E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.08E+03	1.25E+03	1.48E-01	0.00E+00	8.51E-14	7.49E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.25E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.12E+05
17	4.94E-02	1.37E-03	1.51E-05	1.76E-03	2.23E-01	4.29E-02	1.26E-02	1.35E+00	1.85E-06	2.31E-04	2.97E-04	4.47E+01	1.68E+04	0.00E+00	2.63E+04	3.73E+04	4.74E+04	4.71E+04	2.81E+04	3.94E+04	6.95E+04	7.82E+04	6.48E+04	4.93E+04	1.01E+04	4.88E+03	6.16E+04	6.42E+04	5.22E+04	1.20E+04	7.95E-15	0.00E+00	0.00E+00	7.09E+05	5.74E+06
18	4.94E-02	1.37E-03	1.51E-05	1.76E-03	2.44E-01	4.49E-02	1.26E-02	1.35E+00	1.85E-06	2.57E-04	3.94E-04	4.47E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.06E+03	1.24E+03	1.48E-01	0.00E+00	8.49E-14	7.48E+03	1.81E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.34E+01	1.54E-14	0.00E+00	0.00E+00	1.59E+04	2.16E+05
19	4.90E-02	1.34E-03	1.51E-05	1.92E-03	3.02E-01	4.65E-02	1.51E-02	1.79E+00	2.79E-06	2.78E-04	4.45E-04	4.94E+01	1.67E+04	0.00E+00	2.62E+04	3.71E+04	4.71E+04	4.69E+04	2.80E+04	3.92E+04	6.91E+04	7.78E+04	6.45E+04	4.91E+04	9.87E+03	4.75E+03	6.12E+04	6.38E+04	5.18E+04	1.21E+04	7.88E-15	0.00E+00	0.00E+00	7.05E+05	5.74E+06
20	4.90E-02	1.34E-03	1.51E-05	1.92E-03	3.28E-01	4.86E-02	1.51E-02	1.79E+00	2.79E-06	3.08E-04	5.73E-04	4.94E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.02E+03	1.24E+03	1.47E-01	0.00E+00	8.44E-14	7.43E+03	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.41E+01	1.54E-14	0.00E+00	0.00E+00	1.58E+04	2.19E+05
21	4.86E-02	1.30E-03	1.50E-05	2.09E-03	3.97E-01	4.99E-02	1.77E-02	2.29E+00	4.03E-06	3.30E-04	6.36E-04	5.41E+01	1.67E+04	0.00E+00	2.61E+04	3.70E+04	4.70E+04	4.68E+04	2.80E+04	3.91E+04	6.90E+04	7.77E+04	6.44E+04	4.90E+04	9.65E+03	4.62E+03	6.11E+04	6.37E+04	5.18E+04	1.22E+04	7.79E-15	0.00E+00	0.00E+00	7.04E+05	5.76E+06
22	4.86E-02	1.30E-03	1.50E-05	2.09E-03	4.28E-01	5.20E-02	1.77E-02	2.29E+00	4.03E-06	3.61E-04	8.01E-04	5.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.01E+03	1.24E+03	1.47E-01	0.00E+00	8.43E-14	7.42E+03	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.48E+01	1.54E-14	0.00E+00	0.00E+00	1.58E+04	2.22E+05
23	4.81E-02	1.27E-03	1.50E-05	2.25E-03	5.05E-01	5.31E-02	2.04E-02	2.85E+00	5.62E-06	3.84E-04	8.76E-04	5.88E+01	1.66E+04	0.00E+00	2.61E+04	3.70E+04	4.70E+04	4.67E+04	2.79E+04	3.91E+04	6.90E+04	7.76E+04	6.43E+04	4.90E+04	9.44E+03	4.49E+03	6.11E+04	6.36E+04	5.17E+04	1.24E+04	7.69E-15	0.00E+00	0.00E+00	7.03E+05	5.78E+06
24	4.81E-02	1.27E-03	1.50E-05	2.25E-03	5.05E-01	5.31E-02	2.04E-02	2.85E+00	5.62E-06	3.84E-04	8.76E-04	5.88E+01	1.57E+04	0.00E+00	2.01E+04	3.28E+04	6.72E+01	8.01E-13	2.79E+04	3.91E+04	6.86E+04	6.98E+04	6.11E+04	4.90E+04	1.14E+04	4.49E+03	2.85E+02	1.47E+04	1.00E-09	1.24E+04	7.74E-15	0.00E+00	0.00E+00	4.27E+05	2.16E+06

Fuel Failure during Reactor Operation - Resricted Area Dose

Isotope	$T_{1/2}$		Core Actvity (Ci)	4 #1 Plates Actvity 0.0342 (Ci)	Primary Coolant Activity (uCi/gal)	Activity in Pool at 10 min (uCi)	Time interval: Pool Act. Conc. at 10 min (uCi/gal)	t = 0-1 min Containment Concentration (uCi/cc) No I evap @ T_0	t = 1-3 min Containment Concentration w/ decay (uCi/cc)	t = 3-5 min Containment Concentration w/ decay (uCi/cc)	t = 5-7 min Containment Concentration w/ decay (uCi/cc)	t = 7-9 min Containment Concentration w/ decay (uCi/cc)	t = 9-10 min Containment Concentration w/ decay (uCi/cc)	Average Concentration (uCi/cc)	DAC	Dose to Workers 10 min (mrem)
							Time (min):	0.5	2	4	6	8	9.5			
I-131	8.02	d	2.20E+05	7.52E+03	3.76E+06	2.97E+05	1.49E+01	2.33E-10	3.73E-09	1.49E-08	3.36E-08	5.97E-08	8.41E-08	3.08E-08	2.00E-08	6.42E+00
I-132	2.28	h	3.08E+05	1.05E+04	5.27E+06	4.16E+05	2.08E+01	3.26E-10	5.17E-09	2.05E-08	4.56E-08	8.03E-08	1.12E-07	4.16E-08	3.00E-06	5.78E-02
I-133	20.8	h	5.42E+05	1.85E+04	9.27E+06	7.32E+05	3.66E+01	5.74E-10	9.18E-09	3.67E-08	8.25E-08	1.46E-07	2.06E-07	7.56E-08	1.00E-07	3.15E+00
I-134	52.6	m	6.11E+05	2.09E+04	1.04E+07	8.25E+05	4.13E+01	6.43E-10	1.01E-08	3.93E-08	8.62E-08	1.49E-07	2.06E-07	7.77E-08	2.00E-05	1.62E-02
I-135	6.57	h	5.06E+05	1.73E+04	8.65E+06	6.84E+05	3.42E+01	5.36E-10	8.55E-09	3.41E-08	7.64E-08	1.35E-07	1.90E-07	7.00E-08	7.00E-07	4.17E-01
																1.01E+01
Kr-85	10.76	y	4.63E+02	1.58E+01	7.92E+03	6.25E+02		4.91E-09	1.96E-08	3.93E-08	5.89E-08	7.85E-08	9.33E-08	4.91E-08	1.00E-04	2.05E-04
Kr-85m	4.48	h	1.31E+05	4.48E+03	2.24E+06	1.77E+05		1.39E-06	5.53E-06	1.10E-05	1.64E-05	2.18E-05	2.57E-05	1.37E-05	2.00E-05	2.85E-01
Kr-87	1.27	h	2.05E+05	7.01E+03	3.51E+06	2.77E+05		2.16E-06	8.54E-06	1.68E-05	2.47E-05	3.23E-05	3.79E-05	2.05E-05	5.00E-06	1.71E+00
Kr-88	2.84	h	2.91E+05	9.95E+03	4.98E+06	3.93E+05		3.08E-06	1.22E-05	2.43E-05	3.61E-05	4.78E-05	5.64E-05	3.00E-05	2.00E-06	6.26E+00
Kr-89	3.15	m	3.69E+05	1.26E+04	6.31E+06	4.98E+05		3.50E-06	1.01E-05	1.30E-05	1.25E-05	1.08E-05	9.19E-06	1.05E-05	1.90E-06	2.31E+00
Kr-90	32.3	s	3.68E+05	1.26E+04	6.29E+06	4.97E+05		2.05E-06	1.19E-06	1.81E-07	2.07E-08	2.10E-09	3.62E-10	4.84E-07	2.80E-06	7.20E-01
																1.13E+01
Xe-133	5.243	d	3.85E+05	1.32E+04	6.58E+06	5.20E+05		4.08E-06	1.63E-05	3.26E-05	4.90E-05	6.53E-05	7.75E-05	4.08E-05	1.00E-04	1.70E-01
Xe-135	9.1	h	7.56E+04	2.59E+03	1.29E+06	1.02E+05		8.01E-07	3.20E-06	6.38E-06	9.54E-06	1.27E-05	1.50E-05	7.95E-06	1.00E-05	3.31E-01
Xe-135m	15.3	m	3.62E+04	1.24E+03	6.19E+05	4.89E+04		3.75E-07	1.40E-06	2.56E-06	3.51E-06	4.27E-06	4.74E-06	2.86E-06	9.00E-06	1.32E-01
Xe-137	3.82	m	4.81E+05	1.65E+04	8.23E+06	6.50E+05		4.66E-06	1.42E-05	1.97E-05	2.06E-05	1.91E-05	1.73E-05	1.69E-05	2.00E-05	3.53E-01
Xe-138	14.1	m	5.01E+05	1.71E+04	8.57E+06	6.77E+05		5.18E-06	1.93E-05	3.49E-05	4.75E-05	5.74E-05	6.33E-05	3.86E-05	4.00E-06	4.03E+00
Xe-139	39.7	s	4.07E+05	1.39E+04	6.96E+06	5.50E+05		2.56E-06	2.12E-06	5.23E-07	9.66E-08	1.59E-08	3.91E-09	8.08E-07	3.70E-06	9.10E-02
																5.10E+00

Denotes DACs calculated using methodology as described in FGR No. 12.

Total Iodine (CDE) (mrem)	**10.07**
Iodine (CEDE) (mrem) ***(CDE x 0.03)***	**0.302**
Noble Gas (CEDE) mrem	**16.38**
Total Dose (TEDE) mrem	**16.69**

Fuel Failure during Reactor Operation - Unresricted Area Dose

Isotope	$T_{1/2}$		Core Actvity (Ci)	4 #1 Plates Actvity 0.0342 (Ci)	Actvity in Coolant (uCi/gal)	Activity in Pool at 10 min (uCi)	Pool Act. Conc. at 10 min (uCi/gal)	Containment Concentration No I evap @ T_0 (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Exhaust 1st hour Ave. Conc. (uCi/cc)	Total Exhaust Activity (uCi)	Exhaust Overall Ave. Conc. (uCi/cc)	Effluent Conc. Limit (uCi/cc)	Concentration at Maximum Dose Point (EC/292)	Dose to Public 16.5 hr (mrem)
							1 Hr Intervals:	**0.5**	**1.5**	**2.5**	**3.5**	**4.5**	*4 Hr Intervals:*	**7**	**11**	**14.75**						
							Containment Volume scf:	**229801**	**229224**	**228684**	**228181.0**	**227714.0**		**226733.0**	**225605.0**	**225085.0**						
							Containment Average Leakage Rate scf/hr:	**595.6**	**558.7**	**521.8**	**485**	**448.1**		**355.8**	**207.9**	**67.9**						
I-131	8.02	d	2.20E+05	7.52E+03	3.76E+06	2.97E+05	1.49E+01	2.58E-03	2.57E-03	2.56E-03	2.55E-03	2.54E-03		2.52E-03	2.49E-03	2.45E-03	1.48E-11	6.47E+00	7.56E-12	2.00E-10	2.59E-14	1.22E-05
I-132	2.28	h	3.08E+05	1.05E+04	5.27E+06	4.16E+05	2.08E+01	3.11E-03	2.30E-03	1.69E-03	1.25E-03	9.22E-04		4.31E-04	1.28E-04	4.09E-05	1.79E-11	2.88E+00	3.37E-12	2.00E-08	1.16E-14	5.44E-08
I-133	20.8	h	5.42E+05	1.85E+04	9.27E+06	7.32E+05	3.66E+01	6.27E-03	6.06E-03	5.86E-03	5.67E-03	5.49E-03		5.05E-03	4.42E-03	3.90E-03	3.60E-11	1.36E+01	1.59E-11	1.00E-09	5.44E-14	5.13E-06
I-134	52.6	m	6.11E+05	2.09E+04	1.04E+07	8.25E+05	4.13E+01	4.84E-03	2.19E-03	9.96E-04	4.52E-04	2.05E-04		2.84E-05	1.20E-06	6.20E-08	2.78E-11	2.49E+00	2.91E-12	6.00E-08	9.97E-15	1.57E-08
I-135	6.57	h	5.06E+05	1.73E+04	8.65E+06	6.84E+05	3.42E+01	5.64E-03	5.08E-03	4.57E-03	4.11E-03	3.70E-03		2.84E-03	1.86E-03	1.26E-03	3.24E-11	9.07E+00	1.06E-11	6.00E-09	3.63E-14	5.70E-07
																						1.80E-05
Kr-85	10.76	y	4.63E+02	1.58E+01	7.92E+03	6.25E+02		2.72E-03	2.72E-03	2.72E-03	2.72E-03	2.72E-03		2.72E-03	2.72E-03	2.72E-03	3.13E-11	1.39E+01	1.62E-11	7.00E-07	5.56E-14	2.19E-06
Kr-85m	4.48	h	1.31E+05	4.48E+03	2.24E+06	1.77E+05		7.13E-01	6.11E-01	5.23E-01	4.48E-01	3.84E-01		2.61E-01	1.40E-01	7.86E-02	8.19E-09	1.93E+03	2.26E-09	1.00E-07	7.75E-12	2.13E-03
Kr-87	1.27	h	2.05E+05	7.01E+03	3.51E+06	2.77E+05		9.17E-01	5.32E-01	3.08E-01	1.78E-01	1.03E-01		2.64E-02	2.98E-03	3.85E-04	1.05E-08	1.18E+03	1.38E-09	2.00E-08	4.71E-12	6.49E-03
Kr-88	2.84	h	2.91E+05	9.95E+03	4.98E+06	3.93E+05		1.51E+00	1.19E+00	9.29E-01	7.28E-01	5.71E-01		3.10E-01	1.17E-01	4.68E-02	1.74E-08	3.21E+03	3.75E-09	9.00E-09	1.28E-11	3.93E-02
Kr-89	3.15	m	3.69E+05	1.26E+04	6.31E+06	4.98E+05		2.95E-03	5.46E-09	1.01E-14	1.87E-20	3.46E-26		1.61E-40	1.89E-63	6.01E-85	3.39E-11	1.76E+00	2.06E-12	8.60E-09	7.04E-15	2.25E-05
Kr-90	32.3	s	3.68E+05	1.26E+04	6.29E+06	4.97E+05		3.66E-17	1.04E-50	2.98E-84	8.52E-118	2.43E-151		3.35E-235	0.00E+00	0.00E+00	4.20E-25	2.18E-14	2.55E-26	1.20E-08	8.72E-29	2.00E-19
																						4.79E-02
Xe-133	5.243	d	3.85E+05	1.32E+04	6.58E+06	5.20E+05		2.26E+00	2.24E+00	2.23E+00	2.22E+00	2.21E+00		2.18E+00	2.13E+00	2.09E+00	2.59E-08	1.12E+04	1.31E-08	5.00E-07	4.48E-11	2.47E-03
Xe-135	9.1	h	7.56E+04	2.59E+03	1.29E+06	1.02E+05		4.28E-01	3.96E-01	3.67E-01	3.40E-01	3.15E-01		2.61E-01	1.92E-01	1.45E-01	4.92E-09	1.54E+03	1.80E-09	7.00E-08	6.17E-12	2.42E-03
Xe-135m	15.3	m	3.62E+04	1.24E+03	6.19E+05	4.89E+04		5.47E-02	3.61E-03	2.38E-04	1.57E-05	1.04E-06		1.16E-09	2.21E-14	8.30E-19	6.29E-10	3.47E+01	4.06E-11	4.00E-08	1.39E-13	9.56E-05
Xe-137	3.82	m	4.81E+05	1.65E+04	8.23E+06	6.50E+05		1.22E-02	2.29E-07	4.30E-12	8.06E-17	1.51E-21		2.30E-33	2.83E-52	5.31E-70	1.41E-10	7.29E+00	8.53E-12	9.10E-08	2.92E-14	8.83E-06
Xe-138	14.1	m	5.01E+05	1.71E+04	8.57E+06	6.77E+05		6.74E-01	3.53E-02	1.85E-03	9.70E-05	5.08E-06		3.19E-09	2.41E-14	3.79E-19	7.75E-09	4.22E+02	4.94E-10	2.00E-08	1.69E-12	2.33E-03
Xe-139	39.7	s	4.07E+05	1.39E+04	6.96E+06	5.50E+05		5.41E-14	2.76E-41	1.41E-68	7.21E-96	3.69E-123		2.17E-191	1.48E-300	0.00E+00	6.22E-22	3.22E-11	3.77E-23	1.60E-08	1.29E-25	2.22E-16
																						7.32E-03

Denotes Effluent Concentrations derived from DACs calculated using methodology as described in FGR No. 12. (DAC/219)

Total Iodine (CEDE) mrem	**1.80E-05**
Noble Gas (TEDE) mrem	**5.52E-02**
Total Dose (TEDE) mrem	**5.53E-02**

MURR Health & Safety
Technical Basis Report

DATE: March 20, 2016 (Supersedes: January 11, 2016)

BY: Nathan G. Hogue, Health Physics Manager

TITLE: 16-01: Determination of Derived Air Concentrations for Kr-89, Kr-90, Xe-137, and Xe-139.

Purpose

The purpose of this Technical Basis is to document the derivation of derived air concentrations (DAC) for Kr-89, Kr-90, Xe-137, and Xe-139 as no current published values exist within 10CFR20 APP B, Federal Guidance Report 11, or Federal Guidance Report 12.

Background

In conjunction with the MURR application for renewal of the Facility Operating License during evaluation of the maximum hypothetical accident four nuclides (Kr-89, Kr-90, Xe-137, and Xe-139) were observed to be present during a containment evacuation without an available DAC reference for dose determination. Derivations of specific DAC values corresponding to each of these nuclides were needed to determine proper dose consequences during the maximum hypothetical accident. A comprehensive review of Federal Guidance Report (FGR) – 11 and FGR – 12 was conducted to derive each value based on industry acceptable methodologies within.

All the nuclides in question are common in that they are noble gases and are not metabolized to an appreciable extent by the body. The methodology for calculating a DAC for materials of this nature, established within FGR-11 and continued in FGR-12, are based on consideration of external dose due to submersion in air only. In the case of air submersion a worker is assumed to be immersed in a pure parent semi-infinite homogeneous cloud and no radiation from airborne progeny, absorbed gas within the body, or inhalation of radioactive decay products are considered. The derivations within this report also make the aforementioned assumptions.

FGR-12 provides an updated table compared to those in FGR-11 of dose coefficients for air submersion based on use of the continuous energy Monte Carlo photon transport code ALGAMP. Within FGR-12 calculations were performed for twelve monoenergetic sources ranging from 0.01 to 5.0 MeV incident on a phantom with

spectra generated by the PHOFLUX code for air submersion and normalized to a source strength to determine dose coefficients presented in Table II.4. Coefficients for effective dose equivalent were also presented in Table II.4 based on ICRP 60 weighting factors. Using the results of these calculations nuclide specific dose coefficients were derived taking into account the specific photon spectrum of each radionuclide and using interpolation of the determined dose coefficients from the twelve point monoenergetic source. The nuclide specific photon spectra were gathered from the Brookhaven National Laboratory National Nuclear Data Center database and Table 1 of Erdtmann/Soyka gamma ray spectroscopy reference text. The use of both references allowed for collection of a comprehensive listing.

A direct repetition of the methodology of using interpolation of the data presented in Table II.4 of FGR-12 was used to calculate photon dose coefficients for each of the nuclides in question. The skin dose and effective dose equivalent data from Table II.4 FGR-12 were plotted in excel and assigned a best fit line used for the interpolation (See Figure 1 and 2).

Figure 1

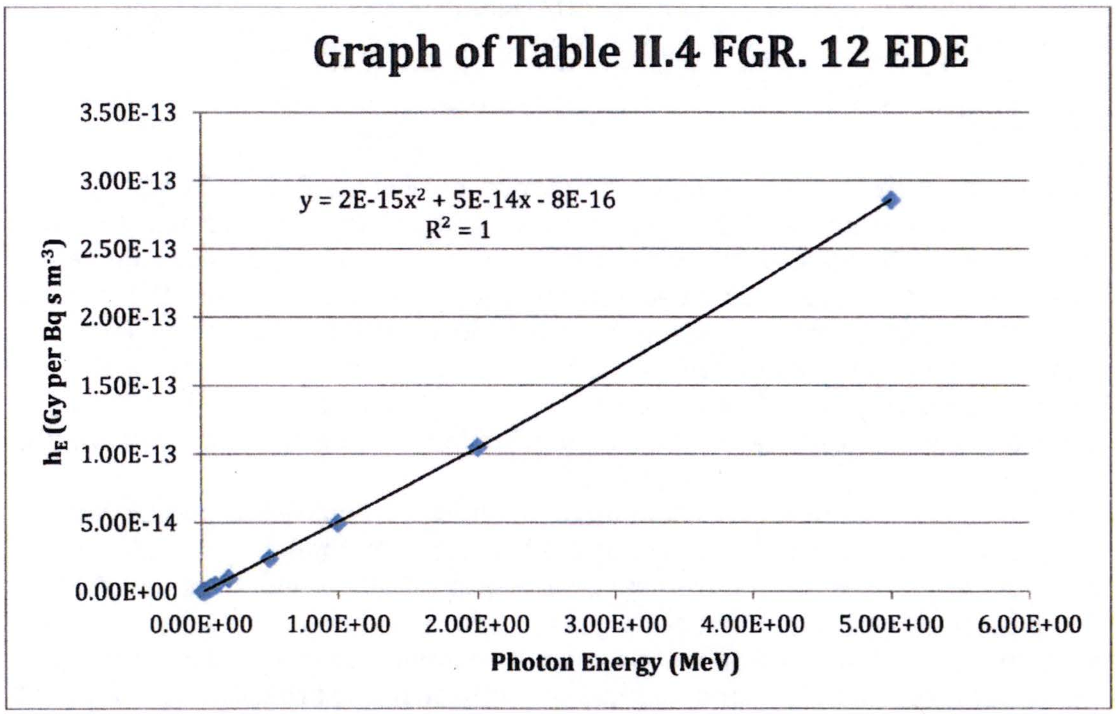
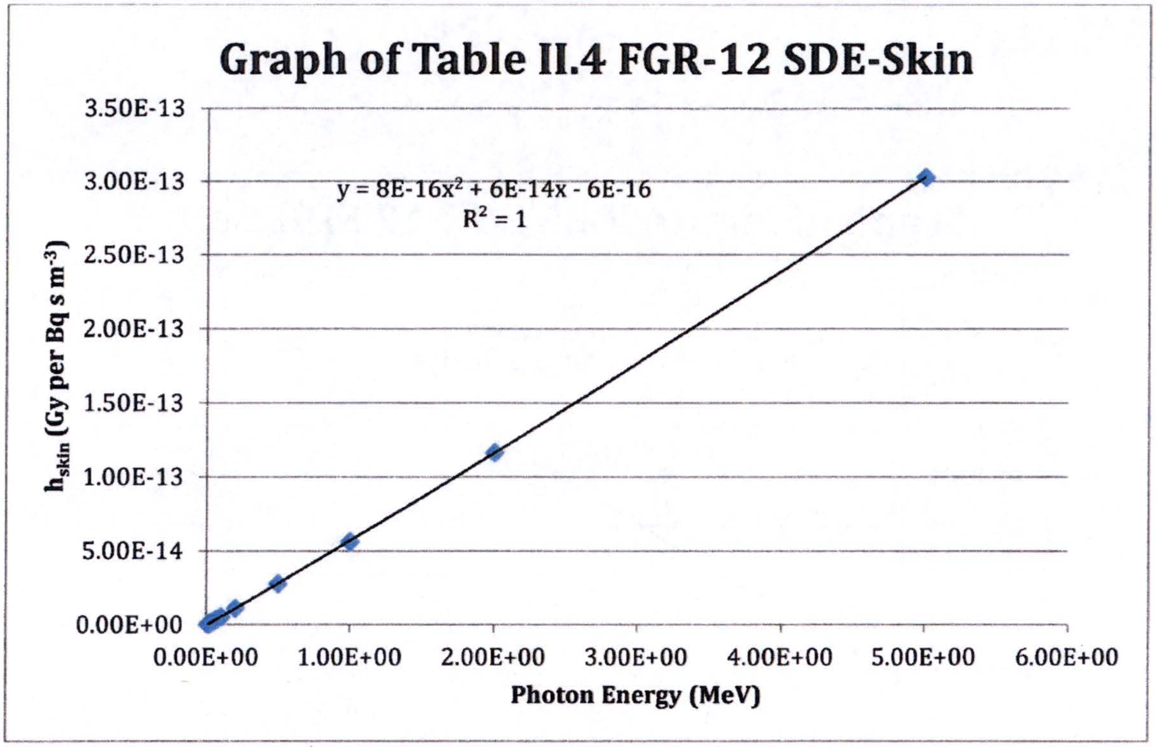


Figure 2



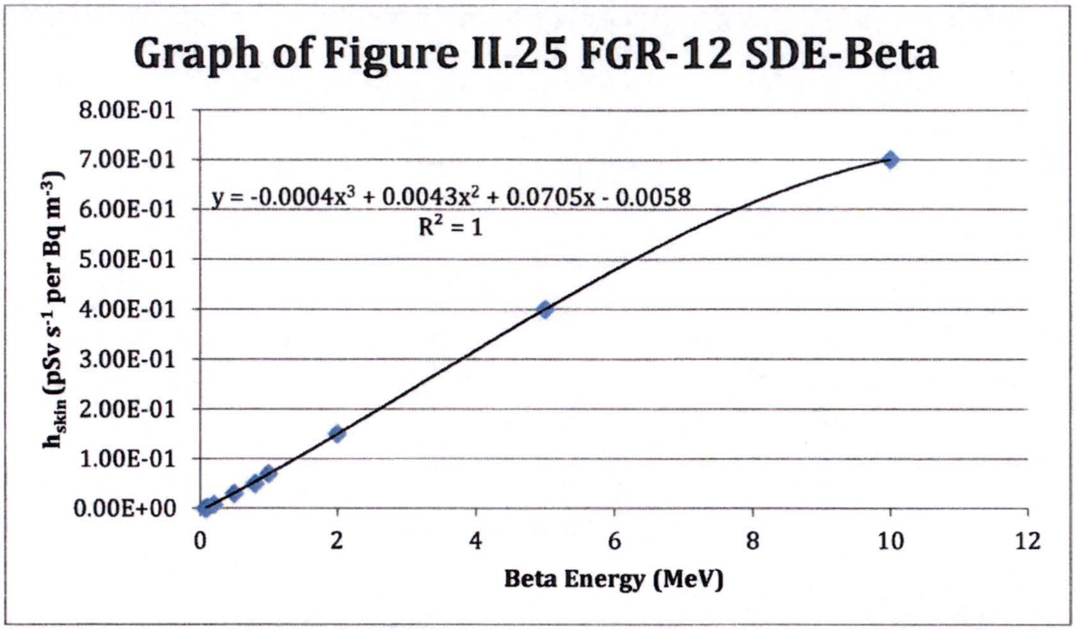
Examination of the limiting coefficients for other isotopes of each nuclide, given by bold-face type within FGR-11 Table 2.3, was completed to determine if other organs should be considered in the determination of the most limiting DAC. During the review of FGR-11 and FGR-12 either the effective dose equivalent or skin was used as the limiting factor and therefore these two components will be considered to ensure the most limiting is selected in derivation of the DAC values.

For the calculation of effective dose equivalent only penetrating photon radiation was considered in the derivation as delineated in FGR-12; the derivation of electrons to dose to organs and tissues of the body other than the skin need not be considered, due to the short range in tissue of electrons emitted.

For the calculation of skin dose both photon and beta radiation was considered in determining the dose coefficients. The decay emission types, energies, and intensities for shallow dose derivations were gathered from the Brookhaven National Laboratory National Nuclear Data Center database. FGR-12 provides Figure II.25, Electron skin dose coefficient for submersion in contaminated air, which was used to interpolate the dose coefficient from the beta average energies (one-third beta max) as seen in Figure 3. For emissions that result in a negative

dose coefficient the values were excluded from the DAC derivation. This is considered acceptable as the decay energies resulting in a negative coefficient are not sufficient to contribute to the dose.

Figure 3



An example subset of the derivation of both the effective dose equivalent and skin dose coefficients are provided below for the readers review. The entire calculation was performed within excel and is attached in two versions; Attachment 1) with the formulas displayed and Attachments 2-5) with the values displayed. The same methodology was used for all other nuclides within an excel file and are also include as Attachments 2-5.

Calculation

Effective Dose Equivalent DAC

Equation 1, derived from plotting the h_E data from Table II.4 of FGR-12, was used to interpolate a dose coefficient specific to each photon energy

(Eqn. 1) $y = 2E - 15x^2 + 5E - 14x - 8E - 16$

$y = h_E(Gy\ per\ Bq\ s\ m^{-3})$

$x = Photon\ energy\ in\ MeV$

Equation 2 was then used to determine a dose rate per unit activity value specific to each photon energy

(Eqn. 2) $R = y \times i$
$R = Dose\ rate\ per\ unit\ activity$
$y = interpolated\ dose\ coefficient\ from\ Eqn.\ 1$
$i = intensity\ of\ decay$

Equation 3 is the summation of each dose rate value determined in Eqn. 2 for each photon energy to determine the total dose coefficient specific to the nuclide

(Eqn. 3) $S = R_1 + R_2 + R_3 + \ldots R_n$
$S = Sum\ of\ dose\ rate\ factors\ per\ unit\ activity$
$R = Dose\ rate\ per\ unit\ activity\ from\ Eqn.\ 2$

Equation 4 is used to convert the units of the total dose coefficient to mRem hr^{-1} per µCi ml^{-1}

(Eqn. 4) $E = S(1.33E19)$
$E = EDE\ coefficient\ specific\ to\ the\ nuclide$
$S = Sum\ of\ dose\ rate\ factors\ per\ unit\ activity\ from\ Eqn.\ 3$

Equation 5 determines the DAC by scaling the derived value to the annual occupational limit of 5 Rem or 2.5 mRem/hr

(Eqn. 5) $D = \frac{2.5}{E}$
$D = EDE\ Derived\ Air\ Concentration\ in\ \mu Ci\ ml^{-1}\ of\ submersed\ air$
$E = EDE\ coefficient\ specific\ to\ the\ nuclide\ from\ Eqn.\ 4$

Shallow Dose Equivalent DAC

In the derivation of SDE both a photon component and electron component will contribute to dose therefore both must be considered. First we will consider the photon component in Equations 6 through 10 and later the electron component in equations 11 through 15.

Equation 6, derived from plotting the h_{skin} data from Table II.4 of FGR-12, was used to interpolate a dose coefficient specific to each photon energy

(Eqn. 6) $y = 8E - 16x^2 + 6E - 14x - 6E - 16$
$y = h_{skin}(Gy\ per\ Bq\ s\ m^{-3})$
$x = Photon\ energy\ in\ MeV$

Equation 7 was then used to determine a dose rate per unit activity value specific to each photon energy

(Eqn. 7) $R = y \times i$
$R = Dose\ rate\ per\ unit\ activity$
$y = interpolated\ dose\ coefficient\ from\ Eqn. 6$
$i = intensity\ of\ decay$

Equation 8 is the summation of each dose rate value determined in Eqn. 7 for each photon energy to determine the total dose coefficient specific to the nuclide

(Eqn. 8) $S = R_1 + R_2 + R_3 + \ldots R_n$
$S = Sum\ of\ dose\ rate\ factors\ per\ unit\ activity$
$R = Dose\ rate\ per\ unit\ activity\ from\ Eqn. 7$

Equation 9 is used to convert the units of the total dose coefficient to mRem hr^{-1} per $\mu Ci\ ml^{-1}$

(Eqn. 9) $E = S(1.33E19)$
$E = SDE\ coefficient\ specific\ to\ the\ nuclide$
$S = Sum\ of\ dose\ rate\ factors\ per\ unit\ activity\ from\ Eqn. 8$

Equation 10 determines the DAC by scaling the derived value to the annual occupational limit of 50 Rem or 25 mRem/hr

(Eqn. 10) $D = \frac{25}{E}$
$D = SDE\ Derived\ Air\ Concentration\ in\ \mu Ci\ ml^{-1}\ of\ submersed\ air$
$E = SDE\ coefficient\ specific\ to\ the\ nuclide\ from\ Eqn. 9$

Equation 11, derived from plotting the h_{skin} data from Figure II.25 of FGR-12, was used to interpolate a dose coefficient specific to each beta energy

(Eqn. 11) $y = -0.0004x^3 + 0.0043x^2 + 0.0705x - 0.0058$
$y = h_{skin}(pSv\ s^{-1}\ per\ Bq\ m^{-3})$
$x = Beta\ energy\ in\ MeV$

Equation 12 was then used to determine a dose rate per unit activity value specific to each average (one third of the maximum) beta energy

(Eqn. 12) $R = y \times i$
$R = Dose\ rate\ per\ unit\ activity$
$y = interpolated\ dose\ coefficient\ from\ Eqn. 11$
$i = intensity\ of\ decay$

Equation 13 is the summation of each dose rate value determined in Eqn. 12 for each beta energy to determine the total dose coefficient specific to the nuclide

(Eqn. 13) $S = R_1 + R_2 + R_3 + \ldots R_n$
$S = Sum\ of\ dose\ rate\ factors\ per\ unit\ activity$
$R = Dose\ rate\ per\ unit\ activity\ from\ Eqn. 12$

Equation 14 is used to convert the units of the total dose coefficient to mRem hr^{-1} per µCi ml^{-1}

(Eqn. 14) $E = S(1.33E7)$
$E = SDE\ coefficient\ specific\ to\ the\ nuclide$
$S = Sum\ of\ dose\ rate\ factors\ per\ unit\ activity\ from\ Eqn. 13$

Equation 15 determines the DAC by scaling the derived value to the annual occupational limit of 50 Rem or 25 mRem/hr

(Eqn. 15) $D = \frac{25}{E}$
$D = SDE\ Derived\ Air\ Concentration\ in\ \mu Ci\ ml^{-1}\ of\ submersed\ air$
$E = SDE\ coefficient\ specific\ to\ the\ nuclide\ from\ Eqn. 14$

Equation 16 sums the SDE DAC from both photon emission and beta emission to determine the total SDE DAC for the nuclide

(Eqn. 16) $T = E_{SDE\ photon} + E_{SDE\ beta}$
$T = SDE_{Total}\ Derived\ Air\ Concentration\ in\ \mu Ci\ ml^{-1}$

Conclusion

Based on the derivation described above the following nuclides may be assigned the following limiting derived air concentration values to determine dose consequence.

Nuclide	DAC (µCi/ml)
Kr-89	1.9 E-6 (EDE)
Kr-90	2.8 E-6 (EDE)
Xe-137	2.0 E-5 (EDE)
Xe-139	3.7 E-6 (EDE)

ATTACHMENT 4

Attachment 1

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
1	Kr-89							
2	T1/2	3.15m						
3								
4					Determination of DAC limited by EDE			
5	Photon Emissions:							
6								
7	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity		
8	(keV)	(MeV)	(%)	Mode	hE (Gy per Bq s m^{-3})	Gy/s		
9								
10	4701.5	=A10/1000	0.01	b-	=(0.00000000000002*(B10*B10))+(0.0000000000005*(B10))-0.000000000000008	=C10/100*E10		
11	4685.6	=A11/1000	0.008	b-	=(0.00000000000002*(B11*B11))+(0.0000000000005*(B11))-0.000000000000008	=C11/100*E11		
12	4655.6	=A12/1000	0.01	b-	=(0.00000000000002*(B12*B12))+(0.0000000000005*(B12))-0.000000000000008	=C12/100*E12		
13	4631.5	=A13/1000	0.028	b-	=(0.00000000000002*(B13*B13))+(0.0000000000005*(B13))-0.000000000000008	=C13/100*E13		
14	4489.2	=A14/1000	0.135	b-	=(0.00000000000002*(B14*B14))+(0.0000000000005*(B14))-0.000000000000008	=C14/100*E14		
15	4478.3	=A15/1000	0.014	b-	=(0.00000000000002*(B15*B15))+(0.0000000000005*(B15))-0.000000000000008	=C15/100*E15		
16	4448.1	=A16/1000	0.01	b-	=(0.00000000000002*(B16*B16))+(0.0000000000005*(B16))-0.000000000000008	=C16/100*E16		
17	4405.1	=A17/1000	0.008	b-	=(0.00000000000002*(B17*B17))+(0.0000000000005*(B17))-0.000000000000008	=C17/100*E17		
18	4368.4	=A18/1000	0.042	b-	=(0.00000000000002*(B18*B18))+(0.0000000000005*(B18))-0.000000000000008	=C18/100*E18		
19	4341.1	=A19/1000	0.105	b-	=(0.00000000000002*(B19*B19))+(0.0000000000005*(B19))-0.000000000000008	=C19/100*E19		
20	4321.2	=A20/1000	0.01	b-	=(0.00000000000002*(B20*B20))+(0.0000000000005*(B20))-0.000000000000008	=C20/100*E20		
21	4307.4	=A21/1000	0.01	b-	=(0.00000000000002*(B21*B21))+(0.0000000000005*(B21))-0.000000000000008	=C21/100*E21		
22	4279.4	=A22/1000	0.02	b-	=(0.00000000000002*(B22*B22))+(0.0000000000005*(B22))-0.000000000000008	=C22/100*E22		
23	4267.7	=A23/1000	0.028	b-	=(0.00000000000002*(B23*B23))+(0.0000000000005*(B23))-0.000000000000008	=C23/100*E23		
24	4253.3	=A24/1000	0.014	b-	=(0.00000000000002*(B24*B24))+(0.0000000000005*(B24))-0.000000000000008	=C24/100*E24		
25	4184.3	=A25/1000	0.05	b-	=(0.00000000000002*(B25*B25))+(0.0000000000005*(B25))-0.000000000000008	=C25/100*E25		
26	4176.2	=A26/1000	0.012	b-	=(0.00000000000002*(B26*B26))+(0.0000000000005*(B26))-0.000000000000008	=C26/100*E26		
27	4162.6	=A27/1000	0.028	b-	=(0.00000000000002*(B27*B27))+(0.0000000000005*(B27))-0.000000000000008	=C27/100*E27		
28	4146.9	=A28/1000	0.016	b-	=(0.00000000000002*(B28*B28))+(0.0000000000005*(B28))-0.000000000000008	=C28/100*E28		
29	4143	=A29/1000	0.026	b-	=(0.00000000000002*(B29*B29))+(0.0000000000005*(B29))-0.000000000000008	=C29/100*E29		
30	4117.7	=A30/1000	0.014	b-	=(0.00000000000002*(B30*B30))+(0.0000000000005*(B30))-0.000000000000008	=C30/100*E30		
31	4081.4	=A31/1000	0.074	b-	=(0.00000000000002*(B31*B31))+(0.0000000000005*(B31))-0.000000000000008	=C31/100*E31		
32	4048	=A32/1000	0.117	b-	=(0.00000000000002*(B32*B32))+(0.0000000000005*(B32))-0.000000000000008	=C32/100*E32		
33	4043.8	=A33/1000	0.02	b-	=(0.00000000000002*(B33*B33))+(0.0000000000005*(B33))-0.000000000000008	=C33/100*E33		
34	4004.9	=A34/1000	0.028	b-	=(0.00000000000002*(B34*B34))+(0.0000000000005*(B34))-0.000000000000008	=C34/100*E34		
35	3996	=A35/1000	0.143	b-	=(0.00000000000002*(B35*B35))+(0.0000000000005*(B35))-0.000000000000008	=C35/100*E35		
36	3977.5	=A36/1000	0.27	b-	=(0.00000000000002*(B36*B36))+(0.0000000000005*(B36))-0.000000000000008	=C36/100*E36		
37	3977.5	=A37/1000	0.07	b-	=(0.00000000000002*(B37*B37))+(0.0000000000005*(B37))-0.000000000000008	=C37/100*E37		
38	3965.5	=A38/1000	0.209	b-	=(0.00000000000002*(B38*B38))+(0.0000000000005*(B38))-0.000000000000008	=C38/100*E38		
39	3923	=A39/1000	0.42	b-	=(0.00000000000002*(B39*B39))+(0.0000000000005*(B39))-0.000000000000008	=C39/100*E39		
40	3901.7	=A40/1000	0.135	b-	=(0.00000000000002*(B40*B40))+(0.0000000000005*(B40))-0.000000000000008	=C40/100*E40		
41	3898.4	=A41/1000	0.034	b-	=(0.00000000000002*(B41*B41))+(0.0000000000005*(B41))-0.000000000000008	=C41/100*E41		
42	3882.5	=A42/1000	0.04	b-	=(0.00000000000002*(B42*B42))+(0.0000000000005*(B42))-0.000000000000008	=C42/100*E42		
43	3842.7	=A43/1000	0.111	b-	=(0.00000000000002*(B43*B43))+(0.0000000000005*(B43))-0.000000000000008	=C43/100*E43		
44	3837.6	=A44/1000	0.082	b-	=(0.00000000000002*(B44*B44))+(0.0000000000005*(B44))-0.000000000000008	=C44/100*E44		
45	3827.4	=A45/1000	0.139	b-	=(0.00000000000002*(B45*B45))+(0.0000000000005*(B45))-0.000000000000008	=C45/100*E45		
46	3809.5	=A46/1000	0.02	b-	=(0.00000000000002*(B46*B46))+(0.0000000000005*(B46))-0.000000000000008	=C46/100*E46		
47	3781.4	=A47/1000	0.133	b-	=(0.00000000000002*(B47*B47))+(0.0000000000005*(B47))-0.000000000000008	=C47/100*E47		
48	3756.5	=A48/1000	0.016	b-	=(0.00000000000002*(B48*B48))+(0.0000000000005*(B48))-0.000000000000008	=C48/100*E48		
49	3732.5	=A49/1000	0.14	b-	=(0.00000000000002*(B49*B49))+(0.0000000000005*(B49))-0.000000000000008	=C49/100*E49		
50	3721.5	=A50/1000	0.048	b-	=(0.00000000000002*(B50*B50))+(0.0000000000005*(B50))-0.000000000000008	=C50/100*E50		
51	3717.8	=A51/1000	0.84	b-	=(0.00000000000002*(B51*B51))+(0.0000000000005*(B51))-0.000000000000008	=C51/100*E51		
52	3677.7	=A52/1000	0.066	b-	=(0.00000000000002*(B52*B52))+(0.0000000000005*(B52))-0.000000000000008	=C52/100*E52		
53	3665.4	=A53/1000	0.084	b-	=(0.00000000000002*(B53*B53))+(0.0000000000005*(B53))-0.000000000000008	=C53/100*E53		
54	3652.3	=A54/1000	0.058	b-	=(0.00000000000002*(B54*B54))+(0.0000000000005*(B54))-0.000000000000008	=C54/100*E54		
55	3639.1	=A55/1000	0.038	b-	=(0.00000000000002*(B55*B55))+(0.0000000000005*(B55))-0.000000000000008	=C55/100*E55		
56	3634.4	=A56/1000	0.038	b-	=(0.00000000000002*(B56*B56))+(0.0000000000005*(B56))-0.000000000000008	=C56/100*E56		
57	3629.2	=A57/1000	0.08	b-	=(0.00000000000002*(B57*B57))+(0.0000000000005*(B57))-0.000000000000008	=C57/100*E57		
58	3583.9	=A58/1000	0.259	b-	=(0.00000000000002*(B58*B58))+(0.0000000000005*(B58))-0.000000000000008	=C58/100*E58		
59	3574	=A59/1000	0.06	b-	=(0.00000000000002*(B59*B59))+(0.0000000000005*(B59))-0.000000000000008	=C59/100*E59		
60	3567.9	=A60/1000	0.056	b-	=(0.00000000000002*(B60*B60))+(0.0000000000005*(B60))-0.000000000000008	=C60/100*E60		
61	3532.88	=A61/1000	1.35	b-	=(0.00000000000002*(B61*B61))+(0.0000000000005*(B61))-0.000000000000008	=C61/100*E61		
62	3503.6	=A62/1000	0.02	b-	=(0.00000000000002*(B62*B62))+(0.0000000000005*(B62))-0.000000000000008	=C62/100*E62		
63	3463.3	=A63/1000	0.042	b-	=(0.00000000000002*(B63*B63))+(0.0000000000005*(B63))-0.000000000000008	=C63/100*E63		
64	3439.6	=A64/1000	0.044	b-	=(0.00000000000002*(B64*B64))+(0.0000000000005*(B64))-0.000000000000008	=C64/100*E64		
65	3399.9	=A65/1000	0.137	b-	=(0.00000000000002*(B65*B65))+(0.0000000000005*(B65))-0.000000000000008	=C65/100*E65		
66	3371.1	=A66/1000	0.62	b-	=(0.00000000000002*(B66*B66))+(0.0000000000005*(B66))-0.000000000000008	=C66/100*E66		
67	3361.7	=A67/1000	1.05	b-	=(0.00000000000002*(B67*B67))+(0.0000000000005*(B67))-0.000000000000008	=C67/100*E67		
68	3351.9	=A68/1000	0.042	b-	=(0.00000000000002*(B68*B68))+(0.0000000000005*(B68))-0.000000000000008	=C68/100*E68		
69	3347.4	=A69/1000	0.068	b-	=(0.00000000000002*(B69*B69))+(0.0000000000005*(B69))-0.000000000000008	=C69/100*E69		
70	3340.8	=A70/1000	0.036	b-	=(0.00000000000002*(B70*B70))+(0.0000000000005*(B70))-0.000000000000008	=C70/100*E70		
71	3321.9	=A71/1000	0.07	b-	=(0.00000000000002*(B71*B71))+(0.0000000000005*(B71))-0.000000000000008	=C71/100*E71		
72	3317.9	=A72/1000	0.082	b-	=(0.00000000000002*(B72*B72))+(0.0000000000005*(B72))-0.000000000000008	=C72/100*E72		
73	3300	=A73/1000	0.038	b-	=(0.00000000000002*(B73*B73))+(0.0000000000005*(B73))-0.000000000000008	=C73/100*E73		
74	3271.3	=A74/1000	0.054	b-	=(0.00000000000002*(B74*B74))+(0.0000000000005*(B74))-0.000000000000008	=C74/100*E74		
75	3257	=A75/1000	0.052	b-	=(0.00000000000002*(B75*B75))+(0.0000000000005*(B75))-0.000000000000008	=C75/100*E75		
76	3219.84	=A76/1000	0.43	b-	=(0.00000000000002*(B76*B76))+(0.0000000000005*(B76))-0.000000000000008	=C76/100*E76		
77	3213.2	=A77/1000	0.032	b-	=(0.00000000000002*(B77*B77))+(0.0000000000005*(B77))-0.000000000000008	=C77/100*E77		

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
78	3172.1	=A78/1000	0.1	b-	=(0.000000000000002*(B78*B78))+(0.000000000000005*(B78))-0.0000000000000008	=C78/100*E78		
79	3159.8	=A79/1000	0.062	b-	=(0.000000000000002*(B79*B79))+(0.000000000000005*(B79))-0.0000000000000008	=C79/100*E79		
80	3154.4	=A80/1000	0.026	b-	=(0.000000000000002*(B80*B80))+(0.000000000000005*(B80))-0.0000000000000008	=C80/100*E80		
81	3140.26	=A81/1000	1.05	b-	=(0.000000000000002*(B81*B81))+(0.000000000000005*(B81))-0.0000000000000008	=C81/100*E81		
82	3107.26	=A82/1000	0.195	b-	=(0.000000000000002*(B82*B82))+(0.000000000000005*(B82))-0.0000000000000008	=C82/100*E82		
83	3098.8	=A83/1000	0.038	b-	=(0.000000000000002*(B83*B83))+(0.000000000000005*(B83))-0.0000000000000008	=C83/100*E83		
84	3049.7	=A84/1000	0.04	b-	=(0.000000000000002*(B84*B84))+(0.000000000000005*(B84))-0.0000000000000008	=C84/100*E84		
85	3029.16	=A85/1000	0.271	b-	=(0.000000000000002*(B85*B85))+(0.000000000000005*(B85))-0.0000000000000008	=C85/100*E85		
86	3017.9	=A86/1000	0.26	b-	=(0.000000000000002*(B86*B86))+(0.000000000000005*(B86))-0.0000000000000008	=C86/100*E86		
87	2998.4	=A87/1000	0.044	b-	=(0.000000000000002*(B87*B87))+(0.000000000000005*(B87))-0.0000000000000008	=C87/100*E87		
88	2946.9	=A88/1000	0.078	b-	=(0.000000000000002*(B88*B88))+(0.000000000000005*(B88))-0.0000000000000008	=C88/100*E88		
89	2917.4	=A89/1000	0.03	b-	=(0.000000000000002*(B89*B89))+(0.000000000000005*(B89))-0.0000000000000008	=C89/100*E89		
90	2878.69	=A90/1000	0.33	b-	=(0.000000000000002*(B90*B90))+(0.000000000000005*(B90))-0.0000000000000008	=C90/100*E90		
91	2873.8	=A91/1000	0.096	b-	=(0.000000000000002*(B91*B91))+(0.000000000000005*(B91))-0.0000000000000008	=C91/100*E91		
92	2866.23	=A92/1000	1.75	b-	=(0.000000000000002*(B92*B92))+(0.000000000000005*(B92))-0.0000000000000008	=C92/100*E92		
93	2858.9	=A93/1000	0.054	b-	=(0.000000000000002*(B93*B93))+(0.000000000000005*(B93))-0.0000000000000008	=C93/100*E93		
94	2853.3	=A94/1000	0.24	b-	=(0.000000000000002*(B94*B94))+(0.000000000000005*(B94))-0.0000000000000008	=C94/100*E94		
95	2819.58	=A95/1000	0.133	b-	=(0.000000000000002*(B95*B95))+(0.000000000000005*(B95))-0.0000000000000008	=C95/100*E95		
96	2804.1	=A96/1000	0.04	b-	=(0.000000000000002*(B96*B96))+(0.000000000000005*(B96))-0.0000000000000008	=C96/100*E96		
97	2793.75	=A97/1000	0.68	b-	=(0.000000000000002*(B97*B97))+(0.000000000000005*(B97))-0.0000000000000008	=C97/100*E97		
98	2789.2	=A98/1000	0.052	b-	=(0.000000000000002*(B98*B98))+(0.000000000000005*(B98))-0.0000000000000008	=C98/100*E98		
99	2782.11	=A99/1000	0.76	b-	=(0.000000000000002*(B99*B99))+(0.000000000000005*(B99))-0.0000000000000008	=C99/100*E99		
100	2775.7	=A100/1000	0.03	b-	=(0.000000000000002*(B100*B100))+(0.000000000000005*(B100))-0.0000000000000008	=C100/100*E100		
101	2760.3	=A101/1000	0.046	b-	=(0.000000000000002*(B101*B101))+(0.000000000000005*(B101))-0.0000000000000008	=C101/100*E101		
102	2756.6	=A102/1000	0.066	b-	=(0.000000000000002*(B102*B102))+(0.000000000000005*(B102))-0.0000000000000008	=C102/100*E102		
103	2750.9	=A103/1000	0.125	b-	=(0.000000000000002*(B103*B103))+(0.000000000000005*(B103))-0.0000000000000008	=C103/100*E103		
104	2742.3	=A104/1000	0.028	b-	=(0.000000000000002*(B104*B104))+(0.000000000000005*(B104))-0.0000000000000008	=C104/100*E104		
105	2721.9	=A105/1000	0.036	b-	=(0.000000000000002*(B105*B105))+(0.000000000000005*(B105))-0.0000000000000008	=C105/100*E105		
106	2703.2	=A106/1000	0.034	b-	=(0.000000000000002*(B106*B106))+(0.000000000000005*(B106))-0.0000000000000008	=C106/100*E106		
107	2659.1	=A107/1000	0.086	b-	=(0.000000000000002*(B107*B107))+(0.000000000000005*(B107))-0.0000000000000008	=C107/100*E107		
108	2645.26	=A108/1000	0.42	b-	=(0.000000000000002*(B108*B108))+(0.000000000000005*(B108))-0.0000000000000008	=C108/100*E108		
109	2630.1	=A109/1000	0.14	b-	=(0.000000000000002*(B109*B109))+(0.000000000000005*(B109))-0.0000000000000008	=C109/100*E109		
110	2622.8	=A110/1000	0.022	b-	=(0.000000000000002*(B110*B110))+(0.000000000000005*(B110))-0.0000000000000008	=C110/100*E110		
111	2597.92	=A111/1000	0.109	b-	=(0.000000000000002*(B111*B111))+(0.000000000000005*(B111))-0.0000000000000008	=C111/100*E111		
112	2555.3	=A112/1000	0.034	b-	=(0.000000000000002*(B112*B112))+(0.000000000000005*(B112))-0.0000000000000008	=C112/100*E112		
113	2549.9	=A113/1000	0.03	b-	=(0.000000000000002*(B113*B113))+(0.000000000000005*(B113))-0.0000000000000008	=C113/100*E113		
114	2545.4	=A114/1000	0.05	b-	=(0.000000000000002*(B114*B114))+(0.000000000000005*(B114))-0.0000000000000008	=C114/100*E114		
115	2534.9	=A115/1000	0.094	b-	=(0.000000000000002*(B115*B115))+(0.000000000000005*(B115))-0.0000000000000008	=C115/100*E115		
116	2522	=A116/1000	0.05	b-	=(0.000000000000002*(B116*B116))+(0.000000000000005*(B116))-0.0000000000000008	=C116/100*E116		
117	2510.8	=A117/1000	0.24	b-	=(0.000000000000002*(B117*B117))+(0.000000000000005*(B117))-0.0000000000000008	=C117/100*E117		
118	2503	=A118/1000	0.05	b-	=(0.000000000000002*(B118*B118))+(0.000000000000005*(B118))-0.0000000000000008	=C118/100*E118		
119	2487.8	=A119/1000	0.024	b-	=(0.000000000000002*(B119*B119))+(0.000000000000005*(B119))-0.0000000000000008	=C119/100*E119		
120	2467.3	=A120/1000	0.016	b-	=(0.000000000000002*(B120*B120))+(0.000000000000005*(B120))-0.0000000000000008	=C120/100*E120		
121	2440.9	=A121/1000	0.046	b-	=(0.000000000000002*(B121*B121))+(0.000000000000005*(B121))-0.0000000000000008	=C121/100*E121		
122	2400.99	=A122/1000	0.72	b-	=(0.000000000000002*(B122*B122))+(0.000000000000005*(B122))-0.0000000000000008	=C122/100*E122		
123	2377.4	=A123/1000	0.8	b-	=(0.000000000000002*(B123*B123))+(0.000000000000005*(B123))-0.0000000000000008	=C123/100*E123		
124	2352.7	=A124/1000	0.28	b-	=(0.000000000000002*(B124*B124))+(0.000000000000005*(B124))-0.0000000000000008	=C124/100*E124		
125	2335.2	=A125/1000	0.1	b-	=(0.000000000000002*(B125*B125))+(0.000000000000005*(B125))-0.0000000000000008	=C125/100*E125		
126	2330	=A126/1000	0.036	b-	=(0.000000000000002*(B126*B126))+(0.000000000000005*(B126))-0.0000000000000008	=C126/100*E126		
127	2321.7	=A127/1000	0.052	b-	=(0.000000000000002*(B127*B127))+(0.000000000000005*(B127))-0.0000000000000008	=C127/100*E127		
128	2285.6	=A128/1000	0.046	b-	=(0.000000000000002*(B128*B128))+(0.000000000000005*(B128))-0.0000000000000008	=C128/100*E128		
129	2280.2	=A129/1000	0.21	b-	=(0.000000000000002*(B129*B129))+(0.000000000000005*(B129))-0.0000000000000008	=C129/100*E129		
130	2249	=A130/1000	0.08	b-	=(0.000000000000002*(B130*B130))+(0.000000000000005*(B130))-0.0000000000000008	=C130/100*E130		
131	2239.8	=A131/1000	0.05	b-	=(0.000000000000002*(B131*B131))+(0.000000000000005*(B131))-0.0000000000000008	=C131/100*E131		
132	2232.6	=A132/1000	0.024	b-	=(0.000000000000002*(B132*B132))+(0.000000000000005*(B132))-0.0000000000000008	=C132/100*E132		
133	2207.2	=A133/1000	0.046	b-	=(0.000000000000002*(B133*B133))+(0.000000000000005*(B133))-0.0000000000000008	=C133/100*E133		
134	2195.8	=A134/1000	0.12	b-	=(0.000000000000002*(B134*B134))+(0.000000000000005*(B134))-0.0000000000000008	=C134/100*E134		
135	2190	=A135/1000	0.026	b-	=(0.000000000000002*(B135*B135))+(0.000000000000005*(B135))-0.0000000000000008	=C135/100*E135		
136	2167.9	=A136/1000	0.042	b-	=(0.000000000000002*(B136*B136))+(0.000000000000005*(B136))-0.0000000000000008	=C136/100*E136		
137	2160.02	=A137/1000	0.53	b-	=(0.000000000000002*(B137*B137))+(0.000000000000005*(B137))-0.0000000000000008	=C137/100*E137		
138	2150.1	=A138/1000	0.02	b-	=(0.000000000000002*(B138*B138))+(0.000000000000005*(B138))-0.0000000000000008	=C138/100*E138		
139	2143.8	=A139/1000	0.064	b-	=(0.000000000000002*(B139*B139))+(0.000000000000005*(B139))-0.0000000000000008	=C139/100*E139		
140	2140.5	=A140/1000	0.062	b-	=(0.000000000000002*(B140*B140))+(0.000000000000005*(B140))-0.0000000000000008	=C140/100*E140		
141	2100.63	=A141/1000	0.94	b-	=(0.000000000000002*(B141*B141))+(0.000000000000005*(B141))-0.0000000000000008	=C141/100*E141		
142	2082.5	=A142/1000	0.058	b-	=(0.000000000000002*(B142*B142))+(0.000000000000005*(B142))-0.0000000000000008	=C142/100*E142		
143	2079.3	=A143/1000	0.03	b-	=(0.000000000000002*(B143*B143))+(0.000000000000005*(B143))-0.0000000000000008	=C143/100*E143		
144	2046.47	=A144/1000	0.263	b-	=(0.000000000000002*(B144*B144))+(0.000000000000005*(B144))-0.0000000000000008	=C144/100*E144		
145	2039.5	=A145/1000	0.018	b-	=(0.000000000000002*(B145*B145))+(0.000000000000005*(B145))-0.0000000000000008	=C145/100*E145		
146	2021.04	=A146/1000	0.245	b-	=(0.000000000000002*(B146*B146))+(0.000000000000005*(B146))-0.0000000000000008	=C146/100*E146		
147	2012.23	=A147/1000	1.57	b-	=(0.000000000000002*(B147*B147))+(0.000000000000005*(B147))-0.0000000000000008	=C147/100*E147		
148	2001.6	=A148/1000	0.036	b-	=(0.000000000000002*(B148*B148))+(0.000000000000005*(B148))-0.0000000000000008	=C148/100*E148		
149	1998.6	=A149/1000	0.119	b-	=(0.000000000000002*(B149*B149))+(0.000000000000005*(B149))-0.0000000000000008	=C149/100*E149		
150	1977.7	=A150/1000	0.038	b-	=(0.000000000000002*(B150*B150))+(0.000000000000005*(B150))-0.0000000000000008	=C150/100*E150		
151	1966.55	=A151/1000	0.133	b-	=(0.000000000000002*(B151*B151))+(0.000000000000005*(B151))-0.0000000000000008	=C151/100*E151		
152	1939.11	=A152/1000	0.64	b-	=(0.000000000000002*(B152*B152))+(0.000000000000005*(B152))-0.0000000000000008	=C152/100*E152		
153	1935.1	=A153/1000	0.034	b-	=(0.000000000000002*(B153*B153))+(0.000000000000005*(B153))-0.0000000000000008	=C153/100*E153		
154	1927.5	=A154/1000	0.111	b-	=(0.000000000000002*(B154*B154))+(0.000000000000005*(B154))-0.0000000000000008	=C154/100*E154		
155	1925.3	=A155/1000	0.016	b-	=(0.000000000000002*(B155*B155))+(0.000000000000005*(B155))-0.0000000000000008	=C155/100*E155		

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
156	1903.4	=A156/1000	1.05	b-	=(0.00000000000002*(B156*B156))+(0.0000000000005*(B156))-0.00000000000008	=C156/100*E156		
157	1897.8	=A157/1000	0.03	b-	=(0.00000000000002*(B157*B157))+(0.0000000000005*(B157))-0.00000000000008	=C157/100*E157		
158	1886.5	=A158/1000	0.034	b-	=(0.00000000000002*(B158*B158))+(0.0000000000005*(B158))-0.00000000000008	=C158/100*E158		
159	1879.8	=A159/1000	0.159	b-	=(0.00000000000002*(B159*B159))+(0.0000000000005*(B159))-0.00000000000008	=C159/100*E159		
160	1868.47	=A160/1000	0.197	b-	=(0.00000000000002*(B160*B160))+(0.0000000000005*(B160))-0.00000000000008	=C160/100*E160		
161	1865.2	=A161/1000	0.08	b-	=(0.00000000000002*(B161*B161))+(0.0000000000005*(B161))-0.00000000000008	=C161/100*E161		
162	1850.6	=A162/1000	0.05	b-	=(0.00000000000002*(B162*B162))+(0.0000000000005*(B162))-0.00000000000008	=C162/100*E162		
163	1839.72	=A163/1000	0.35	b-	=(0.00000000000002*(B163*B163))+(0.0000000000005*(B163))-0.00000000000008	=C163/100*E163		
164	1837.5	=A164/1000	0.12	b-	=(0.00000000000002*(B164*B164))+(0.0000000000005*(B164))-0.00000000000008	=C164/100*E164		
165	1831.3	=A165/1000	0.086	b-	=(0.00000000000002*(B165*B165))+(0.0000000000005*(B165))-0.00000000000008	=C165/100*E165		
166	1827.3	=A166/1000	0.064	b-	=(0.00000000000002*(B166*B166))+(0.0000000000005*(B166))-0.00000000000008	=C166/100*E166		
167	1823.6	=A167/1000	0.066	b-	=(0.00000000000002*(B167*B167))+(0.0000000000005*(B167))-0.00000000000008	=C167/100*E167		
168	1810.73	=A168/1000	0.141	b-	=(0.00000000000002*(B168*B168))+(0.0000000000005*(B168))-0.00000000000008	=C168/100*E168		
169	1804.4	=A169/1000	0.03	b-	=(0.00000000000002*(B169*B169))+(0.0000000000005*(B169))-0.00000000000008	=C169/100*E169		
170	1791.4	=A170/1000	0.046	b-	=(0.00000000000002*(B170*B170))+(0.0000000000005*(B170))-0.00000000000008	=C170/100*E170		
171	1788.2	=A171/1000	0.107	b-	=(0.00000000000002*(B171*B171))+(0.0000000000005*(B171))-0.00000000000008	=C171/100*E171		
172	1777.6	=A172/1000	0.76	b-	=(0.00000000000002*(B172*B172))+(0.0000000000005*(B172))-0.00000000000008	=C172/100*E172		
173	1766.1	=A173/1000	0.048	b-	=(0.00000000000002*(B173*B173))+(0.0000000000005*(B173))-0.00000000000008	=C173/100*E173		
174	1735.5	=A174/1000	0.056	b-	=(0.00000000000002*(B174*B174))+(0.0000000000005*(B174))-0.00000000000008	=C174/100*E174		
175	1729.9	=A175/1000	0.03	b-	=(0.00000000000002*(B175*B175))+(0.0000000000005*(B175))-0.00000000000008	=C175/100*E175		
176	1721.29	=A176/1000	0.225	b-	=(0.00000000000002*(B176*B176))+(0.0000000000005*(B176))-0.00000000000008	=C176/100*E176		
177	1710.7	=A177/1000	0.034	b-	=(0.00000000000002*(B177*B177))+(0.0000000000005*(B177))-0.00000000000008	=C177/100*E177		
178	1707.9	=A178/1000	0.024	b-	=(0.00000000000002*(B178*B178))+(0.0000000000005*(B178))-0.00000000000008	=C178/100*E178		
179	1693.7	=A179/1000	4.4	b-	=(0.00000000000002*(B179*B179))+(0.0000000000005*(B179))-0.00000000000008	=C179/100*E179		
180	1692	=A180/1000	0.26	b-	=(0.00000000000002*(B180*B180))+(0.0000000000005*(B180))-0.00000000000008	=C180/100*E180		
181	1683.8	=A181/1000	0.133	b-	=(0.00000000000002*(B181*B181))+(0.0000000000005*(B181))-0.00000000000008	=C181/100*E181		
182	1680.3	=A182/1000	0.084	b-	=(0.00000000000002*(B182*B182))+(0.0000000000005*(B182))-0.00000000000008	=C182/100*E182		
183	1676.9	=A183/1000	0.141	b-	=(0.00000000000002*(B183*B183))+(0.0000000000005*(B183))-0.00000000000008	=C183/100*E183		
184	1667.51	=A184/1000	0.129	b-	=(0.00000000000002*(B184*B184))+(0.0000000000005*(B184))-0.00000000000008	=C184/100*E184		
185	1657.6	=A185/1000	0.04	b-	=(0.00000000000002*(B185*B185))+(0.0000000000005*(B185))-0.00000000000008	=C185/100*E185		
186	1643.82	=A186/1000	0.34	b-	=(0.00000000000002*(B186*B186))+(0.0000000000005*(B186))-0.00000000000008	=C186/100*E186		
187	1634.06	=A187/1000	0.82	b-	=(0.00000000000002*(B187*B187))+(0.0000000000005*(B187))-0.00000000000008	=C187/100*E187		
188	1600.7	=A188/1000	0.072	b-	=(0.00000000000002*(B188*B188))+(0.0000000000005*(B188))-0.00000000000008	=C188/100*E188		
189	1582.9	=A189/1000	0.09	b-	=(0.00000000000002*(B189*B189))+(0.0000000000005*(B189))-0.00000000000008	=C189/100*E189		
190	1573.78	=A190/1000	0.191	b-	=(0.00000000000002*(B190*B190))+(0.0000000000005*(B190))-0.00000000000008	=C190/100*E190		
191	1571.8	=A191/1000	0.068	b-	=(0.00000000000002*(B191*B191))+(0.0000000000005*(B191))-0.00000000000008	=C191/100*E191		
192	1555.28	=A192/1000	0.153	b-	=(0.00000000000002*(B192*B192))+(0.0000000000005*(B192))-0.00000000000008	=C192/100*E192		
193	1545.2	=A193/1000	0.1	b-	=(0.00000000000002*(B193*B193))+(0.0000000000005*(B193))-0.00000000000008	=C193/100*E193		
194	1533.68	=A194/1000	5.1	b-	=(0.00000000000002*(B194*B194))+(0.0000000000005*(B194))-0.00000000000008	=C194/100*E194		
195	1530.04	=A195/1000	3.34	b-	=(0.00000000000002*(B195*B195))+(0.0000000000005*(B195))-0.00000000000008	=C195/100*E195		
196	1506.2	=A196/1000	0.113	b-	=(0.00000000000002*(B196*B196))+(0.0000000000005*(B196))-0.00000000000008	=C196/100*E196		
197	1500.96	=A197/1000	1.33	b-	=(0.00000000000002*(B197*B197))+(0.0000000000005*(B197))-0.00000000000008	=C197/100*E197		
198	1488.1	=A198/1000	0.094	b-	=(0.00000000000002*(B198*B198))+(0.0000000000005*(B198))-0.00000000000008	=C198/100*E198		
199	1481.9	=A199/1000	0.044	b-	=(0.00000000000002*(B199*B199))+(0.0000000000005*(B199))-0.00000000000008	=C199/100*E199		
200	1472.76	=A200/1000	6.9	b-	=(0.00000000000002*(B200*B200))+(0.0000000000005*(B200))-0.00000000000008	=C200/100*E200		
201	1468.5	=A201/1000	0.19	b-	=(0.00000000000002*(B201*B201))+(0.0000000000005*(B201))-0.00000000000008	=C201/100*E201		
202	1464.2	=A202/1000	0.179	b-	=(0.00000000000002*(B202*B202))+(0.0000000000005*(B202))-0.00000000000008	=C202/100*E202		
203	1461.3	=A203/1000	0.123	b-	=(0.00000000000002*(B203*B203))+(0.0000000000005*(B203))-0.00000000000008	=C203/100*E203		
204	1458.3	=A204/1000	0.074	b-	=(0.00000000000002*(B204*B204))+(0.0000000000005*(B204))-0.00000000000008	=C204/100*E204		
205	1455.3	=A205/1000	0.052	b-	=(0.00000000000002*(B205*B205))+(0.0000000000005*(B205))-0.00000000000008	=C205/100*E205		
206	1441.3	=A206/1000	0.02	b-	=(0.00000000000002*(B206*B206))+(0.0000000000005*(B206))-0.00000000000008	=C206/100*E206		
207	1421.64	=A207/1000	0.225	b-	=(0.00000000000002*(B207*B207))+(0.0000000000005*(B207))-0.00000000000008	=C207/100*E207		
208	1412.59	=A208/1000	0.265	b-	=(0.00000000000002*(B208*B208))+(0.0000000000005*(B208))-0.00000000000008	=C208/100*E208		
209	1381.9	=A209/1000	0.058	b-	=(0.00000000000002*(B209*B209))+(0.0000000000005*(B209))-0.00000000000008	=C209/100*E209		
210	1372.16	=A210/1000	0.127	b-	=(0.00000000000002*(B210*B210))+(0.0000000000005*(B210))-0.00000000000008	=C210/100*E210		
211	1367.48	=A211/1000	0.149	b-	=(0.00000000000002*(B211*B211))+(0.0000000000005*(B211))-0.00000000000008	=C211/100*E211		
212	1340.6	=A212/1000	0.195	b-	=(0.00000000000002*(B212*B212))+(0.0000000000005*(B212))-0.00000000000008	=C212/100*E212		
213	1335.4	=A213/1000	0.13	b-	=(0.00000000000002*(B213*B213))+(0.0000000000005*(B213))-0.00000000000008	=C213/100*E213		
214	1324.28	=A214/1000	3.08	b-	=(0.00000000000002*(B214*B214))+(0.0000000000005*(B214))-0.00000000000008	=C214/100*E214		
215	1308.9	=A215/1000	0.068	b-	=(0.00000000000002*(B215*B215))+(0.0000000000005*(B215))-0.00000000000008	=C215/100*E215		
216	1302.7	=A216/1000	0.1	b-	=(0.00000000000002*(B216*B216))+(0.0000000000005*(B216))-0.00000000000008	=C216/100*E216		
217	1298	=A217/1000	0.044	b-	=(0.00000000000002*(B217*B217))+(0.0000000000005*(B217))-0.00000000000008	=C217/100*E217		
218	1278.5	=A218/1000	0.032	b-	=(0.00000000000002*(B218*B218))+(0.0000000000005*(B218))-0.00000000000008	=C218/100*E218		
219	1273.73	=A219/1000	1.37	b-	=(0.00000000000002*(B219*B219))+(0.0000000000005*(B219))-0.00000000000008	=C219/100*E219		
220	1267.2	=A220/1000	0.024	b-	=(0.00000000000002*(B220*B220))+(0.0000000000005*(B220))-0.00000000000008	=C220/100*E220		
221	1251	=A221/1000	0.038	b-	=(0.00000000000002*(B221*B221))+(0.0000000000005*(B221))-0.00000000000008	=C221/100*E221		
222	1241.5	=A222/1000	0.088	b-	=(0.00000000000002*(B222*B222))+(0.0000000000005*(B222))-0.00000000000008	=C222/100*E222		
223	1235.62	=A223/1000	0.6	b-	=(0.00000000000002*(B223*B223))+(0.0000000000005*(B223))-0.00000000000008	=C223/100*E223		
224	1228.8	=A224/1000	0.145	b-	=(0.00000000000002*(B224*B224))+(0.0000000000005*(B224))-0.00000000000008	=C224/100*E224		
225	1210.2	=A225/1000	0.022	b-	=(0.00000000000002*(B225*B225))+(0.0000000000005*(B225))-0.00000000000008	=C225/100*E225		
226	1200.6	=A226/1000	0.018	b-	=(0.00000000000002*(B226*B226))+(0.0000000000005*(B226))-0.00000000000008	=C226/100*E226		
227	1195.1	=A227/1000	0.084	b-	=(0.00000000000002*(B227*B227))+(0.0000000000005*(B227))-0.00000000000008	=C227/100*E227		
228	1186.54	=A228/1000	0.185	b-	=(0.00000000000002*(B228*B228))+(0.0000000000005*(B228))-0.00000000000008	=C228/100*E228		
229	1182.38	=A229/1000	0.167	b-	=(0.00000000000002*(B229*B229))+(0.0000000000005*(B229))-0.00000000000008	=C229/100*E229		
230	1172.33	=A230/1000	0.98	b-	=(0.00000000000002*(B230*B230))+(0.0000000000005*(B230))-0.00000000000008	=C230/100*E230		
231	1167.4	=A231/1000	0.034	b-	=(0.00000000000002*(B231*B231))+(0.0000000000005*(B231))-0.00000000000008	=C231/100*E231		
232	1162.5	=A232/1000	0.215	b-	=(0.00000000000002*(B232*B232))+(0.0000000000005*(B232))-0.00000000000008	=C232/100*E232		
233	1152.2	=A233/1000	0.064	b-	=(0.00000000000002*(B233*B233))+(0.0000000000005*(B233))-0.00000000000008	=C233/100*E233		

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
234	1131.51	=A234/1000	0.161	b-	=(0.000000000000002*(B234*B234))+(0.00000000000005*(B234))-0.0000000000000008	=C234/100*E234		
235	1119.6	=A235/1000	0.38	b-	=(0.000000000000002*(B235*B235))+(0.00000000000005*(B235))-0.0000000000000008	=C235/100*E235		
236	1116.61	=A236/1000	1.67	b-	=(0.000000000000002*(B236*B236))+(0.00000000000005*(B236))-0.0000000000000008	=C236/100*E236		
237	1107.78	=A237/1000	2.93	b-	=(0.000000000000002*(B237*B237))+(0.00000000000005*(B237))-0.0000000000000008	=C237/100*E237		
238	1103.18	=A238/1000	0.9	b-	=(0.000000000000002*(B238*B238))+(0.00000000000005*(B238))-0.0000000000000008	=C238/100*E238		
239	1098.1	=A239/1000	0.064	b-	=(0.000000000000002*(B239*B239))+(0.00000000000005*(B239))-0.0000000000000008	=C239/100*E239		
240	1088.07	=A240/1000	0.36	b-	=(0.000000000000002*(B240*B240))+(0.00000000000005*(B240))-0.0000000000000008	=C240/100*E240		
241	1076.48	=A241/1000	0.24	b-	=(0.000000000000002*(B241*B241))+(0.00000000000005*(B241))-0.0000000000000008	=C241/100*E241		
242	1067.7	=A242/1000	0.068	b-	=(0.000000000000002*(B242*B242))+(0.00000000000005*(B242))-0.0000000000000008	=C242/100*E242		
243	1063.1	=A243/1000	0.07	b-	=(0.000000000000002*(B243*B243))+(0.00000000000005*(B243))-0.0000000000000008	=C243/100*E243		
244	1058.6	=A244/1000	0.03	b-	=(0.000000000000002*(B244*B244))+(0.00000000000005*(B244))-0.0000000000000008	=C244/100*E244		
245	1048.2	=A245/1000	0.062	b-	=(0.000000000000002*(B245*B245))+(0.00000000000005*(B245))-0.0000000000000008	=C245/100*E245		
246	1044.4	=A246/1000	0.41	b-	=(0.000000000000002*(B246*B246))+(0.00000000000005*(B246))-0.0000000000000008	=C246/100*E246		
247	1038.3	=A247/1000	0.03	b-	=(0.000000000000002*(B247*B247))+(0.00000000000005*(B247))-0.0000000000000008	=C247/100*E247		
248	1010.84	=A248/1000	0.109	b-	=(0.000000000000002*(B248*B248))+(0.00000000000005*(B248))-0.0000000000000008	=C248/100*E248		
249	997.37	=A249/1000	0.66	b-	=(0.000000000000002*(B249*B249))+(0.00000000000005*(B249))-0.0000000000000008	=C249/100*E249		
250	974.39	=A250/1000	0.98	b-	=(0.000000000000002*(B250*B250))+(0.00000000000005*(B250))-0.0000000000000008	=C250/100*E250		
251	969.7	=A251/1000	0.094	b-	=(0.000000000000002*(B251*B251))+(0.00000000000005*(B251))-0.0000000000000008	=C251/100*E251		
252	964.2	=A252/1000	0.058	b-	=(0.000000000000002*(B252*B252))+(0.00000000000005*(B252))-0.0000000000000008	=C252/100*E252		
253	960.42	=A253/1000	0.32	b-	=(0.000000000000002*(B253*B253))+(0.00000000000005*(B253))-0.0000000000000008	=C253/100*E253		
254	953.18	=A254/1000	0.107	b-	=(0.000000000000002*(B254*B254))+(0.00000000000005*(B254))-0.0000000000000008	=C254/100*E254		
255	944.19	=A255/1000	0.165	b-	=(0.000000000000002*(B255*B255))+(0.00000000000005*(B255))-0.0000000000000008	=C255/100*E255		
256	939.4	=A256/1000	0.066	b-	=(0.000000000000002*(B256*B256))+(0.00000000000005*(B256))-0.0000000000000008	=C256/100*E256		
257	934.6	=A257/1000	0.038	b-	=(0.000000000000002*(B257*B257))+(0.00000000000005*(B257))-0.0000000000000008	=C257/100*E257		
258	930.95	=A258/1000	0.62	b-	=(0.000000000000002*(B258*B258))+(0.00000000000005*(B258))-0.0000000000000008	=C258/100*E258		
259	917.78	=A259/1000	0.074	b-	=(0.000000000000002*(B259*B259))+(0.00000000000005*(B259))-0.0000000000000008	=C259/100*E259		
260	904.27	=A260/1000	7.2	b-	=(0.000000000000002*(B260*B260))+(0.00000000000005*(B260))-0.0000000000000008	=C260/100*E260		
261	902.8	=A261/1000	0.8	b-	=(0.000000000000002*(B261*B261))+(0.00000000000005*(B261))-0.0000000000000008	=C261/100*E261		
262	897	=A262/1000	0.48	b-	=(0.000000000000002*(B262*B262))+(0.00000000000005*(B262))-0.0000000000000008	=C262/100*E262		
263	890.4	=A263/1000	0.3	b-	=(0.000000000000002*(B263*B263))+(0.00000000000005*(B263))-0.0000000000000008	=C263/100*E263		
264	887.9	=A264/1000	0.64	b-	=(0.000000000000002*(B264*B264))+(0.00000000000005*(B264))-0.0000000000000008	=C264/100*E264		
265	886.3	=A265/1000	0.2	b-	=(0.000000000000002*(B265*B265))+(0.00000000000005*(B265))-0.0000000000000008	=C265/100*E265		
266	870.42	=A266/1000	0.161	b-	=(0.000000000000002*(B266*B266))+(0.00000000000005*(B266))-0.0000000000000008	=C266/100*E266		
267	867.08	=A267/1000	5.9	b-	=(0.000000000000002*(B267*B267))+(0.00000000000005*(B267))-0.0000000000000008	=C267/100*E267		
268	857.37	=A268/1000	0.287	b-	=(0.000000000000002*(B268*B268))+(0.00000000000005*(B268))-0.0000000000000008	=C268/100*E268		
269	844.7	=A269/1000	0.52	b-	=(0.000000000000002*(B269*B269))+(0.00000000000005*(B269))-0.0000000000000008	=C269/100*E269		
270	835.53	=A270/1000	1.11	b-	=(0.000000000000002*(B270*B270))+(0.00000000000005*(B270))-0.0000000000000008	=C270/100*E270		
271	826.75	=A271/1000	0.76	b-	=(0.000000000000002*(B271*B271))+(0.00000000000005*(B271))-0.0000000000000008	=C271/100*E271		
272	783.5	=A272/1000	0.022	b-	=(0.000000000000002*(B272*B272))+(0.00000000000005*(B272))-0.0000000000000008	=C272/100*E272		
273	776.49	=A273/1000	1.13	b-	=(0.000000000000002*(B273*B273))+(0.00000000000005*(B273))-0.0000000000000008	=C273/100*E273		
274	762.9	=A274/1000	0.92	b-	=(0.000000000000002*(B274*B274))+(0.00000000000005*(B274))-0.0000000000000008	=C274/100*E274		
275	762.9	=A275/1000	0.4	b-	=(0.000000000000002*(B275*B275))+(0.00000000000005*(B275))-0.0000000000000008	=C275/100*E275		
276	753.5	=A276/1000	0.092	b-	=(0.000000000000002*(B276*B276))+(0.00000000000005*(B276))-0.0000000000000008	=C276/100*E276		
277	747.4	=A277/1000	0.11	b-	=(0.000000000000002*(B277*B277))+(0.00000000000005*(B277))-0.0000000000000008	=C277/100*E277		
278	738.39	=A278/1000	4.22	b-	=(0.000000000000002*(B278*B278))+(0.00000000000005*(B278))-0.0000000000000008	=C278/100*E278		
279	729.63	=A279/1000	0.3	b-	=(0.000000000000002*(B279*B279))+(0.00000000000005*(B279))-0.0000000000000008	=C279/100*E279		
280	716.2	=A280/1000	0.26	b-	=(0.000000000000002*(B280*B280))+(0.00000000000005*(B280))-0.0000000000000008	=C280/100*E280		
281	711	=A281/1000	0.5	b-	=(0.000000000000002*(B281*B281))+(0.00000000000005*(B281))-0.0000000000000008	=C281/100*E281		
282	710.05	=A282/1000	0.78	b-	=(0.000000000000002*(B282*B282))+(0.00000000000005*(B282))-0.0000000000000008	=C282/100*E282		
283	707.01	=A283/1000	0.5	b-	=(0.000000000000002*(B283*B283))+(0.00000000000005*(B283))-0.0000000000000008	=C283/100*E283		
284	696.24	=A284/1000	1.79	b-	=(0.000000000000002*(B284*B284))+(0.00000000000005*(B284))-0.0000000000000008	=C284/100*E284		
285	687.3	=A285/1000	0.07	b-	=(0.000000000000002*(B285*B285))+(0.00000000000005*(B285))-0.0000000000000008	=C285/100*E285		
286	674.11	=A286/1000	0.233	b-	=(0.000000000000002*(B286*B286))+(0.00000000000005*(B286))-0.0000000000000008	=C286/100*E286		
287	671.4	=A287/1000	0.107	b-	=(0.000000000000002*(B287*B287))+(0.00000000000005*(B287))-0.0000000000000008	=C287/100*E287		
288	668.6	=A288/1000	0.042	b-	=(0.000000000000002*(B288*B288))+(0.00000000000005*(B288))-0.0000000000000008	=C288/100*E288		
289	665.72	=A289/1000	0.115	b-	=(0.000000000000002*(B289*B289))+(0.00000000000005*(B289))-0.0000000000000008	=C289/100*E289		
290	662.9	=A290/1000	0.078	b-	=(0.000000000000002*(B290*B290))+(0.00000000000005*(B290))-0.0000000000000008	=C290/100*E290		
291	660.5	=A291/1000	0.048	b-	=(0.000000000000002*(B291*B291))+(0.00000000000005*(B291))-0.0000000000000008	=C291/100*E291		
292	652.6	=A292/1000	0.038	b-	=(0.000000000000002*(B292*B292))+(0.00000000000005*(B292))-0.0000000000000008	=C292/100*E292		
293	629.75	=A293/1000	0.34	b-	=(0.000000000000002*(B293*B293))+(0.00000000000005*(B293))-0.0000000000000008	=C293/100*E293		
294	626.2	=A294/1000	0.6	b-	=(0.000000000000002*(B294*B294))+(0.00000000000005*(B294))-0.0000000000000008	=C294/100*E294		
295	610.2	=A295/1000	0.018	b-	=(0.000000000000002*(B295*B295))+(0.00000000000005*(B295))-0.0000000000000008	=C295/100*E295		
296	599.52	=A296/1000	0.088	b-	=(0.000000000000002*(B296*B296))+(0.00000000000005*(B296))-0.0000000000000008	=C296/100*E296		
297	586.03	=A297/1000	16.6	b-	=(0.000000000000002*(B297*B297))+(0.00000000000005*(B297))-0.0000000000000008	=C297/100*E297		
298	576.96	=A298/1000	5.7	b-	=(0.000000000000002*(B298*B298))+(0.00000000000005*(B298))-0.0000000000000008	=C298/100*E298		
299	557.3	=A299/1000	0.161	b-	=(0.000000000000002*(B299*B299))+(0.00000000000005*(B299))-0.0000000000000008	=C299/100*E299		
300	546.9	=A300/1000	0.03	b-	=(0.000000000000002*(B300*B300))+(0.00000000000005*(B300))-0.0000000000000008	=C300/100*E300		
301	542.2	=A301/1000	0.03	b-	=(0.000000000000002*(B301*B301))+(0.00000000000005*(B301))-0.0000000000000008	=C301/100*E301		
302	523.5	=A302/1000	0.034	b-	=(0.000000000000002*(B302*B302))+(0.00000000000005*(B302))-0.0000000000000008	=C302/100*E302		
303	510.1	=A303/1000	0.12	b-	=(0.000000000000002*(B303*B303))+(0.00000000000005*(B303))-0.0000000000000008	=C303/100*E303		
304	509.1	=A304/1000	0.15	b-	=(0.000000000000002*(B304*B304))+(0.00000000000005*(B304))-0.0000000000000008	=C304/100*E304		
305	498.6	=A305/1000	1.15	b-	=(0.000000000000002*(B305*B305))+(0.00000000000005*(B305))-0.0000000000000008	=C305/100*E305		
306	497.38	=A306/1000	6.7	b-	=(0.000000000000002*(B306*B306))+(0.00000000000005*(B306))-0.0000000000000008	=C306/100*E306		
307	490.76	=A307/1000	0.32	b-	=(0.000000000000002*(B307*B307))+(0.00000000000005*(B307))-0.0000000000000008	=C307/100*E307		
308	488.5	=A308/1000	0.08	b-	=(0.000000000000002*(B308*B308))+(0.00000000000005*(B308))-0.0000000000000008	=C308/100*E308		
309	466.13	=A309/1000	0.8	b-	=(0.000000000000002*(B309*B309))+(0.00000000000005*(B309))-0.0000000000000008	=C309/100*E309		
310	465.4	=A310/1000	0.24	b-	=(0.000000000000002*(B310*B310))+(0.00000000000005*(B310))-0.0000000000000008	=C310/100*E310		
311	438.08	=A311/1000	0.96	b-	=(0.000000000000002*(B311*B311))+(0.00000000000005*(B311))-0.0000000000000008	=C311/100*E311		

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
312	435.8	=A312/1000	0.096	b-	=(0.000000000000002*(B312*B312))+(0.0000000000005*(B312))-0.0000000000000008	=C312/100*E312		
313	428.5	=A313/1000	0.11	b-	=(0.000000000000002*(B313*B313))+(0.0000000000005*(B313))-0.0000000000000008	=C313/100*E313		
314	419.2	=A314/1000	0.038	b-	=(0.000000000000002*(B314*B314))+(0.0000000000005*(B314))-0.0000000000000008	=C314/100*E314		
315	411.42	=A315/1000	2.57	b-	=(0.000000000000002*(B315*B315))+(0.0000000000005*(B315))-0.0000000000000008	=C315/100*E315		
316	402.25	=A316/1000	0.32	b-	=(0.000000000000002*(B316*B316))+(0.0000000000005*(B316))-0.0000000000000008	=C316/100*E316		
317	380.7	=A317/1000	0.046	b-	=(0.000000000000002*(B317*B317))+(0.0000000000005*(B317))-0.0000000000000008	=C317/100*E317		
318	369.3	=A318/1000	1.39	b-	=(0.000000000000002*(B318*B318))+(0.0000000000005*(B318))-0.0000000000000008	=C318/100*E318		
319	364.88	=A319/1000	0.9	b-	=(0.000000000000002*(B319*B319))+(0.0000000000005*(B319))-0.0000000000000008	=C319/100*E319		
320	356.16	=A320/1000	4.16	b-	=(0.000000000000002*(B320*B320))+(0.0000000000005*(B320))-0.0000000000000008	=C320/100*E320		
321	354.1	=A321/1000	0.13	b-	=(0.000000000000002*(B321*B321))+(0.0000000000005*(B321))-0.0000000000000008	=C321/100*E321		
322	345.03	=A322/1000	1.19	b-	=(0.000000000000002*(B322*B322))+(0.0000000000005*(B322))-0.0000000000000008	=C322/100*E322		
323	338.2	=A323/1000	0.34	b-	=(0.000000000000002*(B323*B323))+(0.0000000000005*(B323))-0.0000000000000008	=C323/100*E323		
324	318.3	=A324/1000	0.044	b-	=(0.000000000000002*(B324*B324))+(0.0000000000005*(B324))-0.0000000000000008	=C324/100*E324		
325	304.7	=A325/1000	0.022	b-	=(0.000000000000002*(B325*B325))+(0.0000000000005*(B325))-0.0000000000000008	=C325/100*E325		
326	295.5	=A326/1000	0.016	b-	=(0.000000000000002*(B326*B326))+(0.0000000000005*(B326))-0.0000000000000008	=C326/100*E326		
327	286.3	=A327/1000	0.026	b-	=(0.000000000000002*(B327*B327))+(0.0000000000005*(B327))-0.0000000000000008	=C327/100*E327		
328	267.7	=A328/1000	0.084	b-	=(0.000000000000002*(B328*B328))+(0.0000000000005*(B328))-0.0000000000000008	=C328/100*E328		
329	264.35	=A329/1000	0.66	b-	=(0.000000000000002*(B329*B329))+(0.0000000000005*(B329))-0.0000000000000008	=C329/100*E329		
330	242.2	=A330/1000	0.012	b-	=(0.000000000000002*(B330*B330))+(0.0000000000005*(B330))-0.0000000000000008	=C330/100*E330		
331	220.95	=A331/1000	20.1	b-	=(0.000000000000002*(B331*B331))+(0.0000000000005*(B331))-0.0000000000000008	=C331/100*E331		
332	205.03	=A332/1000	0.125	b-	=(0.000000000000002*(B332*B332))+(0.0000000000005*(B332))-0.0000000000000008	=C332/100*E332		
333	197.5	=A333/1000	1.83	b-	=(0.000000000000002*(B333*B333))+(0.0000000000005*(B333))-0.0000000000000008	=C333/100*E333		
334	196.2	=A334/1000	0.22	b-	=(0.000000000000002*(B334*B334))+(0.0000000000005*(B334))-0.0000000000000008	=C334/100*E334		
335	83.4	=A335/1000	0.012	b-	=(0.000000000000002*(B335*B335))+(0.0000000000005*(B335))-0.0000000000000008	=C335/100*E335		
336	79.4	=A336/1000	0.028	b-	=(0.000000000000002*(B336*B336))+(0.0000000000005*(B336))-0.0000000000000008	=C336/100*E336		
337	76	=A337/1000	0.008	b-	=(0.000000000000002*(B337*B337))+(0.0000000000005*(B337))-0.0000000000000008	=C337/100*E337		
338	74.9	=A338/1000	0.012	b-	=(0.000000000000002*(B338*B338))+(0.0000000000005*(B338))-0.0000000000000008	=C338/100*E338		
339								
340					Sum - EDE	=SUM(F10:F338)	Gy/s per Bq/m3	
341						=F340*100*1000*60*60	mRem/hr per Bq/m3	
342						=F341*37000*1000000	mRem/hr per uCi/ml	
343					DAC	=2.5/F342	uCi/ml	
344								
345								
346					Determination of DAC by SDE			
347	Beta Emissions:							
348								
349	Endpoint	Energy	Avg. Beta	Intensity	Decay	Interpelated Beta Skin Dose Factor	Dose Rate per Unit Activity	
350	Energy (keV)	(MeV)	Energy (MeV)	(%)	Mode	(pSv s^{-1} per Bq m^{-3})	pSv/s	
351								
352	4990	=A352/1000	=B352*0.33	23	b-	=-0.0004*(C352*C352*C352)+0.0043*(C352*C352)+0.0705*(C352)-0.0058	=D352/100*F352	
353	4769.05	=A353/1000	=B353*0.33	0.9	b-	=-0.0004*(C353*C353*C353)+0.0043*(C353*C353)+0.0705*(C353)-0.0058	=D353/100*F353	
354	4492.6	=A354/1000	=B354*0.33	1.5	b-	=-0.0004*(C354*C354*C354)+0.0043*(C354*C354)+0.0705*(C354)-0.0058	=D354/100*F354	
355	4412.89	=A355/1000	=B355*0.33	4.2	b-	=-0.0004*(C355*C355*C355)+0.0043*(C355*C355)+0.0705*(C355)-0.0058	=D355/100*F355	
356	4404	=A356/1000	=B356*0.33	2.2	b-	=-0.0004*(C356*C356*C356)+0.0043*(C356*C356)+0.0705*(C356)-0.0058	=D356/100*F356	
357	4122.88	=A357/1000	=B357*0.33	1	b-	=-0.0004*(C357*C357*C357)+0.0043*(C357*C357)+0.0705*(C357)-0.0058	=D357/100*F357	
358	4058.99	=A358/1000	=B358*0.33	0.96	b-	=-0.0004*(C358*C358*C358)+0.0043*(C358*C358)+0.0705*(C358)-0.0058	=D358/100*F358	
359	3794.64	=A359/1000	=B359*0.33	1.5	b-	=-0.0004*(C359*C359*C359)+0.0043*(C359*C359)+0.0705*(C359)-0.0058	=D359/100*F359	
360	3665.64	=A360/1000	=B360*0.33	3.7	b-	=-0.0004*(C360*C360*C360)+0.0043*(C360*C360)+0.0705*(C360)-0.0058	=D360/100*F360	
361	3649.98	=A361/1000	=B361*0.33	0.59	b-	=-0.0004*(C361*C361*C361)+0.0043*(C361*C361)+0.0705*(C361)-0.0058	=D361/100*F361	
362	3501.69	=A362/1000	=B362*0.33	0.13	b-	=-0.0004*(C362*C362*C362)+0.0043*(C362*C362)+0.0705*(C362)-0.0058	=D362/100*F362	
363	3459.75	=A363/1000	=B363*0.33	2.8	b-	=-0.0004*(C363*C363*C363)+0.0043*(C363*C363)+0.0705*(C363)-0.0058	=D363/100*F363	
364	3296.21	=A364/1000	=B364*0.33	9.7	b-	=-0.0004*(C364*C364*C364)+0.0043*(C364*C364)+0.0705*(C364)-0.0058	=D364/100*F364	
365	3168.3	=A365/1000	=B365*0.33	0.17	b-	=-0.0004*(C365*C365*C365)+0.0043*(C365*C365)+0.0705*(C365)-0.0058	=D365/100*F365	
366	3125.39	=A366/1000	=B366*0.33	0.47	b-	=-0.0004*(C366*C366*C366)+0.0043*(C366*C366)+0.0705*(C366)-0.0058	=D366/100*F366	
367	2991.46	=A367/1000	=B367*0.33	2.23	b-	=-0.0004*(C367*C367*C367)+0.0043*(C367*C367)+0.0705*(C367)-0.0058	=D367/100*F367	
368	2848.64	=A368/1000	=B368*0.33	0.04	b-	=-0.0004*(C368*C368*C368)+0.0043*(C368*C368)+0.0705*(C368)-0.0058	=D368/100*F368	
369	2829.99	=A369/1000	=B369*0.33	2.99	b-	=-0.0004*(C369*C369*C369)+0.0043*(C369*C369)+0.0705*(C369)-0.0058	=D369/100*F369	
370	2720.3	=A370/1000	=B370*0.33	0.08	b-	=-0.0004*(C370*C370*C370)+0.0043*(C370*C370)+0.0705*(C370)-0.0058	=D370/100*F370	
371	2624.74	=A371/1000	=B371*0.33	0.05	b-	=-0.0004*(C371*C371*C371)+0.0043*(C371*C371)+0.0705*(C371)-0.0058	=D371/100*F371	
372	2602.02	=A372/1000	=B372*0.33	0.35	b-	=-0.0004*(C372*C372*C372)+0.0043*(C372*C372)+0.0705*(C372)-0.0058	=D372/100*F372	
373	2589.1	=A373/1000	=B373*0.33	5.6	b-	=-0.0004*(C373*C373*C373)+0.0043*(C373*C373)+0.0705*(C373)-0.0058	=D373/100*F373	
374	2391.88	=A374/1000	=B374*0.33	14.5	b-	=-0.0004*(C374*C374*C374)+0.0043*(C374*C374)+0.0705*(C374)-0.0058	=D374/100*F374	
375	2207.96	=A375/1000	=B375*0.33	1.45	b-	=-0.0004*(C375*C375*C375)+0.0043*(C375*C375)+0.0705*(C375)-0.0058	=D375/100*F375	
376	2201.26	=A376/1000	=B376*0.33	0.28	b-	=-0.0004*(C376*C376*C376)+0.0043*(C376*C376)+0.0705*(C376)-0.0058	=D376/100*F376	
377	2123.86	=A377/1000	=B377*0.33	4	b-	=-0.0004*(C377*C377*C377)+0.0043*(C377*C377)+0.0705*(C377)-0.0058	=D377/100*F377	
378	1972.58	=A378/1000	=B378*0.33	0.85	b-	=-0.0004*(C378*C378*C378)+0.0043*(C378*C378)+0.0705*(C378)-0.0058	=D378/100*F378	
379	1739.94	=A379/1000	=B379*0.33	0.31	b-	=-0.0004*(C379*C379*C379)+0.0043*(C379*C379)+0.0705*(C379)-0.0058	=D379/100*F379	
380	1662.07	=A380/1000	=B380*0.33	1.99	b-	=-0.0004*(C380*C380*C380)+0.0043*(C380*C380)+0.0705*(C380)-0.0058	=D380/100*F380	
381	1628.6	=A381/1000	=B381*0.33	1.56	b-	=-0.0004*(C381*C381*C381)+0.0043*(C381*C381)+0.0705*(C381)-0.0058	=D381/100*F381	
382	1619.21	=A382/1000	=B382*0.33	2	b-	=-0.0004*(C382*C382*C382)+0.0043*(C382*C382)+0.0705*(C382)-0.0058	=D382/100*F382	
383	1559.6	=A383/1000	=B383*0.33	0.21	b-	=-0.0004*(C383*C383*C383)+0.0043*(C383*C383)+0.0705*(C383)-0.0058	=D383/100*F383	
384	1533.1	=A384/1000	=B384*0.33	0.074	b-	=-0.0004*(C384*C384*C384)+0.0043*(C384*C384)+0.0705*(C384)-0.0058	=D384/100*F384	
385	1525.01	=A385/1000	=B385*0.33	0.4	b-	=-0.0004*(C385*C385*C385)+0.0043*(C385*C385)+0.0705*(C385)-0.0058	=D385/100*F385	
386	1457.2	=A386/1000	=B386*0.33	1.53	b-	=-0.0004*(C386*C386*C386)+0.0043*(C386*C386)+0.0705*(C386)-0.0058	=D386/100*F386	
387	1272.58	=A387/1000	=B387*0.33	2.37	b-	=-0.0004*(C387*C387*C387)+0.0043*(C387*C387)+0.0705*(C387)-0.0058	=D387/100*F387	
388	1270.17	=A388/1000	=B388*0.33	0.32	b-	=-0.0004*(C388*C388*C388)+0.0043*(C388*C388)+0.0705*(C388)-0.0058	=D388/100*F388	

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
389	1156.1	=A389/1000	=B389*0.33	0.24	b-	=-0.0004*(C389*C389*C389)+0.0043*(C389*C389)+0.0705*(C389)-0.0058	=D389/100*F389	
390	1091.2	=A390/1000	=B390*0.33	0.21	b-	=-0.0004*(C390*C390*C390)+0.0043*(C390*C390)+0.0705*(C390)-0.0058	=D390/100*F390	
391	1024.51	=A391/1000	=B391*0.33	0.23	b-	=-0.0004*(C391*C391*C391)+0.0043*(C391*C391)+0.0705*(C391)-0.0058	=D391/100*F391	
392	1012.69	=A392/1000	=B392*0.33	0.48	b-	=-0.0004*(C392*C392*C392)+0.0043*(C392*C392)+0.0705*(C392)-0.0058	=D392/100*F392	
393	941.37	=A393/1000	=B393*0.33	0.49	b-	=-0.0004*(C393*C393*C393)+0.0043*(C393*C393)+0.0705*(C393)-0.0058	=D393/100*F393	
394	931.4	=A394/1000	=B394*0.33	0.123	b-	=-0.0004*(C394*C394*C394)+0.0043*(C394*C394)+0.0705*(C394)-0.0058	=D394/100*F394	
395	908.99	=A395/1000	=B395*0.33	0.66	b-	=-0.0004*(C395*C395*C395)+0.0043*(C395*C395)+0.0705*(C395)-0.0058	=D395/100*F395	
396	846.12	=A396/1000	=B396*0.33	0.65	b-	=-0.0004*(C396*C396*C396)+0.0043*(C396*C396)+0.0705*(C396)-0.0058	=D396/100*F396	
397	791.5	=A397/1000	=B397*0.33	0.07	b-	=-0.0004*(C397*C397*C397)+0.0043*(C397*C397)+0.0705*(C397)-0.0058	=D397/100*F397	
398	773.1	=A398/1000	=B398*0.33	0.181	b-	=-0.0004*(C398*C398*C398)+0.0043*(C398*C398)+0.0705*(C398)-0.0058	=D398/100*F398	
399	759.3	=A399/1000	=B399*0.33	0.2	b-	=-0.0004*(C399*C399*C399)+0.0043*(C399*C399)+0.0705*(C399)-0.0058	=D399/100*F399	
400	682.8	=A400/1000	=B400*0.33	0.14	b-	=-0.0004*(C400*C400*C400)+0.0043*(C400*C400)+0.0705*(C400)-0.0058	=D400/100*F400	
401	651.28	=A401/1000	=B401*0.33	0.159	b-	=-0.0004*(C401*C401*C401)+0.0043*(C401*C401)+0.0705*(C401)-0.0058	=D401/100*F401	
402	649.5	=A402/1000	=B402*0.33	0.215	b-	=-0.0004*(C402*C402*C402)+0.0043*(C402*C402)+0.0705*(C402)-0.0058	=D402/100*F402	
403	622.62	=A403/1000	=B403*0.33	0.59	b-	=-0.0004*(C403*C403*C403)+0.0043*(C403*C403)+0.0705*(C403)-0.0058	=D403/100*F403	
404	585.2	=A404/1000	=B404*0.33	0.2	b-	=-0.0004*(C404*C404*C404)+0.0043*(C404*C404)+0.0705*(C404)-0.0058	=D404/100*F404	
405	511.85	=A405/1000	=B405*0.33	0.32	b-	=-0.0004*(C405*C405*C405)+0.0043*(C405*C405)+0.0705*(C405)-0.0058	=D405/100*F405	
406	501.8	=A406/1000	=B406*0.33	0.32	b-	=-0.0004*(C406*C406*C406)+0.0043*(C406*C406)+0.0705*(C406)-0.0058	=D406/100*F406	
407	358.75	=A407/1000	=B407*0.33	0.57	b-	=-0.0004*(C407*C407*C407)+0.0043*(C407*C407)+0.0705*(C407)-0.0058	=D407/100*F407	
408	303.8	=A408/1000	=B408*0.33	0.084	b-	=-0.0004*(C408*C408*C408)+0.0043*(C408*C408)+0.0705*(C408)-0.0058	=D408/100*F408	
409								
410						SUM - SDE Beta	=SUM(G352:G408)	(pSv s-1 per Bq m-3)
411							=G410*100*1000*60*60/1000000000000	mRem/hr per Bq/m3
412							=G411*37000*1000000	mRem/hr per uCi/ml
413						DAC	=25/G412	uCi/ml
414								
415	Photon Emissions:							
416								
417	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity		
418	(keV)	(MeV)	(%)	Mode	hSkin (Gy per Bq s m^{-3})	Gy/s		
419								
420	4701.5	=A420/1000	0.01	b-	=(0.0000000000000008*(B420*B420))+(0.00000000000006*(B420))-0.0000000000000006	=C420/100*E420		
421	4685.6	=A421/1000	0.008	b-	=(0.0000000000000008*(B421*B421))+(0.00000000000006*(B421))-0.0000000000000006	=C421/100*E421		
422	4655.6	=A422/1000	0.01	b-	=(0.0000000000000008*(B422*B422))+(0.00000000000006*(B422))-0.0000000000000006	=C422/100*E422		
423	4631.5	=A423/1000	0.028	b-	=(0.0000000000000008*(B423*B423))+(0.00000000000006*(B423))-0.0000000000000006	=C423/100*E423		
424	4489.2	=A424/1000	0.135	b-	=(0.0000000000000008*(B424*B424))+(0.00000000000006*(B424))-0.0000000000000006	=C424/100*E424		
425	4478.3	=A425/1000	0.014	b-	=(0.0000000000000008*(B425*B425))+(0.00000000000006*(B425))-0.0000000000000006	=C425/100*E425		
426	4448.1	=A426/1000	0.01	b-	=(0.0000000000000008*(B426*B426))+(0.00000000000006*(B426))-0.0000000000000006	=C426/100*E426		
427	4405.1	=A427/1000	0.008	b-	=(0.0000000000000008*(B427*B427))+(0.00000000000006*(B427))-0.0000000000000006	=C427/100*E427		
428	4368.4	=A428/1000	0.042	b-	=(0.0000000000000008*(B428*B428))+(0.00000000000006*(B428))-0.0000000000000006	=C428/100*E428		
429	4341.1	=A429/1000	0.105	b-	=(0.0000000000000008*(B429*B429))+(0.00000000000006*(B429))-0.0000000000000006	=C429/100*E429		
430	4321.2	=A430/1000	0.01	b-	=(0.0000000000000008*(B430*B430))+(0.00000000000006*(B430))-0.0000000000000006	=C430/100*E430		
431	4307.4	=A431/1000	0.01	b-	=(0.0000000000000008*(B431*B431))+(0.00000000000006*(B431))-0.0000000000000006	=C431/100*E431		
432	4279.4	=A432/1000	0.02	b-	=(0.0000000000000008*(B432*B432))+(0.00000000000006*(B432))-0.0000000000000006	=C432/100*E432		
433	4267.7	=A433/1000	0.028	b-	=(0.0000000000000008*(B433*B433))+(0.00000000000006*(B433))-0.0000000000000006	=C433/100*E433		
434	4253.3	=A434/1000	0.014	b-	=(0.0000000000000008*(B434*B434))+(0.00000000000006*(B434))-0.0000000000000006	=C434/100*E434		
435	4184.3	=A435/1000	0.05	b-	=(0.0000000000000008*(B435*B435))+(0.00000000000006*(B435))-0.0000000000000006	=C435/100*E435		
436	4176.2	=A436/1000	0.012	b-	=(0.0000000000000008*(B436*B436))+(0.00000000000006*(B436))-0.0000000000000006	=C436/100*E436		
437	4162.6	=A437/1000	0.028	b-	=(0.0000000000000008*(B437*B437))+(0.00000000000006*(B437))-0.0000000000000006	=C437/100*E437		
438	4146.9	=A438/1000	0.016	b-	=(0.0000000000000008*(B438*B438))+(0.00000000000006*(B438))-0.0000000000000006	=C438/100*E438		
439	4143	=A439/1000	0.026	b-	=(0.0000000000000008*(B439*B439))+(0.00000000000006*(B439))-0.0000000000000006	=C439/100*E439		
440	4117.7	=A440/1000	0.014	b-	=(0.0000000000000008*(B440*B440))+(0.00000000000006*(B440))-0.0000000000000006	=C440/100*E440		
441	4081.4	=A441/1000	0.074	b-	=(0.0000000000000008*(B441*B441))+(0.00000000000006*(B441))-0.0000000000000006	=C441/100*E441		
442	4048	=A442/1000	0.117	b-	=(0.0000000000000008*(B442*B442))+(0.00000000000006*(B442))-0.0000000000000006	=C442/100*E442		
443	4043.8	=A443/1000	0.02	b-	=(0.0000000000000008*(B443*B443))+(0.00000000000006*(B443))-0.0000000000000006	=C443/100*E443		
444	4004.9	=A444/1000	0.028	b-	=(0.0000000000000008*(B444*B444))+(0.00000000000006*(B444))-0.0000000000000006	=C444/100*E444		
445	3996	=A445/1000	0.143	b-	=(0.0000000000000008*(B445*B445))+(0.00000000000006*(B445))-0.0000000000000006	=C445/100*E445		
446	3977.5	=A446/1000	0.27	b-	=(0.0000000000000008*(B446*B446))+(0.00000000000006*(B446))-0.0000000000000006	=C446/100*E446		
447	3977.5	=A447/1000	0.07	b-	=(0.0000000000000008*(B447*B447))+(0.00000000000006*(B447))-0.0000000000000006	=C447/100*E447		
448	3965.5	=A448/1000	0.209	b-	=(0.0000000000000008*(B448*B448))+(0.00000000000006*(B448))-0.0000000000000006	=C448/100*E448		
449	3923	=A449/1000	0.42	b-	=(0.0000000000000008*(B449*B449))+(0.00000000000006*(B449))-0.0000000000000006	=C449/100*E449		
450	3901.7	=A450/1000	0.135	b-	=(0.0000000000000008*(B450*B450))+(0.00000000000006*(B450))-0.0000000000000006	=C450/100*E450		
451	3898.4	=A451/1000	0.034	b-	=(0.0000000000000008*(B451*B451))+(0.00000000000006*(B451))-0.0000000000000006	=C451/100*E451		
452	3882.5	=A452/1000	0.04	b-	=(0.0000000000000008*(B452*B452))+(0.00000000000006*(B452))-0.0000000000000006	=C452/100*E452		
453	3842.7	=A453/1000	0.111	b-	=(0.0000000000000008*(B453*B453))+(0.00000000000006*(B453))-0.0000000000000006	=C453/100*E453		
454	3837.6	=A454/1000	0.082	b-	=(0.0000000000000008*(B454*B454))+(0.00000000000006*(B454))-0.0000000000000006	=C454/100*E454		
455	3827.4	=A455/1000	0.139	b-	=(0.0000000000000008*(B455*B455))+(0.00000000000006*(B455))-0.0000000000000006	=C455/100*E455		
456	3809.5	=A456/1000	0.02	b-	=(0.0000000000000008*(B456*B456))+(0.00000000000006*(B456))-0.0000000000000006	=C456/100*E456		
457	3781.4	=A457/1000	0.133	b-	=(0.0000000000000008*(B457*B457))+(0.00000000000006*(B457))-0.0000000000000006	=C457/100*E457		
458	3756.5	=A458/1000	0.016	b-	=(0.0000000000000008*(B458*B458))+(0.00000000000006*(B458))-0.0000000000000006	=C458/100*E458		
459	3732.5	=A459/1000	0.14	b-	=(0.0000000000000008*(B459*B459))+(0.00000000000006*(B459))-0.0000000000000006	=C459/100*E459		
460	3721.5	=A460/1000	0.048	b-	=(0.0000000000000008*(B460*B460))+(0.00000000000006*(B460))-0.0000000000000006	=C460/100*E460		
461	3717.8	=A461/1000	0.84	b-	=(0.0000000000000008*(B461*B461))+(0.00000000000006*(B461))-0.0000000000000006	=C461/100*E461		
462	3677.7	=A462/1000	0.066	b-	=(0.0000000000000008*(B462*B462))+(0.00000000000006*(B462))-0.0000000000000006	=C462/100*E462		
463	3665.4	=A463/1000	0.084	b-	=(0.0000000000000008*(B463*B463))+(0.00000000000006*(B463))-0.0000000000000006	=C463/100*E463		
464	3652.3	=A464/1000	0.058	b-	=(0.0000000000000008*(B464*B464))+(0.00000000000006*(B464))-0.0000000000000006	=C464/100*E464		
465	3639.1	=A465/1000	0.038	b-	=(0.0000000000000008*(B465*B465))+(0.00000000000006*(B465))-0.0000000000000006	=C465/100*E465		

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
466	3634.4	=A466/1000	0.038	b-	=(0.0000000000000008*(B466*B466))+(0.00000000000006*(B466))-0.0000000000000006	=C466/100*E466		
467	3629.2	=A467/1000	0.08	b-	=(0.0000000000000008*(B467*B467))+(0.00000000000006*(B467))-0.0000000000000006	=C467/100*E467		
468	3583.9	=A468/1000	0.259	b-	=(0.0000000000000008*(B468*B468))+(0.00000000000006*(B468))-0.0000000000000006	=C468/100*E468		
469	3574	=A469/1000	0.06	b-	=(0.0000000000000008*(B469*B469))+(0.00000000000006*(B469))-0.0000000000000006	=C469/100*E469		
470	3567.9	=A470/1000	0.056	b-	=(0.0000000000000008*(B470*B470))+(0.00000000000006*(B470))-0.0000000000000006	=C470/100*E470		
471	3532.88	=A471/1000	1.35	b-	=(0.0000000000000008*(B471*B471))+(0.00000000000006*(B471))-0.0000000000000006	=C471/100*E471		
472	3503.6	=A472/1000	0.02	b-	=(0.0000000000000008*(B472*B472))+(0.00000000000006*(B472))-0.0000000000000006	=C472/100*E472		
473	3463.3	=A473/1000	0.042	b-	=(0.0000000000000008*(B473*B473))+(0.00000000000006*(B473))-0.0000000000000006	=C473/100*E473		
474	3439.6	=A474/1000	0.044	b-	=(0.0000000000000008*(B474*B474))+(0.00000000000006*(B474))-0.0000000000000006	=C474/100*E474		
475	3399.9	=A475/1000	0.137	b-	=(0.0000000000000008*(B475*B475))+(0.00000000000006*(B475))-0.0000000000000006	=C475/100*E475		
476	3371.1	=A476/1000	0.62	b-	=(0.0000000000000008*(B476*B476))+(0.00000000000006*(B476))-0.0000000000000006	=C476/100*E476		
477	3361.7	=A477/1000	1.05	b-	=(0.0000000000000008*(B477*B477))+(0.00000000000006*(B477))-0.0000000000000006	=C477/100*E477		
478	3351.9	=A478/1000	0.042	b-	=(0.0000000000000008*(B478*B478))+(0.00000000000006*(B478))-0.0000000000000006	=C478/100*E478		
479	3347.4	=A479/1000	0.068	b-	=(0.0000000000000008*(B479*B479))+(0.00000000000006*(B479))-0.0000000000000006	=C479/100*E479		
480	3340.8	=A480/1000	0.036	b-	=(0.0000000000000008*(B480*B480))+(0.00000000000006*(B480))-0.0000000000000006	=C480/100*E480		
481	3321.9	=A481/1000	0.07	b-	=(0.0000000000000008*(B481*B481))+(0.00000000000006*(B481))-0.0000000000000006	=C481/100*E481		
482	3317.9	=A482/1000	0.082	b-	=(0.0000000000000008*(B482*B482))+(0.00000000000006*(B482))-0.0000000000000006	=C482/100*E482		
483	3300	=A483/1000	0.038	b-	=(0.0000000000000008*(B483*B483))+(0.00000000000006*(B483))-0.0000000000000006	=C483/100*E483		
484	3271.3	=A484/1000	0.054	b-	=(0.0000000000000008*(B484*B484))+(0.00000000000006*(B484))-0.0000000000000006	=C484/100*E484		
485	3257	=A485/1000	0.052	b-	=(0.0000000000000008*(B485*B485))+(0.00000000000006*(B485))-0.0000000000000006	=C485/100*E485		
486	3219.84	=A486/1000	0.43	b-	=(0.0000000000000008*(B486*B486))+(0.00000000000006*(B486))-0.0000000000000006	=C486/100*E486		
487	3213.2	=A487/1000	0.032	b-	=(0.0000000000000008*(B487*B487))+(0.00000000000006*(B487))-0.0000000000000006	=C487/100*E487		
488	3172.1	=A488/1000	0.1	b-	=(0.0000000000000008*(B488*B488))+(0.00000000000006*(B488))-0.0000000000000006	=C488/100*E488		
489	3159.8	=A489/1000	0.062	b-	=(0.0000000000000008*(B489*B489))+(0.00000000000006*(B489))-0.0000000000000006	=C489/100*E489		
490	3154.4	=A490/1000	0.026	b-	=(0.0000000000000008*(B490*B490))+(0.00000000000006*(B490))-0.0000000000000006	=C490/100*E490		
491	3140.26	=A491/1000	1.05	b-	=(0.0000000000000008*(B491*B491))+(0.00000000000006*(B491))-0.0000000000000006	=C491/100*E491		
492	3107.26	=A492/1000	0.195	b-	=(0.0000000000000008*(B492*B492))+(0.00000000000006*(B492))-0.0000000000000006	=C492/100*E492		
493	3098.8	=A493/1000	0.038	b-	=(0.0000000000000008*(B493*B493))+(0.00000000000006*(B493))-0.0000000000000006	=C493/100*E493		
494	3049.7	=A494/1000	0.04	b-	=(0.0000000000000008*(B494*B494))+(0.00000000000006*(B494))-0.0000000000000006	=C494/100*E494		
495	3029.16	=A495/1000	0.271	b-	=(0.0000000000000008*(B495*B495))+(0.00000000000006*(B495))-0.0000000000000006	=C495/100*E495		
496	3017.9	=A496/1000	0.26	b-	=(0.0000000000000008*(B496*B496))+(0.00000000000006*(B496))-0.0000000000000006	=C496/100*E496		
497	2998.4	=A497/1000	0.044	b-	=(0.0000000000000008*(B497*B497))+(0.00000000000006*(B497))-0.0000000000000006	=C497/100*E497		
498	2946.9	=A498/1000	0.078	b-	=(0.0000000000000008*(B498*B498))+(0.00000000000006*(B498))-0.0000000000000006	=C498/100*E498		
499	2917.4	=A499/1000	0.03	b-	=(0.0000000000000008*(B499*B499))+(0.00000000000006*(B499))-0.0000000000000006	=C499/100*E499		
500	2878.69	=A500/1000	0.33	b-	=(0.0000000000000008*(B500*B500))+(0.00000000000006*(B500))-0.0000000000000006	=C500/100*E500		
501	2873.8	=A501/1000	0.096	b-	=(0.0000000000000008*(B501*B501))+(0.00000000000006*(B501))-0.0000000000000006	=C501/100*E501		
502	2866.23	=A502/1000	1.75	b-	=(0.0000000000000008*(B502*B502))+(0.00000000000006*(B502))-0.0000000000000006	=C502/100*E502		
503	2858.9	=A503/1000	0.054	b-	=(0.0000000000000008*(B503*B503))+(0.00000000000006*(B503))-0.0000000000000006	=C503/100*E503		
504	2853.3	=A504/1000	0.24	b-	=(0.0000000000000008*(B504*B504))+(0.00000000000006*(B504))-0.0000000000000006	=C504/100*E504		
505	2819.58	=A505/1000	0.133	b-	=(0.0000000000000008*(B505*B505))+(0.00000000000006*(B505))-0.0000000000000006	=C505/100*E505		
506	2804.1	=A506/1000	0.04	b-	=(0.0000000000000008*(B506*B506))+(0.00000000000006*(B506))-0.0000000000000006	=C506/100*E506		
507	2793.75	=A507/1000	0.68	b-	=(0.0000000000000008*(B507*B507))+(0.00000000000006*(B507))-0.0000000000000006	=C507/100*E507		
508	2789.2	=A508/1000	0.052	b-	=(0.0000000000000008*(B508*B508))+(0.00000000000006*(B508))-0.0000000000000006	=C508/100*E508		
509	2782.11	=A509/1000	0.76	b-	=(0.0000000000000008*(B509*B509))+(0.00000000000006*(B509))-0.0000000000000006	=C509/100*E509		
510	2775.7	=A510/1000	0.03	b-	=(0.0000000000000008*(B510*B510))+(0.00000000000006*(B510))-0.0000000000000006	=C510/100*E510		
511	2760.3	=A511/1000	0.046	b-	=(0.0000000000000008*(B511*B511))+(0.00000000000006*(B511))-0.0000000000000006	=C511/100*E511		
512	2756.6	=A512/1000	0.066	b-	=(0.0000000000000008*(B512*B512))+(0.00000000000006*(B512))-0.0000000000000006	=C512/100*E512		
513	2750.9	=A513/1000	0.125	b-	=(0.0000000000000008*(B513*B513))+(0.00000000000006*(B513))-0.0000000000000006	=C513/100*E513		
514	2742.3	=A514/1000	0.028	b-	=(0.0000000000000008*(B514*B514))+(0.00000000000006*(B514))-0.0000000000000006	=C514/100*E514		
515	2721.9	=A515/1000	0.036	b-	=(0.0000000000000008*(B515*B515))+(0.00000000000006*(B515))-0.0000000000000006	=C515/100*E515		
516	2703.2	=A516/1000	0.034	b-	=(0.0000000000000008*(B516*B516))+(0.00000000000006*(B516))-0.0000000000000006	=C516/100*E516		
517	2659.1	=A517/1000	0.086	b-	=(0.0000000000000008*(B517*B517))+(0.00000000000006*(B517))-0.0000000000000006	=C517/100*E517		
518	2645.26	=A518/1000	0.42	b-	=(0.0000000000000008*(B518*B518))+(0.00000000000006*(B518))-0.0000000000000006	=C518/100*E518		
519	2630.1	=A519/1000	0.14	b-	=(0.0000000000000008*(B519*B519))+(0.00000000000006*(B519))-0.0000000000000006	=C519/100*E519		
520	2622.8	=A520/1000	0.022	b-	=(0.0000000000000008*(B520*B520))+(0.00000000000006*(B520))-0.0000000000000006	=C520/100*E520		
521	2597.92	=A521/1000	0.109	b-	=(0.0000000000000008*(B521*B521))+(0.00000000000006*(B521))-0.0000000000000006	=C521/100*E521		
522	2555.3	=A522/1000	0.034	b-	=(0.0000000000000008*(B522*B522))+(0.00000000000006*(B522))-0.0000000000000006	=C522/100*E522		
523	2549.9	=A523/1000	0.03	b-	=(0.0000000000000008*(B523*B523))+(0.00000000000006*(B523))-0.0000000000000006	=C523/100*E523		
524	2545.4	=A524/1000	0.05	b-	=(0.0000000000000008*(B524*B524))+(0.00000000000006*(B524))-0.0000000000000006	=C524/100*E524		
525	2534.9	=A525/1000	0.094	b-	=(0.0000000000000008*(B525*B525))+(0.00000000000006*(B525))-0.0000000000000006	=C525/100*E525		
526	2522	=A526/1000	0.05	b-	=(0.0000000000000008*(B526*B526))+(0.00000000000006*(B526))-0.0000000000000006	=C526/100*E526		
527	2510.8	=A527/1000	0.24	b-	=(0.0000000000000008*(B527*B527))+(0.00000000000006*(B527))-0.0000000000000006	=C527/100*E527		
528	2503	=A528/1000	0.05	b-	=(0.0000000000000008*(B528*B528))+(0.00000000000006*(B528))-0.0000000000000006	=C528/100*E528		
529	2487.8	=A529/1000	0.024	b-	=(0.0000000000000008*(B529*B529))+(0.00000000000006*(B529))-0.0000000000000006	=C529/100*E529		
530	2467.3	=A530/1000	0.016	b-	=(0.0000000000000008*(B530*B530))+(0.00000000000006*(B530))-0.0000000000000006	=C530/100*E530		
531	2440.9	=A531/1000	0.046	b-	=(0.0000000000000008*(B531*B531))+(0.00000000000006*(B531))-0.0000000000000006	=C531/100*E531		
532	2400.99	=A532/1000	0.72	b-	=(0.0000000000000008*(B532*B532))+(0.00000000000006*(B532))-0.0000000000000006	=C532/100*E532		
533	2377.4	=A533/1000	0.8	b-	=(0.0000000000000008*(B533*B533))+(0.00000000000006*(B533))-0.0000000000000006	=C533/100*E533		
534	2352.7	=A534/1000	0.28	b-	=(0.0000000000000008*(B534*B534))+(0.00000000000006*(B534))-0.0000000000000006	=C534/100*E534		
535	2335.2	=A535/1000	0.1	b-	=(0.0000000000000008*(B535*B535))+(0.00000000000006*(B535))-0.0000000000000006	=C535/100*E535		
536	2330	=A536/1000	0.036	b-	=(0.0000000000000008*(B536*B536))+(0.00000000000006*(B536))-0.0000000000000006	=C536/100*E536		
537	2321.7	=A537/1000	0.052	b-	=(0.0000000000000008*(B537*B537))+(0.00000000000006*(B537))-0.0000000000000006	=C537/100*E537		
538	2285.6	=A538/1000	0.046	b-	=(0.0000000000000008*(B538*B538))+(0.00000000000006*(B538))-0.0000000000000006	=C538/100*E538		
539	2280.2	=A539/1000	0.21	b-	=(0.0000000000000008*(B539*B539))+(0.00000000000006*(B539))-0.0000000000000006	=C539/100*E539		
540	2249	=A540/1000	0.08	b-	=(0.0000000000000008*(B540*B540))+(0.00000000000006*(B540))-0.0000000000000006	=C540/100*E540		
541	2239.8	=A541/1000	0.05	b-	=(0.0000000000000008*(B541*B541))+(0.00000000000006*(B541))-0.0000000000000006	=C541/100*E541		
542	2232.6	=A542/1000	0.024	b-	=(0.0000000000000008*(B542*B542))+(0.00000000000006*(B542))-0.0000000000000006	=C542/100*E542		
543	2207.2	=A543/1000	0.046	b-	=(0.0000000000000008*(B543*B543))+(0.00000000000006*(B543))-0.0000000000000006	=C543/100*E543		

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
544	2195.8	=A544/1000	0.12	b-	=(0.00000000000000008*(B544*B544))+(0.000000000000006*(B544))-0.000000000000000006	=C544/100*E544		
545	2190	=A545/1000	0.026	b-	=(0.00000000000000008*(B545*B545))+(0.000000000000006*(B545))-0.000000000000000006	=C545/100*E545		
546	2167.9	=A546/1000	0.042	b-	=(0.00000000000000008*(B546*B546))+(0.000000000000006*(B546))-0.000000000000000006	=C546/100*E546		
547	2160.02	=A547/1000	0.53	b-	=(0.00000000000000008*(B547*B547))+(0.000000000000006*(B547))-0.000000000000000006	=C547/100*E547		
548	2150.1	=A548/1000	0.02	b-	=(0.00000000000000008*(B548*B548))+(0.000000000000006*(B548))-0.000000000000000006	=C548/100*E548		
549	2143.8	=A549/1000	0.064	b-	=(0.00000000000000008*(B549*B549))+(0.000000000000006*(B549))-0.000000000000000006	=C549/100*E549		
550	2140.5	=A550/1000	0.062	b-	=(0.00000000000000008*(B550*B550))+(0.000000000000006*(B550))-0.000000000000000006	=C550/100*E550		
551	2100.63	=A551/1000	0.94	b-	=(0.00000000000000008*(B551*B551))+(0.000000000000006*(B551))-0.000000000000000006	=C551/100*E551		
552	2082.5	=A552/1000	0.058	b-	=(0.00000000000000008*(B552*B552))+(0.000000000000006*(B552))-0.000000000000000006	=C552/100*E552		
553	2079.3	=A553/1000	0.03	b-	=(0.00000000000000008*(B553*B553))+(0.000000000000006*(B553))-0.000000000000000006	=C553/100*E553		
554	2046.47	=A554/1000	0.263	b-	=(0.00000000000000008*(B554*B554))+(0.000000000000006*(B554))-0.000000000000000006	=C554/100*E554		
555	2039.5	=A555/1000	0.018	b-	=(0.00000000000000008*(B555*B555))+(0.000000000000006*(B555))-0.000000000000000006	=C555/100*E555		
556	2021.04	=A556/1000	0.245	b-	=(0.00000000000000008*(B556*B556))+(0.000000000000006*(B556))-0.000000000000000006	=C556/100*E556		
557	2012.23	=A557/1000	1.57	b-	=(0.00000000000000008*(B557*B557))+(0.000000000000006*(B557))-0.000000000000000006	=C557/100*E557		
558	2001.6	=A558/1000	0.036	b-	=(0.00000000000000008*(B558*B558))+(0.000000000000006*(B558))-0.000000000000000006	=C558/100*E558		
559	1998.6	=A559/1000	0.119	b-	=(0.00000000000000008*(B559*B559))+(0.000000000000006*(B559))-0.000000000000000006	=C559/100*E559		
560	1977.7	=A560/1000	0.038	b-	=(0.00000000000000008*(B560*B560))+(0.000000000000006*(B560))-0.000000000000000006	=C560/100*E560		
561	1966.55	=A561/1000	0.133	b-	=(0.00000000000000008*(B561*B561))+(0.000000000000006*(B561))-0.000000000000000006	=C561/100*E561		
562	1939.11	=A562/1000	0.64	b-	=(0.00000000000000008*(B562*B562))+(0.000000000000006*(B562))-0.000000000000000006	=C562/100*E562		
563	1935.1	=A563/1000	0.034	b-	=(0.00000000000000008*(B563*B563))+(0.000000000000006*(B563))-0.000000000000000006	=C563/100*E563		
564	1927.5	=A564/1000	0.111	b-	=(0.00000000000000008*(B564*B564))+(0.000000000000006*(B564))-0.000000000000000006	=C564/100*E564		
565	1925.3	=A565/1000	0.016	b-	=(0.00000000000000008*(B565*B565))+(0.000000000000006*(B565))-0.000000000000000006	=C565/100*E565		
566	1903.4	=A566/1000	1.05	b-	=(0.00000000000000008*(B566*B566))+(0.000000000000006*(B566))-0.000000000000000006	=C566/100*E566		
567	1897.8	=A567/1000	0.03	b-	=(0.00000000000000008*(B567*B567))+(0.000000000000006*(B567))-0.000000000000000006	=C567/100*E567		
568	1886.5	=A568/1000	0.034	b-	=(0.00000000000000008*(B568*B568))+(0.000000000000006*(B568))-0.000000000000000006	=C568/100*E568		
569	1879.8	=A569/1000	0.159	b-	=(0.00000000000000008*(B569*B569))+(0.000000000000006*(B569))-0.000000000000000006	=C569/100*E569		
570	1868.47	=A570/1000	0.197	b-	=(0.00000000000000008*(B570*B570))+(0.000000000000006*(B570))-0.000000000000000006	=C570/100*E570		
571	1865.2	=A571/1000	0.08	b-	=(0.00000000000000008*(B571*B571))+(0.000000000000006*(B571))-0.000000000000000006	=C571/100*E571		
572	1850.6	=A572/1000	0.05	b-	=(0.00000000000000008*(B572*B572))+(0.000000000000006*(B572))-0.000000000000000006	=C572/100*E572		
573	1839.72	=A573/1000	0.35	b-	=(0.00000000000000008*(B573*B573))+(0.000000000000006*(B573))-0.000000000000000006	=C573/100*E573		
574	1837.5	=A574/1000	0.12	b-	=(0.00000000000000008*(B574*B574))+(0.000000000000006*(B574))-0.000000000000000006	=C574/100*E574		
575	1831.3	=A575/1000	0.086	b-	=(0.00000000000000008*(B575*B575))+(0.000000000000006*(B575))-0.000000000000000006	=C575/100*E575		
576	1827.3	=A576/1000	0.064	b-	=(0.00000000000000008*(B576*B576))+(0.000000000000006*(B576))-0.000000000000000006	=C576/100*E576		
577	1823.6	=A577/1000	0.066	b-	=(0.00000000000000008*(B577*B577))+(0.000000000000006*(B577))-0.000000000000000006	=C577/100*E577		
578	1810.73	=A578/1000	0.141	b-	=(0.00000000000000008*(B578*B578))+(0.000000000000006*(B578))-0.000000000000000006	=C578/100*E578		
579	1804.4	=A579/1000	0.03	b-	=(0.00000000000000008*(B579*B579))+(0.000000000000006*(B579))-0.000000000000000006	=C579/100*E579		
580	1791.4	=A580/1000	0.046	b-	=(0.00000000000000008*(B580*B580))+(0.000000000000006*(B580))-0.000000000000000006	=C580/100*E580		
581	1788.2	=A581/1000	0.107	b-	=(0.00000000000000008*(B581*B581))+(0.000000000000006*(B581))-0.000000000000000006	=C581/100*E581		
582	1777.6	=A582/1000	0.76	b-	=(0.00000000000000008*(B582*B582))+(0.000000000000006*(B582))-0.000000000000000006	=C582/100*E582		
583	1766.1	=A583/1000	0.048	b-	=(0.00000000000000008*(B583*B583))+(0.000000000000006*(B583))-0.000000000000000006	=C583/100*E583		
584	1735.5	=A584/1000	0.056	b-	=(0.00000000000000008*(B584*B584))+(0.000000000000006*(B584))-0.000000000000000006	=C584/100*E584		
585	1729.9	=A585/1000	0.03	b-	=(0.00000000000000008*(B585*B585))+(0.000000000000006*(B585))-0.000000000000000006	=C585/100*E585		
586	1721.29	=A586/1000	0.225	b-	=(0.00000000000000008*(B586*B586))+(0.000000000000006*(B586))-0.000000000000000006	=C586/100*E586		
587	1710.7	=A587/1000	0.034	b-	=(0.00000000000000008*(B587*B587))+(0.000000000000006*(B587))-0.000000000000000006	=C587/100*E587		
588	1707.9	=A588/1000	0.024	b-	=(0.00000000000000008*(B588*B588))+(0.000000000000006*(B588))-0.000000000000000006	=C588/100*E588		
589	1693.7	=A589/1000	4.4	b-	=(0.00000000000000008*(B589*B589))+(0.000000000000006*(B589))-0.000000000000000006	=C589/100*E589		
590	1692	=A590/1000	0.26	b-	=(0.00000000000000008*(B590*B590))+(0.000000000000006*(B590))-0.000000000000000006	=C590/100*E590		
591	1683.8	=A591/1000	0.133	b-	=(0.00000000000000008*(B591*B591))+(0.000000000000006*(B591))-0.000000000000000006	=C591/100*E591		
592	1680.3	=A592/1000	0.084	b-	=(0.00000000000000008*(B592*B592))+(0.000000000000006*(B592))-0.000000000000000006	=C592/100*E592		
593	1676.9	=A593/1000	0.141	b-	=(0.00000000000000008*(B593*B593))+(0.000000000000006*(B593))-0.000000000000000006	=C593/100*E593		
594	1667.51	=A594/1000	0.129	b-	=(0.00000000000000008*(B594*B594))+(0.000000000000006*(B594))-0.000000000000000006	=C594/100*E594		
595	1657.6	=A595/1000	0.04	b-	=(0.00000000000000008*(B595*B595))+(0.000000000000006*(B595))-0.000000000000000006	=C595/100*E595		
596	1643.82	=A596/1000	0.34	b-	=(0.00000000000000008*(B596*B596))+(0.000000000000006*(B596))-0.000000000000000006	=C596/100*E596		
597	1634.06	=A597/1000	0.82	b-	=(0.00000000000000008*(B597*B597))+(0.000000000000006*(B597))-0.000000000000000006	=C597/100*E597		
598	1600.7	=A598/1000	0.072	b-	=(0.00000000000000008*(B598*B598))+(0.000000000000006*(B598))-0.000000000000000006	=C598/100*E598		
599	1582.9	=A599/1000	0.09	b-	=(0.00000000000000008*(B599*B599))+(0.000000000000006*(B599))-0.000000000000000006	=C599/100*E599		
600	1573.78	=A600/1000	0.191	b-	=(0.00000000000000008*(B600*B600))+(0.000000000000006*(B600))-0.000000000000000006	=C600/100*E600		
601	1571.8	=A601/1000	0.068	b-	=(0.00000000000000008*(B601*B601))+(0.000000000000006*(B601))-0.000000000000000006	=C601/100*E601		
602	1555.28	=A602/1000	0.153	b-	=(0.00000000000000008*(B602*B602))+(0.000000000000006*(B602))-0.000000000000000006	=C602/100*E602		
603	1545.2	=A603/1000	0.1	b-	=(0.00000000000000008*(B603*B603))+(0.000000000000006*(B603))-0.000000000000000006	=C603/100*E603		
604	1533.68	=A604/1000	5.1	b-	=(0.00000000000000008*(B604*B604))+(0.000000000000006*(B604))-0.000000000000000006	=C604/100*E604		
605	1530.04	=A605/1000	3.34	b-	=(0.00000000000000008*(B605*B605))+(0.000000000000006*(B605))-0.000000000000000006	=C605/100*E605		
606	1506.2	=A606/1000	0.113	b-	=(0.00000000000000008*(B606*B606))+(0.000000000000006*(B606))-0.000000000000000006	=C606/100*E606		
607	1500.96	=A607/1000	1.33	b-	=(0.00000000000000008*(B607*B607))+(0.000000000000006*(B607))-0.000000000000000006	=C607/100*E607		
608	1488.1	=A608/1000	0.094	b-	=(0.00000000000000008*(B608*B608))+(0.000000000000006*(B608))-0.000000000000000006	=C608/100*E608		
609	1481.9	=A609/1000	0.044	b-	=(0.00000000000000008*(B609*B609))+(0.000000000000006*(B609))-0.000000000000000006	=C609/100*E609		
610	1472.76	=A610/1000	6.9	b-	=(0.00000000000000008*(B610*B610))+(0.000000000000006*(B610))-0.000000000000000006	=C610/100*E610		
611	1468.5	=A611/1000	0.19	b-	=(0.00000000000000008*(B611*B611))+(0.000000000000006*(B611))-0.000000000000000006	=C611/100*E611		
612	1464.2	=A612/1000	0.179	b-	=(0.00000000000000008*(B612*B612))+(0.000000000000006*(B612))-0.000000000000000006	=C612/100*E612		
613	1461.3	=A613/1000	0.123	b-	=(0.00000000000000008*(B613*B613))+(0.000000000000006*(B613))-0.000000000000000006	=C613/100*E613		
614	1458.3	=A614/1000	0.074	b-	=(0.00000000000000008*(B614*B614))+(0.000000000000006*(B614))-0.000000000000000006	=C614/100*E614		
615	1455.3	=A615/1000	0.052	b-	=(0.00000000000000008*(B615*B615))+(0.000000000000006*(B615))-0.000000000000000006	=C615/100*E615		
616	1441.3	=A616/1000	0.02	b-	=(0.00000000000000008*(B616*B616))+(0.000000000000006*(B616))-0.000000000000000006	=C616/100*E616		
617	1421.64	=A617/1000	0.225	b-	=(0.00000000000000008*(B617*B617))+(0.000000000000006*(B617))-0.000000000000000006	=C617/100*E617		
618	1412.59	=A618/1000	0.265	b-	=(0.00000000000000008*(B618*B618))+(0.000000000000006*(B618))-0.000000000000000006	=C618/100*E618		
619	1381.9	=A619/1000	0.058	b-	=(0.00000000000000008*(B619*B619))+(0.000000000000006*(B619))-0.000000000000000006	=C619/100*E619		
620	1372.16	=A620/1000	0.127	b-	=(0.00000000000000008*(B620*B620))+(0.000000000000006*(B620))-0.000000000000000006	=C620/100*E620		
621	1367.48	=A621/1000	0.149	b-	=(0.00000000000000008*(B621*B621))+(0.000000000000006*(B621))-0.000000000000000006	=C621/100*E621		

ATTACHMENT 4

Attachment 1

	A	B	C	D	E	F	G	H
622	1340.6	=A622/1000	0.195	b-	=(0.0000000000000008*(B622*B622))+(0.00000000000006*(B622))-0.000000000000006	=C622/100*E622		
623	1335.4	=A623/1000	0.13	b-	=(0.0000000000000008*(B623*B623))+(0.00000000000006*(B623))-0.000000000000006	=C623/100*E623		
624	1324.28	=A624/1000	3.08	b-	=(0.0000000000000008*(B624*B624))+(0.00000000000006*(B624))-0.000000000000006	=C624/100*E624		
625	1308.9	=A625/1000	0.068	b-	=(0.0000000000000008*(B625*B625))+(0.00000000000006*(B625))-0.000000000000006	=C625/100*E625		
626	1302.7	=A626/1000	0.1	b-	=(0.0000000000000008*(B626*B626))+(0.00000000000006*(B626))-0.000000000000006	=C626/100*E626		
627	1298	=A627/1000	0.044	b-	=(0.0000000000000008*(B627*B627))+(0.00000000000006*(B627))-0.000000000000006	=C627/100*E627		
628	1278.5	=A628/1000	0.032	b-	=(0.0000000000000008*(B628*B628))+(0.00000000000006*(B628))-0.000000000000006	=C628/100*E628		
629	1273.73	=A629/1000	1.37	b-	=(0.0000000000000008*(B629*B629))+(0.00000000000006*(B629))-0.000000000000006	=C629/100*E629		
630	1267.2	=A630/1000	0.024	b-	=(0.0000000000000008*(B630*B630))+(0.00000000000006*(B630))-0.000000000000006	=C630/100*E630		
631	1251	=A631/1000	0.038	b-	=(0.0000000000000008*(B631*B631))+(0.00000000000006*(B631))-0.000000000000006	=C631/100*E631		
632	1241.5	=A632/1000	0.088	b-	=(0.0000000000000008*(B632*B632))+(0.00000000000006*(B632))-0.000000000000006	=C632/100*E632		
633	1235.62	=A633/1000	0.6	b-	=(0.0000000000000008*(B633*B633))+(0.00000000000006*(B633))-0.000000000000006	=C633/100*E633		
634	1228.8	=A634/1000	0.145	b-	=(0.0000000000000008*(B634*B634))+(0.00000000000006*(B634))-0.000000000000006	=C634/100*E634		
635	1210.2	=A635/1000	0.022	b-	=(0.0000000000000008*(B635*B635))+(0.00000000000006*(B635))-0.000000000000006	=C635/100*E635		
636	1200.6	=A636/1000	0.018	b-	=(0.0000000000000008*(B636*B636))+(0.00000000000006*(B636))-0.000000000000006	=C636/100*E636		
637	1195.1	=A637/1000	0.084	b-	=(0.0000000000000008*(B637*B637))+(0.00000000000006*(B637))-0.000000000000006	=C637/100*E637		
638	1186.54	=A638/1000	0.185	b-	=(0.0000000000000008*(B638*B638))+(0.00000000000006*(B638))-0.000000000000006	=C638/100*E638		
639	1182.38	=A639/1000	0.167	b-	=(0.0000000000000008*(B639*B639))+(0.00000000000006*(B639))-0.000000000000006	=C639/100*E639		
640	1172.33	=A640/1000	0.98	b-	=(0.0000000000000008*(B640*B640))+(0.00000000000006*(B640))-0.000000000000006	=C640/100*E640		
641	1167.4	=A641/1000	0.034	b-	=(0.0000000000000008*(B641*B641))+(0.00000000000006*(B641))-0.000000000000006	=C641/100*E641		
642	1162.5	=A642/1000	0.215	b-	=(0.0000000000000008*(B642*B642))+(0.00000000000006*(B642))-0.000000000000006	=C642/100*E642		
643	1152.2	=A643/1000	0.064	b-	=(0.0000000000000008*(B643*B643))+(0.00000000000006*(B643))-0.000000000000006	=C643/100*E643		
644	1131.51	=A644/1000	0.161	b-	=(0.0000000000000008*(B644*B644))+(0.00000000000006*(B644))-0.000000000000006	=C644/100*E644		
645	1119.6	=A645/1000	0.38	b-	=(0.0000000000000008*(B645*B645))+(0.00000000000006*(B645))-0.000000000000006	=C645/100*E645		
646	1116.61	=A646/1000	1.67	b-	=(0.0000000000000008*(B646*B646))+(0.00000000000006*(B646))-0.000000000000006	=C646/100*E646		
647	1107.78	=A647/1000	2.93	b-	=(0.0000000000000008*(B647*B647))+(0.00000000000006*(B647))-0.000000000000006	=C647/100*E647		
648	1103.18	=A648/1000	0.9	b-	=(0.0000000000000008*(B648*B648))+(0.00000000000006*(B648))-0.000000000000006	=C648/100*E648		
649	1098.1	=A649/1000	0.064	b-	=(0.0000000000000008*(B649*B649))+(0.00000000000006*(B649))-0.000000000000006	=C649/100*E649		
650	1088.07	=A650/1000	0.36	b-	=(0.0000000000000008*(B650*B650))+(0.00000000000006*(B650))-0.000000000000006	=C650/100*E650		
651	1076.48	=A651/1000	0.24	b-	=(0.0000000000000008*(B651*B651))+(0.00000000000006*(B651))-0.000000000000006	=C651/100*E651		
652	1067.7	=A652/1000	0.068	b-	=(0.0000000000000008*(B652*B652))+(0.00000000000006*(B652))-0.000000000000006	=C652/100*E652		
653	1063.1	=A653/1000	0.07	b-	=(0.0000000000000008*(B653*B653))+(0.00000000000006*(B653))-0.000000000000006	=C653/100*E653		
654	1058.6	=A654/1000	0.03	b-	=(0.0000000000000008*(B654*B654))+(0.00000000000006*(B654))-0.000000000000006	=C654/100*E654		
655	1048.2	=A655/1000	0.062	b-	=(0.0000000000000008*(B655*B655))+(0.00000000000006*(B655))-0.000000000000006	=C655/100*E655		
656	1044.4	=A656/1000	0.41	b-	=(0.0000000000000008*(B656*B656))+(0.00000000000006*(B656))-0.000000000000006	=C656/100*E656		
657	1038.3	=A657/1000	0.03	b-	=(0.0000000000000008*(B657*B657))+(0.00000000000006*(B657))-0.000000000000006	=C657/100*E657		
658	1010.84	=A658/1000	0.109	b-	=(0.0000000000000008*(B658*B658))+(0.00000000000006*(B658))-0.000000000000006	=C658/100*E658		
659	997.37	=A659/1000	0.66	b-	=(0.0000000000000008*(B659*B659))+(0.00000000000006*(B659))-0.000000000000006	=C659/100*E659		
660	974.39	=A660/1000	0.98	b-	=(0.0000000000000008*(B660*B660))+(0.00000000000006*(B660))-0.000000000000006	=C660/100*E660		
661	969.7	=A661/1000	0.094	b-	=(0.0000000000000008*(B661*B661))+(0.00000000000006*(B661))-0.000000000000006	=C661/100*E661		
662	964.2	=A662/1000	0.058	b-	=(0.0000000000000008*(B662*B662))+(0.00000000000006*(B662))-0.000000000000006	=C662/100*E662		
663	960.42	=A663/1000	0.32	b-	=(0.0000000000000008*(B663*B663))+(0.00000000000006*(B663))-0.000000000000006	=C663/100*E663		
664	953.18	=A664/1000	0.107	b-	=(0.0000000000000008*(B664*B664))+(0.00000000000006*(B664))-0.000000000000006	=C664/100*E664		
665	944.19	=A665/1000	0.165	b-	=(0.0000000000000008*(B665*B665))+(0.00000000000006*(B665))-0.000000000000006	=C665/100*E665		
666	939.4	=A666/1000	0.066	b-	=(0.0000000000000008*(B666*B666))+(0.00000000000006*(B666))-0.000000000000006	=C666/100*E666		
667	934.6	=A667/1000	0.038	b-	=(0.0000000000000008*(B667*B667))+(0.00000000000006*(B667))-0.000000000000006	=C667/100*E667		
668	930.95	=A668/1000	0.62	b-	=(0.0000000000000008*(B668*B668))+(0.00000000000006*(B668))-0.000000000000006	=C668/100*E668		
669	917.78	=A669/1000	0.074	b-	=(0.0000000000000008*(B669*B669))+(0.00000000000006*(B669))-0.000000000000006	=C669/100*E669		
670	904.27	=A670/1000	7.2	b-	=(0.0000000000000008*(B670*B670))+(0.00000000000006*(B670))-0.000000000000006	=C670/100*E670		
671	902.8	=A671/1000	0.8	b-	=(0.0000000000000008*(B671*B671))+(0.00000000000006*(B671))-0.000000000000006	=C671/100*E671		
672	897	=A672/1000	0.48	b-	=(0.0000000000000008*(B672*B672))+(0.00000000000006*(B672))-0.000000000000006	=C672/100*E672		
673	890.4	=A673/1000	0.3	b-	=(0.0000000000000008*(B673*B673))+(0.00000000000006*(B673))-0.000000000000006	=C673/100*E673		
674	887.9	=A674/1000	0.64	b-	=(0.0000000000000008*(B674*B674))+(0.00000000000006*(B674))-0.000000000000006	=C674/100*E674		
675	886.3	=A675/1000	0.2	b-	=(0.0000000000000008*(B675*B675))+(0.00000000000006*(B675))-0.000000000000006	=C675/100*E675		
676	870.42	=A676/1000	0.161	b-	=(0.0000000000000008*(B676*B676))+(0.00000000000006*(B676))-0.000000000000006	=C676/100*E676		
677	867.08	=A677/1000	5.9	b-	=(0.0000000000000008*(B677*B677))+(0.00000000000006*(B677))-0.000000000000006	=C677/100*E677		
678	857.37	=A678/1000	0.287	b-	=(0.0000000000000008*(B678*B678))+(0.00000000000006*(B678))-0.000000000000006	=C678/100*E678		
679	844.7	=A679/1000	0.52	b-	=(0.0000000000000008*(B679*B679))+(0.00000000000006*(B679))-0.000000000000006	=C679/100*E679		
680	835.53	=A680/1000	1.11	b-	=(0.0000000000000008*(B680*B680))+(0.00000000000006*(B680))-0.000000000000006	=C680/100*E680		
681	826.75	=A681/1000	0.76	b-	=(0.0000000000000008*(B681*B681))+(0.00000000000006*(B681))-0.000000000000006	=C681/100*E681		
682	783.5	=A682/1000	0.022	b-	=(0.0000000000000008*(B682*B682))+(0.00000000000006*(B682))-0.000000000000006	=C682/100*E682		
683	776.49	=A683/1000	1.13	b-	=(0.0000000000000008*(B683*B683))+(0.00000000000006*(B683))-0.000000000000006	=C683/100*E683		
684	762.9	=A684/1000	0.92	b-	=(0.0000000000000008*(B684*B684))+(0.00000000000006*(B684))-0.000000000000006	=C684/100*E684		
685	762.9	=A685/1000	0.4	b-	=(0.0000000000000008*(B685*B685))+(0.00000000000006*(B685))-0.000000000000006	=C685/100*E685		
686	753.5	=A686/1000	0.092	b-	=(0.0000000000000008*(B686*B686))+(0.00000000000006*(B686))-0.000000000000006	=C686/100*E686		
687	747.4	=A687/1000	0.11	b-	=(0.0000000000000008*(B687*B687))+(0.00000000000006*(B687))-0.000000000000006	=C687/100*E687		
688	738.39	=A688/1000	4.22	b-	=(0.0000000000000008*(B688*B688))+(0.00000000000006*(B688))-0.000000000000006	=C688/100*E688		
689	729.63	=A689/1000	0.3	b-	=(0.0000000000000008*(B689*B689))+(0.00000000000006*(B689))-0.000000000000006	=C689/100*E689		
690	716.2	=A690/1000	0.26	b-	=(0.0000000000000008*(B690*B690))+(0.00000000000006*(B690))-0.000000000000006	=C690/100*E690		
691	711	=A691/1000	0.5	b-	=(0.0000000000000008*(B691*B691))+(0.00000000000006*(B691))-0.000000000000006	=C691/100*E691		
692	710.05	=A692/1000	0.78	b-	=(0.0000000000000008*(B692*B692))+(0.00000000000006*(B692))-0.000000000000006	=C692/100*E692		
693	707.01	=A693/1000	0.5	b-	=(0.0000000000000008*(B693*B693))+(0.00000000000006*(B693))-0.000000000000006	=C693/100*E693		
694	696.24	=A694/1000	1.79	b-	=(0.0000000000000008*(B694*B694))+(0.00000000000006*(B694))-0.000000000000006	=C694/100*E694		
695	687.3	=A695/1000	0.07	b-	=(0.0000000000000008*(B695*B695))+(0.00000000000006*(B695))-0.000000000000006	=C695/100*E695		
696	674.11	=A696/1000	0.233	b-	=(0.0000000000000008*(B696*B696))+(0.00000000000006*(B696))-0.000000000000006	=C696/100*E696		
697	671.4	=A697/1000	0.107	b-	=(0.0000000000000008*(B697*B697))+(0.00000000000006*(B697))-0.000000000000006	=C697/100*E697		
698	668.6	=A698/1000	0.042	b-	=(0.0000000000000008*(B698*B698))+(0.00000000000006*(B698))-0.000000000000006	=C698/100*E698		
699	665.72	=A699/1000	0.115	b-	=(0.0000000000000008*(B699*B699))+(0.00000000000006*(B699))-0.000000000000006	=C699/100*E699		

ATTACHMENT 4

Attachment 2

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
1	Kr-89								
2	T1/2	3.15m							
3									
4	Determination of DAC limited by EDE								
5	Photon Emissions:								
6									
7	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity			
8	(keV)	(MeV)	(%)	Mode	hE (Gy per Bq s m^{-3})	Gy/s			
9									
10	4701.5	4.7015	0.01	b-	2.78483E-13	2.78483E-17			
11	4685.6	4.6856	0.008	b-	2.7739E-13	2.21912E-17			
12	4655.6	4.6556	0.01	b-	2.75329E-13	2.75329E-17			
13	4631.5	4.6315	0.028	b-	2.73677E-13	7.66294E-17			
14	4489.2	4.4892	0.135	b-	2.63966E-13	3.56354E-16			
15	4478.3	4.4783	0.014	b-	2.63225E-13	3.68515E-17			
16	4448.1	4.4481	0.01	b-	2.61176E-13	2.61176E-17			
17	4405.1	4.4051	0.008	b-	2.58265E-13	2.06612E-17			
18	4368.4	4.3684	0.042	b-	2.55786E-13	1.0743E-16			
19	4341.1	4.3411	0.105	b-	2.53945E-13	2.66643E-16			
20	4321.2	4.3212	0.01	b-	2.52606E-13	2.52606E-17			
21	4307.4	4.3074	0.01	b-	2.51677E-13	2.51677E-17			
22	4279.4	4.2794	0.02	b-	2.49797E-13	4.99593E-17			
23	4267.7	4.2677	0.028	b-	2.49012E-13	6.97232E-17			
24	4253.3	4.2533	0.014	b-	2.48046E-13	3.47265E-17			
25	4184.3	4.1843	0.05	b-	2.43432E-13	1.21716E-16			
26	4176.2	4.1762	0.012	b-	2.42891E-13	2.9147E-17			
27	4162.6	4.1626	0.028	b-	2.41984E-13	6.77557E-17			
28	4146.9	4.1469	0.016	b-	2.40939E-13	3.85502E-17			
29	4143	4.143	0.026	b-	2.40679E-13	6.25765E-17			
30	4117.7	4.1177	0.014	b-	2.38996E-13	3.34594E-17			
31	4081.4	4.0814	0.074	b-	2.36586E-13	1.75073E-16			
32	4048	4.048	0.117	b-	2.34373E-13	2.74216E-16			
33	4043.8	4.0438	0.02	b-	2.34095E-13	4.68189E-17			
34	4004.9	4.0049	0.028	b-	2.31523E-13	6.48266E-17			
35	3996	3.996	0.143	b-	2.30936E-13	3.30239E-16			
36	3977.5	3.9775	0.27	b-	2.29716E-13	6.20233E-16			
37	3977.5	3.9775	0.07	b-	2.29716E-13	1.60801E-16			
38	3965.5	3.9655	0.209	b-	2.28925E-13	4.78454E-16			
39	3923	3.923	0.42	b-	2.2613E-13	9.49745E-16			
40	3901.7	3.9017	0.135	b-	2.24732E-13	3.03388E-16			
41	3898.4	3.8984	0.034	b-	2.24515E-13	7.63351E-17			
42	3882.5	3.8825	0.04	b-	2.23473E-13	8.9389E-17			
43	3842.7	3.8427	0.111	b-	2.20868E-13	2.45163E-16			
44	3837.6	3.8376	0.082	b-	2.20534E-13	1.80838E-16			
45	3827.4	3.8274	0.139	b-	2.19868E-13	3.05616E-16			

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
46	3809.5	3.8095	0.02	b-	2.187E-13	4.37399E-17			
47	3781.4	3.7814	0.133	b-	2.16868E-13	2.88434E-16			
48	3756.5	3.7565	0.016	b-	2.15248E-13	3.44396E-17			
49	3732.5	3.7325	0.14	b-	2.13688E-13	2.99163E-16			
50	3721.5	3.7215	0.048	b-	2.12974E-13	1.02228E-16			
51	3717.8	3.7178	0.84	b-	2.12734E-13	1.78697E-15			
52	3677.7	3.6777	0.066	b-	2.10136E-13	1.3869E-16			
53	3665.4	3.6654	0.084	b-	2.0934E-13	1.75846E-16			
54	3652.3	3.6523	0.058	b-	2.08494E-13	1.20926E-16			
55	3639.1	3.6391	0.038	b-	2.07641E-13	7.89036E-17			
56	3634.4	3.6344	0.038	b-	2.07338E-13	7.87883E-17			
57	3629.2	3.6292	0.08	b-	2.07002E-13	1.65602E-16			
58	3583.9	3.5839	0.259	b-	2.04084E-13	5.28577E-16			
59	3574	3.574	0.06	b-	2.03447E-13	1.22068E-16			
60	3567.9	3.5679	0.056	b-	2.03055E-13	1.13711E-16			
61	3532.88	3.53288	1.35	b-	2.00806E-13	2.71089E-15			
62	3503.6	3.5036	0.02	b-	1.9893E-13	3.97861E-17			
63	3463.3	3.4633	0.042	b-	1.96354E-13	8.24686E-17			
64	3439.6	3.4396	0.044	b-	1.94842E-13	8.57303E-17			
65	3399.9	3.3999	0.137	b-	1.92314E-13	2.6347E-16			
66	3371.1	3.3711	0.62	b-	1.90484E-13	1.181E-15			
67	3361.7	3.3617	1.05	b-	1.89887E-13	1.99381E-15			
68	3351.9	3.3519	0.042	b-	1.89265E-13	7.94915E-17			
69	3347.4	3.3474	0.068	b-	1.8898E-13	1.28507E-16			
70	3340.8	3.3408	0.036	b-	1.88562E-13	6.78823E-17			
71	3321.9	3.3219	0.07	b-	1.87365E-13	1.31156E-16			
72	3317.9	3.3179	0.082	b-	1.87112E-13	1.53432E-16			
73	3300	3.3	0.038	b-	1.8598E-13	7.06724E-17			
74	3271.3	3.2713	0.054	b-	1.84168E-13	9.94506E-17			
75	3257	3.257	0.052	b-	1.83266E-13	9.52984E-17			
76	3219.84	3.21984	0.43	b-	1.80927E-13	7.77985E-16			
77	3213.2	3.2132	0.032	b-	1.80509E-13	5.7763E-17			
78	3172.1	3.1721	0.1	b-	1.77929E-13	1.77929E-16			
79	3159.8	3.1598	0.062	b-	1.77159E-13	1.09838E-16			
80	3154.4	3.1544	0.026	b-	1.7682E-13	4.59733E-17			
81	3140.26	3.14026	1.05	b-	1.75935E-13	1.84732E-15			
82	3107.26	3.10726	0.195	b-	1.73873E-13	3.39053E-16			
83	3098.8	3.0988	0.038	b-	1.73345E-13	6.58711E-17			
84	3049.7	3.0497	0.04	b-	1.70286E-13	6.81145E-17			
85	3029.16	3.02916	0.271	b-	1.6901E-13	4.58016E-16			
86	3017.9	3.0179	0.26	b-	1.6831E-13	4.37607E-16			
87	2998.4	2.9984	0.044	b-	1.67101E-13	7.35244E-17			
88	2946.9	2.9469	0.078	b-	1.63913E-13	1.27852E-16			
89	2917.4	2.9174	0.03	b-	1.62092E-13	4.86277E-17			
90	2878.69	2.87869	0.33	b-	1.59708E-13	5.27037E-16			

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
91	2873.8	2.8738	0.096	b-	1.59407E-13	1.53031E-16			
92	2866.23	2.86623	1.75	b-	1.58942E-13	2.78149E-15			
93	2858.9	2.8589	0.054	b-	1.58492E-13	8.55855E-17			
94	2853.3	2.8533	0.24	b-	1.58148E-13	3.79554E-16			
95	2819.58	2.81958	0.133	b-	1.56079E-13	2.07585E-16			
96	2804.1	2.8041	0.04	b-	1.55131E-13	6.20524E-17			
97	2793.75	2.79375	0.68	b-	1.54498E-13	1.05058E-15			
98	2789.2	2.7892	0.052	b-	1.54219E-13	8.0194E-17			
99	2782.11	2.78211	0.76	b-	1.53786E-13	1.16877E-15			
100	2775.7	2.7757	0.03	b-	1.53394E-13	4.60182E-17			
101	2760.3	2.7603	0.046	b-	1.52454E-13	7.01286E-17			
102	2756.6	2.7566	0.066	b-	1.52228E-13	1.0047E-16			
103	2750.9	2.7509	0.125	b-	1.5188E-13	1.8985E-16			
104	2742.3	2.7423	0.028	b-	1.51355E-13	4.23795E-17			
105	2721.9	2.7219	0.036	b-	1.50112E-13	5.40405E-17			
106	2703.2	2.7032	0.034	b-	1.48975E-13	5.06514E-17			
107	2659.1	2.6591	0.086	b-	1.46297E-13	1.25815E-16			
108	2645.26	2.64526	0.42	b-	1.45458E-13	6.10923E-16			
109	2630.1	2.6301	0.14	b-	1.4454E-13	2.02356E-16			
110	2622.8	2.6228	0.022	b-	1.44098E-13	3.17016E-17			
111	2597.92	2.59792	0.109	b-	1.42594E-13	1.55428E-16			
112	2555.3	2.5553	0.034	b-	1.40024E-13	4.76082E-17			
113	2549.9	2.5499	0.03	b-	1.39699E-13	4.19097E-17			
114	2545.4	2.5454	0.05	b-	1.39428E-13	6.97141E-17			
115	2534.9	2.5349	0.094	b-	1.38796E-13	1.30469E-16			
116	2522	2.522	0.05	b-	1.38021E-13	6.90105E-17			
117	2510.8	2.5108	0.24	b-	1.37348E-13	3.29636E-16			
118	2503	2.503	0.05	b-	1.3688E-13	6.844E-17			
119	2487.8	2.4878	0.024	b-	1.35968E-13	3.26324E-17			
120	2467.3	2.4673	0.016	b-	1.3474E-13	2.15584E-17			
121	2440.9	2.4409	0.046	b-	1.33161E-13	6.12541E-17			
122	2400.99	2.40099	0.72	b-	1.30779E-13	9.41609E-16			
123	2377.4	2.3774	0.8	b-	1.29374E-13	1.03499E-15			
124	2352.7	2.3527	0.28	b-	1.27905E-13	3.58135E-16			
125	2335.2	2.3352	0.1	b-	1.26866E-13	1.26866E-16			
126	2330	2.33	0.036	b-	1.26558E-13	4.55608E-17			
127	2321.7	2.3217	0.052	b-	1.26066E-13	6.55541E-17			
128	2285.6	2.2856	0.046	b-	1.23928E-13	5.70068E-17			
129	2280.2	2.2802	0.21	b-	1.23609E-13	2.59578E-16			
130	2249	2.249	0.08	b-	1.21766E-13	9.74128E-17			
131	2239.8	2.2398	0.05	b-	1.21223E-13	6.06117E-17			
132	2232.6	2.2326	0.024	b-	1.20799E-13	2.89918E-17			
133	2207.2	2.2072	0.046	b-	1.19303E-13	5.48796E-17			
134	2195.8	2.1958	0.12	b-	1.18633E-13	1.4236E-16			
135	2190	2.19	0.026	b-	1.18292E-13	3.0756E-17			

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
136	2167.9	2.1679	0.042	b-	1.16995E-13	4.91377E-17			
137	2160.02	2.16002	0.53	b-	1.16532E-13	6.17622E-16			
138	2150.1	2.1501	0.02	b-	1.15951E-13	2.31902E-17			
139	2143.8	2.1438	0.064	b-	1.15582E-13	7.39723E-17			
140	2140.5	2.1405	0.062	b-	1.15388E-13	7.15409E-17			
141	2100.63	2.10063	0.94	b-	1.13057E-13	1.06273E-15			
142	2082.5	2.0825	0.058	b-	1.11999E-13	6.49592E-17			
143	2079.3	2.0793	0.03	b-	1.11812E-13	3.35436E-17			
144	2046.47	2.04647	0.263	b-	1.099E-13	2.89036E-16			
145	2039.5	2.0395	0.018	b-	1.09494E-13	1.97089E-17			
146	2021.04	2.02104	0.245	b-	1.08421E-13	2.65632E-16			
147	2012.23	2.01223	1.57	b-	1.0791E-13	1.69418E-15			
148	2001.6	2.0016	0.036	b-	1.07293E-13	3.86254E-17			
149	1998.6	1.9986	0.119	b-	1.07119E-13	1.27471E-16			
150	1977.7	1.9777	0.038	b-	1.05908E-13	4.02449E-17			
151	1966.55	1.96655	0.133	b-	1.05262E-13	1.39999E-16			
152	1939.11	1.93911	0.64	b-	1.03676E-13	6.63525E-16			
153	1935.1	1.9351	0.034	b-	1.03444E-13	3.5171E-17			
154	1927.5	1.9275	0.111	b-	1.03006E-13	1.14336E-16			
155	1925.3	1.9253	0.016	b-	1.02879E-13	1.64606E-17			
156	1903.4	1.9034	1.05	b-	1.01616E-13	1.06697E-15			
157	1897.8	1.8978	0.03	b-	1.01293E-13	3.0388E-17			
158	1886.5	1.8865	0.034	b-	1.00643E-13	3.42185E-17			
159	1879.8	1.8798	0.159	b-	1.00257E-13	1.59409E-16			
160	1868.47	1.86847	0.197	b-	9.96059E-14	1.96224E-16			
161	1865.2	1.8652	0.08	b-	9.94179E-14	7.95344E-17			
162	1850.6	1.8506	0.05	b-	9.85794E-14	4.92897E-17			
163	1839.72	1.83972	0.35	b-	9.79551E-14	3.42843E-16			
164	1837.5	1.8375	0.12	b-	9.78278E-14	1.17393E-16			
165	1831.3	1.8313	0.086	b-	9.74723E-14	8.38262E-17			
166	1827.3	1.8273	0.064	b-	9.72431E-14	6.22356E-17			
167	1823.6	1.8236	0.066	b-	9.7031E-14	6.40405E-17			
168	1810.73	1.81073	0.141	b-	9.6294E-14	1.35775E-16			
169	1804.4	1.8044	0.03	b-	9.59317E-14	2.87795E-17			
170	1791.4	1.7914	0.046	b-	9.51882E-14	4.37866E-17			
171	1788.2	1.7882	0.107	b-	9.50053E-14	1.01656E-16			
172	1777.6	1.7776	0.76	b-	9.43997E-14	7.17438E-16			
173	1766.1	1.7661	0.048	b-	9.37432E-14	4.49967E-17			
174	1735.5	1.7355	0.056	b-	9.19989E-14	5.15194E-17			
175	1729.9	1.7299	0.03	b-	9.16801E-14	2.7504E-17			
176	1721.29	1.72129	0.225	b-	9.11902E-14	2.05178E-16			
177	1710.7	1.7107	0.034	b-	9.0588E-14	3.07999E-17			
178	1707.9	1.7079	0.024	b-	9.04288E-14	2.17029E-17			
179	1693.7	1.6937	4.4	b-	8.96222E-14	3.94338E-15			
180	1692	1.692	0.26	b-	8.95257E-14	2.32767E-16			

ATTACHMENT 4

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	A	B	C	D	E	F	G	H	I
181	1683.8	1.6838	0.133	b-	8.90604E-14	1.1845E-16			
182	1680.3	1.6803	0.084	b-	8.88618E-14	7.46439E-17			
183	1676.9	1.6769	0.141	b-	8.8669E-14	1.25023E-16			
184	1667.51	1.66751	0.129	b-	8.81367E-14	1.13696E-16			
185	1657.6	1.6576	0.04	b-	8.75753E-14	3.50301E-17			
186	1643.82	1.64382	0.34	b-	8.67953E-14	2.95104E-16			
187	1634.06	1.63406	0.82	b-	8.62433E-14	7.07195E-16			
188	1600.7	1.6007	0.072	b-	8.43595E-14	6.07388E-17			
189	1582.9	1.5829	0.09	b-	8.33561E-14	7.50205E-17			
190	1573.78	1.57378	0.191	b-	8.28426E-14	1.58229E-16			
191	1571.8	1.5718	0.068	b-	8.27311E-14	5.62572E-17			
192	1555.28	1.55528	0.153	b-	8.18018E-14	1.25157E-16			
193	1545.2	1.5452	0.1	b-	8.12353E-14	8.12353E-17			
194	1533.68	1.53368	5.1	b-	8.05883E-14	4.11001E-15			
195	1530.04	1.53004	3.34	b-	8.0384E-14	2.68483E-15			
196	1506.2	1.5062	0.113	b-	7.90473E-14	8.93234E-17			
197	1500.96	1.50096	1.33	b-	7.87538E-14	1.04743E-15			
198	1488.1	1.4881	0.094	b-	7.80339E-14	7.33519E-17			
199	1481.9	1.4819	0.044	b-	7.76871E-14	3.41823E-17			
200	1472.76	1.47276	6.9	b-	7.7176E-14	5.32515E-15			
201	1468.5	1.4685	0.19	b-	7.6938E-14	1.46182E-16			
202	1464.2	1.4642	0.179	b-	7.66978E-14	1.37289E-16			
203	1461.3	1.4613	0.123	b-	7.65358E-14	9.4139E-17			
204	1458.3	1.4583	0.074	b-	7.63683E-14	5.65125E-17			
205	1455.3	1.4553	0.052	b-	7.62008E-14	3.96244E-17			
206	1441.3	1.4413	0.02	b-	7.54197E-14	1.50839E-17			
207	1421.64	1.42164	0.225	b-	7.43241E-14	1.67229E-16			
208	1412.59	1.41259	0.265	b-	7.38203E-14	1.95624E-16			
209	1381.9	1.3819	0.058	b-	7.21143E-14	4.18263E-17			
210	1372.16	1.37216	0.127	b-	7.15736E-14	9.08985E-17			
211	1367.48	1.36748	0.149	b-	7.1314E-14	1.06258E-16			
212	1340.6	1.3406	0.195	b-	6.98244E-14	1.36158E-16			
213	1335.4	1.3354	0.13	b-	6.95366E-14	9.03976E-17			
214	1324.28	1.32428	3.08	b-	6.89214E-14	2.12278E-15			
215	1308.9	1.3089	0.068	b-	6.80714E-14	4.62886E-17			
216	1302.7	1.3027	0.1	b-	6.77291E-14	6.77291E-17			
217	1298	1.298	0.044	b-	6.74696E-14	2.96866E-17			
218	1278.5	1.2785	0.032	b-	6.63941E-14	2.12461E-17			
219	1273.73	1.27373	1.37	b-	6.61313E-14	9.05998E-16			
220	1267.2	1.2672	0.024	b-	6.57716E-14	1.57852E-17			
221	1251	1.251	0.038	b-	6.488E-14	2.46544E-17			
222	1241.5	1.2415	0.088	b-	6.43576E-14	5.66347E-17			
223	1235.62	1.23562	0.6	b-	6.40345E-14	3.84207E-16			
224	1228.8	1.2288	0.145	b-	6.36599E-14	9.23069E-17			
225	1210.2	1.2102	0.022	b-	6.26392E-14	1.37806E-17			

ATTACHMENT 4

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	A	B	C	D	E	F	G	H	I
226	1200.6	1.2006	0.018	b-	6.21129E-14	1.11803E-17			
227	1195.1	1.1951	0.084	b-	6.18115E-14	5.19217E-17			
228	1186.54	1.18654	0.185	b-	6.13428E-14	1.13484E-16			
229	1182.38	1.18238	0.167	b-	6.1115E-14	1.02062E-16			
230	1172.33	1.17233	0.98	b-	6.05652E-14	5.93539E-16			
231	1167.4	1.1674	0.034	b-	6.02956E-14	2.05005E-17			
232	1162.5	1.1625	0.215	b-	6.00278E-14	1.2906E-16			
233	1152.2	1.1522	0.064	b-	5.94651E-14	3.80577E-17			
234	1131.51	1.13151	0.161	b-	5.83361E-14	9.39212E-17			
235	1119.6	1.1196	0.38	b-	5.7687E-14	2.19211E-16			
236	1116.61	1.11661	1.67	b-	5.75241E-14	9.60653E-16			
237	1107.78	1.10778	2.93	b-	5.70434E-14	1.67137E-15			
238	1103.18	1.10318	0.9	b-	5.6793E-14	5.11137E-16			
239	1098.1	1.0981	0.064	b-	5.65166E-14	3.61707E-17			
240	1088.07	1.08807	0.36	b-	5.59713E-14	2.01497E-16			
241	1076.48	1.07648	0.24	b-	5.53416E-14	1.3282E-16			
242	1067.7	1.0677	0.068	b-	5.4865E-14	3.73082E-17			
243	1063.1	1.0631	0.07	b-	5.46154E-14	3.82308E-17			
244	1058.6	1.0586	0.03	b-	5.43713E-14	1.63114E-17			
245	1048.2	1.0482	0.062	b-	5.38074E-14	3.33606E-17			
246	1044.4	1.0444	0.41	b-	5.36015E-14	2.19766E-16			
247	1038.3	1.0383	0.03	b-	5.32711E-14	1.59813E-17			
248	1010.84	1.01084	0.109	b-	5.17856E-14	5.64463E-17			
249	997.37	0.99737	0.66	b-	5.1058E-14	3.36983E-16			
250	974.39	0.97439	0.98	b-	4.98184E-14	4.8822E-16			
251	969.7	0.9697	0.094	b-	4.95656E-14	4.65917E-17			
252	964.2	0.9642	0.058	b-	4.92694E-14	2.85762E-17			
253	960.42	0.96042	0.32	b-	4.90658E-14	1.57011E-16			
254	953.18	0.95318	0.107	b-	4.86761E-14	5.20834E-17			
255	944.19	0.94419	0.165	b-	4.81925E-14	7.95176E-17			
256	939.4	0.9394	0.066	b-	4.79349E-14	3.16371E-17			
257	934.6	0.9346	0.038	b-	4.7677E-14	1.81172E-17			
258	930.95	0.93095	0.62	b-	4.74808E-14	2.94381E-16			
259	917.78	0.91778	0.074	b-	4.67736E-14	3.46125E-17			
260	904.27	0.90427	7.2	b-	4.60489E-14	3.31552E-15			
261	902.8	0.9028	0.8	b-	4.59701E-14	3.67761E-16			
262	897	0.897	0.48	b-	4.56592E-14	2.19164E-16			
263	890.4	0.8904	0.3	b-	4.53056E-14	1.35917E-16			
264	887.9	0.8879	0.64	b-	4.51717E-14	2.89099E-16			
265	886.3	0.8863	0.2	b-	4.50861E-14	9.01721E-17			
266	870.42	0.87042	0.161	b-	4.42363E-14	7.12204E-17			
267	867.08	0.86708	5.9	b-	4.40577E-14	2.5994E-15			
268	857.37	0.85737	0.287	b-	4.35387E-14	1.24956E-16			
269	844.7	0.8447	0.52	b-	4.2862E-14	2.22883E-16			
270	835.53	0.83553	1.11	b-	4.23727E-14	4.70337E-16			

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
271	826.75	0.82675	0.76	b-	4.19045E-14	3.18474E-16			
272	783.5	0.7835	0.022	b-	3.96027E-14	8.7126E-18			
273	776.49	0.77649	1.13	b-	3.92304E-14	4.43303E-16			
274	762.9	0.7629	0.92	b-	3.8509E-14	3.54283E-16			
275	762.9	0.7629	0.4	b-	3.8509E-14	1.54036E-16			
276	753.5	0.7535	0.092	b-	3.80105E-14	3.49697E-17			
277	747.4	0.7474	0.11	b-	3.76872E-14	4.14559E-17			
278	738.39	0.73839	4.22	b-	3.72099E-14	1.57026E-15			
279	729.63	0.72963	0.3	b-	3.67462E-14	1.10239E-16			
280	716.2	0.7162	0.26	b-	3.60359E-14	9.36933E-17			
281	711	0.711	0.5	b-	3.5761E-14	1.78805E-16			
282	710.05	0.71005	0.78	b-	3.57108E-14	2.78545E-16			
283	707.01	0.70701	0.5	b-	3.55502E-14	1.77751E-16			
284	696.24	0.69624	1.79	b-	3.49815E-14	6.26169E-16			
285	687.3	0.6873	0.07	b-	3.45098E-14	2.41568E-17			
286	674.11	0.67411	0.233	b-	3.38143E-14	7.87874E-17			
287	671.4	0.6714	0.107	b-	3.36716E-14	3.60286E-17			
288	668.6	0.6686	0.042	b-	3.35241E-14	1.40801E-17			
289	665.72	0.66572	0.115	b-	3.33724E-14	3.83782E-17			
290	662.9	0.6629	0.078	b-	3.32239E-14	2.59146E-17			
291	660.5	0.6605	0.048	b-	3.30975E-14	1.58868E-17			
292	652.6	0.6526	0.038	b-	3.26818E-14	1.24191E-17			
293	629.75	0.62975	0.34	b-	3.14807E-14	1.07034E-16			
294	626.2	0.6262	0.6	b-	3.12943E-14	1.87766E-16			
295	610.2	0.6102	0.018	b-	3.04547E-14	5.48184E-18			
296	599.52	0.59952	0.088	b-	2.98948E-14	2.63075E-17			
297	586.03	0.58603	16.6	b-	2.91884E-14	4.84527E-15			
298	576.96	0.57696	5.7	b-	2.87138E-14	1.63668E-15			
299	557.3	0.5573	0.161	b-	2.76862E-14	4.45747E-17			
300	546.9	0.5469	0.03	b-	2.71432E-14	8.14296E-18			
301	542.2	0.5422	0.03	b-	2.6898E-14	8.06939E-18			
302	523.5	0.5235	0.034	b-	2.59231E-14	8.81386E-18			
303	510.1	0.5101	0.12	b-	2.52254E-14	3.02705E-17			
304	509.1	0.5091	0.15	b-	2.51734E-14	3.776E-17			
305	498.6	0.4986	1.15	b-	2.46272E-14	2.83213E-16			
306	497.38	0.49738	6.7	b-	2.45638E-14	1.64577E-15			
307	490.76	0.49076	0.32	b-	2.42197E-14	7.7503E-17			
308	488.5	0.4885	0.08	b-	2.41023E-14	1.92818E-17			
309	466.13	0.46613	0.8	b-	2.29411E-14	1.83528E-16			
310	465.4	0.4654	0.24	b-	2.29032E-14	5.49677E-17			
311	438.08	0.43808	0.96	b-	2.14878E-14	2.06283E-16			
312	435.8	0.4358	0.096	b-	2.13698E-14	2.0515E-17			
313	428.5	0.4285	0.11	b-	2.09922E-14	2.30914E-17			
314	419.2	0.4192	0.038	b-	2.05115E-14	7.79435E-18			
315	411.42	0.41142	2.57	b-	2.01095E-14	5.16815E-16			

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
316	402.25	0.40225	0.32	b-	1.96361E-14	6.28356E-17			
317	380.7	0.3807	0.046	b-	1.85249E-14	8.52144E-18			
318	369.3	0.3693	1.39	b-	1.79378E-14	2.49335E-16			
319	364.88	0.36488	0.9	b-	1.77103E-14	1.59392E-16			
320	356.16	0.35616	4.16	b-	1.72617E-14	7.18087E-16			
321	354.1	0.3541	0.13	b-	1.71558E-14	2.23025E-17			
322	345.03	0.34503	1.19	b-	1.66896E-14	1.98606E-16			
323	338.2	0.3382	0.34	b-	1.63388E-14	5.55518E-17			
324	318.3	0.3183	0.044	b-	1.53176E-14	6.73976E-18			
325	304.7	0.3047	0.022	b-	1.46207E-14	3.21655E-18			
326	295.5	0.2955	0.016	b-	1.41496E-14	2.26394E-18			
327	286.3	0.2863	0.026	b-	1.36789E-14	3.55652E-18			
328	267.7	0.2677	0.084	b-	1.27283E-14	1.06918E-17			
329	264.35	0.26435	0.66	b-	1.25573E-14	8.28779E-17			
330	242.2	0.2422	0.012	b-	1.14273E-14	1.37128E-18			
331	220.95	0.22095	20.1	b-	1.03451E-14	2.07937E-15			
332	205.03	0.20503	0.125	b-	9.53557E-15	1.19195E-17			
333	197.5	0.1975	1.83	b-	9.15301E-15	1.675E-16			
334	196.2	0.1962	0.22	b-	9.08699E-15	1.99914E-17			
335	83.4	0.0834	0.012	b-	3.38391E-15	4.06069E-19			
336	79.4	0.0794	0.028	b-	3.18261E-15	8.9113E-19			
337	76	0.076	0.008	b-	3.01155E-15	2.40924E-19			
338	74.9	0.0749	0.012	b-	2.95622E-15	3.54746E-19			
339									
340					Sum - EDE	1.01143E-13	Gy/s per Bq/m3		
341						3.64114E-05	mRem/hr per Bq/m3		
342						1347222.057	mRem/hr per uCi/ml		
343					DAC	1.85567E-06	uCi/ml		
344									
345									
346					**Determination of DAC by SDE**				
347	Beta Emissions:								
348									
349	Endpoint	Energy	Avg. Beta	Intensity	Decay	Interpelated Beta Skin Dose Factor	se Rate per Unit Activity		
350	Energy (keV)	(MeV)	Energy (MeV)	(%)	Mode	(pSv s^{-1} per Bq m^{-3})	pSv/s		
351									
352	4990	4.99	1.6467	23	b-	0.120166229	0.027638233		
353	4769.05	4.76905	1.5737865	0.9	b-	0.114243021	0.001028187		
354	4492.6	4.4926	1.482558	1.5	b-	0.106868193	0.001603023		
355	4412.89	4.41289	1.4562537	4.2	b-	0.104749491	0.004399479		
356	4404	4.404	1.45332	2.2	b-	0.104513412	0.002299295		
357	4122.88	4.12288	1.3605504	1	b-	0.097071117	0.000970711		
358	4058.99	4.05899	1.3394667	0.96	b-	0.095386045	0.000915706		
359	3794.64	3.79464	1.2522312	1.5	b-	0.088439615	0.001326594		
360	3665.64	3.66564	1.2096612	3.7	b-	0.08506519	0.003147412		

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
361	3649.98	3.64998	1.2044934	0.59	b-	0.08465625	0.000499472		
362	3501.69	3.50169	1.1555577	0.13	b-	0.080791454	0.000105029		
363	3459.75	3.45975	1.1417175	2.8	b-	0.079700915	0.002231626		
364	3296.21	3.29621	1.0877493	9.7	b-	0.07545927	0.007319549		
365	3168.3	3.1683	1.045539	0.17	b-	0.072153879	0.000122662		
366	3125.39	3.12539	1.0313787	0.47	b-	0.071047441	0.000333923		
367	2991.46	2.99146	0.9871818	2.23	b-	0.067601972	0.001507524		
368	2848.64	2.84864	0.9400512	0.04	b-	0.063941216	2.55765E-05		
369	2829.99	2.82999	0.9338967	2.99	b-	0.063464214	0.00189758		
370	2720.3	2.7203	0.897699	0.08	b-	0.060663623	4.85309E-05		
371	2624.74	2.62474	0.8661642	0.05	b-	0.058230677	2.91153E-05		
372	2602.02	2.60202	0.8586666	0.35	b-	0.05765318	0.000201786		
373	2589.1	2.5891	0.854403	5.6	b-	0.057324944	0.003210197		
374	2391.88	2.39188	0.7893204	14.5	b-	0.052329396	0.007587762		
375	2207.96	2.20796	0.7286268	1.45	b-	0.047696316	0.000691597		
376	2201.26	2.20126	0.7264158	0.28	b-	0.047528012	0.000133078		
377	2123.86	2.12386	0.7008738	4	b-	0.045586152	0.001823446		
378	1972.58	1.97258	0.6509514	0.85	b-	0.041803813	0.000355332		
379	1739.94	1.73994	0.5741802	0.31	b-	0.036021622	0.000111667		
380	1662.07	1.66207	0.5484831	1.99	b-	0.034095643	0.000678503		
381	1628.6	1.6286	0.537438	1.56	b-	0.033269296	0.000519001		
382	1619.21	1.61921	0.5343393	2	b-	0.033037625	0.000660752		
383	1559.6	1.5596	0.514668	0.21	b-	0.031568561	6.6294E-05		
384	1533.1	1.5331	0.505923	0.074	b-	0.030916393	2.28781E-05		
385	1525.01	1.52501	0.5032533	0.4	b-	0.03071741	0.00012287		
386	1457.2	1.4572	0.480876	1.53	b-	0.029051618	0.00044449		
387	1272.58	1.27258	0.4199514	2.37	b-	0.024535293	0.000581486		
388	1270.17	1.27017	0.4191561	0.32	b-	0.024476523	7.83249E-05		
389	1156.1	1.1561	0.381513	0.24	b-	0.021700329	5.20808E-05		
390	1091.2	1.0912	0.360096	0.21	b-	0.020125668	4.22639E-05		
391	1024.51	1.02451	0.3380883	0.23	b-	0.018511273	4.25759E-05		
392	1012.69	1.01269	0.3341877	0.48	b-	0.018225534	8.74826E-05		
393	941.37	0.94137	0.3106521	0.49	b-	0.016503952	8.08694E-05		
394	931.4	0.9314	0.307362	0.123	b-	0.016263633	2.00043E-05		
395	908.99	0.90899	0.2999667	0.66	b-	0.01572377	0.000103777		
396	846.12	0.84612	0.2792196	0.65	b-	0.014211518	9.23749E-05		
397	791.5	0.7915	0.261195	0.07	b-	0.012900478	9.03033E-06		
398	773.1	0.7731	0.255123	0.181	b-	0.012459407	2.25515E-05		
399	759.3	0.7593	0.250569	0.2	b-	0.012128796	2.42576E-05		
400	682.8	0.6828	0.225324	0.14	b-	0.010299081	1.44187E-05		
401	651.28	0.65128	0.2149224	0.159	b-	0.009546682	1.51792E-05		
402	649.5	0.6495	0.214335	0.215	b-	0.009504219	2.04341E-05		
403	622.62	0.62262	0.2054646	0.59	b-	0.008863312	5.22935E-05		
404	585.2	0.5852	0.193116	0.2	b-	0.00797216	1.59443E-05		
405	511.85	0.51185	0.1689105	0.32	b-	0.006228945	1.99326E-05		

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
406	501.8	0.5018	0.165594	0.32	b-	0.005990473	1.91695E-05		
407	358.75	0.35875	0.1183875	0.57	b-	0.002605922	1.48538E-05		
408	303.8	0.3038	0.100254	0.084	b-	0.001310723	1.10101E-06		
409									
410						SUM - SDE Beta	0.075489287	(pSv s-1 per Bq m-3)	
411							2.71761E-05	mRem/hr per Bq/m3	
412							1005517.306	mRem/hr per uCi/ml	
413						DAC	2.48628E-05	uCi/ml	
414									
415	Photon Emissions:								
416									
417	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity			
418	(keV)	(MeV)	(%)	Mode	hSkin (Gy per Bq s m^{-3})	Gy/s			
419									
420	4701.5	4.7015	0.01	b-	2.99173E-13	2.99173E-17			
421	4685.6	4.6856	0.008	b-	2.981E-13	2.3848E-17			
422	4655.6	4.6556	0.01	b-	2.96076E-13	2.96076E-17			
423	4631.5	4.6315	0.028	b-	2.94451E-13	8.24462E-17			
424	4489.2	4.4892	0.135	b-	2.84874E-13	3.8458E-16			
425	4478.3	4.4783	0.014	b-	2.84142E-13	3.97799E-17			
426	4448.1	4.4481	0.01	b-	2.82114E-13	2.82114E-17			
427	4405.1	4.4051	0.008	b-	2.7923E-13	2.23384E-17			
428	4368.4	4.3684	0.042	b-	2.7677E-13	1.16244E-16			
429	4341.1	4.3411	0.105	b-	2.74942E-13	2.88689E-16			
430	4321.2	4.3212	0.01	b-	2.7361E-13	2.7361E-17			
431	4307.4	4.3074	0.01	b-	2.72687E-13	2.72687E-17			
432	4279.4	4.2794	0.02	b-	2.70815E-13	5.41629E-17			
433	4267.7	4.2677	0.028	b-	2.70033E-13	7.56091E-17			
434	4253.3	4.2533	0.014	b-	2.6907E-13	3.76699E-17			
435	4184.3	4.1843	0.05	b-	2.64465E-13	1.32232E-16			
436	4176.2	4.1762	0.012	b-	2.63925E-13	3.16709E-17			
437	4162.6	4.1626	0.028	b-	2.63018E-13	7.3645E-17			
438	4146.9	4.1469	0.016	b-	2.61971E-13	4.19154E-17			
439	4143	4.143	0.026	b-	2.61712E-13	6.8045E-17			
440	4117.7	4.1177	0.014	b-	2.60026E-13	3.64037E-17			
441	4081.4	4.0814	0.074	b-	2.5761E-13	1.90632E-16			
442	4048	4.048	0.117	b-	2.55389E-13	2.98805E-16			
443	4043.8	4.0438	0.02	b-	2.5511E-13	5.1022E-17			
444	4004.9	4.0049	0.028	b-	2.52525E-13	7.07071E-17			
445	3996	3.996	0.143	b-	2.51934E-13	3.60266E-16			
446	3977.5	3.9775	0.27	b-	2.50706E-13	6.76907E-16			
447	3977.5	3.9775	0.07	b-	2.50706E-13	1.75494E-16			
448	3965.5	3.9655	0.209	b-	2.4991E-13	5.22312E-16			
449	3923	3.923	0.42	b-	2.47092E-13	1.03779E-15			
450	3901.7	3.9017	0.135	b-	2.45681E-13	3.31669E-16			

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
451	3898.4	3.8984	0.034	b-	2.45462E-13	8.34571E-17			
452	3882.5	3.8825	0.04	b-	2.44409E-13	9.77636E-17			
453	3842.7	3.8427	0.111	b-	2.41775E-13	2.6837E-16			
454	3837.6	3.8376	0.082	b-	2.41438E-13	1.97979E-16			
455	3827.4	3.8274	0.139	b-	2.40763E-13	3.34661E-16			
456	3809.5	3.8095	0.02	b-	2.3958E-13	4.7916E-17			
457	3781.4	3.7814	0.133	b-	2.37723E-13	3.16172E-16			
458	3756.5	3.7565	0.016	b-	2.36079E-13	3.77726E-17			
459	3732.5	3.7325	0.14	b-	2.34495E-13	3.28293E-16			
460	3721.5	3.7215	0.048	b-	2.3377E-13	1.12209E-16			
461	3717.8	3.7178	0.84	b-	2.33526E-13	1.96162E-15			
462	3677.7	3.6777	0.066	b-	2.30882E-13	1.52382E-16			
463	3665.4	3.6654	0.084	b-	2.30072E-13	1.93261E-16			
464	3652.3	3.6523	0.058	b-	2.29209E-13	1.32941E-16			
465	3639.1	3.6391	0.038	b-	2.2834E-13	8.67694E-17			
466	3634.4	3.6344	0.038	b-	2.28031E-13	8.66518E-17			
467	3629.2	3.6292	0.08	b-	2.27689E-13	1.82151E-16			
468	3583.9	3.5839	0.259	b-	2.24709E-13	5.81998E-16			
469	3574	3.574	0.06	b-	2.24059E-13	1.34435E-16			
470	3567.9	3.5679	0.056	b-	2.23658E-13	1.25248E-16			
471	3532.88	3.53288	1.35	b-	2.21358E-13	2.98833E-15			
472	3503.6	3.5036	0.02	b-	2.19436E-13	4.38872E-17			
473	3463.3	3.4633	0.042	b-	2.16794E-13	9.10533E-17			
474	3439.6	3.4396	0.044	b-	2.15241E-13	9.47059E-17			
475	3399.9	3.3999	0.137	b-	2.12641E-13	2.91319E-16			
476	3371.1	3.3711	0.62	b-	2.10757E-13	1.3067E-15			
477	3361.7	3.3617	1.05	b-	2.10143E-13	2.2065E-15			
478	3351.9	3.3519	0.042	b-	2.09502E-13	8.79909E-17			
479	3347.4	3.3474	0.068	b-	2.09208E-13	1.42261E-16			
480	3340.8	3.3408	0.036	b-	2.08777E-13	7.51596E-17			
481	3321.9	3.3219	0.07	b-	2.07542E-13	1.45279E-16			
482	3317.9	3.3179	0.082	b-	2.07281E-13	1.6997E-16			
483	3300	3.3	0.038	b-	2.06112E-13	7.83226E-17			
484	3271.3	3.2713	0.054	b-	2.04239E-13	1.10289E-16			
485	3257	3.257	0.052	b-	2.03306E-13	1.05719E-16			
486	3219.84	3.21984	0.43	b-	2.00884E-13	8.63802E-16			
487	3213.2	3.2132	0.032	b-	2.00452E-13	6.41446E-17			
488	3172.1	3.1721	0.1	b-	1.97776E-13	1.97776E-16			
489	3159.8	3.1598	0.062	b-	1.96975E-13	1.22125E-16			
490	3154.4	3.1544	0.026	b-	1.96624E-13	5.11223E-17			
491	3140.26	3.14026	1.05	b-	1.95705E-13	2.0549E-15			
492	3107.26	3.10726	0.195	b-	1.9356E-13	3.77441E-16			
493	3098.8	3.0988	0.038	b-	1.9301E-13	7.33438E-17			
494	3049.7	3.0497	0.04	b-	1.89823E-13	7.5929E-17			
495	3029.16	3.02916	0.271	b-	1.8849E-13	5.10809E-16			

ATTACHMENT 4

Attachment 2

	A	B	C	D	E	F	G	H	I
496	3017.9	3.0179	0.26	b-	1.8776E-13	4.88176E-16			
497	2998.4	2.9984	0.044	b-	1.86496E-13	8.20584E-17			
498	2946.9	2.9469	0.078	b-	1.83161E-13	1.42866E-16			
499	2917.4	2.9174	0.03	b-	1.81253E-13	5.43759E-17			
500	2878.69	2.87869	0.33	b-	1.78751E-13	5.89878E-16			
501	2873.8	2.8738	0.096	b-	1.78435E-13	1.71298E-16			
502	2866.23	2.86623	1.75	b-	1.77946E-13	3.11406E-15			
503	2858.9	2.8589	0.054	b-	1.77473E-13	9.58352E-17			
504	2853.3	2.8533	0.24	b-	1.77111E-13	4.25067E-16			
505	2819.58	2.81958	0.133	b-	1.74935E-13	2.32663E-16			
506	2804.1	2.8041	0.04	b-	1.73936E-13	6.95746E-17			
507	2793.75	2.79375	0.68	b-	1.73269E-13	1.17823E-15			
508	2789.2	2.7892	0.052	b-	1.72976E-13	8.99474E-17			
509	2782.11	2.78211	0.76	b-	1.72519E-13	1.31114E-15			
510	2775.7	2.7757	0.03	b-	1.72106E-13	5.16317E-17			
511	2760.3	2.7603	0.046	b-	1.71113E-13	7.87122E-17			
512	2756.6	2.7566	0.066	b-	1.70875E-13	1.12778E-16			
513	2750.9	2.7509	0.125	b-	1.70508E-13	2.13135E-16			
514	2742.3	2.7423	0.028	b-	1.69954E-13	4.75872E-17			
515	2721.9	2.7219	0.036	b-	1.68641E-13	6.07108E-17			
516	2703.2	2.7032	0.034	b-	1.67438E-13	5.69289E-17			
517	2659.1	2.6591	0.086	b-	1.64603E-13	1.41558E-16			
518	2645.26	2.64526	0.42	b-	1.63714E-13	6.87597E-16			
519	2630.1	2.6301	0.14	b-	1.6274E-13	2.27836E-16			
520	2622.8	2.6228	0.022	b-	1.62271E-13	3.56997E-17			
521	2597.92	2.59792	0.109	b-	1.60675E-13	1.75135E-16			
522	2555.3	2.5553	0.034	b-	1.57942E-13	5.37002E-17			
523	2549.9	2.5499	0.03	b-	1.57596E-13	4.72787E-17			
524	2545.4	2.5454	0.05	b-	1.57307E-13	7.86536E-17			
525	2534.9	2.5349	0.094	b-	1.56635E-13	1.47236E-16			
526	2522	2.522	0.05	b-	1.55808E-13	7.79042E-17			
527	2510.8	2.5108	0.24	b-	1.55091E-13	3.72219E-16			
528	2503	2.503	0.05	b-	1.54592E-13	7.7296E-17			
529	2487.8	2.4878	0.024	b-	1.53619E-13	3.68686E-17			
530	2467.3	2.4673	0.016	b-	1.52308E-13	2.43693E-17			
531	2440.9	2.4409	0.046	b-	1.5062E-13	6.92854E-17			
532	2400.99	2.40099	0.72	b-	1.48071E-13	1.06611E-15			
533	2377.4	2.3774	0.8	b-	1.46566E-13	1.17252E-15			
534	2352.7	2.3527	0.28	b-	1.4499E-13	4.05972E-16			
535	2335.2	2.3352	0.1	b-	1.43875E-13	1.43875E-16			
536	2330	2.33	0.036	b-	1.43543E-13	5.16755E-17			
537	2321.7	2.3217	0.052	b-	1.43014E-13	7.43674E-17			
538	2285.6	2.2856	0.046	b-	1.40715E-13	6.4729E-17			
539	2280.2	2.2802	0.21	b-	1.40371E-13	2.9478E-16			
540	2249	2.249	0.08	b-	1.38386E-13	1.10709E-16			

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541	2239.8	2.2398	0.05	b-	1.37801E-13	6.89007E-17			
542	2232.6	2.2326	0.024	b-	1.37344E-13	3.29625E-17			
543	2207.2	2.2072	0.046	b-	1.35729E-13	6.24355E-17			
544	2195.8	2.1958	0.12	b-	1.35005E-13	1.62006E-16			
545	2190	2.19	0.026	b-	1.34637E-13	3.50056E-17			
546	2167.9	2.1679	0.042	b-	1.33234E-13	5.59582E-17			
547	2160.02	2.16002	0.53	b-	1.32734E-13	7.03489E-16			
548	2150.1	2.1501	0.02	b-	1.32104E-13	2.64209E-17			
549	2143.8	2.1438	0.064	b-	1.31705E-13	8.4291E-17			
550	2140.5	2.1405	0.062	b-	1.31495E-13	8.15271E-17			
551	2100.63	2.10063	0.94	b-	1.28968E-13	1.2123E-15			
552	2082.5	2.0825	0.058	b-	1.27819E-13	7.41353E-17			
553	2079.3	2.0793	0.03	b-	1.27617E-13	3.8285E-17			
554	2046.47	2.04647	0.263	b-	1.25539E-13	3.30167E-16			
555	2039.5	2.0395	0.018	b-	1.25098E-13	2.25176E-17			
556	2021.04	2.02104	0.245	b-	1.2393E-13	3.03629E-16			
557	2012.23	2.01223	1.57	b-	1.23373E-13	1.93696E-15			
558	2001.6	2.0016	0.036	b-	1.22701E-13	4.41724E-17			
559	1998.6	1.9986	0.119	b-	1.22512E-13	1.45789E-16			
560	1977.7	1.9777	0.038	b-	1.21191E-13	4.60526E-17			
561	1966.55	1.96655	0.133	b-	1.20487E-13	1.60248E-16			
562	1939.11	1.93911	0.64	b-	1.18755E-13	7.6003E-16			
563	1935.1	1.9351	0.034	b-	1.18502E-13	4.02906E-17			
564	1927.5	1.9275	0.111	b-	1.18022E-13	1.31005E-16			
565	1925.3	1.9253	0.016	b-	1.17883E-13	1.88613E-17			
566	1903.4	1.9034	1.05	b-	1.16502E-13	1.22327E-15			
567	1897.8	1.8978	0.03	b-	1.16149E-13	3.48448E-17			
568	1886.5	1.8865	0.034	b-	1.15437E-13	3.92486E-17			
569	1879.8	1.8798	0.159	b-	1.15015E-13	1.82874E-16			
570	1868.47	1.86847	0.197	b-	1.14301E-13	2.25173E-16			
571	1865.2	1.8652	0.08	b-	1.14095E-13	9.12761E-17			
572	1850.6	1.8506	0.05	b-	1.13176E-13	5.65879E-17			
573	1839.72	1.83972	0.35	b-	1.12491E-13	3.93718E-16			
574	1837.5	1.8375	0.12	b-	1.12351E-13	1.34821E-16			
575	1831.3	1.8313	0.086	b-	1.11961E-13	9.62864E-17			
576	1827.3	1.8273	0.064	b-	1.11709E-13	7.14939E-17			
577	1823.6	1.8236	0.066	b-	1.11476E-13	7.35744E-17			
578	1810.73	1.81073	0.141	b-	1.10667E-13	1.5604E-16			
579	1804.4	1.8044	0.03	b-	1.10269E-13	3.30806E-17			
580	1791.4	1.7914	0.046	b-	1.09451E-13	5.03476E-17			
581	1788.2	1.7882	0.107	b-	1.0925E-13	1.16898E-16			
582	1777.6	1.7776	0.76	b-	1.08584E-13	8.25238E-16			
583	1766.1	1.7661	0.048	b-	1.07861E-13	5.17734E-17			
584	1735.5	1.7355	0.056	b-	1.0594E-13	5.93262E-17			
585	1729.9	1.7299	0.03	b-	1.05588E-13	3.16764E-17			

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586	1721.29	1.72129	0.225	b-	1.05048E-13	2.36357E-16			
587	1710.7	1.7107	0.034	b-	1.04383E-13	3.54903E-17			
588	1707.9	1.7079	0.024	b-	1.04208E-13	2.50098E-17			
589	1693.7	1.6937	4.4	b-	1.03317E-13	4.54594E-15			
590	1692	1.692	0.26	b-	1.0321E-13	2.68347E-16			
591	1683.8	1.6838	0.133	b-	1.02696E-13	1.36586E-16			
592	1680.3	1.6803	0.084	b-	1.02477E-13	8.60805E-17			
593	1676.9	1.6769	0.141	b-	1.02264E-13	1.44192E-16			
594	1667.51	1.66751	0.129	b-	1.01675E-13	1.31161E-16			
595	1657.6	1.6576	0.04	b-	1.01054E-13	4.04216E-17			
596	1643.82	1.64382	0.34	b-	1.00191E-13	3.40649E-16			
597	1634.06	1.63406	0.82	b-	9.95797E-14	8.16554E-16			
598	1600.7	1.6007	0.072	b-	9.74918E-14	7.01941E-17			
599	1582.9	1.5829	0.09	b-	9.63785E-14	8.67406E-17			
600	1573.78	1.57378	0.191	b-	9.58082E-14	1.82994E-16			
601	1571.8	1.5718	0.068	b-	9.56844E-14	6.50654E-17			
602	1555.28	1.55528	0.153	b-	9.46519E-14	1.44817E-16			
603	1545.2	1.5452	0.1	b-	9.40221E-14	9.40221E-17			
604	1533.68	1.53368	5.1	b-	9.33025E-14	4.75843E-15			
605	1530.04	1.53004	3.34	b-	9.30752E-14	3.10871E-15			
606	1506.2	1.5062	0.113	b-	9.15869E-14	1.03493E-16			
607	1500.96	1.50096	1.33	b-	9.12599E-14	1.21376E-15			
608	1488.1	1.4881	0.094	b-	9.04576E-14	8.50301E-17			
609	1481.9	1.4819	0.044	b-	9.00708E-14	3.96312E-17			
610	1472.76	1.47276	6.9	b-	8.95008E-14	6.17556E-15			
611	1468.5	1.4685	0.19	b-	8.92352E-14	1.69547E-16			
612	1464.2	1.4642	0.179	b-	8.89671E-14	1.59251E-16			
613	1461.3	1.4613	0.123	b-	8.87863E-14	1.09207E-16			
614	1458.3	1.4583	0.074	b-	8.85993E-14	6.55635E-17			
615	1455.3	1.4553	0.052	b-	8.84123E-14	4.59744E-17			
616	1441.3	1.4413	0.02	b-	8.75399E-14	1.7508E-17			
617	1421.64	1.42164	0.225	b-	8.63152E-14	1.94209E-16			
618	1412.59	1.41259	0.265	b-	8.57517E-14	2.27242E-16			
619	1381.9	1.3819	0.058	b-	8.38417E-14	4.86282E-17			
620	1372.16	1.37216	0.127	b-	8.32359E-14	1.0571E-16			
621	1367.48	1.36748	0.149	b-	8.29448E-14	1.23588E-16			
622	1340.6	1.3406	0.195	b-	8.12738E-14	1.58484E-16			
623	1335.4	1.3354	0.13	b-	8.09506E-14	1.05236E-16			
624	1324.28	1.32428	3.08	b-	8.02598E-14	2.472E-15			
625	1308.9	1.3089	0.068	b-	7.93046E-14	5.39271E-17			
626	1302.7	1.3027	0.1	b-	7.89196E-14	7.89196E-17			
627	1298	1.298	0.044	b-	7.86278E-14	3.45963E-17			
628	1278.5	1.2785	0.032	b-	7.74176E-14	2.47736E-17			
629	1273.73	1.27373	1.37	b-	7.71217E-14	1.05657E-15			
630	1267.2	1.2672	0.024	b-	7.67166E-14	1.8412E-17			

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631	1251	1.251	0.038	b-	7.5712E-14	2.87706E-17			
632	1241.5	1.2415	0.088	b-	7.51231E-14	6.61083E-17			
633	1235.62	1.23562	0.6	b-	7.47586E-14	4.48552E-16			
634	1228.8	1.2288	0.145	b-	7.4336E-14	1.07787E-16			
635	1210.2	1.2102	0.022	b-	7.31837E-14	1.61004E-17			
636	1200.6	1.2006	0.018	b-	7.25892E-14	1.3066E-17			
637	1195.1	1.1951	0.084	b-	7.22486E-14	6.06888E-17			
638	1186.54	1.18654	0.185	b-	7.17187E-14	1.3268E-16			
639	1182.38	1.18238	0.167	b-	7.14612E-14	1.1934E-16			
640	1172.33	1.17233	0.98	b-	7.08393E-14	6.94225E-16			
641	1167.4	1.1674	0.034	b-	7.05343E-14	2.39816E-17			
642	1162.5	1.1625	0.215	b-	7.02311E-14	1.50997E-16			
643	1152.2	1.1522	0.064	b-	6.95941E-14	4.45402E-17			
644	1131.51	1.13151	0.161	b-	6.83149E-14	1.09987E-16			
645	1119.6	1.1196	0.38	b-	6.75788E-14	2.56799E-16			
646	1116.61	1.11661	1.67	b-	6.73941E-14	1.12548E-15			
647	1107.78	1.10778	2.93	b-	6.68485E-14	1.95866E-15			
648	1103.18	1.10318	0.9	b-	6.65644E-14	5.9908E-16			
649	1098.1	1.0981	0.064	b-	6.62507E-14	4.24004E-17			
650	1088.07	1.08807	0.36	b-	6.56313E-14	2.36273E-16			
651	1076.48	1.07648	0.24	b-	6.49158E-14	1.55798E-16			
652	1067.7	1.0677	0.068	b-	6.4374E-14	4.37743E-17			
653	1063.1	1.0631	0.07	b-	6.40901E-14	4.48631E-17			
654	1058.6	1.0586	0.03	b-	6.38125E-14	1.91438E-17			
655	1048.2	1.0482	0.062	b-	6.3171E-14	3.9166E-17			
656	1044.4	1.0444	0.41	b-	6.29366E-14	2.5804E-16			
657	1038.3	1.0383	0.03	b-	6.25605E-14	1.87681E-17			
658	1010.84	1.01084	0.109	b-	6.08678E-14	6.63459E-17			
659	997.37	0.99737	0.66	b-	6.0038E-14	3.96251E-16			
660	974.39	0.97439	0.98	b-	5.86229E-14	5.74505E-16			
661	969.7	0.9697	0.094	b-	5.83343E-14	5.48342E-17			
662	964.2	0.9642	0.058	b-	5.79957E-14	3.36375E-17			
663	960.42	0.96042	0.32	b-	5.77631E-14	1.84842E-16			
664	953.18	0.95318	0.107	b-	5.73176E-14	6.13299E-17			
665	944.19	0.94419	0.165	b-	5.67646E-14	9.36616E-17			
666	939.4	0.9394	0.066	b-	5.647E-14	3.72702E-17			
667	934.6	0.9346	0.038	b-	5.61748E-14	2.13464E-17			
668	930.95	0.93095	0.62	b-	5.59503E-14	3.46892E-16			
669	917.78	0.91778	0.074	b-	5.51407E-14	4.08041E-17			
670	904.27	0.90427	7.2	b-	5.43104E-14	3.91035E-15			
671	902.8	0.9028	0.8	b-	5.422E-14	4.3376E-16			
672	897	0.897	0.48	b-	5.38637E-14	2.58546E-16			
673	890.4	0.8904	0.3	b-	5.34582E-14	1.60375E-16			
674	887.9	0.8879	0.64	b-	5.33047E-14	3.4115E-16			
675	886.3	0.8863	0.2	b-	5.32064E-14	1.06413E-16			

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676	870.42	0.87042	0.161	b-	5.22313E-14	8.40924E-17			
677	867.08	0.86708	5.9	b-	5.20263E-14	3.06955E-15			
678	857.37	0.85737	0.287	b-	5.14303E-14	1.47605E-16			
679	844.7	0.8447	0.52	b-	5.06528E-14	2.63395E-16			
680	835.53	0.83553	1.11	b-	5.00903E-14	5.56002E-16			
681	826.75	0.82675	0.76	b-	4.95518E-14	3.76594E-16			
682	783.5	0.7835	0.022	b-	4.69011E-14	1.03182E-17			
683	776.49	0.77649	1.13	b-	4.64717E-14	5.25131E-16			
684	762.9	0.7629	0.92	b-	4.56396E-14	4.19884E-16			
685	762.9	0.7629	0.4	b-	4.56396E-14	1.82558E-16			
686	753.5	0.7535	0.092	b-	4.50642E-14	4.14591E-17			
687	747.4	0.7474	0.11	b-	4.46909E-14	4.916E-17			
688	738.39	0.73839	4.22	b-	4.41396E-14	1.86269E-15			
689	729.63	0.72963	0.3	b-	4.36037E-14	1.30811E-16			
690	716.2	0.7162	0.26	b-	4.27824E-14	1.11234E-16			
691	711	0.711	0.5	b-	4.24644E-14	2.12322E-16			
692	710.05	0.71005	0.78	b-	4.24063E-14	3.30769E-16			
693	707.01	0.70701	0.5	b-	4.22205E-14	2.11102E-16			
694	696.24	0.69624	1.79	b-	4.15622E-14	7.43963E-16			
695	687.3	0.6873	0.07	b-	4.10159E-14	2.87111E-17			
696	674.11	0.67411	0.233	b-	4.02101E-14	9.36896E-17			
697	671.4	0.6714	0.107	b-	4.00446E-14	4.28477E-17			
698	668.6	0.6686	0.042	b-	3.98736E-14	1.67469E-17			
699	665.72	0.66572	0.115	b-	3.96977E-14	4.56524E-17			
700	662.9	0.6629	0.078	b-	3.95255E-14	3.08299E-17			
701	660.5	0.6605	0.048	b-	3.9379E-14	1.89019E-17			
702	652.6	0.6526	0.038	b-	3.88967E-14	1.47807E-17			
703	629.75	0.62975	0.34	b-	3.75023E-14	1.27508E-16			
704	626.2	0.6262	0.6	b-	3.72857E-14	2.23714E-16			
705	610.2	0.6102	0.018	b-	3.63099E-14	6.53578E-18			
706	599.52	0.59952	0.088	b-	3.56587E-14	3.13797E-17			
707	586.03	0.58603	16.6	b-	3.48365E-14	5.78287E-15			
708	576.96	0.57696	5.7	b-	3.42839E-14	1.95418E-15			
709	557.3	0.5573	0.161	b-	3.30865E-14	5.32692E-17			
710	546.9	0.5469	0.03	b-	3.24533E-14	9.73598E-18			
711	542.2	0.5422	0.03	b-	3.21672E-14	9.65016E-18			
712	523.5	0.5235	0.034	b-	3.10292E-14	1.05499E-17			
713	510.1	0.5101	0.12	b-	3.02142E-14	3.6257E-17			
714	509.1	0.5091	0.15	b-	3.01533E-14	4.523E-17			
715	498.6	0.4986	1.15	b-	2.95149E-14	3.39421E-16			
716	497.38	0.49738	6.7	b-	2.94407E-14	1.97253E-15			
717	490.76	0.49076	0.32	b-	2.90383E-14	9.29225E-17			
718	488.5	0.4885	0.08	b-	2.89009E-14	2.31207E-17			
719	466.13	0.46613	0.8	b-	2.75416E-14	2.20333E-16			
720	465.4	0.4654	0.24	b-	2.74973E-14	6.59935E-17			

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721	438.08	0.43808	0.96	b-	2.58383E-14	2.48048E-16			
722	435.8	0.4358	0.096	b-	2.56999E-14	2.46719E-17			
723	428.5	0.4285	0.11	b-	2.52569E-14	2.77826E-17			
724	419.2	0.4192	0.038	b-	2.46926E-14	9.38318E-18			
725	411.42	0.41142	2.57	b-	2.42206E-14	6.2247E-16			
726	402.25	0.40225	0.32	b-	2.36644E-14	7.57262E-17			
727	380.7	0.3807	0.046	b-	2.23579E-14	1.02847E-17			
728	369.3	0.3693	1.39	b-	2.16671E-14	3.01173E-16			
729	364.88	0.36488	0.9	b-	2.13993E-14	1.92594E-16			
730	356.16	0.35616	4.16	b-	2.08711E-14	8.68237E-16			
731	354.1	0.3541	0.13	b-	2.07463E-14	2.69702E-17			
732	345.03	0.34503	1.19	b-	2.0197E-14	2.40345E-16			
733	338.2	0.3382	0.34	b-	1.97835E-14	6.72639E-17			
734	318.3	0.3183	0.044	b-	1.85791E-14	8.17478E-18			
735	304.7	0.3047	0.022	b-	1.77563E-14	3.90638E-18			
736	295.5	0.2955	0.016	b-	1.71999E-14	2.75198E-18			
737	286.3	0.2863	0.026	b-	1.66436E-14	4.32733E-18			
738	267.7	0.2677	0.084	b-	1.55193E-14	1.30362E-17			
739	264.35	0.26435	0.66	b-	1.53169E-14	1.01092E-16			
740	242.2	0.2422	0.012	b-	1.39789E-14	1.67747E-18			
741	220.95	0.22095	20.1	b-	1.26961E-14	2.55191E-15			
742	205.03	0.20503	0.125	b-	1.17354E-14	1.46693E-17			
743	197.5	0.1975	1.83	b-	1.12812E-14	2.06446E-16			
744	196.2	0.1962	0.22	b-	1.12028E-14	2.46462E-17			
745	83.4	0.0834	0.012	b-	4.40956E-15	5.29148E-19			
746	79.4	0.0794	0.028	b-	4.16904E-15	1.16733E-18			
747	76	0.076	0.008	b-	3.96462E-15	3.1717E-19			
748	74.9	0.0749	0.012	b-	3.89849E-15	4.67819E-19			
749									
750					Sum - SDE Photon	1.16405E-13	Gy/s per Bq/m3		
751						4.19059E-05	mRem/hr per Bq/m3		
752						1550517.397	mRem/hr per uCi/ml		
753					DAC	1.61237E-05	uCi/ml		
754									
755									
756					SUM - SDE Total	2556034.703	mRem/hr per uCi/ml		
757					DAC	9.78077E-06	uCi/ml		

ATTACHMENT 4

Attachment 3

ATTACHMENT 4

Attachment 3

	A	B	C	D	E	F	G	H
1	Kr-90							
2	T1/2	32.32s						
3								
4				Determination of DAC limited by EDE				
5	Gamma Emissions:							
6								
7	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity		
8	(keV)	(MeV)	(%)	Mode	hE (Gy per Bq s m^{-3})	Gy/s		
9								
10								
11	106.05	0.10605	0.4017	b-	4.52499E-15	1.82E-17		
12	120.92	0.12092	2.847	b-	5.27524E-15	1.50E-16		
13	121.82	0.12182	33.58	b-	5.32068E-15	1.79E-15		
14	180.66	0.18066	0.039	b-	8.29828E-15	3.24E-18		
15	220.82	0.22082	0.039	b-	1.03385E-14	4.03E-18		
16	227.76	0.22776	0.1248	b-	1.06917E-14	1.33E-17		
17	234.44	0.23444	2.613	b-	1.10319E-14	2.88E-16		
18	242.19	0.24219	10.02	b-	1.14268E-14	1.14E-15		
19	249.32	0.24932	1.342	b-	1.17903E-14	1.58E-16		
20	305.1	0.3051	0.0546	b-	1.46412E-14	7.99E-18		
21	309.07	0.30907	0.1365	b-	1.48445E-14	2.03E-17		
22	356	0.356	0.1053	b-	1.72535E-14	1.82E-17		
23	386.48	0.38648	0.1287	b-	1.88227E-14	2.42E-17		
24	392.6	0.3926	0.0234	b-	1.91383E-14	4.48E-18		
25	396.54	0.39654	0.0507	b-	1.93415E-14	9.81E-18		
26	419.12	0.41912	0.3198	b-	2.05073E-14	6.56E-17		
27	429.93	0.42993	0.1482	b-	2.10662E-14	3.12E-17		
28	433.47	0.43347	1.306	b-	2.12493E-14	2.78E-16		
29	433.9	0.4339	0.1014	b-	2.12715E-14	2.16E-17		
30	465.28	0.46528	0.0702	b-	2.2897E-14	1.61E-17		
31	470.34	0.47034	0.2379	b-	2.31594E-14	5.51E-17		
32	476.1	0.4761	0.1326	b-	2.34583E-14	3.11E-17		
33	492.63	0.49263	1.209	b-	2.43169E-14	2.94E-16		
34	498.59	0.49859	0.1521	b-	2.46267E-14	3.75E-17		
35	508	0.508	0.0624	b-	2.51161E-14	1.57E-17		
36	539.49	0.53949	30.81	b-	2.67566E-14	8.24E-15		
37	554.37	0.55437	5.07	b-	2.75332E-14	1.40E-15		
38	565.19	0.56519	0.2067	b-	2.80984E-14	5.81E-17		
39	569.2	0.5692	0.6045	b-	2.8308E-14	1.71E-16		
40	577.71	0.57771	0.0546	b-	2.8753E-14	1.57E-17		
41	585.86	0.58586	0.0507	b-	2.91795E-14	1.48E-17		
42	614.38	0.61438	0.2106	b-	3.06739E-14	6.46E-17		
43	619.08	0.61908	1.084	b-	3.09205E-14	3.35E-16		
44	621.3	0.6213	0.039	b-	3.1037E-14	1.21E-17		
45	626.49	0.62649	0.2847	b-	3.13095E-14	8.91E-17		
46	658.1	0.6581	0.0312	b-	3.29712E-14	1.03E-17		
47	661.23	0.66123	0.3315	b-	3.3136E-14	1.10E-16		
48	677.69	0.67769	0.3822	b-	3.4003E-14	1.30E-16		
49	690.72	0.69072	0.3978	b-	3.46902E-14	1.38E-16		

ATTACHMENT 4

Attachment 3

	A	B	C	D	E	F	G	H
50	705.47	0.70547	0.1248	b-	3.54689E-14	4.43E-17		
51	731.33	0.73133	1.486	b-	3.68362E-14	5.47E-16		
52	739	0.739	0.0234	b-	3.72422E-14	8.71E-18		
53	745.8	0.7458	0.0624	b-	3.76024E-14	2.35E-17		
54	925.49	0.92549	0.2223	b-	4.71876E-14	1.05E-16		
55	941.86	0.94186	1.338	b-	4.80672E-14	6.43E-16		
56	947.6	0.9476	0.0585	b-	4.83759E-14	2.83E-17		
57	967.33	0.96733	0.2145	b-	4.9438E-14	1.06E-16		
58	980.29	0.98029	0.1872	b-	5.01364E-14	9.39E-17		
59	1031.2	1.0312	0.0624	b-	5.28867E-14	3.30E-17		
60	1039.11	1.03911	0.4173	b-	5.3315E-14	2.22E-16		
61	1103.92	1.10392	0.3432	b-	5.68333E-14	1.95E-16		
62	1118.69	1.11869	39	b-	5.76374E-14	2.25E-14		
63	1165.56	1.16556	0.8268	b-	6.01951E-14	4.98E-16		
64	1240.34	1.24034	0.351	b-	6.42939E-14	2.26E-16		
65	1293.7	1.2937	0.0585	b-	6.72323E-14	3.93E-17		
66	1303.36	1.30336	0.0936	b-	6.77655E-14	6.34E-17		
67	1309.68	1.30968	0.2769	b-	6.81145E-14	1.89E-16		
68	1341.31	1.34131	0.156	b-	6.98637E-14	1.09E-16		
69	1386.62	1.38662	0.195	b-	7.23764E-14	1.41E-16		
70	1423.77	1.42377	2.937	b-	7.44427E-14	2.19E-15		
71	1460.6	1.4606	0.0663	b-	7.64967E-14	5.07E-17		
72	1466.26	1.46626	0.2457	b-	7.68128E-14	1.89E-16		
73	1530.5	1.5305	0.039	b-	8.04099E-14	3.14E-17		
74	1537.85	1.53785	9.672	b-	8.08225E-14	7.82E-15		
75	1552.18	1.55218	2.196	b-	8.16275E-14	1.79E-15		
76	1620.22	1.62022	0.1521	b-	8.54612E-14	1.30E-16		
77	1658.18	1.65818	1.326	b-	8.76081E-14	1.16E-15		
78	1692.6	1.6926	0.078	b-	8.95598E-14	6.99E-17		
79	1695.2	1.6952	0.01287	b-	8.97074E-14	1.15E-17		
80	1751	1.751	0.0585	b-	9.2882E-14	5.43E-17		
81	1780.04	1.78004	6.708	b-	9.45391E-14	6.34E-15		
82	1819.1	1.8191	0.0741	b-	9.67732E-14	7.17E-17		
83	1885.42	1.88542	0.2262	b-	1.00581E-13	2.28E-16		
84	1899.61	1.89961	0.1911	b-	1.01398E-13	1.94E-16		
85	1980.99	1.98099	0.1716	b-	1.06098E-13	1.82E-16		
86	2006	2.006	0.117	b-	1.07548E-13	1.26E-16		
87	2127.52	2.12752	1.377	b-	1.14629E-13	1.58E-15		
88	2149.51	2.14951	0.2769	b-	1.15916E-13	3.21E-16		
89	2160.9	2.1609	0.03159	b-	1.16584E-13	3.68E-17		
90	2191.46	2.19146	0.1131	b-	1.18378E-13	1.34E-16		
91	2205.06	2.20506	0.039	b-	1.19178E-13	4.65E-17		
92	2352.7	2.3527	0.0897	b-	1.27905E-13	1.15E-16		
93	2417.33	2.41733	0.1911	b-	1.31753E-13	2.52E-16		
94	2421.5	2.4215	0.0507	b-	1.32002E-13	6.69E-17		
95	2432.78	2.43278	0.1521	b-	1.32676E-13	2.02E-16		
96	2468.56	2.46856	0.468	b-	1.34816E-13	6.31E-16		
97	2479.4	2.4794	0.039	b-	1.35465E-13	5.28E-17		
98	2497.6	2.4976	0.0156	b-	1.36556E-13	2.13E-17		

ATTACHMENT 4

Attachment 3

	A	B	C	D	E	F	G	H
99	2726.68	2.72668	0.8736	b-	1.50404E-13	1.31E-15		
100	2770.9	2.7709	0.0585	b-	1.53101E-13	8.96E-17		
101	2855.4	2.8554	0.3237	b-	1.58277E-13	5.12E-16		
102	2865.73	2.86573	0.1872	b-	1.58911E-13	2.97E-16		
103	2948.8	2.9488	0.039	b-	1.64031E-13	6.40E-17		
104	3010.3	3.0103	0.03081	b-	1.67839E-13	5.17E-17		
105	3205.1	3.2051	0.03471	b-	1.8E-13	6.25E-17		
106	3217.1	3.2171	0.01092	b-	1.80754E-13	1.97E-17		
107	3256.2	3.2562	0.02067	b-	1.83216E-13	3.79E-17		
108	3269	3.269	0.0663	b-	1.84023E-13	1.22E-16		
109	3344.3	3.3443	0.1131	b-	1.88784E-13	2.14E-16		
110	3465.1	3.4651	0.0351	b-	1.96469E-13	6.90E-17		
111	3855.3	3.8553	0.1209	b-	2.21692E-13	2.68E-16		
112	4166.5	4.1665	0.0312	b-	2.42244E-13	7.56E-17		
113								
114					Sum - EDE	6.84E-14	Gy/s per Bq/m3	
115						2.46E-05	mRem/hr per Bq/m3	
116						9.11E+05	mRem/hr per uCi/ml	
117					DAC	2.75E-06	uCi/ml	
118								
119								
120					Determination of DAC by SDE			
121	Beta Emissions:							
122								
123	Endpoint	Energy	Avg. Beta	Intensity	Decay	Interpelated Beta Skin Dose Factor	Dose Rate per Unit Activity	
124	Energy (keV)	(MeV)	Energy (MeV)	(%)	Mode	(pSv s^{-1} per Bq m^{-3})	pSv/s	
125								
126	4392	4.392	1.44936	29	b-	0.104194815	0.030216496	
127	4270.21	4.27021	1.4091693	1.5	b-	0.100965888	0.001514488	
128	4164.17	4.16417	1.3741761	0.2	b-	0.098161387	0.000196323	
129	4035.77	4.03577	1.3318041	0.29	b-	0.094774219	0.000274845	
130	3777.58	3.77758	1.2466014	0.2	b-	0.087992768	0.000175986	
131	3715.9	3.7159	1.226247	0.1	b-	0.086378691	8.63787E-05	
132	3679.54	3.67954	1.2142482	0.2	b-	0.085428298	0.000170857	
133	3651.13	3.65113	1.2048729	0.34	b-	0.084686275	0.000287933	
134	3553.8	3.5538	1.172754	0.15	b-	0.082147991	0.000123222	
135	3458.92	3.45892	1.1414436	0.58	b-	0.079679344	0.00046214	
136	2991.4	2.9914	0.987162	0.082	b-	0.067600432	5.54324E-05	
137	2929.03	2.92903	0.9665799	0.029	b-	0.066000052	1.914E-05	
138	2703.83	2.70383	0.8922639	0.18	b-	0.06024384	0.000108439	
139	2611.99	2.61199	0.8619567	65	b-	0.057906553	0.037639259	
140	2490.37	2.49037	0.8218221	0.35	b-	0.054820621	0.000191872	
141	2264.42	2.26442	0.7472586	2.29	b-	0.049115925	0.001124755	
142	2120.66	2.12066	0.6998178	0.1	b-	0.045505965	4.5506E-05	
143	1958.41	1.95841	0.6462753	0.3	b-	0.041450425	0.000124351	
144	1308.93	1.30893	0.4319469	2.07	b-	0.025422306	0.000526242	
145	1298.26	1.29826	0.4284258	0.69	b-	0.025161823	0.000173617	
146	1153.32	1.15332	0.3805956	0.19	b-	0.021632806	4.11023E-05	
147	916.4	0.9164	0.302412	0.036	b-	0.015902291	5.7248E-06	

ATTACHMENT 4

Attachment 3

	A	B	C	D	E	F	G	H
148	766.8	0.7668	0.253044	0.105	b-	0.012308455	1.29239E-05	
149	688.02	0.68802	0.2270466	0.17	b-	0.010423769	1.77204E-05	
150	513.4	0.5134	0.169422	0.069	b-	0.006265732	4.32336E-06	
151	510.7	0.5107	0.168531	0.148	b-	0.006201652	9.17845E-06	
152								
153						SUM - SDE Beta	0.073608255	(pSv s-1 per Bq m-3)
154							2.6499E-05	mRem/hr per Bq/m3
155							980461.9581	mRem/hr per uCi/ml
156						DAC	2.54982E-05	uCi/ml
157								
158	Photon Emissions:							
159								
160	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity		
161	(keV)	(MeV)	(%)	Mode	hSkin (Gy per Bq s m^{-3})	Gy/s		
162								
163	15.2	0.0152	0.001	X-Ray	3.12185E-16	3.12185E-21		
164	15.185	0.015185	0.0331	X-Ray	3.11284E-16	1.03035E-19		
165	15.089	0.015089	0.0007	X-Ray	3.05522E-16	2.13865E-21		
166	14.961	0.014961	0.211	X-Ray	2.97839E-16	6.2844E-19		
167	14.952	0.014952	0.109	X-Ray	2.97299E-16	3.24056E-19		
168	13.395	0.013395	1.49	X-Ray	2.03844E-16	3.03727E-18		
169	13.336	0.013336	0.77	X-Ray	2.00302E-16	1.54233E-18		
170	2.051	0.002051	0.0004	X-Ray	-4.76937E-16	0.00E+00		
171	2.05	0.00205	0.0002	X-Ray	-4.76997E-16	0.00E+00		
172	1.827	0.001827	0.0022	X-Ray	-4.90377E-16	0.00E+00		
173	1.818	0.001818	0.0015	X-Ray	-4.90917E-16	0.00E+00		
174	1.775	0.001775	0.0003	X-Ray	-4.93497E-16	0.00E+00		
175	1.752	0.001752	0.032	X-Ray	-4.94878E-16	0.00E+00		
176	1.694	0.001694	0.056	X-Ray	-4.98358E-16	0.00E+00		
177	1.693	0.001693	0.0062	X-Ray	-4.98418E-16	0.00E+00		
178	1.542	0.001542	0.0016	X-Ray	-5.07478E-16	0.00E+00		
179	1.482	0.001482	0.0029	X-Ray	-5.11078E-16	0.00E+00		
180								
181					Sum - SDE Photon	5.64039E-18	Gy/s per Bq/m3	
182						2.03054E-09	mRem/hr per Bq/m3	
183						75.12997007	mRem/hr per uCi/ml	
184					DAC	3.33E-01	uCi/ml	
185								
186								
187					SUM - SDE Total	980537.0881	mRem/hr per uCi/ml	
188					DAC	2.54962E-05	uCi/ml	

ATTACHMENT 4

Attachment 4

ATTACHMENT 4

Attachment 4

	A	B	C	D	E	F	G	H
1	Xe-137							
2	T1/2	3.818m						
3								
4	Determination of DAC limited by EDE							
5	Photon Emissions:							
6								
7	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity		
8	(keV)	(MeV)	(%)	Mode	hE (Gy per Bq s m^{-3})	Gy/s		
9								
10	3976.4	3.9764	0.0003	b-	2.29644E-13	6.88931E-19		
11	3955.5	3.9555	0.0003	b-	2.28267E-13	6.84801E-19		
12	3940.7	3.9407	0.0002	b-	2.27293E-13	4.54586E-19		
13	3907.1	3.9071	0.0013	b-	2.25086E-13	2.92612E-18		
14	3736.9	3.7369	0.0003	b-	2.13974E-13	6.41922E-19		
15	3694	3.694	0.0062	b-	2.11191E-13	1.30939E-17		
16	3583.7	3.5837	0.002	b-	2.04071E-13	4.08142E-18		
17	3476.3	3.4763	0.0009	b-	1.97184E-13	1.77466E-18		
18	3458.3	3.4583	0.0013	b-	1.96035E-13	2.54845E-18		
19	3451.8	3.4518	0.0005	b-	1.9562E-13	9.78099E-19		
20	3377.4	3.3774	0.002	b-	1.90884E-13	3.81767E-18		
21	3250	3.25	0.0011	b-	1.82825E-13	2.01108E-18		
22	3194	3.194	0.0009	b-	1.79303E-13	1.61373E-18		
23	3159.4	3.1594	0.0119	b-	1.77134E-13	2.10789E-17		
24	3135.6	3.1356	0.0004	b-	1.75644E-13	7.02576E-19		
25	3037.4	3.0374	0.0044	b-	1.69522E-13	7.45895E-18		
26	2921.9	2.9219	0.0178	b-	1.6237E-13	2.89019E-17		
27	2849.8	2.8498	0.184	b-	1.57933E-13	2.90596E-16		
28	2735.2	2.7352	0.0014	b-	1.50923E-13	2.11292E-18		
29	2638.9	2.6389	0.0009	b-	1.45073E-13	1.30565E-18		
30	2581.71	2.58171	0.0234	b-	1.41616E-13	3.31381E-17		
31	2528.6	2.5286	0.0015	b-	1.38418E-13	2.07626E-18		
32	2489.6	2.4896	0.0027	b-	1.36076E-13	3.67406E-18		
33	2463.3	2.4633	0.0007	b-	1.34501E-13	9.41505E-19		
34	2393.53	2.39353	0.081	b-	1.30334E-13	1.05571E-16		
35	2367.65	2.36765	0.0066	b-	1.28794E-13	8.50041E-18		
36	2311.1	2.3111	0.001	b-	1.25437E-13	1.25437E-18		
37	2304.5	2.3045	0.0006	b-	1.25046E-13	7.50279E-19		
38	2287.1	2.2871	0.0014	b-	1.24017E-13	1.73623E-18		
39	2255.3	2.2553	0.0025	b-	1.22138E-13	3.05344E-18		
40	2216.8	2.2168	0.0024	b-	1.19868E-13	2.87684E-18		
41	2212.1	2.2121	0.0041	b-	1.19592E-13	4.90326E-18		
42	2188.44	2.18844	0.0081	b-	1.18201E-13	9.57424E-18		
43	2119.4	2.1194	0.0017	b-	1.14154E-13	1.94061E-18		
44	2099.42	2.09942	0.0134	b-	1.12986E-13	1.51401E-17		
45	2096.4	2.0964	0.0072	b-	1.1281E-13	8.1223E-18		
46	2084.47	2.08447	0.0137	b-	1.12114E-13	1.53596E-17		
47	2068	2.068	0.0103	b-	1.11153E-13	1.14488E-17		
48	2043.6	2.0436	0.0018	b-	1.09733E-13	1.97519E-18		
49	2003.4	2.0034	0.0066	b-	1.07397E-13	7.08822E-18		

ATTACHMENT 4

Attachment 4

	A	B	C	D	E	F	G	H
50	2000.3	2.0003	0.0178	b-	1.07217E-13	1.90847E-17		
51	1974.9	1.9749	0.0012	b-	1.05745E-13	1.26895E-18		
52	1947	1.947	0.0027	b-	1.04132E-13	2.81155E-18		
53	1933.3	1.9333	0.0013	b-	1.0334E-13	1.34342E-18		
54	1916.31	1.91631	0.097	b-	1.0236E-13	9.92892E-17		
55	1907.7	1.9077	0.0053	b-	1.01864E-13	5.39877E-18		
56	1867.96	1.86796	0.0162	b-	9.95765E-14	1.61314E-17		
57	1843	1.843	0.0014	b-	9.81433E-14	1.37401E-18		
58	1783.43	1.78343	0.415	b-	9.47327E-14	3.93141E-16		
59	1761.3	1.7613	0.0059	b-	9.34694E-14	5.51469E-18		
60	1726.3	1.7263	0.0024	b-	9.14752E-14	2.19541E-18		
61	1720.9	1.7209	0.0011	b-	9.1168E-14	1.00285E-18		
62	1713.2	1.7132	0.0007	b-	9.07301E-14	6.35111E-19		
63	1677.2	1.6772	0.001	b-	8.8686E-14	8.8686E-19		
64	1665.3	1.6653	0.053	b-	8.80114E-14	4.66461E-17		
65	1651.14	1.65114	0.0044	b-	8.72095E-14	3.83722E-18		
66	1644	1.644	0.0009	b-	8.68055E-14	7.81249E-19		
67	1612.52	1.61252	0.125	b-	8.50264E-14	1.06283E-16		
68	1594	1.594	0.0031	b-	8.39817E-14	2.60343E-18		
69	1576.75	1.57675	0.103	b-	8.30098E-14	8.55001E-17		
70	1574.83	1.57483	0.072	b-	8.29017E-14	5.96892E-17		
71	1569.77	1.56977	0.085	b-	8.26169E-14	7.02243E-17		
72	1564	1.564	0.01	b-	8.22922E-14	8.22922E-18		
73	1518.8	1.5188	0.0019	b-	7.97535E-14	1.51532E-18		
74	1461.16	1.46116	0.0172	b-	7.6528E-14	1.31628E-17		
75	1327.98	1.32798	0.0293	b-	6.91261E-14	2.02539E-17		
76	1280.05	1.28005	0.0094	b-	6.64796E-14	6.24908E-18		
77	1273.23	1.27323	0.228	b-	6.61037E-14	1.50717E-16		
78	1250.6	1.2506	0.0066	b-	6.4858E-14	4.28063E-18		
79	1236.2	1.2362	0.0034	b-	6.40664E-14	2.17826E-18		
80	1232.1	1.2321	0.0016	b-	6.38411E-14	1.02146E-18		
81	1219	1.219	0.0028	b-	6.31219E-14	1.76741E-18		
82	1195.75	1.19575	0.048	b-	6.18471E-14	2.96866E-17		
83	1184.7	1.1847	0.084	b-	6.1242E-14	5.14433E-17		
84	1119.33	1.11933	0.107	b-	5.76723E-14	6.17094E-17		
85	1114.32	1.11432	0.092	b-	5.73994E-14	5.28075E-17		
86	1108.63	1.10863	0.051	b-	5.70896E-14	2.91157E-17		
87	1102.42	1.10242	0.0165	b-	5.67517E-14	9.36402E-18		
88	1067.4	1.0674	0.049	b-	5.48487E-14	2.68759E-17		
89	1066.6	1.0666	0.054	b-	5.48053E-14	2.95948E-17		
90	1009.9	1.0099	0.0041	b-	5.17348E-14	2.12113E-18		
91	982.25	0.98225	0.209	b-	5.02421E-14	1.05006E-16		
92	933.82	0.93382	0.084	b-	4.7635E-14	4.00134E-17		
93	848.95	0.84895	0.62	b-	4.30889E-14	2.67151E-16		
94	802.4	0.8024	0.0041	b-	4.06077E-14	1.66492E-18		
95	750.65	0.75065	0.0209	b-	3.78595E-14	7.91263E-18		
96	715.2	0.7152	0.0066	b-	3.5983E-14	2.37488E-18		
97	683.2	0.6832	0.0203	b-	3.42935E-14	6.96159E-18		
98	633.4	0.6334	0.0025	b-	3.16724E-14	7.9181E-19		

ATTACHMENT 4

Attachment 4

.	A	B	C	D	E	F	G	H
99	594.7	0.5947	0.084	b-	2.96423E-14	2.48996E-17		
100	482.14	0.48214	0.015	b-	2.37719E-14	3.56579E-18		
101	455.49	0.45549	31	b-	2.23894E-14	6.94073E-15		
102	393.35	0.39335	0.14	b-	1.91769E-14	2.68477E-17		
103	298	0.298	0.119	b-	1.42776E-14	1.69904E-17		
104	35.907	0.035907	0.0018	X-Ray	9.97929E-16	1.79627E-20		
105	35.818	0.035818	0.0087	X-Ray	9.93466E-16	8.64315E-20		
106	35.252	0.035252	0.0003	X-Ray	9.65085E-16	2.89526E-21		
107	34.987	0.034987	0.0281	X-Ray	9.51798E-16	2.67455E-19		
108	34.92	0.03492	0.0145	X-Ray	9.48439E-16	1.37524E-19		
109	30.973	0.030973	0.157	X-Ray	7.50569E-16	1.17839E-18		
110	30.625	0.030625	0.0848	X-Ray	7.33126E-16	6.21691E-19		
111	5.553	0.005553	0.0003	X-Ray	-5.22288E-16	0.00E+00		
112	5.542	0.005542	0.0002	X-Ray	-5.22839E-16	0.00E+00		
113	5.281	0.005281	0.0013	X-Ray	-5.35894E-16	0.00E+00		
114	4.934	0.004934	0.0028	X-Ray	-5.53251E-16	0.00E+00		
115	4.781	0.004781	0.0001	X-Ray	-5.60904E-16	0.00E+00		
116	4.717	0.004717	0.0013	X-Ray	-5.64105E-16	0.00E+00		
117	4.649	0.004649	0.0008	X-Ray	-5.67507E-16	0.00E+00		
118	4.62	0.00462	0.0088	X-Ray	-5.68957E-16	0.00E+00		
119	4.286	0.004286	0.0139	X-Ray	-5.85663E-16	0.00E+00		
120	4.272	0.004272	0.0015	X-Ray	-5.86364E-16	0.00E+00		
121	4.142	0.004142	0.0003	X-Ray	-5.92866E-16	0.00E+00		
122	3.795	0.003795	0.0006	X-Ray	-6.10221E-16	0.00E+00		
123								
124					Sum - EDE	9.50155E-15	Gy/s per Bq/m3	
125						3.42056E-06	mRem/hr per Bq/m3	
126						126560.6737	mRem/hr per uCi/ml	
127					DAC	1.97534E-05	uCi/ml	
128								
129								
130					**Determination of DAC by SDE**			
131	Beta Emissions:							
132								
133	Endpoint	Energy	Avg. Beta	Intensity	Decay	Interpelated Beta Skin Dose Factor	Dose Rate per Unit Activity	
134	Energy (keV)	(MeV)	Energy (MeV)	(%)	Mode	(pSv s^{-1} per Bq m^{-3})	pSv/s	
135								
136	4173	4.173	1.37709	67	b-	0.098394673	0.065924431	
137	3717.51	3.71751	1.2267783	30	b-	0.086420792	0.025926238	
138	3324.1	3.3241	1.096953	0.65	b-	0.076181414	0.000495179	
139	2988.29	2.98829	0.9861357	0.02	b-	0.067520568	1.35041E-05	
140	2899.8	2.8998	0.956934	0.04	b-	0.06525094	2.61004E-05	
141	2608.87	2.60887	0.8609271	0.066	b-	0.057827255	3.8166E-05	
142	2598.16	2.59816	0.8573928	0.17	b-	0.057555103	9.78437E-05	
143	2521.76	2.52176	0.8321808	0.051	b-	0.055616081	2.83642E-05	
144	2389.53	2.38953	0.7885449	0.38	b-	0.052270041	0.000198626	
145	2305.13	2.30513	0.7606929	0.03	b-	0.050140989	1.50423E-05	
146	2256.73	2.25673	0.7447209	0.073	b-	0.048922431	3.57134E-05	
147	2104.97	2.10497	0.6946401	0.14	b-	0.045112912	6.31581E-05	

ATTACHMENT 4

Attachment 4

	A	B	C	D	E	F	G	H
148	2073.59	2.07359	0.6842847	0.003	b-	0.044327362	1.32982E-06	
149	1956.2	1.9562	0.645546	0.005	b-	0.041395323	2.06977E-06	
150	1805.16	1.80516	0.5957028	0.003	b-	0.037638396	1.12915E-06	
151	1377.1	1.3771	0.454443	0.004	b-	0.02708872	1.08355E-06	
152	1323.89	1.32389	0.4368837	0.1	b-	0.025787676	2.57877E-05	
153	1322.96	1.32296	0.4365768	0.72	b-	0.025764957	0.000185508	
154	1227.81	1.22781	0.4051773	0.01	b-	0.023444318	2.34443E-06	
155	1135.69	1.13569	0.3747777	0.036	b-	0.021204742	7.63371E-06	
156	1068.8	1.0688	0.352704	0.006	b-	0.019583002	1.17498E-06	
157	1013.5	1.0135	0.334455	0.013	b-	0.018245111	2.37186E-06	
158	795.54	0.79554	0.2625282	0.027	b-	0.012997361	3.50929E-06	
159	588.9	0.5889	0.194337	0.0056	b-	0.00806022	4.51372E-07	
160	478.9	0.4789	0.158037	0.0062	b-	0.005447425	3.3774E-07	
161	436.3	0.4363	0.143979	0.001	b-	0.004438464	4.43846E-08	
162	386.1	0.3861	0.127413	0.011	b-	0.003251596	3.57676E-07	
163	349	0.349	0.11517	0.0061	b-	0.00237591	1.4493E-07	
164	265.84	0.26584	0.0877272	0.0018	b-	0.000417591	7.51663E-09	
165	234.8	0.2348	0.077484	0.0011	b-	-0.000311748	0.00E+00	
166	232.2	0.2322	0.076626	0.0002	b-	-0.000372799	0.00E+00	
167	220.59	0.22059	0.0727947	0.03	b-	-0.000645342	0.00E+00	
168	217.3	0.2173	0.071709	0.0009	b-	-0.000722552	0.00E+00	
169	196.6	0.1966	0.064878	0.0003	b-	-0.001208111	0.00E+00	
170								
171						SUM - SDE Beta	0.093097652	(pSv s-1 per Bq m-3)
172							3.35152E-05	mRem/hr per Bq/m3
173							1240060.719	mRem/hr per uCi/ml
174						DAC	2.01603E-05	uCi/ml
175								
176	Photon Emissions:							
177								
178	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity		
179	(keV)	(MeV)	(%)	Mode	hSkin (Gy per Bq s m^{-3})	Gy/s		
180								
181	35.907	0.035907	0.0018	X-Ray	1.55545E-15	2.79981E-20		
182	35.818	0.035818	0.0087	X-Ray	1.55011E-15	1.34859E-19		
183	35.252	0.035252	0.0003	X-Ray	1.51611E-15	4.54834E-21		
184	34.987	0.034987	0.0281	X-Ray	1.5002E-15	4.21556E-19		
185	34.92	0.03492	0.0145	X-Ray	1.49618E-15	2.16945E-19		
186	30.973	0.030973	0.157	X-Ray	1.25915E-15	1.97686E-18		
187	30.625	0.030625	0.0848	X-Ray	1.23825E-15	1.05004E-18		
188	5.553	0.005553	0.0003	X-Ray	-2.66795E-16	0.00E+00		
189	5.542	0.005542	0.0002	X-Ray	-2.67455E-16	0.00E+00		
190	5.281	0.005281	0.0013	X-Ray	-2.83118E-16	0.00E+00		
191	4.934	0.004934	0.0028	X-Ray	-3.03941E-16	0.00E+00		
192	4.781	0.004781	0.0001	X-Ray	-3.13122E-16	0.00E+00		
193	4.717	0.004717	0.0013	X-Ray	-3.16962E-16	0.00E+00		
194	4.649	0.004649	0.0008	X-Ray	-3.21043E-16	0.00E+00		
195	4.62	0.00462	0.0088	X-Ray	-3.22783E-16	0.00E+00		
196	4.286	0.004286	0.0139	X-Ray	-3.42825E-16	0.00E+00		

ATTACHMENT 4

Attachment 4

	A	B	C	D	E	F	G	H
197	4.272	0.004272	0.0015	X-Ray	-3.43665E-16	0.00E+00		
198	4.142	0.004142	0.0003	X-Ray	-3.51466E-16	0.00E+00		
199	3.795	0.003795	0.0006	X-Ray	-3.72288E-16	0.00E+00		
200								
201					Sum - SDE Photon	3.8328E-18	Gy/s per Bq/m3	
202						1.37981E-09	mRem/hr per Bq/m3	
203						51.05296189	mRem/hr per uCi/ml	
204					DAC	4.90E-01	uCi/ml	
205								
206								
207					SUM - SDE Total	1240111.772	mRem/hr per uCi/ml	
208					DAC	2.01595E-05	uCi/ml	

ATTACHMENT 4

Attachment 5

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
1	Xe-139							
2	T1/2	39.68s						
3								
4					Determination of DAC limited by EDE			
5	Photon Emissions:							
6								
7	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity		
8	(keV)	(MeV)	(%)	Mode	hE (Gy per Bq s m^{-3})	Gy/s		
9								
10	3504.7	3.5047	0.067	b-	1.99001E-13	1.33331E-16		
11	3424.8	3.4248	0.073	b-	1.93899E-13	1.41546E-16		
12	3375.51	3.37551	0.151	b-	1.90764E-13	2.88053E-16		
13	3214.8	3.2148	0.039	b-	1.8061E-13	7.04379E-17		
14	3168.7	3.1687	0.062	b-	1.77716E-13	1.10184E-16		
15	3156.3	3.1563	0.045	b-	1.76939E-13	7.96228E-17		
16	3146.6	3.1466	0.062	b-	1.76332E-13	1.09326E-16		
17	3130.6	3.1306	0.08	b-	1.75331E-13	1.40265E-16		
18	3110.8	3.1108	0.039	b-	1.74094E-13	6.78967E-17		
19	3028.6	3.0286	0.067	b-	1.68975E-13	1.13213E-16		
20	2989.4	2.9894	0.073	b-	1.66543E-13	1.21576E-16		
21	2941.8	2.9418	0.078	b-	1.63598E-13	1.27607E-16		
22	2936.2	2.9362	0.056	b-	1.63253E-13	9.14214E-17		
23	2918.3	2.9183	0.123	b-	1.62148E-13	1.99442E-16		
24	2911.7	2.9117	0.067	b-	1.61741E-13	1.08366E-16		
25	2903.8	2.9038	0.078	b-	1.61254E-13	1.25778E-16		
26	2886.6	2.8866	0.084	b-	1.60195E-13	1.34564E-16		
27	2872.65	2.87265	0.123	b-	1.59337E-13	1.95984E-16		
28	2854.2	2.8542	0.09	b-	1.58203E-13	1.42383E-16		
29	2832.8	2.8328	0.062	b-	1.5689E-13	9.72715E-17		
30	2815.03	2.81503	0.224	b-	1.558E-13	3.48993E-16		
31	2790.89	2.79089	0.269	b-	1.54323E-13	4.15128E-16		
32	2769.32	2.76932	0.297	b-	1.53004E-13	4.54423E-16		
33	2761.6	2.7616	0.067	b-	1.52533E-13	1.02197E-16		
34	2754.2	2.7542	0.067	b-	1.52081E-13	1.01894E-16		
35	2736.7	2.7367	0.118	b-	1.51014E-13	1.78197E-16		
36	2693.4	2.6934	0.078	b-	1.48379E-13	1.15735E-16		
37	2673.4	2.6734	0.056	b-	1.47164E-13	8.24119E-17		
38	2640.1	2.6401	0.034	b-	1.45145E-13	4.93494E-17		
39	2633.75	2.63375	0.106	b-	1.44761E-13	1.53446E-16		
40	2613.7	2.6137	0.034	b-	1.43548E-13	4.88063E-17		
41	2578.9	2.5789	0.062	b-	1.41446E-13	8.76968E-17		
42	2574.04	2.57404	0.34	b-	1.41153E-13	4.79921E-16		
43	2535	2.535	0.062	b-	1.38802E-13	8.60575E-17		
44	2510.41	2.51041	0.27	b-	1.37325E-13	3.70777E-16		
45	2507.6	2.5076	0.078	b-	1.37156E-13	1.06982E-16		
46	2464.6	2.4646	0.112	b-	1.34579E-13	1.50728E-16		
47	2451.6	2.4516	0.045	b-	1.33801E-13	6.02103E-17		
48	2437.8	2.4378	0.095	b-	1.32976E-13	1.26327E-16		
49	2430.3	2.4303	0.039	b-	1.32528E-13	5.16858E-17		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
50	2423.6	2.4236	0.045	b-	1.32128E-13	5.94575E-17		
51	2403.75	2.40375	0.263	b-	1.30944E-13	3.44381E-16		
52	2366.97	2.36697	0.134	b-	1.28754E-13	1.7253E-16		
53	2328.8	2.3288	0.63	b-	1.26487E-13	7.96866E-16		
54	2304.97	2.30497	0.29	b-	1.25074E-13	3.62715E-16		
55	2291.61	2.29161	0.4	b-	1.24283E-13	4.97134E-16		
56	2255.3	2.2553	0.09	b-	1.22138E-13	1.09924E-16		
57	2249.7	2.2497	0.067	b-	1.21807E-13	8.16109E-17		
58	2238.4	2.2384	0.146	b-	1.21141E-13	1.76866E-16		
59	2227.28	2.22728	0.37	b-	1.20486E-13	4.45797E-16		
60	2204.6	2.2046	0.045	b-	1.19151E-13	5.36177E-17		
61	2192.32	2.19232	0.34	b-	1.18429E-13	4.02657E-16		
62	2116.88	2.11688	0.319	b-	1.14006E-13	3.6368E-16		
63	2110.12	2.11012	0.34	b-	1.13611E-13	3.86278E-16		
64	2103.7	2.1037	0.056	b-	1.13236E-13	6.34122E-17		
65	2099.48	2.09948	0.157	b-	1.1299E-13	1.77394E-16		
66	2085.91	2.08591	0.627	b-	1.12198E-13	7.03479E-16		
67	2063.9	2.0639	0.392	b-	1.10914E-13	4.34784E-16		
68	2039.1	2.0391	0.078	b-	1.09471E-13	8.53873E-17		
69	2025.1	2.0251	0.056	b-	1.08657E-13	6.0848E-17		
70	2021.8	2.0218	0.101	b-	1.08465E-13	1.0955E-16		
71	2015.11	2.01511	0.174	b-	1.08077E-13	1.88054E-16		
72	2007.6	2.0076	0.112	b-	1.07641E-13	1.20558E-16		
73	2006.8	2.0068	0.112	b-	1.07594E-13	1.20506E-16		
74	1994.2	1.9942	0.084	b-	1.06864E-13	8.97655E-17		
75	1979.57	1.97957	0.521	b-	1.06016E-13	5.52343E-16		
76	1967.3	1.9673	0.123	b-	1.05306E-13	1.29526E-16		
77	1939.5	1.9395	0.095	b-	1.03698E-13	9.85134E-17		
78	1935.1	1.9351	0.112	b-	1.03444E-13	1.15858E-16		
79	1911.7	1.9117	0.118	b-	1.02094E-13	1.20471E-16		
80	1911.42	1.91142	0.118	b-	1.02078E-13	1.20452E-16		
81	1895.98	1.89598	0.599	b-	1.01188E-13	6.06119E-16		
82	1862.4	1.8624	0.297	b-	9.92571E-14	2.94793E-16		
83	1862.4	1.8624	0.073	b-	9.92571E-14	7.24577E-17		
84	1857.6	1.8576	0.112	b-	9.89814E-14	1.10859E-16		
85	1854.5	1.8545	0.13	b-	9.88033E-14	1.28444E-16		
86	1853.3	1.8533	0.19	b-	9.87344E-14	1.87595E-16		
87	1852.3	1.8523	0.095	b-	9.8677E-14	9.37432E-17		
88	1851.8	1.8518	0.095	b-	9.86483E-14	9.37159E-17		
89	1830.2	1.8302	0.078	b-	9.74093E-14	7.59792E-17		
90	1830.2	1.8302	0.034	b-	9.74093E-14	3.31191E-17		
91	1818.5	1.8185	0.151	b-	9.67389E-14	1.46076E-16		
92	1817.6	1.8176	0.151	b-	9.66873E-14	1.45998E-16		
93	1814.1	1.8141	0.123	b-	9.64869E-14	1.18679E-16		
94	1804.1	1.8041	0.112	b-	9.59146E-14	1.07424E-16		
95	1803.99	1.80399	0.112	b-	9.59083E-14	1.07417E-16		
96	1793	1.793	0.062	b-	9.52797E-14	5.90734E-17		
97	1790.85	1.79085	0.431	b-	9.51568E-14	4.10126E-16		
98	1786.6	1.7866	0.062	b-	9.49139E-14	5.88466E-17		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
99	1776.9	1.7769	0.185	b-	9.43597E-14	1.74566E-16		
100	1773.84	1.77384	0.302	b-	9.4185E-14	2.84439E-16		
101	1769	1.769	0.039	b-	9.39087E-14	3.66244E-17		
102	1765.2	1.7652	0.05	b-	9.36919E-14	4.68459E-17		
103	1765	1.765	0.05	b-	9.36805E-14	4.68402E-17		
104	1722.6	1.7226	0.106	b-	9.12647E-14	9.67406E-17		
105	1711.44	1.71144	0.28	b-	9.06301E-14	2.53764E-16		
106	1700.2	1.7002	0.16	b-	8.99914E-14	1.43986E-16		
107	1681.1	1.6811	0.19	b-	8.89072E-14	1.68924E-16		
108	1670.33	1.67033	1.103	b-	8.82965E-14	9.7391E-16		
109	1666.2	1.6662	0.045	b-	8.80624E-14	3.96281E-17		
110	1665.4	1.6654	0.045	b-	8.80171E-14	3.96077E-17		
111	1653.6	1.6536	0.26	b-	8.73488E-14	2.27107E-16		
112	1652.8	1.6528	0.11	b-	8.73035E-14	9.60338E-17		
113	1641.7	1.6417	0.157	b-	8.66754E-14	1.3608E-16		
114	1635.2	1.6352	0.073	b-	8.63078E-14	6.30047E-17		
115	1615	1.615	0.16	b-	8.51665E-14	1.36266E-16		
116	1613.8	1.6138	0.263	b-	8.50987E-14	2.2381E-16		
117	1612.4	1.6124	0.15	b-	8.50197E-14	1.2753E-16		
118	1611.6	1.6116	0.09	b-	8.49745E-14	7.64771E-17		
119	1608.7	1.6087	0.095	b-	8.48108E-14	8.05703E-17		
120	1584.7	1.5847	0.12	b-	8.34575E-14	1.00149E-16		
121	1579.5	1.5795	0.2	b-	8.31646E-14	1.66329E-16		
122	1543.6	1.5436	0.028	b-	8.11454E-14	2.27207E-17		
123	1540.1	1.5401	0.062	b-	8.09488E-14	5.01883E-17		
124	1520.17	1.52017	0.71	b-	7.98303E-14	5.66795E-16		
125	1503.1	1.5031	0.202	b-	7.88736E-14	1.59325E-16		
126	1490	1.49	0.21	b-	7.81402E-14	1.64094E-16		
127	1481.5	1.4815	0.067	b-	7.76647E-14	5.20353E-17		
128	1458.98	1.45898	0.25	b-	7.64062E-14	1.91016E-16		
129	1453.32	1.45332	0.487	b-	7.60903E-14	3.7056E-16		
130	1448.7	1.4487	0.14	b-	7.58325E-14	1.06165E-16		
131	1437.7	1.4377	0.11	b-	7.5219E-14	8.27409E-17		
132	1434.13	1.43413	0.246	b-	7.502E-14	1.84549E-16		
133	1428.7	1.4287	0.185	b-	7.47174E-14	1.38227E-16		
134	1416.94	1.41694	0.157	b-	7.40624E-14	1.16278E-16		
135	1416.5	1.4165	0.174	b-	7.40379E-14	1.28826E-16		
136	1404.16	1.40416	0.129	b-	7.33513E-14	9.46232E-17		
137	1386.19	1.38619	0.515	b-	7.23525E-14	3.72616E-16		
138	1367.19	1.36719	0.168	b-	7.12979E-14	1.19781E-16		
139	1362.91	1.36291	0.314	b-	7.10605E-14	2.2313E-16		
140	1351.6	1.3516	0.095	b-	7.04336E-14	6.6912E-17		
141	1344.93	1.34493	1.01	b-	7.00642E-14	7.07648E-16		
142	1324.38	1.32438	0.207	b-	6.8927E-14	1.42679E-16		
143	1316.4	1.3164	0.151	b-	6.84858E-14	1.03414E-16		
144	1309.4	1.3094	0.33	b-	6.80991E-14	2.24727E-16		
145	1309.4	1.3094	0.09	b-	6.80991E-14	6.12892E-17		
146	1299.8	1.2998	0.05	b-	6.7569E-14	3.37845E-17		
147	1297.85	1.29785	0.442	b-	6.74613E-14	2.98179E-16		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
148	1291.4	1.2914	0.17	b-	6.71054E-14	1.14079E-16		
149	1289.47	1.28947	0.493	b-	6.6999E-14	3.30305E-16		
150	1273.1	1.2731	0.045	b-	6.60966E-14	2.97435E-17		
151	1267	1.267	0.045	b-	6.57606E-14	2.95923E-17		
152	1259.26	1.25926	0.549	b-	6.53345E-14	3.58686E-16		
153	1242.88	1.24288	0.65	b-	6.44335E-14	4.18818E-16		
154	1233.8	1.2338	0.039	b-	6.39345E-14	2.49345E-17		
155	1228.8	1.2288	0.078	b-	6.36599E-14	4.96547E-17		
156	1219.33	1.21933	0.19	b-	6.314E-14	1.19966E-16		
157	1214.9	1.2149	0.073	b-	6.2897E-14	4.59148E-17		
158	1206.45	1.20645	0.19	b-	6.24335E-14	1.18624E-16		
159	1199.43	1.19943	0.18	b-	6.20488E-14	1.11688E-16		
160	1190.6	1.1906	0.08	b-	6.15651E-14	4.9252E-17		
161	1178.73	1.17873	0.34	b-	6.09153E-14	2.07112E-16		
162	1178.73	1.17873	0.028	b-	6.09153E-14	1.70563E-17		
163	1176.3	1.1763	0.078	b-	6.07824E-14	4.74102E-17		
164	1171.5	1.1715	0.146	b-	6.05198E-14	8.83589E-17		
165	1149.2	1.1492	0.14	b-	5.93013E-14	8.30218E-17		
166	1137.52	1.13752	0.36	b-	5.86639E-14	2.1119E-16		
167	1129.2	1.1292	0.078	b-	5.82102E-14	4.54039E-17		
168	1115	1.115	0.17	b-	5.74365E-14	9.7642E-17		
169	1114.8	1.1148	0.134	b-	5.74256E-14	7.69502E-17		
170	1105.6	1.1056	0.101	b-	5.69247E-14	5.74939E-17		
171	1099.4	1.0994	0.062	b-	5.65874E-14	3.50842E-17		
172	1067.56	1.06756	0.017	b-	5.48574E-14	9.32575E-18		
173	1046.31	1.04631	0.297	b-	5.3705E-14	1.59504E-16		
174	1036.3	1.0363	0.123	b-	5.31628E-14	6.53903E-17		
175	1022	1.022	0.039	b-	5.2389E-14	2.04317E-17		
176	1017.7	1.0177	0.09	b-	5.21564E-14	4.69408E-17		
177	1006.25	1.00625	0.258	b-	5.15376E-14	1.32967E-16		
178	1001.7	1.0017	0.062	b-	5.12918E-14	3.18009E-17		
179	996.19	0.99619	0.297	b-	5.09943E-14	1.51453E-16		
180	986.02	0.98602	0.302	b-	5.04455E-14	1.52345E-16		
181	980.8	0.9808	0.123	b-	5.01639E-14	6.17016E-17		
182	980.59	0.98059	0.123	b-	5.01526E-14	6.16877E-17		
183	970.3	0.9703	0.084	b-	4.9598E-14	4.16623E-17		
184	967.3	0.9673	0.067	b-	4.94363E-14	3.31223E-17		
185	960.6	0.9606	0.056	b-	4.90755E-14	2.74823E-17		
186	957.3	0.9573	0.067	b-	4.88978E-14	3.27616E-17		
187	946.5	0.9465	0.06	b-	4.83167E-14	2.899E-17		
188	942.61	0.94261	0.08	b-	4.81075E-14	3.8486E-17		
189	937.9	0.9379	0.067	b-	4.78543E-14	3.20624E-17		
190	926	0.926	0.034	b-	4.7215E-14	1.60531E-17		
191	924.5	0.9245	0.162	b-	4.71344E-14	7.63577E-17		
192	908.9	0.9089	0.218	b-	4.62972E-14	1.00928E-16		
193	896.3	0.8963	0.15	b-	4.56217E-14	6.84326E-17		
194	891.76	0.89176	0.174	b-	4.53785E-14	7.89585E-17		
195	888.6	0.8886	0.067	b-	4.52092E-14	3.02902E-17		
196	879.74	0.87974	0.157	b-	4.47349E-14	7.02338E-17		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
197	868.7	0.8687	0.056	b-	4.41443E-14	2.47208E-17		
198	847.45	0.84745	0.258	b-	4.30088E-14	1.10963E-16	\	
199	832.41	0.83241	0.073	b-	4.22063E-14	3.08106E-17		
200	820.5	0.8205	0.078	b-	4.15714E-14	3.24257E-17		
201	818.29	0.81829	0.274	b-	4.14537E-14	1.13583E-16		
202	801.62	0.80162	0.594	b-	4.05662E-14	2.40963E-16		
203	788.04	0.78804	3.53	b-	3.9844E-14	1.40649E-15		
204	786.7	0.7867	0.022	b-	3.97728E-14	8.75001E-18		
205	783.1	0.7831	0.062	b-	3.95815E-14	2.45405E-17		
206	775.6	0.7756	0.084	b-	3.91831E-14	3.29138E-17		
207	773.4	0.7734	0.112	b-	3.90663E-14	4.37543E-17		
208	772	0.772	0.056	b-	3.8992E-14	2.18355E-17		
209	761.04	0.76104	0.196	b-	3.84104E-14	7.52843E-17		
210	745.16	0.74516	0.47	b-	3.75685E-14	1.76572E-16		
211	732.42	0.73242	1.91	b-	3.68939E-14	7.04673E-16		
212	730.4	0.7304	0.151	b-	3.6787E-14	5.55483E-17		
213	723.84	0.72384	1.803	b-	3.64399E-14	6.57011E-16		
214	719.8	0.7198	0.07	b-	3.62262E-14	2.53584E-17		
215	716.96	0.71696	0.162	b-	3.60761E-14	5.84432E-17		
216	710.4	0.7104	0.196	b-	3.57293E-14	7.00295E-17		
217	699.6	0.6996	0.084	b-	3.51589E-14	2.95335E-17		
218	675.79	0.67579	0.162	b-	3.39029E-14	5.49227E-17		
219	672.39	0.67239	0.146	b-	3.37237E-14	4.92366E-17		
220	652.28	0.65228	0.269	b-	3.26649E-14	8.78687E-17		
221	646.5	0.6465	0.622	b-	3.23609E-14	2.01285E-16		
222	634.2	0.6342	0.034	b-	3.17144E-14	1.07829E-17		
223	626.89	0.62689	0.95	b-	3.13305E-14	2.9764E-16		
224	624.3	0.6243	0.095	b-	3.11945E-14	2.96348E-17		
225	612.82	0.61282	4.5	b-	3.05921E-14	1.37664E-15		
226	601.84	0.60184	1.2	b-	3.00164E-14	3.60197E-16		
227	595.43	0.59543	0.28	b-	2.96806E-14	8.31056E-17		
228	589.8	0.5898	0.084	b-	2.93857E-14	2.4684E-17		
229	585.6	0.5856	0.045	b-	2.91659E-14	1.31246E-17		
230	579.4	0.5794	0.056	b-	2.88414E-14	1.61512E-17		
231	569.64	0.56964	0.15	b-	2.8331E-14	4.24965E-17		
232	565.4	0.5654	0.09	b-	2.81094E-14	2.52984E-17		
233	549.02	0.54902	0.062	b-	2.72538E-14	1.68974E-17		
234	523.9	0.5239	0.045	b-	2.59439E-14	1.16748E-17		
235	518.8	0.5188	0.05	b-	2.56783E-14	1.28392E-17		
236	515.44	0.51544	0.37	b-	2.55034E-14	9.43624E-17		
237	513.88	0.51388	0.84	b-	2.54221E-14	2.13546E-16		
238	505.07	0.50507	0.358	b-	2.49637E-14	8.937E-17		
239	498.2	0.4982	0.045	b-	2.46064E-14	1.10729E-17		
240	491.47	0.49147	1.46	b-	2.42566E-14	3.54146E-16		
241	491.47	0.49147	0.34	b-	2.42566E-14	8.24724E-17		
242	482.6	0.4826	0.022	b-	2.37958E-14	5.23508E-18		
243	466.8	0.4668	0.073	b-	2.29758E-14	1.67723E-17		
244	454.46	0.45446	0.258	b-	2.23361E-14	5.76271E-17		
245	446.8	0.4468	0.101	b-	2.19393E-14	2.21587E-17		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
246	442.7	0.4427	0.179	b-	2.1727E-14	3.88913E-17		
247	441.3	0.4413	0.095	b-	2.16545E-14	2.05718E-17		
248	427.7	0.4277	0.073	b-	2.09509E-14	1.52941E-17		
249	393.5	0.3935	6.7	b-	1.91847E-14	1.28537E-15		
250	388.6	0.3886	0.062	b-	1.8932E-14	1.17379E-17		
251	356.72	0.35672	0.526	b-	1.72905E-14	9.0948E-17		
252	338.86	0.33886	0.622	b-	1.63727E-14	1.01838E-16		
253	326.8	0.3268	0.09	b-	1.57536E-14	1.41782E-17		
254	305	0.305	0.039	b-	1.46361E-14	5.70806E-18		
255	296.53	0.29653	21.7	b-	1.42024E-14	3.08191E-15		
256	289.78	0.28978	9.2	b-	1.38569E-14	1.27484E-15		
257	225.38	0.22538	3.02	b-	1.05706E-14	3.19232E-16		
258	218.59	0.21859	56	b-	1.02251E-14	5.72604E-15		
259	181.3	0.1813	0.14	b-	8.33074E-15	1.1663E-17		
260	174.97	0.17497	11.3	b-	8.00973E-15	9.05099E-16		
261	174.97	0.17497	8.6	b-	8.00973E-15	6.88837E-16		
262	121.37	0.12137	0.47	b-	5.29796E-15	2.49004E-17		
263	119.4	0.1194	0.067	b-	5.19851E-15	3.483E-18		
264	103.75	0.10375	0.314	b-	4.40903E-15	1.38443E-17		
265	71	0.071	0.202	b-	2.76008E-15	5.57537E-18		
266	55.7	0.0557	0.11	b-	1.9912E-15	2.19033E-18		
267	35.907	0.035907	0.056	X-Ray	9.97929E-16	5.5884E-19		
268	35.818	0.035818	0.273	X-Ray	9.93466E-16	2.71216E-18		
269	35.252	0.035252	0.0093	X-Ray	9.65085E-16	8.97529E-20		
270	34.987	0.034987	0.88	X-Ray	9.51798E-16	8.37582E-18		
271	34.92	0.03492	0.46	X-Ray	9.48439E-16	4.36282E-18		
272	30.973	0.030973	4.9	X-Ray	7.50569E-16	3.67779E-17		
273	30.625	0.030625	2.65	X-Ray	7.33126E-16	1.94278E-17		
274	30.27	0.03027	0.0003	X-Ray	7.15333E-16	2.146E-21		
275	5.553	0.005553	0.0096	X-Ray	-5.22288E-16	0.00E+00		
276	5.542	0.005542	0.0066	X-Ray	-5.22839E-16	0.00E+00		
277	5.281	0.005281	0.041	X-Ray	-5.35894E-16	0.00E+00		
278	4.934	0.004934	0.09	X-Ray	-5.53251E-16	0.00E+00		
279	4.781	0.004781	0.0036	X-Ray	-5.60904E-16	0.00E+00		
280	4.717	0.004717	0.041	X-Ray	-5.64105E-16	0.00E+00		
281	4.649	0.004649	0.024	X-Ray	-5.67507E-16	0.00E+00		
282	4.62	0.00462	0.29	X-Ray	-5.68957E-16	0.00E+00		
283	4.286	0.004286	0.45	X-Ray	-5.85663E-16	0.00E+00		
284	4.272	0.004272	0.05	X-Ray	-5.86364E-16	0.00E+00		
285	4.142	0.004142	0.0084	X-Ray	-5.92866E-16	0.00E+00		
286	3.795	0.003795	0.018	X-Ray	-6.10221E-16	0.00E+00		
287								
288					Sum - EDE	5.07429E-14	Gy/s per Bq/m3	
289						1.82674E-05	mRem/hr per Bq/m3	
290						675895.5897	mRem/hr per uCi/ml	
291					DAC	3.6988E-06	uCi/ml	
292								
293								
294	Determination of DAC by SDE							

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
295	Beta Emissions:							
296								
297	Endpoint	Energy	Avg. Beta	Intensity	Decay	Interpelated Beta Skin Dose Factor	Dose Rate per Unit Activity	
298	Energy (keV)	(MeV)	Energy (MeV)	(%)	Mode	(pSv s^{-1} per Bq m^{-3})	pSv/s	
299								
300	5057	5.057	1.66881	16	b-	0.121967285	0.019514766	
301	4838.36	4.83836	1.5966588	4.4	b-	0.116098361	0.005108328	
302	4767.22	4.76722	1.5731826	2	b-	0.114194068	0.002283881	
303	4663.51	4.66351	1.5389583	13.6	b-	0.111422706	0.015153488	
304	4662.99	4.66299	1.5387867	1.7	b-	0.111408824	0.00189395	
305	4541.79	4.54179	1.4987907	21.9	b-	0.108177413	0.023690853	
306	4410.48	4.41048	1.4554584	0.36	b-	0.104685488	0.000376868	
307	4346.71	4.34671	1.4344143	0.11	b-	0.102993101	0.000113292	
308	4324.64	4.32464	1.4271312	2.2	b-	0.102407917	0.002252974	
309	4165.41	4.16541	1.3745853	1.1	b-	0.098194145	0.001080136	
310	4114.5	4.1145	1.357785	1.2	b-	0.096849963	0.0011622	
311	4050.25	4.05025	1.3365825	8.8	b-	0.095155717	0.008373703	
312	4036.7	4.0367	1.332111	1.17	b-	0.094798717	0.001109145	
313	4019.83	4.01983	1.3265439	0.23	b-	0.094354398	0.000217015	
314	3842.14	3.84214	1.2679062	0.22	b-	0.0896847	0.000197306	
315	3661.74	3.66174	1.2083742	0.34	b-	0.084963333	0.000288875	
316	3645.3	3.6453	1.202949	0.11	b-	0.084534067	9.29875E-05	
317	3595.7	3.5957	1.186581	0.86	b-	0.08323998	0.000715864	
318	3548.75	3.54875	1.1710875	0.1	b-	0.082016453	8.20165E-05	
319	3457.06	3.45706	1.1408298	0.36	b-	0.079631007	0.000286672	
320	3404.24	3.40424	1.1233992	1.8	b-	0.078259251	0.001408667	
321	3363	3.363	1.10979	0.35	b-	0.077189479	0.000270163	
322	3338.6	3.3386	1.101738	0.57	b-	0.076557056	0.000436375	
323	3318.28	3.31828	1.0950324	1.3	b-	0.076030677	0.000988399	
324	3263.8	3.2638	1.077054	0.1	b-	0.074620729	7.46207E-05	
325	3239.4	3.2394	1.069002	0.084	b-	0.073989884	6.21515E-05	
326	3225.5	3.2255	1.064415	0.32	b-	0.073630684	0.000235618	
327	2993.25	2.99325	0.9877725	0.8	b-	0.067647942	0.000541184	
328	2957.39	2.95739	0.9759387	0.27	b-	0.066727425	0.000180164	
329	2953.31	2.95331	0.9745923	0.15	b-	0.066622748	9.99341E-05	
330	2937.29	2.93729	0.9693057	0.6	b-	0.066211846	0.000397271	
331	2871.47	2.87147	0.9475851	2.8	b-	0.064525454	0.001806713	
332	2752.28	2.75228	0.9082524	2.3	b-	0.061479266	0.001414023	
333	2728.24	2.72824	0.9003192	2.6	b-	0.060866064	0.001582518	
334	2684.01	2.68401	0.8857233	0.71	b-	0.059738925	0.000424146	
335	2633.5	2.6335	0.869055	0.06	b-	0.058453437	3.50721E-05	
336	2624.6	2.6246	0.866118	0.29	b-	0.058227118	0.000168859	
337	2546.5	2.5465	0.840345	1.84	b-	0.056243521	0.001034881	
338	2470.84	2.47084	0.8153772	0.96	b-	0.054326066	0.00052153	
339	2436.35	2.43635	0.8039955	0.79	b-	0.053453357	0.000422282	
340	2329.37	2.32937	0.7686921	0.2	b-	0.050751925	0.000101504	
341	2302.84	2.30284	0.7599372	0.78	b-	0.050083295	0.00039065	
342	2259.32	2.25932	0.7455756	1.08	b-	0.048987595	0.000529066	
343	2204.69	2.20469	0.7275477	0.29	b-	0.047614169	0.000138081	

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
344	2120.15	2.12015	0.6996495	0.24	b-	0.045493186	0.000109184	
345	2089.53	2.08953	0.6895449	0.82	b-	0.044726302	0.000366756	
346	2076.52	2.07652	0.6852516	0.26	b-	0.044400678	0.000115442	
347	1926.67	1.92667	0.6358011	0.26	b-	0.040659415	0.000105714	
348	1910.3	1.9103	0.630399	0.26	b-	0.040251753	0.000104655	
349	1900.87	1.90087	0.6272871	0.23	b-	0.040017011	9.20391E-05	
350	1847.99	1.84799	0.6098367	0.4	b-	0.038701941	0.000154808	
351	1684.28	1.68428	0.5558124	0.24	b-	0.03464448	8.31468E-05	
352	1681.57	1.68157	0.5549181	0.41	b-	0.034577491	0.000141768	
353	1552.31	1.55231	0.5122623	0.63	b-	0.031389097	0.000197751	
354	1311.53	1.31153	0.4328049	0.4	b-	0.025485793	0.000101943	
355	1280.98	1.28098	0.4227234	0.39	b-	0.024740173	9.64867E-05	
356	1241.8	1.2418	0.409794	0.18	b-	0.023785054	4.28131E-05	
357	1132.25	1.13225	0.3736425	0.27	b-	0.021121248	5.70274E-05	
358	829.33	1.2418	0.409794	0.17	b-	0.023785054	4.04346E-05	
359								
360						SUM - SDE Beta	0.099068158	(pSv s-1 per Bq m-3)
361							3.56645E-05	mRem/hr per Bq/m3
362							1319587.87	mRem/hr per uCi/ml
363						DAC	1.89453E-05	uCi/ml
364								
365	Photon Emissions:							
366								
367	Energy	Energy	Intensity	Decay	Interpelated Gamma Dose Factor	Dose Rate per Unit Activity		
368	(keV)	(MeV)	(%)	Mode	hSkin (Gy per Bq s m^{-3})	Gy/s		
369								
370	3504.7	3.5047	0.067	b-	2.19508E-13	1.47071E-16		
371	3424.8	3.4248	0.073	b-	2.14271E-13	1.56418E-16		
372	3375.51	3.37551	0.151	b-	2.11046E-13	3.18679E-16		
373	3214.8	3.2148	0.039	b-	2.00556E-13	7.82168E-17		
374	3168.7	3.1687	0.062	b-	1.97555E-13	1.22484E-16		
375	3156.3	3.1563	0.045	b-	1.96748E-13	8.85365E-17		
376	3146.6	3.1466	0.062	b-	1.96117E-13	1.21592E-16		
377	3130.6	3.1306	0.08	b-	1.95077E-13	1.56061E-16		
378	3110.8	3.1108	0.039	b-	1.9379E-13	7.5578E-17		
379	3028.6	3.0286	0.067	b-	1.88454E-13	1.26264E-16		
380	2989.4	2.9894	0.073	b-	1.85913E-13	1.35717E-16		
381	2941.8	2.9418	0.078	b-	1.82831E-13	1.42608E-16		
382	2936.2	2.9362	0.056	b-	1.82469E-13	1.02183E-16		
383	2918.3	2.9183	0.123	b-	1.81311E-13	2.23013E-16		
384	2911.7	2.9117	0.067	b-	1.80884E-13	1.21193E-16		
385	2903.8	2.9038	0.078	b-	1.80374E-13	1.40691E-16		
386	2886.6	2.8866	0.084	b-	1.79262E-13	1.5058E-16		
387	2872.65	2.87265	0.123	b-	1.78361E-13	2.19384E-16		
388	2854.2	2.8542	0.09	b-	1.77169E-13	1.59452E-16		
389	2832.8	2.8328	0.062	b-	1.75788E-13	1.08988E-16		
390	2815.03	2.81503	0.224	b-	1.74641E-13	3.91197E-16		
391	2790.89	2.79089	0.269	b-	1.73085E-13	4.65598E-16		
392	2769.32	2.76932	0.297	b-	1.71695E-13	5.09933E-16		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
393	2761.6	2.7616	0.067	b-	1.71197E-13	1.14702E-16		
394	2754.2	2.7542	0.067	b-	1.7072E-13	1.14383E-16		
395	2736.7	2.7367	0.118	b-	1.69594E-13	2.0012E-16		
396	2693.4	2.6934	0.078	b-	1.66808E-13	1.3011E-16		
397	2673.4	2.6734	0.056	b-	1.65522E-13	9.26921E-17		
398	2640.1	2.6401	0.034	b-	1.63382E-13	5.55499E-17		
399	2633.75	2.63375	0.106	b-	1.62974E-13	1.72753E-16		
400	2613.7	2.6137	0.034	b-	1.61687E-13	5.49736E-17		
401	2578.9	2.5789	0.062	b-	1.59455E-13	9.88618E-17		
402	2574.04	2.57404	0.34	b-	1.59143E-13	5.41086E-16		
403	2535	2.535	0.062	b-	1.56641E-13	9.71174E-17		
404	2510.41	2.51041	0.27	b-	1.55066E-13	4.18679E-16		
405	2507.6	2.5076	0.078	b-	1.54886E-13	1.20811E-16		
406	2464.6	2.4646	0.112	b-	1.52135E-13	1.70392E-16		
407	2451.6	2.4516	0.045	b-	1.51304E-13	6.80869E-17		
408	2437.8	2.4378	0.095	b-	1.50422E-13	1.42901E-16		
409	2430.3	2.4303	0.039	b-	1.49943E-13	5.84778E-17		
410	2423.6	2.4236	0.045	b-	1.49515E-13	6.72818E-17		
411	2403.75	2.40375	0.263	b-	1.48247E-13	3.89891E-16		
412	2366.97	2.36697	0.134	b-	1.459E-13	1.95506E-16		
413	2328.8	2.3288	0.63	b-	1.43467E-13	9.0384E-16		
414	2304.97	2.30497	0.29	b-	1.41949E-13	4.11651E-16		
415	2291.61	2.29161	0.4	b-	1.41098E-13	5.64391E-16		
416	2255.3	2.2553	0.09	b-	1.38787E-13	1.24908E-16		
417	2249.7	2.2497	0.067	b-	1.38431E-13	9.27487E-17		
418	2238.4	2.2384	0.146	b-	1.37712E-13	2.0106E-16		
419	2227.28	2.22728	0.37	b-	1.37005E-13	5.0692E-16		
420	2204.6	2.2046	0.045	b-	1.35564E-13	6.10039E-17		
421	2192.32	2.19232	0.34	b-	1.34784E-13	4.58266E-16		
422	2116.88	2.11688	0.319	b-	1.29998E-13	4.14693E-16		
423	2110.12	2.11012	0.34	b-	1.29569E-13	4.40536E-16		
424	2103.7	2.1037	0.056	b-	1.29162E-13	7.2331E-17		
425	2099.48	2.09948	0.157	b-	1.28895E-13	2.02365E-16		
426	2085.91	2.08591	0.627	b-	1.28035E-13	8.02782E-16		
427	2063.9	2.0639	0.392	b-	1.26642E-13	4.96436E-16		
428	2039.1	2.0391	0.078	b-	1.25072E-13	9.75564E-17		
429	2025.1	2.0251	0.056	b-	1.24187E-13	6.95446E-17		
430	2021.8	2.0218	0.101	b-	1.23978E-13	1.25218E-16		
431	2015.11	2.01511	0.174	b-	1.23555E-13	2.14986E-16		
432	2007.6	2.0076	0.112	b-	1.2308E-13	1.3785E-16		
433	2006.8	2.0068	0.112	b-	1.2303E-13	1.37793E-16		
434	1994.2	1.9942	0.084	b-	1.22233E-13	1.02676E-16		
435	1979.57	1.97957	0.521	b-	1.21309E-13	6.32021E-16		
436	1967.3	1.9673	0.123	b-	1.20534E-13	1.48257E-16		
437	1939.5	1.9395	0.095	b-	1.18779E-13	1.1284E-16		
438	1935.1	1.9351	0.112	b-	1.18502E-13	1.32722E-16		
439	1911.7	1.9117	0.118	b-	1.17026E-13	1.3809E-16		
440	1911.42	1.91142	0.118	b-	1.17008E-13	1.38069E-16		
441	1895.98	1.89598	0.599	b-	1.16035E-13	6.95047E-16		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
442	1862.4	1.8624	0.297	b-	1.13919E-13	3.38339E-16		
443	1862.4	1.8624	0.073	b-	1.13919E-13	8.31607E-17		
444	1857.6	1.8576	0.112	b-	1.13617E-13	1.27251E-16		
445	1854.5	1.8545	0.13	b-	1.13421E-13	1.47448E-16		
446	1853.3	1.8533	0.19	b-	1.13346E-13	2.15357E-16		
447	1852.3	1.8523	0.095	b-	1.13283E-13	1.07619E-16		
448	1851.8	1.8518	0.095	b-	1.13251E-13	1.07589E-16		
449	1830.2	1.8302	0.078	b-	1.11892E-13	8.72755E-17		
450	1830.2	1.8302	0.034	b-	1.11892E-13	3.80432E-17		
451	1818.5	1.8185	0.151	b-	1.11156E-13	1.67845E-16		
452	1817.6	1.8176	0.151	b-	1.11099E-13	1.67759E-16		
453	1814.1	1.8141	0.123	b-	1.10879E-13	1.36381E-16		
454	1804.1	1.8041	0.112	b-	1.1025E-13	1.2348E-16		
455	1803.99	1.80399	0.112	b-	1.10243E-13	1.23472E-16		
456	1793	1.793	0.062	b-	1.09552E-13	6.79222E-17		
457	1790.85	1.79085	0.431	b-	1.09417E-13	4.71586E-16		
458	1786.6	1.7866	0.062	b-	1.0915E-13	6.76727E-17		
459	1776.9	1.7769	0.185	b-	1.0854E-13	2.00799E-16		
460	1773.84	1.77384	0.302	b-	1.08348E-13	3.2721E-16		
461	1769	1.769	0.039	b-	1.08043E-13	4.2137E-17		
462	1765.2	1.7652	0.05	b-	1.07805E-13	5.39024E-17		
463	1765	1.765	0.05	b-	1.07792E-13	5.38961E-17		
464	1722.6	1.7226	0.106	b-	1:0513E-13	1.11438E-16		
465	1711.44	1.71144	0.28	b-	1.0443E-13	2.92403E-16		
466	1700.2	1.7002	0.16	b-	1.03725E-13	1.65959E-16		
467	1681.1	1.6811	0.19	b-	1.02527E-13	1.94801E-16		
468	1670.33	1.67033	1.103	b-	1.01852E-13	1.12343E-15		
469	1666.2	1.6662	0.045	b-	1.01593E-13	4.57168E-17		
470	1665.4	1.6654	0.045	b-	1.01543E-13	4.56943E-17		
471	1653.6	1.6536	0.26	b-	1.00804E-13	2.62089E-16		
472	1652.8	1.6528	0.11	b-	1.00753E-13	1.10829E-16		
473	1641.7	1.6417	0.157	b-	1.00058E-13	1.57091E-16		
474	1635.2	1.6352	0.073	b-	9.96511E-14	7.27453E-17		
475	1615	1.615	0.16	b-	9.83866E-14	1.57419E-16		
476	1613.8	1.6138	0.263	b-	9.83115E-14	2.58559E-16		
477	1612.4	1.6124	0.15	b-	9.82239E-14	1.47336E-16		
478	1611.6	1.6116	0.09	b-	9.81738E-14	8.83564E-17		
479	1608.7	1.6087	0.095	b-	9.79923E-14	9.30927E-17		
480	1584.7	1.5847	0.12	b-	9.6491E-14	1.15789E-16		
481	1579.5	1.5795	0.2	b-	9.61659E-14	1.92332E-16		
482	1543.6	1.5436	0.028	b-	9.39222E-14	2.62982E-17		
483	1540.1	1.5401	0.062	b-	9.37035E-14	5.80962E-17		
484	1520.17	1.52017	0.71	b-	9.24589E-14	6.56458E-16		
485	1503.1	1.5031	0.202	b-	9.13934E-14	1.84615E-16		
486	1490	1.49	0.21	b-	9.05761E-14	1.9021E-16		
487	1481.5	1.4815	0.067	b-	9.00459E-14	6.03307E-17		
488	1458.98	1.45898	0.25	b-	8.86417E-14	2.21604E-16		
489	1453.32	1.45332	0.487	b-	8.82889E-14	4.29967E-16		
490	1448.7	1.4487	0.14	b-	8.8001E-14	1.23201E-16		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
491	1437.7	1.4377	0.11	b-	8.73156E-14	9.60471E-17		
492	1434.13	1.43413	0.246	b-	8.70932E-14	2.14249E-16		
493	1428.7	1.4287	0.185	b-	8.67549E-14	1.60497E-16		
494	1416.94	1.41694	0.157	b-	8.60226E-14	1.35055E-16		
495	1416.5	1.4165	0.174	b-	8.59952E-14	1.49632E-16		
496	1404.16	1.40416	0.129	b-	8.52269E-14	1.09943E-16		
497	1386.19	1.38619	0.515	b-	8.41086E-14	4.33159E-16		
498	1367.19	1.36719	0.168	b-	8.29268E-14	1.39317E-16		
499	1362.91	1.36291	0.314	b-	8.26606E-14	2.59554E-16		
500	1351.6	1.3516	0.095	b-	8.19575E-14	7.78596E-17		
501	1344.93	1.34493	1.01	b-	8.15429E-14	8.23583E-16		
502	1324.38	1.32438	0.207	b-	8.0266E-14	1.66151E-16		
503	1316.4	1.3164	0.151	b-	7.97703E-14	1.20453E-16		
504	1309.4	1.3094	0.33	b-	7.93356E-14	2.61808E-16		
505	1309.4	1.3094	0.09	b-	7.93356E-14	7.14021E-17		
506	1299.8	1.2998	0.05	b-	7.87396E-14	3.93698E-17		
507	1297.85	1.29785	0.442	b-	7.86185E-14	3.47494E-16		
508	1291.4	1.2914	0.17	b-	7.82182E-14	1.32971E-16		
509	1289.47	1.28947	0.493	b-	7.80984E-14	3.85025E-16		
510	1273.1	1.2731	0.045	b-	7.70826E-14	3.46872E-17		
511	1267	1.267	0.045	b-	7.67042E-14	3.45169E-17		
512	1259.26	1.25926	0.549	b-	7.62242E-14	4.18471E-16		
513	1242.88	1.24288	0.65	b-	7.52086E-14	4.88856E-16		
514	1233.8	1.2338	0.039	b-	7.46458E-14	2.91119E-17		
515	1228.8	1.2288	0.078	b-	7.4336E-14	5.7982E-17		
516	1219.33	1.21933	0.19	b-	7.37492E-14	1.40124E-16		
517	1214.9	1.2149	0.073	b-	7.34748E-14	5.36366E-17		
518	1206.45	1.20645	0.19	b-	7.29514E-14	1.38608E-16		
519	1199.43	1.19943	0.18	b-	7.25167E-14	1.3053E-16		
520	1190.6	1.1906	0.08	b-	7.197E-14	5.7576E-17		
521	1178.73	1.17873	0.34	b-	7.12353E-14	2.422E-16		
522	1178.73	1.17873	0.028	b-	7.12353E-14	1.99459E-17		
523	1176.3	1.1763	0.078	b-	7.10849E-14	5.54463E-17		
524	1171.5	1.1715	0.146	b-	7.07879E-14	1.0335E-16		
525	1149.2	1.1492	0.14	b-	6.94085E-14	9.71719E-17		
526	1137.52	1.13752	0.36	b-	6.86864E-14	2.47271E-16		
527	1129.2	1.1292	0.078	b-	6.81721E-14	5.31742E-17		
528	1115	1.115	0.17	b-	6.72946E-14	1.14401E-16		
529	1114.8	1.1148	0.134	b-	6.72822E-14	9.01582E-17		
530	1105.6	1.1056	0.101	b-	6.67139E-14	6.7381E-17		
531	1099.4	1.0994	0.062	b-	6.63309E-14	4.11252E-17		
532	1067.56	1.06756	0.017	b-	6.43653E-14	1.09421E-17		
533	1046.31	1.04631	0.297	b-	6.30544E-14	1.87272E-16		
534	1036.3	1.0363	0.123	b-	6.24371E-14	7.67977E-17		
535	1022	1.022	0.039	b-	6.15556E-14	2.40067E-17		
536	1017.7	1.0177	0.09	b-	6.12906E-14	5.51615E-17		
537	1006.25	1.00625	0.258	b-	6.0585E-14	1.56309E-16		
538	1001.7	1.0017	0.062	b-	6.03047E-14	3.73889E-17		
539	996.19	0.99619	0.297	b-	5.99653E-14	1.78097E-16		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
540	986.02	0.98602	0.302	b-	5.9339E-14	1.79204E-16		
541	980.8	0.9808	0.123	b-	5.90176E-14	7.25916E-17		
542	980.59	0.98059	0.123	b-	5.90046E-14	7.25757E-17		
543	970.3	0.9703	0.084	b-	5.83712E-14	4.90318E-17		
544	967.3	0.9673	0.067	b-	5.81865E-14	3.8985E-17		
545	960.6	0.9606	0.056	b-	5.77742E-14	3.23536E-17		
546	957.3	0.9573	0.067	b-	5.75711E-14	3.85727E-17		
547	946.5	0.9465	0.06	b-	5.69067E-14	3.4144E-17		
548	942.61	0.94261	0.08	b-	5.66674E-14	4.53339E-17		
549	937.9	0.9379	0.067	b-	5.63777E-14	3.77731E-17		
550	926	0.926	0.034	b-	5.5646E-14	1.89196E-17		
551	924.5	0.9245	0.162	b-	5.55538E-14	8.99971E-17		
552	908.9	0.9089	0.218	b-	5.45949E-14	1.19017E-16		
553	896.3	0.8963	0.15	b-	5.38207E-14	8.0731E-17		
554	891.76	0.89176	0.174	b-	5.35418E-14	9.31627E-17		
555	888.6	0.8886	0.067	b-	5.33477E-14	3.5743E-17		
556	879.74	0.87974	0.157	b-	5.28036E-14	8.29016E-17		
557	868.7	0.8687	0.056	b-	5.21257E-14	2.91904E-17		
558	847.45	0.84745	0.258	b-	5.08215E-14	1.3112E-16		
559	832.41	0.83241	0.073	b-	4.98989E-14	3.64262E-17		
560	820.5	0.8205	0.078	b-	4.91686E-14	3.83515E-17		
561	818.29	0.81829	0.274	b-	4.90331E-14	1.34351E-16		
562	801.62	0.80162	0.594	b-	4.80113E-14	2.85187E-16		
563	788.04	0.78804	3.53	b-	4.71792E-14	1.66543E-15		
564	786.7	0.7867	0.022	b-	4.70971E-14	1.03614E-17		
565	783.1	0.7831	0.062	b-	4.68766E-14	2.90635E-17		
566	775.6	0.7756	0.084	b-	4.64172E-14	3.89905E-17		
567	773.4	0.7734	0.112	b-	4.62825E-14	5.18364E-17		
568	772	0.772	0.056	b-	4.61968E-14	2.58702E-17		
569	761.04	0.76104	0.196	b-	4.55257E-14	8.92305E-17		
570	745.16	0.74516	0.47	b-	4.45538E-14	2.09403E-16		
571	732.42	0.73242	1.91	b-	4.37744E-14	8.3609E-16		
572	730.4	0.7304	0.151	b-	4.36508E-14	6.59127E-17		
573	723.84	0.72384	1.803	b-	4.32496E-14	7.79789E-16		
574	719.8	0.7198	0.07	b-	4.30025E-14	3.01017E-17		
575	716.96	0.71696	0.162	b-	4.28288E-14	6.93827E-17		
576	710.4	0.7104	0.196	b-	4.24277E-14	8.31584E-17		
577	699.6	0.6996	0.084	b-	4.17676E-14	3.50847E-17		
578	675.79	0.67579	0.162	b-	4.03128E-14	6.53067E-17		
579	672.39	0.67239	0.146	b-	4.01051E-14	5.85534E-17		
580	652.28	0.65228	0.269	b-	3.88772E-14	1.0458E-16		
581	646.5	0.6465	0.622	b-	3.85244E-14	2.39622E-16		
582	634.2	0.6342	0.034	b-	3.77738E-14	1.28431E-17		
583	626.89	0.62689	0.95	b-	3.73278E-14	3.54614E-16		
584	624.3	0.6243	0.095	b-	3.71698E-14	3.53113E-17		
585	612.82	0.61282	4.5	b-	3.64696E-14	1.64113E-15		
586	601.84	0.60184	1.2	b-	3.58002E-14	4.29602E-16		
587	595.43	0.59543	0.28	b-	3.54094E-14	9.91464E-17		
588	589.8	0.5898	0.084	b-	3.50663E-14	2.94557E-17		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
589	585.6	0.5856	0.045	b-	3.48103E-14	1.56647E-17		
590	579.4	0.5794	0.056	b-	3.44326E-14	1.92822E-17		
591	569.64	0.56964	0.15	b-	3.3838E-14	5.0757E-17		
592	565.4	0.5654	0.09	b-	3.35797E-14	3.02218E-17		
593	549.02	0.54902	0.062	b-	3.25823E-14	2.0201E-17		
594	523.9	0.5239	0.045	b-	3.10536E-14	1.39741E-17		
595	518.8	0.5188	0.05	b-	3.07433E-14	1.53717E-17		
596	515.44	0.51544	0.37	b-	3.05389E-14	1.12994E-16		
597	513.88	0.51388	0.84	b-	3.04441E-14	2.5573E-16		
598	505.07	0.50507	0.358	b-	2.99083E-14	1.07072E-16		
599	498.2	0.4982	0.045	b-	2.94906E-14	1.32708E-17		
600	491.47	0.49147	1.46	b-	2.90814E-14	4.24589E-16		
601	491.47	0.49147	0.34	b-	2.90814E-14	9.88769E-17		
602	482.6	0.4826	0.022	b-	2.85423E-14	6.27931E-18		
603	466.8	0.4668	0.073	b-	2.75823E-14	2.01351E-17		
604	454.46	0.45446	0.258	b-	2.68328E-14	6.92287E-17		
605	446.8	0.4468	0.101	b-	2.63677E-14	2.66314E-17		
606	442.7	0.4427	0.179	b-	2.61188E-14	4.67526E-17		
607	441.3	0.4413	0.095	b-	2.60338E-14	2.47321E-17		
608	427.7	0.4277	0.073	b-	2.52083E-14	1.84021E-17		
609	393.5	0.3935	6.7	b-	2.31339E-14	1.54997E-15		
610	388.6	0.3886	0.062	b-	2.28368E-14	1.41588E-17		
611	356.72	0.35672	0.526	b-	2.0905E-14	1.0996E-16		
612	338.86	0.33886	0.622	b-	1.98235E-14	1.23302E-16		
613	326.8	0.3268	0.09	b-	1.90934E-14	1.71841E-17		
614	305	0.305	0.039	b-	1.77744E-14	6.93202E-18		
615	296.53	0.29653	21.7	b-	1.72621E-14	3.74589E-15		
616	289.78	0.28978	9.2	b-	1.6854E-14	1.55057E-15		
617	225.38	0.22538	3.02	b-	1.29634E-14	3.91496E-16		
618	218.59	0.21859	56	b-	1.25536E-14	7.03003E-15		
619	181.3	0.1813	0.14	b-	1.03043E-14	1.4426E-17		
620	174.97	0.17497	11.3	b-	9.92269E-15	1.12126E-15		
621	174.97	0.17497	8.6	b-	9.92269E-15	8.53351E-16		
622	121.37	0.12137	0.47	b-	6.69398E-15	3.14617E-17		
623	119.4	0.1194	0.067	b-	6.57541E-15	4.40552E-18		
624	103.75	0.10375	0.314	b-	5.63361E-15	1.76895E-17		
625	71	0.071	0.202	b-	3.66403E-15	7.40135E-18		
626	55.7	0.0557	0.11	b-	2.74448E-15	3.01893E-18		
627	35.907	0.035907	0.056	X-Ray	1.55545E-15	8.71053E-19		
628	35.818	0.035818	0.273	X-Ray	1.55011E-15	4.23179E-18		
629	35.252	0.035252	0.0093	X-Ray	1.51611E-15	1.40999E-19		
630	34.987	0.034987	0.88	X-Ray	1.5002E-15	1.32018E-17		
631	34.92	0.03492	0.46	X-Ray	1.49618E-15	6.88241E-18		
632	30.973	0.030973	4.9	X-Ray	1.25915E-15	6.16982E-17		
633	30.625	0.030625	2.65	X-Ray	1.23825E-15	3.28136E-17		
634	30.27	0.03027	0.0003	X-Ray	1.21693E-15	3.6508E-21		
635	5.553	0.005553	0.0096	X-Ray	-2.66795E-16	0.00E+00		
636	5.542	0.005542	0.0066	X-Ray	-2.67455E-16	0.00E+00		
637	5.281	0.005281	0.041	X-Ray	-2.83118E-16	0.00E+00		

ATTACHMENT 4

Attachment 5

	A	B	C	D	E	F	G	H
638	4.934	0.004934	0.09	X-Ray	-3.03941E-16	0.00E+00		
639	4.781	0.004781	0.0036	X-Ray	-3.13122E-16	0.00E+00		
640	4.717	0.004717	0.041	X-Ray	-3.16962E-16	0.00E+00		
641	4.649	0.004649	0.024	X-Ray	-3.21043E-16	0.00E+00		
642	4.62	0.00462	0.29	X-Ray	-3.22783E-16	0.00E+00		
643	4.286	0.004286	0.45	X-Ray	-3.42825E-16	0.00E+00		
644	4.272	0.004272	0.05	X-Ray	-3.43665E-16	0.00E+00		
645	4.142	0.004142	0.0084	X-Ray	-3.51466E-16	0.00E+00		
646	3.795	0.003795	0.018	X-Ray	-3.72288E-16	0.00E+00		
647								
648								
649					Sum - SDE Photon	5.95777E-14	Gy/s per Bq/m3	
650						2.1448E-05	mRem/hr per Bq/m3	
651						793575.2967	mRem/hr per uCi/ml	
652					DAC	3.1503E-05	uCi/ml	
653								
654								
655					SUM - SDE Total	2113163.166	mRem/hr per uCi/ml	
656					DAC	1.18306E-05	uCi/ml	

Containment Building Leakage Rate (scf/min) = 17.68 scf x (Containment Presssure - 14.7 psia)$^{1/2}$

Time (min)	Containment Pressure (psia)	LR (scfm)	Vol. scf	Ave. LR (scf/m)	Ave. LR (scf/h)
0	15.0333	10.2075	230102.0		
5	15.0300	10.1563	230051.0		
10	15.0267	10.1051	230000.2		
15	15.0234	10.0539	229949.6		
20	15.0201	10.0028	229899.4		
25	15.0168	9.9516	229849.4	**1st Hour**	
30	15.0136	9.9004	229799.6	**9.926**	**595.6**
35	15.0103	9.8492	229750.1	(scf/m)	(scf/h)
40	15.0071	9.7980	229700.9		
45	15.0039	9.7468	229651.9		
50	15.0007	9.6956	229603.1		
55	14.9976	9.6444	229554.7		
60	14.9944	9.5933	229506.4		
65	14.9913	9.5421	229458.5		
70	14.9882	9.4909	229410.8		
75	14.9851	9.4397	229363.3		
80	14.9820	9.3885	229316.1		
85	14.9789	9.3373	229269.2	**2nd Hour**	
90	14.9759	9.2861	229222.5	**9.312**	**558.7**
95	14.9728	9.2349	229176.0	(scf/m)	(scf/h)
100	14.9698	9.1837	229129.9		
105	14.9668	9.1325	229083.9		
110	14.9638	9.0813	229038.3		
115	14.9609	9.0301	228992.9		
120	14.9579	8.9789	228947.7		
125	14.9550	8.9277	228902.8		
130	14.9521	8.8765	228858.2		
135	14.9492	8.8253	228813.8		
140	14.9463	8.7741	228769.7		
145	14.9434	8.7229	228725.8	**3rd Hour**	
150	14.9406	8.6717	228682.2	**8.697**	**521.8**
155	14.9377	8.6205	228638.8	(scf/m)	(scf/h)
160	14.9349	8.5693	228595.7		
165	14.9321	8.5181	228552.9		
170	14.9293	8.4669	228510.3		
175	14.9266	8.4156	228468.0		
180	14.9238	8.3644	228425.9		
185	14.9211	8.3132	228384.1		
190	14.9184	8.2620	228342.5		
195	14.9157	8.2108	228301.2		
200	14.9130	8.1596	228260.1		
205	14.9103	8.1084	228219.3	**4th Hour**	
210	14.9077	8.0571	228178.8	**8.083**	**485.0**
215	14.9050	8.0059	228138.5	(scf/m)	(scf/h)
220	14.9024	7.9547	228098.5		
225	14.8998	7.9035	228058.7		
230	14.8973	7.8523	228019.2		
235	14.8947	7.8010	227979.9		
240	14.8921	7.7498	227940.9		
245	14.8896	7.6986	227902.2		
250	14.8871	7.6474	227863.7		
255	14.8846	7.5961	227825.4		
260	14.8821	7.5449	227787.5		
265	14.8796	7.4937	227749.7	**5th Hour**	
270	14.8772	7.4425	227712.3	**7.468**	**448.1**
275	14.8748	7.3912	227675.1	(scf/m)	(scf/h)
280	14.8724	7.3400	227638.1		
285	14.8700	7.2888	227601.4		
290	14.8676	7.2375	227565.0		
295	14.8652	7.1863	227528.8		
300	14.8629	7.1351	227492.8		

Time (min)	Containment Pressure (psia)	LR (scfm)	Vol. scf	Ave. LR (scf/m)	Ave. LR (scf/h)
305	14.8605	7.0838	227457.2		
310	14.8582	7.0326	227421.7		
315	14.8559	6.9813	227386.6		
320	14.8536	6.9301	227351.7		
325	14.8514	6.8788	227317.0		
330	14.8491	6.8276	227282.6		
335	14.8469	6.7764	227248.5		
340	14.8447	6.7251	227214.6		
345	14.8425	6.6739	227181.0		
350	14.8403	6.6226	227147.6		
355	14.8381	6.5713	227114.5		
360	14.8360	6.5201	227081.7		
365	14.8339	6.4688	227049.1		
370	14.8318	6.4176	227016.7	**5th thru 8th Hour**	
375	14.8297	6.3663	226984.6	**5.930**	**355.8**
380	14.8276	6.3151	226952.8	(scf/m)	(scf/h)
385	14.8255	6.2638	226921.2		
390	14.8235	6.2125	226889.9		
395	14.8214	6.1613	226858.8		
400	14.8194	6.1100	226828.0		
405	14.8174	6.0587	226797.5		
410	14.8155	6.0074	226767.2		
415	14.8135	5.9562	226737.1		
420	14.8115	5.9049	226707.4		
425	14.8096	5.8536	226677.8		
430	14.8077	5.8023	226648.6		
435	14.8058	5.7511	226619.6		
440	14.8039	5.6998	226590.8		
445	14.8021	5.6485	226562.3		
450	14.8002	5.5972	226534.1		
455	14.7984	5.5459	226506.1		
460	14.7966	5.4946	226478.3		
465	14.7948	5.4433	226450.9		
470	14.7930	5.3920	226423.7		
475	14.7913	5.3407	226396.7		
480	14.7895	5.2894	226370.0		
485	14.7878	5.2381	226343.5		
490	14.7861	5.1868	226317.4		
495	14.7844	5.1355	226291.4		
500	14.7827	5.0842	226265.7		
505	14.7810	5.0329	226240.3		
510	14.77939	4.9816	226215.2		
515	14.77776	4.9302	226190.2		
520	14.77615	4.8789	226165.6		
525	14.77456	4.8276	226141.2		
530	14.77298	4.7763	226117.1		
535	14.77142	4.7249	226093.2		
540	14.76988	4.6736	226069.6		
545	14.76835	4.6223	226046.2		
550	14.76684	4.5709	226023.1		
555	14.76535	4.5196	226000.2		
560	14.76387	4.4682	225977.6		
565	14.76241	4.4169	225955.3		
570	14.76097	4.3655	225933.2		
575	14.75954	4.3142	225911.4		
580	14.75813	4.2628	225889.8		
585	14.75674	4.2115	225868.5		
590	14.75537	4.1601	225847.4		
595	14.75401	4.1087	225826.6		
600	14.75266	4.0573	225806.1		
605	14.75134	4.0060	225785.8		
610	14.75003	3.9546	225765.8		
615	14.74874	3.9032	225746.0		

Time (min)	Containment Pressure (psia)	LR (scfm)	Vol. scf	Ave. LR (scf/m)	Ave. LR (scf/h)
620	14.74746	3.8518	225726.5		
625	14.74621	3.8004	225707.2		
630	14.74496	3.7490	225688.2		
635	14.74374	3.6976	225669.5	**9th thru 12th Hour**	
640	14.74253	3.6462	225651.0	**3.466**	**207.9**
645	14.74134	3.5947	225632.8	(scf/m)	(scf/h)
650	14.74017	3.5433	225614.8		
655	14.73901	3.4919	225597.1		
660	14.73787	3.4405	225579.6		
665	14.73674	3.3890	225562.4		
670	14.73564	3.3376	225545.5		
675	14.73455	3.2861	225528.8		
680	14.73347	3.2347	225512.3		
685	14.73242	3.1832	225496.2		
690	14.73138	3.1317	225480.3		
695	14.73035	3.0803	225464.6		
700	14.72935	3.0288	225449.2		
705	14.72836	2.9773	225434.0		
710	14.72739	2.9258	225419.2		
715	14.72643	2.8743	225404.5		
720	14.72549	2.8228	225390.2		
725	14.72457	2.7712	225376.0		
730	14.72366	2.7197	225362.2		
735	14.72277	2.6681	225348.6		
740	14.72190	2.6166	225335.3		
745	14.72105	2.5650	225322.2		
750	14.72021	2.5135	225309.3		
755	14.71939	2.4619	225296.8		
760	14.71859	2.4103	225284.5		
765	14.71780	2.3587	225272.4		
770	14.71703	2.3070	225260.6		
775	14.71627	2.2554	225249.1		
780	14.71554	2.2038	225237.8		
785	14.71482	2.1521	225226.8		
790	14.71411	2.1004	225216.0		
795	14.71343	2.0487	225205.5		
800	14.71276	1.9970	225195.3		
805	14.71211	1.9453	225185.3		
810	14.71147	1.8936	225175.6		
815	14.71085	1.8418	225166.1		
820	14.71025	1.7900	225156.9		
825	14.70967	1.7382	225147.9		
830	14.70910	1.6864	225139.3		
835	14.70855	1.6345	225130.8		
840	14.70801	1.5827	225122.7		
845	14.70750	1.5308	225114.7		
850	14.70700	1.4788	225107.1		
855	14.70651	1.4268	225099.7		
860	14.70605	1.3748	225092.6		
865	14.70560	1.3228	225085.7		
870	14.70517	1.2707	225079.1		
875	14.70475	1.2186	225072.7		
880	14.70435	1.1664	225066.6		
885	14.70397	1.1142	225060.8		
890	14.70361	1.0619	225055.2		
895	14.70326	1.0096	225049.9		
900	14.70293	0.9572	225044.9		
902	14.70281	0.9365	225042.95		
904	14.70268	0.9159	225041.07		
906	14.70256	0.8952	225039.24		
908	14.70245	0.8746	225037.45		
910	14.70233	0.8539	225035.70		
912	14.70222	0.8332	225033.99		

	Time (min)	Containment Pressure (psia)	LR (scfm)	Vol. scf	Ave. LR (scf/m)	Ave. LR (scf/h)
	914	14.70211	0.8125	225032.33		
	916	14.70201	0.7918	225030.70		
	918	14.70190	0.7712	225029.12		
	920	14.70180	0.7505	225027.58		
	922	14.70170	0.7297	225026.08		
	924	14.70161	0.7090	225024.62		
	926	14.70152	0.6883	225023.20	**13th thru 15.5th Hour**	
	928	14.70143	0.6676	225021.82	**1.132**	**67.9**
	930	14.70134	0.6468	225020.49	(scf/m)	(scf/h)
	932	14.70125	0.6261	225019.19		
	934	14.70117	0.6053	225017.94		
	936	14.70109	0.5845	225016.73		
	938	14.70102	0.5637	225015.56		
	940	14.70094	0.5429	225014.43		
	942	14.70087	0.5221	225013.35		
	944	14.70080	0.5013	225012.30		
	946	14.70074	0.4804	225011.30		
	948	14.70068	0.4595	225010.34		
	950	14.70062	0.4386	225009.42		
	951	14.70059	0.4283	225008.98		
	952	14.70056	0.4180	225008.55		
	953	14.70053	0.4076	225008.14		
	954	14.70050	0.3973	225007.73		
	955	14.70048	0.3869	225007.33		
	956	14.70045	0.3766	225006.94		
	957	14.70043	0.3662	225006.57		
	958	14.70041	0.3559	225006.20		
	959	14.70038	0.3455	225005.85		
	960	14.70036	0.3352	225005.50		
	961	14.70034	0.3248	225005.17		
	962	14.70032	0.3144	225004.84		
	963	14.70030	0.3040	225004.53		
	964	14.70028	0.2936	225004.22		
	965	14.70026	0.2832	225003.93		
	966	14.70024	0.2728	225003.65		
	967	14.70022	0.2624	225003.37		
	968	14.70020	0.2520	225003.11		
	969	14.70019	0.2416	225002.86		
	970	14.70017	0.2312	225002.62		
	971	14.70016	0.2207	225002.39		
	972	14.70014	0.2102	225002.16		
	973	14.70013	0.1998	225001.95		
	974	14.70011	0.1893	225001.75		
	975	14.70010	0.1788	225001.57		
	976	14.70009	0.1683	225001.39		
	977	14.70008	0.1577	225001.22		
	978	14.70007	0.1472	225001.06		
	979	14.70006	0.1366	225000.91		
	980	14.70005	0.1259	225000.78		
	981	14.70004	0.1153	225000.65		
	982	14.70003	0.1046	225000.54		
	983	14.700028	0.0938	225000.43		
	984	14.700022	0.0830	225000.34		
	985	14.700017	0.0720	225000.25		
	986	14.700012	0.0610	225000.18		
	987	14.700008	0.0497	225000.12		
	988	14.700005	0.0382	225000.07		
	989	14.700002	0.0260	225000.03		
16.5 hr =	990	14.700000	0.0121	225000.01		

Overall Average Leak Rate = 5.154 scf/min

MicroShield 8.02
Nathan Hogue (8.00-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
Fuel Element Failure.msd	March 29, 2016	10:27:53 AM	00:00:00

Project Info	
Case Title	Containment Shine
Description	Fuel Element Failure Accident Analysis
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	1.9e+3 cm (60 ft 9.9 in)
Width	1.9e+3 cm (60 ft 9.9 in)
Height	1.8e+3 cm (60 ft 0.1 in)

Dose Points

A	X	Y	Z
#1	1.9e+3 cm (62 ft 9.5 in)	914.0 cm (29 ft 11.8 in)	914.0 cm (29 ft 11.8 in)
#2	1.5e+4 cm (492 ft 1.5 in)	914.0 cm (29 ft 11.8 in)	914.0 cm (29 ft 11.8 in)

Shields

Shield N	Dimension	Material	Density
Source	6.29e+09 cm³	Air	0.00122
Shield 1	30.0 cm	Concrete	2.35
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	μCi/cm³	Bq/cm³
I-131	2.9700e-001	1.0989e+010	4.7241e-005	1.7479e+000
I-132	4.1600e-001	1.5392e+010	6.6170e-005	2.4483e+000
I-133	7.3200e-001	2.7084e+010	1.1643e-004	4.3080e+000
I-134	8.2500e-001	3.0525e+010	1.3123e-004	4.8554e+000
I-135	6.8400e-001	2.5308e+010	1.0880e-004	4.0255e+000
Kr-85	6.2500e-004	2.3125e+007	9.9414e-008	3.6783e-003
Kr-85m	1.7700e-001	6.5490e+009	2.8154e-005	1.0417e+000
Kr-87	2.7700e-001	1.0249e+010	4.4060e-005	1.6302e+000
Kr-88	3.9300e-001	1.4541e+010	6.2511e-005	2.3129e+000
Kr-89	4.9800e-001	1.8426e+010	7.9213e-005	2.9309e+000
Kr-90	4.9700e-001	1.8389e+010	7.9054e-005	2.9250e+000

Xe-133	5.2000e-001	1.9240e+010	8.2712e-005	3.0604e+000
Xe-135	1.0200e-001	3.7740e+009	1.6224e-005	6.0030e-001
Xe-135m	4.8900e-002	1.8093e+009	7.7781e-006	2.8779e-001
Xe-137	6.5000e-001	2.4050e+010	1.0339e-004	3.8254e+000
Xe-138	6.7700e-001	2.5049e+010	1.0769e-004	3.9843e+000

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results - Dose Point # 1 - (1914,914,914) cm

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.920e+09	3.327e-250	7.710e-26	2.853e-251	6.613e-27
0.03	1.223e+10	5.112e-36	5.542e-25	5.066e-38	5.493e-27
0.08	7.349e+09	3.477e-06	8.553e-05	5.502e-09	1.353e-07
0.1	6.506e+09	3.682e-05	1.354e-03	5.633e-08	2.071e-06
0.15	8.408e+09	7.362e-04	3.611e-02	1.212e-06	5.947e-05
0.2	1.611e+10	5.921e-03	2.820e-01	1.045e-05	4.978e-04
0.3	1.179e+10	2.601e-02	9.294e-01	4.933e-05	1.763e-03
0.4	2.973e+10	2.168e-01	5.714e+00	4.224e-04	1.113e-02
0.5	5.015e+10	8.956e-01	1.813e+01	1.758e-03	3.559e-02
0.6	3.807e+10	1.383e+00	2.239e+01	2.700e-03	4.370e-02
0.8	7.924e+10	8.512e+00	9.745e+01	1.619e-02	1.854e-01
1.0	4.160e+10	1.003e+01	8.849e+01	1.849e-02	1.631e-01
1.5	3.319e+10	3.190e+01	1.822e+02	5.368e-02	3.065e-01
2.0	3.012e+10	7.046e+01	3.103e+02	1.090e-01	4.799e-01
3.0	3.439e+09	2.449e+01	7.862e+01	3.323e-02	1.067e-01
4.0	8.464e+08	1.205e+01	3.191e+01	1.491e-02	3.948e-02
Totals	**3.747e+11**	**1.600e+02**	**8.364e+02**	**2.504e-01**	**1.374e+00**

Results - Dose Point # 2 - (15000,914,914) cm

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.920e+09	7.298e-261	3.473e-28	6.260e-262	2.979e-29
0.03	1.223e+10	5.629e-39	2.496e-27	5.579e-41	2.474e-29
0.08	7.349e+09	1.101e-08	3.055e-07	1.742e-11	4.834e-10
0.1	6.506e+09	1.203e-07	5.189e-06	1.840e-10	7.938e-09
0.15	8.408e+09	2.675e-06	1.599e-04	4.405e-09	2.633e-07
0.2	1.611e+10	2.367e-05	1.380e-03	4.178e-08	2.436e-06
0.3	1.179e+10	1.196e-04	5.123e-03	2.268e-07	9.718e-06
0.4	2.973e+10	1.092e-03	3.371e-02	2.127e-06	6.569e-05
0.5	5.015e+10	4.814e-03	1.119e-01	9.449e-06	2.196e-04

0.6	3.807e+10	7.802e-03	1.426e-01	1.523e-05	2.784e-04
0.8	7.924e+10	5.127e-02	6.446e-01	9.752e-05	1.226e-03
1.0	4.160e+10	6.308e-02	5.999e-01	1.163e-04	1.106e-03
1.5	3.319e+10	2.126e-01	1.270e+00	3.577e-04	2.137e-03
2.0	3.012e+10	4.826e-01	2.183e+00	7.463e-04	3.376e-03
3.0	3.439e+09	1.718e-01	5.540e-01	2.330e-04	7.516e-04
4.0	8.464e+08	8.521e-02	2.243e-01	1.054e-04	2.775e-04
Totals	**3.747e+11**	**1.080e+00**	**5.770e+00**	**1.683e-03**	**9.449e-03**

Fuel Handling Accident - Resricted Area Dose

Isotope	$T_{1/2}$		Core Activity 30 min Decay (Ci)	Released Activity (Ci)	Released Activity (uCi)	Pool Activity Con. (uCi/gal)	Containment Concentration No I evap @ T_0 (uCi/cc)	Containment Concentration w/ decay (uCi/cc)	Containment Concentration w/ decay (uCi/cc)	Containment Concentration w/ decay (uCi/cc)	Containment Concentration w/ decay (uCi/cc)	Average Concentration (uCi/cc)	DAC	Dose to Workers 5 min (mrem)
						Time (min):	0.5	1.5	2.5	3.5	4.5			
I-131	8.02	d	2.20E+05	2.07E+01	2.07E+07	1.03E+03	3.25E-07	9.74E-07	1.62E-06	2.27E-06	2.92E-06	1.62E-06	2.00E-08	1.69E+02
I-132	2.28	h	3.07E+05	2.89E+01	2.89E+07	1.44E+03	4.52E-07	1.35E-06	2.24E-06	3.11E-06	3.98E-06	2.23E-06	3.00E-06	1.55E+00
I-133	20.8	h	5.39E+05	5.07E+01	5.07E+07	2.53E+03	7.95E-07	2.38E-06	3.97E-06	5.56E-06	7.14E-06	3.97E-06	1.00E-07	8.26E+01
I-134	52.6	m	5.49E+05	5.16E+01	5.16E+07	2.58E+03	8.05E-07	2.38E-06	3.92E-06	5.41E-06	6.87E-06	3.88E-06	2.00E-05	4.04E-01
I-135	6.57	h	4.80E+05	4.51E+01	4.51E+07	2.26E+03	7.07E-07	2.12E-06	3.52E-06	4.93E-06	6.32E-06	3.52E-06	7.00E-07	1.05E+01
				1.97E+02	**1.97E+08**									264.00
Kr-85	10.76	y	4.63E+02	4.35E-02	4.35E+04		6.83E-06	6.83E-06	6.83E-06	6.83E-06	6.83E-06	6.83E-06	1.00E-04	1.42E-02
Kr-85m	4.48	h	1.23E+05	1.16E+01	1.16E+07		1.81E-03	1.81E-03	1.80E-03	1.80E-03	1.79E-03	1.80E-03	2.00E-05	1.88E+01
Kr-87	1.27	h	1.58E+05	1.49E+01	1.49E+07		2.32E-03	2.30E-03	2.28E-03	2.26E-03	2.24E-03	2.28E-03	5.00E-06	9.49E+01
Kr-88	2.84	h	2.58E+05	2.42E+01	2.42E+07		3.80E-03	3.78E-03	3.77E-03	3.75E-03	3.74E-03	3.77E-03	2.00E-06	3.92E+02
Kr-89	3.15	m	5.28E+02	4.96E-02	4.96E+04		6.98E-06	5.60E-06	4.49E-06	3.61E-06	2.89E-06	4.71E-06	1.90E-06	5.17E-01
Kr-90	32.3	s	6.31E-12	5.93E-16	5.93E-10		4.89E-20	1.35E-20	3.73E-21	1.03E-21	2.84E-22	1.35E-20	2.80E-06	1.00E-14
				5.08E+01	**5.08E+07**									506.51
Xe-133	5.243	d	3.85E+05	3.62E+01	3.62E+07		5.68E-03	5.68E-03	5.68E-03	5.68E-03	5.68E-03	5.68E-03	1.00E-04	1.18E+01
Xe-135	9.1	h	9.11E+04	8.56E+00	8.56E+06		1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.00E-05	2.79E+01
Xe-135m	15.3	m	3.62E+04	3.40E+00	3.40E+06		5.22E-04	4.99E-04	4.77E-04	4.56E-04	4.36E-04	4.78E-04	9.00E-06	1.11E+01
Xe-137	3.82	m	2.24E+03	2.11E-01	2.11E+05		3.02E-05	2.52E-05	2.10E-05	1.75E-05	1.46E-05	2.17E-05	2.00E-05	2.26E-01
Xe-138	14.1	m	1.16E+05	1.09E+01	1.09E+07		1.67E-03	1.59E-03	1.51E-03	1.44E-03	1.37E-03	1.52E-03	4.00E-06	7.90E+01
Xe-139	39.7	s	7.89E-09	7.42E-13	7.42E-07		6.89E-17	2.42E-17	8.49E-18	2.98E-18	1.04E-18	2.11E-17	3.70E-06	1.19E-12
				5.93E+01	**5.93E+07**									129.99

Denotes DACs calculated using methodology as described in FGR No. 12.

Total Iodine (CDE) (mrem)	**264.00**
Iodine (CEDE) (mrem) ***(CDE x 0.03)***	**7.92**
Noble Gas (CEDE) mrem	**636.49**
Total Dose (TEDE) mrem	**644.41**

Fuel Handling Accident - Unresricted Area Dose

Isotope	$T_{1/2}$		Core Activity 30 min Decay (Ci)	Released Actvity (Ci)	Released Activity (uCi)	Pool Actvity Conc. (uCi/gal)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)		Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Ave. 1st Hour Exhaust Concentration (uCi/cc)	Average Exhaust Concentration (uCi/cc)	Effluent Concentration Limit (uCi/cc)	Concentration at Maximum Dose Point (EC/292)	Dose to Public 16.5 hr (mrem)
						1 Hr Intervals:	**0.5**	**1.5**	**2.5**	**3.5**	**4.5**	*4 Hr Intervals:*	**7**	**11**	**14.75**					
						Containment Volume scf:	**229801**	**229224**	**228684**	**228181**	**227714**		**226733**	**225605**	**225044**					
						Containment Average Leakage Rate scf/hr:	**595.6**	**558.7**	**521.8**	**485.0**	**448.1**		**355.8**	**207.9**	**67.9**					
I-131	8.02	d	2.20E+05	2.07E+01	2.07E+07	1.03E+03	8.98E-02	8.95E-02	8.92E-02	8.89E-02	8.85E-02		8.77E-02	8.65E-02	8.53E-02	5.16E-10	2.63E-10	2.00E-10	9.01E-13	4.24E-04
I-132	2.28	h	3.07E+05	2.89E+01	2.89E+07	1.44E+03	1.08E-01	7.96E-02	5.87E-02	4.33E-02	3.20E-02		1.50E-02	4.43E-03	1.42E-03	6.20E-10	1.17E-10	2.00E-08	4.01E-13	1.89E-06
I-133	20.8	h	5.39E+05	5.07E+01	5.07E+07	2.53E+03	2.17E-01	2.10E-01	2.03E-01	1.96E-01	1.90E-01		1.75E-01	1.53E-01	1.35E-01	1.25E-09	5.50E-10	1.00E-09	1.88E-12	1.77E-04
I-134	52.6	m	5.49E+05	5.16E+01	5.16E+07	2.58E+03	1.51E-01	6.86E-02	3.11E-02	1.41E-02	6.40E-03		8.87E-04	3.76E-05	1.94E-06	8.69E-10	9.10E-11	6.00E-08	3.12E-13	4.89E-07
I-135	6.57	h	4.80E+05	4.51E+01	4.51E+07	2.26E+03	1.86E-01	1.68E-01	1.51E-01	1.36E-01	1.22E-01		9.38E-02	6.15E-02	4.14E-02	1.07E-09	3.50E-10	6.00E-09	1.20E-12	1.88E-05
				1.97E+02	**1.97E+08**															**6.23E-04**
Kr-85	10.76	y	4.63E+02	4.35E-02	4.35E+04		1.89E-01	1.89E-01	1.89E-01	1.89E-01	1.89E-01		1.89E-01	1.89E-01	1.89E-01	2.18E-09	1.13E-09	7.00E-07	3.87E-12	5.21E-07
Kr-85m	4.48	h	1.23E+05	1.16E+01	1.16E+07		4.66E+01	3.99E+01	3.42E+01	2.93E+01	2.51E+01		1.70E+01	9.18E+00	5.14E+00	5.35E-07	1.48E-07	1.00E-07	5.06E-10	4.77E-04
Kr-87	1.27	h	1.58E+05	1.49E+01	1.49E+07		4.92E+01	2.85E+01	1.65E+01	9.57E+00	5.55E+00		1.42E+00	1.60E-01	2.06E-02	5.65E-07	7.38E-08	2.00E-08	2.53E-10	1.19E-03
Kr-88	2.84	h	2.58E+05	2.42E+01	2.42E+07		9.34E+01	7.32E+01	5.73E+01	4.49E+01	3.52E+01		1.91E+01	7.21E+00	2.89E+00	1.07E-06	2.31E-07	9.00E-09	7.93E-10	8.30E-03
Kr-89	3.15	m	5.28E+02	4.96E-02	4.96E+04		2.94E-04	5.44E-10	1.01E-15	1.86E-21	3.45E-27		1.61E-41	1.88E-64	5.99E-86	3.38E-12	2.05E-13	8.60E-09	7.01E-16	7.68E-09
Kr-90	32.3	s	6.31E-12	5.93E-16	5.93E-10		4.36E-32	1.25E-65	3.56E-99	1.02E-132	2.90E-166		4.00E-250	0.00E+00	0.00E+00	5.01E-40	3.04E-41	1.20E-08	1.04E-43	8.17E-37
				5.08E+01	**5.08E+07**															**9.97E-03**
Xe-133	5.243	d	3.85E+05	3.62E+01	3.62E+07		1.57E+02	1.56E+02	1.55E+02	1.54E+02	1.54E+02		1.52E+02	1.48E+02	1.45E+02	1.80E-06	9.11E-07	5.00E-07	3.12E-09	5.88E-04
Xe-135	9.1	h	9.11E+04	8.56E+00	8.56E+06		3.59E+01	3.32E+01	3.08E+01	2.85E+01	2.64E+01		2.19E+01	1.61E+01	1.21E+01	4.12E-07	1.51E-07	7.00E-08	5.17E-10	6.96E-04
Xe-135m	15.3	m	3.62E+04	3.40E+00	3.40E+06		3.80E+00	2.51E-01	1.66E-02	1.10E-03	7.23E-05		8.10E-08	1.54E-12	5.78E-17	4.37E-08	2.83E-09	4.00E-08	9.68E-12	2.28E-05
Xe-137	3.82	m	2.24E+03	2.11E-01	2.11E+05		3.97E-03	7.43E-08	1.39E-12	2.61E-17	4.89E-22		7.44E-34	9.17E-53	1.72E-70	4.56E-11	2.76E-12	9.10E-08	9.46E-15	9.80E-09
Xe-138	14.1	m	1.16E+05	1.09E+01	1.09E+07		1.09E+01	5.69E-01	2.98E-02	1.56E-03	8.18E-05		5.14E-08	3.88E-13	6.11E-18	1.25E-07	7.96E-09	2.00E-08	2.72E-11	1.28E-04
Xe-139	39.7	s	7.89E-09	7.42E-13	7.42E-07		7.29E-26	3.73E-53	1.90E-80	9.73E-108	4.97E-135		2.93E-203	0.00E+00	0.00E+00	8.38E-34	5.08E-35	1.60E-08	1.74E-37	1.02E-30
				5.93E+01	**5.93E+07**															**1.44E-03**

Denotes Effluent Concentrations derived from DACs calculated using methodology as described in FGR No. 12. (DAC/219)

Total Iodine (CDE) (mrem)	**6.23E-04**
Noble Gas (TEDE) mrem	**1.14E-02**
Total Dose (TEDE) mrem	**1.20E-02**

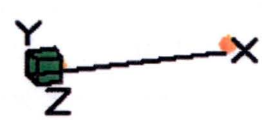
MicroShield 8.02
Nathan Hogue (8.00-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
Fuel Handling Accident.msd	February 1, 2016	4:10:32 PM	00:00:00

Project Info	
Case Title	Containment Shine
Description	Fuel Handling Accident Analysis
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	1.9e+3 cm (60 ft 9.9 in)
Width	1.9e+3 cm (60 ft 9.9 in)
Height	1.8e+3 cm (60 ft 0.1 in)



Dose Points			
A	X	Y	Z
#1	1.9e+3 cm (62 ft 9.5 in)	914.0 cm (29 ft 11.8 in)	914.0 cm (29 ft 11.8 in)
#2	1.5e+4 cm (492 ft 1.5 in)	914.0 cm (29 ft 11.8 in)	914.0 cm (29 ft 11.8 in)

Shields			
Shield N	Dimension	Material	Density
Source	6.29e+09 cm³	Air	0.00122
Shield 1	30.0 cm	Concrete	2.35
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	μCi/cm³	Bq/cm³
I-131	9.3300e+000	3.4521e+011	1.4840e-003	5.4910e+001
I-132	2.5200e+001	9.3240e+011	4.0084e-003	1.4831e+002
I-133	5.3100e+001	1.9647e+012	8.4462e-003	3.1251e+002
I-134	5.4500e+001	2.0165e+012	8.6689e-003	3.2075e+002
I-135	4.7700e+001	1.7649e+012	7.5873e-003	2.8073e+002
Kr-85	2.3200e-003	8.5840e+007	3.6902e-007	1.3654e-002
Kr-85m	1.2100e+001	4.4770e+011	1.9247e-003	7.1212e+001
Kr-87	1.5700e+001	5.8090e+011	2.4973e-003	9.2399e+001
Kr-88	2.5700e+001	9.5090e+011	4.0879e-003	1.5125e+002
Kr-89	5.2500e-002	1.9425e+009	8.3508e-006	3.0898e-001
Kr-90	6.2600e-016	2.3162e-005	9.9573e-020	3.6842e-015

Xe-133	2.5700e+001	9.5090e+011	4.0879e-003	1.5125e+002
Xe-135	1.0600e+001	3.9220e+011	1.6861e-003	6.2384e+001
Xe-135m	4.5000e+000	1.6650e+011	7.1578e-004	2.6484e+001
Xe-137	2.2300e-001	8.2510e+009	3.5471e-005	1.3124e+000
Xe-138	1.1500e+001	4.2550e+011	1.8292e-003	6.7681e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results - Dose Point # 1 - (1914,914,914) cm

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.085e+11	1.172e-248	2.715e-24	1.005e-249	2.329e-25
0.03	6.009e+11	2.512e-34	2.723e-23	2.489e-36	2.699e-25
0.08	3.580e+11	1.694e-04	4.167e-03	2.680e-07	6.594e-06
0.1	1.875e+09	1.061e-05	3.902e-04	1.624e-08	5.970e-07
0.15	4.935e+11	4.322e-02	2.120e+00	7.117e-05	3.491e-03
0.2	7.142e+11	2.626e-01	1.251e+01	4.634e-04	2.207e-02
0.3	3.346e+11	7.380e-01	2.638e+01	1.400e-03	5.003e-02
0.4	1.102e+12	8.031e+00	2.117e+02	1.565e-02	4.125e-01
0.5	2.512e+12	4.485e+01	9.082e+02	8.804e-02	1.783e+00
0.6	1.965e+12	7.139e+01	1.156e+03	1.393e-01	2.255e+00
0.8	4.917e+12	5.282e+02	6.047e+03	1.005e+00	1.150e+01
1.0	1.942e+12	4.683e+02	4.130e+03	8.632e-01	7.613e+00
1.5	1.613e+12	1.551e+03	8.853e+03	2.609e+00	1.490e+01
2.0	1.160e+12	2.713e+03	1.195e+04	4.196e+00	1.848e+01
3.0	8.875e+10	6.320e+02	2.029e+03	8.575e-01	2.753e+00
4.0	8.699e+07	1.238e+00	3.280e+00	1.532e-03	4.057e-03
Totals	**1.801e+13**	**6.019e+03**	**3.533e+04**	**9.776e+00**	**5.977e+01**

Results - Dose Point # 2 - (15000,914,914) cm

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.085e+11	2.570e-259	1.223e-26	2.205e-260	1.049e-27
0.03	6.009e+11	2.766e-37	1.227e-25	2.741e-39	1.216e-27
0.08	3.580e+11	5.363e-07	1.488e-05	8.488e-10	2.355e-08
0.1	1.875e+09	3.468e-08	1.496e-06	5.305e-11	2.288e-09
0.15	4.935e+11	1.570e-04	9.385e-03	2.586e-07	1.545e-05
0.2	7.142e+11	1.050e-03	6.119e-02	1.853e-06	1.080e-04
0.3	3.346e+11	3.393e-03	1.454e-01	6.437e-06	2.758e-04
0.4	1.102e+12	4.045e-02	1.249e+00	7.882e-05	2.434e-03
0.5	2.512e+12	2.411e-01	5.604e+00	4.733e-04	1.100e-02

0.6	1.965e+12	4.027e-01	7.362e+00	7.860e-04	1.437e-02
0.8	4.917e+12	3.181e+00	4.000e+01	6.051e-03	7.608e-02
1.0	1.942e+12	2.944e+00	2.800e+01	5.427e-03	5.161e-02
1.5	1.613e+12	1.033e+01	6.172e+01	1.739e-02	1.038e-01
2.0	1.160e+12	1.858e+01	8.405e+01	2.874e-02	1.300e-01
3.0	8.875e+10	4.433e+00	1.430e+01	6.014e-03	1.940e-02
4.0	8.699e+07	8.757e-03	2.305e-02	1.083e-05	2.852e-05
Totals	**1.801e+13**	**4.017e+01**	**2.425e+02**	**6.497e-02**	**4.091e-01**

Fueled Experiment Failure - Restricted Dose

Isotope	$T_{1/2}$		Activity (Ci)	Activity (uCi)	Pool Actvity (uCi/gal)	20 gal Evap (uCi)	Act w/Decay 17 Second Bubble Assent (uCi/cc)	Containment Conc. (uCi/cc)	Containment Concentration w/ decay (uCi/cc)	Containment Concentration w/ decay (uCi/cc)	Containment Concentration w/ decay (uCi/cc)	Containment Concentration w/ decay (uCi/cc)	Average Concentration (uCi/cc)	DAC	Dose to Workers 5 min (mrem)
						Time (min):	0.283333	0.5	1.5	2.5	3.5	4.5			
I-131	8.02	d	6.755	6.76E+06	3.38E+02	6.76E+03		1.06E-07	3.18E-07	5.30E-07	7.42E-07	9.54E-07	5.30E-07	2.00E-08	5.52E+01
I-132	2.28	h	18.635	1.86E+07	9.32E+02	1.86E+04		2.91E-07	8.69E-07	1.44E-06	2.01E-06	2.57E-06	1.44E-06	3.00E-06	9.97E-01
I-133	20.8	h	39.875	3.99E+07	1.99E+03	3.99E+04		6.26E-07	1.88E-06	3.12E-06	4.37E-06	5.62E-06	3.12E-06	1.00E-07	6.50E+01
I-134	52.6	m	45.405	4.54E+07	2.27E+03	4.54E+04		7.05E-07	2.09E-06	3.43E-06	4.75E-06	6.02E-06	3.40E-06	2.00E-05	3.54E-01
I-135	6.57	h	37.695	3.77E+07	1.88E+03	3.77E+04		5.92E-07	1.77E-06	2.96E-06	4.14E-06	5.32E-06	2.96E-06	7.00E-07	8.80E+00
			148.365												**1.30E+02**
Kr-85	10.76	y	0.0020	2.00E+03			3.14E-07	3.14E-07	3.14E-07	3.14E-07	3.14E-07	3.14E-07	3.14E-07	1.00E-04	6.54E-04
Kr-85m	4.48	h	7.580	7.58E+06			1.19E-03	1.19E-03	1.18E-03	1.18E-03	1.18E-03	1.18E-03	1.18E-03	2.00E-05	1.23E+01
Kr-87	1.27	h	15.405	1.54E+07			2.41E-03	2.40E-03	2.38E-03	2.36E-03	2.34E-03	2.31E-03	2.36E-03	5.00E-06	9.82E+01
Kr-88	2.84	h	21.660	2.17E+07			3.40E-03	3.39E-03	3.38E-03	3.36E-03	3.35E-03	3.33E-03	3.36E-03	2.00E-06	3.50E+02
Kr-89	3.15	m	27.740	2.77E+07			4.09E-03	3.66E-03	2.94E-03	2.36E-03	1.89E-03	1.52E-03	2.48E-03	1.90E-06	2.71E+02
Kr-90	32.3	s	27.410	2.74E+07			2.99E-03	1.57E-03	4.33E-04	1.20E-04	3.30E-05	9.11E-06	4.33E-04	2.80E-06	3.22E+01
			99.797												**7.64E+02**
Xe-133	5.243	d	18.925	1.89E+07			2.97E-03	2.97E-03	2.97E-03	2.97E-03	2.97E-03	2.97E-03	2.97E-03	1.00E-04	6.18E+00
Xe-135	9.1	h	13.630	1.36E+07			2.14E-03	2.14E-03	2.13E-03	2.13E-03	2.13E-03	2.13E-03	2.13E-03	1.00E-05	4.44E+01
Xe-135m	15.3	m	6.760	6.76E+06			1.05E-03	1.02E-03	9.79E-04	9.35E-04	8.94E-04	8.54E-04	9.37E-04	9.00E-06	2.17E+01
Xe-137	3.82	m	35.800	3.58E+07			5.34E-03	4.87E-03	4.07E-03	3.39E-03	2.83E-03	2.36E-03	3.50E-03	2.00E-05	3.65E+01
Xe-138	14.1	m	37.380	3.74E+07			5.79E-03	5.65E-03	5.37E-03	5.12E-03	4.87E-03	4.64E-03	5.13E-03	4.00E-06	2.67E+02
Xe-139	39.7	s	30.675	3.07E+07			3.58E-03	2.12E-03	7.44E-04	2.61E-04	9.16E-05	3.21E-05	6.50E-04	3.70E-06	3.66E+01
			143.170												**4.12E+02**

Denotes DACs calculated with methodology as described in FGR No. 12.

Total Iodine (CDE) (mrem)	**130.36**
Iodine (CEDE) (mrem) ***(CDE x 0.03)***	**3.91**
Noble Gas (CEDE) (mrem)	**1176.42**
Whole Body (TEDE) (mrem)	**1180.33**

Fueled Experiment Failure - Unrestricted Area Dose

Isotope	$T_{1/2}$		Activity (Ci)	Actvity (uCi)	Actvity in Pool at 10 min (uCi/gal)	Containment Concentration (uCi/scf) No I evap @ T_0	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)
					1 Hour Intervals:	**0.5**	**1.5**	**2.5**	**3.5**	**4.5**
					Containment Volume scf:	**229800**	**229223**	**228682**	**228179**	**227712**
					Containment Average Leakage Rate ft3/hr:	**595.6**	**558.7**	**521.8**	**485**	**448.1**
I-131	8.02	d	6.755	6.76E+06	3.38E+02	2.94E-02	2.93E-02	2.92E-02	2.90E-02	2.89E-02
I-132	2.28	h	18.635	1.86E+07	9.32E+02	6.97E-02	5.14E-02	3.79E-02	2.80E-02	2.07E-02
I-133	20.8	h	39.875	3.99E+07	1.99E+03	1.70E-01	1.65E-01	1.59E-01	1.54E-01	1.49E-01
I-134	52.6	m	45.405	4.54E+07	2.27E+03	1.33E-01	6.04E-02	2.74E-02	1.24E-02	5.63E-03
I-135	6.57	h	37.695	3.77E+07	1.88E+03	1.55E-01	1.40E-01	1.26E-01	1.13E-01	1.02E-01
			148.365							
Kr-85	10.76	y	0.0020	2.00E+03		8.70E-03	8.70E-03	8.70E-03	8.70E-03	8.70E-03
Kr-85m	4.48	h	7.580	7.58E+06		3.05E+01	2.62E+01	2.24E+01	1.92E+01	1.64E+01
Kr-87	1.27	h	15.405	1.54E+07		5.10E+01	2.96E+01	1.71E+01	9.93E+00	5.75E+00
Kr-88	2.84	h	21.660	2.17E+07		8.34E+01	6.54E+01	5.12E+01	4.01E+01	3.14E+01
Kr-89	3.15	m	27.740	2.77E+07		1.64E-01	3.04E-07	5.62E-13	1.04E-18	1.93E-24
Kr-90	32.3	s	27.410	2.74E+07		2.02E-15	5.76E-49	1.64E-82	4.70E-116	1.34E-149
			99.797							
Xe-133	5.243	d	18.925	1.89E+07		8.21E+01	8.17E+01	8.12E+01	8.08E+01	8.03E+01
Xe-135	9.1	h	13.630	1.36E+07		5.71E+01	5.29E+01	4.90E+01	4.54E+01	4.21E+01
Xe-135m	15.3	m	6.760	6.76E+06		7.56E+00	4.99E-01	3.30E-02	2.18E-03	1.44E-04
Xe-137	3.82	m	35.800	3.58E+07		6.74E-01	1.26E-05	2.37E-10	4.44E-15	8.32E-20
Xe-138	14.1	m	37.380	3.74E+07		3.72E+01	1.95E+00	1.02E-01	5.36E-03	2.81E-04
Xe-139	39.7	s	30.675	3.07E+07		3.02E-12	1.54E-39	7.88E-67	4.02E-94	2.06E-121
			143.170							

Isotope		Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Containment Concentration w/ decay (uCi/scf)	Exhaust 1st hour Ave. Conc (uCi/cc)	Exhaust Average Concentration (uCi/cc)	Effluent Concentration Limit (uCi/cc)	Concentration at Maximum Dose Point (EC/292)	Dose to Public (16.5 hrs) (mrem)
	4 hr intervals:	**7**	**11**	**14.75**					
		226707	**225580**	**225061**					
		355.8	**207.9**	**67.9**					
I-131		2.87E-02	2.83E-02	2.79E-02	1.69E-10	8.60E-11	2.00E-10	2.95E-13	1.39E-04
I-132		9.66E-03	2.86E-03	9.16E-04	4.00E-10	7.56E-11	2.00E-08	2.59E-13	1.22E-06
I-133		1.37E-01	1.20E-01	1.06E-01	9.79E-10	4.32E-10	1.00E-09	1.48E-12	1.39E-04
I-134		7.81E-04	3.31E-05	1.71E-06	7.65E-10	8.01E-11	6.00E-08	2.74E-13	4.31E-07
I-135		7.82E-02	5.13E-02	3.45E-02	8.92E-10	2.92E-10	6.00E-09	9.99E-13	1.57E-05
									2.95E-04
Kr-85		8.70E-03	8.70E-03	8.70E-03	1.00E-10	5.19E-11	7.00E-07	1.78E-13	2.39E-08
Kr-85m		1.12E+01	6.02E+00	3.37E+00	3.51E-07	9.69E-08	1.00E-07	3.32E-10	3.13E-04
Kr-87		1.47E+00	1.66E-01	2.14E-02	5.87E-07	7.66E-08	2.00E-08	2.62E-10	1.24E-03
Kr-88		1.71E+01	6.44E+00	2.58E+00	9.59E-07	2.07E-07	9.00E-09	7.08E-10	7.41E-03
Kr-89		8.97E-39	1.05E-61	3.35E-83	1.89E-09	1.14E-10	8.60E-09	3.92E-13	4.29E-06
Kr-90		1.85E-233	0.00E+00	0.00E+00	2.32E-23	1.40E-24	1.20E-08	4.81E-27	3.78E-20
									8.96E-03
Xe-133		7.92E+01	7.75E+01	7.59E+01	9.44E-07	4.76E-07	5.00E-07	1.63E-09	3.07E-04
Xe-135		3.48E+01	2.57E+01	1.93E+01	6.56E-07	2.40E-07	7.00E-08	8.23E-10	1.11E-03
Xe-135m		1.61E-07	3.06E-12	1.15E-16	8.69E-08	5.61E-09	4.00E-08	1.92E-11	4.53E-05
Xe-137		1.26E-31	1.56E-50	2.92E-68	7.75E-09	4.70E-10	9.10E-08	1.61E-12	1.67E-06
Xe-138		1.76E-07	1.33E-12	2.09E-17	4.28E-07	2.73E-08	2.00E-08	9.34E-11	4.40E-04
Xe-139		1.21E-189	8.27E-299	0.00E+00	3.47E-20	2.10E-21	1.60E-08	7.20E-24	4.24E-17
									1.90E-03

(green) Denotes Effluent Release Limits calculated from DAC values that were calculated using FGR No. 12 methodology. (FGR 12 DAC/219)

Total Iodine (CEDE) mrem	**2.95E-04**
Noble Gas (CEDE) mrem	**1.09E-02**
Total Dose (TEDE) mrem	**1.12E-02**

MicroShield 8.02
Nathan Hogue (8.00-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
Fueled Experiment Failure Shine.msd	February 1, 2016	1:13:10 PM	00:00:00

Project Info	
Case Title	Containment Shine
Description	Fueled Experiment Accident Analysis
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	1.9e+3 cm (60 ft 9.9 in)
Width	1.9e+3 cm (60 ft 9.9 in)
Height	1.8e+3 cm (60 ft 0.1 in)

Dose Points

A	X	Y	Z
#1	1.9e+3 cm (62 ft 9.5 in)	914.0 cm (29 ft 11.8 in)	914.0 cm (29 ft 11.8 in)
#2	1.5e+4 cm (492 ft 1.5 in)	914.0 cm (29 ft 11.8 in)	914.0 cm (29 ft 11.8 in)

Shields

Shield N	Dimension	Material	Density
Source	6.29e+09 cm³	Air	0.00122
Shield 1	30.0 cm	Concrete	2.35
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
I-131	6.7550e+000	2.4994e+011	1.0745e-003	3.9755e+001
I-132	1.8635e+001	6.8950e+011	2.9641e-003	1.0967e+002
I-133	3.9875e+001	1.4754e+012	6.3426e-003	2.3468e+002
I-134	4.5405e+001	1.6800e+012	7.2222e-003	2.6722e+002
I-135	3.7695e+001	1.3947e+012	5.9958e-003	2.2185e+002
Kr-85	2.0000e-003	7.4000e+007	3.1812e-007	1.1771e-002
Kr-85m	7.5800e+000	2.8046e+011	1.2057e-003	4.4611e+001
Kr-87	1.5405e+001	5.6999e+011	2.4504e-003	9.0663e+001
Kr-88	2.1660e+001	8.0142e+011	3.4453e-003	1.2748e+002
Kr-89	2.7740e+001	1.0264e+012	4.4124e-003	1.6326e+002
Kr-90	2.7410e+001	1.0142e+012	4.3599e-003	1.6132e+002

Xe-133	1.8925e+001	7.0023e+011	3.0103e-003	1.1138e+002
Xe-135	1.3630e+001	5.0431e+011	2.1680e-003	8.0217e+001
Xe-135m	6.7600e+000	2.5012e+011	1.0753e-003	3.9785e+001
Xe-137	3.5800e+001	1.3246e+012	5.6944e-003	2.1069e+002
Xe-138	3.7380e+001	1.3831e+012	5.9457e-003	2.1999e+002

Buildup: The material reference is Shield 1 **Integration Parameters**	
X Direction	10
Y Direction	20
Z Direction	20

Results - Dose Point # 1 - (1914,914,914) cm

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.019e+11	1.696e-248	3.932e-24	1.455e-249	3.373e-25
0.03	5.188e+11	2.169e-34	2.351e-23	2.149e-36	2.330e-25
0.08	2.635e+11	1.247e-04	3.067e-03	1.973e-07	4.854e-06
0.1	3.588e+11	2.031e-03	7.465e-02	3.106e-06	1.142e-04
0.15	4.031e+11	3.530e-02	1.731e+00	5.812e-05	2.851e-03
0.2	1.155e+12	4.247e-01	2.023e+01	7.496e-04	3.570e-02
0.3	6.123e+11	1.350e+00	4.826e+01	2.562e-03	9.155e-02
0.4	1.352e+12	9.856e+00	2.598e+02	1.920e-02	5.063e-01
0.5	2.832e+12	5.057e+01	1.024e+03	9.927e-02	2.010e+00
0.6	1.880e+12	6.829e+01	1.105e+03	1.333e-01	2.158e+00
0.8	4.207e+12	4.519e+02	5.174e+03	8.596e-01	9.841e+00
1.0	2.248e+12	5.420e+02	4.781e+03	9.991e-01	8.812e+00
1.5	1.807e+12	1.737e+03	9.920e+03	2.923e+00	1.669e+01
2.0	1.657e+12	3.878e+03	1.708e+04	5.997e+00	2.641e+01
3.0	1.912e+11	1.362e+03	4.371e+03	1.847e+00	5.930e+00
4.0	4.713e+10	6.711e+02	1.777e+03	8.302e-01	2.198e+00
Totals	**1.984e+13**	**8.772e+03**	**4.556e+04**	**1.371e+01**	**7.469e+01**

Results - Dose Point # 2 - (15000,914,914) cm

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.019e+11	3.722e-259	1.771e-26	3.192e-260	1.519e-27
0.03	5.188e+11	2.388e-37	1.059e-25	2.367e-39	1.050e-27
0.08	2.635e+11	3.948e-07	1.095e-05	6.247e-10	1.733e-08
0.1	3.588e+11	6.634e-06	2.862e-04	1.015e-08	4.378e-07
0.15	4.031e+11	1.282e-04	7.665e-03	2.112e-07	1.262e-05
0.2	1.155e+12	1.698e-03	9.897e-02	2.997e-06	1.747e-04
0.3	6.123e+11	6.210e-03	2.661e-01	1.178e-05	5.047e-04
0.4	1.352e+12	4.964e-02	1.533e+00	9.673e-05	2.987e-03
0.5	2.832e+12	2.719e-01	6.319e+00	5.336e-04	1.240e-02

0.6	1.880e+12	3.852e-01	7.043e+00	7.519e-04	1.375e-02
0.8	4.207e+12	2.722e+00	3.422e+01	5.177e-03	6.509e-02
1.0	2.248e+12	3.408e+00	3.241e+01	6.282e-03	5.974e-02
1.5	1.807e+12	1.158e+01	6.916e+01	1.948e-02	1.164e-01
2.0	1.657e+12	2.656e+01	1.201e+02	4.107e-02	1.858e-01
3.0	1.912e+11	9.549e+00	3.080e+01	1.296e-02	4.178e-02
4.0	4.713e+10	4.745e+00	1.249e+01	5.870e-03	1.545e-02
Totals	**1.984e+13**	**5.928e+01**	**3.145e+02**	**9.224e-02**	**5.140e-01**