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NLS2012045

June 25, 2012

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: License Amendment Request for Revisions to the Fuel Handling Accident
Cooper Nuclear Station; Docket No. 50-298, License No. DPR-46

- References:**
1. Letter from Brian J. O'Grady, Nebraska Public Power District, to U.S. Nuclear Regulatory Commission, dated September 16, 2011, "License Amendment Request for Implementing a 24-Month Fuel Cycle and Adoption of TSTF-493, Revision 4, Option A" (NLS2011071)
 2. Letter from Brian Benney, U.S. Nuclear Regulatory Commission, to Randall K. Edington, Nebraska Public Power District, dated September 5, 2006, "Cooper Nuclear Station – Issuance of Amendment Re: Application of the Alternative Source Term for Reevaluation of the Fuel Handling Accident Dose Consequences and Related Technical Specification Changes (TAC No. MC8566)

Dear Sir or Madam:

The purpose of this letter is for the Nebraska Public Power District (NPPD) to request an amendment to Facility Operating License DPR-46 under the provisions of 10 CFR 50.4 and 10 CFR 50.90 to revise the Cooper Nuclear Station (CNS) Updated Safety Analysis Report (USAR) to reflect changes to the Fuel Handling Accident (FHA) dose calculation. In Reference 1, NPPD submitted a License Amendment Request to revise the CNS Technical Specifications to support operation with a 24-month fuel cycle (ADAMS Accession Number ML11264A165). In that License Amendment Request, NPPD summarized the effect on the design basis accident (DBA) radiological source term, and stated that these changes would be reviewed under the provisions of 10 CFR 50.59, and were not part of that application. After further review, NPPD has determined that it is appropriate that the changes to the USAR resulting from the revision to the FHA dose calculation be submitted for prior Nuclear Regulatory Commission (NRC) review and approval.

In Reference 2, the NRC issued CNS License Amendment 222, which approved the FHA dose consequences resulting from the adoption of the alternative source term per 10 CFR 50.67. Pursuant to this, NPPD submitted a revised DBA FHA calculation (ADAMS Accession Number ML052770499). As part of the transition to a 24-month fuel cycle, NPPD has revised this calculation to reflect the source term associated with the use of a Global Nuclear Fuels 10x10

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fuel array exposed over a 24-month fuel cycle, resulting in a more than minimal increase in the dose consequences of this accident. To offset this increase, NPPD has reduced the Radial Peaking Factor from 2.0 (as stated in License Amendment 222) to 1.95, a value that is still bounding for CNS core design. Finally, NPPD has included a calculated shine value to the FHA dose consequences, which supersedes the qualitative shine assessment that was accepted in License Amendment 222. NPPD has determined from the No Significant Hazards Consideration determination that these changes do not involve a significant hazard.

NPPD requests approval of the proposed amendment by June 22, 2013. Once approved, the amendment will be implemented within 30 days.

Attachment 1 provides a description of the changes to the DBA FHA dose calculation, the No Significant Hazards Consideration evaluation pursuant to 10 CFR 50.91(a)(1), and the Environmental Impact evaluation pursuant to 10 CFR 51.22. Attachment 2 provides the proposed USAR changes. A copy of the revised FHA dose calculation is also enclosed.

This License Amendment Request has been reviewed by the necessary safety review committees (Station Operations Review Committee and Safety Review and Audit Board). Amendments to the CNS Facility Operating License through Amendment 241 issued February 16, 2012, have been incorporated into this request. This request is submitted under affirmation pursuant to 10 CFR 50.30(b).

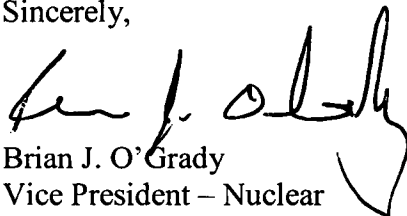
By copy of this letter and its attachments, the appropriate State of Nebraska official is notified in accordance with 10 CFR 50.91(b)(1). Copies are also being provided to the NRC Region IV office and the CNS Senior Resident Inspector in accordance with 10 CFR 50.4(b)(1).

There are no commitments made in this License Amendment Request. Should you have any questions concerning this matter, please contact Mike Boyce, CNS Strategic Initiatives Project Manager, at (402) 825-5100.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: June 25 2012
(Date)

Sincerely,



Brian J. O'Grady
Vice President – Nuclear
and Chief Nuclear Officer

BJO/wv

Attachments: 1. License Amendment Request for Revisions to the Fuel Handling Accident
2. Proposed Updated Safety Analysis Report Revisions (Markup)

Enclosure: NEDC 05-031, Rev. 3C1, "Radiological Dose Analysis for a Fuel Handling Accident (FHA) at Cooper Nuclear Station"

cc: Regional Administrator w/Attachments and Enclosure
USNRC - Region IV

Cooper Project Manager w/Attachments and Enclosure
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/Attachments and Enclosure
USNRC - CNS

Nebraska Health and Human Services w/Attachments and Enclosure
Department of Regulation and Licensure

NPG Distribution w/o Attachments or Enclosure

CNS Records w/Attachments and Enclosure

Attachment 1

License Amendment Request for Revisions to the Fuel Handling Accident

Cooper Nuclear Station; Docket No. 50-298, DPR-46

- 1.0 Summary Description
- 2.0 Detailed Description
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1.0 SUMMARY DESCRIPTION

This letter is a request to the Nuclear Regulatory Commission (NRC) to amend Facility Operating License DPR-46 for Cooper Nuclear Station (CNS). The requested change revises the description of the Fuel Handling Accident (FHA) in Section XIV-6.4 of the CNS Updated Safety Analysis Report (USAR). The revised USAR FHA description is based on changes to the Design Basis Accident FHA dose calculation, to reflect a 24-month cycle source term using a Global Nuclear Fuels (GNF) 10x10 fuel array, a reduced Radial Peaking Factor, and inclusion of a calculated shine contribution to the total dose.

As demonstrated in this submittal, the proposed changes do not adversely impact safety, as the net dose results are minor. The Nebraska Public Power District (NPPD) is requesting approval of this application by June 22, 2013. Once approved, NPPD will implement the amendment within 30 days.

2.0 DETAILED DESCRIPTION

2.1 Proposed Changes

2.1.1 Source Term Changes For a 24-Month Fuel Cycle Using a GNF 10x10 Fuel Array

The current FHA source term is based on the limiting case of GE14 fuel with a radionuclide inventory based on an 18-month exposure. The transition to a 24-month fuel cycle at CNS will involve the use of a GNF 10x10 fuel array with a radionuclide inventory based on a 24-month exposure. The change in FHA source term is described in USAR Table XIV-6-11 provided in Attachment 2. The resulting dose effects are described in USAR Table XIV-6-16 provided in Attachment 2.

2.1.2 Change to the Radial Peaking Factor

To limit the calculated dose to Control Room occupants that would otherwise increase with the 24-month cycle/GNF 10x10 source term, the bounding Radial Peaking Factor was changed from a limit of 2.0 to 1.95. This is described in USAR Section XIV-6.4.7.1 and Table XIV-6-11 provided in Attachment 2.

2.1.3 Inclusion of Shine Contribution

License Amendment 222 accepted a qualitative assessment made by NPPD in the application regarding the potential gamma shine dose from external sources to the Control Room occupants during the FHA (Reference 6.1). That assessment determined that the cloud shine and Control Room Emergency Filter System (CREFS) filter shine contribution to Control Room occupant doses would be a fraction of the inhalation doses and the resulting total dose would still be below regulatory criteria. In the revised FHA dose calculation, NPPD has replaced this qualitative assessment with calculated values that have been added to the dose

consequences of the FHA, per Regulatory Guide (RG) 1.183. The new shine contribution is described in USAR Section XIV-6.4.7.4.2 and Table XIV-6-16 provided in Attachment 2.

2.2 Need for Changes

The transition to a 24-month fuel cycle is a CNS Strategic Initiative, as described in Reference 6.2. The changes in FHA dose consequences to the Control Room occupant resulting from the 24-month cycle/GNF 10x10 source term for the first and second dose cases (without crediting the offset by a reduced Radial Peaking Factor), results in more than a minimal increase in the consequences of an accident previously evaluated in the USAR, as stated in 10 CFR 50.59(c)(2)(iii). A license amendment is therefore required for the Control Room occupant dose results per 10 CFR 50.90.

3.0 TECHNICAL EVALUATION

3.1 FHA Source Term Changes

The design basis FHA for the CNS core will be a GNF 10x10 fuel bundle dropped on another GNF 10x10 fuel bundle. The source term and dose consequences for this FHA are bounding over other combinations of bundle drops with the fuel types currently used in the CNS core. Accordingly, the previous FHA analysis, based on GE14 fuel exposed to 18-months with a 2.0 Radial Peaking Factor, is superseded by an FHA involving GNF 10x10 fuel exposed to 24-months with a 1.95 Radial Peaking Factor.

The changes to the FHA source term are described in USAR Table XIV-6-11, as provided in Attachment 2. Changes in the "RADTRAD Ci/MWt" column were calculated based on use of GNF 10x10 fuel exposed for a 24-month period, using the isotope generation and depletion code General Electric Hitachi (GEH) Non-Level-2 ECP ORIGEN01P. ORIGEN01P is the GEH-controlled version of the Oak Ridge National Laboratory code ORIGEN2 version 2.1, incorporating the boiling water reactor extended burnup library BWRUE.

The MWt and Power Uncertainty Factor (PUF) columns are revised. These terms are multiplied together to obtain the maximum full power operation of the core for assessing the inventory of fission products available for release. The original values were based on a licensed thermal power of 2381 Megawatts, with a 1.02 (two percent) 10 CFR 50 Appendix K PUF. License Amendment 231, a measurement uncertainty recapture power uprate (Reference 6.3), raised the licensed thermal power to 2419 Megawatts. As such, the resulting PUF was back calculated ($1.02 \text{ PUF} \times 2381 \text{ MWt} / 2419 \text{ MWt} = 1.00398 \text{ PUF}$). As a result, multiplying the original MWt column by the original PUF is equivalent to multiplying the revised values, so there is no dose impact by these changes.

To offset the isotopic increase in RADTRAD Ci/MWt, the Radial Peaking Factor is being reduced from 2.0 to 1.95. The previous value, acknowledged in License Amendment 222, represented the maximum possible value as specified by the fuel provider. Since the maximum expected Radial Peaking Factor per core design (including operational margin) would not be expected to exceed 1.7, the revised value of 1.95 will not be exceeded throughout the operating cycle.

The changes to the Fraction of Core Failed column of USAR Table XIV-6-11, as provided in Attachment 2, is based on an analysis provided by Global Nuclear Fuels Americas, LLC, related to GNF2 Advantage fuel compliance with Amendment 22 of NEDC-24011-P-A (GESTAR II) (Reference 6.4) regarding the FHA. The analysis addressed the worst fuel drop using a comparison which validated that the GNF 10x10 fuel array is bounding. The activity released in an FHA for a GNF 10x10 core is based on 150 rods assumed to have been damaged (using the current CNS triangular refueling mast and grapple head). Each bundle has an equivalent of 85.6 full length fuel rods. With a total of 548 fuel bundles in the core, the fraction of the core damage is calculated to be $150 \text{ damaged rods} / (548 \times 85.6) \text{ total rods} = 0.0031977$.

There are two cases considered in the CNS FHA analysis. The first case involves damaged fuel decayed from 24 hours to 7 days without Secondary Containment intact. The second case involves damaged fuel decayed 7 days or longer without Secondary Containment or CREFS in service. The changes in total dose for these two cases are described in USAR Table XIV-6-16, as provided in Attachment 2.

3.2 Shine Contribution

In the FHA dose consequences calculation approved with License Amendment 222, NPPD provided a qualitative assessment of the gamma shine from external sources to the Control Room, consisting of an airborne cloud shine dose comparison, and a CREFS filter shine dose assessment. NPPD concluded that including the shine contribution to the Control Room occupant dose consequences would not result in exceeding the 5 rem Total Effective Dose Equivalent (TEDE). This qualitative shine contribution was not included in the dose results described in the USAR. In the revised FHA dose calculation, NPPD has established a quantitative value for cloud and CREFS filter Control Room shine (114 mrem), which has been added to the dose consequences of Case 1. The results of the shine contribution are described in USAR Section XIV-6.4.7.4.2 and Table XIV-6-16, as provided in Attachment 2.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

The following is a discussion of the applicable regulations, and other applicable regulatory criteria, along with a discussion of continued conformance.

4.1.1 10 CFR 50.67, Accident Source Term

10 CFR 50.67 permits licensees to voluntarily revise the accident source term used in design basis radiological consequence analyses. The regulation replaces 10 CFR 100 and 10 CFR 50 Appendix A, General Design Criterion 19, in providing dose limits to the Exclusion Area Boundary, Low Population Zone, and Control Room occupant. The NRC approved use of the alternative source term (AST) in License Amendment 222. The revised dose calculation continues to comply with 10 CFR 50.67.

4.1.2 Regulatory Guide 1.183

RG 1.183 (Reference 6.5) provides guidance to licensees of operating power reactors on acceptable applications of ASTs; the scope, nature, and documentation of associated analyses and evaluations; consideration of impacts on analyzed risk; and content of submittals. The License Amendment Request associated with License Amendment 222 provided a comparison of the CNS FHA AST calculation with the RG 1.183 regulatory positions. The changes made to that FHA AST calculation referenced in the current submittal maintain the same level of conformance to this Regulatory Guide.

4.2 Precedent

The most recent precedent involving a change to the design basis accident (DBA) FHA calculation has involved the transition to the AST per 10 CFR 50.67:

Monticello – License Amendment 145, dated April 24, 2006 (ADAMS Accession Number ML060600572). This application was based on GE 8x8 fuel with a Radial Peaking Factor of 1.7.

4.3 No Significant Hazards Consideration

The Nebraska Public Power District (NPPD) proposes to change the Cooper Nuclear Station (CNS) Updated Safety Analysis Report (USAR) to incorporate a revision to the Fuel Handling Accident (FHA) dose calculation. This proposed change to the USAR has been determined to require prior Nuclear Regulatory Commission (NRC) review and approval under the provisions of 10 CFR 50.59. In accordance with 10 CFR 50.59(c)(2), NPPD is submitting an application for amendment of the license, pursuant to 10 CFR 50.90, to request NRC review and approval of the proposed change.

The NRC has provided standards for determining whether an amendment involves no significant hazards consideration, which are stated in 10 CFR 50.92(c). A proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not: (1)

involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. NPPD has evaluated the proposed license amendment in accordance with 10 CFR 50.91(a), and is providing its analysis of the issue of no significant hazards consideration using the three standards in 10 CFR 50.92(c).

1. Do the proposed changes involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The analyses changes described by this proposed change to the USAR are not initiators to events, and, therefore, do not involve the probability of an accident. The changes to the FHA calculation for radiological dose following a FHA incorporate the following:

- accounts for the increase to the source term owing to the use of Global Nuclear Fuels (GNF) 10x10 fuel exposed over a 24-month fuel cycle,
- reduces the Radial Peaking Factor from 2.0 to 1.95,
- uses a calculated Control Room shine contribution that is added to the FHA dose consequences.

The NRC computer code RADTRAD Version 3.03 is used for the offsite and Control Room dose calculation. The RADTRAD code was approved for use with the CNS FHA alternative source term (AST) dose calculation in License Amendment 222.

Because the analysis affected by the changes are not considered to be an initiator to any previously analyzed accident, these changes cannot increase the probability of any previously evaluated accident. Therefore, these changes do not increase the probability of occurrence of an accident evaluated previously in the USAR.

The changes in FHA dose consequences to the Control Room occupant resulting from the 24-month cycle/GNF 10x10 source term (without crediting the offset by a reduced Radial Peaking Factor), results in more than a minimal increase in the consequences of an accident previously evaluated in the USAR, as stated in 10 CFR 50.59(c)(2)(iii). However, the resultant dose remains well within the regulatory limits of 10 CFR 50.67. When the reduced Radial Peaking Factor is applied, the dose consequences are minor. Therefore, this change does not significantly increase the consequences of an accident previously evaluated in the USAR.

In summary, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Do the proposed changes create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

This change does not involve initiators to any events in the USAR, nor does the activity create the possibility for any new accidents. Rather, this change is a result of the evaluation of the most limiting FHA, which can occur at CNS. The changes to the FHA calculation for radiological dose following a FHA incorporate the following:

- accounts for the increase to the source term owing to the use of GNF 10x10 fuel exposed over a 24-month fuel cycle,
- reduces the Radial Peaking Factor from 2.0 to 1.95, and
- uses a calculated Control Room shine contribution that is added to the FHA dose consequences.

The RADTRAD code accommodates the use of GNF 10x10 fuel exposed over a 24-month fuel cycle in calculating the FHA dose consequences. The reduction in Radial Peaking Factor remains bounding over the CNS core design. The calculated Control Room shine contribution replaces the previously approved qualitative assessment. The proposed change does not introduce any new modes of plant operation and does not involve physical modifications to the plant. As a result, no new failure modes are being introduced.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Do the proposed changes involve a significant reduction in a margin of safety?

Response: No.

The dose consequences are calculated in accordance with the regulatory guidance found in RG 1.183. The RADTRAD code was used, as approved for application at CNS with License Amendment 222. With the reduced Radial Peaking Factor applied to the GNF 10x10 fuel that has been exposed over a 24-month fuel cycle, the dose consequences are minor. The calculated shine contribution being added to the total Control Room occupant FHA dose results are less than the previous qualitative assessment results that are being replaced. Accordingly, the safety margins to the regulatory dose limits are preserved.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the responses to the above questions, NPPD concludes that the proposed license amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c) and, accordingly, a finding of “no significant hazards consideration” is justified.

4.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

The proposed change would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20. However, the proposed change does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed change.

6.0 REFERENCES

- 6.1** Letter from Brian Benney, U.S. Nuclear Regulatory Commission, to Randall K. Edington, Nebraska Public Power District, dated September 5, 2006, “Cooper Nuclear Station – Issuance of Amendment Re: Application of the Alternative Source Term For Reevaluation of the Fuel Handling Accident Dose Consequences and Related Technical Specification Changes (TAC No. MC8566)”
- 6.2** Letter from Brian J. O’Grady, Nebraska Public Power District, to U.S. Nuclear Regulatory Commission, dated September 16, 2011, “License Amendment Request for Implementing a 24-Month Fuel Cycle and Adoption of TSTF-493, Revision 4, Option A” (NLS2011071)
- 6.3** Letter from Carl F. Lyon, U.S. Nuclear Regulatory Commission, to Stewart B. Minahan, Nebraska Public Power District, dated June 30, 2008, “Cooper Nuclear Station – Issuance of Amendment Re: Measurement Uncertainty Recapture Power Uprate (TAC No. MD7385)”

- 6.4** GNF NEDC-33270P, “GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II),” Rev. 3, March 2010
- 6.5** Regulatory Guide 1.183, “Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors,” July 2000

Attachment 2

**Proposed Updated Safety Analysis Report Revisions
(Markup)**

Cooper Nuclear Station, Docket No. 50-298, DPR-46

6.4 Fuel Handling Accident

Accidents that result in the release of radioactive materials directly to the Secondary Containment can occur when the drywell is open. A survey of the various conditions that could exist when the drywell is open reveals that the greatest potential for the release of radioactive material occurs when the drywell head and reactor vessel head have been removed. In this case, radioactive material released as a result of fuel failure is available for transport directly to the Secondary Containment.

Various mechanisms for fuel failure under this condition have been investigated. With the current fuel design the refueling interlocks, which impose restrictions on the movement of refueling equipment and control rods, prevent an inadvertent criticality during refueling operations. Loss of refueling cavity inventory due to a seal failure^[71] was evaluated that, if refueling cavity seal failed, the Core Spray and/or the Reactor Heat Removal systems would allow ample time to place fuel in a safe location per CNS Emergency Operating Procedures. In addition, the Reactor Protection System can initiate a reactor scram in time to prevent fuel damage for errors or malfunctions occurring during planned criticality tests with the reactor vessel head off. It is concluded that the only accident that could result in the release of significant quantities of fission products directly to the Secondary Containment during this mode of operation is one resulting from the accidental dropping of a fuel bundle onto the top of the core.

6.4.1 Identification of Causes

This event occurs under non-operating conditions for the fuel. The key assumption of this postulated occurrence is the inadvertent mechanical damage to the fuel rod cladding as a consequence of the fuel bundle being dropped on the core while in the cold condition.

6.4.2 Frequency Classification

The Fuel Handling Accident is classified as a design basis accident (limiting fault).

6.4.3 Starting Conditions and Assumptions

The assumptions and analyses applicable to the Fuel Handling Accident are described below.

(1) The fuel assembly is dropped from 32.95 feet (the maximum height allowed by the fuel handling equipment).

(2) The entire amount of potential energy, including the energy of the entire assemblage falling on its side from a vertical position (referenced to the top of the reactor core) is available for application to the fuel assemblies involved in the accident. This assumption neglects the dissipation of some of the mechanical energy of the falling fuel assembly in the water above the core. Of the possible ways that a fuel assembly could be dropped, the most potential energy would be involved if the grapple cable breaks, allowing the grapple head and three sections of the telescoping mast to remain attached to the falling assembly.

(3) None of the energy associated with the dropped fuel assembly is absorbed by the fuel material (uranium dioxide).

(4) All fuel rods, including tie rods, were assumed to fail by 1 percent plastic strain in compression, the same mode as ordinary fuel rods.

For the fuel designs considered here, there is no propensity for preferential failure of tie rods.

(5) Because the event occurs under non-operating conditions, fuel densification considerations do not enter into or affect the accident results.

(6) The RPV water level is at least 21 feet above the top of RPV flange. This assures that there will be a water height over Fuel Zone Zero and the top of the dropped bundle that exceeds the 23 feet assumed by Regulatory Guide 1.183 for decontamination factor considerations.

(7) At least 24 hours has elapsed since shutdown. Secondary Containment Integrity is not required during the movement of fuel that has had at least a 24 hour decay time.

(8) A loss of offsite or onsite power is not assumed for this accident.

(9) For fuel movements that have decayed less than 7 days, either a Reactor Building exhaust fan or an SGT System fan is running. Otherwise, the Control Room Emergency Filter System is manually initiated prior to the start of the fuel handling evolution.

6.4.4 Sequence of Events and Systems Operation

The most severe Fuel Handling Accident from a radiological release viewpoint is the drop of a channeled exposed fuel bundle onto other fuel in the reactor vessel. In the hypothesized accident, the fuel grapple cable breaks, allowing the fuel bundle, grapple head, and three sections of the telescoping mast to remain attached to the falling assembly. On impact, rods in both the dropped and struck bundles fail, releasing radioactive gases to the water in the reactor vessel. From there the gases are released to the refueling floor of the Reactor Building. With the Primary Containment and the reactor vessel open, the reactor cavity water pool and the Secondary Containment (Reactor Building) serve as the major barriers to the release of radioactive materials.

6.4.5 Core and System Performance

The severity of the Fuel Handling Accident is directly based on the number of fuel rods damaged and the radial peaking factor for each fuel type. This analysis addresses the worst case fuel drop for the fuel types used in the CNS core combination of GE 8x8NB and GE14 10x10 fuel. The limiting case is a GE14 Global Nuclear Fuels (GNF) 10x10 fuel bundle dropped over GE14 GNF 10x10 bundles, which results in 151150 fuel rods that are assumed to be damaged. The methodology used to determine the number of damaged fuel rods is contained in NEDC-32868 GNF NEDC-33270P, "GE14 GNF2 Advantage Generic Compliance With Amendment 22 of NEDE-24011-P-A (GESTAR II)." [18996]

6.4.6 Barrier Performance (Secondary Containment Response)

Secondary Containment integrity is not required for this accident. However, consistent with NUMARC 93-01, Revision 3, Section 11.3.6.5, NPPD implements a Secondary Containment breach control strategy during the movement of irradiated fuel inside Secondary Containment (see Section V-3.4). This ensures that Secondary Containment is structurally intact during the accident. With Reactor Building ventilation exhaust flow established prior to the start of the event, high radiation levels in the Reactor Building exhaust plenum will initiate the Control Room Emergency Filter System.

6.4.7 Radiological Consequences

The radiological consequences of a Fuel Handling Accident are based on a fuel failure due to the drop of a fuel assembly onto the core, in conjunction with a conservative transport methodology based on Regulatory Guide 1.183 and 10CFR50.67 "Accident Source Term." As a result of the accident, radionuclides are released from the damaged fuel rods to the water pool above the core. Subsequently, the radionuclides are released to the refueling floor and then to the environment via the Reactor Building HVAC System. From this release, doses are calculated for individuals offsite. The release of radionuclides to the environment can result in a dose to the Control Room occupants due to intake of contaminated air via the Main Control Room Air Conditioning System.

The radiological consequences of the Fuel Handling Accident were assessed using the RADTRAD 3.03 software code. This code was used to calculate the Control Room occupant, Exclusion Area Boundary and Low Population Zone TEDE doses.^[92]

6.4.7.1 Fission Product Release From Fuel

The radionuclide source term during a Fuel Handling Accident is based on the fraction of the reactor core that is damaged as a result of the accident ~~and the maximum radial peaking factor of the fuel used~~. As discussed in USAR Section XIV-6.4.5, ~~151150~~ GE14GNF fuel rods are assumed to be damaged. Each fuel bundle has an equivalent of ~~87.33385.6~~ full length fuel rods. With 548 fuel bundles in the core the fraction of the core failed is calculated to be ~~151150/(548 x 87.33385.6)~~ or ~~0.0031550.0031977~~.

The core is assumed to have been operated at rated thermal power plus 2%, to account for uncertainties in power measurement for a sufficiently extended period (approximately 3 years) such that fission product equilibrium is reached. For radionuclides which have not reached equilibrium the core inventory at time of shutdown is used. The source term used for this accident is based on ~~NEDE-32868PGNF~~ NEDE-33270P, "GE14GNF2 Advantage Compliance With Amendment 22 of NEDE-24011-P-A (GESTAR II)."^[92] This core inventory source term was calculated using the isotope generation and depletion code ORIGEN2, which incorporates the BWR extended burnup library BWRUE. Additionally, the calculated source term is based on a 24-hour decay period from when the fuel was last irradiated until the Fuel Handling Accident initiating event. A 7 day decay case was performed to demonstrate that CREFS is not needed for Control Room occupant dose mitigation.

A radial peaking factor of ~~2.01.95~~ is applied to the radionuclide inventory calculation to reflect ~~at the highest~~ peaking factor that bounds core designs within GE14GNF 10x10 fuel. The combination of the ~~102%1.00398~~ power uncertainty factor applied to the licensed thermal power of 2419 MW, and a radial peaking factor of ~~2.01.95~~ results in a very conservative source term.

The fuel gap fraction of radionuclides released from the damaged rods is 8% of the I-131, 10% of the KR-85, 5% of the other iodines and noble gases, and 0.12% alkali metals in the rods at the time of the accident per the assumptions of Regulatory Guide 1.183. The chemical forms of radioiodine released from the fuel to the pool are 95% aerosol (cesium iodine), 4.85% elemental and 0.15% organic. The particulate iodine is entirely retained within the reactor cavity pool.

6.4.7.2 Fission Product Release to Secondary Containment

The source term release to the Refueling floor is shown on Table XIV-6-11. Immediately after the fuel bundle drop, radionuclides are assumed to be released from the reactor cavity pool to the refueling floor in sufficient quantities to initiate CREFS due to high radiation (if decay time is less than 7 days). The following assumptions and initial conditions are used to calculate the fission product release to the Secondary Containment.

a. The fission product activity released to the Secondary Containment will be in proportion to the removal efficiency of the water in the refueling pool. The refueling cavity water height is at least 23 feet

USAR
TABLE XIV-6-11
FUEL HANDLING ACCIDENT
SECONDARY CONTAINMENT AIRBORNE FISSION PRODUCT INVENTORY 24 HOURS AFTER SHUTDOWN

Isotope	RADTRAD Ci/MWt ⁽¹⁾	MWt	Power Uncertainty Factor	Total Core Inventory (Ci)	Radioactive Half Life (sec) ⁽²⁾	Time After Shutdown (sec)	Core Inventory at Time After Shutdown (Ci) ⁽³⁾	Fraction of Core Inventory Released	Water Pool Decon Factor	Radial Peaking Factor	Fraction of Core Failed	FHA Source Term (Ci)
Br-82	1.800E870 E+02	2381 2419	1.021.00398	4.372E542E+05	1.271E+05	86400	2.729E835E+05	0.05	0.005	2.001.95	0.00319770- 003155123	4.305420E -01
Br-83	3.260E240 E+03	2381 2419	1.021.00398	7.917E869E+06	8.604E+03	86400	7.522E476E+03	0.05	0.005	2.001.95	0.00319770- 003155123	1.187165E -02
B4-84	5.610E560 E+03	2381 2419	1.021.00398	1.362E350E+07	1.908E+03	86400	3.204E175E-07	0.05	0.005	2.001.95	0.00319770- 003155123	5.0544.95 0E-13
Kr-83m	3.270E250 E+03	2381 2419	1.021.00398	7.942E893E+06	6.588E+03	86400	8.970E916E+02	0.05	1	2.001.95	0.00319770- 003155123	2.830780E -01
Kr-85	3.660E26 0E+02	2381 2419	1.021.00398	8.8891.035E+05	3.383E+08	86400	8.8871.034E+050 6	0.10	1	2.001.95	0.00319770- 003155123	5.6086.45 0E+02
Kr-85m	6.810E750 E+03	2381 2419	1.021.00398	1.654E639E+07	1.613E+04	86400	4.038E003E+05	0.05	1	2.001.95	0.00319770- 003155123	1.24874E+ 02
Kr-87	1.300E280 E+04	2381 2419	1.021.00398	3.157E109E+07	4.578E+03	86400	6.595E493E+01	0.05	1	2.001.95	0.00319770- 003155123	2.02581E- 02
Kr-88	1.830E810 E+04	2381 2419	1.021.00398	4.444E396E+07	1.022E+04	86400	1.272E258E+05	0.05	1	2.001.95	0.00319770- 003155123	4.0133.92 2E+01
I-128	4.190E330 E+02	2381 2419	1.021.00398	1.018E052E+06	1.499E+03	86400	4.575E728E-12	0.05	0.005	2.001.95	0.00319770- 003155123	7.217370E -18
I-130	1.060E100 E+03	2381 2419	1.021.00398	2.574E671E+06	4.450E+04	86400	6.703E956E+05	0.05	0.005	2.001.95	0.00319770- 003155123	1.05784E+ 00
I-131	2.720E+04	2381 2419	1.021.00398	6.606E606E+07	6.947E+05	86400	6.060E+07	0.08	0.005	2.001.95	0.00319770- 003155123	1.53012E+ 02
I-132	3.930E960 E+04	2381 2419	1.021.00398	9.544E617E+07	8.280E+03	86400	6.906E959E+04	0.05	0.005	2.001.95	0.00319770- 003155123	1.0895E- 01
I-133	5.510E480 E+04	2381 2419	1.021.00398	1.338E331E+08	7.488E+04	86400	6.0155.982E+07	0.05	0.005	2.001.95	0.00319770- 003155123	9.489326E +01
I-134	6.040E+04	2381 2419	1.021.00398	1.467E+08	3.156E+03	86400	8.453E453E-01	0.05	0.005	2.001.95	0.00319770- 003155123	1.33418E- 06
I-135	5.160E+04	2381 2419	1.021.00398	1.253E+08	2.380E+04	86400	1.012E+07	0.05	0.005	2.001.95	0.00319770- 003155123	1.59778E+ 01
Te-129 ⁽⁴⁾	8.790E840 E+03	2381 2419	1.021.00398	2.135E147E+07	4.176E+03	86400	1.266E273E+01	0.00	0.00	2.001.95	0.00319770- 003155123	0.000E+00
Te-131 ⁽⁴⁾	2.420E+04	2381 2419	1.021.00398	5.877E+07	1.500E+03	86400	2.7134E-10	0.00	0.00	2.001.95	0.00319770- 003155123	0.000E+00
Te-131m ⁽⁴⁾	3.960E970 E+03	2381 2419	1.021.00398	9.617E642E+06	1.080E+05	86400	5.524E538E+06	0.00	0.00	2.001.95	0.00319770- 003155123	0.000E+00
Te-132 ⁽⁴⁾	3.850E860 E+04	2381 2419	1.021.00398	9.350E375E+07	2.815E+05	86400	7.559E578E+07	0.00	0.00	2.001.95	0.00319770- 003155123	0.000E+00
Te-133 ⁽⁴⁾	3.240E+04	2381 2419	1.021.00398	7.869E869E+07	7.470E+02	86400	1.217E-27	0.00	0.00	2.001.95	0.00319770- 003155123	0.000E+00

USAR												
Te-133m ⁽⁴⁾	1.980E970 E+04	2381 2419	1.021.00398	4.809E784E+07	3.324E+03	86400	7.229E193E-01	0.00	0.00	2.001.95	0.00319770- 003155123	0.000E+00
Te-134 ⁽⁴⁾	4.500E480 E+04	2381 2419	1.021.00398	1.093E088E+08	2.508E+03	86400	4.681E660E-03	0.00	0.00	2.001.95	0.00319770- 003155123	0.000E+00
Xe-129m	2.060E230 E-01	2381 2419	1.021.00398	5.003E416E+02	6.912E+05	86400	4.588E966E+02	0.05	1	2.001.95	0.00319770- 003155123	1.448548E -01
Xe-131m	3.040E+02	2381 2419	1.021.00398	7.383E383E+05	1.028E+06	86400	6.965E+05	0.05	1	2.001.95	0.00319770- 003155123	2.19872E+ 02
Xe-133	5.260E450 E+04	2381 2419	1.021.00398	1.277E324E+08	4.532E+05	86400	1.119E160E+08	0.05	1	2.001.95	0.00319770- 003155123	3.532616E +04
Xe-133m	1.580E730 E+03	2381 2419	1.021.00398	3.8374.202E+06	1.890E+05	86400	2.7963.061E+06	0.05	1	2.001.95	0.00319770- 003155123	8.8209.54 3E+02
Xe-135	1.3602.04 0E+04	2381 2419	1.021.00398	4.517E954E+07	3.272E+04	86400	7.248E950E+06	0.05	1	2.001.95	0.00319770- 003155123	2.287479E +03
Xe-135m	1.090E100 E+04	2381 2419	1.021.00398	2.647E671E+07	9.174E+02	86400	1.197E208E-21	0.05	1	2.001.95	0.00319770- 003155123	3.776E-25
Xe-138	4.500E490 E+04	2381 2419	1.021.00398	1.093E090E+08	8.502E+02	86400	2.841E835E-23	0.05	1	2.001.95	0.00319770- 003155123	8.963838E -27

- (1) The radionuclide release to the refueling area used in RADTRAD 3.03 is based on the ORIGEN2 generated source term, as compiled in this table.
- (2) From RADTRAD nuclide inventory file (NIF) Attachment B.
- (3) Calculated from standard equation $N = N_i \times e^{-(.693/\text{Half Life}) \times \text{Decay Time}}$
- (4) Tellurium Metals were included in the nuclide inventory file (NIF) based on their daughtering contribution to iodine as analyzed by RADTRAD.

above the top of the damaged fuel bundles. Therefore, the water decontamination factors provided in Regulatory Guide 1.183 are used.

b. The effective air volume of the refuel floor is $7.95 \times 10^5 \text{ ft}^3$.

6.4.7.3 Fission Product Release to Environs

The following assumptions and initial conditions are used to calculate the fission product release to the environs.

a. High radiation levels in the reactor building exhaust plenum will start the Control Room Emergency Filter System, if less than a 7 day decay time has elapsed.

b. In accordance with RG 1.183, the radioactive material released to the refueling floor is released over a 2-hour period. Since Secondary Containment is not assumed to be functioning, the discharge is a ground level, unfiltered release from the ventilation exhaust plenum to the discharge point on the Reactor Building roof. This release point was determined to provide the most limiting dose consequences over other Reactor Building hatches, doors, and airlocks. Using the relationship for dilution with 100% makeup for an enclosed space, the resulting flow rate is 4.576×10^4 cubic feet/minute.

The chemical/physical form of iodine released to the refueling floor in RADTRAD 3.03 is apportioned among the three iodine species:

1. 0.57 for elemental iodine
2. 0.43 for organic iodine

As identified in Regulatory Guide 1.183, this analysis uses an effective pool decontamination factor of 200 (which encompasses a decontamination factor for elemental and organic species of 500 and 1, respectively).

6.4.7.4 Radiological Effects

6.4.7.4.1 Offsite Consequence Results

The offsite consequences in terms of radiological doses resulting from the activity released to the environment during a Fuel Handling Accident have been determined based on the calculated Reactor Building atmospheric dispersion factors (X/Q) for the Exclusion Area Boundary and Low Population Zone shown on Table X-6-14. The X/Q values were generated using the methodology presented in Regulatory Guides 1.3 and 1.25. Building wake effect is factored into the atmospheric dispersion factor determinations. Two dose periods were evaluated, the worst case 2-hour dose period at the Exclusion Area Boundary and a 30-day dose period for the Low Population Zone. The Exclusion Area Boundary and Low Population Zone radiological consequences of the Fuel Handling Accident have been assessed using the RADTRAD 3.03 software code. The code was used to calculate the TEDE at these receptor locations. The RADTRAD 3.03 assessment results are shown on Table XIV-6-16 and are well within the 10CFR50.67 dose limits.

6.4.7.4.2 Onsite (Control Room Occupant) Consequence Results

The Control Room occupant radiological doses from a Fuel Handling Accident were assessed using the RADTRAD 3.03 software code. The doses have been determined based on the calculated Reactor Building atmospheric dispersion factors (X/Q) for the Control Room Air Conditioning System ventilation intake, with consideration of the effects of the Control Room Emergency Filter System (CREFS) when damaged fuel has had less than a 7 day decay period. The Reactor Building X/Q values for the Control Room dose calculations were generated using the ARCON96 software code and site specific meteorology for the years 1994-1998. The Reactor Building exhaust vent was modeled as a single release point using the ground level release mode of ARCON96. Occupancy factors for Control Room occupants after 1 day are applied to the X/Q values to allow for actual time that the occupants are assumed to be present in the Control Room. The results are shown on Table XIV-6-15.

Within 60 seconds of the Group 6 PCIS isolation signal, CREFS initiates, which isolates the normal unfiltered Control Room Air Conditioning System supply. Prior to isolation, the total air intake rate is 3635 cfm (which includes normal air intake flow, infiltration leakage, and inleakage through opening and closing of doors). No credit is taken for filtration in the first 60 seconds. After isolation, the total air intake rate is 1210 cfm, which includes CREFS intake flow, ingress/egress inleakage, and unfiltered inleakage (400 cfm unfiltered inleakage is assumed even when the isolated Control Room is at positive pressure). CREFS filter efficiency is specified as 90 percent for all iodine species. This is reduced by 1% to account for bypass. The resulting radionuclide concentration within the Control Room Envelope is diluted by the air space volume. Assuming 20% of the volume of the Control Room Envelope (including the Control Room proper) includes walls floors, and equipment, the net volume is 64,640 ft³ for the Control Room proper, and 141,860 ft³ for the entire Control Room Envelope.

The RADTRAD 3.03 software code was used to calculate the TEDE doses at the Control Room receptor location. The Control Room occupant dose also includes gamma shine from both external cloud shine to the Control Room and CREFS filter shine. The results of the dose ~~RADTRAD 3.03~~ assessment are presented on Table XIV-6-16. The results are within the dose limits of 10CFR50.67.

TABLE XIV-6-14

X/Q VALUES FOR THE EXCLUSION AREA BOUNDARY
AND LOW POPULATION ZONE

X/Q Value for the Exclusion Area Boundary

<u>Time Period</u>	<u>X/Q Value (sec/m³)</u>	<u>Comments</u>
0 to 2 hours	5.2E-4	Reactor Building Vent (Ground level release)

X/Q Values for the Low Population Zone

<u>Time Period</u>	<u>X/Q Value (sec/m³)</u>	<u>Comments</u>
0 to 0.5 hours	2.9E-4	Reactor Building Vent (Ground level release)
0.5 - 8 hours	2.9E-4	Reactor Building Vent (Ground level release)
8 to 24 hours	7.3E-5	Reactor Building Vent (Ground level release)
1 to 4 days	2.5E-5	Reactor Building Vent (Ground level release)
4 to 30 days	5.2E-6	Reactor Building Vent (Ground level release)

USAR

TABLE XIV-6-15

X/Q VALUES FOR THE CONTROL ROOM INTAKE

<u>Time Period</u>	<u>X/Q Value (sec/m³)</u>	<u>Occupancy Factor</u>	<u>X/Q Value (sec/m³) Adjusted for Occupancy</u>	<u>Comments</u>
0 to 2 hours	4.15E-03	1	4.15E-03	Reactor Building Vent (Ground level release)
2 to 8 hours	3.24E-03	1	3.24E-03	Reactor Building Vent (Ground level release)
8 to 24 hours	1.32E-03	1	1.32E-03	Reactor Building Vent (Ground level release)
1 to 4 days	9.01E-04	0.6	5.41E-04	Reactor Building Vent (Ground level release)
4 to 30 days	7.22E-04	0.4	2.89E-04	Reactor Building Vent (Ground level release)

USAR

TABLE XIV-6-16

FUEL HANDLING ACCIDENT EXCLUSION AREA BOUNDARY,
LOW POPULATION ZONE, AND CONTROL ROOM
RADIOLOGICAL DOSE CONSEQUENCES

Case 1 - Damaged fuel decayed 24 hours to 7 days (no Secondary Containment)

<u>Dose Location</u>	<u>Accumulated Dose (rem TEDE)</u>	<u>Accident Dose Criteria (rem TEDE)</u>
Control Room	4. 507 <u>568</u> *	5.0
Exclusion Area Boundary	1.45	6.3
Low Population Zone	0. 815 <u>809</u>	6.3

Case 2 - Damaged fuel decayed 7 days or longer (no Secondary Containment or CREFS)

<u>Dose Location</u>	<u>Accumulated Dose (rem TEDE)</u>	<u>Accident Dose Criteria (rem TEDE)</u>
Control Room	4. 446 <u>393</u>	5.0
Exclusion Area Boundary	0. 627 <u>622</u>	6.3
Low Population Zone	0. 350 <u>347</u>	6.3

* Includes 114 mrem due to gamma shine from external sources.

USAR

77. General Electric Report NEDC-32675P, Rev. 1, "Cooper Nuclear Station SAFER/GESTR-LOCA Analysis Basis Document," June 1997.

78. Q/A 14.8, Amend. 11.

79. NEDC 99-034, Control Room, EAB, and LPZ Doses Following a CRDA.

80. NEDC 07-082, Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station.

81. Deleted.

82. "General Electric Model for LOCA Analysis in Accordance with 10CFR50 Appendix K," NEDE-20566-P-A, September 1986.

83. "Maximum Extended Load Line Limit and Increased Core Flow for Cooper Nuclear Station," NEDC-32914P, Revision 0, January 2000.

84. NPPD Calculation NEDC 94-034H, "Containment Analysis for Appendix R Shutdown from Alternate Shutdown Room."

85. NPPD Calculation NEDC 94-034C, "USAR Cases E and F Containment Analysis."

86. NPPD Calculation NEDC 00-049, "Containment Spray Flow Rate for RHR Mode C2."

87. EE 01-047, "Evaluation of Service Level I Coatings."

88. NEDC-32868P, Revision 0, GE14 Compliance with Amendment 22 of NEDE-24011-P-A (GESTAR II), December 1998.

89. NPPD Calculation NEDC 91-031, "Appendix R Torus Area Equipment Functionality."

90. NPPD Calculation NEDC 94-034I, "ATWS Evaluation for Suppression Pool Heat-Up."

91. NEDC 99-035, Dose Calculation for Control Room, EAB, and LPZ for a MSLB.

92. NEDC 05-031, Review of Alion Calculation ALION-CAL-NPPD-3236-001, Radiological Dose Analysis for a Fuel Handling Accident (FHA) at Cooper Nuclear Station.

93. NEDC 94-273, Minimum Required Air Flow for SGT Decay Heat Removal.

94. License Amendment No. 240, Amendment to Technical Specification 3.4.3 to Reduce the Number of Safety Relief Valves Required to be Operable for Overpressure Protection.


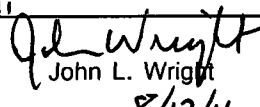
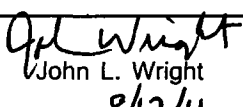
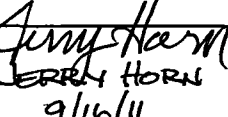
95. GE Hitachi Nuclear Energy Report NEDC-33543P, Rev. 0, "NPPD/CNS Safety/Relief Valve Capacity and Setpoint Evaluation," February 2010.

96. Global Nuclear Fuel NEDC-33270P, Rev. 3, GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), March 2010.

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NEDC 05-031, Rev. 3C1
“Radiological Dose Analysis for a Fuel Handling Accident (FHA)
at Cooper Nuclear Station”

Title: <u>Radiological Dose Analysis for a Fuel Handling Accident (FHA) at Cooper Nuclear Station</u>		Calculation Number: <u>NEDC 05-031</u>			
System/Structure: <u>HV, SGT, SC</u>		CED/EE Number: <u>EE11-016</u>			
Component: <u>N/A</u>		Setpoint Change/Part Eval Number: <u>N/A</u>			
Classification: <input checked="" type="checkbox"/> Essential; <input type="checkbox"/> Non-Essential		Discipline: <u>Mechanical Design</u>			
		SQAP Requirements Met? <input checked="" type="checkbox"/> YES; <input type="checkbox"/> N/A			
Proprietary Information Included? <input type="checkbox"/> YES; <input checked="" type="checkbox"/> NO					
Stand-Alone? <input type="checkbox"/> YES; <input checked="" type="checkbox"/> NO					
<p>Description:</p> <p>The purpose of this calculation is to determine the dose to the control room operator and to a person at the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) at the Cooper Nuclear Station site following a design basis Fuel Handling Accident (FHA). The analysis is performed using an Alternate Source Term (AST) in accordance with the guidance provided by the NRC in Regulatory Guide 1.183 (July 2000) and as allowed by 10 CFR 50.67.</p> <p>Rev. 1 - Incorporates Rev. 1 of Alion's calculation, which was revised primarily to incorporate an additional Case 1 analysis to determine total Control Room dose assuming 168 hour fuel decay time before fuel movement and without CREFS operation.</p> <p>Rev. 2 - Adds Section 4.1 to evaluate additional potential Secondary Containment release points and upgrades the calculation from Status 2 to Status 3. Alion calculation ALION-CAL-NPPD-3236-001, Rev. 1 is not changed by this revision. Revision 2 approvals are not applicable to the Alion calculation (Attachment 1).</p> <p>Rev. 3 - Upgrades Calculation NEDC 05-031 to Status 1. It also updates the Cross Reference Index to reflect that License Amendment 222 has been issued and corrects typographical errors to change the reference for Technical Specification 3.4.6.1 to Technical Specification 3.6.4.1, and to reflect the correct revision for DCDs 10 and 31.</p> <p>CNN - 3C1 - Revises the analysis for implementation of CNS 24-Month Fuel Cycle and the use of Global Nuclear Fuels-Americas, LLC, GNF2 fuel. The calculation incorporates all previous revisions directly (including ALION-CAL-NPPD-3236-001, Rev. 1) or by attachment.</p>					
<p>Conclusions and Recommendations:</p> <p>All calculated doses are shown to be below the regulatory limits for all three stipulated locations which included; (1) Control Room, (2) Low Population Zone (LPZ), and (3) Exclusion Area Boundary (EAB).</p>					
3C1	3	 Peter Brasilio/Ken Thomas 8/17/11	 John L. Wright 8/17/11	 John L. Wright 8/17/11	 JERRY HORN 9/16/11
3	1	Billy W. Reid 9/27/06	Jim Drasler 9/27/06	Jim Drasler 9/27/06	T. Stevens 10/3/06
Rev. Number	Status	Prepared By/Date	Reviewed By/Date	IDVed By/Date	Approved By/Date

Status Codes

- | | | |
|---------------------|--------------------------------------|----|
| 1. Active | 4. Superseded or Deleted | 7. |
| PRA/PSA | | |
| 2. Information Only | 5. OD/OE Support Only | |
| 3. Pending | 6. Maintenance Activity Support Only | |

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ITEM NO.	DESIGN INPUTS	REV. NO.	PENDING CHANGES TO DESIGN INPUTS
1	NEDC 99-031	6	N/A
2	NEDC 99-036	4	N/A
3	Burns and Roe Dwg 2019, sheet 1	N43	N/A
4	Burns and Roe Dwg 2051	N27	N/A
5	Burns and Roe Dwg 2052	N35	N/A
6	TS 1.1	Adm. 231	N/A
7	TS 3.7.4	Adm. 230	N/A
8	TS 3.9.6	Adm. 178	N/A
9	TS 5.5.7	Adm. 228	N/A
10	NPPD Response letter, NLS990117	12/2/1999	N/A
11	USAR XIV-6.4	02/05/10	N/A
12	LAT Final Report LAT w/o 3428 (Retrieval No. 73619 2179-2277)	4/21/2010	N/A
13	Burns and Roe Calculation - Book 4, Retrieval No. 00103-0487	4/16/69	N/A
14	NEDC-33270P	Rev. 3, 2010	N/A
15	NUREG/CR-6331	Rev. 1, 1997	N/A
16	NUREG/CR-6604	Dec. 1997	N/A
17	NUREG-1465	Feb. 1995	N/A
18	Reg Guide 1.183	July 2000	N/A
19	USAEC TID-14844	1962	N/A
20	Industrial Ventilation: Engineering Principles	1/ 1991	N/A

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21	NEDC 11-082 (GE Hitachi PTR 000-0123-3481-RO, , Task T0802 GEH Proprietary Information Nebraska Public Power District Cooper Nuclear Station 24 – Month Fuel Cycle Implementation)	0	N/A
22	GE Licensing TR, NEDE-24011-P-A-10-US	March 1991	N/A
23	Federal Guidance Report 11 (FGR 11)	1988	N/A
24	Federal Guidance Report 12 (FGR 12)	1993	N/A
25	Not Used.		
26	CNS General Operating Procedure 2.1.20.2	Rev. 16	N/A
27	The Health Physics and Radiological Health Physics Handbook, Exposure and Shielding from External Radiation, pages 188-193	N/A	N/A
28	NEDC 01-065	1	N/A
29	NEDC 05-045	2	2C1
30	Not Used		
31	Not Used.		
32	B&R Drawing 2060	N14	N/A
33	B&R Drawing 2209	3	N/A
34	B&R Drawing 4003	N37	DCN 11-0695
35	B&R Drawing 4215	N02	N/A
36	B&R Drawing 4219	N05	N/A
37	B&R Drawing 4222	N01	DCN 10-1266
38	B&R Drawing 4223	N02	N/A
39	B&R Drawing 4504	N19	DCN 05-1518, 10-0847
40	B&R Drawing 4506	N09	N/A
41	B&R Drawing 4507	N05	N/A
42	B&R Drawing 4535	N15	DCN 05-1521
43	B&R Drawing 4536	N28	DCN 97-1523, 09-1665, 11-0430, 11-0699, 10-0848

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44	6.SC.701	3	N/A
45	Technical Specification 3.6.4.1	Adm. 222	N/A
46	USAR XIV-6.4.7.1	02/05/10	N/A
47	TRM 3.9.1	10/05/06	N/A
48	NEDC 07-082	3	3C1
49	NEDC 11-082 (GEH Letter Report, GEH-HP1WX21E-024, DRF 0000-0110-4161)	0	N/A

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DESIGN CALCULATION CROSS-REFERENCE INDEX

ITEM NUMBER	AFFECTED DOCUMENTS	REVISION NUMBER
1	NEDC 02-074	0
2	NEDC 00-0105	10
3	USAR V-3.3	02/05/10
4	USAR VII-17	09/19/06
5	USAR X-4.5.2.1	05/30/00
6	USAR X-10.2.5.2	03/09/07
7	USAR XIV-6	08/01/03
8	USAR XIV-7	05/31/05
9	USAR Appendix G	02/05/10
10	TRM T 3.9	10/05/06
11	TRM B 3.9	10/05/06
12	Procedure 0.50.5	22
13	Procedure 2.1.20.2	16
14	Procedure 2.2.47	45
15	Procedure 2.3 A-1	32
16	Procedure 2.3 J-1	6
17	Procedure 2.3 R-2	14
18	Procedure 2.3 9-3-3	12
19	Procedure 6.LOG.602	55
20	Procedure 6.REFUEL.304	12
21	Procedure 6.REFUEL.305	15
22	Procedure 6.SC.501	24
23	Procedure 7.4.9	12
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26	Procedure 7.4.15	12
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28	Procedure 10.25	56
29	Procedure 10.25.1	26
30	Procedure 10.27	25
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32	Procedure 6.HV.106	0
33	Procedure 0.55	1
34	DCD 3	03/31/11
35	DCD 4	04/01/11
36	DCD 5	02/02/09
37	DCD 6	02/02/09
39	DCD 7	01/22/10
40	DCD10	02/12/10
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✓ 43	NEDC 05-007	3
44	NEDC 05-011	2
45	NEDC 05-012	2
46	NEDC 06-007	1
47	NEDC 07-082	3
48	NEDC 09-020	1
49	USAR V-3.4	Loep.xxiv6
50	USAR XIV-9 (Ref. 92)	Loep.xxiv6
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The purpose of this form is to assist the Preparer in screening new and revised design calculations to determine potential impacts to procedures and plant operations.®²

SCREENING QUESTIONS	YES	NO	UNCERTAIN
1. Does it involve the addition, deletion, or manipulation of a component or components which could impact a system lineup and/or checklist for valves, power supplies (breakers), process control switches, HVAC dampers, or instruments?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Could it impact system operating parameters (e.g., temperatures, flowrates, pressures, voltage, or fluid chemistry)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. Does it impact equipment operation or response such as valve closure time?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4. Does it involve assumptions or necessitate changes to the sequencing of operational steps?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5. Does it transfer an electrical load to a different circuit, or impact when electrical loads are added to or removed from the system during an event?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6. Does it influence fuse, breaker, or relay coordination?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7. Does it have the potential to affect the analyzed conditions of the environment for any part of the Reactor Building, Containment, or Control Room?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Does it affect TS/TS Bases, USAR, or other Licensing Basis documents?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Does it affect a Dry Fuel Storage (CoC) or associated Technical Specification, Dry Fuel Storage UFSAR, or CNS 10CFR72.212 Report?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10. Does it constitute any change or addition to, or removal from, the Independent Spent Fuel Storage Installation (ISFSI) facility or spent fuel storage cask design, or procedures that affects a design function, method of performing or controlling the function, or an evaluation that demonstrates that intended functions will be accomplished?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
11. Does it affect DCDs?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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<u>SCREENING QUESTIONS</u>	<u>YES</u>	<u>NO</u>	<u>UNCERTAIN</u>
12. Does it have the potential to affect procedures in any way not already mentioned (refer to review checklists in Procedure EDP-06)? If so, identify:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

If all answers are NO, then additional review or assistance is not required.

If any answers are YES or UNCERTAIN, then the Preparer shall obtain assistance from the System Engineer and other departments, as appropriate, to determine impacts to procedures and plant operations. Affected documents shall be listed on Attachment 2.

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DESIGN CALCULATIONS SHEET**Acronyms and Units**

Acronym	Definition
ALARA	As Low as is Reasonably Achievable
AST	Alternate Source Term
BWR	Boiling Water Reactor
CEDE	Committed Effective Dose Equivalent
CREFS	Control Room Emergency Filtration System
DBA	Design Basis Accident
DCF	Dose Conversion Factor
DDE	Deep Dose Equivalent
EAB	Exclusion Area Boundary
ESF	Engineered Safety Features
FHA	Fuel Handling Accident
FSAR	Final Safety Analysis Report
GUI	Graphical User's Interface
REM	Roentgen Equivalent Man
RP	Regulatory Position
RPF	Radial Peaking Factor
RADTRAD	A Simplified Model for RADionuclide Transport and Removal And Dose Estimation
SFP	Spent Fuel Pool
SGTS	Standby Gas Treatment System
TEDE	Total Effective Dose Equivalent
USAR	Updated Safety Analysis Report
V&V	Verification and Validation
Variable	Definition and Units of Measure
A	Fission Product Activity (Ci/Mwt)
C	Dilution Concentration (dimensionless)
t	Time (seconds)
Q	Flow (ft ³ /min.)
V	Volume (ft ³)
χ/Q	Atmospheric Dispersion Factor (sec/m ³)

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DESIGN CALCULATIONS SHEET**1. PURPOSE**

The purpose of this calculation is to determine the dose to the control room occupant and to a person at the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) at the Cooper Nuclear Station site following a design basis Fuel Handling Accident (FHA). The analysis is performed using an Alternate Source Term (AST) in accordance with the guidance provided by the NRC in Regulatory Guide 1.183 (July 2000) (Ref. 1, D.I. 18) and as allowed by 10 CFR 50.67. The RADTRAD Version 3.03 (Ref. 2, D.I. 16) computer code (currently used by the USNRC in performing radiological consequences assessments) is used to estimate the dose values at the above mentioned locations.

2. DESIGN INPUT DEVELOPMENT**2.1 Postulated Accident****FUEL HANDLING ACCIDENTS WITHIN THE REACTOR CAVITY**

The limiting postulated FHA event (accidents within the SFP were also considered) begins with the drop of a fuel assembly into the reactor core during refueling operations from a height of 32.95 feet (Ref. 3, D.I. 11), which is the maximum height allowed by the fuel handling equipment. The resulting impact of the fuel assembly onto the top of the core will damage a number of fuel rods sufficiently to cause a release of radionuclides to the water pool above the core. Assuming primary containment remains open during refueling, it is assumed the radionuclides will be released to the refueling area and then to the environment over the following 2 hour period. The water pool above the core serves as a barrier to the release of a significant amount of the radionuclides. Release of the radionuclides to the environment may result in a dose to the control room occupants and to personnel located both within and beyond the site boundary.

The radionuclide source term generated during a fuel handling accident is based on the total number of fuel rods in the reactor core damaged as a result of the dropped fuel assembly (including attached rigging) on the irradiated fuel rods. Global Nuclear Fuels-Americas, LLC provided CNS with a revised analysis for GNF2 Advantage fuel compliance with Amendment 22 of NEDE-24011-P-A (GESTAR II) regarding a refueling accident (Ref. 8, D. I. 14). The analysis addresses the worst fuel drop using a comparison to validate the GNF2 10x10 fuel. The activity released in a FHA for 10x10 core is based on 150 rods assumed to have been damaged (using current Cooper Nuclear Station triangular refueling mast and grapple head). Each bundle has an equivalent of 85.6 full length fuel rods. With a total of 548 fuel bundles in the core the fraction of the core damaged is calculated to be $150 \text{ damaged rods} / (548 \times 85.6) \text{ total rods} = 0.0031977$.

Nebraska Public Power District
DESIGN CALCULATIONS SHEET**FUEL HANDLING ACCIDENTS WITHIN THE SPENT FUEL POOL**

The CNS USAR (Ref. 3, D. I. 11) specifically states the following, "Similarly, the most severe accident of the second variety is the dropping of a fuel assembly into the fuel pool, but this results in a smaller radioactivity release to the environs than that resulting from dropping a fuel assembly on the fuel in the reactor vessel during refueling." With reference to the "second variety" meaning accidents that result in release directly to secondary containment or the environment. Therefore the limiting fuel handling accident and related accident source term is analyzed as occurring within the reactor core based on the amount of fuel rods damaged and their related activity level.

Regarding the fuel handling accident evaluated for CNS and for the performance of this calculation, Non-status 1 inputs were verified using additional information and were found to be acceptable for use in this calculation.

2.2 Source Term

Since the publication of TID-14844 (Ref. 9, D. I. 19), significant advances have been made in understanding the timing, magnitude, and chemical form of fission product releases from severe nuclear power plant accidents. In 1995, the NRC published NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants" (Ref. 10, D.I. 17). NUREG-1465 used this research to provide estimates of the accident source term that were more physically based and that could be applied to the design of future light-water power reactors. NUREG-1465 presents a representative accident source term for a boiling-water reactor (BWR) and for a pressurized-water reactor (PWR). These source terms are characterized by the composition and magnitude of the radioactive material, the chemical and physical properties of the material, and the timing of the release to the containment. This analysis utilizes an accident specific nuclide inventory (Halogens, Noble Gases, and Alkali Metals for FHA) as matched to the CNS site inventory (Ref. 11, D.I. 21) and as modified for gap release in accordance with Regulatory Guide 1.183, RP 3.2 Table 3 presented as Figure 1 below.

Table 3¹¹
Non-LOCA Fraction of Fission Product Inventory in Gap

Group	Fraction
I-131	0.08
Kr-85	0.10
Other Noble Gases	0.05
Other Halogens	0.05
Alkali Metals	0.12

Figure 1

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¹¹ The release fractions listed here have been determined to be acceptable for use with currently approved LWR fuel with a peak burnup up to 62,000 MWD/MTU provided that the maximum linear heat generation rate does not exceed 6.3 kw/ft peak rod average power for burnups exceeding 54 GWD/MTU. As an alternative, fission gas release calculations performed using NRC-approved methodologies may be considered on a case-by-case basis. To be acceptable, these calculations must use a projected power history that will bound the limiting projected plant-specific power history for the specific fuel load. For the BWR rod drop accident and the PWR rod ejection accident, the gap fractions are assumed to be 10% for iodines and noble gases.

All the gap activity in the damaged fuel rods is assumed to be instantaneously released to the pool per Regulatory Guide 1.183 Appendix B. Radionuclides considered include xenons, krytons, halogens, cesiums, and rubidiums. The chemical form of radioiodine released from the fuel to the pool is assumed to be 95% aerosol (cesium iodide, CsI), 4.85 percent elemental iodine, and 0.15 percent organic iodide. The CsI released from the fuel is assumed to completely dissociate in the pool water. Because of the low pH of the pool water, the iodine re-evolves as elemental iodine which is assumed to occur instantaneously. Regulatory Guide 1.183 Appendix B states if the depth of water above the damaged fuel is 23 feet or greater, as is the case at CNS (Ref. 3, D.I.11, and Ref. 5, D.I. 8), the decontamination factors for the elemental and organic species are 500 and 1, respectively, giving an overall effective decontamination factor of 200 (i.e., 99.5% of the total iodine released is retained within the pool water). The difference in decontamination factors for elemental and organic iodine species results in the iodine above the water being composed of 57% elemental and 43% organic species. Appendix B goes on to state the retention of noble gases in the pool water is considered negligible (i.e., decontamination factor of 1) which is assumed in this analysis.

The inventory of fission products in the fuel rods and available for release to the containment is based on the maximum full power operation of the core with an assumed core power equal to the current licensed rated thermal power of 2419 MWt (D.I. 6, Ref. 7). In addition, this value is multiplied by factor of 1.003977 to account for maximum possible measurement uncertainty as required by Appendix K to 10 CFR 50 for nuclear reactor power operation. The factor of 1.003977 is derived from the current licensed thermal power limit of 2419 MWt [D. I. 6], amendment 231, which raised the power level from the original licensed thermal power of 2381 MWt, and the original appendix K uncertainty of 2%. As such, the resulting uncertainty back calculated is the value noted above, i.e. $1.02 \times 2381 / 2419 = 1.003977$. The core is assumed to have operated at this power level for an extended period of time such that fission product equilibrium is reached. For radionuclides which have not reached equilibrium, the core inventory at time of shutdown is used. The source term used for this accident is based on the GNF2 Advantage fuel in compliance with Amendment 22 of NEDE-24011-P-A (GESTAR II) regarding a refueling accident (Ref. 8, D.I. 14) for a bounding core inventory source term (Ref. 11, D. I. 21). An assessment was documented in Design Input

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49 [40] to confirm that GE14 fuel type performance for a 24 month period would be bounded by the GNF2 fuel type under the same operating conditions for the isotopes of consideration in this FHA calculation with respect to the source production in Curies per isotope. GE14 fuel will be used in transition cores for the 24 month implementation. The Global Nuclear Fuels-Americas, LLC, GNF2 fuel source term was calculated using the isotope generation and depletion code GEH Non-Level-2 ECP ORIGN01P. ORIGN01P is the GEH controlled version of the Oak Ridge National Laboratory code ORIGEN2 version 2.1, incorporating the BWR extended burnup library BWRUE. In addition, a radial peaking factor (RPF) of 1.95 (Assumption 10) is applied to the radionuclide inventory to account for differences in power level across the core for a non-LOCA event to reflect the maximum possible value as provide by the fuel vendor (GNF). This value for RPF was determined by CNS Nuclear Engineering Department to be a maximum conservative analytical value as its actual value is determined and controlled by CNS Procedure 10.3 (Ref. 34). FRED documents for future reloads will need to be revised to capture this RPF limit of 1.95 linked to the FHA radiological consequences calculation.

2.3 Release Rate from Secondary Containment

The approximate free volume of the refueling floor area is $7.95 \times 10^5 \text{ ft}^3$ based on Reference 14. The radioactive material that immediately escapes from the pool to the refueling floor area is then assumed to be released to the environment over a 2-hour period using the relationship for dilution with 100% makeup for an enclosed space (Ref. 15, D.I. 20). For an enclosed containment the following equation can be applied:

$$C_{(t)}/C_{ss} = 1 - \exp^{(-Qt/V)} \quad \text{Equation 1}$$

Where:

$C_{(t)}$ – Concentration of volume at time t (fraction 0-1.0, representing 0 to 100%)

C_{ss} – Steady-State concentration at end of dilution period (fraction 0-1.0, representing 0 to 100%)

Q – Constant flow rate of contaminate out of space ($\text{ft}^3/\text{min.}$)

V – Refueling floor ($7.95\text{E}+05 \text{ ft}^3$)

t – time duration of dilution period (120 minutes)

As $C_{(t)}$ approaches steady state or complete dilution (assume a value of 99.9%) $C_{(t)}/C_{ss}$ approaches a value of 1 and the equation can be simplified to:

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$$.999 = 1 - [\exp^{(-Qt/V)}] \quad \text{or} \quad 0.001 = [\exp^{(-Qt/V)}] \quad \text{Equation 2}$$

Taking the natural log (ln) of both sides gives:

$$\ln(.001) = \ln [\exp^{(-Qt/V)}] \quad \text{or} \quad -6.9077 = -Qt/V \quad \text{Equation 3}$$

Substituting all values and solving for Q (flow rate leaving the structure) yields:

$$Q = (6.9077 \times 7.95 \times 10^5) / 120 = 4.576 \times 10^4 \text{ (ft}^3 \text{ /min.)}$$

This is the flow rate that will be used to simulate the rejection of the source term from the reactor building as a ground release to the outside environment within a 2 hour period.

2.4 Control Room Parameters

The air intake rate to the control room, the control room HVAC system filter efficiency, and the control room volume are needed to determine the portion of radiological dose received within the control room area.

The total control room volume is made up of the control room proper and the cable spreading room area (Ref. 17, D.I. 4 and Ref. 18, D.I. 5). The volume of the control room is calculated below (rounded to the 3rd significant figure), assuming 20% of the total volume is occupied by walls, floors, equipment, etc.

Control Room Volume drawing takeoff

Width = 72' (Ref. 17)

Length = 80'-9" minus 13'-3" = 67.5' (Ref. 18, D.I. 5)

Floor Elevation = 932'-6" (Ref. 18)

High point of roof slab = 949'-1.5"

Cable Room

west of column H7

Outside wall to H7 = 80'-9" - 13'-3" = 67.5' (Ref. 18, D.I. 5)

N-S = 72' (Ref. 17)

Floor El = 918' (Ref. 17)

column H7 to G

H7 to G = 35' + 13'-3" = 48.25' (Ref. 18, D.I. 5)

E-W = 37'-3" (Ref. 17)

Floor El = 918' (Ref. 17)

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Control Room proper

$$\text{Height} = 949'-1.5'' - 932'-6'' = 16.625'$$
$$\text{Volume} = 72' \times 67.5' \times 16.625' = 80,800 \text{ ft}^3$$

Cable Room

$$\text{Height} = 932'-6'' - 918' = 14.5'$$
$$\text{Volume} = (72' \times 67.5' \times 14.5') + (37.25' \times 48.25' \times 14.5') = 96,530 \text{ ft}^3$$

$$\text{Total Volume} = 80,800 \text{ ft}^3 + 96,530 \text{ ft}^3 = 177,330 \text{ ft}^3$$

Assuming 20% of the volumes include walls, floors, and equipment, (Refer to Assumption 8) the net volumes equate to the following:

$$\text{Control Room proper} = 64,640 \text{ ft}^3$$

$$\text{Control Center (Control Room Envelope, CRE)} = 141,860 \text{ ft}^3$$

The air intake to the control room is modeled using two flow rates in order to represent the two distinct operating modes of normal fresh air intake prior to a high radiation isolation signal and operation in the Control Room Emergency Filtration (CREFs) lineup following isolation and pressurization.

Prior to isolation:

- 3,235 CFM normal Control Room Ventilation System maximum fresh air intake flow per reference (Ref. 19, D.I. 3)
- Unfiltered inleakage was set constant at a value of 400 CFM (Assumption 1). The 400 CFM inleakage is also greater than the maximum actual CNS inleakage measured for the CRE during tracer gas testing for the Control Room Ventilation System operating in the recirculation/toxic only mode of operation ($251 + 10 = 261$ CFM). This value includes the standard value of 10 CFM recognized by the industry for access/egress to the control room envelope.

$$\text{Total air intake rate} = 3,635 \text{ CFM}$$

After CREFS isolation:

- 900 +/- 10% CFM used 810 CFM CREFS design air intake flow per reference (Ref. 20, D.I. 7 and Ref. 21, D.I. 9) (lower value picked for conservative removal rate of radionuclides from control room space)
- Unfiltered inleakage was set constant at a value of 400 CFM (Assumption 1). The 400 CFM inleakage is also significantly greater than the maximum actual CNS inleakage measured for the CRE during tracer gas testing for the CREVS system operating in the Pressurization Mode ($17 + 10 = 27$ CFM). This

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value includes the standard value of 10 CFM recognized by the industry for access/egress to the control room envelope.

Total air intake rate = **1,210 CFM**

The control room emergency filtration system is currently specified as having 95% efficiency (associates to a maximum methyl iodide penetration of 2.5% when tested in accordance with Regulatory Guide 1.52, Revision 2) for all iodine species (Ref. 21, D.I. 9, D.I. 10). This efficiency is reduced by 1% to account for maximum bypass (Ref. 22, D.I. 9). For this analysis in order to provide future analytical and operational margin a filter efficiency of 90% (using an appropriate penetration test criteria) for all iodine species will be assumed with a reduction of 1% for maximum bypass flow (resulting in a final efficiency of 89%).

2.5 Atmospheric Dispersion (χ/Q) Factors

The χ/Q values are taken from existing CNS calculations developed specifically for various Control Room Intake, Exclusion Area Boundary (EAB), and Low Population Zone (LPZ) receptor points for use in the development of the bounding Design Basis Accidents (DBA) Radiological Analysis. These receptor locations were previously determine to be the most limiting in determining compliance with the dose criteria established.

The control room intake χ/Q values were taken from reference 23 for a release emanating from the Reactor Building. The reactor building vent release case was analyzed as a ground release for three release rates through the reactor building vent. The lowest release flow which coincides with the highest χ/Q values was chosen for the most conservative approach. The values were developed using the ARCON96 computer code (Ref. 24, D.I. 15) and are presented in Table 1 below.

0 - 2 hours	2 - 8 hours	8 - 24 hours	1 - 4 days	4 - 30 days
4.15E-3	3.24E-3	1.32E-3	9.01E-4	7.22E-4

Note: Units = sec/m^3

Table 1

The EAB and LPZ Atmospheric Dispersion χ/Q values were taken from reference 25 for a ground release emanating from the Reactor Building. The χ/Q values were developed from figures presented in Regulatory Guides 1.3 and 1.25 and corrected for building wake effects as appropriate. The values are presented in Table 2 below.

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LOCATION	χ/Q (sec/m ³)
EAB	
0 – 0.5 hours	5.2E-4 ⁽¹⁾
0.5 – 2 hours ⁽²⁾	5.2E-4 ⁽¹⁾
LPZ	
0 – 0.5 hours	2.9E-4 ⁽¹⁾
0.5 – 8 hours	2.9E-4 ⁽¹⁾
8 – 24 hours	7.3E-5
1 – 4 days	2.5E-5
4 – 30 days	5.2E-6

Table 2

Note: 1. Includes building wake considerations
2. Based on worst 2-hour period for the EAB which is the 0 to 2-hour period for this event.

2.6 Additional Design Inputs

The following inputs are used by the RADTRAD code in determining the TEDE for persons located at or beyond the boundary of the exclusion area which are consistent with the Regulatory Guide 1.183 RP 4.0 guidelines:

- ♦ Dose calculations are based on the TEDE. The TEDE is determined as the sum of the committed effective dose equivalent (CEDE) from inhalation and the deep dose equivalent (DDE) from external exposure.
- ♦ All doses are estimated by RADTRAD using the Federal Guidance Reports 11 and 12 (Ref. 26, D.I. 23 and Ref. 27, D.I. 24) (FGR 11 and 12) dose conversion factors (DCFs) for the following organs and pseudo organs:
 - Gonads
 - Breast
 - Lungs
 - Red bone marrow
 - Bone surface
 - Thyroid
 - Skin
 - Effective dose equivalent
- ♦ EAB and LPZ - For the first 8 hours, the breathing rate of persons is assumed to be 3.5 x E-4 m³/sec. From 8 to 24 hours following the accident, the

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breathing rate is assumed to be $1.8 \times 10^{-4} \text{ m}^3/\text{sec}$. After that and until the end of the accident, the rate is assumed to be $2.3 \times 10^{-4} \text{ m}^3/\text{sec}$.

- Control Room - The dose receptor for this analysis is the hypothetical maximum exposed individual who is present in the control room for 100% of the time during the first 24 hours after the event, 60% of the time between 1 and 4 days, and 40% of the time from 4 days to 30 days. For the duration of the event, the breathing rate of this individual is assumed to be $3.5 \times 10^{-4} \text{ m}^3/\text{sec}$.
- The radiological acceptance criteria for the EAB, the outer boundary of the LPZ, and for the control room are in 10 CFR 50.67. These criteria are stated for evaluating reactor accidents of exceedingly low probability of occurrence and low risk of public exposure to radiation. For the FHA the EAB and LPZ dose criteria is presented in Table 6 of Regulatory Guide 1.183 and stated as 6.3 Rem TEDE for the 2 hour accident duration. The acceptance criteria for the control room dose is stated by both 10 CFR 50.67 (b) (2) (iii) and General Design Criteria 19 (GDC 19) from Appendix A to 10 CFR Part 50 as 5 Rem TEDE. Both the LPZ and control room dose criteria are based on a total period of 30 days.

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DESIGN CALCULATIONS SHEET**3. ASSUMPTIONS**

1. A control room unfiltered inleakage value of 400 CFM was assumed for this analysis in order to provide future analytical and operational margin in lieu of the current tracer gas testing results (Ref. 16, D.I. 12). The current tracer gas test performed in accordance with ASTM Standard E741-00 revealed a value of 17 CFM of inleakage to the Control Room Envelope (CRE) from the CREVS system operating in the Pressurization Mode. A second tracer gas test performed to the same testing criteria, revealed a value 251 CFM of inleakage to the Control Room Envelope (CRE) from the CREVS System operating in the Recirculation/Toxic Mode. As can be seen, these values are both significantly below the assumed value of 400 CFM used in the analysis.
2. The required time for isolation of the control room intake upon the start of the FHA is assumed to be 1 minute (60 seconds). This was selected as a conservative value in order to provide future analytical and operational margin in lieu of the current CNS CREF system having an auto-isolation time of 11 seconds upon receipt of a high radiation signal.
3. The control room emergency filtration system is currently specified as having a 95% efficiency (associates to a maximum methyl iodide penetration of 2.5% when tested in accordance with Regulatory Guide 1.52, Revision 2) for all iodine species (Ref. 21, D.I. 9). This efficiency is reduced by 1% to account for maximum bypass (Ref. 22, D.I. 9, D.I. 10). For this analysis in order to provide future analytical and operational margin a filter efficiency of 90% (using an appropriate penetration test criteria) for all iodine species will be assumed with a reduction of 1% for maximum bypass flow.
4. No credit is taken for reduction in the amount of radioactive material released from the reactor building as a result of operation of engineered safety feature (ESF) filter systems (i.e., SGTS).
5. For this analysis (Base Case), a decay time of 24 hours was assumed (Ref. 35, D.I. 47), which represents the earliest expected start of refueling activities at CNS. Fuel which has had less than 24 hours of decay time constitutes "recently irradiated fuel" for application of TSTF-51. A second analysis (Case 1) was performed assuming a decay time of 168 hours before fuel movement and not crediting the operation of CREFS.
6. No credit is taken for the use of personal protective equipment or prophylactic drugs.
7. The CNS Technical Specification Bases for AC Source -- Shutdown states that, having to assume a single failure and concurrent loss of all offsite power (LOOP) is not required when the unit is shutdown. Notwithstanding, it is determined a LOOP will not have an adverse impact on the radiological consequences of the Fuel Handling Accident. The basis for this is supported by the fact that a LOOP

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will cause the control circuit for the Group 6 PCIS signal to de-energize, resulting in Group 6 PCIS Control Room Emergency Filter System (CREFS) initiation (at $T = 0$ of the event). Therefore, the one-minute CREFS initiation time assumed in this analysis will bound diesel generator start time considerations associated with a LOOP which are determined to occur well within that time frame.

8. An occupied by floor, walls, equipment, etc., volume of 20% of the control room envelope was assumed based on review of applicable drawings and simple volumetric estimates.
9. No correction is made for depletion of the effluent plume by deposition on the ground (Ref. 1, D.I. 18, Regulatory Position 4.1.7)

The previous radial peaking factor of 2.0 was applied to the radionuclide inventory calculation to reflect the highest peaking factor in the GE14 fuel as determined by CNS in conjunction with the fuel vendor. The radial peaking factor was adjusted lower based on the fact that if it remained at the highly conservative value of 2.0 the dose consequence impact would be in excess of the guidelines which specify a significant impact to dose consequences. The radial peaking factor value of 1.95 for GNF2 fuel is an assumption based upon review of the current CNS FRED documents (Ref. 34, D.I. 46). The current value used by CNS in performing core design analysis is a significantly lower value. This calculation assumption will need to be added to FRED documents for review on core design basis to ensure that this radial peaking factor will not be exceeded in future reloads. The radial peaking factor was required to be lowered due to the fact that if it remained at a conservative value of 2.0 the dose consequence impact would be in excess of the guidelines which specify a significant impact to dose consequences.

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A V&V version of the NRC computer code RADTRAD Version 3.03 was used to analyze a postulated Fuel Handling Accident (FHA) at the Cooper Nuclear Station. The radiological consequences of an accident in a nuclear power plant depend upon the quantity of the radioactive material that escapes to the environment and/or enters the plant's control room. RADTRAD is designed to calculate doses at offsite locations, such as the low population zone, and in the control room. The code has two default source terms to describe fission product release to the containment: those from TID-14844 (Ref. 9) and those from NUREG-1465 (Ref. 10, D.I. 17). As the material is transported through the containment and other buildings, credit is given for several natural and engineered removal mechanisms. Containment sprays remove aerosols, elemental iodine, and organic iodine. The flow between buildings or rooms may be through HEPA filters or a suppression pool. Leakage to the environment may occur. Aerosols can deposit on surfaces within rooms and also in connecting paths. Models are provided within RADTRAD for these different removal mechanisms. Alternatively, the user may elect to input time-dependent values for a specific removal coefficient. After transporting the nuclides to different locations, RADTRAD calculates the dose at user-specified locations (i.e., EAB, LPZ, Control Room, etc.).

4.1 Fuel Handling Accident Scenario

Currently by CNS procedure (Ref. 6, D.I. 26) fuel handling activities in the fuel pool and containment areas cannot be initiated until 24 hours¹ (Ref. 35, D.I. 47) after reactor shut down (as described by Assumption 5). It is postulated that the accident results in the damage of 150 fuel rods thus releasing all of the fuel gap activity associated with those rods. As discussed in Section 2, the gap fractions utilized for Non-LOCA analyses follow the recommended values stated in Regulatory Guide 1.183 Table 3. A radial peaking factor of 1.95 (Assumption 10) is applied to the activity release based on a conservative value determined by the CNS reactor engineering group. The activity (consisting of noble gases, halogens, and alkali metals) is instantaneously released to the pool which has a minimum of 23 ft of water above the damaged fuel assembly.

The radioiodine release from the water is assumed to escape into the reactor building area and out through the reactor building vent over a two (2) hour period. The radioiodine released from the fuel gap is assumed to be 95% Csl, 4.85% elemental, and 0.15% organic. Due to the nature of the water in the pool, the Csl is assumed to immediately disassociate, thus changing the chemical form of the iodine in the water to 99.85% elemental and 0.15% organic. Based on

¹ Note – fuel handling can occur at any time within the spent fuel pool, as long as the fuel has experienced a minimum of at least 24 hours of decay time.

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decontamination factors of 500 and 1 for the elemental and organic iodines, respectively the chemical form of the iodines above the pool is 57% elemental and 43% organic. Noble gas and unscrubbed iodines are assumed to rise to the water surface where they are mixed in the available air space. Per Regulatory Guide 1.183 it is assumed all of the alkali metals released from the gap are retained in the pool.

The radiological activity associated with a FHA is collected within the reactor building (secondary containment). Since it is assumed there is no means of isolating the area release (no credit is taken for maintaining secondary containment boundary) all of the airborne activity is postulated to be exhausted out of the building within a period of 2 hours.

The worst case atmospheric dispersion factors (χ/Q) assuming a ground release from the reactor building release point were used based on the guidance in Regulatory Guide 1.183 Appendix B, Section 4 considering the assumption of direct openings to the environment (i.e., railroad airlock, ground level doors, etc.).

4.2 RADTRAD Computer Model

Figure 2 below represents a simplified representation of the radiological release and transport model used in the CNS FHA analysis. The model simulates an accident which has initially released within the containment. Radionuclides are then released to the environment (pathway 1). Once released to the environment radionuclides are diluted as a function of the atmospheric conditions (χ/Q values), thus leaving a smaller fraction available for intake into adjacent buildings (i.e., control room) or site boundary defined locations. The radionuclides may enter the control room from either the Control Room Emergency Filtration System (CREFS) air intake (pathway 2) or indirectly as unfiltered inleakage (pathway 3). Radionuclides mixed within the control room volume are then exhausted (pathway 4).

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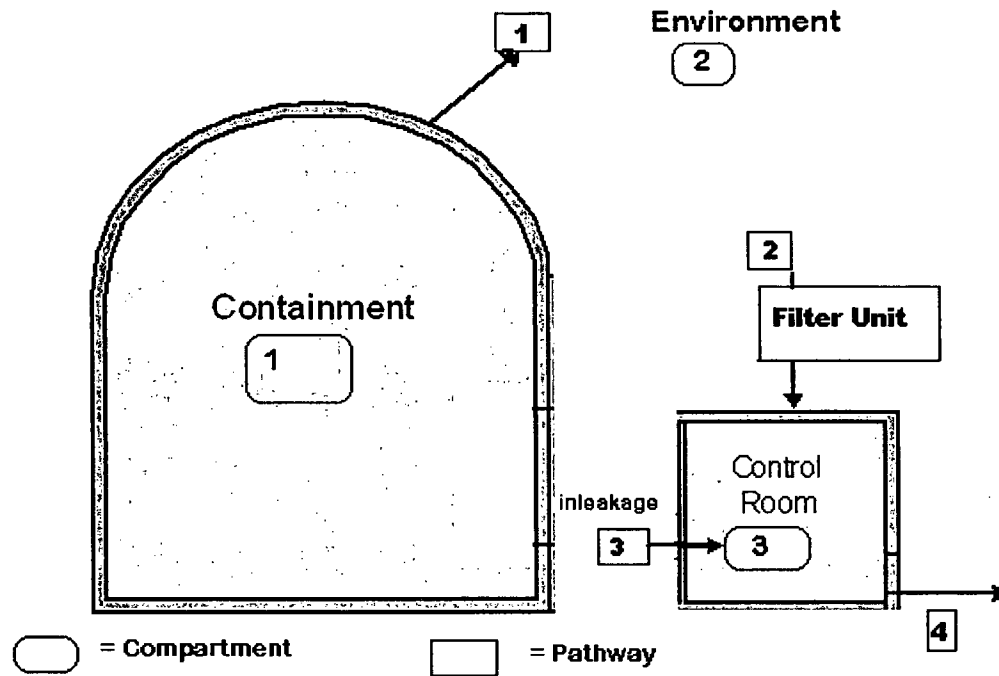


Figure 2
Radionuclide release and transport model

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4.3 RADTRAD FILES

RADTRAD 3.03 requires the use/development of four individual input files in order to perform a radiological dose analysis. These files include; the plant specific compartment/pathway model file (PSF), the nuclide inventory file (NIF), the release fraction and timing file (RFT), and the dose conversion factor file (INP).

Plant Specific File (PSF)

This file was created using the RADTRAD Graphical User's Interface (GUI) and defines all the plant specific parameters required to perform the analysis including specifying all compartments and pathways as detailed in Figure 2 above. The pathways for the FHA model were developed using the filtered pathway option in RADTRAD in order to specify fixed flow rate values. The following major parameters were inputted based on values documented/determined in Section 2 of this analysis:

Plant Power Level – Is based on the rated thermal power multiplied by the fraction of fuel damaged, maximum power uncertainty, and the fuel peaking factor. The radionuclide inventory is multiplied within RADTRAD by this value to determine the total amount of radionuclides released to the pool. The following value was calculated:

$$\text{Power level} = 2419 \times 3.1977\text{E-}3 \times 1.00398 \times 1.95 = 15.144 \text{ Mwt}$$

Model Compartments and Pathways

Compartment 1 – Refueling floor volume (7.95E+05 ft³)

Compartment 2 – Environment volume (0.00E+00 ft³) Note: treated as an infinite space within the code

Compartment 3 – Control room volume (1.4186E+05 ft³)

Pathway 1 – primary to environment (flow = 4.571E+04) CFM in order to remove 99.9% of the radionuclides from the containment envelope in the first 2 hours)

Pathway 2 – environment to control room (flow = 3235 CFM at time 0 to 1 min., flow = 810 CFM at time 1 min. to end of event using a filter efficiency of 89%)

Pathway 3 – environment to control room (flow = 400 CFM of unfiltered inleakage for duration of event. The 400 CFM CR inleakage is also greater than the actual CNS inleakage measured during tracer gas testing for the recirculation only mode of operation.

Pathway 4 – control room to environment (flow = 3635 CFM outflow at time 0 to 1 min., flow = 1210 CFM at time 1 min. to end of event)

Source Term

Decay time = 24 hours

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Iodine chemical fractions = Aerosol = .95, Elemental = .0485, Organic = .0015
Decay and Daughter products is invoked and generated by RADTRAD

Dose Locations

Three dose locations were defined as control room, EAB, and LPZ. Input values for χ/Q values, breathing rates, and occupancy factors for the control room were provided.

Attachment A of this analysis provides the associated RADRAD input file.

Nuclide Inventory File (NIF)

The nuclear inventory file was created by modifying the RADTRAD default file bwr_non_loca.nif based on the CNS specific nuclide activity values (Ci/Mwt) as defined in Section 2 of this analysis.

All of the Bromine isotopes originally identified by the CNS specific GNF2 Fission Product Inventory (Ref. 11, D.I. 21) had been initially considered as possible dose sources. Those Bromine isotopes are listed below, along with their half-lives.

Nuclide Name	Half-life (seconds)	Half-life (hours)
Br-82	1.27E+05	35.30400
Br-82m	3.66E+02	0.101670
Br-83	8.64E+03	2.400000
Br-84	1.91E+03	0.530000
Br-84m	3.60E+02	0.100000
Br-85	1.72E+02	0.047840
Br-86	5.55E+01	0.015420
Br-87	5.59E+01	0.015530
Br-88	1.64E+01	0.004560
Br-89	4.37E+00	0.001210
Br-90	1.90E+00	0.000530
Br-91	5.40E-01	0.000150
Br-92	3.40E-01	0.000090
Br-93	1.00E-01	0.000030
Br-94	7.00E-02	0.000020
Br-95	5.00E-02	0.000014
Br-96	2.00E-02	0.000006

Bromine Isotopes Included in GNF2 (CNS Specific) Inventory with Half Lives
Table 3

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Examination of this data revealed that all of the Bromine isotopes present in the core except for Br-82, 83, and 84 would decay to negligible amounts over the duration of the 24 hour delay period following a FHA. Table 3 with the exception of Br-95 and Br-96, was generated in the original FHA AST calculation (NEDC 05-031, Rev. 3) based upon the GE14 ORIGEN2 fuel inventory. A comparison of the GNF2 to that inventory has also concluded that due to either the insignificance of the fission product inventory of these isotopes or the half-life would result in no impact on dose consequences. Since the Bromine sources listed in Table 3 were the derived reviewed and approved isotopes they were evaluated for this update, and due to the fact that their dose consequence is not an impact they were not considered. Other Bromine isotopes listed in D. I. 21 such as BR-80, -80m, 79m and 86m are dispositioned as follows.

The half-life of BR-80 and -80m is 17.6 m and 4.38 hr respectively, with only 10-2 Ci/Mwt source terms these are decayed out within the 24 hour time period. The half-life for 79m is 4.86 sec. values provided by the National Nuclear Data Center of Brookhaven National Laboratories and Nuclear Chemical Engineering 2nd Edition (Ref. 36 and 37 respectively). The half-life for 86m is not listed in the National Nuclear Data Center nor the IAEA Chart of Nuclides (Ref. 38) nor the Nuclear Chemical Engineering 2nd Edition properties of nuclides. The half-life for the isotopes presented in Table 3 is part of the RADTRAD v. 3.03 Nuclide inventory file. The code V&V package has verified the utilization which is based upon D. I. 23 and 24. It was therefore hypothesized that only these Bromine isotopes listed in Table 3 could potentially be a factor in this analysis.

A nuclide inventory file that contained 29 isotopes was created based on the CNS GNF2 source term library. These 29 isotopes were all halogens and noble gases that were previously evaluated in CNS GE 14 EQ dose calculations (Ref. 29, D.I. 28), with the exception of Xe 137, Br 84m, Br85, Br 87 and Kr 89. These nuclides were excluded since their half life is less than 3.9 minutes.

The .nif file was further modified to account for the increased Gap Fractions of I-131 (8% versus the 5% assumed for all other halogens) and Kr-85 (10% versus the 5% assumed for all other noble gases). The following values were calculated:

I-131 activity level = $.08/.05 \times 2.72\text{E}+04 = 4.35\text{E}+04$ (Ci/Mwt)

Kr-85 activity level = $.10/.05 \times 4.26\text{E}+02 = 8.52\text{E}+02$ (Ci/Mwt)

Attachment B of this analysis provides the associated RADRAD input file.

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Isotope	RADTRAD Ci/MWt ⁽¹⁾	MWt	Power Uncertainty Factor	Total Core Inventory (Ci)	Radioactive Half Life (sec) ⁽²⁾	Time After Shutdown (sec)	Core Inventory at Time After Shutdown (Ci) ⁽³⁾	Fraction of Core Inventory Released	Water Pool Decon Factor	Radial Peaking Factor	Fraction of Core Failed	FHA Source Term (Ci)
Br-82	1.870E+02	2419	1.00398	4.542E+05	1.271E+05	86400	2.835E+05	0.05	0.005	1.95	0.003197700	4.420E-01
Br-83	3.240E+03	2419	1.00398	7.869E+06	8.604E+03	86400	7.476E+03	0.05	0.005	1.95	0.003197700	1.165E-02
Br-84	5.560E+03	2419	1.00398	1.350E+07	1.908E+03	86400	3.175E-07	0.05	0.005	1.95	0.003197700	4.950E-13
Kr-83m	3.250E+03	2419	1.00398	7.893E+06	6.588E+03	86400	8.916E+02	0.05	1	1.95	0.003197700	2.780E-01
Kr-85	4.260E+02	2419	1.00398	1.035E+06	3.383E+08	86400	1.034E+06	0.10	1	1.95	0.003197700	6.450E+02
Kr-85m	6.750E+03	2419	1.00398	1.639E+07	1.613E+04	86400	4.003E+05	0.05	1	1.95	0.003197700	1.248E+02
Kr-87	1.280E+04	2419	1.00398	3.109E+07	4.578E+03	86400	6.493E+01	0.05	1	1.95	0.003197700	2.025E-02
Kr-88	1.810E+04	2419	1.00398	4.396E+07	1.022E+04	86400	1.258E+05	0.05	1	1.95	0.003197700	3.922E+01
I-128	4.330E+02	2419	1.00398	1.052E+06	1.499E+03	86400	4.728E-12	0.05	0.005	1.95	0.003197700	7.370E-18
I-130	1.100E+03	2419	1.00398	2.671E+06	4.450E+04	86400	6.956E+05	0.05	0.005	1.95	0.003197700	1.084E+00
I-131	2.720E+04	2419	1.00398	6.606E+07	6.947E+05	86400	6.060E+07	0.08	0.005	1.95	0.003197700	1.512E+02
I-132	3.960E+04	2419	1.00398	9.617E+07	8.280E+03	86400	6.959E+04	0.05	0.005	1.95	0.003197700	1.085E-01
I-133	5.480E+04	2419	1.00398	1.331E+08	7.488E+04	86400	5.982E+07	0.05	0.005	1.95	0.003197700	9.326E+01
I-134	6.040E+04	2419	1.00398	1.467E+08	3.156E+03	86400	8.453E-01	0.05	0.005	1.95	0.003197700	1.318E-06
I-135	5.160E+04	2419	1.00398	1.253E+08	2.380E+04	86400	1.012E+07	0.05	0.005	1.95	0.003197700	1.578E+01
Te-129 ⁽⁴⁾	8.840E+03	2419	1.00398	2.147E+07	4.176E+03	86400	1.273E+01	0.00	0.00	1.95	0.003197700	0.000E+00
Te-131 ⁽⁴⁾	2.420E+04	2419	1.00398	5.877E+07	1.500E+03	86400	2.714E-10	0.00	0.00	1.95	0.003197700	0.000E+00
Te-131m ⁽⁴⁾	3.970E+03	2419	1.00398	9.642E+06	1.080E+05	86400	5.538E+06	0.00	0.00	1.95	0.003197700	0.000E+00
Te-132 ⁽⁴⁾	3.860E+04	2419	1.00398	9.375E+07	2.815E+05	86400	7.578E+07	0.00	0.00	1.95	0.003197700	0.000E+00
Te-133 ⁽⁴⁾	3.240E+04	2419	1.00398	7.869E+07	7.470E+02	86400	1.217E-27	0.00	0.00	1.95	0.003197700	0.000E+00
Te-133m ⁽⁴⁾	1.970E+04	2419	1.00398	4.784E+07	3.324E+03	86400	7.193E-01	0.00	0.00	1.95	0.003197700	0.000E+00
Te-134 ⁽⁴⁾	4.480E+04	2419	1.00398	1.088E+08	2.508E+03	86400	4.660E-03	0.00	0.00	1.95	0.003197700	0.000E+00
Xe-129m	2.230E-01	2419	1.00398	5.416E+02	6.912E+05	86400	4.966E+02	0.05	1	1.95	0.003197700	1.548E-01
Xe-131m	3.040E+02	2419	1.00398	7.383E+05	1.028E+06	86400	6.965E+05	0.05	1	1.95	0.003197700	2.172E+02
Xe-133	5.450E+04	2419	1.00398	1.324E+08	4.532E+05	86400	1.160E+08	0.05	1	1.95	0.003197700	3.616E+04
Xe-133m	1.730E+03	2419	1.00398	4.202E+06	1.890E+05	86400	3.061E+06	0.05	1	1.95	0.003197700	9.543E+02
Xe-135	2.040E+04	2419	1.00398	4.954E+07	3.272E+04	86400	7.950E+06	0.05	1	1.95	0.003197700	2.479E+03
Xe-135m	1.100E+04	2419	1.00398	2.671E+07	9.174E+02	86400	1.208E-21	0.05	1	1.95	0.003197700	3.766E-25
Xe-138	4.490E+04	2419	1.00398	1.090E+08	8.502E+02	86400	2.835E-23	0.05	1	1.95	0.003197700	8.838E-27

(1) From Reference 11 and as modified for RADTRAD nuclide inventory file (NIF) Input File

(2) From RADTRAD nuclide inventory file (NIF) input file Attachment B

(3) Calculated from standard equation $N = N_0 \times e^{-(0.693/\text{Half Life}) \times \text{Decay Time}}$

(4) Tellurium Metals were included in the nuclide inventory file (NIF) based on their daughtering contribution to iodine as analyzed by RADTRAD

Post-FHA Activity Released to Refueling Floor Used In RADTRAD (24 hrs. After Shutdown)
Table 4

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The radionuclide release fractions and timing file was created by modifying the RADTRAD default file non_LOCA.rft (which is based on RG 1.183 Table 3 and retention of all particulate radionuclides per Appendix B of the guide) for the decontamination factor of iodine (200). This was accomplished by modifying the release percentage (based on gap fraction) by the following:

$$\text{Release fraction} = .05 (\text{iodine group gap fraction}) / 200 = 0.25\text{E-}03$$

The release fraction for noble gases was maintained at .05 (having a decontamination factor of 1) while all other radionuclide groups were given a zero (0) release fraction based on their retention in the pool. Cs and Rb isotopes, as well as all other particulates, are excluded from nuclide inventory and release fraction files since they are assumed to be retained by the water in the fuel pool or reactor cavity (i.e., infinite decontamination factor) per the guidance in RG 1.183. Attachment C of this analysis provides the associated RADRAD input file.

Nuclide Dose Conversion File (INP)

The nuclide dose conversion file used the RADTRAD default file fgr11&12.inp which is based on the Federal Guidance Reports 11 and 12 as documented in Section 2 of this analysis. This file was modified to match the CNS specific nuclide group defined by the Nuclear Inventory File .nif mentioned above.

Attachment D of this analysis provides the associated RADTRAD input file.

Detailed Output File (oO)

RADTRAD develops a detailed output file sequentially numbered (.o0, o1, o2, etc). as a function of the amount of cases generated (only one for this analysis) that documents all input parameters and output detail.

Attachment E of this analysis provides the associated RADRAD output file.

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DESIGN CALCULATIONS SHEET**5. RESULTS AND CONCLUSIONS****5.1 Base Case Results**

The results of the Base Case RADTRAD generated dose analysis as documented in Attachment E are summarized in Table 5 below:

Dose Location	Accumulated Dose (rem TEDE)	Accident Dose Criteria (rem TEDE)
Control Room	4.4540	5.0 (1)
EAB	1.4499	6.3 (2,3)
LPZ	0.80935	6.3 (2)

Table 5

Note: (1) based on both General Design Criteria (GDC) 19 from Appendix A to 10 CFR Part 50 and 10 CFR50.67 (b) (2) (iii)
(2) based on Regulatory Guide 1.183 Table 6 (based on the analysis release duration of 2 hours)
(3) Since the event is based on a 2-hour release, the worst 2-hour period for the EAB is the 0 to 2-hour period.

All calculated doses were found to be below the stipulated limits. It is therefore concluded that the regulatory dose limits will not be exceeded following a postulated design basis FHA at Cooper Nuclear Station.

GNF2 (24 Month Fuel) Versus GE14 12 (18 Month Fuel)

Also all calculated TEDE doses were compared to the GE14 fuel dose consequences (18 month cycle). The GNF2 24 month fuel cycle FHA radiological dose consequences revealed a slight decrease from the previous calculated doses. The decrease in value can be attributed to the reduction in the conservative assumption for the Radial Peaking Factor used in the revised analysis (1.95 versus 2.0 assumed to reflect the highest peaking factor in the original GE14 fuel as determined by CNS).

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5.2 Case 1 - 168 Hour Fuel Decay Time with CREFS not Operating

An additional RADTRAD analysis was performed to evaluate the accumulated dose at the identified receptor points assuming an initial decay period of 168 hours before fuel movement and no credit for CREFS filtration (assumes CREFS non-operable). The results of the Case 1 RADTRAD generated dose analysis as documented in Attachment F are summarized in Table 6 below: All calculated doses were found to be below the stipulated limits.

Dose Location	Accumulated Dose (rem TEDE)	Accident Dose Criteria (rem TEDE)
Control Room	4.3932	5.0 (1)
EAB	0.6216	6.3 (2,3)
LPZ	0.3470	6.3 (2)

Table 6

Note: (1, 2 & 3) Refer to Table 5 notes above.

5.3 External Airborne Shine Dose and CREFS Shine Dose to the Control Room

The purpose of this discussion is to qualitatively assess potential gamma shine from external sources to the control room proper during a FHA using alternative source terms to assess contained radioactivity while considering limited geometry. The radiation sources external to the control room would be from airborne external cloud and CREFS filters (located within the Control Room Envelope). The following were considered and should be evaluated for local administrative controls on occupant dose:

1. Doses were conservatively evaluated with credit for Control Room occupancy per RG 1.183 of 1.0 for the first day, 0.6 for the next 3 days, and 0.4 for the following 26 days. If occupancy is limited the actual control room occupant dose would be lowered.
2. Administrative controls would be important for evaluating and maintaining control room occupant doses as low as is reasonably achievable (ALARA).

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A shine calculation was performed for the Fuel Handling Accident using RADTRAD v. 3.03 output from the base case documented in the previous sections. It is appropriate to use this case, as it is conservative in regards to a release to the environment, i.e. a complete release within 2 hours, and the amount of filtration from CREFS is conservatively assumed lowered so as to discharge more inventory out to the environment as well. The input file for this case was modified to provide output for additional time points. The reason for the additional time points is in order to provide adequate RADTRAD v. 3.03 output information into the Microshield computer code for the development of shine calculations.

RADTRAD v. 3.03 was initially run and the output for the activity released to the environment was extracted at the time points consistent with NEDC 05-045 (Ref. 30, D.I. 29), which is the shine calculation to the Control Room operators based on a LOCA event. The same methodology and geometry modeling used in NEDC 05-045 (Ref. 30, D.I. 29) was used for this FHA calculation. The output from RADTRAD v. 3.03 was then inputted to an EXCEL spreadsheet for the time points required to perform the shine calculation. The EXCEL spreadsheet was used only to reorder the RADTRAD output so that it could then be used in the proper format for the Microshield source term input computer deck files. The geometry decks that were created for NEDC 05-045 (Ref.30, D.I. 29) were utilized for this calculation. (Refer to NEDC 05-045 for discussion on the cloud geometry modeling). The reason for this is that the environment (cloud) geometry model developed for the LOCA calculation is for the same dose point as in this FHA calculation (i.e. the control room personnel). As such, no changes were made in the geometry files for Microshield, only the source term input files were modified to reflect the FHA RADTRAD source term output Attachment H. Once the Microshield files were updated, then they were run in Microshield v. 8.03, and the output for each time point was put into a trapezoidal rule calculation to integrate the dose and derive a total dose contribution from shine. This analysis is performed and documented in the EXCEL spreadsheets provided as Attachment G to this calculation. A 10% Equilibrium Daughter Factor is added to this calculation per the same approach used in NEDC 05-045. The results indicate that the cloud shine contribution for the subject control room person as a result of shine from an FHA release is **0.135 mRem** (including the 10% Equilibrium Daughter Factor). The cloud shine dose is not impacted by using RG 1.183 Occupancy factors as the dose impact is from the first 24 hours after a release, which is considered a 100% occupancy, and there is no relevant dose contribution after that time regarding control room shine dose from the cloud.

CREFS Shine Dose to the Control Room

The CREFS shine dose to the Control Room was also calculated for a Fuel Handling Accident. The calculation performed required utilization of RADTRAD v.

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3.10 in order to determine the total amount of activity that was loaded upon the CREFS Filter during a FHA release. Also changes had to be made from the base case model described in previous sections of this analysis, in order to be more conservative with regard to design inputs controlling the total source term accumulated on the filter.

These changes included:

- CREFS Flowrate – increased to 990 cfm versus using 810 cfm. The use of a higher flowrate results in higher halogen accumulation onto the CREFS filter versus the base case. (This is conservative as it results in higher shine contribution).
- Filter Efficiency – a value of 100% filter efficiency was used for all halogen species as that also maximizes higher halogen accumulation onto the filter versus the base case.
- X/Qs – the values used in the FHA calculation were utilized in the EXCEL spreadsheets for CR calculations versus using those from LOCA analysis.

All other design input remained the same as that noted in the previous sections of this analysis.

Once the changes were made to the items noted above, the time points also needed to be changed so that the activity on the filter would be calculated for the time points that are consistent with NEDC 05-045 (Ref. 30, D.I. 29) as previously mentioned.

Next RADTRAD v. 3.10 was run to extract the activity that is loaded on the filter at the various time points. That information was then extracted and put into an EXCEL spreadsheet to convert the output data to a format for Microshield input. This information is provided as Attachment J to this calculation. Once that was completed the Microshield input decks were set up at the various time points in order to calculate the dose rate at each time point. As previously outlined, the Microshield geometry decks documented in NEDC 05-045 (Ref. 30, D.I. 29) were utilized without changes, as these were for CREFS and control room personnel dose calculation. No changes were required in the geometry input files as a result of this calculation.

When the Microshield runs were completed the dose rate at each time point was then extracted and put into an EXCEL spreadsheet provided as Attachment I to this calculation (sheet noted as "4MAIN"). Dropping in the dose rate values into the trapezoidal rule calculation then yielded the final dose assuming 100% occupancy. The results were adjusted upwards to include an Equilibrium Daughter Factor of 10% as per NEDC 05-045. The value calculated for this conservative analysis was 217 mRem (including the equilibrium daughter factor). By inputting

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RG 1.183 Control Room occupancy factors the total dose to the control room person is reduced to 114 mRem as a result of CREFS using the assumptions and design inputs established in NEDC 05-045, (Ref. 30, D.I. 29).

In summary, the shine dose contribution from a Fuel Handling Accident environment and CREFS shine dose is 0.135 and 114 mRem respectively (including RG 1.183 occupancy factors). The dose at 720 hours after accident indicates that I131 is the predominant source term. When combined with the 30 Day Control Room Dose for inhalation the resultant total dose would still be below the regulatory criteria of 5 Rem TEDE.

5.4 Release Point Evaluation

Revision 3 of this analysis specifically analyzed release points other than the original bounding Reactor Building Vent release path (believed to be the bounding release point).

Additional ingress/egress points that could be open to establish a release path for radioactive materials outside Secondary Containment are identified in Attachment 1 to Surveillance Procedure 6.SC.701 (Ref. 33, D.I. 44), "Technical Specification Verification of Secondary Containment Access Doors and Hatches." The expected release of radioactive material at these additional points was evaluated to demonstrate a radioactive material release at the Reactor Building Vent is bounding.

The original revision of this calculation was performed assuming no credit for reduction of radioactive material released from the reactor building as a result of operation of engineered safety features (i.e., SGTS) Assumption 4. The Fuel Handling Accident is analyzed assuming fuel decay times of 24 hours (Base Case) and 168 hours not crediting the operation of the Control Room Emergency Filtration System (CREFS) (Case 1). Atmospheric dispersion factors (χ/Q) assuming a ground level release from the Reactor Building vent was used in the analysis. The reactor building vent analysis assumes a release rate of 4.576×10^4 (ft³/min.).

5.4.1 Control Room Location

The location and cross-sectional area of the Reactor Building Vent and the additional ingress/egress points with respect to the CREFS intake are summarized in Table 13, and graphically represented in Figure 3.

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To assure operability of the Reactor Building Exhaust Plenum Radiation Monitor, a Reactor Building exhaust fan, or a Standby Gas Treatment System fan will be operating. Forced outflow with a Reactor Building exhaust fan egresses from the Reactor Building vent. A release with an SGT fan operating is via the Elevated Release Point. An elevated release is less bounding than the vent release based on χ/Q values calculated in NEDC 99-031 (Ref. 23, D.I. 1). With one of these fans in service, a potential inflow into Secondary Containment through the additional ingress/egress points is created with the potential to reduce or eliminate the release of radioactive material. As a minimum, for a case where CREFS is running in lieu of a Reactor Building exhaust fan or SGT fan, the outflow through the additional points is expected to occur over a longer period of time due to natural air diffusion as opposed to the 2 hour forced outflow assumed in the FHA analysis.

The following paragraphs summarize the expected release of radioactive material at the additional ingress/egress points assuming a FHA on the refuel floor (elev. 1,001).

Release points 3, 4, 6 and 7 provide a direct release from Secondary Containment. These points are located at least three times further away from the CREFS intake than the Reactor Building Vent. A release at these points would require transport of the radioactive material through numerous compartments to a lower level in Secondary Containment which will reduce the amount of radioactive material available for release to the environment and any potential release would be counteracted by an expected air inflow or as a worst case, via a non-forced outflow.

Release points 8, 9, 10 and 11 provide a release point from Secondary Containment that is located in a compartment within permanent site structures. These points are located a minimum of 20 percent further away from the CREFS intake than the Reactor Building Vent. A release from Secondary Containment at these points would require transport of the radioactive material through numerous compartments to a lower level in Secondary Containment which will reduce the amount of radioactive material available for release to the environment, require transport of the radioactive material through at least one additional compartment outside Secondary Containment further reducing the amount of radioactive material available for release and would be counteracted by an expected air inflow or as a worst case, via a non-forced outflow.

Release point 2 provides a release point from Secondary Containment that is located in a compartment within a permanent site structure. Although this point is located marginally closer to the CREFS intake, a release at this point would require transport of the radioactive material through numerous compartments to a lower level in Secondary Containment which will reduce the amount of radioactive

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material available for release to the environment, require transport of the radioactive material through at least one additional compartment outside Secondary Containment further reducing the amount of radioactive material available for release and would be counteracted by an expected air inflow or as a worst case, via a non-forced outflow.

Release point 5 provides a direct release from Secondary Containment. This point is located marginally closer to the CREFS intake. However, the cross-sectional area of this point is less than 30 % of the Reactor Building Vent cross-sectional area and any potential release would be counteracted by an expected air inflow or as a worst case, via a non-forced outflow.

Based on the above discussion, it is concluded that the analysis of the FHA utilizing the Reactor Building Vent release path is bounding for all other release paths with respect to Control Room Dose.

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Possible Release Points Comparison Table						
Release Point	Description/ Location	N-S (Ft.)	E-W (Ft.)	Distance (Ft.)	Angle From True North	Cross-section (Ft. ²)
1	Reactor Building Vent R-1001 Overhead	53.33 S	20.33 E	57	125	32
2	Personnel Airlock R-903	40.33 S	29.58 E	50	110	42
3	Railroad Airlock R-903	145.67 S	160.42 W	217	194	433
4	Alternate Shutdown Hatch R-903	168.83 S	59.08 E	179	127	8
5	Reactor Building Roof Hatch R-1001 Overhead	45.33 S	17.58 E	49	125	9
6	HPCI Hatch R-859 Overhead	175.67 S	92.42 W	198	174	165
7	Southwest Vestibule R-903	183.33 S	53.92 W	191	163	21
8	Reactor Building HVAC Airlock R-958	70.83 S	0.42 W	71	146	35
9	RRMG Exhaust Airlock R-976	65.42 S	27.17 W	71	169	21
10	RRMG Filter Airlock R-976	46.67 S	54.83 W	72	196	14
11	RHR A Heat Exchanger Hatch R-958	49.83 S	48.83 W	70	190	59

Table 7

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5.1.2 EAB and LPZ Locations

The EAB and LPZ receptor points are analyzed using (χ/Q) values established in calculation NEDC 99-036 (Ref. 25, D.I. 2). The (χ/Q) values were calculated utilizing a minimum distance from the Elevated Release Point (ERP) to the site boundary in the East-South-East sector of 920 meters for the EAB, and a distance of 1 mile from the center of the reactor for the LPZ.

The additional ingress/egress points that could be open to establish a path outside Secondary Containment are all located north and west of the ERP to provide a greater distance to the site boundary than that used in the EAB analysis. The railroad airlock (Point 3), which is farthest from the center of the reactor, is within 200 feet of the center of the reactor. A change of this distance in relation to the 1 mile distance used for the LPZ dose calculation is considered to have a minimal potential impact on results because of the small difference with respect to the overall distance.

Based on the previous discussion on the amount of radioactive material available for release at the additional ingress/egress points, the minor change in distance used to calculate (χ/Q) values and the relatively low Accumulated Dose at these locations, it is concluded that the analysis of the FHA utilizing the Reactor Building Vent release path is representative of all other release paths with respect to the EAB and LPZ dose analysis. Any impact on accumulated dose at the EAB or LPZ due to a release at any of the additional ingress/egress points would be minimal.

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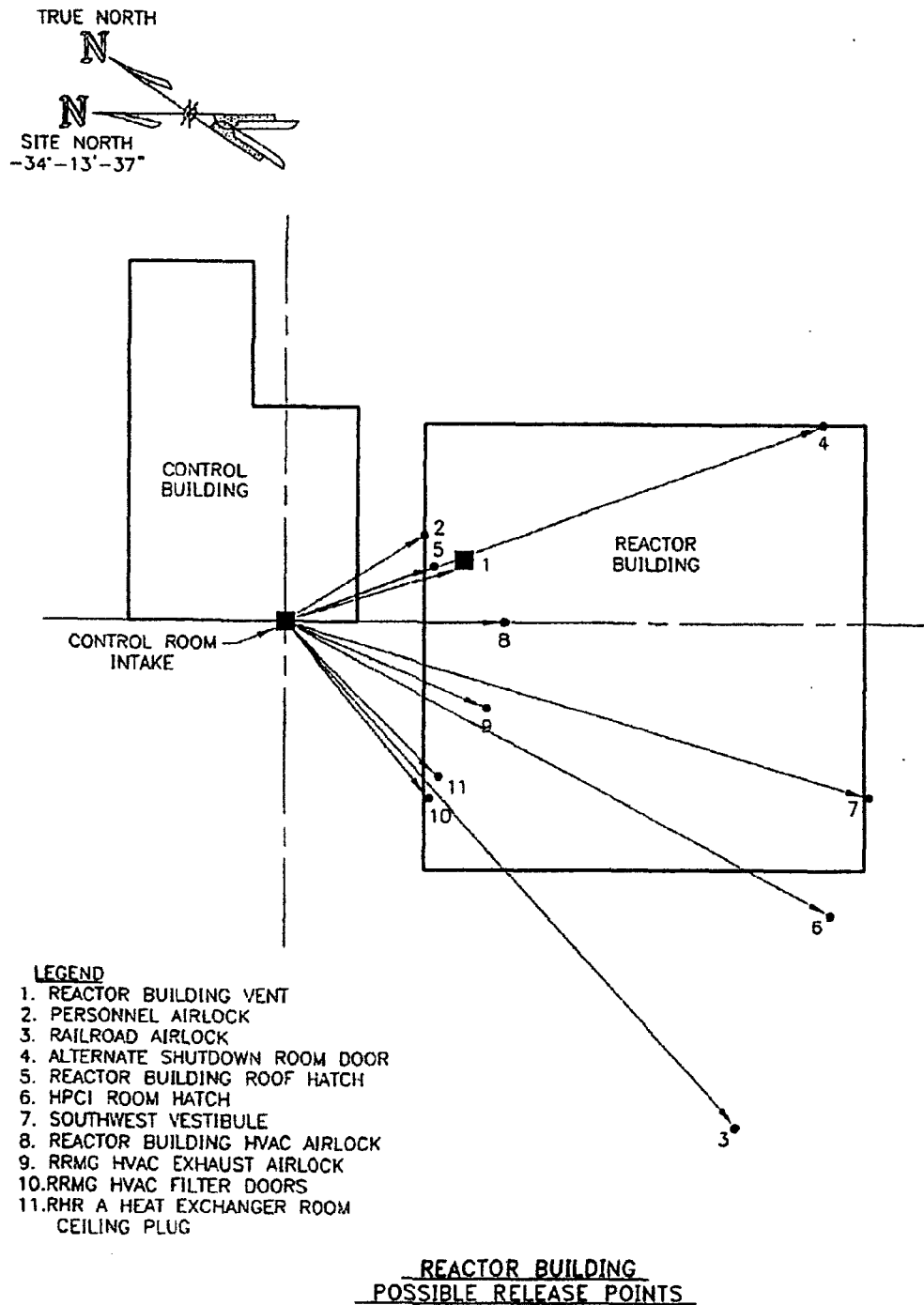


Figure 3

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6. REFERENCES

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7. ATTACHMENTS

- A. RADTRAD Plant Specific Input File (PSF) 11 pages
- B. RADTRAD Nuclear Inventory File (NIF) 6 pages
- C. RADTRAD Radionuclide Release Fractions and Timing File (RFT) 1 page
- D. RADTRAD Nuclide Dose Conversion File (INP) 5 pages
- E. RADTRAD Base Case Detailed Output File (oO) 32 pages
- F. RADTRAD Case 1 Detailed Output File (oO) 28 pages
- G. FHA Cloud Shine Analysis EXCEL Spreadsheets 5 pages
- H. RADTRAD v. 3.03 Detailed Output File (oO) FHA Cloud Shine Analysis 41 pages
- I. CREFS Shine Analysis EXCEL Spreadsheets 5 pages
- J. RADTRAD v 3.10 Detailed Output File (oO) CREFS Shine Analysis 63 pages
- K. Microshield Files, Cloud Shine, .MX5, .MD5, Output-.txt 19 pages
- L. Microshield Files, CREFS Shine, .MX5, .MD5, Output-.txt 30 pages

Attachment A

Attachment A RADTRAD Plant Specific Input File (PSF) Base Case

Radtrad 3.03 4/15/2001

Base Case 1-01-2011

Nuclide Inventory File:

C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.nif

Plant Power Level:

1.5144E+01

Compartments:

3

Compartment 1:

primary

3

7.9500E+05

0

0

0

0

0

Compartment 2:

Environment

2

0.0000E+00

0

0

0

0

0

Compartment 3:

Control Room

1

1.4186E+05

0

0

0

0

0

Pathways:

4

Pathway 1:

primary to Environment

1

2

2

Pathway 2:

Environment to Control Room

2

3

Attachment A

2

Pathway 3:

Environment to Control Room

2

3

2

Pathway 4:

Control Room to Environment

3

2

2

End of Plant Model File

Scenario Description Name:

Plant Model Filename:

Source Term:

1

1 1.0000E+00

C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.inp

C:\RADTRAD\RADTRAD_310\RG1_183.rft

2.4000E+01

1

9.5000E-01 4.8500E-02 1.5000E-03 1.0000E+00

Overlying Pool:

0

0.0000E+00

0

0

0

0

Compartments:

3

Compartment 1:

1

1

0

0

0

0

0

0

0

Compartment 2:

1

1

0

0

Attachment A

0
0
0
0
0

Compartment 3:

1
1
0
0
0
0
0
0
0
0

Pathways:

4

Pathway 1:

0
0
0
0
0
0
1
1
2.4000E+01 4.5760E+04 0.0000E+00 0.0000E+00 0.0000E+00
0
0
0
0
0
0
0

Pathway 2:

0
0
0
0
0
0
1
2
2.4000E+01 3.2350E+03 0.0000E+00 0.0000E+00 0.0000E+00
2.4017E+01 8.1000E+02 8.9000E+01 8.9000E+01 8.9000E+01
0
0
0
0
0
0

Attachment A

Pathway 3:

0
0
0
0
0
1
1
2.4000E+01 4.0000E+02 0.0000E+00 0.0000E+00 0.0000E+00
0
0
0
0
0
0
0

Pathway 4:

0
0
0
0
0
1
2
2.4000E+01 3.6350E+03 0.0000E+00 0.0000E+00 0.0000E+00
2.4017E+01 1.2100E+03 0.0000E+00 0.0000E+00 0.0000E+00
0
0
0
0
0
0
0

Dose Locations:

3

Location 1:

EAB

2

1

2

2.4000E+01 5.2000E-04

2.6000E+01 0.0000E+00

1

4

2.4000E+01 3.5000E-04

3.2000E+01 1.8000E-04

4.8000E+01 2.3000E-04

7.4400E+02 0.0000E+00

0

Location 2:

Attachment A

LPZ

2

1

5

2.4000E+01 2.9000E-04

3.2000E+01 7.3000E-05

4.8000E+01 2.5000E-05

1.2000E+02 5.2000E-06

7.4400E+02 0.0000E+00

1

4

2.4000E+01 3.5000E-04

3.2000E+01 1.8000E-04

4.8000E+01 2.3000E-04

7.4400E+02 0.0000E+00

0

Location 3:

Control Room

3

0

1

2

2.4000E+01 3.5000E-04

7.4400E+02 0.0000E+00

1

4

2.4000E+01 1.0000E+00

4.8000E+01 6.0000E-01

1.2000E+02 4.0000E-01

7.4400E+02 0.0000E+00

Effective Volume Location:

1

6

2.4000E+01 4.1500E-03

2.6000E+01 3.2400E-03

3.2000E+01 1.3200E-03

4.8000E+01 9.0100E-04

1.2000E+02 7.2200E-04

7.4400E+02 0.0000E+00

Simulation Parameters:

1

2.4000E+01 0.0000E+00

Output Filename:

C:\Documents and Settings\j1boste\My Documents\FHA cooperGNF2 BC 06-16-11.o0

1

1

1

0

Attachment A

0
End of Scenario File

RADTRAD Plant Specific Input File (PSF) Case 1

Radtrad 3.03 4/15/2001
Case1 3-31-2011
Nuclide Inventory File:
C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.nif
Plant Power Level:
1.5144E+01
Compartments:
3
Compartment 1:
primary
3
7.9500E+05
0
0
0
0
0
Compartment 2:
Environment
2
0.0000E+00
0
0
0
0
0
Compartment 3:
Control Room
1
1.4186E+05
0
0
0
0
0
Pathways:
4
Pathway 1:
primary to Environment
1
2
2

Attachment A

Pathway 2:

Environment to Control Room

2

3

2

Pathway 3:

Environment to Control Room

2

3

2

Pathway 4:

Control Room to Environment

3

2

2

End of Plant Model File

Scenario Description Name:

Plant Model Filename:

Source Term:

1

1 1.0000E+00

C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.inp

C:\RADTRAD\RADTRAD_310\RG1_183.rft

1.6800E+02

1

9.5000E-01 4.8500E-02 1.5000E-03 1.0000E+00

Overlying Pool:

0

0.0000E+00

0

0

0

0

Compartments:

3

Compartment 1:

1

1

0

0

0

0

0

0

0

Compartment 2:

Attachment A

1
1
0
0
0
0
0
0
0
0

Compartment 3:

1
1
0
0
0
0
0
0
0
0

Pathways:

4

Pathway 1:

0
0
0
0
0
0
1
1
1.6800E+02 4.5760E+04 0.0000E+00 0.0000E+00 0.0000E+00
0
0
0
0
0
0
0

Pathway 2:

0
0
0
0
0
0
1
1
1.6800E+02 3.2350E+03 0.0000E+00 0.0000E+00 0.0000E+00
0
0
0

8.8800E+02 0.0000E+00

Attachment A

0
Location 2:
LPZ
2
1
5
1.6800E+02 2.9000E-04
1.7600E+02 7.3000E-05
1.9200E+02 2.5000E-05
2.6400E+02 5.2000E-06
8.8800E+02 0.0000E+00
1
4
1.6800E+02 3.5000E-04
1.7600E+02 1.8000E-04
1.9200E+02 2.3000E-04
8.8800E+02 0.0000E+00
0
Location 3:
Control Room
3
0
1
2
1.6800E+02 3.5000E-04
8.8800E+02 0.0000E+00
1
4
1.6800E+02 1.0000E+00
1.9200E+02 6.0000E-01
2.6400E+02 4.0000E-01
8.8800E+02 0.0000E+00
Effective Volume Location:
1
6
1.6800E+02 4.1500E-03
1.7000E+02 3.2400E-03
1.7600E+02 1.3200E-03
1.9200E+02 9.0100E-04
2.6400E+02 7.2200E-04
8.8800E+02 0.0000E+00
Simulation Parameters:
1
1.6800E+02 0.0000E+00
Output Filename:
C:\Documents and Settings\j1boste\My Documents\FHA cooperGNF2 Case1-06-16-11.o0
1
1

Attachment A

1
0
0
End of Scenario File

Attachment B

Attachment B RADTRAD Nuclear Inventory File (NIF)

Nuclide Inventory Name:

Cooper GNF2 Fission Product Inventory Kr85 and I131 Adjusted for NonLOCA

Power Level:

1.0000E+00

Nuclides:

29

Nuclide 001:

Br-82

2

1.2708000000E+05

8.2000E+01

1.8700E+02

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 002:

Br-83

2

8.6040000000E+03

8.3000E+01

3.2400E+03

Kr-83m 1.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 003:

Br-84

2

1.9080000000E+03

8.4000E+01

5.5600E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 004:

Kr-83m

1

6.5880000000E+03

8.3000E+01

3.2500E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 005:

Kr-85

1

3.3829747200E+08

none	0.0000E+00
------	------------

Attachment B

none 0.0000E+00
none 0.0000E+00
Nuclide 011:
I-131
2
6.9465600000E+05
1.3100E+02
4.3520E+04
Xe-131m 1.1000E-02
none 0.0000E+00
none 0.0000E+00
Nuclide 012:
I-132
2
8.2800000000E+03
1.3200E+02
3.9600E+04
none 0.0000E+00
none 0.0000E+00
none 0.0000E+00
Nuclide 013:
I-133
2
7.4880000000E+04
1.3300E+02
5.4800E+04
Xe-133m 2.9000E-02
Xe-133 9.7000E-01
none 0.0000E+00
Nuclide 014:
I-134
2
3.1560000000E+03
1.3400E+02
6.0400E+04
none 0.0000E+00
none 0.0000E+00
none 0.0000E+00
Nuclide 015:
I-135
2
2.3796000000E+04
1.3500E+02
5.1600E+04
Xe-135m 1.5000E-01
Xe-135 8.5000E-01
none 0.0000E+00
Nuclide 016:

Attachment B

Te-129

4

4.1760000000E+03

1.2900E+02

8.8400E+03

I-129 1.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 017:

Te-131

4

1.5000000000E+03

1.3100E+02

2.4200E+04

I-131 1.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 018:

Te-131m

4

1.0800000000E+05

1.3100E+02

3.9700E+03

I-131 7.7800E-01

Te-131 2.2200E-01

none 0.0000E+00

Nuclide 019:

Te-132

4

2.8152000000E+05

1.3200E+02

3.8600E+04

I-132 1.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 020:

Te-133

4

7.4700000000E+02

1.3300E+02

3.2400E+04

I-133 1.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 021:

Te-133m

4

3.3240000000E+03

Attachment B

1.3300E+02
1.9700E+04
I-133 8.7000E-01
Te-133 1.3000E-01
none 0.0000E+00
Nuclide 022:
Te-134
4
2.5080000000E+03
1.3400E+02
4.4800E+04
I-134 1.0000E+00
none 0.0000E+00
none 0.0000E+00
Nuclide 023:
Xe-129m
1
6.9120000000E+05
1.2900E+02
2.2300E-01
none 0.0000E+00
none 0.0000E+00
none 0.0000E+00
Nuclide 024:
Xe-131m
1
1.0281600000E+06
1.3100E+02
3.0400E+02
none 0.0000E+00
none 0.0000E+00
none 0.0000E+00
Nuclide 025:
Xe-133
1
4.5316800000E+05
1.3300E+02
5.4500E+04
none 0.0000E+00
none 0.0000E+00
none 0.0000E+00
Nuclide 026:
Xe-133m
1
1.8904320000E+05
1.3300E+02
1.7300E+03
Xe-133 1.0000E+00

Attachment B

none 0.0000E+00

none 0.0000E+00

Nuclide 027:

Xe-135

1

3.2724000000E+04

1.3500E+02

2.0400E+04

Cs-135 1.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 028:

Xe-135m

1

9.1740000000E+02

1.3500E+02

1.1000E+04

Cs-135 4.5000E-05

Xe-135 9.9990E-01

none 0.0000E+00

Nuclide 029:

Xe-138

1

8.5020000000E+02

1.3800E+02

4.4900E+04

Cs-138 1.0000E+00

none 0.0000E+00

none 0.0000E+00

End of Nuclear Inventory File

Attachment C

Attachment C RADTRAD Radionuclide Release Fractions and Timing File (RFT)

Release Fraction and Timing Name:
RG 1.183, Tables 3 with DF iodine=200, all aerosols
Duration (h): NON-LOCA Accident chk inventory
0.0036E+00 0.0000E+00 0.0000E+00 0.0000E+00
Noble Gases:
0.0500E+00 0.0000E+00 0.0000E+00 0.0000E+00
Iodine:
0.2500E-03 0.0000E+00 0.0000E+00 0.0000E+00
Cesium:
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
Tellurium:
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
Strontium:
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
Barium:
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
Ruthenium:
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
Cerium:
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
Lanthanum:
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
Non-Radioactive Aerosols (kg):
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
End of Release File

Br-82							
GONADS	1.270E-13	7.116E-11	4.714E-10	2.670E-15-1.000E+00	2.520E-10	4.480E-10	
BREAST	1.440E-13	6.796E-11	4.502E-10	2.550E-15-1.000E+00	2.370E-10	3.810E-10	
LUNGS	1.270E-13	6.530E-11	4.326E-10	2.450E-15-1.000E+00	7.820E-10	3.840E-10	
RED MARR	1.240E-13	6.663E-11	4.414E-10	2.500E-15-1.000E+00	2.540E-10	4.140E-10	
BONE SUR	1.990E-13	9.355E-11	6.198E-10	3.510E-15-1.000E+00	2.310E-10	3.800E-10	
THYROID	1.300E-13	6.690E-11	4.432E-10	2.510E-15-1.000E+00	2.380E-10	3.830E-10	
REMAINDER	1.220E-13	6.450E-11	4.273E-10	2.420E-15-1.000E+00	3.150E-10	5.800E-10	
EFFECTIVE	1.300E-13	6.796E-11	4.502E-10	2.550E-15-1.000E+00	3.310E-10	4.620E-10	
SKIN (FGR)	1.540E-13	8.129E-11	5.385E-10	3.050E-15-1.000E+00	0.000E+00	0.000E+00	
Br-83							
GONADS	3.740E-16	9.637E-14	1.069E-13	8.610E-18-1.000E+00	3.280E-12	7.350E-12	
BREAST	4.290E-16	9.302E-14	1.032E-13	8.310E-18-1.000E+00	3.290E-12	7.340E-12	
LUNGS	3.690E-16	8.608E-14	9.546E-14	7.690E-18-1.000E+00	1.500E-10	7.350E-12	
RED MARR	3.540E-16	8.630E-14	9.570E-14	7.710E-18-1.000E+00	3.300E-12	7.350E-12	
BONE SUR	6.750E-16	1.422E-13	1.576E-13	1.270E-17-1.000E+00	3.290E-12	7.330E-12	
THYROID	3.800E-16	9.033E-14	1.002E-13	8.070E-18-1.000E+00	3.290E-12	7.330E-12	
REMAINDER	3.520E-16	8.440E-14	9.359E-14	7.540E-18-1.000E+00	1.130E-11	6.540E-11	
EFFECTIVE	3.820E-16	9.100E-14	1.009E-13	8.130E-18-1.000E+00	2.330E-11	2.470E-11	
SKIN (FGR)	1.850E-14	2.339E-11	2.594E-11	2.090E-15-1.000E+00	0.000E+00	0.000E+00	
Br-84							
GONADS	9.160E-14	4.569E-12	4.569E-12	1.660E-15-1.000E+00	2.840E-12	6.750E-12	
BREAST	1.020E-13	4.349E-12	4.349E-12	1.580E-15-1.000E+00	3.310E-12	6.620E-12	
LUNGS	9.270E-14	4.239E-12	4.239E-12	1.540E-15-1.000E+00	1.560E-10	6.990E-12	
RED MARR	9.260E-14	4.377E-12	4.377E-12	1.590E-15-1.000E+00	3.270E-12	6.210E-12	

Attachment D

BONE SUR	1.280E-13	5.725E-12	5.726E-12	2.080E-15-1.000E+00	2.990E-12	5.560E-12
THYROID	9.500E-14	4.101E-12	4.101E-12	1.490E-15-1.000E+00	3.120E-12	5.200E-12
REMAINDER	8.990E-14	4.267E-12	4.267E-12	1.550E-15-1.000E+00	1.870E-11	1.480E-10
EFFECTIVE	9.410E-14	4.404E-12	4.404E-12	1.600E-15-1.000E+00	2.610E-11	4.910E-11
SKIN (FGR)	1.880E-13	3.523E-11	3.523E-11	1.280E-14-1.000E+00	0.000E+00	0.000E+00
Kr-83m						
GONADS	1.710E-18	5.572E-15	5.855E-15	6.160E-19-1.000E+00	0.000E+00	0.000E+00
BREAST	5.050E-18	9.498E-15	9.980E-15	1.050E-18-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.640E-19	1.266E-16	1.331E-16	1.400E-20-1.000E+00	0.000E+00	0.000E+00
RED MARR	3.830E-19	5.617E-16	5.902E-16	6.210E-20-1.000E+00	0.000E+00	0.000E+00
BONE SUR	2.250E-18	3.437E-15	3.612E-15	3.800E-19-1.000E+00	0.000E+00	0.000E+00
THYROID	6.430E-19	7.698E-16	8.088E-16	8.510E-20-1.000E+00	0.000E+00	0.000E+00
REMAINDER	5.300E-19	1.393E-15	1.464E-15	1.540E-19-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.500E-18	3.437E-15	3.612E-15	3.800E-19-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	3.560E-17	1.167E-13	1.226E-13	1.290E-17-1.000E+00	0.000E+00	0.000E+00
Kr-85						
GONADS	1.170E-16	8.121E-14	1.704E-12	2.820E-18-1.000E+00	0.000E+00	0.000E+00
BREAST	1.340E-16	7.891E-14	1.656E-12	2.740E-18-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.140E-16	7.056E-14	1.481E-12	2.450E-18-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.090E-16	6.998E-14	1.469E-12	2.430E-18-1.000E+00	0.000E+00	0.000E+00
BONE SUR	2.200E-16	1.287E-13	2.702E-12	4.470E-18-1.000E+00	0.000E+00	0.000E+00
THYROID	1.180E-16	7.459E-14	1.565E-12	2.590E-18-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.090E-16	6.941E-14	1.457E-12	2.410E-18-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.190E-16	7.603E-14	1.596E-12	2.640E-18-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	1.320E-14	2.304E-11	4.835E-10	8.000E-16-1.000E+00	0.000E+00	0.000E+00
Kr-85m						
GONADS	7.310E-15	2.594E-12	3.653E-12	1.570E-16-1.000E+00	0.000E+00	0.000E+00
BREAST	8.410E-15	2.527E-12	3.560E-12	1.530E-16-1.000E+00	0.000E+00	0.000E+00
LUNGS	7.040E-15	2.379E-12	3.351E-12	1.440E-16-1.000E+00	0.000E+00	0.000E+00
RED MARR	6.430E-15	2.346E-12	3.304E-12	1.420E-16-1.000E+00	0.000E+00	0.000E+00
BONE SUR	1.880E-14	5.286E-12	7.446E-12	3.200E-16-1.000E+00	0.000E+00	0.000E+00
THYROID	7.330E-15	2.395E-12	3.374E-12	1.450E-16-1.000E+00	0.000E+00	0.000E+00
REMAINDER	6.640E-15	2.313E-12	3.257E-12	1.400E-16-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	7.480E-15	2.511E-12	3.537E-12	1.520E-16-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	2.240E-14	2.247E-11	3.164E-11	1.360E-15-1.000E+00	0.000E+00	0.000E+00
Kr-87						
GONADS	4.000E-14	4.962E-12	5.026E-12	7.610E-16-1.000E+00	0.000E+00	0.000E+00
BREAST	4.500E-14	4.740E-12	4.802E-12	7.270E-16-1.000E+00	0.000E+00	0.000E+00
LUNGS	4.040E-14	4.603E-12	4.663E-12	7.060E-16-1.000E+00	0.000E+00	0.000E+00
RED MARR	4.000E-14	4.708E-12	4.769E-12	7.220E-16-1.000E+00	0.000E+00	0.000E+00
BONE SUR	6.020E-14	6.514E-12	6.598E-12	9.990E-16-1.000E+00	0.000E+00	0.000E+00
THYROID	4.130E-14	4.473E-12	4.531E-12	6.860E-16-1.000E+00	0.000E+00	0.000E+00
REMAINDER	3.910E-14	4.590E-12	4.650E-12	7.040E-16-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	4.120E-14	4.773E-12	4.835E-12	7.320E-16-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	1.370E-13	8.802E-11	8.916E-11	1.350E-14-1.000E+00	0.000E+00	0.000E+00
Kr-88						
GONADS	9.900E-14	2.278E-11	2.655E-11	1.800E-15-1.000E+00	0.000E+00	0.000E+00
BREAST	1.110E-13	2.177E-11	2.537E-11	1.720E-15-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.010E-13	2.139E-11	2.493E-11	1.690E-15-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.000E-13	2.190E-11	2.552E-11	1.730E-15-1.000E+00	0.000E+00	0.000E+00
BONE SUR	1.390E-13	2.886E-11	3.363E-11	2.280E-15-1.000E+00	0.000E+00	0.000E+00
THYROID	1.030E-13	2.012E-11	2.345E-11	1.590E-15-1.000E+00	0.000E+00	0.000E+00
REMAINDER	9.790E-14	2.139E-11	2.493E-11	1.690E-15-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.020E-13	2.202E-11	2.567E-11	1.740E-15-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	1.350E-13	5.607E-11	6.534E-11	4.430E-15-1.000E+00	0.000E+00	0.000E+00
I-128						
GONADS	4.070E-15	2.007E-13	2.007E-13	9.280E-17-1.000E+00	6.800E-13	1.390E-12
BREAST	4.670E-15	1.938E-13	1.938E-13	8.960E-17-1.000E+00	7.150E-13	1.440E-12
LUNGS	4.010E-15	1.795E-13	1.795E-13	8.300E-17-1.000E+00	7.220E-11	1.470E-12
RED MARR	3.850E-15	1.804E-13	1.804E-13	8.340E-17-1.000E+00	7.170E-13	1.430E-12
BONE SUR	7.470E-15	2.920E-13	2.920E-13	1.350E-16-1.000E+00	7.030E-13	1.390E-12
THYROID	4.130E-15	1.882E-13	1.882E-13	8.700E-17-1.000E+00	5.340E-11	1.080E-10
REMAINDER	3.830E-15	1.761E-13	1.761E-13	8.140E-17-1.000E+00	7.020E-12	6.710E-11
EFFECTIVE	4.160E-15	1.897E-13	1.897E-13	8.770E-17-1.000E+00	1.280E-11	2.430E-11
SKIN (FGR)	5.380E-14	1.899E-11	1.899E-11	8.780E-15-1.000E+00	0.000E+00	0.000E+00
I-130						
GONADS	1.010E-13	5.105E-11	1.412E-10	2.200E-15-1.000E+00	2.810E-11	5.520E-11
BREAST	1.160E-13	4.897E-11	1.354E-10	2.110E-15-1.000E+00	4.870E-11	7.320E-11
LUNGS	1.010E-13	4.664E-11	1.290E-10	2.010E-15-1.000E+00	6.030E-10	7.180E-11
RED MARR	9.820E-14	4.734E-11	1.309E-10	2.040E-15-1.000E+00	4.550E-11	6.740E-11
BONE SUR	1.680E-13	6.869E-11	1.900E-10	2.960E-15-1.000E+00	4.030E-11	6.120E-11

Attachment D

THYROID	1.040E-13	4.850E-11	1.342E-10	2.090E-15	-1.000E+00	1.990E-08	3.940E-08
REMAINDER	9.660E-14	4.572E-11	1.265E-10	1.970E-15	-1.000E+00	8.020E-11	1.970E-10
EFFECTIVE	1.040E-13	4.873E-11	1.348E-10	2.100E-15	-1.000E+00	7.140E-10	1.280E-09
SKIN (FGR)	1.360E-13	9.956E-11	2.754E-10	4.290E-15	-1.000E+00	0.000E+00	0.000E+00
I-131							
GONADS	1.780E-14	1.119E-11	1.789E-10	3.940E-16	-1.000E+00	2.530E-11	4.070E-11
BREAST	2.040E-14	1.082E-11	1.730E-10	3.810E-16	-1.000E+00	7.880E-11	1.210E-10
LUNGS	1.760E-14	1.016E-11	1.626E-10	3.580E-16	-1.000E+00	6.570E-10	1.020E-10
RED MARR	1.680E-14	1.022E-11	1.635E-10	3.600E-16	-1.000E+00	6.260E-11	9.440E-11
BONE SUR	3.450E-14	1.675E-11	2.679E-10	5.900E-16	-1.000E+00	5.730E-11	8.720E-11
THYROID	1.810E-14	1.053E-11	1.685E-10	3.710E-16	-1.000E+00	2.920E-07	4.760E-07
REMAINDER	1.670E-14	9.908E-12	1.585E-10	3.490E-16	-1.000E+00	8.030E-11	1.570E-10
EFFECTIVE	1.820E-14	1.067E-11	1.707E-10	3.760E-16	-1.000E+00	8.890E-09	1.440E-08
SKIN (FGR)	2.980E-14	1.825E-11	2.920E-10	6.430E-16	-1.000E+00	0.000E+00	0.000E+00
I-132							
GONADS	1.090E-13	2.523E-11	2.771E-11	2.320E-15	-1.000E+00	9.950E-12	2.330E-11
BREAST	1.240E-13	2.414E-11	2.652E-11	2.220E-15	-1.000E+00	1.410E-11	2.520E-11
LUNGS	1.090E-13	2.305E-11	2.532E-11	2.120E-15	-1.000E+00	2.710E-10	2.640E-11
RED MARR	1.070E-13	2.360E-11	2.592E-11	2.170E-15	-1.000E+00	1.400E-11	2.460E-11
BONE SUR	1.730E-13	3.327E-11	3.655E-11	3.060E-15	-1.000E+00	1.240E-11	2.190E-11
THYROID	1.120E-13	2.381E-11	2.616E-11	2.190E-15	-1.000E+00	1.740E-09	3.870E-09
REMAINDER	1.050E-13	2.283E-11	2.509E-11	2.100E-15	-1.000E+00	3.780E-11	1.650E-10
EFFECTIVE	1.120E-13	2.403E-11	2.640E-11	2.210E-15	-1.000E+00	1.030E-10	1.820E-10
SKIN (FGR)	1.580E-13	8.199E-11	9.007E-11	7.540E-15	-1.000E+00	0.000E+00	0.000E+00
I-133							
GONADS	2.870E-14	1.585E-11	6.748E-11	6.270E-16	-1.000E+00	1.950E-11	3.630E-11
BREAST	3.280E-14	1.519E-11	6.468E-11	6.010E-16	-1.000E+00	2.940E-11	4.680E-11
LUNGS	2.860E-14	1.446E-11	6.156E-11	5.720E-16	-1.000E+00	8.200E-10	4.530E-11
RED MARR	2.770E-14	1.466E-11	6.242E-11	5.800E-16	-1.000E+00	2.720E-10	4.300E-11
BONE SUR	4.870E-14	2.161E-11	9.202E-11	8.550E-16	-1.000E+00	2.520E-11	4.070E-11
THYROID	2.930E-14	1.502E-11	6.393E-11	5.940E-16	-1.000E+00	4.860E-08	9.100E-08
REMAINDER	2.730E-14	1.418E-11	6.038E-11	5.610E-16	-1.000E+00	5.000E-11	1.550E-10
EFFECTIVE	2.940E-14	1.509E-11	6.425E-11	5.970E-16	-1.000E+00	1.580E-09	2.800E-09
SKIN (FGR)	5.830E-14	1.150E-10	4.897E-10	4.550E-15	-1.000E+00	0.000E+00	0.000E+00
I-134							
GONADS	1.270E-13	1.200E-11	1.202E-11	2.640E-15	-1.000E+00	4.250E-12	1.100E-11
BREAST	1.440E-13	1.145E-11	1.147E-11	2.520E-15	-1.000E+00	6.170E-12	1.170E-11
LUNGS	1.270E-13	1.100E-11	1.102E-11	2.420E-15	-1.000E+00	1.430E-10	1.260E-11
RED MARR	1.250E-13	1.127E-11	1.129E-11	2.480E-15	-1.000E+00	6.080E-12	1.090E-11
BONE SUR	1.960E-13	1.568E-11	1.571E-11	3.450E-15	-1.000E+00	5.310E-12	9.320E-12
THYROID	1.300E-13	1.127E-11	1.129E-11	2.480E-15	-1.000E+00	2.880E-10	6.210E-10
REMAINDER	1.220E-13	1.091E-11	1.093E-11	2.400E-15	-1.000E+00	2.270E-11	1.340E-10
EFFECTIVE	1.300E-13	1.150E-11	1.152E-11	2.530E-15	-1.000E+00	3.550E-11	6.660E-11
SKIN (FGR)	1.870E-13	4.477E-11	4.485E-11	9.850E-15	-1.000E+00	0.000E+00	0.000E+00
I-135							
GONADS	8.078E-14	3.113E-11	5.489E-11	1.599E-15	-1.000E+00	1.700E-11	3.610E-11
BREAST	9.143E-14	2.971E-11	5.240E-11	1.526E-15	-1.000E+00	2.340E-11	3.850E-11
LUNGS	8.145E-14	2.886E-11	5.089E-11	1.482E-15	-1.000E+00	4.410E-10	3.750E-11
RED MARR	8.054E-14	2.965E-11	5.228E-11	1.523E-15	-1.000E+00	2.240E-11	3.650E-11
BONE SUR	1.184E-13	3.983E-11	7.024E-11	2.046E-15	-1.000E+00	2.010E-11	3.360E-11
THYROID	8.324E-14	2.852E-11	5.030E-11	1.465E-15	-1.000E+00	8.460E-09	1.790E-08
REMAINDER	7.861E-14	2.883E-11	5.084E-11	1.481E-15	-1.000E+00	4.700E-11	1.540E-10
EFFECTIVE	8.294E-14	2.989E-11	5.271E-11	1.535E-15	-1.000E+00	3.320E-10	6.080E-10
SKIN (FGR)	1.156E-13	9.826E-11	1.733E-10	5.047E-15	-1.000E+00	0.000E+00	0.000E+00
Te-129							
GONADS	2.710E-15	3.889E-13	3.922E-13	6.510E-17	-1.000E+00	5.050E-13	1.590E-12
BREAST	3.120E-15	3.800E-13	3.832E-13	6.360E-17	-1.000E+00	5.390E-13	6.050E-13
LUNGS	2.640E-15	3.298E-13	3.326E-13	5.520E-17	-1.000E+00	1.530E-10	4.910E-13
RED MARR	2.540E-15	3.298E-13	3.326E-13	5.520E-17	-1.000E+00	6.190E-13	7.640E-13
BONE SUR	4.880E-15	5.753E-13	5.802E-13	9.630E-17	-1.000E+00	6.220E-13	5.400E-13
THYROID	2.740E-15	3.525E-13	3.555E-13	5.900E-17	-1.000E+00	5.090E-13	3.360E-13
REMAINDER	2.520E-15	3.262E-13	3.289E-13	5.460E-17	-1.000E+00	7.280E-12	1.790E-10
EFFECTIVE	2.750E-15	3.590E-13	3.621E-13	6.010E-17	-1.000E+00	2.090E-11	5.450E-11
SKIN (FGR)	3.570E-14	3.429E-11	3.458E-11	5.740E-15	-1.000E+00	0.000E+00	0.000E+00
Te-131							
GONADS	1.990E-14	9.284E-13	9.284E-13	4.290E-16	-1.000E+00	2.170E-12	1.570E-11
BREAST	2.280E-14	8.937E-13	8.937E-13	4.130E-16	-1.000E+00	2.670E-12	4.960E-12
LUNGS	1.960E-14	8.440E-13	8.440E-13	3.900E-16	-1.000E+00	2.990E-10	3.390E-12
RED MARR	1.880E-14	8.483E-13	8.483E-13	3.920E-16	-1.000E+00	2.940E-12	6.600E-12
BONE SUR	3.800E-14	1.459E-12	1.459E-12	6.740E-16	-1.000E+00	2.610E-12	3.690E-12
THYROID	2.030E-14	8.678E-13	8.678E-13	4.010E-16	-1.000E+00	2.660E-09	4.210E-09

SECRET

Attachment D

EFFECTIVE	3.890E-16	5.876E-13	1.023E-11	2.060E-17-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	4.820E-15	1.266E-12	2.205E-11	4.440E-17-1.000E+00	0.000E+00	0.000E+00
Xe-133						
GONADS	1.610E-15	1.465E-12	2.052E-11	5.200E-17-1.000E+00	0.000E+00	0.000E+00
BREAST	1.960E-15	1.505E-12	2.107E-11	5.340E-17-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.320E-15	1.045E-12	1.464E-11	3.710E-17-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.070E-15	8.791E-13	1.231E-11	3.120E-17-1.000E+00	0.000E+00	0.000E+00
BONE SUR	5.130E-15	4.254E-12	5.958E-11	1.510E-16-1.000E+00	0.000E+00	0.000E+00
THYROID	1.510E-15	1.181E-12	1.653E-11	4.190E-17-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.240E-15	1.042E-12	1.460E-11	3.700E-17-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.560E-15	1.299E-12	1.819E-11	4.610E-17-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	4.970E-15	1.953E-12	2.734E-11	6.930E-17-1.000E+00	0.000E+00	0.000E+00
Xe-133m						
GONADS	1.420E-15	1.337E-12	1.188E-11	4.890E-17-1.000E+00	0.000E+00	0.000E+00
BREAST	1.700E-15	1.383E-12	1.230E-11	5.060E-17-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.190E-15	8.609E-13	7.656E-12	3.150E-17-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.100E-15	7.844E-13	6.975E-12	2.870E-17-1.000E+00	0.000E+00	0.000E+00
BONE SUR	3.230E-15	2.599E-12	2.311E-11	9.510E-17-1.000E+00	0.000E+00	0.000E+00
THYROID	1.360E-15	1.028E-12	9.138E-12	3.760E-17-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.150E-15	8.855E-13	7.874E-12	3.240E-17-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.370E-15	1.112E-12	9.892E-12	4.070E-17-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	1.040E-14	1.894E-12	1.684E-11	6.930E-17-1.000E+00	0.000E+00	0.000E+00
Xe-135						
GONADS	1.170E-14	5.455E-12	1.194E-11	2.530E-16-1.000E+00	0.000E+00	0.000E+00
BREAST	1.330E-14	5.325E-12	1.166E-11	2.470E-16-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.130E-14	4.959E-12	1.086E-11	2.300E-16-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.070E-14	4.959E-12	1.086E-11	2.300E-16-1.000E+00	0.000E+00	0.000E+00
BONE SUR	2.570E-14	9.120E-12	1.997E-11	4.230E-16-1.000E+00	0.000E+00	0.000E+00
THYROID	1.180E-14	5.023E-12	1.100E-11	2.330E-16-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.080E-14	4.829E-12	1.058E-11	2.240E-16-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.190E-14	5.217E-12	1.142E-11	2.420E-16-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	3.120E-14	4.506E-11	9.867E-11	2.090E-15-1.000E+00	0.000E+00	0.000E+00
Xe-135m						
GONADS	2.000E-14	5.929E-13	5.929E-13	4.480E-16-1.000E+00	0.000E+00	0.000E+00
BREAST	2.290E-14	5.691E-13	5.691E-13	4.300E-16-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.980E-14	5.347E-13	5.347E-13	4.040E-16-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.910E-14	5.400E-13	5.400E-13	4.080E-16-1.000E+00	0.000E+00	0.000E+00
BONE SUR	3.500E-14	8.246E-13	8.246E-13	6.230E-16-1.000E+00	0.000E+00	0.000E+00
THYROID	2.040E-14	5.612E-13	5.612E-13	4.240E-16-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.890E-14	5.241E-13	5.241E-13	3.960E-16-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	2.040E-14	5.612E-13	5.612E-13	4.240E-16-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	2.970E-14	1.866E-12	1.866E-12	1.410E-15-1.000E+00	0.000E+00	0.000E+00
Xe-138						
GONADS	5.590E-14	1.312E-12	1.312E-12	1.070E-15-1.000E+00	0.000E+00	0.000E+00
BREAST	6.320E-14	1.251E-12	1.251E-12	1.020E-15-1.000E+00	0.000E+00	0.000E+00
LUNGS	5.660E-14	1.223E-12	1.223E-12	9.970E-16-1.000E+00	0.000E+00	0.000E+00
RED MARR	5.600E-14	1.251E-12	1.251E-12	1.020E-15-1.000E+00	0.000E+00	0.000E+00
BONE SUR	8.460E-14	1.729E-12	1.729E-12	1.410E-15-1.000E+00	0.000E+00	0.000E+00
THYROID	5.770E-14	1.171E-12	1.171E-12	9.550E-16-1.000E+00	0.000E+00	0.000E+00
REMAINDER	5.490E-14	1.219E-12	1.219E-12	9.940E-16-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	5.770E-14	1.263E-12	1.263E-12	1.030E-15-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	1.070E-13	9.383E-12	9.383E-12	7.650E-15-1.000E+00	0.000E+00	0.000E+00

Attachment E

Attachment E RADTRAD Base Case Detailed Output File (oO)

RADTRAD Version 3.03 (Spring 2001) run on 6/16/2011 at 13:38:44
#####

File information
#####

Plant file = C:\Documents and Settings\jlboste\My Documents\FHA cooperGNF2
BC 06-16-11.psf
Inventory file = C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.nif
Release file = C:\RADTRAD\RADTRAD_310\RG1_183.rft
Dose Conversion file = C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.inp

```
#####
# # # # # # # # # #
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# # # # # # # # # #
```

Radtrad 3.03 4/15/2001
Base Case 1-01-2011
Nuclide Inventory File:
C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.nif
Plant Power Level:
1.5144E+01
Compartments:
3
Compartment 1:
primary
3
7.9500E+05
0
0
0
0
0
Compartment 2:
Environment
2
0.0000E+00
0
0
0
0
0
Compartment 3:
Control Room
1
1.4186E+05
0
0
0
0
0

1. DATE 11/11/1964
 2. TO Mr. J. Edgar Hoover
 3. FROM Mr. J. Edgar Hoover
 4. SUBJECT [illegible]
 5. RE [illegible]
 6. ATTN [illegible]
 7. INFO [illegible]
 8. FILE [illegible]
 9. CLASS [illegible]
 10. INDEX [illegible]
 11. SEARCH [illegible]
 12. RECORD [illegible]
 13. ADMIN [illegible]
 14. OTHER [illegible]

Pathway 4:
0
0
0

Attachment E

```

0
0
1
2
2.4000E+01  3.6350E+03  0.0000E+00  0.0000E+00  0.0000E+00
2.4017E+01  1.2100E+03  0.0000E+00  0.0000E+00  0.0000E+00
0
0
0
0
0
0
Dose Locations:
3
Location 1:
EAB
2
1
2
2.4000E+01  5.2000E-04
2.6000E+01  0.0000E+00
1
4
2.4000E+01  3.5000E-04
3.2000E+01  1.8000E-04
4.8000E+01  2.3000E-04
7.4400E+02  0.0000E+00
0
Location 2:
LPZ
2
1
5
2.4000E+01  2.9000E-04
3.2000E+01  7.3000E-05
4.8000E+01  2.5000E-05
1.2000E+02  5.2000E-06
7.4400E+02  0.0000E+00
1
4
2.4000E+01  3.5000E-04
3.2000E+01  1.8000E-04
4.8000E+01  2.3000E-04
7.4400E+02  0.0000E+00
0
Location 3:
Control Room
3
0
1
2
2.4000E+01  3.5000E-04
7.4400E+02  0.0000E+00
1
4
2.4000E+01  1.0000E+00
4.8000E+01  6.0000E-01
1.2000E+02  4.0000E-01
7.4400E+02  0.0000E+00
Effective Volume Location:
1
6
2.4000E+01  4.1500E-03

```

Attachment E

2.6000E+01	3.2400E-03
3.2000E+01	1.3200E-03
4.8000E+01	9.0100E-04
1.2000E+02	7.2200E-04
7.4400E+02	0.0000E+00

Simulation Parameters:

1
2.4000E+01 0.0000E+00

Output Filename:

C:\Documents and Settings\jlboste\My Documents\FHA cooperGNF2 BC 06-16-11.o0

1
1
1
0
0

End of Scenario File

Attachment E

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Attachment E

RADTRAD Version 3.03 (Spring 2001) run on 6/16/2011 at 13:38:44
#####

Plant Description
#####

Number of Nuclides = 29

Inventory Power = 1.0000E+00 MWth
Plant Power Level = 1.5144E+01 MWth

Number of compartments = 3

Compartment information

Compartment number 1 (Source term fraction = 1.0000E+00
)

Name: primary

Compartment volume = 7.9500E+05 (Cubic feet)

Compartment type is Normal

Pathways into and out of compartment 1

Exit Pathway Number 1: primary to Environment

Compartment number 2

Name: Environment

Compartment type is Environment

Pathways into and out of compartment 2

Inlet Pathway Number 1: primary to Environment

Inlet Pathway Number 4: Control Room to Environment

Exit Pathway Number 2: Environment to Control Room

Exit Pathway Number 3: Environment to Control Room

Compartment number 3

Name: Control Room

Compartment volume = 1.4186E+05 (Cubic feet)

Compartment type is Control Room

Pathways into and out of compartment 3

Inlet Pathway Number 2: Environment to Control Room

Inlet Pathway Number 3: Environment to Control Room

Exit Pathway Number 4: Control Room to Environment

Total number of pathways = 4

Attachment E

RADTRAD Version 3.03 (Spring 2001) run on 6/16/2011 at 13:38:44
#####

Scenario Description
#####

Time between shutdown and first release = 2.4000E+01 (Hours)

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	5.0000E-02	0.0000E+00	0.0000E+00	1.879E+00
IODINE	2.5000E-04	0.0000E+00	0.0000E+00	1.595E-03
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 15. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
Br-82	2	1.870E+02	1.271E+05	1.300E-13	2.380E-10	3.310E-10
Br-83	2	3.240E+03	8.604E+03	3.820E-16	3.290E-12	2.330E-11
Br-84	2	5.560E+03	1.908E+03	9.410E-14	3.120E-12	2.610E-11
Kr-83m	1	3.250E+03	6.588E+03	1.500E-18	0.000E+00	0.000E+00
Kr-85	1	8.520E+02	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	6.750E+03	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	1.280E+04	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	1.810E+04	1.022E+04	1.020E-13	0.000E+00	0.000E+00
I-128	2	4.330E+02	1.499E+03	4.160E-15	5.340E-11	1.280E-11
I-130	2	1.100E+03	4.450E+04	1.040E-13	1.990E-08	7.140E-10
I-131	2	4.352E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.960E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.480E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.040E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.160E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Xe-129m	1	2.230E-01	6.912E+05	1.060E-15	0.000E+00	0.000E+00
Xe-131m	1	3.040E+02	1.028E+06	3.890E-16	0.000E+00	0.000E+00
Xe-133	1	5.450E+04	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-133m	1	1.730E+03	1.890E+05	1.370E-15	0.000E+00	0.000E+00
Xe-135	1	2.040E+04	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Xe-135m	1	1.100E+04	9.174E+02	2.040E-14	0.000E+00	0.000E+00
Xe-138	1	4.490E+04	8.502E+02	5.770E-14	0.000E+00	0.000E+00

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Br-83	Kr-83m	1.00	none	0.00	none	0.00
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00

Attachment E

Te-129	I-129	1.00	none	0.00	none	0.00
Te-131	I-131	1.00	none	0.00	none	0.00
Te-131m	I-131	0.78	Te-131	0.22	none	0.00
Te-132	I-132	1.00	none	0.00	none	0.00
Te-133	I-133	1.00	none	0.00	none	0.00
Te-133m	I-133	0.87	Te-133	0.13	none	0.00
Te-134	I-134	1.00	none	0.00	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Cs-135	0.00	Xe-135	1.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol = 9.5000E-01
Elemental = 4.8500E-02
Organic = 1.5000E-03

COMPARTMENT DATA

Compartment number 1: primary
Compartment number 2: Environment
Compartment number 3: Control Room

PATHWAY DATA

Pathway number 1: primary to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00
2.4017E+01	8.1000E+02	8.9000E+01	8.9000E+01	8.9000E+01

Pathway number 3: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00
2.4017E+01	1.2100E+03	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location EAB is in compartment 2

Attachment E

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	5.2000E-04
2.6000E+01	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
2.4000E+01	3.5000E-04
3.2000E+01	1.8000E-04
4.8000E+01	2.3000E-04
7.4400E+02	0.0000E+00

Location LPZ is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	2.9000E-04
3.2000E+01	7.3000E-05
4.8000E+01	2.5000E-05
1.2000E+02	5.2000E-06
7.4400E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
2.4000E+01	3.5000E-04
3.2000E+01	1.8000E-04
4.8000E+01	2.3000E-04
7.4400E+02	0.0000E+00

Location Control Room is in compartment 3

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	4.1500E-03
2.6000E+01	3.2400E-03
3.2000E+01	1.3200E-03
4.8000E+01	9.0100E-04
1.2000E+02	7.2200E-04
7.4400E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
2.4000E+01	3.5000E-04
7.4400E+02	0.0000E+00

Location Occupancy Factor Data

Time (hr)	Occupancy Factor
2.4000E+01	1.0000E+00
4.8000E+01	6.0000E-01
1.2000E+02	4.0000E-01
7.4400E+02	0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS

Time	Time step
0.0000E+00	0.0000E+00

Attachment E

RADTRAD Version 3.03 (Spring 2001) run on 6/16/2011 at 13:38:44
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Dose, Detailed model and Detailed Inventory Output
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EAB Doses:

Time (h) = 24.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.7409E-03	2.0624E-01	9.0914E-03
Accumulated dose (rem)	2.7409E-03	2.0624E-01	9.0914E-03

LPZ Doses:

Time (h) = 24.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.5286E-03	1.1502E-01	5.0702E-03
Accumulated dose (rem)	1.5286E-03	1.1502E-01	5.0702E-03

Control Room Doses:

Time (h) = 24.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.2136E-06	3.5446E-03	1.1136E-04
Accumulated dose (rem)	2.2136E-06	3.5446E-03	1.1136E-04

primary Compartment Nuclide Inventory:

Time (h) = 24.0036	Ci	kg	Atoms	Decay
Br-82	4.3917E-01	4.0564E-10	2.9791E+15	1.6071E+11
Br-83	1.1553E-02	7.3128E-13	5.3059E+12	4.2293E+09
Kr-83m	9.1008E+00	4.4110E-10	3.2004E+15	3.3321E+12
Kr-85	6.4108E+02	1.6340E-03	1.1577E+22	2.3459E+14
Kr-85m	1.2386E+02	1.5050E-08	1.0663E+17	4.5333E+13
Kr-87	2.0025E-02	7.0696E-13	4.8935E+12	7.3335E+09
Kr-88	3.8895E+01	3.1019E-09	2.1227E+16	1.4238E+13
I-130	1.0771E+00	5.5227E-10	2.5584E+15	3.9419E+11
I-131	1.5134E+02	1.2207E-06	5.6117E+18	5.5381E+13
I-132	1.2238E+02	1.1856E-08	5.4091E+16	4.4803E+13
I-133	9.4760E+01	8.3650E-08	3.7876E+17	3.4678E+13
I-134	5.1319E-06	1.9237E-16	8.6456E+08	1.8800E+06
I-135	1.5666E+01	4.4610E-09	1.9900E+16	5.7338E+12
Xe-129m	1.5388E-01	1.2162E-09	5.6776E+15	5.6311E+10
Xe-131m	2.3543E+02	2.8107E-06	1.2921E+19	8.6153E+13
Xe-133	3.9541E+04	2.1124E-04	9.5649E+20	1.4470E+16
Xe-133m	1.1720E+03	2.6120E-06	1.1827E+19	4.2889E+14
Xe-135	1.0794E+04	4.2269E-06	1.8855E+19	3.9504E+15
Xe-135m	5.4241E+02	5.9545E-09	2.6562E+16	1.9921E+14

primary Transport Group Inventory:

Attachment E

Time (h) = 24.0036	Atmosphere	Sump	
Noble gases (atoms)	1.2577E+22	0.0000E+00	
Elemental I (atoms)	2.9440E+17	0.0000E+00	
Organic I (atoms)	9.1051E+15	0.0000E+00	
Aerosols (kg)	1.2556E-06	0.0000E+00	
Dose Effective (Ci/cc) I-131 (Thyroid)			7.4758E-09
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)			8.1017E-09
Total I (Ci)			3.8415E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.8346E+19
Elemental I (atoms)	0.0000E+00	1.8339E+15
Organic I (atoms)	0.0000E+00	5.6720E+13
Aerosols (kg)	0.0000E+00	7.8215E-09

Environment Integral Nuclide Release:

Time (h) = 24.0036	Ci	kg	Atoms	Bq
Br-82	2.7357E-03	2.5269E-12	1.8558E+13	1.0122E+08
Br-83	7.1970E-05	4.5557E-15	3.3054E+10	2.6629E+06
Kr-83m	5.6696E-02	2.7480E-12	1.9938E+13	2.0978E+09
Kr-85	3.9935E+00	1.0179E-05	7.2115E+19	1.4776E+11
Kr-85m	7.7157E-01	9.3756E-11	6.6425E+14	2.8548E+10
Kr-87	1.2476E-04	4.4045E-15	3.0488E+10	4.6161E+06
Kr-88	2.4231E-01	1.9324E-11	1.3224E+14	8.9653E+09
I-130	6.7098E-03	3.4403E-12	1.5937E+13	2.4826E+08
I-131	9.4274E-01	7.6043E-09	3.4957E+16	3.4882E+10
I-132	7.6238E-01	7.3859E-11	3.3696E+14	2.8208E+10
I-133	5.9030E-01	5.2109E-10	2.3595E+15	2.1841E+10
I-134	3.1975E-08	1.1986E-18	5.3867E+06	1.1831E+03
I-135	9.7594E-02	2.7790E-11	1.2397E+14	3.6110E+09
Xe-129m	9.5858E-04	7.5761E-12	3.5368E+13	3.5467E+07
Xe-131m	1.4666E+00	1.7509E-08	8.0490E+16	5.4263E+10
Xe-133	2.4631E+02	1.3159E-06	5.9583E+18	9.1135E+12
Xe-133m	7.3008E+00	1.6271E-08	7.3673E+16	2.7013E+11
Xe-135	6.7242E+01	2.6331E-08	1.1746E+17	2.4880E+12
Xe-135m	3.3796E+00	3.7101E-11	1.6550E+14	1.2505E+11

Environment Transport Group Inventory:

	Total	Release
Time (h) = 24.0036	Release	Rate/s
Noble gases (atoms)	7.8346E+19	6.0452E+18
Elemental I (atoms)	1.8339E+15	1.4150E+14
Organic I (atoms)	5.6719E+13	4.3764E+12
Aerosols (kg)	7.8214E-09	6.0350E-10
Dose Effective (Ci) I-131 (Thyroid)		1.0484E+00
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.1361E+00
Total I (Ci)		2.3930E+00

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.8346E+19
Elemental I (atoms)	0.0000E+00	1.8339E+15
Organic I (atoms)	0.0000E+00	5.6720E+13
Aerosols (kg)	0.0000E+00	7.8215E-09

Environment to Control Room Transport Group Inventory:

Attachment E

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.9640E+17
Elemental I (atoms)	0.0000E+00	1.1620E+13
Organic I (atoms)	0.0000E+00	3.5938E+11
Aerosols (kg)	0.0000E+00	4.9557E-11

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	6.1379E+16
Elemental I (atoms)	0.0000E+00	1.4368E+12
Organic I (atoms)	0.0000E+00	4.4436E+10
Aerosols (kg)	0.0000E+00	6.1277E-12

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	1.0283E+15	0.0000E+00
Elemental I (atoms)	2.4072E+10	0.0000E+00
Organic I (atoms)	7.4449E+08	0.0000E+00
Aerosols (kg)	1.0266E-13	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0036	Ci	kg	Atoms	Decay
Br-82	1.9441E-05	1.7957E-14	1.3188E+11	6.6172E+06
Br-83	5.1141E-07	3.2372E-17	2.3488E+08	1.7413E+05
Kr-83m	4.0286E-04	1.9526E-14	1.4167E+11	1.3719E+08
Kr-85	2.8379E-02	7.2333E-08	5.1247E+17	9.6593E+09
Kr-85m	5.4828E-03	6.6623E-13	4.7202E+12	1.8665E+09
Kr-87	8.8646E-07	3.1295E-17	2.1663E+08	3.0193E+05
Kr-88	1.7218E-03	1.3731E-13	9.3968E+11	5.8623E+08
I-130	4.7682E-05	2.4448E-14	1.1325E+11	1.6231E+07
I-131	6.6994E-03	5.4039E-11	2.4842E+14	2.2803E+09
I-132	5.4173E-03	5.2482E-13	2.3944E+12	1.8446E+09
I-133	4.1948E-03	3.7030E-12	1.6767E+13	1.4278E+09
I-134	2.2718E-10	8.5160E-21	3.8272E+04	7.7403E+01
I-135	6.9352E-04	1.9748E-13	8.8092E+11	2.3608E+08
Xe-129m	6.8119E-06	5.3838E-14	2.5133E+11	2.3186E+06
Xe-131m	1.0422E-02	1.2442E-10	5.7198E+14	3.5473E+09
Xe-133	1.7504E+00	9.3512E-09	4.2341E+16	5.9578E+11
Xe-133m	5.1882E-02	1.1563E-10	5.2354E+14	1.7659E+10
Xe-135	4.7784E-01	1.8711E-10	8.3468E+14	1.6266E+11
Xe-135m	2.4000E-02	2.6347E-13	1.1753E+12	8.1971E+09

Control Room Transport Group Inventory:

Time (h) = 24.0036	Atmosphere	Sump
Noble gases (atoms)	5.5675E+17	0.0000E+00
Elemental I (atoms)	1.3032E+13	0.0000E+00
Organic I (atoms)	4.0306E+11	0.0000E+00
Aerosols (kg)	5.5581E-11	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		1.8546E-12
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		2.0099E-12
Total I (Ci)		1.7005E-02

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported

Attachment E

Noble gases (atoms)	0.0000E+00	4.9640E+17
Elemental I (atoms)	0.0000E+00	1.1620E+13
Organic I (atoms)	0.0000E+00	3.5938E+11
Aerosols (kg)	0.0000E+00	4.9557E-11

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	6.1379E+16
Elemental I (atoms)	0.0000E+00	1.4368E+12
Organic I (atoms)	0.0000E+00	4.4436E+10
Aerosols (kg)	0.0000E+00	6.1277E-12

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	1.0283E+15	0.0000E+00
Elemental I (atoms)	2.4072E+10	0.0000E+00
Organic I (atoms)	7.4449E+08	0.0000E+00
Aerosols (kg)	1.0266E-13	0.0000E+00

EAB Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9889E-02	1.4972E+00	6.5991E-02
Accumulated dose (rem)	2.2630E-02	1.7034E+00	7.5083E-02

LPZ Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1092E-02	8.3498E-01	3.6803E-02
Accumulated dose (rem)	1.2621E-02	9.4999E-01	4.1873E-02

Control Room Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.6952E-05	1.5531E-01	4.8794E-03
Accumulated dose (rem)	9.9165E-05	1.5886E-01	4.9908E-03

primary Compartment Nuclide Inventory:

Time (h) = 24.0170	Ci	kg	Atoms	Decay
Br-82	4.1919E-01	3.8720E-10	2.8436E+15	9.0902E+11
Br-83	1.0987E-02	6.9550E-13	5.0463E+12	2.3879E+10
Kr-83m	8.6453E+00	4.1902E-10	3.0403E+15	1.8802E+13
Kr-85	6.1208E+02	1.5601E-03	1.1053E+22	1.3271E+15
Kr-85m	1.1801E+02	1.4340E-08	1.0160E+17	2.5618E+14
Kr-87	1.8980E-02	6.7007E-13	4.6382E+12	4.1335E+10
Kr-88	3.7015E+01	2.9519E-09	2.0201E+16	8.0413E+13
I-130	1.0276E+00	5.2690E-10	2.4408E+15	2.2291E+12
I-131	1.4449E+02	1.1655E-06	5.3577E+18	3.1328E+14
I-132	1.1638E+02	1.1275E-08	5.1437E+16	2.5294E+14
I-133	9.0434E+01	7.9832E-08	3.6147E+17	1.9613E+14
I-134	4.8482E-06	1.8174E-16	8.1676E+08	1.0580E+07
I-135	1.4937E+01	4.2533E-09	1.8973E+16	3.2413E+13
Xe-129m	1.4691E-01	1.1611E-09	5.4206E+15	3.1854E+11
Xe-131m	2.2478E+02	2.6835E-06	1.2336E+19	4.8736E+14
Xe-133	3.7750E+04	2.0167E-04	9.1317E+20	8.1851E+16
Xe-133m	1.1188E+03	2.4934E-06	1.1290E+19	2.4260E+15
Xe-135	1.0296E+04	4.0318E-06	1.7985E+19	2.2336E+16
Xe-135m	4.9942E+02	5.4826E-09	2.4457E+16	1.1069E+15

Attachment E

primary Transport Group Inventory:

Time (h) =	24.0170	Atmosphere	Sump
Noble gases (atoms)	1.2008E+22	0.0000E+00	
Elemental I (atoms)	2.8105E+17	0.0000E+00	
Organic I (atoms)	8.6923E+15	0.0000E+00	
Aerosols (kg)	1.1987E-06	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)	7.1370E-09	
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	7.7337E-09	
Total I (Ci)		3.6624E+02	

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	24.0170	Filtered Transported
Noble gases (atoms)	0.0000E+00	6.4712E+20
Elemental I (atoms)	0.0000E+00	1.5148E+16
Organic I (atoms)	0.0000E+00	4.6848E+14
Aerosols (kg)	0.0000E+00	6.4603E-08

Environment Integral Nuclide Release:

Time (h) = 24.0170	Ci	kg	Atoms	Bq
Br-82	2.2591E-02	2.0867E-11	1.5325E+14	8.3587E+08
Br-83	5.9239E-04	3.7499E-14	2.7207E+11	2.1919E+07
Kr-83m	4.6619E-01	2.2595E-11	1.6394E+14	1.7249E+10
Kr-85	3.2985E+01	8.4074E-05	5.9565E+20	1.2205E+12
Kr-85m	6.3611E+00	7.7297E-10	5.4764E+15	2.3536E+11
Kr-87	1.0238E-03	3.6143E-14	2.5018E+11	3.7879E+07
Kr-88	1.9955E+00	1.5914E-10	1.0891E+15	7.3835E+10
I-130	5.5384E-02	2.8397E-11	1.3155E+14	2.0492E+09
I-131	7.7865E+00	6.2807E-08	2.8873E+17	2.8810E+11
I-132	6.2747E+00	6.0788E-10	2.7733E+15	2.3216E+11
I-133	4.8738E+00	4.3024E-09	1.9481E+16	1.8033E+11
I-134	2.6161E-07	9.8068E-18	4.4073E+07	9.6797E+03
I-135	8.0509E-01	2.2925E-10	1.0226E+15	2.9788E+10
Xe-129m	7.9173E-03	6.2574E-11	2.9212E+14	2.9294E+08
Xe-131m	1.2113E+01	1.4462E-07	6.6481E+17	4.4819E+11
Xe-133	2.0344E+03	1.0868E-05	4.9211E+19	7.5271E+13
Xe-133m	6.0293E+01	1.3437E-07	6.0843E+17	2.2309E+12
Xe-135	5.5492E+02	2.1730E-07	9.6934E+17	2.0532E+13
Xe-135m	2.7035E+01	2.9679E-10	1.3239E+15	1.0003E+12

Environment Transport Group Inventory:

	Total	Release	
Time (h) =	24.0170	Release	Rate/s
Noble gases (atoms)	6.4712E+20	1.0574E+19	
Elemental I (atoms)	1.5146E+16	2.4748E+14	
Organic I (atoms)	4.6844E+14	7.6542E+12	
Aerosols (kg)	6.4596E-08	1.0555E-09	
Dose Effective (Ci)	I-131 (Thyroid)	8.6584E+00	
Dose Effective (Ci)	I-131 (ICRP2 Thyroid)	9.3825E+00	
Total I (Ci)		1.9740E+01	

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	24.0170	Filtered Transported
Noble gases (atoms)	0.0000E+00	6.4712E+20
Elemental I (atoms)	0.0000E+00	1.5148E+16
Organic I (atoms)	0.0000E+00	4.6848E+14
Aerosols (kg)	0.0000E+00	6.4603E-08

Attachment E

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.1002E+18
Elemental I (atoms)	0.0000E+00	9.5976E+13
Organic I (atoms)	0.0000E+00	2.9683E+12
Aerosols (kg)	0.0000E+00	4.0933E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.0698E+17
Elemental I (atoms)	0.0000E+00	1.1867E+13
Organic I (atoms)	0.0000E+00	3.6703E+11
Aerosols (kg)	0.0000E+00	5.0612E-11

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	5.4130E+16	0.0000E+00
Elemental I (atoms)	1.2671E+12	0.0000E+00
Organic I (atoms)	3.9187E+10	0.0000E+00
Aerosols (kg)	5.4039E-12	0.0000E+00

EAB Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0475E-01	3.1513E+01	1.3748E+00
Accumulated dose (rem)	4.2738E-01	3.3217E+01	1.4499E+00

LPZ Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.2573E-01	1.7575E+01	7.6671E-01
Accumulated dose (rem)	2.3835E-01	1.8525E+01	8.0858E-01

Control Room Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.1939E-02	8.3593E+01	2.6631E+00
Accumulated dose (rem)	9.2038E-02	8.3752E+01	2.6681E+00

primary Compartment Nuclide Inventory:

Time (h) = 26.0000	Ci	kg	Atoms	Decay
Br-82	4.2782E-04	3.9516E-13	2.9021E+12	1.4354E+13
Br-83	6.5596E-06	4.1522E-16	3.0127E+09	3.5072E+11
Kr-83m	4.3331E-03	2.1002E-13	1.5238E+12	2.7001E+14
Kr-85	6.4947E-01	1.6554E-06	1.1728E+19	2.1071E+16
Kr-85m	9.2134E-02	1.1196E-11	7.9319E+13	3.8990E+15
Kr-87	6.8334E-06	2.4124E-16	1.6699E+09	5.6967E+11
Kr-88	2.4207E-02	1.9305E-12	1.3211E+13	1.1953E+15
I-130	9.7565E-04	5.0025E-13	2.3174E+12	3.4847E+13
I-131	1.5223E-01	1.2279E-09	5.6447E+15	4.9692E+15
I-132	6.7933E-02	6.5813E-12	3.0025E+13	3.7043E+15
I-133	8.9822E-02	7.9292E-11	3.5903E+14	3.0853E+15
I-134	1.0725E-09	4.0205E-20	1.8069E+05	1.3765E+08
I-135	1.2874E-02	3.6658E-12	1.6353E+13	4.9999E+14
Xe-129m	1.5478E-04	1.2233E-12	5.7107E+12	5.0526E+12
Xe-131m	2.3737E-01	2.8339E-09	1.3028E+16	7.7329E+15
Xe-133	3.9635E+01	2.1174E-07	9.5876E+17	1.2977E+18
Xe-133m	1.1565E+00	2.5775E-09	1.1671E+16	3.8378E+16

Attachment E

Xe-135	9.4070E+00	3.6837E-09	1.6432E+16	3.4743E+17
Xe-135m	4.6803E-03	5.1380E-14	2.2920E+11	1.0084E+16

primary Transport Group Inventory:

Time (h) =	26.0000	Atmosphere	Sump	
Noble gases (atoms)	1.2728E+19	0.0000E+00		
Elemental I (atoms)	2.9368E+14	0.0000E+00		
Organic I (atoms)	9.0829E+12	0.0000E+00		
Aerosols (kg)	1.2524E-09	0.0000E+00		
Dose Effective (Ci/cc)	I-131 (Thyroid)			7.4607E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)			7.9850E-12
Total I (Ci)				3.2286E-01

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2634E+22
Elemental I (atoms)	0.0000E+00	2.9518E+17
Organic I (atoms)	0.0000E+00	9.1293E+15
Aerosols (kg)	0.0000E+00	1.2589E-06

Environment Integral Nuclide Release:

Time (h) =	26.0000	Ci	kg	Atoms	Bq
Br-82		4.3856E-01	4.0508E-10	2.9750E+15	1.6227E+10
Br-83		1.0568E-02	6.6896E-13	4.8537E+12	3.9102E+08
Kr-83m		8.0995E+00	3.9257E-10	2.8483E+15	2.9968E+11
Kr-85		6.4442E+02	1.6425E-03	1.1637E+22	2.3844E+13
Kr-85m		1.1830E+02	1.4375E-08	1.0185E+17	4.3772E+12
Kr-87		1.6943E-02	5.9816E-13	4.1405E+12	6.2690E+08
Kr-88		3.6101E+01	2.8790E-09	1.9702E+16	1.3357E+12
I-130		1.0626E+00	5.4485E-10	2.5240E+15	3.9318E+10
I-131		1.5195E+02	1.2256E-06	5.6342E+18	5.6220E+12
I-132		1.1155E+02	1.0807E-08	4.9305E+16	4.1275E+12
I-133		9.4197E+01	8.3153E-08	3.7651E+17	3.4853E+12
I-134		4.0433E-06	1.5157E-16	6.8116E+08	1.4960E+05
I-135		1.5209E+01	4.3308E-09	1.9319E+16	5.6274E+11
Xe-129m		1.5450E-01	1.2211E-09	5.7003E+15	5.7163E+09
Xe-131m		2.3647E+02	2.8231E-06	1.2978E+19	8.7492E+12
Xe-133		3.9676E+04	2.1196E-04	9.5976E+20	1.4680E+15
Xe-133m		1.1729E+03	2.6140E-06	1.1836E+19	4.3398E+13
Xe-135		1.0586E+04	4.1455E-06	1.8492E+19	3.9170E+14
Xe-135m		2.6954E+02	2.9589E-09	1.3199E+16	9.9729E+12

Environment Transport Group Inventory:

	Total	Release
Time (h) = 26.0000	Release	Rate/s
Noble gases (atoms)	1.2640E+22	1.7556E+18
Elemental I (atoms)	2.9512E+17	4.0988E+13
Organic I (atoms)	9.1273E+15	1.2677E+12
Aerosols (kg)	1.2586E-06	1.7481E-10
Dose Effective (Ci) I-131 (Thyroid)		1.6873E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.8241E+02
Total I (Ci)		3.7291E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2634E+22
Elemental I (atoms)	0.0000E+00	2.9518E+17

Attachment E

Organic I (atoms)	0.0000E+00	9.1293E+15
Aerosols (kg)	0.0000E+00	1.2589E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3128E+19
Elemental I (atoms)	3.9563E+14	1.4487E+14
Organic I (atoms)	1.2236E+13	4.4806E+12
Aerosols (kg)	1.6873E-09	6.1787E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9033E+18
Elemental I (atoms)	0.0000E+00	2.3138E+14
Organic I (atoms)	0.0000E+00	7.1562E+12
Aerosols (kg)	0.0000E+00	9.8682E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	1.9304E+19	0.0000E+00
Elemental I (atoms)	2.2238E+14	0.0000E+00
Organic I (atoms)	6.8776E+12	0.0000E+00
Aerosols (kg)	9.4837E-10	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 26.0000	Ci	kg	Atoms	Decay
Br-82	2.1927E-04	2.0254E-13	1.4874E+12	8.5489E+10
Br-83	3.3621E-06	2.1282E-16	1.5441E+09	1.7696E+09
Kr-83m	4.6649E-03	2.2610E-13	1.6405E+12	2.6103E+12
Kr-85	6.9954E-01	1.7830E-06	1.2632E+19	2.5846E+14
Kr-85m	9.9238E-02	1.2059E-11	8.5435E+13	4.3235E+13
Kr-87	7.3602E-06	2.5984E-16	1.7986E+09	5.0063E+09
Kr-88	2.6073E-02	2.0793E-12	1.4229E+13	1.2532E+13
I-130	5.0006E-04	2.5640E-13	1.1877E+12	2.0276E+11
I-131	7.8023E-02	6.2934E-10	2.8931E+15	2.9902E+13
I-132	3.4818E-02	3.3732E-12	1.5389E+13	1.8567E+13
I-133	4.6038E-02	4.0640E-11	1.8402E+14	1.8214E+13
I-134	5.4972E-10	2.0607E-20	9.2609E+04	5.3204E+05
I-135	6.5984E-03	1.8789E-12	8.3814E+12	2.8213E+12
Xe-129m	1.6671E-04	1.3176E-12	6.1510E+12	6.1827E+10
Xe-131m	2.5567E-01	3.0523E-09	1.4032E+16	9.4700E+13
Xe-133	4.2690E+01	2.2807E-07	1.0327E+18	1.5861E+16
Xe-133m	1.2457E+00	2.7762E-09	1.2570E+16	4.6663E+14
Xe-135	1.0131E+01	3.9673E-09	1.7697E+16	4.0550E+15
Xe-135m	3.7788E-03	4.1483E-14	1.8505E+11	3.9078E+13

Control Room Transport Group Inventory:

Time (h) = 26.0000	Atmosphere	Sump
Noble gases (atoms)	1.3710E+19	0.0000E+00
Elemental I (atoms)	1.5052E+14	0.0000E+00
Organic I (atoms)	4.6554E+12	0.0000E+00
Aerosols (kg)	6.4191E-10	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		2.1430E-11
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		2.2936E-11
Total I (Ci)		1.6548E-01

Attachment E

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3128E+19
Elemental I (atoms)	3.9563E+14	1.4487E+14
Organic I (atoms)	1.2236E+13	4.4806E+12
Aerosols (kg)	1.6873E-09	6.1787E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9033E+18
Elemental I (atoms)	0.0000E+00	2.3138E+14
Organic I (atoms)	0.0000E+00	7.1562E+12
Aerosols (kg)	0.0000E+00	9.8682E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	1.9304E+19	0.0000E+00
Elemental I (atoms)	2.2238E+14	0.0000E+00
Organic I (atoms)	6.8776E+12	0.0000E+00
Aerosols (kg)	9.4837E-10	0.0000E+00

EAB Doses:

Time (h) = 32.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2738E-01	3.3217E+01	1.4499E+00

LPZ Doses:

Time (h) = 32.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0406E-04	1.8394E-02	7.6905E-04
Accumulated dose (rem)	2.3855E-01	1.8543E+01	8.0935E-01

Control Room Doses:

Time (h) = 32.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.3360E-02	5.3874E+01	1.7067E+00
Accumulated dose (rem)	1.4540E-01	1.3763E+02	4.3748E+00

primary Compartment Nuclide Inventory:

Time (h) = 32.0000	Ci	kg	Atoms	Decay
Kr-85	6.5058E-10	1.6582E-15	1.1748E+10	2.1092E+16
Kr-85m	3.6477E-11	4.4325E-21	3.1403E+04	3.9019E+15
I-131	1.4924E-10	1.2038E-18	5.5340E+06	4.9741E+15
I-133	7.3674E-11	6.5036E-20	2.9448E+05	3.0882E+15
Xe-131m	2.3437E-10	2.7981E-18	1.2863E+07	7.7406E+15
Xe-133	3.8453E-08	2.0543E-16	9.3017E+08	1.2989E+18
Xe-133m	1.0705E-09	2.3858E-18	1.0803E+07	3.8415E+16
Xe-135	5.9672E-09	2.3367E-18	1.0424E+07	3.4773E+17

primary Transport Group Inventory:

Time (h) = 32.0000	Atmosphere	Sump
Noble gases (atoms)	1.2713E+10	0.0000E+00
Elemental I (atoms)	2.8355E+05	0.0000E+00
Organic I (atoms)	8.7696E+03	0.0000E+00
Aerosols (kg)	1.2090E-18	0.0000E+00

Attachment E

Dose Effective (Ci/cc) I-131 (Thyroid) 7.1860E-21
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 7.5476E-21
Total I (Ci) 2.4095E-10

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9547E+17
Organic I (atoms)	0.0000E+00	9.1384E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment Integral Nuclide Release:

Time (h) = 32.0000	Ci	kg	Atoms	Bq
Br-82	4.3898E-01	4.0548E-10	2.9778E+15	1.6242E+10
Br-83	1.0574E-02	6.6933E-13	4.8564E+12	3.9124E+08
Kr-83m	8.1033E+00	3.9275E-10	2.8497E+15	2.9982E+11
Kr-85	6.4507E+02	1.6442E-03	1.1649E+22	2.3868E+13
Kr-85m	1.1839E+02	1.4386E-08	1.0192E+17	4.3804E+12
Kr-87	1.6949E-02	5.9837E-13	4.1419E+12	6.2712E+08
Kr-88	3.6123E+01	2.8808E-09	1.9714E+16	1.3366E+12
I-130	1.0636E+00	5.4534E-10	2.5263E+15	3.9353E+10
I-131	1.5210E+02	1.2268E-06	5.6399E+18	5.6276E+12
I-132	1.1162E+02	1.0813E-08	4.9332E+16	4.1298E+12
I-133	9.4286E+01	8.3232E-08	3.7687E+17	3.4886E+12
I-134	4.0441E-06	1.5160E-16	6.8130E+08	1.4963E+05
I-135	1.5222E+01	4.3344E-09	1.9335E+16	5.6320E+11
Xe-129m	1.5465E-01	1.2223E-09	5.7060E+15	5.7221E+09
Xe-131m	2.3670E+02	2.8259E-06	1.2991E+19	8.7580E+12
Xe-133	3.9715E+04	2.1218E-04	9.6071E+20	1.4695E+15
Xe-133m	1.1741E+03	2.6166E-06	1.1848E+19	4.3441E+13
Xe-135	1.0596E+04	4.1490E-06	1.8508E+19	3.9203E+14
Xe-135m	2.6954E+02	2.9590E-09	1.3200E+16	9.9730E+12

Environment Transport Group Inventory:

	Total	Release
Time (h) = 32.0000	Release	Rate/s
Noble gases (atoms)	1.2653E+22	4.3934E+17
Elemental I (atoms)	2.9541E+17	1.0257E+13
Organic I (atoms)	9.1363E+15	3.1723E+11
Aerosols (kg)	1.2599E-06	4.3745E-11
Dose Effective (Ci) I-131 (Thyroid)		1.6890E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.8259E+02
Total I (Ci)		3.7322E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9547E+17
Organic I (atoms)	0.0000E+00	9.1384E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3144E+19
Elemental I (atoms)	3.9595E+14	1.4491E+14

Attachment E

Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6887E-09	6.1804E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1618E+12
Aerosols (kg)	0.0000E+00	9.8758E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	3.2389E+19	0.0000E+00
Elemental I (atoms)	3.6461E+14	0.0000E+00
Organic I (atoms)	1.1277E+13	0.0000E+00
Aerosols (kg)	1.5549E-09	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 32.0000	Ci	kg	Atoms	Decay
Br-82	9.0574E-06	8.3661E-15	6.1441E+10	1.3692E+11
Br-83	2.7420E-08	1.7357E-18	1.2594E+07	2.3102E+09
Kr-83m	2.2394E-05	1.0854E-15	7.8752E+09	3.2883E+12
Kr-85	3.2517E-02	8.2881E-08	5.8720E+17	4.2797E+14
Kr-85m	1.8232E-03	2.2154E-13	1.5696E+12	6.2241E+13
Kr-87	1.2998E-08	4.5888E-19	3.1764E+06	5.9100E+09
Kr-88	2.8024E-04	2.2349E-14	1.5294E+11	1.6969E+13
I-130	1.6599E-05	8.5108E-15	3.9425E+10	3.1345E+11
I-131	3.5485E-03	2.8623E-11	1.3158E+14	4.8692E+13
I-132	2.6528E-04	2.5700E-14	1.1725E+11	2.4090E+13
I-133	1.7517E-03	1.5463E-12	7.0017E+12	2.8778E+13
I-135	1.6344E-04	4.6541E-14	2.0761E+11	4.1780E+12
Xe-129m	7.5835E-06	5.9936E-14	2.7980E+11	1.0198E+11
Xe-131m	1.1713E-02	1.3984E-10	6.4287E+14	1.5641E+14
Xe-133	1.9218E+00	1.0267E-08	4.6489E+16	2.6114E+16
Xe-133m	5.3501E-02	1.1923E-10	5.3988E+14	7.6199E+14
Xe-135	2.9813E-01	1.1674E-10	5.2077E+14	6.2299E+15
Xe-135m	2.9132E-05	3.1980E-16	1.4266E+09	3.9395E+13

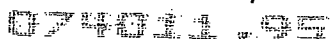
Control Room Transport Group Inventory:

Time (h) = 32.0000	Atmosphere	Sump
Noble gases (atoms)	6.3539E+17	0.0000E+00
Elemental I (atoms)	6.7419E+12	0.0000E+00
Organic I (atoms)	2.0851E+11	0.0000E+00
Aerosols (kg)	2.8745E-11	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	9.5752E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	1.0057E-12
Total I (Ci)		5.7289E-03

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3144E+19
Elemental I (atoms)	3.9595E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6887E-09	6.1804E-10

Environment to Control Room Transport Group Inventory:



Control Room to Environment Transport Group Inventory:

EAB Doses:

LPZ Doses:

Control Room Doses:

primary Compartment Nuclide Inventory:

Time (h) = 48.0000 Ci kg Atoms Decay

primary Transport Group Inventory:

Time (h) = 48.0000	Atmosphere	Sump
Noble gases (atoms)	1.2684E-14	0.0000E+00
Elemental I (atoms)	2.6322E-19	0.0000E+00
Organic I (atoms)	8.1409E-21	0.0000E+00
Aerosols (kg)	1.1220E-42	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	6.6113E-45
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	6.8092E-45
Total I (Ci)		1.8638E-34

primary to Environment Transport Group Inventory:

Environment Integral Nuclide Release:

Time (h) = 48.0000	Ci	kg	Atoms	Bq
Br-82	4.3898E-01	4.0548E-10	2.9778E+15	1.6242E+10
Br-83	1.0574E-02	6.6933E-13	4.8564E+12	3.9124E+08

Attachment E

Kr-83m	8.1033E+00	3.9275E-10	2.8497E+15	2.9982E+11
Kr-85	6.4507E+02	1.6442E-03	1.1649E+22	2.3868E+13
Kr-85m	1.1839E+02	1.4386E-08	1.0192E+17	4.3804E+12
Kr-87	1.6949E-02	5.9837E-13	4.1419E+12	6.2712E+08
Kr-88	3.6123E+01	2.8808E-09	1.9714E+16	1.3366E+12
I-130	1.0636E+00	5.4534E-10	2.5263E+15	3.9353E+10
I-131	1.5210E+02	1.2268E-06	5.6399E+18	5.6276E+12
I-132	1.1162E+02	1.0813E-08	4.9332E+16	4.1298E+12
I-133	9.4286E+01	8.3232E-08	3.7687E+17	3.4886E+12
I-134	4.0441E-06	1.5160E-16	6.8130E+08	1.4963E+05
I-135	1.5222E+01	4.3344E-09	1.9335E+16	5.6320E+11
Xe-129m	1.5465E-01	1.2223E-09	5.7060E+15	5.7221E+09
Xe-131m	2.3670E+02	2.8259E-06	1.2991E+19	8.7580E+12
Xe-133	3.9715E+04	2.1218E-04	9.6071E+20	1.4695E+15
Xe-133m	1.1741E+03	2.6166E-06	1.1848E+19	4.3441E+13
Xe-135	1.0596E+04	4.1490E-06	1.8508E+19	3.9203E+14
Xe-135m	2.6954E+02	2.9590E-09	1.3200E+16	9.9730E+12

Environment Transport Group Inventory:

	Total	Release
Time (h) = 48.0000	Release	Rate/s
Noble gases (atoms)	1.2653E+22	1.4645E+17
Elemental I (atoms)	2.9541E+17	3.4191E+12
Organic I (atoms)	9.1363E+15	1.0574E+11
Aerosols (kg)	1.2599E-06	1.4582E-11
Dose Effective (Ci) I-131 (Thyroid)		1.6890E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.8259E+02
Total I (Ci)		3.7322E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9547E+17
Organic I (atoms)	0.0000E+00	9.1384E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3144E+19
Elemental I (atoms)	3.9595E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6887E-09	6.1804E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1618E+12
Aerosols (kg)	0.0000E+00	9.8758E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7128E+14	0.0000E+00

Attachment E

Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5833E-09	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 48.0000	Ci	kg	Atoms	Decay
Br-82	1.8382E-09	1.6979E-18	1.2470E+07	1.3910E+11
Kr-85	9.0344E-06	2.3027E-11	1.6315E+14	4.3607E+14
Kr-85m	4.2615E-08	5.1783E-18	3.6688E+07	6.2593E+13
Kr-88	1.5683E-09	1.2507E-19	8.5591E+05	1.7017E+13
I-130	1.8804E-09	9.6412E-19	4.4662E+06	3.1720E+11
I-131	9.3095E-07	7.5092E-15	3.4520E+10	4.9570E+13
I-132	5.9350E-10	5.7498E-20	2.6232E+05	2.4133E+13
I-133	2.8559E-07	2.5211E-16	1.1415E+09	2.9189E+13
I-135	8.4830E-09	2.4155E-18	1.0775E+07	4.2121E+12
Xe-129m	1.9890E-09	1.5720E-17	7.3385E+07	1.0386E+11
Xe-131m	3.1313E-06	3.7383E-14	1.7185E+11	1.5931E+14
Xe-133	4.9015E-04	2.6186E-12	1.1857E+13	2.6588E+16
Xe-133m	1.2038E-05	2.6828E-14	1.2148E+11	7.7499E+14
Xe-135	2.4469E-05	9.5819E-15	4.2743E+10	6.2949E+15
Xe-135m	3.9371E-09	4.3221E-20	1.9280E+05	3.9400E+13

Control Room Transport Group Inventory:

Time (h) = 48.0000	Atmosphere	Sump	
Noble gases (atoms)	1.7534E+14	0.0000E+00	
Elemental I (atoms)	1.7310E+09	0.0000E+00	
Organic I (atoms)	5.3535E+07	0.0000E+00	
Aerosols (kg)	7.3781E-15	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		2.4365E-16
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		2.5094E-16
Total I (Ci)			1.2256E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3144E+19
Elemental I (atoms)	3.9595E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6887E-09	6.1804E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1618E+12
Aerosols (kg)	0.0000E+00	9.8758E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7128E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5833E-09	0.0000E+00

EAB Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00

LPZ Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.5651E-39	9.2457E-37	3.5811E-38
Accumulated dose (rem)	2.3855E-01	1.8543E+01	8.0935E-01

Control Room Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9892E-07	3.9442E-04	1.2247E-05
Accumulated dose (rem)	1.4733E-01	1.4015E+02	4.4540E+00

primary Compartment Nuclide Inventory:

Time (h) = 120.0000 Ci kg Atoms Decay

primary Transport Group Inventory:

Time (h) = 120.0000	Atmosphere	Sump
Noble gases (atoms)	1.2655-122	0.0000E+00
Elemental I (atoms)	2.0156-127	0.0000E+00
Organic I (atoms)	6.2338-129	0.0000E+00
Aerosols (kg)	8.5885-151	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	4.9885-153
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	5.0065-153
Total I (Ci)		1.1566-142

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9547E+17
Organic I (atoms)	0.0000E+00	9.1384E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment Integral Nuclide Release:

Time (h) = 120.0000	Ci	kg	Atoms	Bq
Br-82	4.3898E-01	4.0548E-10	2.9778E+15	1.6242E+10
Br-83	1.0574E-02	6.6933E-13	4.8564E+12	3.9124E+08
Kr-83m	8.1033E+00	3.9275E-10	2.8497E+15	2.9982E+11
Kr-85	6.4507E+02	1.6442E-03	1.1649E+22	2.3868E+13
Kr-85m	1.1839E+02	1.4386E-08	1.0192E+17	4.3804E+12
Kr-87	1.6949E-02	5.9837E-13	4.1419E+12	6.2712E+08
Kr-88	3.6123E+01	2.8808E-09	1.9714E+16	1.3366E+12
I-130	1.0636E+00	5.4534E-10	2.5263E+15	3.9353E+10
I-131	1.5210E+02	1.2268E-06	5.6399E+18	5.6276E+12
I-132	1.1162E+02	1.0813E-08	4.9332E+16	4.1298E+12
I-133	9.4286E+01	8.3232E-08	3.7687E+17	3.4886E+12
I-134	4.0441E-06	1.5160E-16	6.8130E+08	1.4963E+05
I-135	1.5222E+01	4.3344E-09	1.9335E+16	5.6320E+11
Xe-129m	1.5465E-01	1.2223E-09	5.7060E+15	5.7221E+09
Xe-131m	2.3670E+02	2.8259E-06	1.2991E+19	8.7580E+12
Xe-133	3.9715E+04	2.1218E-04	9.6071E+20	1.4695E+15
Xe-133m	1.1741E+03	2.6166E-06	1.1848E+19	4.3441E+13
Xc-135	1.0596E+04	4.1490E-06	1.8508E+19	3.9203E+14
Xe-135m	2.6954E+02	2.9590E-09	1.3200E+16	9.9730E+12

Environment Transport Group Inventory:

Total	Release
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Attachment E

Time (h) = 120.0000	Release	Rate/s	
Noble gases (atoms)	1.2653E+22	3.6612E+16	
Elemental I (atoms)	2.9541E+17	8.5477E+11	
Organic I (atoms)	9.1363E+15	2.6436E+10	
Aerosols (kg)	1.2599E-06	3.6454E-12	
Dose Effective (Ci) I-131 (Thyroid)			1.6890E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)			1.8259E+02
Total I (Ci)			3.7322E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9547E+17
Organic I (atoms)	0.0000E+00	9.1384E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3144E+19
Elemental I (atoms)	3.9595E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6887E-09	6.1804E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1618E+12
Aerosols (kg)	0.0000E+00	9.8758E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7129E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5834E-09	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 120.0000	Ci	kg	Atoms	Decay
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Control Room Transport Group Inventory:

Time (h) = 120.0000	Atmosphere	Sump	
Noble gases (atoms)	1.7022E-02	0.0000E+00	
Elemental I (atoms)	1.2898E-07	0.0000E+00	
Organic I (atoms)	3.9890E-09	0.0000E+00	
Aerosols (kg)	5.4958E-31	0.0000E+00	
Dose Effective (Ci/cc) I-131 (Thyroid)			1.7889E-32
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)			1.7954E-32
Total I (Ci)			7.4009E-23

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported

Attachment E

Noble gases (atoms)	0.0000E+00	2.3144E+19
Elemental I (atoms)	3.9595E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6887E-09	6.1804E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1618E+12
Aerosols (kg)	0.0000E+00	9.8758E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7129E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5834E-09	0.0000E+00

EAB Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2738E-01	3.3217E+01	1.4499E+00

LPZ Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.9203-148	1.4509-145	5.2113-147
Accumulated dose (rem)	2.3855E-01	1.8543E+01	8.0935E-01

Control Room Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.6446E-24	1.9339E-20	5.9567E-22
Accumulated dose (rem)	1.4733E-01	1.4015E+02	4.4540E+00

primary Compartment Nuclide Inventory:

Time (h) = 744.0000	Ci	kg	Atoms	Decay
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primary Transport Group Inventory:

Time (h) = 744.0000	Atmosphere	Sump
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9547E+17
Organic I (atoms)	0.0000E+00	9.1384E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Attachment E

Environment Integral Nuclide Release:

Time (h) = 744.0000	Ci	kg	Atoms	Bq
Br-82	4.3898E-01	4.0548E-10	2.9778E+15	1.6242E+10
Br-83	1.0574E-02	6.6933E-13	4.8564E+12	3.9124E+08
Kr-83m	8.1033E+00	3.9275E-10	2.8497E+15	2.9982E+11
Kr-85	6.4507E+02	1.6442E-03	1.1649E+22	2.3868E+13
Kr-85m	1.1839E+02	1.4386E-08	1.0192E+17	4.3804E+12
Kr-87	1.6949E-02	5.9837E-13	4.1419E+12	6.2712E+08
Kr-88	3.6123E+01	2.8808E-09	1.9714E+16	1.3366E+12
I-130	1.0636E+00	5.4534E-10	2.5263E+15	3.9353E+10
I-131	1.5210E+02	1.2268E-06	5.6399E+18	5.6276E+12
I-132	1.1162E+02	1.0813E-08	4.9332E+16	4.1298E+12
I-133	9.4286E+01	8.3232E-08	3.7687E+17	3.4886E+12
I-134	4.0441E-06	1.5160E-16	6.8130E+08	1.4963E+05
I-135	1.5222E+01	4.3344E-09	1.9335E+16	5.6320E+11
Xe-129m	1.5465E-01	1.2223E-09	5.7060E+15	5.7221E+09
Xe-131m	2.3670E+02	2.8259E-06	1.2991E+19	8.7580E+12
Xe-133	3.9715E+04	2.1218E-04	9.6071E+20	1.4695E+15
Xe-133m	1.1741E+03	2.6166E-06	1.1848E+19	4.3441E+13
Xe-135	1.0596E+04	4.1490E-06	1.8508E+19	3.9203E+14
Xe-135m	2.6954E+02	2.9590E-09	1.3200E+16	9.9730E+12

Environment Transport Group Inventory:

Time (h) = 744.0000	Total Release	Release Rate/s
Noble gases (atoms)	1.2653E+22	4.8816E+15
Elemental I (atoms)	2.9541E+17	1.1397E+11
Organic I (atoms)	9.1363E+15	3.5248E+09
Aerosols (kg)	1.2599E-06	4.8606E-13
Dose Effective (Ci) I-131 (Thyroid)		1.6890E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.8259E+02
Total I (Ci)		3.7322E+02

primary to Environment Transport Group Inventory:

Time (h) = 744.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9547E+17
Organic I (atoms)	0.0000E+00	9.1384E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment to Control Room Transport Group Inventory:

Time (h) = 744.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3144E+19
Elemental I (atoms)	3.9595E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6887E-09	6.1804E-10

Environment to Control Room Transport Group Inventory:

Time (h) = 744.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1618E+12
Aerosols (kg)	0.0000E+00	9.8758E-10

Attachment E

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7129E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5834E-09	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 744.0000	Ci	kg	Atoms	Decay
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Control Room Transport Group Inventory:

Time (h) = 744.0000	Atmosphere	Sump	
Noble gases (atoms)	3.2983-141	0.0000E+00	
Elemental I (atoms)	2.7872-147	0.0000E+00	
Organic I (atoms)	8.6202-149	0.0000E+00	
Aerosols (kg)	1.1876-170	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.8581-172
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.8581-172
Total I (Ci)			1.5498-162

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3144E+19
Elemental I (atoms)	3.9595E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6887E-09	6.1804E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1618E+12
Aerosols (kg)	0.0000E+00	9.8758E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7129E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5834E-09	0.0000E+00

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I-131 Summary
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	primary	Environment	Control Room
Time (hr)	I-131 (Curies)	I-131 (Curies)	I-131 (Curies)
24.000	2.3478E+01	2.2530E-02	1.6036E-04
24.004	1.5134E+02	9.4274E-01	6.6994E-03
24.017	1.4449E+02	7.7865E+00	5.4784E-02
24.417	3.6246E+01	1.1590E+02	1.3604E-01
24.717	1.2848E+01	1.3927E+02	1.3702E-01

Attachment E

25.017	4.5541E+00	1.4755E+02	1.2465E-01
25.317	1.6142E+00	1.5049E+02	1.0937E-01
25.617	5.7219E-01	1.5153E+02	9.4614E-02
25.917	2.0282E-01	1.5189E+02	8.1383E-02
26.000	1.5223E-01	1.5195E+02	7.8023E-02
26.300	5.3959E-02	1.5204E+02	6.6913E-02
26.600	1.9126E-02	1.5208E+02	5.7352E-02
26.900	6.7796E-03	1.5209E+02	4.9144E-02
27.200	2.4031E-03	1.5209E+02	4.2108E-02
27.500	8.5181E-04	1.5210E+02	3.6077E-02
27.800	3.0193E-04	1.5210E+02	3.0909E-02
28.100	1.0702E-04	1.5210E+02	2.6481E-02
28.400	3.7936E-05	1.5210E+02	2.2688E-02
28.700	1.3447E-05	1.5210E+02	1.9438E-02
29.000	4.7664E-06	1.5210E+02	1.6653E-02
29.300	1.6895E-06	1.5210E+02	1.4268E-02
29.600	5.9887E-07	1.5210E+02	1.2224E-02
29.900	2.1228E-07	1.5210E+02	1.0473E-02
30.200	7.5244E-08	1.5210E+02	8.9727E-03
30.500	2.6671E-08	1.5210E+02	7.6873E-03
30.800	9.4540E-09	1.5210E+02	6.5861E-03
31.100	3.3511E-09	1.5210E+02	5.6427E-03
31.400	1.1878E-09	1.5210E+02	4.8343E-03
31.700	4.2104E-10	1.5210E+02	4.1418E-03
32.000	1.4924E-10	1.5210E+02	3.5485E-03
32.300	5.2901E-11	1.5210E+02	3.0402E-03
32.600	1.8751E-11	1.5210E+02	2.6047E-03
32.900	6.6467E-12	1.5210E+02	2.2316E-03
33.200	2.3560E-12	1.5210E+02	1.9119E-03
33.500	8.3511E-13	1.5210E+02	1.6380E-03
33.800	2.9602E-13	1.5210E+02	1.4034E-03
34.100	1.0493E-13	1.5210E+02	1.2023E-03
34.400	3.7192E-14	1.5210E+02	1.0301E-03
48.000	1.4157E-34	1.5210E+02	9.3095E-07
120.000	1.1163-142	1.5210E+02	7.1432E-23
744.000	0.0000E+00	1.5210E+02	1.5498-162

Cumulative Dose Summary
#####

Time (hr)	EAB		LPZ		Control Room	
	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
24.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
24.004	2.0624E-01	9.0914E-03	1.1502E-01	5.0702E-03	3.5446E-03	1.1136E-04
24.017	1.7034E+00	7.5083E-02	9.4999E-01	4.1873E-02	1.5886E-01	4.9908E-03
24.417	2.5349E+01	1.1111E+00	1.4137E+01	6.1968E-01	1.6358E+01	5.2058E-01
24.717	3.0453E+01	1.3317E+00	1.6983E+01	7.4267E-01	3.1961E+01	1.0184E+00
25.017	3.2259E+01	1.4092E+00	1.7991E+01	7.8588E-01	4.6763E+01	1.4904E+00
25.317	3.2899E+01	1.4364E+00	1.8348E+01	8.0109E-01	5.9943E+01	1.9104E+00
25.617	3.3126E+01	1.4460E+00	1.8474E+01	8.0644E-01	7.1404E+01	2.2753E+00
25.917	3.3206E+01	1.4494E+00	1.8519E+01	8.0833E-01	8.1277E+01	2.5894E+00
26.000	3.3217E+01	1.4499E+00	1.8525E+01	8.0858E-01	8.3752E+01	2.6681E+00
26.300	3.3217E+01	1.4499E+00	1.8537E+01	8.0908E-01	9.1869E+01	2.9261E+00
26.600	3.3217E+01	1.4499E+00	1.8541E+01	8.0926E-01	9.8821E+01	3.1468E+00
26.900	3.3217E+01	1.4499E+00	1.8542E+01	8.0932E-01	1.0477E+02	3.3357E+00
27.200	3.3217E+01	1.4499E+00	1.8543E+01	8.0934E-01	1.0987E+02	3.4972E+00
27.500	3.3217E+01	1.4499E+00	1.8543E+01	8.0935E-01	1.1423E+02	3.6354E+00
27.800	3.3217E+01	1.4499E+00	1.8543E+01	8.0935E-01	1.1796E+02	3.7536E+00
28.100	3.3217E+01	1.4499E+00	1.8543E+01	8.0935E-01	1.2115E+02	3.8547E+00
28.400	3.3217E+01	1.4499E+00	1.8543E+01	8.0935E-01	1.2389E+02	3.9412E+00
28.700	3.3217E+01	1.4499E+00	1.8543E+01	8.0935E-01	1.2623E+02	4.0152E+00

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
24.0	4.2738E-01	3.3217E+01	1.4499E+00

Attachment F

Attachment F RADTRAD Case 1 Detailed Output File (oO)

```
#####
RADTRAD Version 3.03 (Spring 2001) run on 6/16/2011 at 13:44:20
#####

#####
File information
#####
```

```
Plant file          = C:\Documents and Settings\jlboste\My Documents\FHA cooperGNF2
Casel-06-16-11.psf
Inventory file      = C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.nif
Release file       = C:\RADTRAD\RADTRAD_310\RGL_183.rft
Dose Conversion file = C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.inp
```

```
#####      #####      #####      # #      # #####      #      # #####
# # #      #      #      # #      # #      # #      #
# # #      #      #      # # #      # #      # #      #
#####      #####      #####      # #      # #####      #      #
#      #      #      #      # #      # #      # #      #
#      #      #      #      # #      # #      # #      #
#      #####      #      #      #      #      #      #
```

```
Radtrad 3.03 4/15/2001
Casel 3-31-2011
Nuclide Inventory File:
C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.nif
Plant Power Level:
1.5144E+01
Compartments:
3
Compartment 1:
primary
3
7.9500E+05
0
0
0
0
0
Compartment 2:
Environment
2
0.0000E+00
0
0
0
0
0
Compartment 3:
Control Room
1
1.4186E+05
0
0
0
```

SECRET

Attachment F

```

0
0
0
Compartment 3:
1
1
0
0
0
0
0
0
0
0
0
Pathways:
4
Pathway 1:
0
0
0
0
0
0
1
1
1.6800E+02    4.5760E+04    0.0000E+00    0.0000E+00    0.0000E+00
0
0
0
0
0
0
Pathway 2:
0
0
0
0
0
0
1
1
1.6800E+02    3.2350E+03    0.0000E+00    0.0000E+00    0.0000E+00
0
0
0
0
0
0
Pathway 3:
0
0
0
0
0
0
1
1
1.6800E+02    4.0000E+02    0.0000E+00    0.0000E+00    0.0000E+00
0
0
0
0
0
0
Pathway 4:
0
0

```

Attachment F

```

0
0
0
1
1
1.6800E+02  3.6350E+03  0.0000E+00  0.0000E+00  0.0000E+00
0
0
0
0
0
0
Dose Locations:
3
Location 1:
EAB
2
1
2
1.6800E+02  5.2000E-04
1.7000E+02  0.0000E+00
1
4
1.6800E+02  3.5000E-04
1.7600E+02  1.8000E-04
1.9200E+02  2.3000E-04
8.8800E+02  0.0000E+00
0
Location 2:
LPZ
2
1
5
1.6800E+02  2.9000E-04
1.7600E+02  7.3000E-05
1.9200E+02  2.5000E-05
2.6400E+02  5.2000E-06
8.8800E+02  0.0000E+00
1
4
1.6800E+02  3.5000E-04
1.7600E+02  1.8000E-04
1.9200E+02  2.3000E-04
8.8800E+02  0.0000E+00
0
Location 3:
Control Room
3
0
1
2
1.6800E+02  3.5000E-04
8.8800E+02  0.0000E+00
1
4
1.6800E+02  1.0000E+00
1.9200E+02  6.0000E-01
2.6400E+02  4.0000E-01
8.8800E+02  0.0000E+00
Effective Volume Location:
1
6
1.6800E+02  4.1500E-03

```

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Attachment F

RADTRAD Version 3.03 (Spring 2001) run on 6/16/2011 at 13:44:20
#####

Plant Description
#####

Number of Nuclides = 29

Inventory Power = 1.0000E+00 MWth
Plant Power Level = 1.5144E+01 MWth

Number of compartments = 3

Compartment information

Compartment number 1 (Source term fraction = 1.0000E+00
)

Name: primary
Compartment volume = 7.9500E+05 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment 1
Exit Pathway Number 1: primary to Environment

Compartment number 2

Name: Environment
Compartment type is Environment
Pathways into and out of compartment 2
Inlet Pathway Number 1: primary to Environment
Inlet Pathway Number 4: Control Room to Environment
Exit Pathway Number 2: Environment to Control Room
Exit Pathway Number 3: Environment to Control Room

Compartment number 3

Name: Control Room
Compartment volume = 1.4186E+05 (Cubic feet)
Compartment type is Control Room
Pathways into and out of compartment 3
Inlet Pathway Number 2: Environment to Control Room
Inlet Pathway Number 3: Environment to Control Room
Exit Pathway Number 4: Control Room to Environment

Total number of pathways = 4

Attachment F

```
#####
RADTRAD Version 3.03 (Spring 2001) run on 6/16/2011 at 13:44:20
#####

#####
Scenario Description
#####
```

Time between shutdown and first release = 1.6800E+02 (Hours)

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	5.0000E-02	0.0000E+00	0.0000E+00	1.879E+00
IODINE	2.5000E-04	0.0000E+00	0.0000E+00	1.595E-03
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 15. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
Br-82	2	1.870E+02	1.271E+05	1.300E-13	2.380E-10	3.310E-10
Br-83	2	3.240E+03	8.604E+03	3.820E-16	3.290E-12	2.330E-11
Br-84	2	5.560E+03	1.908E+03	9.410E-14	3.120E-12	2.610E-11
Kr-83m	1	3.250E+03	6.588E+03	1.500E-18	0.000E+00	0.000E+00
Kr-85	1	8.520E+02	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	6.750E+03	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	1.280E+04	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	1.810E+04	1.022E+04	1.020E-13	0.000E+00	0.000E+00
I-128	2	4.330E+02	1.499E+03	4.160E-15	5.340E-11	1.280E-11
I-130	2	1.100E+03	4.450E+04	1.040E-13	1.990E-08	7.140E-10
I-131	2	4.352E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.960E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.480E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.040E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.160E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Xe-129m	1	2.230E-01	6.912E+05	1.060E-15	0.000E+00	0.000E+00
Xe-131m	1	3.040E+02	1.028E+06	3.890E-16	0.000E+00	0.000E+00
Xe-133	1	5.450E+04	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-133m	1	1.730E+03	1.890E+05	1.370E-15	0.000E+00	0.000E+00
Xe-135	1	2.040E+04	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Xe-135m	1	1.100E+04	9.174E+02	2.040E-14	0.000E+00	0.000E+00
Xe-138	1	4.490E+04	8.502E+02	5.770E-14	0.000E+00	0.000E+00

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Br-83	Kr-83m	1.00	none	0.00	none	0.00
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00

Attachment F

Te-129	I-129	1.00	none	0.00	none	0.00
Te-131	I-131	1.00	none	0.00	none	0.00
Te-131m	I-131	0.78	Te-131	0.22	none	0.00
Te-132	I-132	1.00	none	0.00	none	0.00
Te-133	I-133	1.00	none	0.00	none	0.00
Te-133m	I-133	0.87	Te-133	0.13	none	0.00
Te-134	I-134	1.00	none	0.00	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Cs-135	0.00	Xe-135	1.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol = 9.5000E-01
Elemental = 4.8500E-02
Organic = 1.5000E-03

COMPARTMENT DATA

Compartment number 1: primary
Compartment number 2: Environment
Compartment number 3: Control Room

PATHWAY DATA

Pathway number 1: primary to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
1.6800E+02	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
1.6800E+02	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
1.6800E+02	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
1.6800E+02	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location EAB is in compartment 2

Location X/Q Data

Attachment F

Time (hr)	X/Q (s * m ⁻³)
1.6800E+02	5.2000E-04
1.7000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
1.6800E+02	3.5000E-04
1.7600E+02	1.8000E-04
1.9200E+02	2.3000E-04
8.8800E+02	0.0000E+00

Location LPZ is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
1.6800E+02	2.9000E-04
1.7600E+02	7.3000E-05
1.9200E+02	2.5000E-05
2.6400E+02	5.2000E-06
8.8800E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
1.6800E+02	3.5000E-04
1.7600E+02	1.8000E-04
1.9200E+02	2.3000E-04
8.8800E+02	0.0000E+00

Location Control Room is in compartment 3

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
1.6800E+02	4.1500E-03
1.7000E+02	3.2400E-03
1.7600E+02	1.3200E-03
1.9200E+02	9.0100E-04
2.6400E+02	7.2200E-04
8.8800E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
1.6800E+02	3.5000E-04
8.8800E+02	0.0000E+00

Location Occupancy Factor Data

Time (hr)	Occupancy Factor
1.6800E+02	1.0000E+00
1.9200E+02	6.0000E-01
2.6400E+02	4.0000E-01
8.8800E+02	0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS

Time	Time step
0.0000E+00	0.0000E+00

Attachment F

RADTRAD Version 3.03 (Spring 2001) run on 6/16/2011 at 13:44:20
#####

```

#####
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
#####

```


Dose, Detailed model and Detailed Inventory Output
#####

EAB Doses:

Time (h) = 168.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.4228E-04	1.1201E-01	3.8599E-03
Accumulated dose (rem)	4.4228E-04	1.1201E-01	3.8599E-03

LPZ Doses:

Time (h) = 168.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.4665E-04	6.2465E-02	2.1526E-03
Accumulated dose (rem)	2.4665E-04	6.2465E-02	2.1526E-03

Control Room Doses:

Time (h) = 168.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.5720E-07	1.9251E-03	5.9096E-05
Accumulated dose (rem)	3.5720E-07	1.9251E-03	5.9096E-05

primary Compartment Nuclide Inventory:

Time (h) = 168.0036	Ci	kg	Atoms	Decay
Br-82	2.5979E-02	2.3996E-11	1.7623E+14	9.5071E+09
Kr-85	6.4040E+02	1.6323E-03	1.1564E+22	2.3435E+14
Kr-85m	2.6119E-08	3.1738E-18	2.2486E+07	9.5599E+03
I-130	3.3506E-04	1.7179E-13	7.9582E+11	1.2262E+08
I-131	9.1108E+01	7.3489E-07	3.3783E+18	3.3340E+13
I-132	3.4151E+01	3.3085E-09	1.5094E+16	1.2502E+13
I-133	7.8085E-01	6.8931E-10	3.1211E+15	2.8576E+11
I-135	4.3349E-06	1.2344E-15	5.5063E+09	1.5865E+06
Xe-129m	9.1498E-02	7.2315E-10	3.3759E+15	3.3483E+10
Xe-131m	2.4204E+02	2.8897E-06	1.3284E+19	8.8572E+13
Xe-133	1.9811E+04	1.0584E-04	4.7922E+20	7.2496E+15
Xe-133m	2.2610E+02	5.0389E-07	2.2816E+18	8.2739E+13
Xe-135	3.2513E-01	1.2732E-10	5.6793E+14	1.1899E+11
Xe-135m	1.5008E-04	1.6476E-15	7.3497E+09	5.5122E+07

primary Transport Group Inventory:

Time (h) = 168.0036	Atmosphere	Sump
Noble gases (atoms)	1.2059E+22	0.0000E+00
Elemental I (atoms)	1.6474E+17	0.0000E+00
Organic I (atoms)	5.0951E+15	0.0000E+00
Aerosols (kg)	7.0197E-07	0.0000E+00

Attachment F

Dose Effective (Ci/cc) I-131 (Thyroid) 4.0619E-09
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 4.1111E-09
Total I (Ci) 1.2604E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 168.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.5121E+19
Elemental I (atoms)	0.0000E+00	1.0262E+15
Organic I (atoms)	0.0000E+00	3.1739E+13
Aerosols (kg)	0.0000E+00	4.3728E-09

Environment Integral Nuclide Release:

Time (h) = 168.0036	Ci	kg	Atoms	Bq
Br-82	1.6184E-04	1.4948E-13	1.0978E+12	5.9879E+06
Kr-85	3.9892E+00	1.0168E-05	7.2039E+19	1.4760E+11
Kr-85m	1.6271E-10	1.9771E-20	1.4008E+05	6.0202E+00
I-130	2.0872E-06	1.0702E-15	4.9575E+09	7.7227E+04
I-131	5.6754E-01	4.5779E-09	2.1045E+16	2.0999E+10
I-132	2.1274E-01	2.0610E-11	9.4028E+13	7.8714E+09
I-133	4.8642E-03	4.2940E-12	1.9443E+13	1.7998E+08
I-135	2.7004E-08	7.6895E-18	3.4302E+07	9.9916E+02
Xe-129m	5.6997E-04	4.5048E-12	2.1030E+13	2.1089E+07
Xe-131m	1.5078E+00	1.8001E-08	8.2750E+16	5.5787E+10
Xe-133	1.2341E+02	6.5930E-07	2.9853E+18	4.5661E+12
Xe-133m	1.4084E+00	3.1389E-09	1.4213E+16	5.2112E+10
Xe-135	2.0254E-03	7.9311E-13	3.5379E+12	7.4939E+07
Xe-135m	9.3514E-07	1.0266E-17	4.5794E+07	3.4600E+04

Environment Transport Group Inventory:

	Total	Release	
Time (h) = 168.0036	Release	Rate/s	
Noble gases (atoms)	7.5121E+19	5.7964E+18	
Elemental I (atoms)	1.0262E+15	7.9184E+13	
Organic I (atoms)	3.1739E+13	2.4490E+12	
Aerosols (kg)	4.3728E-09	3.3741E-10	
Dose Effective (Ci) I-131 (Thyroid)			5.6962E-01
Dose Effective (Ci) I-131 (ICRP2 Thyroid)			5.7651E-01
Total I (Ci)			7.8515E-01

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 168.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.5121E+19
Elemental I (atoms)	0.0000E+00	1.0262E+15
Organic I (atoms)	0.0000E+00	3.1739E+13
Aerosols (kg)	0.0000E+00	4.3728E-09

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 168.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.7597E+17
Elemental I (atoms)	0.0000E+00	6.5023E+12
Organic I (atoms)	0.0000E+00	2.0110E+11
Aerosols (kg)	0.0000E+00	2.7706E-11

Environment to Control Room Transport Group Inventory:

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	Pathway	
Time (h) = 168.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.8852E+16
Elemental I (atoms)	0.0000E+00	8.0399E+11
Organic I (atoms)	0.0000E+00	2.4866E+10
Aerosols (kg)	0.0000E+00	3.4258E-12

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 168.0036	Filtered	Transported
Noble gases (atoms)	9.8602E+14	0.0000E+00
Elemental I (atoms)	1.3470E+10	0.0000E+00
Organic I (atoms)	4.1660E+08	0.0000E+00
Aerosols (kg)	5.7397E-14	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 168.0036	Ci	kg	Atoms	Decay
Br-82	1.1500E-06	1.0623E-15	7.8014E+09	3.9145E+05
Kr-85	2.8349E-02	7.2257E-08	5.1193E+17	9.6491E+09
I-130	1.4832E-08	7.6049E-18	3.5229E+07	5.0488E+03
I-131	4.0331E-03	3.2532E-11	1.4955E+14	1.3728E+09
I-132	1.5117E-03	1.4645E-13	6.6814E+11	5.1473E+08
I-133	3.4567E-05	3.0514E-14	1.3817E+11	1.1766E+07
I-135	1.9190E-10	5.4642E-20	2.4375E+05	6.5324E+01
Xe-129m	4.0504E-06	3.2012E-14	1.4944E+11	1.3786E+06
Xe-131m	1.0715E-02	1.2792E-10	5.8805E+14	3.6469E+09
Xe-133	8.7698E-01	4.6852E-09	2.1214E+16	2.9850E+11
Xe-133m	1.0009E-02	2.2306E-11	1.0100E+14	3.4067E+09
Xe-135	1.4393E-05	5.6359E-15	2.5141E+10	4.8993E+06
Xe-135m	6.6409E-09	7.2903E-20	3.2521E+05	2.2681E+03

Control Room Transport Group Inventory:

Time (h) = 168.0036	Atmosphere	Sump
Noble gases (atoms)	5.3383E+17	0.0000E+00
Elemental I (atoms)	7.2927E+12	0.0000E+00
Organic I (atoms)	2.2555E+11	0.0000E+00
Aerosols (kg)	3.1074E-11	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	1.0077E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	1.0199E-12
Total I (Ci)		5.5794E-03

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 168.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.7597E+17
Elemental I (atoms)	0.0000E+00	6.5023E+12
Organic I (atoms)	0.0000E+00	2.0110E+11
Aerosols (kg)	0.0000E+00	2.7706E-11

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 168.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.8852E+16
Elemental I (atoms)	0.0000E+00	8.0399E+11
Organic I (atoms)	0.0000E+00	2.4866E+10
Aerosols (kg)	0.0000E+00	3.4258E-12

Control Room to Environment Transport Group Inventory:

Attachment F

	Pathway	
Time (h) = 168.0036	Filtered	Transported
Noble gases (atoms)	9.8602E+14	0.0000E+00
Elemental I (atoms)	1.3470E+10	0.0000E+00
Organic I (atoms)	4.1660E+08	0.0000E+00
Aerosols (kg)	5.7397E-14	0.0000E+00

EAB Doses:

Time (h) = 170.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.0347E-02	1.7944E+01	6.1778E-01
Accumulated dose (rem)	7.0790E-02	1.8056E+01	6.2164E-01

LPZ Doses:

Time (h) = 170.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.9232E-02	1.0007E+01	3.4453E-01
Accumulated dose (rem)	3.9479E-02	1.0070E+01	3.4669E-01

Control Room Doses:

Time (h) = 170.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.3881E-02	1.3139E+02	4.0313E+00
Accumulated dose (rem)	2.3881E-02	1.3139E+02	4.0313E+00

primary Compartment Nuclide Inventory:

Time (h) = 170.0000	Ci	kg	Atoms	Decay
Br-82	2.5308E-05	2.3376E-14	1.7168E+11	8.4282E+11
Kr-85	6.4878E-01	1.6536E-06	1.1716E+19	2.0893E+16
Kr-85m	1.9429E-11	2.3609E-21	1.6727E+04	8.1584E+05
I-130	3.0349E-07	1.5561E-16	7.2085E+08	1.0758E+10
I-131	9.1642E-02	7.3920E-10	3.3981E+15	2.9693E+15
I-132	1.8957E-02	1.8365E-12	8.3785E+12	1.0253E+15
I-133	7.4017E-04	6.5339E-13	2.9585E+12	2.5234E+13
I-135	3.5622E-09	1.0143E-18	4.5248E+06	1.3729E+08
Xe-129m	9.2031E-05	7.2737E-13	3.3956E+12	2.9820E+12
Xe-131m	2.4403E-01	2.9134E-09	1.3393E+16	7.8910E+15
Xe-133	1.9854E+01	1.0607E-07	4.8026E+17	6.4531E+17
Xe-133m	2.2310E-01	4.9721E-10	2.2513E+15	7.3484E+15
Xe-135	2.8288E-04	1.1077E-13	4.9413E+11	1.0380E+13
Xe-135m	1.2971E-09	1.4240E-20	6.3521E+04	2.7527E+09

primary Transport Group Inventory:

Time (h) = 170.0000	Atmosphere	Sump
Noble gases (atoms)	1.2212E+19	0.0000E+00
Elemental I (atoms)	1.6537E+14	0.0000E+00
Organic I (atoms)	5.1145E+12	0.0000E+00
Aerosols (kg)	7.0463E-10	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	4.0813E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	4.1100E-12
Total I (Ci)		1.1134E-01

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 170.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2114E+22
Elemental I (atoms)	0.0000E+00	1.6531E+17
Organic I (atoms)	0.0000E+00	5.1127E+15
Aerosols (kg)	0.0000E+00	7.0440E-07

Environment Integral Nuclide Release:

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Time (h) = 170.0000	Ci	kg	Atoms	Bq
Br-82	2.5942E-02	2.3962E-11	1.7598E+14	9.5987E+08
Kr-85	6.4374E+02	1.6408E-03	1.1625E+22	2.3818E+13
Kr-85m	2.4939E-08	3.0304E-18	2.1470E+07	9.2275E+02
I-130	3.3052E-04	1.6947E-13	7.8504E+11	1.2229E+07
I-131	9.1472E+01	7.3783E-07	3.3918E+18	3.3845E+12
I-132	3.1108E+01	3.0137E-09	1.3749E+16	1.1510E+12
I-133	7.7616E-01	6.8517E-10	3.1024E+15	2.8718E+10
I-135	4.2075E-06	1.1981E-15	5.3444E+09	1.5568E+05
Xe-129m	9.1863E-02	7.2604E-10	3.3894E+15	3.3989E+09
Xe-131m	2.4310E+02	2.9024E-06	1.3342E+19	8.9949E+12
Xe-133	1.9878E+04	1.0619E-04	4.8084E+20	7.3547E+14
Xe-133m	2.2626E+02	5.0426E-07	2.2833E+18	8.3718E+12
Xe-135	3.1858E-01	1.2475E-10	5.5649E+14	1.1787E+10
Xe-135m	7.3798E-05	8.1014E-16	3.6139E+09	2.7305E+06

Environment Transport Group Inventory:

Time (h) = 170.0000	Total Release	Release Rate/s
Noble gases (atoms)	1.2121E+22	1.6835E+18
Elemental I (atoms)	1.6533E+17	2.2962E+13
Organic I (atoms)	5.1133E+15	7.1018E+11
Aerosols (kg)	7.0447E-07	9.7844E-11
Dose Effective (Ci) I-131 (Thyroid)		9.1787E+01
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		9.2801E+01
Total I (Ci)		1.2336E+02

primary to Environment Transport Group Inventory:

Time (h) = 170.0000	Pathway	Filtered	Transported
Noble gases (atoms)		0.0000E+00	1.2114E+22
Elemental I (atoms)		0.0000E+00	1.6531E+17
Organic I (atoms)		0.0000E+00	5.1127E+15
Aerosols (kg)		0.0000E+00	7.0440E-07

Environment to Control Room Transport Group Inventory:

Time (h) = 170.0000	Pathway	Filtered	Transported
Noble gases (atoms)		0.0000E+00	7.6802E+19
Elemental I (atoms)		0.0000E+00	1.0480E+15
Organic I (atoms)		0.0000E+00	3.2413E+13
Aerosols (kg)		0.0000E+00	4.4657E-09

Environment to Control Room Transport Group Inventory:

Time (h) = 170.0000	Pathway	Filtered	Transported
Noble gases (atoms)		0.0000E+00	9.4964E+18
Elemental I (atoms)		0.0000E+00	1.2959E+14
Organic I (atoms)		0.0000E+00	4.0078E+12
Aerosols (kg)		0.0000E+00	5.5217E-10

Control Room to Environment Transport Group Inventory:

Time (h) = 170.0000	Pathway	Filtered	Transported
Noble gases (atoms)		7.9267E+19	0.0000E+00
Elemental I (atoms)		1.0793E+15	0.0000E+00
Organic I (atoms)		3.3379E+13	0.0000E+00

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Aerosols (kg) 4.5988E-09 0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 170.0000	Ci	kg	Atoms	Decay
Br-82	1.4617E-05	1.3501E-14	9.9153E+10	1.4598E+10
Kr-85	3.7470E-01	9.5506E-07	6.7665E+18	3.6513E+14
I-130	1.7528E-07	8.9874E-17	4.1633E+08	1.8327E+08
I-131	5.2928E-02	4.2693E-10	1.9626E+15	5.1807E+13
I-132	1.0948E-02	1.0607E-12	4.8390E+12	1.5711E+13
I-133	4.2749E-04	3.7737E-13	1.7087E+12	4.3433E+11
I-135	2.0573E-09	5.8583E-19	2.6133E+06	2.2885E+06
Xe-129m	5.3153E-05	4.2009E-13	1.9611E+12	5.2028E+10
Xe-131m	1.4094E-01	1.6827E-09	7.7353E+15	1.3775E+14
Xe-133	1.1466E+01	6.1259E-08	2.7737E+17	1.1250E+16
Xe-133m	1.2885E-01	2.8717E-10	1.3003E+15	1.2765E+14
Xe-135	1.6338E-04	6.3976E-14	2.8539E+11	1.7524E+11
Xe-135m	7.4916E-10	8.2242E-21	3.6687E+04	2.1460E+07

Control Room Transport Group Inventory:

Time (h) = 170.0000	Atmosphere	Sump
Noble gases (atoms)	7.0529E+18	0.0000E+00
Elemental I (atoms)	9.5509E+13	0.0000E+00
Organic I (atoms)	2.9539E+12	0.0000E+00
Aerosols (kg)	4.0696E-10	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		1.3210E-11
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		1.3303E-11
Total I (Ci)		6.4304E-02

Environment to Control Room Transport Group Inventory:

Time (h) = 170.0000	Pathway	Filtered	Transported
Noble gases (atoms)		0.0000E+00	7.6802E+19
Elemental I (atoms)		0.0000E+00	1.0480E+15
Organic I (atoms)		0.0000E+00	3.2413E+13
Aerosols (kg)		0.0000E+00	4.4657E-09

Environment to Control Room Transport Group Inventory:

Time (h) = 170.0000	Pathway	Filtered	Transported
Noble gases (atoms)		0.0000E+00	9.4964E+18
Elemental I (atoms)		0.0000E+00	1.2959E+14
Organic I (atoms)		0.0000E+00	4.0078E+12
Aerosols (kg)		0.0000E+00	5.5217E-10

Control Room to Environment Transport Group Inventory:

Time (h) = 170.0000	Pathway	Filtered	Transported
Noble gases (atoms)		7.9267E+19	0.0000E+00
Elemental I (atoms)		1.0793E+15	0.0000E+00
Organic I (atoms)		3.3379E+13	0.0000E+00
Aerosols (kg)		4.5988E-09	0.0000E+00

EAB Doses:

Time (h) = 176.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	7.0790E-02	1.8056E+01	6.2164E-01

LPZ Doses:

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Time (h) = 176.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.7644E-05	1.0066E-02	3.4446E-04
Accumulated dose (rem)	3.9517E-02	1.0080E+01	3.4703E-01

Control Room Doses:

Time (h) = 176.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0625E-03	1.1802E+01	3.6178E-01
Accumulated dose (rem)	2.5944E-02	1.4319E+02	4.3931E+00

primary Compartment Nuclide Inventory:

Time (h) = 176.0000	Ci	kg	Atoms	Decay
Kr-85	6.4989E-10	1.6565E-15	1.1736E+10	2.0914E+16
I-131	8.9846E-11	7.2471E-19	3.3315E+06	2.9722E+15
Xe-131m	2.4094E-10	2.8765E-18	1.3224E+07	7.8989E+15
Xe-133	1.9249E-08	1.0284E-16	4.6564E+08	6.4595E+17
Xe-133m	2.0648E-10	4.6016E-19	2.0836E+06	7.3556E+15

primary Transport Group Inventory:

Time (h) = 176.0000	Atmosphere	Sump
Noble gases (atoms)	1.2217E+10	0.0000E+00
Elemental I (atoms)	1.6177E+05	0.0000E+00
Organic I (atoms)	5.0032E+03	0.0000E+00
Aerosols (kg)	6.8929E-19	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	3.9964E-21
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	4.0032E-21
Total I (Ci)		9.3566E-11

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 176.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2127E+22
Elemental I (atoms)	0.0000E+00	1.6548E+17
Organic I (atoms)	0.0000E+00	5.1179E+15
Aerosols (kg)	0.0000E+00	7.0510E-07

Environment Integral Nuclide Release:

Time (h) = 176.0000	Ci	kg	Atoms	Bq
Br-82	2.5968E-02	2.3986E-11	1.7615E+14	9.6080E+08
Kr-85	6.4438E+02	1.6424E-03	1.1636E+22	2.3842E+13
Kr-85m	2.4958E-08	3.0327E-18	2.1486E+07	9.2343E+02
I-130	3.3081E-04	1.6962E-13	7.8574E+11	1.2240E+07
I-131	9.1564E+01	7.3857E-07	3.3952E+18	3.3879E+12
I-132	3.1125E+01	3.0154E-09	1.3757E+16	1.1516E+12
I-133	7.7689E-01	6.8581E-10	3.1053E+15	2.8745E+10
I-135	4.2109E-06	1.1990E-15	5.3488E+09	1.5580E+05
Xe-129m	9.1955E-02	7.2677E-10	3.3928E+15	3.4023E+09
Xe-131m	2.4335E+02	2.9053E-06	1.3356E+19	9.0039E+12
Xe-133	1.9897E+04	1.0630E-04	4.8132E+20	7.3620E+14
Xe-133m	2.2649E+02	5.0476E-07	2.2855E+18	8.3800E+12
Xe-135	3.1885E-01	1.2486E-10	5.5697E+14	1.1798E+10
Xe-135m	7.3798E-05	8.1015E-16	3.6140E+09	2.7305E+06

Environment Transport Group Inventory:

	Total	Release
Time (h) = 176.0000	Release	Rate/s
Noble gases (atoms)	1.2133E+22	4.2130E+17
Elemental I (atoms)	1.6549E+17	5.7463E+12

Time (h) = 176.0000	Atmosphere	Sump
Noble gases (atoms)	7.0643E+14	0.0000E+00
Elemental I (atoms)	9.3543E+09	0.0000E+00
Organic I (atoms)	2.8931E+08	0.0000E+00
Aerosols (kg)	3.9858E-14	0.0000E+00

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Dose Effective (Ci/cc)	I-131 (Thyroid)	1.2950E-15
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	1.2973E-15
Total I (Ci)		5.4104E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 176.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.6862E+19
Elemental I (atoms)	0.0000E+00	1.0489E+15
Organic I (atoms)	0.0000E+00	3.2439E+13
Aerosols (kg)	0.0000E+00	4.4692E-09

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 176.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.5038E+18
Elemental I (atoms)	0.0000E+00	1.2969E+14
Organic I (atoms)	0.0000E+00	4.0110E+12
Aerosols (kg)	0.0000E+00	5.5260E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 176.0000	Filtered	Transported
Noble gases (atoms)	8.6385E+19	0.0000E+00
Elemental I (atoms)	1.1754E+15	0.0000E+00
Organic I (atoms)	3.6354E+13	0.0000E+00
Aerosols (kg)	5.0085E-09	0.0000E+00

EAB Doses:

Time (h) = 192.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	7.0790E-02	1.8056E+01	6.2164E-01

LPZ Doses:

Time (h) = 192.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.7577E-15	1.2761E-12	4.7618E-14
Accumulated dose (rem)	3.9517E-02	1.0080E+01	3.4703E-01

Control Room Doses:

Time (h) = 192.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.8987E-07	1.1465E-03	3.5104E-05
Accumulated dose (rem)	2.5944E-02	1.4319E+02	4.3932E+00

primary Compartment Nuclide Inventory:

Time (h) = 192.0000	Ci	kg	Atoms	Decay
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primary Transport Group Inventory:

Time (h) = 192.0000	Atmosphere	Sump
Noble gases (atoms)	1.2233E-14	0.0000E+00
Elemental I (atoms)	1.5335E-19	0.0000E+00
Organic I (atoms)	4.7426E-21	0.0000E+00
Aerosols (kg)	6.5339E-43	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	3.7885E-45
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	3.7901E-45
Total I (Ci)		8.5609E-35

Attachment F

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 192.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2127E+22
Elemental I (atoms)	0.0000E+00	1.6548E+17
Organic I (atoms)	0.0000E+00	5.1179E+15
Aerosols (kg)	0.0000E+00	7.0510E-07

Environment Integral Nuclide Release:

Time (h) = 192.0000	Ci	kg	Atoms	Bq
Br-82	2.5968E-02	2.3986E-11	1.7615E+14	9.6080E+08
Kr-85	6.4438E+02	1.6424E-03	1.1636E+22	2.3842E+13
Kr-85m	2.4958E-08	3.0327E-18	2.1486E+07	9.2343E+02
I-130	3.3081E-04	1.6962E-13	7.8574E+11	1.2240E+07
I-131	9.1564E+01	7.3857E-07	3.3952E+18	3.3879E+12
I-132	3.1125E+01	3.0154E-09	1.3757E+16	1.1516E+12
I-133	7.7689E-01	6.8581E-10	3.1053E+15	2.8745E+10
I-135	4.2109E-06	1.1990E-15	5.3488E+09	1.5580E+05
Xe-129m	9.1955E-02	7.2677E-10	3.3928E+15	3.4023E+09
Xe-131m	2.4335E+02	2.9053E-06	1.3356E+19	9.0039E+12
Xe-133	1.9897E+04	1.0630E-04	4.8132E+20	7.3620E+14
Xe-133m	2.2649E+02	5.0476E-07	2.2855E+18	8.3800E+12
Xe-135	3.1885E-01	1.2486E-10	5.5697E+14	1.1798E+10
Xe-135m	7.3798E-05	8.1015E-16	3.6140E+09	2.7305E+06

Environment Transport Group Inventory:

	Total	Release
Time (h) = 192.0000	Release	Rate/s
Noble gases (atoms)	1.2133E+22	1.4043E+17
Elemental I (atoms)	1.6549E+17	1.9154E+12
Organic I (atoms)	5.1184E+15	5.9241E+10
Aerosols (kg)	7.0518E-07	8.1618E-12
Dose Effective (Ci) I-131 (Thyroid)		9.1878E+01
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		9.2893E+01
Total I (Ci)		1.2347E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 192.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2127E+22
Elemental I (atoms)	0.0000E+00	1.6548E+17
Organic I (atoms)	0.0000E+00	5.1179E+15
Aerosols (kg)	0.0000E+00	7.0510E-07

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 192.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.6862E+19
Elemental I (atoms)	0.0000E+00	1.0489E+15
Organic I (atoms)	0.0000E+00	3.2439E+13
Aerosols (kg)	0.0000E+00	4.4692E-09

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 192.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.5038E+18
Elemental I (atoms)	0.0000E+00	1.2969E+14

Time (h) = 264.0000 Whole Body Thyroid TEDE

Attachment F

Delta dose (rem)	2.7390E-39	5.2975E-37	1.8868E-38
Accumulated dose (rem)	3.9517E-02	1.0080E+01	3.4703E-01

Control Room Doses:

Time (h) = 264.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5537E-18	1.6002E-14	4.8976E-16
Accumulated dose (rem)	2.5944E-02	1.4319E+02	4.3932E+00

primary Compartment Nuclide Inventory:

Time (h) = 264.0000	Ci	kg	Atoms	Decay
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primary Transport Group Inventory:

Time (h) = 264.0000	Atmosphere	Sump
Noble gases (atoms)	1.2341-122	0.0000E+00
Elemental I (atoms)	1.2087-127	0.0000E+00
Organic I (atoms)	3.7381-129	0.0000E+00
Aerosols (kg)	5.1500-151	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		2.9855-153
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		2.9856-153
Total I (Ci)		6.7236-143

primary to Environment Transport Group Inventory:

	Pathway
Time (h) = 264.0000	Filtered Transported
Noble gases (atoms)	0.0000E+00 1.2127E+22
Elemental I (atoms)	0.0000E+00 1.6548E+17
Organic I (atoms)	0.0000E+00 5.1179E+15
Aerosols (kg)	0.0000E+00 7.0510E-07

Environment Integral Nuclide Release:

Time (h) = 264.0000	Ci	kg	Atoms	Bq
Br-82	2.5968E-02	2.3986E-11	1.7615E+14	9.6080E+08
Kr-85	6.4438E+02	1.6424E-03	1.1636E+22	2.3842E+13
Kr-85m	2.4958E-08	3.0327E-18	2.1486E+07	9.2343E+02
I-130	3.3081E-04	1.6962E-13	7.8574E+11	1.2240E+07
I-131	9.1564E+01	7.3857E-07	3.3952E+18	3.3879E+12
I-132	3.1125E+01	3.0154E-09	1.3757E+16	1.1516E+12
I-133	7.7689E-01	6.8581E-10	3.1053E+15	2.8745E+10
I-135	4.2109E-06	1.1990E-15	5.3488E+09	1.5580E+05
Xe-129m	9.1955E-02	7.2677E-10	3.3928E+15	3.4023E+09
Xe-131m	2.4335E+02	2.9053E-06	1.3356E+19	9.0039E+12
Xe-133	1.9897E+04	1.0630E-04	4.8132E+20	7.3620E+14
Xe-133m	2.2649E+02	5.0476E-07	2.2855E+18	8.3800E+12
Xe-135	3.1885E-01	1.2486E-10	5.5697E+14	1.1798E+10
Xe-135m	7.3798E-05	8.1015E-16	3.6140E+09	2.7305E+06

Environment Transport Group Inventory:

	Total	Release
Time (h) = 264.0000	Release	Rate/s
Noble gases (atoms)	1.2133E+22	3.5108E+16
Elemental I (atoms)	1.6549E+17	4.7886E+11
Organic I (atoms)	5.1184E+15	1.4810E+10
Aerosols (kg)	7.0518E-07	2.0404E-12
Dose Effective (Ci) I-131 (Thyroid)		9.1878E+01
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		9.2893E+01
Total I (Ci)		1.2347E+02

primary to Environment Transport Group Inventory:

070000

Attachment F

Elemental I (atoms)	0.0000E+00	1.2969E+14
Organic I (atoms)	0.0000E+00	4.0110E+12
Aerosols (kg)	0.0000E+00	5.5260E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 264.0000	Filtered	Transported
Noble gases (atoms)	8.6386E+19	0.0000E+00
Elemental I (atoms)	1.1754E+15	0.0000E+00
Organic I (atoms)	3.6354E+13	0.0000E+00
Aerosols (kg)	5.0086E-09	0.0000E+00

EAB Doses:

Time (h) = 888.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	7.0790E-02	1.8056E+01	6.2164E-01

LPZ Doses:

Time (h) = 888.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.9480-148	8.6834-146	3.0385-147
Accumulated dose (rem)	3.9517E-02	1.0080E+01	3.4703E-01

Control Room Doses:

Time (h) = 888.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.7368E-67	6.9381E-63	2.1221E-64
Accumulated dose (rem)	2.5944E-02	1.4319E+02	4.3932E+00

primary Compartment Nuclide Inventory:

Time (h) = 888.0000	Ci	kg	Atoms	Decay
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primary Transport Group Inventory:

Time (h) = 888.0000	Atmosphere	Sump
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 888.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2127E+22
Elemental I (atoms)	0.0000E+00	1.6548E+17
Organic I (atoms)	0.0000E+00	5.1179E+15
Aerosols (kg)	0.0000E+00	7.0510E-07

Environment Integral Nuclide Release:

Time (h) = 888.0000	Ci	kg	Atoms	Bq
Br-82	2.5968E-02	2.3986E-11	1.7615E+14	9.6080E+08
Kr-85	6.4438E+02	1.6424E-03	1.1636E+22	2.3842E+13
Kr-85m	2.4958E-08	3.0327E-18	2.1486E+07	9.2343E+02
I-130	3.3081E-04	1.6962E-13	7.8574E+11	1.2240E+07
I-131	9.1564E+01	7.3857E-07	3.3952E+18	3.3879E+12
I-132	3.1125E+01	3.0154E-09	1.3757E+16	1.1516E+12

Attachment F

Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)		0.0000E+00

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 888.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.6862E+19
Elemental I (atoms)	0.0000E+00	1.0489E+15
Organic I (atoms)	0.0000E+00	3.2439E+13
Aerosols (kg)	0.0000E+00	4.4692E-09

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 888.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.5038E+18
Elemental I (atoms)	0.0000E+00	1.2969E+14
Organic I (atoms)	0.0000E+00	4.0110E+12
Aerosols (kg)	0.0000E+00	5.5260E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 888.0000	Filtered	Transported
Noble gases (atoms)	8.6386E+19	0.0000E+00
Elemental I (atoms)	1.1754E+15	0.0000E+00
Organic I (atoms)	3.6354E+13	0.0000E+00
Aerosols (kg)	5.0086E-09	0.0000E+00

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I-131 Summary
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	primary	Environment	Control Room
Time (hr)	I-131 (Curies)	I-131 (Curies)	I-131 (Curies)
168.000	1.4134E+01	1.3564E-02	9.6537E-05
168.004	9.1108E+01	5.6754E-01	4.0331E-03
168.404	2.2855E+01	6.8737E+01	3.4007E-01
168.704	8.1013E+00	8.3472E+01	2.9494E-01
169.004	2.8716E+00	8.8695E+01	2.1439E-01
169.304	1.0179E+00	9.0547E+01	1.4517E-01
169.604	3.6080E-01	9.1203E+01	9.5031E-02
169.904	1.2789E-01	9.1436E+01	6.1128E-02
170.000	9.1642E-02	9.1472E+01	5.2928E-02
170.300	3.2484E-02	9.1531E+01	3.3589E-02
170.600	1.1514E-02	9.1552E+01	2.1245E-02
170.900	4.0814E-03	9.1559E+01	1.3412E-02
171.200	1.4467E-03	9.1562E+01	8.4587E-03
171.500	5.1280E-04	9.1563E+01	5.3315E-03
171.800	1.8177E-04	9.1563E+01	3.3594E-03
172.100	6.4430E-05	9.1563E+01	2.1163E-03
172.400	2.2838E-05	9.1564E+01	1.3331E-03
172.700	8.0952E-06	9.1564E+01	8.3969E-04
173.000	2.8694E-06	9.1564E+01	5.2888E-04
173.300	1.0171E-06	9.1564E+01	3.3311E-04

Attachment F

173.600	3.6053E-07	9.1564E+01	2.0981E-04
173.900	1.2779E-07	9.1564E+01	1.3214E-04
174.200	4.5298E-08	9.1564E+01	8.3228E-05
174.500	1.6056E-08	9.1564E+01	5.2420E-05
174.800	5.6914E-09	9.1564E+01	3.3015E-05
175.100	2.0174E-09	9.1564E+01	2.0794E-05
175.400	7.1509E-10	9.1564E+01	1.3097E-05
175.700	2.5347E-10	9.1564E+01	8.2487E-06
176.000	8.9846E-11	9.1564E+01	5.1953E-06
176.300	3.1847E-11	9.1564E+01	3.2721E-06
176.600	1.1289E-11	9.1564E+01	2.0609E-06
176.900	4.0014E-12	9.1564E+01	1.2980E-06
177.200	1.4183E-12	9.1564E+01	8.1752E-07
177.500	5.0275E-13	9.1564E+01	5.1490E-07
177.800	1.7820E-13	9.1564E+01	3.2430E-07
178.100	6.3167E-14	9.1564E+01	2.0425E-07
178.400	2.2390E-14	9.1564E+01	1.2864E-07
192.000	8.5225E-35	9.1564E+01	1.0174E-16
264.000	6.7203E-143	9.1564E+01	6.6207E-65
888.000	0.0000E+00	9.1564E+01	0.0000E+00

Cumulative Dose Summary
#####

Time (hr)	EAB		LPZ		Control Room	
	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
168.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
168.004	1.1201E-01	3.8599E-03	6.2465E-02	2.1526E-03	1.9251E-03	5.9096E-05
168.404	1.3569E+01	4.6740E-01	7.5674E+00	2.6067E-01	3.2355E+01	9.9308E-01
168.704	1.6477E+01	5.6743E-01	9.1893E+00	3.1645E-01	6.5386E+01	2.0067E+00
169.004	1.7508E+01	6.0285E-01	9.7641E+00	3.3620E-01	9.1365E+01	2.8037E+00
169.304	1.7873E+01	6.1539E-01	9.9679E+00	3.4320E-01	1.0956E+02	3.3618E+00
169.604	1.8003E+01	6.1983E-01	1.0040E+01	3.4567E-01	1.2167E+02	3.7332E+00
169.904	1.8049E+01	6.2140E-01	1.0066E+01	3.4655E-01	1.2952E+02	3.9741E+00
170.000	1.8056E+01	6.2164E-01	1.0070E+01	3.4669E-01	1.3139E+02	4.0313E+00
170.300	1.8056E+01	6.2164E-01	1.0076E+01	3.4691E-01	1.3574E+02	4.1646E+00
170.600	1.8056E+01	6.2164E-01	1.0078E+01	3.4699E-01	1.3849E+02	4.2489E+00
170.900	1.8056E+01	6.2164E-01	1.0079E+01	3.4701E-01	1.4023E+02	4.3022E+00
171.200	1.8056E+01	6.2164E-01	1.0080E+01	3.4702E-01	1.4132E+02	4.3359E+00
171.500	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4202E+02	4.3571E+00
171.800	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4245E+02	4.3704E+00
172.100	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4273E+02	4.3788E+00
172.400	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4290E+02	4.3841E+00
172.700	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4301E+02	4.3875E+00
173.000	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4308E+02	4.3896E+00
173.300	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4312E+02	4.3909E+00
173.600	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4315E+02	4.3917E+00
173.900	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4317E+02	4.3923E+00
174.200	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4318E+02	4.3926E+00
174.500	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4318E+02	4.3928E+00
174.800	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3929E+00
175.100	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3930E+00
175.400	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3931E+00
175.700	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3931E+00
176.000	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3931E+00
176.300	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3931E+00
176.600	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3931E+00
176.900	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00
177.200	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00
177.500	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00
177.800	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00

Attachment F

178.100	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00
178.400	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00
192.000	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00
264.000	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00
888.000	1.8056E+01	6.2164E-01	1.0080E+01	3.4703E-01	1.4319E+02	4.3932E+00

Worst Two-Hour Doses
#####

EAB

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
168.0	7.0790E-02	1.8056E+01	6.2164E-01

Outside Cloud Shine - General Notes

- 1 Table 1 input is taken from RADTRAD 3.03 output files for FHA.
- 2 Table 2 manipulates input data from Table 1 to fit the geometry of the specific situation being considered.

Cumulative isotopic activities (C_i) released at various times are given in the Alion results. This table combines three separate computations. The first is the computation of isotopic release rate (C_i/sec). For each time interval, the average release rate is computed by taking delta isotopic activity released (C_i) and dividing by delta time (h) and dividing by 3600 (sec/h) to give C_i/sec .

The second computation takes the X/Q (sec/ m^3) (see in the FHA calc body) for that time interval and multiplies it by the release rate (C_i/sec) to give concentration in C_i/m^3 . X/Q 's are very conservatively selected by time, by release location, and by position. By time, the worst X/Q for the time interval is selected. By location, the worst X/Q at the CR is taken, irrespective of actual release point. By position, X/Q s are themselves computed to represent cloud centerline concentration. In actuality, the concentration falls off exponentially from plume centerline (RG 1.145). This analysis conservatively uses the cloud centerline concentration at the CR intake.

The third computation takes the concentration and multiplies it by the volume (m^3) being modeled, to give total Curies occupying that volume. This ensures a conservatively large cloud inventory, for example, by not placing curies that have been released too far away (as in a semi infinite cloud), when, in fact, cloud geometry could preclude that from happening.

All three computations are done as one, but are described here separately to facilitate understanding. 800 feet is selected because a sensitivity study on radius showed that 99% of the maximum dose is reached as the radius is increased to 740 feet. The 800 foot values used correspond to between 1 and 4 mean free paths distance for 0.2 to 2 MeV gammas in air, which technically validates this assumption. The volume of a cylinder whose radius and height are 800 feet is $4.77\text{E}7 \text{ m}^3$. As a check on conservation of curies, the total cloud inventory (Curies) just computed is compared against the total inventory that has been released up until now. It shows that the computed cloud inventory is high by a factor of 200 at 0.5h and 35 at 2h. The reason for the conservatism is that the cloud is assumed to be at the centerline concentration throughout, rather than at an exponentially average concentration. However, this conservatism is being retained.

- 3 Table 1 is sorted by RadTrad sort #. Table 2 is sorted by MicroShield iso # by re-sorting Table 1.

Rad Trad Sort	Micro Shield Iso#	time (hrs) >>	Outside Cloud Shine - RadTrad Output Table 1 ENVIRONMENT - Cumul. Curies Released							
			0.25	0.5	1	2	8	24	96	720
58	13	Am-241								
43	41	Ba-139								
44	42	Ba-140								
1	61	Br-82	2.54E-01	3.61E-01	4.25E-01	4.39E-01	4.39E-01	4.39E-01	4.39E-01	4.39E-01
2	62	Br-83	6.41E-03	8.94E-03	1.03E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02	1.06E-02
48	81	Ce-141								
49	82	Ce-143								
50	83	Ce-144								
59	93	Cm-242								
60	95	Cm-244								
1	104	Co-58								
2	106	Co-60								
40	115	Cs-134								
41	118	Cs-136								
42	119	Cs-137								
3	174	I-130	6.19E-01	8.79E-01	1.03E+00	1.06E+00	1.06E+00	1.06E+00	1.06E+00	1.06E+00
33	175	I-131	8.76E+01	1.25E+02	1.47E+02	1.52E+02	1.52E+02	1.52E+02	1.52E+02	1.52E+02
34	176	I-132	6.78E+01	9.45E+01	1.09E+02	1.12E+02	1.12E+02	1.12E+02	1.12E+02	1.12E+02
35	177	I-133	5.46E+01	7.77E+01	9.14E+01	9.42E+01	9.43E+01	9.43E+01	9.43E+01	9.43E+01
36	178	I-134	2.64E-06	3.56E-06	3.99E-06	4.04E-06	4.05E-06	4.05E-06	4.05E-06	4.05E-06
37	179	I-135	8.93E+00	1.26E+01	1.48E+01	1.52E+01	1.52E+01	1.52E+01	1.52E+01	1.52E+01
4	202	Kr-83m	4.98E+00	6.91E+00	7.94E+00	8.10E+00	8.10E+00	8.10E+00	8.10E+00	8.10E+00
3	203	Kr-85	3.71E+02	5.30E+02	6.25E+02	6.44E+02	6.45E+02	6.45E+02	6.45E+02	6.45E+02
4	204	Kr-85m	7.01E+01	9.88E+01	1.15E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02
5	205	Kr-87	1.07E-02	1.46E-02	1.67E-02	1.69E-02	1.70E-02	1.70E-02	1.70E-02	1.70E-02
6	206	Kr-88	2.17E+01	3.04E+01	3.52E+01	3.61E+01	3.61E+01	3.61E+01	3.61E+01	3.61E+01
45	209	La-140								
46	210	La-141								
47	211	La-142								
19	224	Mo-99								
18	238	Nb-95								
52	243	Nd-147								
53	255	Np-239								
51	302	Pr-143								
54	313	Pu-238								
55	314	Pu-239								
56	315	Pu-240								
57	316	Pu-241								
7	332	Rb-86								
24	347	Rh-105								
21	355	Ru-103								
22	356	Ru-105								
23	357	Ru-106								
25	365	Sb-127								
26	366	Sb-129								
8	391	Sr-89								
9	392	Sr-90								
10	393	Sr-91								
11	394	Sr-92								
20	408	Tc-99m								
27	415	Te-127								
28	416	Te-127m								
29	417	Te-129								
30	418	Te-129m								
31	420	Te-131m								
32	421	Te-132								
5	469	Xe-129m	8.91E-02	1.27E-01	1.50E-01	1.55E-01	1.55E-01	1.55E-01	1.55E-01	1.55E-01
5	470	Xe-131m	1.36E+02	1.94E+02	2.29E+02	2.36E+02	2.37E+02	2.37E+02	2.37E+02	2.37E+02
38	471	Xe-133	2.29E+04	3.26E+04	3.85E+04	3.97E+04	3.97E+04	3.97E+04	3.97E+04	3.97E+04
7	472	Xe-133m	6.78E+02	9.65E+02	1.14E+03	1.17E+03	1.17E+03	1.17E+03	1.17E+03	1.17E+03
39	473	Xe-135	6.18E+03	8.77E+03	1.03E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04
8	474	Xe-135m	2.13E+02	2.57E+02	2.71E+02	2.70E+02	2.70E+02	2.70E+02	2.70E+02	2.70E+02
12	480	Y-90								
13	482	Y-91								
14	484	Y-92								
15	485	Y-93								
16	496	Zr-95								
17	497	Zr-97								

Outside Cloud Shine - MicroShield Input

Attachment G
FHA Cloud Shine Analysis EXCEL Spreadsheets

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Table 2 Outside Cloud Inventory (Curies)

t= X/Q =			t= X/Q =			t= X/Q =			t= X/Q =			t= X/Q =			t= X/Q =			t= X/Q =			Cylindrical Volume 1.61E+09 cu ft 4.55E+07 m3		
0.26	4.16E-03		0.6	4.16E-03		1	4.16E-03		2	4.16E-03		6	3.24E-03		24	1.32E-03		96	9.01E-04			720	7.22E-04
Iso #	Curies	Iso	Iso #	Curies	Iso	Iso #	Curies	Iso	Iso #	Curies	Iso	Iso #	Curies	Iso	Iso #	Curies	Iso	Iso #	Curies	Iso	Iso #	Curies	Iso
13	0.00E+00	Am-241	13	0.00E+00	Am-241	13	0.00E+00	Am-241	13	0.00E+00	Am-241	13	0.00E+00	Am-241	13	0.00E+00	Am-241	13	0.00E+00	Am-241	13	0.00E+00	Am-241
41	0.00E+00	Ba-139	41	0.00E+00	Ba-139	41	0.00E+00	Ba-139	41	0.00E+00	Ba-139	41	0.00E+00	Ba-139	41	0.00E+00	Ba-139	41	0.00E+00	Ba-139	41	0.00E+00	Ba-139
42	0.00E+00	Ba-140	42	0.00E+00	Ba-140	42	0.00E+00	Ba-140	42	0.00E+00	Ba-140	42	0.00E+00	Ba-140	42	0.00E+00	Ba-140	42	0.00E+00	Ba-140	42	0.00E+00	Ba-140
61	5.33E+01	Br-82	61	2.26E+01	Br-82	61	6.73E+00	Br-82	61	6.86E-01	Br-82	61	2.84E-03	Br-82	61	0.00E+00	Br-82	61	0.00E+00	Br-82	61	0.00E+00	Br-82
62	1.35E+00	Br-83	62	5.32E-01	Br-83	62	1.46E-01	Br-83	62	1.25E-02	Br-83	62	4.10E-05	Br-83	62	0.00E+00	Br-83	62	0.00E+00	Br-83	62	0.00E+00	Br-83
81	0.00E+00	Ce-141	81	0.00E+00	Ce-141	81	0.00E+00	Ce-141	81	0.00E+00	Ce-141	81	0.00E+00	Ce-141	81	0.00E+00	Ce-141	81	0.00E+00	Ce-141	81	0.00E+00	Ce-141
82	0.00E+00	Ce-143	82	0.00E+00	Ce-143	82	0.00E+00	Ce-143	82	0.00E+00	Ce-143	82	0.00E+00	Ce-143	82	0.00E+00	Ce-143	82	0.00E+00	Ce-143	82	0.00E+00	Ce-143
83	0.00E+00	Ce-144	83	0.00E+00	Ce-144	83	0.00E+00	Ce-144	83	0.00E+00	Ce-144	83	0.00E+00	Ce-144	83	0.00E+00	Ce-144	83	0.00E+00	Ce-144	83	0.00E+00	Ce-144
93	0.00E+00	Cm-242	93	0.00E+00	Cm-242	93	0.00E+00	Cm-242	93	0.00E+00	Cm-242	93	0.00E+00	Cm-242	93	0.00E+00	Cm-242	93	0.00E+00	Cm-242	93	0.00E+00	Cm-242
95	0.00E+00	Cm-244	95	0.00E+00	Cm-244	95	0.00E+00	Cm-244	95	0.00E+00	Cm-244	95	0.00E+00	Cm-244	95	0.00E+00	Cm-244	95	0.00E+00	Cm-244	95	0.00E+00	Cm-244
104	0.00E+00	Co-58	104	0.00E+00	Co-58	104	0.00E+00	Co-58	104	0.00E+00	Co-58	104	0.00E+00	Co-58	104	0.00E+00	Co-58	104	0.00E+00	Co-58	104	0.00E+00	Co-58
106	0.00E+00	Co-60	106	0.00E+00	Co-60	106	0.00E+00	Co-60	106	0.00E+00	Co-60	106	0.00E+00	Co-60	106	0.00E+00	Co-60	106	0.00E+00	Co-60	106	0.00E+00	Co-60
115	0.00E+00	Cs-134	115	0.00E+00	Cs-134	115	0.00E+00	Cs-134	115	0.00E+00	Cs-134	115	0.00E+00	Cs-134	115	0.00E+00	Cs-134	115	0.00E+00	Cs-134	115	0.00E+00	Cs-134
118	0.00E+00	Cs-136	118	0.00E+00	Cs-136	118	0.00E+00	Cs-136	118	0.00E+00	Cs-136	118	0.00E+00	Cs-136	118	0.00E+00	Cs-136	118	0.00E+00	Cs-136	118	0.00E+00	Cs-136
119	0.00E+00	Cs-137	119	0.00E+00	Cs-137	119	0.00E+00	Cs-137	119	0.00E+00	Cs-137	119	0.00E+00	Cs-137	119	0.00E+00	Cs-137	119	0.00E+00	Cs-137	119	0.00E+00	Cs-137
174	1.30E+02	I-130	174	5.48E+01	I-130	174	1.61E+01	I-130	174	1.62E+00	I-130	174	6.15E-03	I-130	174	0.00E+00	I-130	174	0.00E+00	I-130	174	0.00E+00	I-130
175	1.84E+04	I-131	175	7.83E+03	I-131	175	2.35E+03	I-131	175	2.42E+02	I-131	175	1.02E+00	I-131	175	0.00E+00	I-131	175	0.00E+00	I-131	175	0.00E+00	I-131
176	1.42E+04	I-132	176	5.61E+03	I-132	176	1.54E+03	I-132	176	1.31E+02	I-132	176	4.10E-01	I-132	176	0.00E+00	I-132	176	0.00E+00	I-132	176	0.00E+00	I-132
177	1.15E+04	I-133	177	4.85E+03	I-133	177	1.44E+03	I-133	177	1.47E+02	I-133	177	6.08E-01	I-133	177	0.00E+00	I-133	177	0.00E+00	I-133	177	0.00E+00	I-133
178	5.55E+04	I-134	178	1.92E+04	I-134	178	4.58E+05	I-134	178	2.85E+06	I-134	178	5.47E-09	I-134	178	0.00E+00	I-134	178	0.00E+00	I-134	178	0.00E+00	I-134
179	1.88E+03	I-135	179	7.78E+02	I-135	179	2.26E+02	I-135	179	2.21E+01	I-135	179	8.88E-02	I-135	179	0.00E+00	I-135	179	0.00E+00	I-135	179	0.00E+00	I-135
202	1.05E+03	Kr-83m	202	4.04E+02	Kr-83m	202	1.08E+02	Kr-83m	202	8.72E+00	Kr-83m	202	2.60E-02	Kr-83m	202	0.00E+00	Kr-83m	202	0.00E+00	Kr-83m	202	0.00E+00	Kr-83m
203	7.80E+04	Kr-85	203	3.92E+04	Kr-85	203	9.97E+03	Kr-85	203	1.04E+03	Kr-85	203	4.44E-03	Kr-85	203	0.00E+00	Kr-85	203	0.00E+00	Kr-85	203	0.00E+00	Kr-85
204	1.47E+04	Kr-85m	204	6.03E+03	Kr-85m	204	1.72E+03	Kr-85m	204	1.63E+02	Kr-85m	204	6.15E-01	Kr-85m	204	0.00E+00	Kr-85m	204	0.00E+00	Kr-85m	204	0.00E+00	Kr-85m
205	2.25E+00	Kr-87	205	8.30E-01	Kr-87	205	2.12E-01	Kr-87	205	1.50E-02	Kr-87	205	4.10E-05	Kr-87	205	0.00E+00	Kr-87	205	0.00E+00	Kr-87	205	0.00E+00	Kr-87
206	4.56E+03	Kr-88	206	1.82E+03	Kr-88	206	5.08E+02	Kr-88	206	4.51E+01	Kr-88	206	1.50E-01	Kr-88	206	0.00E+00	Kr-88	206	0.00E+00	Kr-88	206	0.00E+00	Kr-88
209	0.00E+00	La-140	209	0.00E+00	La-140	209	0.00E+00	La-140	209	0.00E+00	La-140	209	0.00E+00	La-140	209	0.00E+00	La-140	209	0.00E+00	La-140	209	0.00E+00	La-140
210	0.00E+00	La-141	210	0.00E+00	La-141	210	0.00E+00	La-141	210	0.00E+00	La-141	210	0.00E+00	La-141	210	0.00E+00	La-141	210	0.00E+00	La-141	210	0.00E+00	La-141
211	0.00E+00	La-142	211	0.00E+00	La-142	211	0.00E+00	La-142	211	0.00E+00	La-142	211	0.00E+00	La-142	211	0.00E+00	La-142	211	0.00E+00	La-142	211	0.00E+00	La-142
224	0.00E+00	Mo-99	224	0.00E+00	Mo-99	224	0.00E+00	Mo-99	224	0.00E+00	Mo-99	224	0.00E+00	Mo-99	224	0.00E+00	Mo-99	224	0.00E+00	Mo-99	224	0.00E+00	Mo-99
238	0.00E+00	Nb-95	238	0.00E+00	Nb-95	238	0.00E+00	Nb-95	238	0.00E+00	Nb-95	238	0.00E+00	Nb-95	238	0.00E+00	Nb-95	238	0.00E+00	Nb-95	238	0.00E+00	Nb-95
243	0.00E+00	Nd-147	243	0.00E+00	Nd-147	243	0.00E+00	Nd-147	243	0.00E+00	Nd-147	243	0.00E+00	Nd-147	243	0.00E+00	Nd-147	243	0.00E+00	Nd-147	243	0.00E+00	Nd-147
255	0.00E+00	Np-239	255	0.00E+00	Np-239	255	0.00E+00	Np-239	255	0.00E+00	Np-239	255	0.00E+00	Np-239	255	0.00E+00	Np-239	255	0.00E+00	Np-239	255	0.00E+00	Np-239
302	0.00E+00	Pr-143	302	0.00E+00	Pr-143	302	0.00E+00	Pr-143	302	0.00E+00	Pr-143	302	0.00E+00	Pr-143	302	0.00E+00	Pr-143	302	0.00E+00	Pr-143	302	0.00E+00	Pr-143
313	0.00E+00	Pu-238	313	0.00E+00	Pu-238	313	0.00E+00	Pu-238	313	0.00E+00	Pu-238	313	0.00E+00	Pu-238	313	0.00E+00	Pu-238	313	0.00E+00	Pu-238	313	0.00E+00	Pu-238
314	0.00E+00	Pu-239	314	0.00E+00	Pu-239	314	0.00E+00	Pu-239	314	0.00E+00	Pu-239	314	0.00E+00	Pu-239	314	0.00E+00	Pu-239	314	0.00E+00	Pu-239	314	0.00E+00	Pu-239
315	0.00E+00	Pu-240	315	0.00E+00	Pu-240	315	0.00E+00	Pu-240	315	0.00E+00	Pu-240	315	0.00E+00	Pu-240	315	0.00E+00	Pu-240	315	0.00E+00	Pu-240	315	0.00E+00	Pu-240
316	0.00E+00	Pu-241	316	0.00E+00	Pu-241	316	0.00E+00	Pu-241	316	0.00E+00	Pu-241	316	0.00E+00	Pu-241	316	0.00E+00	Pu-241	316	0.00E+00	Pu-241	316	0.00E+00	Pu-241
332	0.00E+00	Rb-86	332	0.00E+00	Rb-86	332	0.00E+00	Rb-86	332	0.00E+00	Rb-86	332	0.00E+00	Rb-86	332	0.00E+00	Rb-86	332	0.00E+00	Rb-86	332	0.00E+00	Rb-86
347	0.00E+00	Rh-105	347	0.00E+00	Rh-105	347	0.00E+00	Rh-105	347	0.00E+00	Rh-105	347	0.00E+00	Rh-105	347	0.00E+00	Rh-105	347	0.00E+00	Rh-105	347	0.00E+00	Rh-105
355	0.00E+00	Ru-103	355	0.00E+00	Ru-103	355	0.00E+00	Ru-103	355	0.00E+00	Ru-103	35											

Outside Cloud Shine - MAIN

<u>Ctl. Bldg.</u>	<u>Dim. ft</u>	<u>Ref.</u>	
N-S	73.5	Dwg 4175	
E-W	68.1	Dwg 4175	
Vert	16.6	Dwg 4175, 4176	Room height, for info only, not used.

	<u>North</u>	<u>Roof</u>	
Area (sqft)	1131.9	5004.1	$A = \pi d^2 / 4$
eqv dia (ft)	38.0	79.8	$d = \sqrt{4A / \pi}$
eqv rad (ft)	19.0	39.9	

1. For extreme conservatism, the Outside Cloud is modeled as a large cylinder extending upward from the control building roof. Use a cylinder radius approximately 20 times the largest above equivalent radius (i.e., roof), say 800 feet, and a height of also 800 feet. This begins to substantially approach an infinite cloud in size. A sensitivity study on radius showed that 99% of the maximum dose is reached as the radius is increased to 740 feet. The 800 foot values used correspond to between 1 and 4 mean free paths distance for 0.2 to 2 MeV gammas in air, which technically validates this assumption.
2. Conservatively use an end cyl model to put source nearest the dose point.
3. Conservatively assume that the dose point is on the cylinder axis.
4. Assume a uniform cloud concentration within the cloud itself within a given time period, based on the highest CR X/Q for that time period. This is extremely conservative because plume centerline concentrations are used to specify the X/Q factors used in typical dose analyses, whereas, actual concentration falls off exponentially from plume centerline (RG 1.145).
5. MicroShield calculates a constant dose rate (mR/hr) for each time interval from concentrations that based on the average release (Ci/sec) for that interval and the highest X/Q for that interval (sec/m3). For time intervals before the time at which the peak dose rate occurs, a bounding approach is used which selects the highest dose rate for the interval. This is conservative because it takes the bounding value for the entire interval. For time intervals after the peak dose rate, a linear average is used, which is conservative since the dose rate drops off exponentially, rather than linearly.

	<u>Thickness</u>	
<u>Shielding</u>	<u>Dim. ft</u>	<u>Ref.</u>
concrete	2	Dwg 4175, 4176
air	9.6	Dose point is 5 feet up from CR floor, making the air distance 9.5 feet.

Attachment G
FHA Cloud Shine Analysis EXCEL Spreadsheets

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Dose Results

<u>time (h)</u>	<u>Micro-Shield mR/hr</u>	<u>time period h</u>	<u>bounding or average mR/hr</u>	<u>time interval h</u>	<u>Exposure mR</u>
0	not compu.				
0.25	0.1927 PEAK	0.25	1.927E-01	0.25	4.82E-02
0.5	7.360E-02	0.25 to 0.5	1.332E-01	0.25	3.33E-02
1	2.145E-02	0.5 to 1	4.753E-02	0.5	2.38E-02
2	1.832E-03	0.5 to 2	1.164E-02	1	1.16E-02
8	6.207E-06	2 to 8	9.191E-04	6	5.51E-03
24	0.000E+00	8 to 24	3.104E-06	16	4.97E-05
96	0.000E+00	24 to 96	0.000E+00	72	0.00E+00
720	0.000E+00	96 to 720	0.000E+00	624	<u>0.00E+00</u>
					1.22E-01

Total Cloud Shine

1.22E-01

10% Factor for Equilibrium Daughters

Total Cloud Shine with 10% Equilibrium Daughters

1.35E-01

RG 1.183
Occupancy **Exposure**
Factors **mR**

1	4.82E-02
1	3.33E-02
1	2.38E-02
1	1.16E-02
1	5.51E-03
1	4.97E-05
0.6	0.00E+00
0.4	0.00E+00
	1.22E-01

Total Cloud Shine

10% Factor for Equilibrium Daughters

Total Cloud Shine with 10% Equilibrium Daughters

1.35E-01

```
#####
RADTRAD Version 3.03 (Spring 2001) run on 8/17/2011 at 15:10:59
#####
```

```
#####
File information
#####
```

```
Plant file          = C:\Documents and Settings\jlboste\My Documents\QA_FHA
cooperGNF2 BC 06-06-11shinedose.psf
Inventory file      = C:\Documents and Settings\jlboste\My
Documents\cooper29fha24monthGNF2.nif
Release file       = C:\Documents and Settings\jlboste\My Documents\RG1_183.rft
Dose Conversion file = C:\Documents and Settings\jlboste\My Documents\cooperGNF2-
29fha.inp
```

```
#####      #####      #####      # #      # #####      # #      #####
# #      # #      # #      # #      # #      # #      # #      #
# #      # #      # #      # #      # #      # #      # #      #
#####      #####      #####      # #      # #      #####      # #      #
# #      # #      # #      # #      # #      # #      # #      #
# #      # #      # #      # #      # #      # #      # #      #
# #      # #      # #      # #      # #      # #      # #      #
```

```
Radtrad 3.03 4/15/2001
Base Case 1-01-2011
Nuclide Inventory File:
C:\Documents and Settings\jlboste\My Documents\cooper29fha24monthGNF2.nif
Plant Power Level:
1.5144E+01
Compartments:
3
Compartment 1:
primary
3
7.9500E+05
0
0
0
0
0
0
Compartment 2:
Environment
2
0.0000E+00
0
0
0
0
0
0
Compartment 3:
Control Room
1
1.4186E+05
0
0
0
```

```

0
0
Pathways:
4
Pathway 1:
primary to Environment
1
2
2
Pathway 2:
Environment to Control Room
2
3
2
Pathway 3:
Environment to Control Room
2
3
2
Pathway 4:
Control Room to Environment
3
2
2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
1
1 1.0000E+00
C:\Documents and Settings\jlboste\My Documents\cooperGNF2-29fha.inp
C:\Documents and Settings\jlboste\My Documents\RG1_183.rft
2.4000E+01
1
9.5000E-01 4.8500E-02 1.5000E-03 1.0000E+00
Overlying Pool:
0
0.0000E+00
0
0
0
0
0
Compartments:
3
Compartment 1:
1
1
0
0
0
0
0
0
0
0
Compartment 2:
1
1
0
0
0
0

```

```

0
0
0
Compartment 3:
1
1
0
0
0
0
0
0
0
0
0
Pathways:
4
Pathway 1:
0
0
0
0
0
1
9
2.4000E+01  4.5760E+04  0.0000E+00  0.0000E+00  0.0000E+00
2.4250E+01  4.5760E+04  0.0000E+00  0.0000E+00  0.0000E+00
2.4500E+01  4.5760E+04  0.0000E+00  0.0000E+00  0.0000E+00
2.5000E+01  4.5760E+04  0.0000E+00  0.0000E+00  0.0000E+00
2.6000E+01  4.5760E+04  0.0000E+00  0.0000E+00  0.0000E+00
3.2000E+01  4.5760E+04  0.0000E+00  0.0000E+00  0.0000E+00
4.8000E+01  4.5760E+04  0.0000E+00  0.0000E+00  0.0000E+00
1.2000E+02  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
7.4400E+02  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
0
0
0
0
0
0
Pathway 2:
0
0
0
0
0
1
2
2.4000E+01  3.2350E+03  0.0000E+00  0.0000E+00  0.0000E+00
2.4017E+01  8.1000E+02  8.9000E+01  8.9000E+01  8.9000E+01
0
0
0
0
0
0
0
Pathway 3:
0
0
0
0
0
1
1
2.4000E+01  4.0000E+02  0.0000E+00  0.0000E+00  0.0000E+00

```

```

0
0
0
0
0
0
0
Pathway 4:
0
0
0
0
0
1
2
2.4000E+01  3.6350E+03  0.0000E+00  0.0000E+00  0.0000E+00
2.4017E+01  1.2100E+03  0.0000E+00  0.0000E+00  0.0000E+00
0
0
0
0
0
0
Dose Locations:
3
Location 1:
EAB
2
1
2
2.4000E+01  5.2000E-04
2.6000E+01  0.0000E+00
1
4
2.4000E+01  3.5000E-04
3.2000E+01  1.8000E-04
4.8000E+01  2.3000E-04
7.4400E+02  0.0000E+00
0
Location 2:
LPZ
2
1
5
2.4000E+01  2.9000E-04
3.2000E+01  7.3000E-05
4.8000E+01  2.5000E-05
1.2000E+02  5.2000E-06
7.4400E+02  0.0000E+00
1
4
2.4000E+01  3.5000E-04
3.2000E+01  1.8000E-04
4.8000E+01  2.3000E-04
7.4400E+02  0.0000E+00
0
Location 3:
Control Room
3
0
1
2
2.4000E+01  3.5000E-04
7.4400E+02  0.0000E+00

```

```
1
4
2.4000E+01  1.0000E+00
4.8000E+01  6.0000E-01
1.2000E+02  4.0000E-01
7.4400E+02  0.0000E+00
Effective Volume Location:
1
6
2.4000E+01  4.1500E-03
2.6000E+01  3.2400E-03
3.2000E+01  1.3200E-03
4.8000E+01  9.0100E-04
1.2000E+02  7.2200E-04
7.4400E+02  0.0000E+00
Simulation Parameters:
1
2.4000E+01  0.0000E+00
Output Filename:
C:\Documents and Settings\jlboste\My Documents\QA_FHA cooperGNF2 BC 06-06-
11shinedose.o0
1
1
1
0
0
End of Scenario File
```


RADTRAD Version 3.03 (Spring 2001) run on 8/17/2011 at 15:10:59
#####

Plant Description
#####

Number of Nuclides = 29

Inventory Power = 1.0000E+00 MWth
Plant Power Level = 1.5144E+01 MWth

Number of compartments = 3

Compartment information

Compartment number 1 (Source term fraction = 1.0000E+00
)

Name: primary

Compartment volume = 7.9500E+05 (Cubic feet)

Compartment type is Normal

Pathways into and out of compartment 1

Exit Pathway Number 1: primary to Environment

Compartment number 2

Name: Environment

Compartment type is Environment

Pathways into and out of compartment 2

Inlet Pathway Number 1: primary to Environment

Inlet Pathway Number 4: Control Room to Environment

Exit Pathway Number 2: Environment to Control Room

Exit Pathway Number 3: Environment to Control Room

Compartment number 3

Name: Control Room

Compartment volume = 1.4186E+05 (Cubic feet)

Compartment type is Control Room

Pathways into and out of compartment 3

Inlet Pathway Number 2: Environment to Control Room

Inlet Pathway Number 3: Environment to Control Room

Exit Pathway Number 4: Control Room to Environment

Total number of pathways = 4

 RADTRAD Version 3.03 (Spring 2001) run on 8/17/2011 at 15:10:59
 #####

 Scenario Description
 #####

Time between shutdown and first release = 2.4000E+01 (Hours)

Radioactive Decay is enabled
 Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	5.0000E-02	0.0000E+00	0.0000E+00	1.879E+00
IODINE	2.5000E-04	0.0000E+00	0.0000E+00	1.595E-03
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 15. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
Br-82	2	1.870E+02	1.271E+05	1.300E-13	2.380E-10	3.310E-10
Br-83	2	3.240E+03	8.604E+03	3.820E-16	3.290E-12	2.330E-11
Br-84	2	5.560E+03	1.908E+03	9.410E-14	3.120E-12	2.610E-11
Kr-83m	1	3.250E+03	6.588E+03	1.500E-18	0.000E+00	0.000E+00
Kr-85	1	8.520E+02	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	6.750E+03	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	1.280E+04	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	1.810E+04	1.022E+04	1.020E-13	0.000E+00	0.000E+00
I-128	2	4.330E+02	1.499E+03	4.160E-15	5.340E-11	1.280E-11
I-130	2	1.100E+03	4.450E+04	1.040E-13	1.990E-08	7.140E-10
I-131	2	4.352E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.960E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.480E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.040E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.160E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Xe-129m	1	2.230E-01	6.912E+05	1.060E-15	0.000E+00	0.000E+00
Xe-131m	1	3.040E+02	1.028E+06	3.890E-16	0.000E+00	0.000E+00
Xe-133	1	5.450E+04	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-133m	1	1.730E+03	1.890E+05	1.370E-15	0.000E+00	0.000E+00
Xe-135	1	2.040E+04	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Xe-135m	1	1.100E+04	9.174E+02	2.040E-14	0.000E+00	0.000E+00
Xe-138	1	4.490E+04	8.502E+02	5.770E-14	0.000E+00	0.000E+00

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Br-83	Kr-83m	1.00	none	0.00	none	0.00
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00

Te-129	I-129	1.00	none	0.00	none	0.00
Te-131	I-131	1.00	none	0.00	none	0.00
Te-131m	I-131	0.78	Te-131	0.22	none	0.00
Te-132	I-132	1.00	none	0.00	none	0.00
Te-133	I-133	1.00	none	0.00	none	0.00
Te-133m	I-133	0.87	Te-133	0.13	none	0.00
Te-134	I-134	1.00	none	0.00	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Cs-135	0.00	Xe-135	1.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol	=	9.5000E-01
Elemental	=	4.8500E-02
Organic	=	1.5000E-03

COMPARTMENT DATA

Compartment number	1: primary
Compartment number	2: Environment
Compartment number	3: Control Room

PATHWAY DATA

Pathway number 1: primary to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
2.4250E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
2.4500E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
2.5000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
2.6000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
3.2000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
4.8000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
1.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.4400E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00
2.4017E+01	8.1000E+02	8.9000E+01	8.9000E+01	8.9000E+01

Pathway number 3: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00
2.4017E+01	1.2100E+03	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location EAB is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	5.2000E-04
2.6000E+01	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
2.4000E+01	3.5000E-04
3.2000E+01	1.8000E-04
4.8000E+01	2.3000E-04
7.4400E+02	0.0000E+00

Location LPZ is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	2.9000E-04
3.2000E+01	7.3000E-05
4.8000E+01	2.5000E-05
1.2000E+02	5.2000E-06
7.4400E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
2.4000E+01	3.5000E-04
3.2000E+01	1.8000E-04
4.8000E+01	2.3000E-04
7.4400E+02	0.0000E+00

Location Control Room is in compartment 3

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	4.1500E-03
2.6000E+01	3.2400E-03
3.2000E+01	1.3200E-03
4.8000E+01	9.0100E-04
1.2000E+02	7.2200E-04
7.4400E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
2.4000E+01	3.5000E-04
7.4400E+02	0.0000E+00

Location Occupancy Factor Data

Time (hr)	Occupancy Factor
2.4000E+01	1.0000E+00
4.8000E+01	6.0000E-01
1.2000E+02	4.0000E-01
7.4400E+02	0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS

Time	Time step
0.0000E+00	0.0000E+00

 RADTRAD Version 3.03 (Spring 2001) run on 8/17/2011 at 15:10:59
 #####

```

#####
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
#####

```


 Dose, Detailed model and Detailed Inventory Output
 #####

EAB Doses:

Time (h) =	24.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.7409E-03	2.0624E-01	9.0914E-03
Accumulated dose (rem)		2.7409E-03	2.0624E-01	9.0914E-03

LPZ Doses:

Time (h) =	24.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.5286E-03	1.1502E-01	5.0702E-03
Accumulated dose (rem)		1.5286E-03	1.1502E-01	5.0702E-03

Control Room Doses:

Time (h) =	24.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.2136E-06	3.5446E-03	1.1136E-04
Accumulated dose (rem)		2.2136E-06	3.5446E-03	1.1136E-04

primary Compartment Nuclide Inventory:

Time (h) =	24.0036	Ci	kg	Atoms	Decay
Br-82		4.3917E-01	4.0564E-10	2.9791E+15	1.6071E+11
Br-83		1.1553E-02	7.3128E-13	5.3059E+12	4.2293E+09
Kr-83m		9.1008E+00	4.4110E-10	3.2004E+15	3.3321E+12
Kr-85		6.4108E+02	1.6340E-03	1.1577E+22	2.3459E+14
Kr-85m		1.2386E+02	1.5050E-08	1.0663E+17	4.5333E+13
Kr-87		2.0025E-02	7.0696E-13	4.8935E+12	7.3335E+09
Kr-88		3.8895E+01	3.1019E-09	2.1227E+16	1.4238E+13
I-130		1.0771E+00	5.5227E-10	2.5584E+15	3.9419E+11
I-131		1.5134E+02	1.2207E-06	5.6117E+18	5.5381E+13
I-132		1.2238E+02	1.1856E-08	5.4091E+16	4.4803E+13
I-133		9.4760E+01	8.3650E-08	3.7876E+17	3.4678E+13
I-134		5.1319E-06	1.9237E-16	8.6456E+08	1.8800E+06
I-135		1.5666E+01	4.4610E-09	1.9900E+16	5.7338E+12
Xe-129m		1.5388E-01	1.2162E-09	5.6776E+15	5.6311E+10
Xe-131m		2.3543E+02	2.8107E-06	1.2921E+19	8.6153E+13
Xe-133		3.9541E+04	2.1124E-04	9.5649E+20	1.4470E+16
Xe-133m		1.1720E+03	2.6120E-06	1.1827E+19	4.2889E+14
Xe-135		1.0794E+04	4.2269E-06	1.8855E+19	3.9504E+15
Xe-135m		5.4241E+02	5.9545E-09	2.6562E+16	1.9921E+14

primary Transport Group Inventory:

Time (h) = 24.0036	Atmosphere	Sump
Noble gases (atoms)	1.2577E+22	0.0000E+00
Elemental I (atoms)	2.9440E+17	0.0000E+00
Organic I (atoms)	9.1051E+15	0.0000E+00
Aerosols (kg)	1.2556E-06	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		7.4758E-09
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		8.1017E-09
Total I (Ci)		3.8415E+02

primary to Environment Transport Group Inventory:

	Pathway
Time (h) = 24.0036	Filtered Transported
Noble gases (atoms)	0.0000E+00 7.8346E+19
Elemental I (atoms)	0.0000E+00 1.8339E+15
Organic I (atoms)	0.0000E+00 5.6720E+13
Aerosols (kg)	0.0000E+00 7.8215E-09

Environment Integral Nuclide Release:

Time (h) = 24.0036	Ci	kg	Atoms	Bq
Br-82	2.7357E-03	2.5269E-12	1.8558E+13	1.0122E+08
Br-83	7.1970E-05	4.5557E-15	3.3054E+10	2.6629E+06
Kr-83m	5.6696E-02	2.7480E-12	1.9938E+13	2.0978E+09
Kr-85	3.9935E+00	1.0179E-05	7.2115E+19	1.4776E+11
Kr-85m	7.7157E-01	9.3756E-11	6.6425E+14	2.8548E+10
Kr-87	1.2476E-04	4.4045E-15	3.0488E+10	4.6161E+06
Kr-88	2.4231E-01	1.9324E-11	1.3224E+14	8.9653E+09
I-130	6.7098E-03	3.4403E-12	1.5937E+13	2.4826E+08
I-131	9.4274E-01	7.6043E-09	3.4957E+16	3.4882E+10
I-132	7.6238E-01	7.3859E-11	3.3696E+14	2.8208E+10
I-133	5.9030E-01	5.2109E-10	2.3595E+15	2.1841E+10
I-134	3.1975E-08	1.1986E-18	5.3867E+06	1.1831E+03
I-135	9.7594E-02	2.7790E-11	1.2397E+14	3.6110E+09
Xe-129m	9.5858E-04	7.5761E-12	3.5368E+13	3.5467E+07
Xe-131m	1.4666E+00	1.7509E-08	8.0490E+16	5.4263E+10
Xe-133	2.4631E+02	1.3159E-06	5.9583E+18	9.1135E+12
Xe-133m	7.3008E+00	1.6271E-08	7.3673E+16	2.7013E+11
Xe-135	6.7242E+01	2.6331E-08	1.1746E+17	2.4880E+12
Xe-135m	3.3796E+00	3.7101E-11	1.6550E+14	1.2505E+11

Environment Transport Group Inventory:

	Total	Release
Time (h) = 24.0036	Release	Rate/s
Noble gases (atoms)	7.8346E+19	6.0452E+18
Elemental I (atoms)	1.8339E+15	1.4150E+14
Organic I (atoms)	5.6719E+13	4.3764E+12
Aerosols (kg)	7.8214E-09	6.0350E-10
Dose Effective (Ci) I-131 (Thyroid)		1.0484E+00
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.1361E+00
Total I (Ci)		2.3930E+00

primary to Environment Transport Group Inventory:

	Pathway
Time (h) = 24.0036	Filtered Transported
Noble gases (atoms)	0.0000E+00 7.8346E+19
Elemental I (atoms)	0.0000E+00 1.8339E+15
Organic I (atoms)	0.0000E+00 5.6720E+13
Aerosols (kg)	0.0000E+00 7.8215E-09

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.9640E+17
Elemental I (atoms)	0.0000E+00	1.1620E+13
Organic I (atoms)	0.0000E+00	3.5938E+11
Aerosols (kg)	0.0000E+00	4.9557E-11

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	6.1379E+16
Elemental I (atoms)	0.0000E+00	1.4368E+12
Organic I (atoms)	0.0000E+00	4.4436E+10
Aerosols (kg)	0.0000E+00	6.1277E-12

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	1.0283E+15	0.0000E+00
Elemental I (atoms)	2.4072E+10	0.0000E+00
Organic I (atoms)	7.4449E+08	0.0000E+00
Aerosols (kg)	1.0266E-13	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0036	Ci	kg	Atoms	Decay
Br-82	1.9441E-05	1.7957E-14	1.3188E+11	6.6172E+06
Br-83	5.1141E-07	3.2372E-17	2.3488E+08	1.7413E+05
Kr-83m	4.0286E-04	1.9526E-14	1.4167E+11	1.3719E+08
Kr-85	2.8379E-02	7.2333E-08	5.1247E+17	9.6593E+09
Kr-85m	5.4828E-03	6.6623E-13	4.7202E+12	1.8665E+09
Kr-87	8.8646E-07	3.1295E-17	2.1663E+08	3.0193E+05
Kr-88	1.7218E-03	1.3731E-13	9.3968E+11	5.8623E+08
I-130	4.7682E-05	2.4448E-14	1.1325E+11	1.6231E+07
I-131	6.6994E-03	5.4039E-11	2.4842E+14	2.2803E+09
I-132	5.4173E-03	5.2482E-13	2.3944E+12	1.8446E+09
I-133	4.1948E-03	3.7030E-12	1.6767E+13	1.4278E+09
I-134	2.2718E-10	8.5160E-21	3.8272E+04	7.7403E+01
I-135	6.9352E-04	1.9748E-13	8.8092E+11	2.3608E+08
Xe-129m	6.8119E-06	5.3838E-14	2.5133E+11	2.3186E+06
Xe-131m	1.0422E-02	1.2442E-10	5.7198E+14	3.5473E+09
Xe-133	1.7504E+00	9.3512E-09	4.2341E+16	5.9578E+11
Xe-133m	5.1882E-02	1.1563E-10	5.2354E+14	1.7659E+10
Xe-135	4.7784E-01	1.8711E-10	8.3468E+14	1.6266E+11
Xe-135m	2.4000E-02	2.6347E-13	1.1753E+12	8.1971E+09

Control Room Transport Group Inventory:

Time (h) = 24.0036	Atmosphere	Sump	
Noble gases (atoms)	5.5675E+17	0.0000E+00	
Elemental I (atoms)	1.3032E+13	0.0000E+00	
Organic I (atoms)	4.0306E+11	0.0000E+00	
Aerosols (kg)	5.5581E-11	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.8546E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		2.0099E-12
Total I (Ci)			1.7005E-02

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported

Noble gases (atoms)	0.0000E+00	4.9640E+17
Elemental I (atoms)	0.0000E+00	1.1620E+13
Organic I (atoms)	0.0000E+00	3.5938E+11
Aerosols (kg)	0.0000E+00	4.9557E-11

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	0.0000E+00	6.1379E+16
Elemental I (atoms)	0.0000E+00	1.4368E+12
Organic I (atoms)	0.0000E+00	4.4436E+10
Aerosols (kg)	0.0000E+00	6.1277E-12

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (atoms)	1.0283E+15	0.0000E+00
Elemental I (atoms)	2.4072E+10	0.0000E+00
Organic I (atoms)	7.4449E+08	0.0000E+00
Aerosols (kg)	1.0266E-13	0.0000E+00

EAB Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9889E-02	1.4972E+00	6.5991E-02
Accumulated dose (rem)	2.2630E-02	1.7034E+00	7.5083E-02

LPZ Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1092E-02	8.3498E-01	3.6803E-02
Accumulated dose (rem)	1.2621E-02	9.4999E-01	4.1873E-02

Control Room Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.6952E-05	1.5531E-01	4.8794E-03
Accumulated dose (rem)	9.9165E-05	1.5886E-01	4.9908E-03

primary Compartment Nuclide Inventory:

Time (h) = 24.0170	Ci	kg	Atoms	Decay
Br-82	4.1919E-01	3.8720E-10	2.8436E+15	9.0902E+11
Br-83	1.0987E-02	6.9550E-13	5.0463E+12	2.3879E+10
Kr-83m	8.6453E+00	4.1902E-10	3.0403E+15	1.8802E+13
Kr-85	6.1208E+02	1.5601E-03	1.1053E+22	1.3271E+15
Kr-85m	1.1801E+02	1.4340E-08	1.0160E+17	2.5618E+14
Kr-87	1.8980E-02	6.7007E-13	4.6382E+12	4.1335E+10
Kr-88	3.7015E+01	2.9519E-09	2.0201E+16	8.0413E+13
I-130	1.0276E+00	5.2690E-10	2.4408E+15	2.2291E+12
I-131	1.4449E+02	1.1655E-06	5.3577E+18	3.1328E+14
I-132	1.1638E+02	1.1275E-08	5.1437E+16	2.5294E+14
I-133	9.0434E+01	7.9832E-08	3.6147E+17	1.9613E+14
I-134	4.8482E-06	1.8174E-16	8.1676E+08	1.0580E+07
I-135	1.4937E+01	4.2533E-09	1.8973E+16	3.2413E+13
Xe-129m	1.4691E-01	1.1611E-09	5.4206E+15	3.1854E+11
Xe-131m	2.2478E+02	2.6835E-06	1.2336E+19	4.8736E+14
Xe-133	3.7750E+04	2.0167E-04	9.1317E+20	8.1851E+16
Xe-133m	1.1188E+03	2.4934E-06	1.1290E+19	2.4260E+15
Xe-135	1.0296E+04	4.0318E-06	1.7985E+19	2.2336E+16
Xe-135m	4.9942E+02	5.4826E-09	2.4457E+16	1.1069E+15

primary Transport Group Inventory:

Time (h) =	24.0170	Atmosphere	Sump
Noble gases (atoms)	1.2008E+22	0.0000E+00	
Elemental I (atoms)	2.8105E+17	0.0000E+00	
Organic I (atoms)	8.6923E+15	0.0000E+00	
Aerosols (kg)	1.1987E-06	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)	7.1370E-09	
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	7.7337E-09	
Total I (Ci)		3.6624E+02	

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	24.0170	Filtered Transported
Noble gases (atoms)	0.0000E+00	6.4712E+20
Elemental I (atoms)	0.0000E+00	1.5148E+16
Organic I (atoms)	0.0000E+00	4.6848E+14
Aerosols (kg)	0.0000E+00	6.4603E-08

Environment Integral Nuclide Release:

Time (h) =	24.0170	Ci	kg	Atoms	Bq
Br-82		2.2591E-02	2.0867E-11	1.5325E+14	8.3587E+08
Br-83		5.9239E-04	3.7499E-14	2.7207E+11	2.1919E+07
Kr-83m		4.6619E-01	2.2595E-11	1.6394E+14	1.7249E+10
Kr-85		3.2985E+01	8.4074E-05	5.9565E+20	1.2205E+12
Kr-85m		6.3611E+00	7.7297E-10	5.4764E+15	2.3536E+11
Kr-87		1.0238E-03	3.6143E-14	2.5018E+11	3.7879E+07
Kr-88		1.9955E+00	1.5914E-10	1.0891E+15	7.3835E+10
I-130		5.5384E-02	2.8397E-11	1.3155E+14	2.0492E+09
I-131		7.7865E+00	6.2807E-08	2.8873E+17	2.8810E+11
I-132		6.2747E+00	6.0788E-10	2.7733E+15	2.3216E+11
I-133		4.8738E+00	4.3024E-09	1.9481E+16	1.8033E+11
I-134		2.6161E-07	9.8068E-18	4.4073E+07	9.6797E+03
I-135		8.0509E-01	2.2925E-10	1.0226E+15	2.9788E+10
Xe-129m		7.9173E-03	6.2574E-11	2.9212E+14	2.9294E+08
Xe-131m		1.2113E+01	1.4462E-07	6.6481E+17	4.4819E+11
Xe-133		2.0344E+03	1.0868E-05	4.9211E+19	7.5271E+13
Xe-133m		6.0293E+01	1.3437E-07	6.0843E+17	2.2309E+12
Xe-135		5.5492E+02	2.1730E-07	9.6934E+17	2.0532E+13
Xe-135m		2.7035E+01	2.9679E-10	1.3239E+15	1.0003E+12

Environment Transport Group Inventory:

	Total	Release
Time (h) =	24.0170	Rate/s
Noble gases (atoms)	6.4712E+20	1.0574E+19
Elemental I (atoms)	1.5146E+16	2.4748E+14
Organic I (atoms)	4.6844E+14	7.6542E+12
Aerosols (kg)	6.4596E-08	1.0555E-09
Dose Effective (Ci)	I-131 (Thyroid)	8.6584E+00
Dose Effective (Ci)	I-131 (ICRP2 Thyroid)	9.3825E+00
Total I (Ci)		1.9740E+01

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	24.0170	Filtered Transported
Noble gases (atoms)	0.0000E+00	6.4712E+20
Elemental I (atoms)	0.0000E+00	1.5148E+16
Organic I (atoms)	0.0000E+00	4.6848E+14
Aerosols (kg)	0.0000E+00	6.4603E-08

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.1002E+18
Elemental I (atoms)	0.0000E+00	9.5976E+13
Organic I (atoms)	0.0000E+00	2.9683E+12
Aerosols (kg)	0.0000E+00	4.0933E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.0698E+17
Elemental I (atoms)	0.0000E+00	1.1867E+13
Organic I (atoms)	0.0000E+00	3.6703E+11
Aerosols (kg)	0.0000E+00	5.0612E-11

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	5.4130E+16	0.0000E+00
Elemental I (atoms)	1.2671E+12	0.0000E+00
Organic I (atoms)	3.9187E+10	0.0000E+00
Aerosols (kg)	5.4039E-12	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0170	Ci	kg	Atoms	Decay
Br-82	1.5894E-04	1.4681E-13	1.0782E+12	2.9035E+08
Br-83	4.1660E-06	2.6371E-16	1.9133E+09	7.6243E+06
Kr-83m	3.2779E-03	1.5888E-13	1.1527E+12	6.0027E+09
Kr-85	2.3208E-01	5.9153E-07	4.1909E+18	4.2389E+11
Kr-85m	4.4744E-02	5.4370E-12	3.8521E+13	8.1813E+10
Kr-87	7.1965E-06	2.5406E-16	1.7586E+09	1.3194E+07
Kr-88	1.4035E-02	1.1193E-12	7.6594E+12	2.5677E+10
I-130	3.8964E-04	1.9978E-13	9.2546E+11	7.1195E+08
I-131	5.4784E-02	4.4190E-10	2.0314E+15	1.0007E+11
I-132	4.4125E-02	4.2748E-12	1.9503E+13	8.0762E+10
I-133	3.4289E-02	3.0269E-11	1.3706E+14	6.2643E+10
I-134	1.8382E-09	6.8908E-20	3.0968E+05	3.3759E+03
I-135	5.6635E-03	1.6127E-12	7.1939E+12	1.0352E+10
Xe-129m	5.5704E-05	4.4026E-13	2.0553E+12	1.0175E+08
Xe-131m	8.5226E-02	1.0175E-09	4.6774E+15	1.5567E+11
Xe-133	1.4313E+01	7.6467E-08	3.4624E+17	2.6144E+13
Xe-133m	4.2420E-01	9.4539E-10	4.2807E+15	7.7488E+11
Xe-135	3.9039E+00	1.5287E-09	6.8193E+15	7.1338E+12
Xe-135m	1.8935E-01	2.0787E-12	9.2726E+12	3.5234E+11

Control Room Transport Group Inventory:

Time (h) = 24.0170	Atmosphere	Sump
Noble gases (atoms)	4.5530E+18	0.0000E+00
Elemental I (atoms)	1.0656E+14	0.0000E+00
Organic I (atoms)	3.2958E+12	0.0000E+00
Aerosols (kg)	4.5448E-10	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		1.5165E-11
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		1.6433E-11
Total I (Ci)		1.3886E-01

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.1002E+18
Elemental I (atoms)	0.0000E+00	9.5976E+13
Organic I (atoms)	0.0000E+00	2.9683E+12
Aerosols (kg)	0.0000E+00	4.0933E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.0698E+17
Elemental I (atoms)	0.0000E+00	1.1867E+13
Organic I (atoms)	0.0000E+00	3.6703E+11
Aerosols (kg)	0.0000E+00	5.0612E-11

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (atoms)	5.4130E+16	0.0000E+00
Elemental I (atoms)	1.2671E+12	0.0000E+00
Organic I (atoms)	3.9187E+10	0.0000E+00
Aerosols (kg)	5.4039E-12	0.0000E+00

EAB Doses:

Time (h) = 24.2500	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.2923E-01	1.7463E+01	7.6691E-01
Accumulated dose (rem)	2.5186E-01	1.9167E+01	8.4199E-01

LPZ Doses:

Time (h) = 24.2500	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2784E-01	9.7390E+00	4.2770E-01
Accumulated dose (rem)	1.4046E-01	1.0689E+01	4.6957E-01

Control Room Doses:

Time (h) = 24.2500	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.8949E-03	8.0958E+00	2.5715E-01
Accumulated dose (rem)	7.9941E-03	8.2546E+00	2.6214E-01

primary Compartment Nuclide Inventory:

Time (h) = 24.2500	Ci	kg	Atoms	Decay
Br-82	1.8662E-01	1.7238E-10	1.2659E+15	8.4692E+12
Br-83	4.5928E-03	2.9072E-13	2.1094E+12	2.1652E+11
Kr-83m	3.5402E+00	1.7159E-10	1.2450E+15	1.6900E+14
Kr-85	2.7374E+02	6.9772E-04	4.9433E+21	1.2389E+16
Kr-85m	5.0908E+01	6.1861E-09	4.3827E+16	2.3546E+15
Kr-87	7.4761E-03	2.6393E-13	1.8270E+12	3.6547E+11
Kr-88	1.5639E+01	1.2472E-09	8.5350E+15	7.3250E+14
I-130	4.5362E-01	2.3259E-10	1.0774E+15	2.0692E+13
I-131	6.4565E+01	5.2079E-07	2.3941E+18	2.9235E+15
I-132	4.8518E+01	4.7004E-09	2.1444E+16	2.2910E+15
I-133	4.0132E+01	3.5427E-08	1.6041E+17	1.8248E+15
I-134	1.8034E-06	6.7604E-17	3.0382E+08	9.1325E+07
I-135	6.5190E+00	1.8563E-09	8.2806E+15	2.9941E+14
Xe-129m	6.5649E-02	5.1886E-10	2.4222E+15	2.9726E+12
Xe-131m	1.0047E+02	1.1995E-06	5.5141E+18	4.5485E+15
Xe-133	1.6862E+04	9.0083E-05	4.0789E+20	7.6368E+17
Xe-133m	4.9883E+02	1.1117E-06	5.0337E+18	2.2617E+16

Xe-135	4.5267E+03	1.7726E-06	7.9072E+18	2.0696E+17
Xe-135m	1.1903E+02	1.3067E-09	5.8291E+15	8.0050E+15

primary Transport Group Inventory:

Time (h) = 24.2500	Atmosphere	Sump
Noble gases (atoms)	5.3697E+21	0.0000E+00
Elemental I (atoms)	1.2545E+17	0.0000E+00
Organic I (atoms)	3.8799E+15	0.0000E+00
Aerosols (kg)	5.3502E-07	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		3.1860E-09
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		3.4464E-09
Total I (Ci)		1.5973E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.2811E+21
Elemental I (atoms)	0.0000E+00	1.7035E+17
Organic I (atoms)	0.0000E+00	5.2685E+15
Aerosols (kg)	0.0000E+00	7.2651E-07

Environment Integral Nuclide Release:

Time (h) = 24.2500	Ci	kg	Atoms	Bq
Br-82	2.5363E-01	2.3427E-10	1.7205E+15	9.3842E+09
Br-83	6.4074E-03	4.0559E-13	2.9428E+12	2.3707E+08
Kr-83m	4.9817E+00	2.4146E-10	1.7519E+15	1.8432E+11
Kr-85	3.7133E+02	9.4646E-04	6.7055E+21	1.3739E+13
Kr-85m	7.0095E+01	8.5175E-09	6.0345E+16	2.5935E+12
Kr-87	1.0694E-02	3.7754E-13	2.6133E+12	3.9568E+08
Kr-88	2.1721E+01	1.7322E-09	1.1854E+16	8.0366E+11
I-130	6.1866E-01	3.1721E-10	1.4694E+15	2.2891E+10
I-131	8.7612E+01	7.0670E-07	3.2487E+18	3.2417E+12
I-132	6.7762E+01	6.5647E-09	2.9950E+16	2.5072E+12
I-133	5.4613E+01	4.8210E-08	2.1829E+17	2.0207E+12
I-134	2.6433E-06	9.9085E-17	4.4530E+08	9.7801E+04
I-135	8.9328E+00	2.5436E-09	1.1347E+16	3.3051E+11
Xe-129m	8.9083E-02	7.0407E-10	3.2868E+15	3.2961E+09
Xe-131m	1.3632E+02	1.6275E-06	7.4815E+18	5.0437E+12
Xe-133	2.2885E+04	1.2226E-04	5.5358E+20	8.4673E+14
Xe-133m	6.7751E+02	1.5099E-06	6.8368E+18	2.5068E+13
Xe-135	6.1841E+03	2.4216E-06	1.0802E+19	2.2881E+14
Xe-135m	2.1285E+02	2.3366E-09	1.0423E+16	7.8754E+12

Environment Transport Group Inventory:

Time (h) = 24.2500	Total Release	Release Rate/s
Noble gases (atoms)	7.2843E+21	8.0937E+18
Elemental I (atoms)	1.7031E+17	1.8923E+14
Organic I (atoms)	5.2672E+15	5.8525E+12
Aerosols (kg)	7.2634E-07	8.0704E-10
Dose Effective (Ci) I-131 (Thyroid)		9.7365E+01
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.0540E+02
Total I (Ci)		2.1892E+02

primary to Environment Transport Group Inventory:

Time (h) = 24.2500	Pathway	
	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.2811E+21
Elemental I (atoms)	0.0000E+00	1.7035E+17

Organic I (atoms)	0.0000E+00	5.2685E+15
Aerosols (kg)	0.0000E+00	7.2651E-07

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.4630E+19
Elemental I (atoms)	2.1925E+14	1.2307E+14
Organic I (atoms)	6.7809E+12	3.8064E+12
Aerosols (kg)	9.3508E-10	5.2490E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.7070E+18
Elemental I (atoms)	0.0000E+00	1.3352E+14
Organic I (atoms)	0.0000E+00	4.1295E+12
Aerosols (kg)	0.0000E+00	5.6945E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (atoms)	1.5861E+18	0.0000E+00
Elemental I (atoms)	2.2883E+13	0.0000E+00
Organic I (atoms)	7.0771E+11	0.0000E+00
Aerosols (kg)	9.7592E-11	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 24.2500	Ci	kg	Atoms	Decay
Br-82	3.4708E-04	3.2059E-13	2.3544E+12	9.7642E+09
Br-83	8.5418E-06	5.4070E-16	3.9231E+09	2.4783E+08
Kr-83m	1.2362E-02	5.9916E-13	4.3472E+12	3.3629E+11
Kr-85	9.5589E-01	2.4364E-06	1.7262E+19	2.4953E+13
Kr-85m	1.7777E-01	2.1601E-11	1.5304E+14	4.7191E+12
Kr-87	2.6106E-05	9.2164E-16	6.3796E+09	7.2339E+08
Kr-88	5.4611E-02	4.3552E-12	2.9804E+13	1.4639E+12
I-130	8.4366E-04	4.3257E-13	2.0038E+12	2.3832E+10
I-131	1.2008E-01	9.6859E-10	4.4526E+15	3.3720E+12
I-132	9.0235E-02	8.7419E-12	3.9882E+13	2.6214E+12
I-133	7.4638E-02	6.5888E-11	2.9833E+14	2.1030E+12
I-134	3.3541E-09	1.2573E-19	5.6505E+05	1.0313E+05
I-135	1.2124E-02	3.4524E-12	1.5400E+13	3.4440E+11
Xe-129m	2.2924E-04	1.8118E-12	8.4582E+12	5.9865E+09
Xe-131m	3.5083E-01	4.1885E-09	1.9255E+16	9.1606E+12
Xe-133	5.8881E+01	3.1456E-07	1.4243E+18	1.5379E+15
Xe-133m	1.7419E+00	3.8820E-09	1.7577E+16	4.5535E+13
Xe-135	1.5807E+01	6.1897E-09	2.7611E+16	4.1588E+14
Xe-135m	4.1499E-01	4.5557E-12	2.0322E+13	1.4765E+13

Control Room Transport Group Inventory:

Time (h) = 24.2500	Atmosphere	Sump
Noble gases (atoms)	1.8751E+19	0.0000E+00
Elemental I (atoms)	2.3332E+14	0.0000E+00
Organic I (atoms)	7.2159E+12	0.0000E+00
Aerosols (kg)	9.9505E-10	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	3.3207E-11
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	3.5920E-11
Total I (Ci)		2.9708E-01

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.4630E+19
Elemental I (atoms)	2.1925E+14	1.2307E+14
Organic I (atoms)	6.7809E+12	3.8064E+12
Aerosols (kg)	9.3508E-10	5.2490E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.7070E+18
Elemental I (atoms)	0.0000E+00	1.3352E+14
Organic I (atoms)	0.0000E+00	4.1295E+12
Aerosols (kg)	0.0000E+00	5.6945E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (atoms)	1.5861E+18	0.0000E+00
Elemental I (atoms)	2.2883E+13	0.0000E+00
Organic I (atoms)	7.0771E+11	0.0000E+00
Aerosols (kg)	9.7592E-11	0.0000E+00

EAB Doses:

Time (h) = 24.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0346E-01	8.1549E+00	3.5446E-01
Accumulated dose (rem)	3.5533E-01	2.7321E+01	1.1965E+00

LPZ Doses:

Time (h) = 24.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.7700E-02	4.5479E+00	1.9768E-01
Accumulated dose (rem)	1.9816E-01	1.5237E+01	6.6725E-01

Control Room Doses:

Time (h) = 24.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3856E-02	1.2405E+01	3.9567E-01
Accumulated dose (rem)	2.1850E-02	2.0660E+01	6.5781E-01

primary Compartment Nuclide Inventory:

Time (h) = 24.5000	Ci	kg	Atoms	Decay
Br-82	7.8317E-02	7.2339E-11	5.3127E+14	1.1991E+13
Br-83	1.8014E-03	1.1403E-13	8.2736E+11	3.0065E+11
Kr-83m	1.3583E+00	6.5834E-11	4.7767E+14	2.3322E+14
Kr-85	1.1544E+02	2.9425E-04	2.0847E+21	1.7567E+16
Kr-85m	2.0655E+01	2.5099E-09	1.7782E+16	3.3011E+15
Kr-87	2.7512E-03	9.7129E-14	6.7232E+11	4.9866E+11
Kr-88	6.2050E+00	4.9485E-10	3.3864E+15	1.0204E+15
I-130	1.8864E-01	9.6723E-11	4.4806E+14	2.9219E+13
I-131	2.7205E+01	2.1944E-07	1.0088E+18	4.1443E+15
I-132	1.8976E+01	1.8384E-09	8.3873E+15	3.1787E+15
I-133	1.6784E+01	1.4817E-08	6.7088E+16	2.5810E+15
I-134	6.2415E-07	2.3397E-17	1.0515E+08	1.2261E+08
I-135	2.6781E+00	7.6259E-10	3.4018E+15	4.2129E+14
Xe-129m	2.7661E-02	2.1862E-10	1.0206E+15	4.2139E+12
Xe-131m	4.2345E+01	5.0555E-07	2.3240E+18	6.4484E+15

Xe-133	7.1016E+03	3.7940E-05	1.7179E+20	1.0824E+18
Xe-133m	2.0968E+02	4.6729E-07	2.1159E+18	3.2039E+16
Xe-135	1.8737E+03	7.3371E-07	3.2730E+18	2.9187E+17
Xe-135m	2.5657E+01	2.8166E-10	1.2565E+15	9.7020E+15

primary Transport Group Inventory:

Time (h) =	24.5000	Atmosphere	Sump
Noble gases (atoms)	2.2642E+21	0.0000E+00	
Elemental I (atoms)	5.2798E+16	0.0000E+00	
Organic I (atoms)	1.6329E+15	0.0000E+00	
Aerosols (kg)	2.2517E-07	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)	1.3410E-09	
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	1.4480E-09	
Total I (Ci)		6.5643E+01	

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	24.5000	Filtered Transported
Noble gases (atoms)	0.0000E+00	1.0385E+22
Elemental I (atoms)	0.0000E+00	2.4282E+17
Organic I (atoms)	0.0000E+00	7.5098E+15
Aerosols (kg)	0.0000E+00	1.0356E-06

Environment Integral Nuclide Release:

Time (h) =	24.5000	Ci	kg	Atoms	Bq
Br-82		3.6121E-01	3.3364E-10	2.4503E+15	1.3365E+10
Br-83		8.9459E-03	5.6628E-13	4.1087E+12	3.3100E+08
Kr-83m		6.9118E+00	3.3500E-10	2.4307E+15	2.5574E+11
Kr-85		5.2962E+02	1.3499E-03	9.5641E+21	1.9596E+13
Kr-85m		9.8832E+01	1.2009E-08	8.5085E+16	3.6568E+12
Kr-87		1.4666E-02	5.1776E-13	3.5840E+12	5.4264E+08
Kr-88		3.0426E+01	2.4265E-09	1.6605E+16	1.1258E+12
I-130		8.7869E-01	4.5053E-10	2.0871E+15	3.2512E+10
I-131		1.2493E+02	1.0077E-06	4.6324E+18	4.6223E+12
I-132		9.4532E+01	9.1581E-09	4.1781E+16	3.4977E+12
I-133		7.7700E+01	6.8590E-08	3.1057E+17	2.8749E+12
I-134		3.5659E-06	1.3367E-16	6.0073E+08	1.3194E+05
I-135		1.2641E+01	3.5996E-09	1.6057E+16	4.6773E+11
Xe-129m		1.2703E-01	1.0039E-09	4.6867E+15	4.6999E+09
Xe-131m		1.9439E+02	2.3208E-06	1.0669E+19	7.1926E+12
Xe-133		3.2627E+04	1.7431E-04	7.8925E+20	1.2072E+15
Xe-133m		9.6538E+02	2.1515E-06	9.7417E+18	3.5719E+13
Xe-135		8.7714E+03	3.4348E-06	1.5322E+19	3.2454E+14
Xe-135m		2.5862E+02	2.8391E-09	1.2665E+16	9.5691E+12

Environment Transport Group Inventory:

	Total	Release
Time (h) =	24.5000	Release Rate/s
Noble gases (atoms)	1.0389E+22	5.7718E+18
Elemental I (atoms)	2.4276E+17	1.3487E+14
Organic I (atoms)	7.5080E+15	4.1711E+12
Aerosols (kg)	1.0353E-06	5.7518E-10
Dose Effective (Ci)	I-131 (Thyroid)	1.3879E+02
Dose Effective (Ci)	I-131 (ICRP2 Thyroid)	1.5016E+02
Total I (Ci)		3.0980E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	24.5000	Filtered Transported

Noble gases (atoms)	0.0000E+00	1.0385E+22
Elemental I (atoms)	0.0000E+00	2.4282E+17
Organic I (atoms)	0.0000E+00	7.5098E+15
Aerosols (kg)	0.0000E+00	1.0356E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.9556E+19
Elemental I (atoms)	3.2163E+14	1.3573E+14
Organic I (atoms)	9.9472E+12	4.1977E+12
Aerosols (kg)	1.3717E-09	5.7886E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	8.1396E+18
Elemental I (atoms)	0.0000E+00	1.9033E+14
Organic I (atoms)	0.0000E+00	5.8863E+12
Aerosols (kg)	0.0000E+00	8.1171E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (atoms)	4.3525E+18	0.0000E+00
Elemental I (atoms)	5.5741E+13	0.0000E+00
Organic I (atoms)	1.7239E+12	0.0000E+00
Aerosols (kg)	2.3773E-10	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 24.5000	Ci	kg	Atoms	Decay
Br-82	3.9959E-04	3.6909E-13	2.7106E+12	2.2771E+10
Br-83	9.1913E-06	5.8181E-16	4.2214E+09	5.5724E+08
Kr-83m	1.4001E-02	6.7858E-13	4.9235E+12	8.0533E+11
Kr-85	1.1900E+00	3.0332E-06	2.1490E+19	6.2999E+13
Kr-85m	2.1292E-01	2.5872E-11	1.8330E+14	1.1657E+13
Kr-87	2.8361E-05	1.0012E-15	6.9305E+09	1.6935E+09
Kr-88	6.3963E-02	5.1010E-12	3.4908E+13	3.5713E+12
I-130	9.6248E-04	4.9350E-13	2.2861E+12	5.5304E+10
I-131	1.3880E-01	1.1196E-09	5.1469E+15	7.8812E+12
I-132	9.6821E-02	9.3799E-12	4.2793E+13	5.8854E+12
I-133	8.5636E-02	7.5597E-11	3.4230E+14	4.8953E+12
I-134	3.1845E-09	1.1937E-19	5.3649E+05	2.1733E+05
I-135	1.3664E-02	3.8909E-12	1.7357E+13	7.9390E+11
Xe-129m	2.8514E-04	2.2536E-12	1.0521E+13	1.5107E+10
Xe-131m	4.3651E-01	5.2113E-09	2.3957E+16	2.3120E+13
Xe-133	7.3206E+01	3.9109E-07	1.7708E+18	3.8798E+15
Xe-133m	2.1614E+00	4.8170E-09	2.1811E+16	1.1475E+14
Xe-135	1.9314E+01	7.5632E-09	3.3738E+16	1.0390E+15
Xe-135m	2.6311E-01	2.8884E-12	1.2884E+13	2.6690E+13

Control Room Transport Group Inventory:

Time (h) = 24.5000	Atmosphere	Sump
Noble gases (atoms)	2.3340E+19	0.0000E+00
Elemental I (atoms)	2.6938E+14	0.0000E+00
Organic I (atoms)	8.3315E+12	0.0000E+00
Aerosols (kg)	1.1489E-09	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		3.8344E-11
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		4.1404E-11

Total I (Ci) 3.3492E-01

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.9556E+19
Elemental I (atoms)	3.2163E+14	1.3573E+14
Organic I (atoms)	9.9472E+12	4.1977E+12
Aerosols (kg)	1.3717E-09	5.7886E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	8.1396E+18
Elemental I (atoms)	0.0000E+00	1.9033E+14
Organic I (atoms)	0.0000E+00	5.8863E+12
Aerosols (kg)	0.0000E+00	8.1171E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (atoms)	4.3525E+18	0.0000E+00
Elemental I (atoms)	5.5741E+13	0.0000E+00
Organic I (atoms)	1.7239E+12	0.0000E+00
Aerosols (kg)	2.3773E-10	0.0000E+00

EAB Doses:

Time (h) = 25.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.9936E-02	4.8774E+00	2.1000E-01
Accumulated dose (rem)	4.1526E-01	3.2199E+01	1.4064E+00

LPZ Doses:

Time (h) = 25.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.3426E-02	2.7201E+00	1.1711E-01
Accumulated dose (rem)	2.3159E-01	1.7957E+01	7.8437E-01

Control Room Doses:

Time (h) = 25.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.8653E-02	2.5316E+01	8.0747E-01
Accumulated dose (rem)	5.0503E-02	4.5976E+01	1.4653E+00

primary Compartment Nuclide Inventory:

Time (h) = 25.0000	Ci	kg	Atoms	Decay
Br-82	1.3793E-02	1.2740E-11	9.3565E+13	1.4063E+13
Br-83	2.7714E-04	1.7543E-14	1.2729E+11	3.4602E+11
Kr-83m	1.9995E-01	9.6912E-12	7.0316E+13	2.6690E+14
Kr-85	2.0532E+01	5.2333E-05	3.7077E+20	2.0631E+16
Kr-85m	3.4001E+00	4.1316E-10	2.9272E+15	3.8342E+15
Kr-87	3.7259E-04	1.3154E-14	9.1050E+10	5.6489E+11
Kr-88	9.7680E-01	7.7900E-11	5.3309E+14	1.1780E+15
I-130	3.2623E-02	1.6727E-11	7.7486E+13	3.4175E+13
I-131	4.8297E+00	3.8958E-08	1.7909E+17	4.8660E+15
I-132	2.9029E+00	2.8123E-10	1.2830E+15	3.6556E+15
I-133	2.9358E+00	2.5916E-09	1.1735E+16	3.0239E+15
I-134	7.4759E-08	2.8024E-18	1.2594E+07	1.3702E+08
I-135	4.5198E-01	1.2870E-10	5.7412E+14	4.9103E+14

Xe-129m	4.9108E-03	3.8812E-11	1.8119E+14	4.9477E+12
Xe-131m	7.5222E+00	8.9805E-08	4.1284E+17	7.5721E+15
Xe-133	1.2597E+03	6.7298E-06	3.0472E+19	1.2708E+18
Xe-133m	3.7047E+01	8.2565E-08	3.7385E+17	3.7592E+16
Xe-135	3.2089E+02	1.2565E-07	5.6053E+17	3.4093E+17
Xe-135m	1.2300E+00	1.3503E-11	6.0233E+13	1.0144E+16

primary Transport Group Inventory:

Time (h) = 25.0000	Atmosphere	Sump
Noble gases (atoms)	4.0260E+20	0.0000E+00
Elemental I (atoms)	9.3534E+15	0.0000E+00
Organic I (atoms)	2.8928E+14	0.0000E+00
Aerosols (kg)	3.9889E-08	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		2.3760E-10
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		2.5572E-10
Total I (Ci)		1.1120E+01

primary to Environment Transport Group Inventory:

Time (h) = 25.0000	Pathway	Filtered	Transported
Noble gases (atoms)		0.0000E+00	1.2245E+22
Elemental I (atoms)		0.0000E+00	2.8615E+17
Organic I (atoms)		0.0000E+00	8.8501E+15
Aerosols (kg)		0.0000E+00	1.2204E-06

Environment Integral Nuclide Release:

Time (h) = 25.0000	Ci	kg	Atoms	Bq
Br-82	4.2531E-01	3.9284E-10	2.8851E+15	1.5736E+10
Br-83	1.0331E-02	6.5393E-13	4.7447E+12	3.8223E+08
Kr-83m	7.9351E+00	3.8460E-10	2.7905E+15	2.9360E+11
Kr-85	6.2454E+02	1.5918E-03	1.1278E+22	2.3108E+13
Kr-85m	1.1521E+02	1.4000E-08	9.9187E+16	4.2628E+12
Kr-87	1.6662E-02	5.8822E-13	4.0717E+12	6.1649E+08
Kr-88	3.5247E+01	2.8109E-09	1.9236E+16	1.3041E+12
I-130	1.0318E+00	5.2902E-10	2.4506E+15	3.8175E+10
I-131	1.4728E+02	1.1879E-06	5.4610E+18	5.4492E+12
I-132	1.0908E+02	1.0568E-08	4.8212E+16	4.0360E+12
I-133	9.1392E+01	8.0677E-08	3.6530E+17	3.3815E+12
I-134	3.9945E-06	1.4974E-16	6.7294E+08	1.4780E+05
I-135	1.4790E+01	4.2114E-09	1.8786E+16	5.4722E+11
Xe-129m	1.4975E-01	1.1835E-09	5.5251E+15	5.5406E+09
Xe-131m	2.2919E+02	2.7362E-06	1.2579E+19	8.4800E+12
Xe-133	3.8458E+04	2.0546E-04	9.3031E+20	1.4230E+15
Xe-133m	1.1372E+03	2.5345E-06	1.1476E+19	4.2078E+13
Xe-135	1.0285E+04	4.0274E-06	1.7966E+19	3.8054E+14
Xe-135m	2.7061E+02	2.9708E-09	1.3252E+16	1.0013E+13

Environment Transport Group Inventory:

Time (h) = 25.0000	Total Release	Release Rate/s
Noble gases (atoms)	1.2250E+22	3.4029E+18
Elemental I (atoms)	2.8609E+17	7.9468E+13
Organic I (atoms)	8.8480E+15	2.4578E+12
Aerosols (kg)	1.2201E-06	3.3892E-10
Dose Effective (Ci) I-131 (Thyroid)		1.6356E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.7687E+02
Total I (Ci)		3.6254E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 25.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2245E+22
Elemental I (atoms)	0.0000E+00	2.8615E+17
Organic I (atoms)	0.0000E+00	8.8501E+15
Aerosols (kg)	0.0000E+00	1.2204E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 25.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.2509E+19
Elemental I (atoms)	3.8285E+14	1.4329E+14
Organic I (atoms)	1.1841E+13	4.4318E+12
Aerosols (kg)	1.6328E-09	6.1113E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 25.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.5979E+18
Elemental I (atoms)	0.0000E+00	2.2430E+14
Organic I (atoms)	0.0000E+00	6.9370E+12
Aerosols (kg)	0.0000E+00	9.5659E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 25.0000	Filtered	Transported
Noble gases (atoms)	1.0277E+19	0.0000E+00
Elemental I (atoms)	1.2263E+14	0.0000E+00
Organic I (atoms)	3.7927E+12	0.0000E+00
Aerosols (kg)	5.2300E-10	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 25.0000	Ci	kg	Atoms	Decay
Br-82	3.5836E-04	3.3101E-13	2.4310E+12	4.8239E+10
Br-83	7.2007E-06	4.5580E-16	3.3071E+09	1.1060E+09
Kr-83m	1.0836E-02	5.2519E-13	3.8106E+12	1.6429E+12
Kr-85	1.1129E+00	2.8366E-06	2.0097E+19	1.4102E+14
Kr-85m	1.8429E-01	2.2394E-11	1.5866E+14	2.5099E+13
Kr-87	2.0195E-05	7.1297E-16	4.9352E+09	3.3247E+09
Kr-88	5.2946E-02	4.2224E-12	2.8895E+13	7.5231E+12
I-130	8.4760E-04	4.3459E-13	2.0132E+12	1.1611E+11
I-131	1.2548E-01	1.0122E-09	4.6530E+15	1.6763E+13
I-132	7.5423E-02	7.3069E-12	3.3336E+13	1.1650E+13
I-133	7.6278E-02	6.7335E-11	3.0489E+14	1.0335E+13
I-134	1.9424E-09	7.2811E-20	3.2722E+05	3.8647E+05
I-135	1.1743E-02	3.3439E-12	1.4916E+13	1.6469E+12
Xe-129m	2.6618E-04	2.1037E-12	9.8209E+12	3.3784E+10
Xe-131m	4.0772E-01	4.8677E-09	2.2377E+16	5.1722E+13
Xe-133	6.8279E+01	3.6477E-07	1.6517E+18	8.6730E+15
Xe-133m	2.0081E+00	4.4752E-09	2.0263E+16	2.5600E+14
Xe-135	1.7392E+01	6.8106E-09	3.0381E+16	2.2821E+15
Xe-135m	6.4803E-02	7.1140E-13	3.1734E+12	3.6274E+13

Control Room Transport Group Inventory:

Time (h) = 25.0000	Atmosphere	Sump
Noble gases (atoms)	2.1822E+19	0.0000E+00
Elemental I (atoms)	2.4302E+14	0.0000E+00
Organic I (atoms)	7.5159E+12	0.0000E+00
Aerosols (kg)	1.0364E-09	0.0000E+00

Dose Effective (Ci/cc) I-131 (Thyroid)	3.4595E-11
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)	3.7234E-11
Total I (Ci)	2.8893E-01

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 25.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.2509E+19
Elemental I (atoms)	3.8285E+14	1.4329E+14
Organic I (atoms)	1.1841E+13	4.4318E+12
Aerosols (kg)	1.6328E-09	6.1113E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 25.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.5979E+18
Elemental I (atoms)	0.0000E+00	2.2430E+14
Organic I (atoms)	0.0000E+00	6.9370E+12
Aerosols (kg)	0.0000E+00	9.5659E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 25.0000	Filtered	Transported
Noble gases (atoms)	1.0277E+19	0.0000E+00
Elemental I (atoms)	1.2263E+14	0.0000E+00
Organic I (atoms)	3.7927E+12	0.0000E+00
Aerosols (kg)	5.2300E-10	0.0000E+00

EAB Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1990E-02	1.0173E+00	4.3269E-02
Accumulated dose (rem)	4.2725E-01	3.3216E+01	1.4497E+00

LPZ Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.6866E-03	5.6735E-01	2.4131E-02
Accumulated dose (rem)	2.3828E-01	1.8524E+01	8.0850E-01

Control Room Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.1538E-02	3.7788E+01	1.2032E+00
Accumulated dose (rem)	9.2041E-02	8.3764E+01	2.6684E+00

primary Compartment Nuclide Inventory:

Time (h) = 26.0000	Ci	kg	Atoms	Decay
Br-82	4.2782E-04	3.9516E-13	2.9021E+12	1.4492E+13
Br-83	6.5596E-06	4.1522E-16	3.0127E+09	3.5408E+11
Kr-83m	4.3331E-03	2.1002E-13	1.5238E+12	2.7258E+14
Kr-85	6.4947E-01	1.6554E-06	1.1728E+19	2.1273E+16
Kr-85m	9.2134E-02	1.1196E-11	7.9319E+13	3.9364E+15
Kr-87	6.8334E-06	2.4124E-16	1.6699E+09	5.7508E+11
Kr-88	2.4207E-02	1.9305E-12	1.3211E+13	1.2067E+15
I-130	9.7565E-04	5.0025E-13	2.3174E+12	3.5181E+13
I-131	1.5223E-01	1.2279E-09	5.6447E+15	5.0169E+15
I-132	6.7933E-02	6.5813E-12	3.0025E+13	3.7397E+15
I-133	8.9822E-02	7.9292E-11	3.5903E+14	3.1149E+15

I-134	1.0725E-09	4.0205E-20	1.8069E+05	1.3895E+08
I-135	1.2874E-02	3.6658E-12	1.6353E+13	5.0479E+14
Xe-129m	1.5478E-04	1.2233E-12	5.7107E+12	5.1011E+12
Xe-131m	2.3737E-01	2.8339E-09	1.3028E+16	7.8071E+15
Xe-133	3.9635E+01	2.1174E-07	9.5876E+17	1.3101E+18
Xe-133m	1.1565E+00	2.5775E-09	1.1671E+16	3.8746E+16
Xe-135	9.4070E+00	3.6836E-09	1.6432E+16	3.5077E+17
Xe-135m	4.6897E-03	5.1482E-14	2.2966E+11	1.0166E+16

primary Transport Group Inventory:

Time (h) =	26.0000	Atmosphere	Sump
Noble gases (atoms)	1.2728E+19	0.0000E+00	
Elemental I (atoms)	2.9368E+14	0.0000E+00	
Organic I (atoms)	9.0829E+12	0.0000E+00	
Aerosols (kg)	1.2524E-09	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)	7.4607E-12	
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	7.9850E-12	
Total I (Ci)		3.2286E-01	

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	26.0000	
	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2634E+22
Elemental I (atoms)	0.0000E+00	2.9519E+17
Organic I (atoms)	0.0000E+00	9.1296E+15
Aerosols (kg)	0.0000E+00	1.2589E-06

Environment Integral Nuclide Release:

Time (h) =	26.0000	Ci	kg	Atoms	Bq
Br-82		4.3858E-01	4.0510E-10	2.9751E+15	1.6228E+10
Br-83		1.0576E-02	6.6949E-13	4.8576E+12	3.9133E+08
Kr-83m		8.1079E+00	3.9298E-10	2.8513E+15	2.9999E+11
Kr-85		6.4442E+02	1.6425E-03	1.1637E+22	2.3844E+13
Kr-85m		1.1835E+02	1.4381E-08	1.0189E+17	4.3790E+12
Kr-87		1.6969E-02	5.9906E-13	4.1467E+12	6.2784E+08
Kr-88		3.6125E+01	2.8810E-09	1.9715E+16	1.3366E+12
I-130		1.0628E+00	5.4494E-10	2.5244E+15	3.9324E+10
I-131		1.5195E+02	1.2256E-06	5.6343E+18	5.6220E+12
I-132		1.1165E+02	1.0816E-08	4.9346E+16	4.1309E+12
I-133		9.4206E+01	8.3161E-08	3.7655E+17	3.4856E+12
I-134		4.0520E-06	1.5189E-16	6.8262E+08	1.4992E+05
I-135		1.5214E+01	4.3321E-09	1.9325E+16	5.6290E+11
Xe-129m		1.5450E-01	1.2211E-09	5.7003E+15	5.7164E+09
Xe-131m		2.3647E+02	2.8231E-06	1.2978E+19	8.7493E+12
Xe-133		3.9676E+04	2.1197E-04	9.5977E+20	1.4680E+15
Xe-133m		1.1730E+03	2.6141E-06	1.1836E+19	4.3400E+13
Xe-135		1.0589E+04	4.1463E-06	1.8496E+19	3.9178E+14
Xe-135m		2.7124E+02	2.9777E-09	1.3283E+16	1.0036E+13

Environment Transport Group Inventory:

	Total	Release
Time (h) =	26.0000	
	Release	Rate/s
Noble gases (atoms)	1.2640E+22	1.7556E+18
Elemental I (atoms)	2.9512E+17	4.0989E+13
Organic I (atoms)	9.1275E+15	1.2677E+12
Aerosols (kg)	1.2586E-06	1.7481E-10
Dose Effective (Ci)	I-131 (Thyroid)	1.6873E+02
Dose Effective (Ci)	I-131 (ICRP2 Thyroid)	1.8242E+02
Total I (Ci)		3.7301E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2634E+22
Elemental I (atoms)	0.0000E+00	2.9519E+17
Organic I (atoms)	0.0000E+00	9.1296E+15
Aerosols (kg)	0.0000E+00	1.2589E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3128E+19
Elemental I (atoms)	3.9562E+14	1.4487E+14
Organic I (atoms)	1.2236E+13	4.4806E+12
Aerosols (kg)	1.6872E-09	6.1786E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9033E+18
Elemental I (atoms)	0.0000E+00	2.3138E+14
Organic I (atoms)	0.0000E+00	7.1561E+12
Aerosols (kg)	0.0000E+00	9.8680E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	1.9304E+19	0.0000E+00
Elemental I (atoms)	2.2237E+14	0.0000E+00
Organic I (atoms)	6.8775E+12	0.0000E+00
Aerosols (kg)	9.4835E-10	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 26.0000	Ci	kg	Atoms	Decay
Br-82	2.1927E-04	2.0254E-13	1.4874E+12	8.5407E+10
Br-83	3.3621E-06	2.1282E-16	1.5441E+09	1.7676E+09
Kr-83m	4.6649E-03	2.2610E-13	1.6405E+12	2.6061E+12
Kr-85	6.9954E-01	1.7830E-06	1.2632E+19	2.5812E+14
Kr-85m	9.9238E-02	1.2059E-11	8.5435E+13	4.3173E+13
Kr-87	7.3602E-06	2.5984E-16	1.7986E+09	4.9976E+09
Kr-88	2.6073E-02	2.0793E-12	1.4229E+13	1.2513E+13
I-130	5.0006E-04	2.5640E-13	1.1877E+12	2.0256E+11
I-131	7.8023E-02	6.2934E-10	2.8931E+15	2.9874E+13
I-132	3.4818E-02	3.3732E-12	1.5389E+13	1.8546E+13
I-133	4.6038E-02	4.0640E-11	1.8402E+14	1.8197E+13
I-134	5.4972E-10	2.0607E-20	9.2609E+04	5.3132E+05
I-135	6.5984E-03	1.8789E-12	8.3814E+12	2.8185E+12
Xe-129m	1.6671E-04	1.3176E-12	6.1510E+12	6.1746E+10
Xe-131m	2.5567E-01	3.0523E-09	1.4032E+16	9.4575E+13
Xe-133	4.2690E+01	2.2807E-07	1.0327E+18	1.5840E+16
Xe-133m	1.2457E+00	2.7762E-09	1.2570E+16	4.6601E+14
Xe-135	1.0131E+01	3.9673E-09	1.7697E+16	4.0495E+15
Xe-135m	3.7836E-03	4.1536E-14	1.8528E+11	3.8944E+13

Control Room Transport Group Inventory:

Time (h) =	26.0000	Atmosphere	Sump
Noble gases (atoms)	1.3710E+19	0.0000E+00	
Elemental I (atoms)	1.5052E+14	0.0000E+00	

Organic I (atoms)	4.6554E+12	0.0000E+00
Aerosols (kg)	6.4191E-10	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		2.1430E-11
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		2.2936E-11
Total I (Ci)		1.6548E-01

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3128E+19
Elemental I (atoms)	3.9562E+14	1.4487E+14
Organic I (atoms)	1.2236E+13	4.4806E+12
Aerosols (kg)	1.6872E-09	6.1786E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9033E+18
Elemental I (atoms)	0.0000E+00	2.3138E+14
Organic I (atoms)	0.0000E+00	7.1561E+12
Aerosols (kg)	0.0000E+00	9.8680E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (atoms)	1.9304E+19	0.0000E+00
Elemental I (atoms)	2.2237E+14	0.0000E+00
Organic I (atoms)	6.8775E+12	0.0000E+00
Aerosols (kg)	9.4835E-10	0.0000E+00

EAB Doses:

Time (h) = 32.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2725E-01	3.3216E+01	1.4497E+00

LPZ Doses:

Time (h) = 32.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0406E-04	1.8394E-02	7.6905E-04
Accumulated dose (rem)	2.3848E-01	1.8543E+01	8.0927E-01

Control Room Doses:

Time (h) = 32.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.3360E-02	5.3874E+01	1.7067E+00
Accumulated dose (rem)	1.4540E-01	1.3764E+02	4.3752E+00

primary Compartment Nuclide Inventory:

Time (h) = 32.0000	Ci	kg	Atoms	Decay
Kr-85	6.5058E-10	1.6582E-15	1.1748E+10	2.1294E+16
Kr-85m	3.6477E-11	4.4325E-21	3.1403E+04	3.9392E+15
I-131	1.4924E-10	1.2038E-18	5.5340E+06	5.0218E+15
I-133	7.3674E-11	6.5036E-20	2.9448E+05	3.1178E+15
Xe-131m	2.3437E-10	2.7981E-18	1.2863E+07	7.8148E+15
Xe-133	3.8453E-08	2.0543E-16	9.3017E+08	1.3114E+18
Xe-133m	1.0705E-09	2.3858E-18	1.0803E+07	3.8783E+16
Xe-135	5.9672E-09	2.3367E-18	1.0424E+07	3.5107E+17

primary Transport Group Inventory:

Time (h) =	32.0000	Atmosphere	Sump
Noble gases (atoms)	1.2713E+10	0.0000E+00	
Elemental I (atoms)	2.8355E+05	0.0000E+00	
Organic I (atoms)	8.7696E+03	0.0000E+00	
Aerosols (kg)	1.2090E-18	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)	7.1860E-21	
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	7.5476E-21	
Total I (Ci)		2.4095E-10	

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	32.0000	Filtered Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9548E+17
Organic I (atoms)	0.0000E+00	9.1386E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment Integral Nuclide Release:

Time (h) =	32.0000	Ci	kg	Atoms	Bq
Br-82		4.3901E-01	4.0550E-10	2.9780E+15	1.6243E+10
Br-83		1.0582E-02	6.6987E-13	4.8603E+12	3.9155E+08
Kr-83m		8.1117E+00	3.9316E-10	2.8526E+15	3.0013E+11
Kr-85		6.4507E+02	1.6442E-03	1.1649E+22	2.3868E+13
Kr-85m		1.1844E+02	1.4392E-08	1.0197E+17	4.3823E+12
Kr-87		1.6974E-02	5.9926E-13	4.1481E+12	6.2805E+08
Kr-88		3.6147E+01	2.8828E-09	1.9728E+16	1.3375E+12
I-130		1.0638E+00	5.4543E-10	2.5267E+15	3.9360E+10
I-131		1.5210E+02	1.2269E-06	5.6399E+18	5.6277E+12
I-132		1.1171E+02	1.0822E-08	4.9373E+16	4.1332E+12
I-133		9.4294E+01	8.3239E-08	3.7690E+17	3.4889E+12
I-134		4.0528E-06	1.5192E-16	6.8277E+08	1.4995E+05
I-135		1.5226E+01	4.3356E-09	1.9341E+16	5.6336E+11
Xe-129m		1.5465E-01	1.2223E-09	5.7060E+15	5.7221E+09
Xe-131m		2.3670E+02	2.8260E-06	1.2991E+19	8.7581E+12
Xe-133		3.9716E+04	2.1218E-04	9.6073E+20	1.4695E+15
Xe-133m		1.1741E+03	2.6167E-06	1.1848E+19	4.3442E+13
Xe-135		1.0598E+04	4.1499E-06	1.8512E+19	3.9211E+14
Xe-135m		2.7125E+02	2.9777E-09	1.3283E+16	1.0036E+13

Environment Transport Group Inventory:

	Total	Release
Time (h) =	32.0000	Release Rate/s
Noble gases (atoms)	1.2653E+22	4.3934E+17
Elemental I (atoms)	2.9542E+17	1.0257E+13
Organic I (atoms)	9.1366E+15	3.1724E+11
Aerosols (kg)	1.2599E-06	4.3746E-11
Dose Effective (Ci)	I-131 (Thyroid)	1.6890E+02
Dose Effective (Ci)	I-131 (ICRP2 Thyroid)	1.8260E+02
Total I (Ci)		3.7333E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) =	32.0000	Filtered Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9548E+17
Organic I (atoms)	0.0000E+00	9.1386E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3143E+19
Elemental I (atoms)	3.9594E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6886E-09	6.1803E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1616E+12
Aerosols (kg)	0.0000E+00	9.8756E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	3.2389E+19	0.0000E+00
Elemental I (atoms)	3.6461E+14	0.0000E+00
Organic I (atoms)	1.1277E+13	0.0000E+00
Aerosols (kg)	1.5549E-09	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 32.0000	Ci	kg	Atoms	Decay
Br-82	9.0574E-06	8.3661E-15	6.1441E+10	1.3684E+11
Br-83	2.7420E-08	1.7357E-18	1.2594E+07	2.3083E+09
Kr-83m	2.2394E-05	1.0854E-15	7.8752E+09	3.2841E+12
Kr-85	3.2517E-02	8.2881E-08	5.8720E+17	4.2763E+14
Kr-85m	1.8232E-03	2.2154E-13	1.5696E+12	6.2180E+13
Kr-87	1.2998E-08	4.5888E-19	3.1764E+06	5.9014E+09
Kr-88	2.8024E-04	2.2349E-14	1.5294E+11	1.6951E+13
I-130	1.6599E-05	8.5108E-15	3.9425E+10	3.1326E+11
I-131	3.5485E-03	2.8623E-11	1.3158E+14	4.8663E+13
I-132	2.6528E-04	2.5700E-14	1.1725E+11	2.4070E+13
I-133	1.7517E-03	1.5463E-12	7.0017E+12	2.8760E+13
I-135	1.6344E-04	4.6541E-14	2.0761E+11	4.1752E+12
Xe-129m	7.5835E-06	5.9936E-14	2.7980E+11	1.0190E+11
Xe-131m	1.1713E-02	1.3984E-10	6.4287E+14	1.5628E+14
Xe-133	1.9218E+00	1.0267E-08	4.6489E+16	2.6093E+16
Xe-133m	5.3501E-02	1.1923E-10	5.3988E+14	7.6137E+14
Xe-135	2.9813E-01	1.1674E-10	5.2077E+14	6.2244E+15
Xe-135m	2.9132E-05	3.1980E-16	1.4266E+09	3.9262E+13

Control Room Transport Group Inventory:

Time (h) = 32.0000	Atmosphere	Sump
Noble gases (atoms)	6.3539E+17	0.0000E+00
Elemental I (atoms)	6.7419E+12	0.0000E+00
Organic I (atoms)	2.0851E+11	0.0000E+00
Aerosols (kg)	2.8745E-11	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		9.5752E-13
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		1.0057E-12
Total I (Ci)		5.7289E-03

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported

Noble gases (atoms)	0.0000E+00	2.3143E+19
Elemental I (atoms)	3.9594E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6886E-09	6.1803E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1616E+12
Aerosols (kg)	0.0000E+00	9.8756E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (atoms)	3.2389E+19	0.0000E+00
Elemental I (atoms)	3.6461E+14	0.0000E+00
Organic I (atoms)	1.1277E+13	0.0000E+00
Aerosols (kg)	1.5549E-09	0.0000E+00

EAB Doses:

Time (h) = 48.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2725E-01	3.3216E+01	1.4497E+00

LPZ Doses:

Time (h) = 48.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.7490E-14	2.2939E-12	1.0774E-13
Accumulated dose (rem)	2.3848E-01	1.8543E+01	8.0927E-01

Control Room Doses:

Time (h) = 48.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9301E-03	2.5239E+00	7.9199E-02
Accumulated dose (rem)	1.4733E-01	1.4016E+02	4.4544E+00

primary Compartment Nuclide Inventory:

Time (h) = 48.0000	Ci	kg	Atoms	Decay
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primary Transport Group Inventory:

Time (h) = 48.0000	Atmosphere	Sump
Noble gases (atoms)	1.2684E-14	0.0000E+00
Elemental I (atoms)	2.6322E-19	0.0000E+00
Organic I (atoms)	8.1409E-21	0.0000E+00
Aerosols (kg)	1.1220E-42	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	6.6113E-45
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	6.8092E-45
Total I (Ci)		1.8638E-34

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9548E+17
Organic I (atoms)	0.0000E+00	9.1386E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment Integral Nuclide Release:

Time (h) = 48.0000	Ci	kg	Atoms	Bq
Br-82	4.3901E-01	4.0550E-10	2.9780E+15	1.6243E+10
Br-83	1.0582E-02	6.6987E-13	4.8603E+12	3.9155E+08
Kr-83m	8.1117E+00	3.9316E-10	2.8526E+15	3.0013E+11
Kr-85	6.4507E+02	1.6442E-03	1.1649E+22	2.3868E+13
Kr-85m	1.1844E+02	1.4392E-08	1.0197E+17	4.3823E+12
Kr-87	1.6974E-02	5.9926E-13	4.1481E+12	6.2805E+08
Kr-88	3.6147E+01	2.8828E-09	1.9728E+16	1.3375E+12
I-130	1.0638E+00	5.4543E-10	2.5267E+15	3.9360E+10
I-131	1.5210E+02	1.2269E-06	5.6399E+18	5.6277E+12
I-132	1.1171E+02	1.0822E-08	4.9373E+16	4.1332E+12
I-133	9.4294E+01	8.3239E-08	3.7690E+17	3.4889E+12
I-134	4.0528E-06	1.5192E-16	6.8277E+08	1.4995E+05
I-135	1.5226E+01	4.3356E-09	1.9341E+16	5.6336E+11
Xe-129m	1.5465E-01	1.2223E-09	5.7060E+15	5.7221E+09
Xe-131m	2.3670E+02	2.8260E-06	1.2991E+19	8.7581E+12
Xe-133	3.9716E+04	2.1218E-04	9.6073E+20	1.4695E+15
Xe-133m	1.1741E+03	2.6167E-06	1.1848E+19	4.3442E+13
Xe-135	1.0598E+04	4.1499E-06	1.8512E+19	3.9211E+14
Xe-135m	2.7125E+02	2.9777E-09	1.3283E+16	1.0036E+13

Environment Transport Group Inventory:

Time (h) = 48.0000	Total Release	Release Rate/s
Noble gases (atoms)	1.2653E+22	1.4645E+17
Elemental I (atoms)	2.9542E+17	3.4192E+12
Organic I (atoms)	9.1366E+15	1.0575E+11
Aerosols (kg)	1.2599E-06	1.4582E-11
Dose Effective (Ci) I-131 (Thyroid)		1.6890E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.8260E+02
Total I (Ci)		3.7333E+02

primary to Environment Transport Group Inventory:

Time (h) = 48.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9548E+17
Organic I (atoms)	0.0000E+00	9.1386E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment to Control Room Transport Group Inventory:

Time (h) = 48.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3143E+19
Elemental I (atoms)	3.9594E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6886E-09	6.1803E-10

Environment to Control Room Transport Group Inventory:

Time (h) = 48.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1616E+12
Aerosols (kg)	0.0000E+00	9.8756E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	3.3023E+19	0.0000E+00
Elemental I (atoms)	3.7128E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5833E-09	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 48.0000	Ci	kg	Atoms	Decay
Br-82	1.8382E-09	1.6979E-18	1.2470E+07	1.3902E+11
Kr-85	9.0344E-06	2.3027E-11	1.6315E+14	4.3573E+14
Kr-85m	4.2615E-08	5.1783E-18	3.6688E+07	6.2532E+13
Kr-88	1.5683E-09	1.2507E-19	8.5591E+05	1.6998E+13
I-130	1.8804E-09	9.6412E-19	4.4662E+06	3.1700E+11
I-131	9.3095E-07	7.5092E-15	3.4520E+10	4.9541E+13
I-132	5.9350E-10	5.7498E-20	2.6232E+05	2.4112E+13
I-133	2.8559E-07	2.5211E-16	1.1415E+09	2.9171E+13
I-135	8.4830E-09	2.4155E-18	1.0775E+07	4.2092E+12
Xe-129m	1.9890E-09	1.5720E-17	7.3385E+07	1.0378E+11
Xe-131m	3.1313E-06	3.7383E-14	1.7185E+11	1.5919E+14
Xe-133	4.9015E-04	2.6186E-12	1.1857E+13	2.6567E+16
Xe-133m	1.2038E-05	2.6828E-14	1.2148E+11	7.7438E+14
Xe-135	2.4469E-05	9.5819E-15	4.2743E+10	6.2894E+15
Xe-135m	3.9371E-09	4.3221E-20	1.9280E+05	3.9267E+13

Control Room Transport Group Inventory:

Time (h) = 48.0000	Atmosphere	Sump
Noble gases (atoms)	1.7534E+14	0.0000E+00
Elemental I (atoms)	1.7310E+09	0.0000E+00
Organic I (atoms)	5.3535E+07	0.0000E+00
Aerosols (kg)	7.3781E-15	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		2.4365E-16
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		2.5094E-16
Total I (Ci)		1.2256E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3143E+19
Elemental I (atoms)	3.9594E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6886E-09	6.1803E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1616E+12
Aerosols (kg)	0.0000E+00	9.8756E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (atoms)	3.3023E+19	0.0000E+00
Elemental I (atoms)	3.7128E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00

Aerosols (kg) 1.5833E-09 0.0000E+00

EAB Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2725E-01	3.3216E+01	1.4497E+00

LPZ Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.5651E-39	9.2457E-37	3.5811E-38
Accumulated dose (rem)	2.3848E-01	1.8543E+01	8.0927E-01

Control Room Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9892E-07	3.9442E-04	1.2247E-05
Accumulated dose (rem)	1.4733E-01	1.4016E+02	4.4544E+00

primary Compartment Nuclide Inventory:

Time (h) = 120.0000	Ci	kg	Atoms	Decay
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primary Transport Group Inventory:

Time (h) = 120.0000	Atmosphere	Sump
Noble gases (atoms)	1.2655-122	0.0000E+00
Elemental I (atoms)	2.0156-127	0.0000E+00
Organic I (atoms)	6.2338-129	0.0000E+00
Aerosols (kg)	8.5885-151	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		4.9885-153
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		5.0065-153
Total I (Ci)		1.1566-142

primary to Environment Transport Group Inventory:

	Pathway
Time (h) = 120.0000	Filtered Transported
Noble gases (atoms)	0.0000E+00 1.2647E+22
Elemental I (atoms)	0.0000E+00 2.9548E+17
Organic I (atoms)	0.0000E+00 9.1386E+15
Aerosols (kg)	0.0000E+00 1.2602E-06

Environment Integral Nuclide Release:

Time (h) = 120.0000	Ci	kg	Atoms	Bq
Br-82	4.3901E-01	4.0550E-10	2.9780E+15	1.6243E+10
Br-83	1.0582E-02	6.6987E-13	4.8603E+12	3.9155E+08
Kr-83m	8.1117E+00	3.9316E-10	2.8526E+15	3.0013E+11
Kr-85	6.4507E+02	1.6442E-03	1.1649E+22	2.3868E+13
Kr-85m	1.1844E+02	1.4392E-08	1.0197E+17	4.3823E+12
Kr-87	1.6974E-02	5.9926E-13	4.1481E+12	6.2805E+08
Kr-88	3.6147E+01	2.8828E-09	1.9728E+16	1.3375E+12
I-130	1.0638E+00	5.4543E-10	2.5267E+15	3.9360E+10
I-131	1.5210E+02	1.2269E-06	5.6399E+18	5.6277E+12
I-132	1.1171E+02	1.0822E-08	4.9373E+16	4.1332E+12
I-133	9.4294E+01	8.3239E-08	3.7690E+17	3.4889E+12
I-134	4.0528E-06	1.5192E-16	6.8277E+08	1.4995E+05
I-135	1.5226E+01	4.3356E-09	1.9341E+16	5.6336E+11
Xe-129m	1.5465E-01	1.2223E-09	5.7060E+15	5.7221E+09
Xe-131m	2.3670E+02	2.8260E-06	1.2991E+19	8.7581E+12
Xe-133	3.9716E+04	2.1218E-04	9.6073E+20	1.4695E+15
Xe-133m	1.1741E+03	2.6167E-06	1.1848E+19	4.3442E+13

Xe-135	1.0598E+04	4.1499E-06	1.8512E+19	3.9211E+14
Xe-135m	2.7125E+02	2.9777E-09	1.3283E+16	1.0036E+13

Environment Transport Group Inventory:

	Total	Release
Time (h) = 120.0000	Release	Rate/s
Noble gases (atoms)	1.2653E+22	3.6612E+16
Elemental I (atoms)	2.9542E+17	8.5479E+11
Organic I (atoms)	9.1366E+15	2.6437E+10
Aerosols (kg)	1.2599E-06	3.6455E-12
Dose Effective (Ci) I-131 (Thyroid)		1.6890E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.8260E+02
Total I (Ci)		3.7333E+02

primary to Environment Transport Group Inventory:

	Pathway
Time (h) = 120.0000	Filtered Transported
Noble gases (atoms)	0.0000E+00 1.2647E+22
Elemental I (atoms)	0.0000E+00 2.9548E+17
Organic I (atoms)	0.0000E+00 9.1386E+15
Aerosols (kg)	0.0000E+00 1.2602E-06

Environment to Control Room Transport Group Inventory:

	Pathway
Time (h) = 120.0000	Filtered Transported
Noble gases (atoms)	0.0000E+00 2.3143E+19
Elemental I (atoms)	3.9594E+14 1.4491E+14
Organic I (atoms)	1.2246E+13 4.4818E+12
Aerosols (kg)	1.6886E-09 6.1803E-10

Environment to Control Room Transport Group Inventory:

	Pathway
Time (h) = 120.0000	Filtered Transported
Noble gases (atoms)	0.0000E+00 9.9111E+18
Elemental I (atoms)	0.0000E+00 2.3156E+14
Organic I (atoms)	0.0000E+00 7.1616E+12
Aerosols (kg)	0.0000E+00 9.8756E-10

Control Room to Environment Transport Group Inventory:

	Pathway
Time (h) = 120.0000	Filtered Transported
Noble gases (atoms)	3.3024E+19 0.0000E+00
Elemental I (atoms)	3.7128E+14 0.0000E+00
Organic I (atoms)	1.1483E+13 0.0000E+00
Aerosols (kg)	1.5833E-09 0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 120.0000	Ci	kg	Atoms	Decay
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Control Room Transport Group Inventory:

Time (h) = 120.0000	Atmosphere	Sump
Noble gases (atoms)	1.7022E-02	0.0000E+00
Elemental I (atoms)	1.2898E-07	0.0000E+00
Organic I (atoms)	3.9890E-09	0.0000E+00
Aerosols (kg)	5.4958E-31	0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)		1.7889E-32
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)		1.7954E-32

Total I (Ci) 7.4009E-23

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3143E+19
Elemental I (atoms)	3.9594E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6886E-09	6.1803E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1616E+12
Aerosols (kg)	0.0000E+00	9.8756E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7128E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5833E-09	0.0000E+00

EAB Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2725E-01	3.3216E+01	1.4497E+00

LPZ Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	2.3848E-01	1.8543E+01	8.0927E-01

Control Room Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.6446E-24	1.9339E-20	5.9567E-22
Accumulated dose (rem)	1.4733E-01	1.4016E+02	4.4544E+00

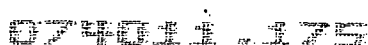
primary Compartment Nuclide Inventory:

Time (h) = 744.0000	Ci	kg	Atoms	Decay
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primary Transport Group Inventory:

Time (h) = 744.0000	Atmosphere	Sump
Noble gases (atoms)	1.2013-122	0.0000E+00
Elemental I (atoms)	2.1340-128	0.0000E+00
Organic I (atoms)	6.5999-130	0.0000E+00
Aerosols (kg)	9.0927-152	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	5.2710-154
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	5.2710-154
Total I (Ci)		1.1866-143

primary to Environment Transport Group Inventory:



	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9548E+17
Organic I (atoms)	0.0000E+00	9.1386E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment Integral Nuclide Release:

Time (h) = 744.0000	Ci	kg	Atoms	Bq
Br-82	4.3901E-01	4.0550E-10	2.9780E+15	1.6243E+10
Br-83	1.0582E-02	6.6987E-13	4.8603E+12	3.9155E+08
Kr-83m	8.1117E+00	3.9316E-10	2.8526E+15	3.0013E+11
Kr-85	6.4507E+02	1.6442E-03	1.1649E+22	2.3868E+13
Kr-85m	1.1844E+02	1.4392E-08	1.0197E+17	4.3823E+12
Kr-87	1.6974E-02	5.9926E-13	4.1481E+12	6.2805E+08
Kr-88	3.6147E+01	2.8828E-09	1.9728E+16	1.3375E+12
I-130	1.0638E+00	5.4543E-10	2.5267E+15	3.9360E+10
I-131	1.5210E+02	1.2269E-06	5.6399E+18	5.6277E+12
I-132	1.1171E+02	1.0822E-08	4.9373E+16	4.1332E+12
I-133	9.4294E+01	8.3239E-08	3.7690E+17	3.4889E+12
I-134	4.0528E-06	1.5192E-16	6.8277E+08	1.4995E+05
I-135	1.5226E+01	4.3356E-09	1.9341E+16	5.6336E+11
Xe-129m	1.5465E-01	1.2223E-09	5.7060E+15	5.7221E+09
Xe-131m	2.3670E+02	2.8260E-06	1.2991E+19	8.7581E+12
Xe-133	3.9716E+04	2.1218E-04	9.6073E+20	1.4695E+15
Xe-133m	1.1741E+03	2.6167E-06	1.1848E+19	4.3442E+13
Xe-135	1.0598E+04	4.1499E-06	1.8512E+19	3.9211E+14
Xe-135m	2.7125E+02	2.9777E-09	1.3283E+16	1.0036E+13

Environment Transport Group Inventory:

Time (h) = 744.0000	Total Release	Release Rate/s
Noble gases (atoms)	1.2653E+22	4.8816E+15
Elemental I (atoms)	2.9542E+17	1.1397E+11
Organic I (atoms)	9.1366E+15	3.5249E+09
Aerosols (kg)	1.2599E-06	4.8607E-13
Dose Effective (Ci) I-131 (Thyroid)		1.6890E+02
Dose Effective (Ci) I-131 (ICRP2 Thyroid)		1.8260E+02
Total I (Ci)		3.7333E+02

primary to Environment Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2647E+22
Elemental I (atoms)	0.0000E+00	2.9548E+17
Organic I (atoms)	0.0000E+00	9.1386E+15
Aerosols (kg)	0.0000E+00	1.2602E-06

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3143E+19
Elemental I (atoms)	3.9594E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6886E-09	6.1803E-10

Environment to Control Room Transport Group Inventory:

Pathway

Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1616E+12
Aerosols (kg)	0.0000E+00	9.8756E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7128E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5833E-09	0.0000E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 744.0000	Ci	kg	Atoms	Decay
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Control Room Transport Group Inventory:

Time (h) = 744.0000	Atmosphere	Sump
Noble gases (atoms)	3.2983-141	0.0000E+00
Elemental I (atoms)	2.7872-147	0.0000E+00
Organic I (atoms)	8.6202-149	0.0000E+00
Aerosols (kg)	1.1876-170	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	3.8581-172
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	3.8581-172
Total I (Ci)		1.5498-162

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.3143E+19
Elemental I (atoms)	3.9594E+14	1.4491E+14
Organic I (atoms)	1.2246E+13	4.4818E+12
Aerosols (kg)	1.6886E-09	6.1803E-10

Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9111E+18
Elemental I (atoms)	0.0000E+00	2.3156E+14
Organic I (atoms)	0.0000E+00	7.1616E+12
Aerosols (kg)	0.0000E+00	9.8756E-10

Control Room to Environment Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (atoms)	3.3024E+19	0.0000E+00
Elemental I (atoms)	3.7128E+14	0.0000E+00
Organic I (atoms)	1.1483E+13	0.0000E+00
Aerosols (kg)	1.5833E-09	0.0000E+00

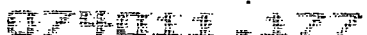
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 I-131 Summary
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primary

Environment

Control Room



Time (hr)	I-131 (Curies)	I-131 (Curies)	I-131 (Curies)
24.000	2.3478E+01	2.2530E-02	1.6036E-04
24.004	1.5134E+02	9.4274E-01	6.6994E-03
24.017	1.4449E+02	7.7865E+00	5.4784E-02
24.250	6.4565E+01	8.7612E+01	1.2008E-01
24.500	2.7205E+01	1.2493E+02	1.3880E-01
24.800	9.6430E+00	1.4247E+02	1.3429E-01
25.000	4.8297E+00	1.4728E+02	1.2548E-01
25.300	1.7120E+00	1.5039E+02	1.1024E-01
25.600	6.0683E-01	1.5149E+02	9.5413E-02
25.900	2.1510E-01	1.5188E+02	8.2088E-02
26.000	1.5223E-01	1.5195E+02	7.8023E-02
26.300	5.3959E-02	1.5205E+02	6.6913E-02
26.600	1.9126E-02	1.5208E+02	5.7352E-02
26.900	6.7796E-03	1.5209E+02	4.9144E-02
27.200	2.4031E-03	1.5210E+02	4.2108E-02
27.500	8.5181E-04	1.5210E+02	3.6077E-02
27.800	3.0193E-04	1.5210E+02	3.0909E-02
28.100	1.0702E-04	1.5210E+02	2.6481E-02
28.400	3.7936E-05	1.5210E+02	2.2688E-02
28.700	1.3447E-05	1.5210E+02	1.9438E-02
29.000	4.7664E-06	1.5210E+02	1.6653E-02
29.300	1.6895E-06	1.5210E+02	1.4268E-02
29.600	5.9887E-07	1.5210E+02	1.2224E-02
29.900	2.1228E-07	1.5210E+02	1.0473E-02
30.200	7.5244E-08	1.5210E+02	8.9727E-03
30.500	2.6671E-08	1.5210E+02	7.6873E-03
30.800	9.4540E-09	1.5210E+02	6.5861E-03
31.100	3.3511E-09	1.5210E+02	5.6427E-03
31.400	1.1878E-09	1.5210E+02	4.8343E-03
31.700	4.2104E-10	1.5210E+02	4.1418E-03
32.000	1.4924E-10	1.5210E+02	3.5485E-03
32.300	5.2901E-11	1.5210E+02	3.0402E-03
32.600	1.8751E-11	1.5210E+02	2.6047E-03
32.900	6.6467E-12	1.5210E+02	2.2316E-03
33.200	2.3560E-12	1.5210E+02	1.9119E-03
33.500	8.3511E-13	1.5210E+02	1.6380E-03
33.800	2.9602E-13	1.5210E+02	1.4034E-03
34.100	1.0493E-13	1.5210E+02	1.2023E-03
34.400	3.7192E-14	1.5210E+02	1.0301E-03
48.000	1.4157E-34	1.5210E+02	9.3095E-07
120.000	1.1163E-142	1.5210E+02	7.1432E-23
744.000	1.1866E-143	1.5210E+02	1.5498E-162

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Cumulative Dose Summary

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Time (hr)	EAB		LPZ		Control Room	
	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
24.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
24.004	2.0624E-01	9.0914E-03	1.1502E-01	5.0702E-03	3.5446E-03	1.1136E-04
24.017	1.7034E+00	7.5083E-02	9.4999E-01	4.1873E-02	1.5886E-01	4.9908E-03
24.250	1.9167E+01	8.4199E-01	1.0689E+01	4.6957E-01	8.2546E+00	2.6214E-01
24.500	2.7321E+01	1.1965E+00	1.5237E+01	6.6725E-01	2.0660E+01	6.5781E-01
24.800	3.1150E+01	1.3615E+00	1.7372E+01	7.5932E-01	3.6204E+01	1.1537E+00
25.000	3.2199E+01	1.4064E+00	1.7957E+01	7.8437E-01	4.5976E+01	1.4653E+00
25.300	3.2877E+01	1.4354E+00	1.8335E+01	8.0050E-01	5.9254E+01	1.8884E+00
25.600	3.3117E+01	1.4456E+00	1.8469E+01	8.0618E-01	7.0810E+01	2.2564E+00
25.900	3.3202E+01	1.4491E+00	1.8517E+01	8.0818E-01	8.0768E+01	2.5732E+00
26.000	3.3216E+01	1.4497E+00	1.8524E+01	8.0850E-01	8.3764E+01	2.6684E+00
26.300	3.3216E+01	1.4497E+00	1.8536E+01	8.0899E-01	9.1881E+01	2.9264E+00

26.600	3.3216E+01	1.4497E+00	1.8540E+01	8.0917E-01	9.8832E+01	3.1472E+00
26.900	3.3216E+01	1.4497E+00	1.8542E+01	8.0923E-01	1.0478E+02	3.3360E+00
27.200	3.3216E+01	1.4497E+00	1.8542E+01	8.0925E-01	1.0988E+02	3.4976E+00
27.500	3.3216E+01	1.4497E+00	1.8543E+01	8.0926E-01	1.1424E+02	3.6358E+00
27.800	3.3216E+01	1.4497E+00	1.8543E+01	8.0926E-01	1.1797E+02	3.7540E+00
28.100	3.3216E+01	1.4497E+00	1.8543E+01	8.0926E-01	1.2116E+02	3.8551E+00
28.400	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.2390E+02	3.9416E+00
28.700	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.2624E+02	4.0156E+00
29.000	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.2824E+02	4.0789E+00
29.300	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.2996E+02	4.1331E+00
29.600	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3143E+02	4.1794E+00
29.900	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3268E+02	4.2191E+00
30.200	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3376E+02	4.2530E+00
30.500	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3468E+02	4.2820E+00
30.800	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3547E+02	4.3068E+00
31.100	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3614E+02	4.3281E+00
31.400	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3672E+02	4.3463E+00
31.700	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3721E+02	4.3618E+00
32.000	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3764E+02	4.3752E+00
32.300	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3800E+02	4.3866E+00
32.600	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3831E+02	4.3963E+00
32.900	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3858E+02	4.4047E+00
33.200	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3880E+02	4.4118E+00
33.500	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3900E+02	4.4179E+00
33.800	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3916E+02	4.4231E+00
34.100	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3931E+02	4.4276E+00
34.400	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.3943E+02	4.4315E+00
48.000	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.4016E+02	4.4544E+00
120.000	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.4016E+02	4.4544E+00
744.000	3.3216E+01	1.4497E+00	1.8543E+01	8.0927E-01	1.4016E+02	4.4544E+00

Worst Two-Hour Doses
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EAB

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
24.0	4.2725E-01	3.3216E+01	1.4497E+00

CREFS Filter Shine - General Notes

- 1 Table 1 input is taken from RADTRAD 3.10 for CREFS calculations.
- 2 Table 2 manipulates input data from Table 4-1 to fit the geometry of the specific situation being considered.

No special manipulations are involved.
- 3 Table 1 is sorted by RadTrad sort #. Table 2 is sorted by MicroShield iso # by re-sorting Table 1.

FHA

			CREFS Filter Shine - RadTrad Output							
Rad	Micro		Table 1 CREFS FILTER - Cumul. Curies for Fuel Handling accident							
Trad	Shield	time								
Sort	Iso#	(hrs) >>	0.25	0.5	1	2	8	24	96	720
58	13	Am-241								
43	41	Ba-139								
44	42	Ba-140								
1	61	Br-82	4.12E-04	6.03E-04	7.11E-04	7.20E-04	6.41E-04	4.68E-04	1.14E-04	5.43E-10
2	62	Br-83	1.01E-05	1.39E-05	1.43E-05	1.10E-05	1.94E-06	1.87E-08	1.60E-17	4.06E-96
3	63	Br-84	3.32E-16	3.52E-16	2.18E-16	6.09E-17	2.38E-20	1.95E-29	2.48E-70	0.00E+00
48	81	Ce-141								
49	82	Ce-143								
50	83	Ce-144								
59	93	Cm-242								
60	95	Cm-244								
1	104	Co-58								
2	106	Co-60								
40	115	Cs-134								
41	118	Cs-136								
42	119	Cs-137								
32	174	I-130	1.00E-03	1.45E-03	1.68E-03	1.64E-03	1.17E-03	4.79E-04	8.44E-06	5.35E-21
33	175	I-131	1.43E-01	2.09E-01	2.49E-01	2.56E-01	2.51E-01	2.37E-01	1.83E-01	1.94E-02
34	176	I-132	1.07E-01	1.45E-01	1.49E-01	1.14E-01	1.87E-02	1.50E-04	5.67E-14	1.21E-95
35	177	I-133	8.87E-02	1.29E-01	1.51E-01	1.51E-01	1.24E-01	7.27E-02	6.60E-03	6.14E-12
36	178	I-134	3.95E-09	4.76E-09	3.82E-09	1.79E-09	1.56E-11	4.99E-17	9.44E-42	5.0790-256
37	179	I-135	1.44E-02	2.06E-02	2.33E-02	2.17E-02	1.16E-02	2.16E-03	1.14E-06	4.34E-35
3	203	Kr-85								
4	204	Kr-85m								
5	205	Kr-87								
6	206	Kr-88								
45	209	La-140								
46	210	La-141								
47	211	La-142								
19	224	Mo-99								
18	238	Nb-95								
52	243	Nd-147								
53	255	Np-239								
51	302	Pr-143								
54	313	Pu-238								
55	314	Pu-239								
56	315	Pu-240								
57	316	Pu-241								
7	332	Rb-86								
24	347	Rh-105								
21	355	Ru-103								
22	356	Ru-105								
23	357	Ru-106								
25	365	Sb-127								
26	366	Sb-129								
8	391	Sr-89								
9	392	Sr-90								
10	393	Sr-91								
11	394	Sr-92								
20	408	Tc-99m								
27	415	Te-127								
28	416	Te-127m								
29	417	Te-129								
30	418	Te-129m								
31	420	Te-131m								
32	421	Te-132								
38	471	Xe-133								
39	473	Xe-135								
12	480	Y-90								
13	482	Y-91								
14	484	Y-92								
15	485	Y-93								
16	496	Zr-95								
17	497	Zr-97								

CREFS Filter Shine

<u>Shielding Parameters</u>	<u>value</u>	<u>units</u>	<u>Ref.</u>
CL distance from CREFS to RO desk, centerline to Fraction of CREFS that is charcoal	36.24	ft	Dwgs. 2019, 117.15M02, CNS-BLDG-442 (scaled)
Density of charcoal	0.6		VM 1682 (conservative assumption)
Density of air	0.5	g/cc	VM 1682 (conservative of .5 to .54 range)
Homogenized filter density	0.0122	g/cc	Standard in MicroShield
CREFS filter dimension 1	0.305	g/cc	
CREFS filter dimension 2	25.75	in	VM 1682 (4UA-921-02)
CREFS filter dimension 3	26.50	in	VM 1682 (4UA-921-02)
CREFS volume	7.75	in	VM 1682 (4UA-921-02)
CREFS volume	5288.4	cu in	
Equiv cylinder h = d	3.06	cu ft	$Vol = \pi d^2 / 4 * h$ $4V/\pi() = h d^2$
Equiv cylinder radius	1.5736	ft	
	0.7868	ft	

1. Use RO desk as dose point. The distance to the BOP station (position behind the BOP desk) is about 5 inches closer than the distance to the RO station (position behind the RO desk); however, it is exactly equal to the distance to the RO desk (center). Therefore, for conservatism, the RO desk (center) is used for the dose point for this source, since the RO station is used as the dose point for the remaining shine sources due to its greater proximity to each of the sources.
2. Assume that radionuclides are uniformly distributed in CREFS filter.
3. Assume that the CREFS filter is a homogeneous composition of charcoal and air. Conservatively assume that it is 60% air, based on VM 1682 (see Filter worksheet).
4. Assume that the CREFS filter is just a single (not stacked) NUCCELL module. This is conservative because it allows for less self-shielding due to the charcoal itself, yet is not overly conservative since amount of self-shielding from charcoal and air is small.
5. Assume that CREFS filter can be approximated as a square cylinder having equal volume. Use an end cyl model with dose point on axis for conservatism.
6. Conservatively neglect shielding from structural steel members in the adsorber tray and CREFS filter housing.
7. Conservatively neglect shielding from structural steel members in the control consoles and cabinets.

Shielding

filter (cyl half length)	0.7868	ft	Coordinate system uses cylinder face farthest from dose point as zero. Full cylinder dimensions are used in the computations. For information only; front face distance to Dose Point
air gap	35.4564	ft	

Attachment I
CREFS Filter Shine FHA Calculation

NEDC 05-031
Revision Number 3C1
Page I-5 of I-5

position of dose point 37.0300 ft Used as input to MicroShield; back face distance to DP

RG 1.183 Occupancy Factors incorporation, 0-24 hours equals 1.0 or 100% occupancy of Control Room person,
24-96 hours, 60% occupancy, 96-720 hours 40% occupancy

Dose Results

<u>time (h)</u>	<u>Micro-Shield mR/hr</u>	<u>time period h</u>	<u>bounding or average mR/hr</u>	<u>time interval h</u>	<u>Exposure mR</u>
0	not compu.				
0.25	1.618	0 to 0.25	1.618	0.25	4.05E-01
0.5	2.254E+00	0.25 to 0.5	2.254E+00	0.25	5.64E-01
1	2.447E+00 PEAK	0.5 to 1	2.447E+00	0.5	1.22E+00
2	2.111E+00	1 to 2	2.279E+00	1	2.28E+00
8	1.070E+00	2 to 8	1.591E+00	6	9.54E+00
24	6.775E-01	8 to 24	8.738E-01	16	1.40E+01
96	3.809E-01	24 to 96	5.292E-01	72	3.81E+01
720	3.843E-02	96 to 720	2.097E-01	624	<u>1.31E+02</u>
					1.97E+02
					Total Shine Dose

2.17E+02

Total Shine with Equilibrium Daughters 10% Factor

RG 1.183

<u>Occupancy Factors</u>	<u>Exposure mR</u>
------------------------------	------------------------

1	4.05E-01
1	5.64E-01
1	1.22E+00
1	2.28E+00
1	9.54E+00
1	1.40E+01
0.6	2.29E+01
0.4	5.23E+01
	<u>1.03E+02</u>

Total Shine Dose

Total Shine with Equilibrium Daughters 10% Factor

1.14E+02

Attachment J

Attachment J RADTRAD v 3.10 Detailed Output File (o0) CREFS Shine Analysis

ALION RADTRAD Version 3.10 Rev 2 run on 6/16/2011 at 13:31:55

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#####

File information
#####

Input File Name = C:\RADTRAD\RADTRAD_310\FHacooper 06-06-11cloud 24 Hour
100percentEAB-ASTmethodCREFS.psf
Output File Name = C:\RADTRAD\RADTRAD_310\FHacooper 06-06-11cloud 24 Hour
100percentEAB-ASTmethodCREFS.o0

Inventory file = c:\radtrad\radtrad_310\coopergnf2-29fha.nif
Release file = c:\radtrad\radtrad_310\rg1_183.rft
Dose Conversion file = C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.inp

```
#####
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
#####
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
# # # # # # # # # #
```

Radtrad 3.10 06/01/2009

Dose Conversion Factor File:
C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.inp
Release Fraction & Timing Files:
1
c:\radtrad\radtrad_310\rg1_183.rft
Nuclide Inventory Files:
1
1 c:\radtrad\radtrad_310\coopergnf2-29fha.nif
Plant Power Level:
1.5144E+01
Number of Compartments:
3
Compartment 1:
containment
3
7.95E+05
0
0
0
0
0
Compartment 2:
environment
2

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SECRET

Attachment J

```

3
1
2
2.4E+01  3.5E-04
7.44E+02  0.00E+00
1
4
2.4E+01  1.00E+00
4.8E+01  6.00E-01
1.2E+02  4.00E-01
7.44E+02  0.00E+00
X/Q Tables:
3
Exclusion Area Boundary
6
2.4E+01  5.2E-04
2.6E+01  0.00E+00
3.2E+01  0.00E+00
4.8E+01  0.00E+00
1.2E+02  0.00E+00
7.44E+02  0.00E+00
Low Population Zone
5
2.4E+01  2.9E-04
3.2E+01  7.3E-05
4.8E+01  2.5E-05
1.2E+02  5.2E-06
7.44E+02  0.00E+00
cr
6
2.4E+01  4.15E-03
2.6E+01  3.24E-03
3.2E+01  1.32E-03
4.8E+01  9.01E-04
1.2E+02  7.22E-04
7.44E+02  0.00E+00
Inflow Pathways:
2 2 3
Exhaust Pathways:
2 1 4
X/Q table ID for Exhaust-Inflow paths:
3 3
-1 -1
Simulation Parameters:
1
2.4E+01  0.00E+00
Output Filename:
C:\RADTRAD\RADTRAD_310\FHAcoper 06-06-11cloud 24 Hour 100percentEAB-
ASTmethodCREFS.o0
1
1
0
1
1
End of Scenario File

```

Attachment J

ALION RADTRAD Version 3.10 Rev 2 run on 6/16/2011 at 13:31:55

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#####

Plant Description
#####

Number of Nuclides = 29

Inventory Power = 1.0000E+00 MWth
Plant Power Level = 1.5144E+01 MWth

Number of compartments = 3

Compartment information

Compartment number 1
Name: containment
Compartment volume = 7.9500E+05 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment 1
Exit Pathway Number 1: containment to environment

Compartment number 2
Name: environment
Compartment type is Environment
Pathways into and out of compartment 2
Inlet Pathway Number 1: containment to environment
Inlet Pathway Number 4: control room to environment
Exit Pathway Number 2: environment to control room
Exit Pathway Number 3: environment to control room

Compartment number 3
Name: control room
Compartment volume = 1.4186E+05 (Cubic feet)
Compartment type is Control Room
Pathways into and out of compartment 3
Inlet Pathway Number 2: environment to control room
Inlet Pathway Number 3: environment to control room
Exit Pathway Number 4: control room to environment

Total number of pathways = 4

Attachment J

ALION RADTRAD Version 3.10 Rev 2 run on 6/16/2011 at 13:31:55

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#####

Scenario Description
#####

Power Ratio = 1.5144E+01

Time between shutdown and accident start = 2.4000E+01 (Hours)

Time between shutdown and first release = 2.4000E+01 (Hours)

End Time = 7.4400E+02 (Hours)

Radioactive Decay is enabled
Calculation of Daughters is enabled

Source Number 1 is used in Compartment 1 containment
Nuclide Distribution given in Ci/MWt
Fraction of Nuclide Distribution in this Compartment 1.00000

Iodine fractions for source number 1
Aerosol = 9.5000E-01
Elemental = 4.8500E-02
Organic = 1.5000E-03

Inventory file = c:\radtrad\radtrad_310\coopergnf2-29fha.nif
Release from file = c:\radtrad\radtrad_310\rgl_183.rft
Dose Conversion file = C:\RADTRAD\RADTRAD_310\cooperGNF2-29fha.inp

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
Br-82	2	1.870E+02	1.271E+05	1.300E-13	2.380E-10	3.310E-10
Br-83	2	3.240E+03	8.604E+03	3.820E-16	3.290E-12	2.330E-11
Br-84	2	5.560E+03	1.908E+03	9.410E-14	3.120E-12	2.610E-11
Kr-83m	1	3.250E+03	6.588E+03	1.500E-18	0.000E+00	0.000E+00
Kr-85	1	8.520E+02	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	6.750E+03	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	1.280E+04	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	1.810E+04	1.022E+04	1.020E-13	0.000E+00	0.000E+00
I-128	2	4.330E+02	1.499E+03	4.160E-15	5.340E-11	1.280E-11
I-130	2	1.100E+03	4.450E+04	1.040E-13	1.990E-08	7.140E-10
I-131	2	4.352E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.960E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.480E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.040E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.160E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Te-131	4	2.420E+04	1.500E+03	2.040E-14	2.660E-09	1.240E-10
Te-131m	4	3.970E+03	1.080E+05	7.463E-14	3.669E-08	1.758E-09
Te-132	4	3.860E+04	2.815E+05	1.030E-14	6.280E-08	2.550E-09
Te-133	4	3.240E+04	7.470E+02	4.600E-14	5.910E-10	2.390E-11
Te-133m	4	1.970E+04	3.324E+03	1.140E-13	2.630E-09	1.100E-10

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
2.4250E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
2.4500E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00

2.5000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
2.6000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
3.2000E+01	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
1.2000E+02	4.5760E+04	0.0000E+00	0.0000E+00	0.0000E+00
7.4400E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: environment to control room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00
2.4017E+01	9.9000E+02	1.0000E+02	1.0000E+02	1.0000E+02

Pathway number 3: environment to control room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: control room to environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
2.4000E+01	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00
2.4017E+01	1.3900E+03	0.0000E+00	0.0000E+00	0.0000E+00

DOSE INFORMATION

Number Dose Locations = 3

Dose Location Name = Exclusion Area Boundary
Located in compartment 2 the environment

Exclusion Area Boundary Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
2.4000E+01	3.5000E-04
3.2000E+01	1.8000E-04
4.8000E+01	2.3000E-04

Dose Location Name = Low Population Zone
Located in compartment 2 the environment

Low Population Zone Breathing Rate Data

Time (hr)	Breathing Rate ($\text{m}^3 \cdot \text{sec}^{-1}$)
2.4000E+01	3.5000E-04
3.2000E+01	1.8000E-04
4.8000E+01	2.3000E-04

Dose Location Name = control room
Located in compartment 3 the control room

control room Breathing Rate Data

Time (hr)	Breathing Rate (m ³ * sec ⁻¹)
2.4000E+01	3.5000E-04
7.4400E+02	0.0000E+00

control room Occupancy Factor Data

Time (hr)	Occupancy Factor
0	0.00
1	0.00
2	0.00
3	0.00
4	0.00
5	0.00
6	0.00
7	0.00
8	0.00
9	0.00
10	0.00
11	0.00
12	0.00
13	0.00
14	0.00
15	0.00
16	0.00
17	0.00
18	0.00
19	0.00
20	0.00
21	0.00
22	0.00
23	0.00
24	0.00

Attachment J

2.4000E+01	1.0000E+00
4.8000E+01	6.0000E-01
1.2000E+02	4.0000E-01
7.4400E+02	0.0000E+00

X/Q, ATMOSPHERIC DISPERSION INFORMATION

X/Q Table Name = Exclusion Area Boundary

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	5.2000E-04
2.6000E+01	0.0000E+00
3.2000E+01	0.0000E+00
4.8000E+01	0.0000E+00
1.2000E+02	0.0000E+00
7.4400E+02	0.0000E+00

X/Q Table Name = Low Population Zone

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	2.9000E-04
3.2000E+01	7.3000E-05
4.8000E+01	2.5000E-05
1.2000E+02	5.2000E-06
7.4400E+02	0.0000E+00

X/Q Table Name = cr

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
2.4000E+01	4.1500E-03
2.6000E+01	3.2400E-03
3.2000E+01	1.3200E-03
4.8000E+01	9.0100E-04
1.2000E+02	7.2200E-04
7.4400E+02	0.0000E+00

This X/Q Table is used for these connected pathways

Path 1 containment to environment and Path 2 environment to control room
Path 1 containment to environment and Path 3 environment to control room

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS

Time (hr)	Time step (hr)
0.0000E+00	0.0000E+00

EDIT EACH MAJOR TIME STEP

EDIT SUPPLEMENTAL TIME STEPS

DO NOT EDIT MODEL DECONTAMINATION

Masses in Curies in detailed output

Nuclide	Filter	Decays	Transported	Activity
				Pathway 1

Attachment J

	Kr-85	2.8379E-02	1.0067E-04	6.3545E-05	8.4641E+09	3.6243E-02	4.4814E-
03	5.8765E-05						
	Kr-85m	5.4828E-03	1.2226E-03	1.2277E-05	1.6356E+09	7.0046E-03	8.6611E-
04	1.1357E-05						
	Kr-87	8.8646E-07	1.0889E-06	1.9852E-09	2.6457E+05	1.1335E-06	1.4016E-
07	1.8377E-09						
	Kr-88	1.7218E-03	5.2359E-03	3.8556E-06	5.1369E+08	2.2002E-03	2.7205E-
04	3.5672E-06						
	I-130	4.7682E-05	5.0305E-04	1.0677E-07	1.4222E+07	6.0903E-05	7.5305E-
06	9.8747E-08						
	I-131	6.6994E-03	6.2505E-01	1.5001E-05	1.9981E+09	8.5560E-03	1.0579E-
03	1.3873E-05						
	I-132	5.3919E-03	2.3799E-02	1.2074E-05	1.6087E+09	6.8911E-03	8.5206E-
04	1.1172E-05						
	I-133	4.1947E-03	7.2829E-02	9.3927E-06	1.2512E+09	5.3576E-03	6.6245E-
04	8.6867E-06						
	I-135	6.9352E-04	4.1172E-03	1.5529E-06	2.0687E+08	8.8591E-04	1.0954E-
04	1.4364E-06						
	Xe-129m	6.8119E-06	2.1525E-07	1.5253E-08	2.0317E+06	8.6997E-06	1.0757E-
06	1.4106E-08						
	Xe-131m	1.0422E-02	1.2086E-04	2.3336E-05	3.1084E+09	1.3310E-02	1.6457E-
03	2.1581E-05						
	Xe-133	1.7504E+00	8.1400E-02	3.9193E-03	5.2206E+11	2.2354E+00	2.7640E-
01	3.6245E-03						
	Xe-133m	5.1880E-02	2.1188E-03	1.1617E-04	1.5474E+10	6.6258E-02	8.1927E-
03	1.0743E-04						
	Xe-135	4.7735E-01	1.6934E-01	1.0689E-03	1.4238E+11	6.0973E-01	7.5392E-
02	9.8861E-04						
	Xe-135m	2.3027E-02	1.4014E-02	5.1598E-05	6.8908E+09	2.9603E-02	3.6604E-
03	4.7944E-05						
	Total	2.3661E+00	1.0000E+00	0.0000E+00	0.0000E+00	3.0221E+00	3.7367E-
01	4.8999E-03						

control room Compartment Group Inventory Distribution:

Time (h) = 24.0036	Atmosphere	Sump
Noble gases (Ci)	2.3490E+00	0.0000E+00
Elemental I (Ci)	8.2679E-04	0.0000E+00
Organic I (Ci)	2.5571E-05	0.0000E+00
Aerosol I (Ci)	1.6195E-02	0.0000E+00
All Aerosols (Ci)	1.6195E-02	0.0000E+00
All Aerosols (kg)	5.5579E-11	0.0000E+00

containment to environment Pathway Nuclide Inventory (Ci) at Time (h) = 24.0036

Nuclide	Filter	Decays	Transported
Br-82	0.0000E+00	0.00E+00	2.7345E-03
Kr-83m	0.0000E+00	0.00E+00	5.6384E-02
Kr-85	0.0000E+00	0.00E+00	3.9915E+00
Kr-85m	0.0000E+00	0.00E+00	7.7142E-01
Kr-87	0.0000E+00	0.00E+00	1.2483E-04
Kr-88	0.0000E+00	0.00E+00	2.4230E-01
I-130	0.0000E+00	0.00E+00	6.7072E-03
I-131	0.0000E+00	0.00E+00	9.4228E-01
I-132	0.0000E+00	0.00E+00	7.5887E-01
I-133	0.0000E+00	0.00E+00	5.9003E-01
I-135	0.0000E+00	0.00E+00	9.7566E-02
Xe-129m	0.0000E+00	0.00E+00	9.5810E-04
Xe-131m	0.0000E+00	0.00E+00	1.4658E+00
Xe-133	0.0000E+00	0.00E+00	2.4619E+02
Xe-133m	0.0000E+00	0.00E+00	7.2971E+00
Xe-135	0.0000E+00	0.00E+00	6.7150E+01

containment to environment Transport Group Inventory:

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 24.0036

environment to control room Transport Group Inventory:

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 24.0036

environment to control room Transport Group Inventory:

05-03-03

Attachment J

Noble gases (Ci)	0.0000E+00	3.7098E-01
Elemental I (Ci)	0.0000E+00	1.3059E-04
Organic I (Ci)	0.0000E+00	4.0390E-06
Aerosol I (Ci)	0.0000E+00	2.5580E-03
All Aerosols (Ci)	0.0000E+00	2.5580E-03
All Aerosols (kg)	0.0000E+00	8.7767E-12

control room to environment Pathway Nuclide Inventory (Ci) at Time (h) = 24.0036

Nuclide	Filter	Decays	Transported
Br-82	4.0258E-08	0.00E+00	0.0000E+00
Br-83	1.0596E-09	0.00E+00	0.0000E+00
Kr-83m	8.3006E-07	0.00E+00	8.4135E-13
Kr-85	5.8765E-05	0.00E+00	3.6881E-14
Kr-85m	1.1357E-05	0.00E+00	0.0000E+00
Kr-87	1.8377E-09	0.00E+00	0.0000E+00
Kr-88	3.5672E-06	0.00E+00	0.0000E+00
I-130	9.8747E-08	0.00E+00	0.0000E+00
I-131	1.3873E-05	0.00E+00	0.0000E+00
I-132	1.1172E-05	0.00E+00	0.0000E+00
I-133	8.6867E-06	0.00E+00	0.0000E+00
I-134	4.6681E-13	0.00E+00	0.0000E+00
I-135	1.4364E-06	0.00E+00	0.0000E+00
Xe-129m	1.4106E-08	0.00E+00	0.0000E+00
Xe-131m	2.1581E-05	0.00E+00	7.7651E-13
Xe-133	3.6245E-03	0.00E+00	1.3376E-09
Xe-133m	1.0743E-04	0.00E+00	6.9717E-12
Xe-135	9.8861E-04	0.00E+00	7.8465E-09
Xe-135m	4.7944E-05	0.00E+00	1.2287E-09

control room to environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0036	Filtered	Transported
Noble gases (Ci)	4.8646E-03	1.0421E-08
Elemental I (Ci)	1.7124E-06	0.0000E+00
Organic I (Ci)	5.2962E-08	0.0000E+00
Aerosol I (Ci)	3.3542E-05	0.0000E+00
All Aerosols (Ci)	3.3542E-05	0.0000E+00
All Aerosols (kg)	1.1509E-13	0.0000E+00

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Exclusion Area Boundary Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9820E-02	1.4971E+00	6.5919E-02
Accumulated dose (rem)	2.2553E-02	1.7034E+00	7.5002E-02

Low Population Zone Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1054E-02	8.3494E-01	3.6762E-02
Accumulated dose (rem)	1.2578E-02	9.4995E-01	4.1828E-02

control room Doses:

Time (h) = 24.0170	Whole Body	Thyroid	TEDE	Skin
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Nuclide	Compartment	Dose Fract
	Atmosphere	Pathway 1
Br-82	2.2595E-02	0.00014
Br-83	5.9393E-04	0.00000
Kr-83m	4.6507E-01	0.00000
Kr-85	3.2985E+01	0.00010
Kr-85m	6.3699E+00	0.00122
Kr-87	1.0288E-03	0.00000
Kr-88	1.9999E+00	0.00523
I-130	5.5412E-02	0.00050
I-131	7.7868E+00	0.62516
I-132	6.2623E+00	0.02378
I-133	4.8751E+00	0.07283
I-135	8.0585E-01	0.00412
Xe-129m	7.9175E-03	0.00000

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Xe-131m	1.2113E+01	0.00012
Xe-133	2.0344E+03	0.08141
Xe-133m	6.0298E+01	0.00212
Xe-135	5.5472E+02	0.16934
Xe-135m	2.6581E+01	0.01391

environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 24.0170		
Noble gases (Ci)	2.7300E+03	4.4607E+01
Elemental I (Ci)	9.6072E-01	1.5698E-02
Organic I (Ci)	2.9713E-02	4.8551E-04
Aerosol I (Ci)	1.8818E+01	3.0749E-01
All Aerosols (Ci)	1.8818E+01	3.0749E-01

control room Compartment Nuclide Inventory (Ci) at Time (h) = 24.0170

Nuclide 3 Pathway	Compartment 4 Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 2 Inflow	Pathway Inflow
Outflow						
Br-82	1.5894E-04	1.4255E-04	1.6833E-06	2.2423E+08	1.4930E-04	1.8461E-
05 1.8901E-06						
Br-83	4.1660E-06	1.2982E-07	4.4147E-08	5.8863E+06	3.9248E-06	4.8529E-
07 4.9665E-08						
Kr-83m	3.2591E-03	1.7848E-08	3.4543E-05	4.6073E+09	3.0734E-03	3.8001E-
04 3.8885E-05						
Kr-85	2.3208E-01	1.0075E-04	2.4578E-03	3.2738E+11	2.1795E-01	2.6949E-
02 2.7594E-03						
Kr-85m	4.4744E-02	1.2213E-03	4.7402E-04	6.3173E+10	4.2092E-02	5.2046E-
03 5.3276E-04						
Kr-87	7.1965E-06	1.0829E-06	7.6303E-08	1.0183E+07	6.7987E-06	8.4064E-
07 8.5994E-08						
Kr-88	1.4035E-02	5.2249E-03	1.4871E-04	1.9825E+10	1.3215E-02	1.6340E-
03 1.6724E-04						
I-130	3.8964E-04	5.0309E-04	4.1269E-06	5.4981E+08	3.6615E-04	4.5273E-
05 4.6352E-06						
I-131	5.4784E-02	6.2548E-01	5.8019E-04	7.7282E+10	5.1452E-02	6.3619E-
03 6.5140E-04						
I-132	4.3920E-02	2.3736E-02	4.6543E-04	6.2060E+10	4.1382E-02	5.1168E-
03 5.2364E-04						
I-133	3.4288E-02	7.2854E-02	3.6315E-04	4.8378E+10	3.2213E-02	3.9831E-
03 4.0781E-04						
I-135	5.6635E-03	4.1152E-03	5.9992E-05	7.9939E+09	5.3249E-03	6.5841E-
04 6.7403E-05						
Xe-129m	5.5704E-05	2.1540E-07	5.8993E-07	7.8580E+07	5.2316E-05	6.4687E-
06 6.6234E-07						
Xe-131m	8.5225E-02	1.2094E-04	9.0257E-04	1.2022E+11	8.0041E-02	9.8969E-
03 1.0134E-03						
Xe-133	1.4313E+01	8.1454E-02	1.5158E-01	2.0191E+13	1.3443E+01	
1.6622E+00	1.7019E-01					
Xe-133m	4.2419E-01	2.1200E-03	4.4924E-03	5.9842E+11	3.9843E-01	4.9265E-
02 5.0442E-03						
Xe-135	3.8999E+00	1.6932E-01	4.1308E-02	5.5035E+12	3.6654E+00	4.5322E-
01 4.6401E-02						
Xe-135m	1.8174E-01	1.3604E-02	1.9359E-03	2.6032E+11	1.7578E-01	2.1734E-
02 2.2148E-03						
Total	1.9338E+01	1.0000E+00	0.0000E+00	0.0000E+00	1.8170E+01	
2.2466E+00	2.3002E-01					

control room Compartment Group Inventory Distribution:

containment to environment Pathway Nuclide Inventory (Ci) at Time (h) = 24.0170

containment to environment Transport Group Inventory:

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 24.0170

environment to control room Transport Group Inventory:

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	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (Ci)	0.0000E+00	1.8039E+01
Elemental I (Ci)	0.0000E+00	6.3482E-03
Organic I (Ci)	0.0000E+00	1.9634E-04
Aerosol I (Ci)	0.0000E+00	1.2435E-01
All Aerosols (Ci)	0.0000E+00	1.2435E-01
All Aerosols (kg)	0.0000E+00	4.2684E-10

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 24.0170

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Kr-83m	0.0000E+00	0.00E+00	3.8001E-04	3.800E-04
Kr-85	0.0000E+00	0.00E+00	2.6949E-02	2.695E-02
Kr-85m	0.0000E+00	0.00E+00	5.2046E-03	5.205E-03
Kr-88	0.0000E+00	0.00E+00	1.6340E-03	1.634E-03
I-131	0.0000E+00	0.00E+00	6.3619E-03	6.362E-03
I-132	0.0000E+00	0.00E+00	5.1168E-03	5.117E-03
I-133	0.0000E+00	0.00E+00	3.9831E-03	3.983E-03
I-135	0.0000E+00	0.00E+00	6.5841E-04	6.584E-04
Xe-131m	0.0000E+00	0.00E+00	9.8969E-03	9.897E-03
Xe-133	0.0000E+00	0.00E+00	1.6622E+00	1.662E+00
Xe-133m	0.0000E+00	0.00E+00	4.9265E-02	4.926E-02
Xe-135	0.0000E+00	0.00E+00	4.5322E-01	4.532E-01
Xe-135m	0.0000E+00	0.00E+00	2.1734E-02	2.173E-02

environment to control room Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (Ci)	0.0000E+00	2.2305E+00
Elemental I (Ci)	0.0000E+00	7.8495E-04
Organic I (Ci)	0.0000E+00	2.4277E-05
Aerosol I (Ci)	0.0000E+00	1.5375E-02
All Aerosols (Ci)	0.0000E+00	1.5375E-02
All Aerosols (kg)	0.0000E+00	5.2778E-11

control room to environment Pathway Nuclide Inventory (Ci) at Time (h) = 24.0170

Nuclide	Filter	Decays	Transported
Br-82	1.8901E-06	0.00E+00	0.0000E+00
Br-83	4.9665E-08	0.00E+00	0.0000E+00
Br-84	2.0818E-18	0.00E+00	0.0000E+00
Kr-83m	3.8885E-05	0.00E+00	1.7165E-10
Kr-85	2.7594E-03	0.00E+00	7.5334E-12
Kr-85m	5.3276E-04	0.00E+00	0.0000E+00
Kr-87	8.5994E-08	0.00E+00	0.0000E+00
Kr-88	1.6724E-04	0.00E+00	0.0000E+00
I-130	4.6352E-06	0.00E+00	0.0000E+00
I-131	6.5140E-04	0.00E+00	0.0000E+00
I-132	5.2364E-04	0.00E+00	0.0000E+00
I-133	4.0781E-04	0.00E+00	0.0000E+00
I-134	2.1810E-11	0.00E+00	0.0000E+00
I-135	6.7403E-05	0.00E+00	0.0000E+00
Xe-129m	6.6234E-07	0.00E+00	0.0000E+00
Xe-131m	1.0134E-03	0.00E+00	1.5883E-10
Xe-133	1.7019E-01	0.00E+00	2.7357E-07
Xe-133m	5.0442E-03	0.00E+00	1.4257E-09
Xe-135	4.6401E-02	0.00E+00	1.5682E-06
Xe-135m	2.2148E-03	0.00E+00	2.5109E-07

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control room to environment Transport Group Inventory:

	Pathway	
Time (h) = 24.0170	Filtered	Transported
Noble gases (Ci)	2.2836E-01	2.0947E-06
Elemental I (Ci)	8.0356E-05	0.0000E+00
Organic I (Ci)	2.4852E-06	0.0000E+00
Aerosol I (Ci)	1.5740E-03	0.0000E+00
All Aerosols (Ci)	1.5740E-03	0.0000E+00
All Aerosols (kg)	5.4040E-12	0.0000E+00

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Exclusion Area Boundary Doses:

Time (h) = 24.2500	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.2781E-01	1.7460E+01	7.6535E-01
Accumulated dose (rem)	2.5036E-01	1.9163E+01	8.4036E-01

Low Population Zone Doses:

Time (h) = 24.2500	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2705E-01	9.7372E+00	4.2683E-01
Accumulated dose (rem)	1.3962E-01	1.0687E+01	4.6866E-01

control room Doses:

Time (h) = 24.2500	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	8.5837E-03	7.4407E+00	2.3766E-01	5.0216E-01
Accumulated dose (rem)	8.6831E-03	7.6004E+00	2.4267E-01	5.0781E-01

containment Compartment Nuclide Inventory (Ci) at Time (h) = 24.2500

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Outflow
Br-82	1.8662E-01	1.4315E-04	6.8525E-02	9.1313E+12	2.5447E-01
Br-83	4.5928E-03	1.2645E-07	1.7431E-03	2.3361E+11	6.5449E-03
Kr-83m	3.5199E+00	1.7214E-08	1.3506E+00	1.8133E+14	5.0890E+00
Kr-85	2.7374E+02	1.0139E-04	1.0028E+02	1.3357E+16	3.7207E+02
Kr-85m	5.0908E+01	1.2078E-03	1.9004E+01	2.5396E+15	7.0960E+01
Kr-87	7.4761E-03	1.0252E-06	2.9285E-03	3.9458E+11	1.1109E-02
Kr-88	1.5639E+01	5.1155E-03	5.9022E+00	7.9023E+14	2.2119E+01
I-130	4.5362E-01	5.0311E-04	1.6731E-01	2.2312E+13	6.2221E-01
I-131	6.4565E+01	6.2924E-01	2.3662E+01	3.1520E+15	8.7809E+01
I-132	4.8292E+01	2.3090E-02	1.8354E+01	2.4604E+15	6.8946E+01
I-133	4.0131E+01	7.3045E-02	1.4760E+01	1.9675E+15	5.4843E+01
I-134	1.7866E-06	8.7341E-10	7.2170E-07	9.7737E+07	2.7648E-06
I-135	6.5190E+00	4.0927E-03	2.4187E+00	3.2289E+14	9.0131E+00
Xe-129m	6.5649E-02	2.1670E-07	2.4059E-02	3.2049E+12	8.9283E-02
Xe-131m	1.0047E+02	1.2168E-04	3.6814E+01	4.9039E+15	1.3661E+02
Xe-133	1.6862E+04	8.1928E-02	6.1807E+03	8.2336E+17	2.2938E+04
Xe-133m	4.9881E+02	2.1305E-03	1.8301E+02	2.4384E+16	6.7944E+02
Xe-135	4.5219E+03	1.6900E-01	1.6714E+03	2.2297E+17	6.2203E+03
Xe-135m	1.1423E+02	1.0275E-02	5.9274E+01	8.3413E+15	2.4443E+02
Total	2.2601E+04	1.0000E+00	0.0000E+00	0.0000E+00	3.0911E+04

3	Nuclide Pathway	Compartment 4 Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 2 Inflow	Pathway Inflow
	Outflow						
	Br-82	3.0531E-04	1.1173E-04	6.2225E-05	8.2922E+09	1.4930E-04	1.8556E-
04	3.5514E-05						
	Br-83	7.5137E-06	9.7772E-08	1.5681E-06	2.1030E+08	3.9248E-06	4.7744E-
06	9.0680E-07						
	Kr-83m	1.3570E-02	2.7155E-08	2.4787E-03	3.3318E+11	1.1323E-02	3.7128E-
03	1.3499E-03						

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Kr-85	1.0554E+00	1.6270E-04	1.8721E-01	2.4936E+13	8.2275E-01	2.7131E-
01 1.0018E-01						
Kr-85m	1.9627E-01	1.9247E-03	3.5233E-02	4.7105E+12	1.5730E-01	5.1754E-
02 1.8990E-02						
Kr-87	2.8823E-05	1.6050E-06	5.3342E-06	7.1987E+08	2.4783E-05	8.1070E-
06 2.9273E-06						
Kr-88	6.0294E-02	8.1188E-03	1.0899E-02	1.4602E+12	4.9104E-02	1.6135E-
02 5.8984E-03						
I-130	7.4212E-04	3.9218E-04	1.5173E-04	2.0237E+10	3.6615E-04	4.5375E-
04 8.6754E-05						
I-131	1.0563E-01	4.9139E-01	2.1498E-02	2.8638E+12	5.1452E-02	6.4030E-
02 1.2260E-02						
I-132	7.9005E-02	1.7846E-02	1.6505E-02	2.2141E+12	4.1382E-02	5.0296E-
02 9.5496E-03						
I-133	6.5654E-02	5.6984E-02	1.3397E-02	1.7859E+12	3.2213E-02	3.9993E-
02 7.6513E-03						
I-135	1.0665E-02	3.1849E-03	2.1899E-03	2.9241E+11	5.3249E-03	6.5732E-
03 1.2550E-03						
Xe-129m	2.5310E-04	3.4767E-07	4.4909E-05	5.9824E+09	1.9744E-04	6.5105E-
05 2.4036E-05						
Xe-131m	3.8735E-01	1.9524E-04	6.8723E-02	9.1544E+12	3.0210E-01	9.9616E-
02 3.6779E-02						
Xe-133	6.5008E+01	1.3144E-01	1.1536E+01	1.5368E+15	5.0727E+01	
1.6727E+01	6.1749E+00					
Xe-133m	1.9231E+00	3.4167E-03	3.4148E-01	4.5499E+13	1.5027E+00	4.9545E-
01 1.8284E-01						
Xe-135	1.7434E+01	2.7030E-01	3.1101E+00	4.1499E+14	1.3771E+01	
4.5362E+00	1.6700E+00					
Xe-135m	4.4037E-01	1.4541E-02	9.7597E-02	1.3866E+13	5.6576E-01	1.7893E-
01 5.9112E-02						
Total	8.6780E+01	1.0000E+00	0.0000E+00	0.0000E+00	6.8041E+01	
2.2541E+01	8.2809E+00					

control room Compartment Group Inventory Distribution:

Time (h) = 24.2500	Atmosphere	Sump
Noble gases (Ci)	8.6518E+01	0.0000E+00
Elemental I (Ci)	1.2707E-02	0.0000E+00
Organic I (Ci)	3.9301E-04	0.0000E+00
Aerosol I (Ci)	2.4891E-01	0.0000E+00
All Aerosols (Ci)	2.4891E-01	0.0000E+00
All Aerosols (kg)	8.7526E-10	0.0000E+00

containment to environment Pathway Nuclide Inventory (Ci) at Time (h) = 24.2500

Nuclide	Filter	Decays	Transported
Br-82	0.0000E+00	0.00E+00	2.5447E-01
Br-83	0.0000E+00	0.00E+00	6.5449E-03
Kr-83m	0.0000E+00	0.00E+00	5.0890E+00
Kr-85	0.0000E+00	0.00E+00	3.7207E+02
Kr-85m	0.0000E+00	0.00E+00	7.0960E+01
Kr-87	0.0000E+00	0.00E+00	1.1109E-02
Kr-88	0.0000E+00	0.00E+00	2.2119E+01
I-130	0.0000E+00	0.00E+00	6.2221E-01
I-131	0.0000E+00	0.00E+00	8.7809E+01
I-132	0.0000E+00	0.00E+00	6.8946E+01
I-133	0.0000E+00	0.00E+00	5.4843E+01
I-135	0.0000E+00	0.00E+00	9.0131E+00
Xe-129m	0.0000E+00	0.00E+00	8.9283E-02
Xe-131m	0.0000E+00	0.00E+00	1.3661E+02
Xe-133	0.0000E+00	0.00E+00	2.2938E+04
Xe-133m	0.0000E+00	0.00E+00	6.7944E+02

containment to environment Transport Group Inventory:

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 24.2500

environment to control room Transport Group Inventory:

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 24.2500

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	0.0000E+00	0.00E+00	1.8556E-04	1.856E-04
Kr-83m	0.0000E+00	0.00E+00	3.7128E-03	3.713E-03
Kr-85	0.0000E+00	0.00E+00	2.7131E-01	2.713E-01
Kr-85m	0.0000E+00	0.00E+00	5.1754E-02	5.175E-02
Kr-88	0.0000E+00	0.00E+00	1.6135E-02	1.613E-02
I-130	0.0000E+00	0.00E+00	4.5375E-04	4.537E-04
I-131	0.0000E+00	0.00E+00	6.4030E-02	6.403E-02
I-132	0.0000E+00	0.00E+00	5.0296E-02	5.030E-02
I-133	0.0000E+00	0.00E+00	3.9993E-02	3.999E-02
I-135	0.0000E+00	0.00E+00	6.5732E-03	6.573E-03

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Xe-131m	0.0000E+00	0.00E+00	9.9616E-02	9.962E-02
Xe-133	0.0000E+00	0.00E+00	1.6727E+01	1.673E+01
Xe-133m	0.0000E+00	0.00E+00	4.9545E-01	4.954E-01
Xe-135	0.0000E+00	0.00E+00	4.5362E+00	4.536E+00
Xe-135m	0.0000E+00	0.00E+00	1.7893E-01	1.789E-01

environment to control room Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (Ci)	0.0000E+00	2.2380E+01
Elemental I (Ci)	0.0000E+00	7.8345E-03
Organic I (Ci)	0.0000E+00	2.4230E-04
Aerosol I (Ci)	0.0000E+00	1.5346E-01
All Aerosols (Ci)	0.0000E+00	1.5346E-01
All Aerosols (kg)	0.0000E+00	5.3098E-10

control room to environment Pathway Nuclide Inventory (Ci) at Time (h) = 24.2500

Nuclide	Filter	Decays	Transported
Br-82	3.5514E-05	0.00E+00	0.0000E+00
Br-83	9.0680E-07	0.00E+00	0.0000E+00
Br-84	3.4223E-17	0.00E+00	0.0000E+00
Kr-83m	1.3499E-03	0.00E+00	4.6856E-08
Kr-85	1.0018E-01	0.00E+00	3.6294E-09
Kr-85m	1.8990E-02	0.00E+00	0.0000E+00
Kr-87	2.9273E-06	0.00E+00	0.0000E+00
Kr-88	5.8984E-03	0.00E+00	0.0000E+00
I-130	8.6754E-05	0.00E+00	0.0000E+00
I-131	1.2260E-02	0.00E+00	0.0000E+00
I-132	9.5496E-03	0.00E+00	0.0000E+00
I-133	7.6513E-03	0.00E+00	0.0000E+00
I-134	3.7796E-10	0.00E+00	0.0000E+00
I-135	1.2550E-03	0.00E+00	0.0000E+00
Xe-129m	2.4036E-05	0.00E+00	0.0000E+00
Xe-131m	3.6779E-02	0.00E+00	4.4351E-08
Xe-133	6.1749E+00	0.00E+00	1.2936E-04
Xe-133m	1.8284E-01	0.00E+00	3.9714E-07
Xe-135	1.6700E+00	0.00E+00	6.0015E-04
Xe-135m	5.9112E-02	0.00E+00	6.9550E-05

control room to environment Transport Group Inventory:

	Pathway	
Time (h) = 24.2500	Filtered	Transported
Noble gases (Ci)	8.2500E+00	7.9956E-04
Elemental I (Ci)	1.4957E-03	0.0000E+00
Organic I (Ci)	4.6259E-05	0.0000E+00
Aerosol I (Ci)	2.9297E-02	0.0000E+00
All Aerosols (Ci)	2.9297E-02	0.0000E+00
All Aerosols (kg)	1.0166E-10	0.0000E+00

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Exclusion Area Boundary Doses:

Time (h) = 24.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0298E-01	8.1533E+00	3.5392E-01

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Accumulated dose (rem) 3.5334E-01 2.7316E+01 1.1943E+00

Low Population Zone Doses:

Time (h) =	24.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		5.7433E-02	4.5470E+00	1.9738E-01
Accumulated dose (rem)		1.9706E-01	1.5234E+01	6.6604E-01

control room Doses:

Time (h) =	24.5000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)		1.5101E-02	1.0727E+01	3.4523E-01	8.9618E-01
Accumulated dose (rem)		2.3784E-02	1.8327E+01	5.8791E-01	1.4040E+00

containment Compartment Nuclide Inventory (Ci) at Time (h) = 24.5000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Outflow
Br-82	7.8317E-02	1.4344E-04	9.7400E-02	1.2979E+13	3.6242E-01
Br-83	1.8014E-03	1.2424E-07	2.4296E-03	3.2563E+11	9.1411E-03
Kr-83m	1.3505E+00	1.6809E-08	1.8708E+00	2.5121E+14	7.0640E+00
Kr-85	1.1544E+02	1.0174E-04	1.4274E+02	1.9013E+16	5.3069E+02
Kr-85m	2.0655E+01	1.1983E-03	2.6745E+01	3.5742E+15	1.0007E+02
Kr-87	2.7512E-03	9.8976E-07	4.0106E-03	5.4041E+11	1.5246E-02
Kr-88	6.2050E+00	5.0427E-03	8.2535E+00	1.1051E+15	3.0994E+01
I-130	1.8864E-01	5.0276E-04	2.3717E-01	3.1628E+13	8.8381E-01
I-131	2.7205E+01	6.3125E-01	3.3672E+01	4.4855E+15	1.2521E+02
I-132	1.8888E+01	2.2669E-02	2.5562E+01	3.4268E+15	9.6219E+01
I-133	1.6784E+01	7.3116E-02	2.0959E+01	2.7937E+15	7.8031E+01
I-134	6.1833E-07	8.2964E-10	9.7247E-07	1.3172E+08	3.7334E-06
I-135	2.6781E+00	4.0752E-03	3.4164E+00	4.5608E+14	1.2757E+01
Xe-129m	2.7661E-02	2.1739E-07	3.4237E-02	4.5608E+12	1.2731E-01
Xe-131m	4.2345E+01	1.2208E-04	5.2394E+01	6.9792E+15	1.9482E+02
Xe-133	7.1016E+03	8.2179E-02	8.7944E+03	1.1716E+18	3.2705E+04
Xe-133m	2.0967E+02	2.1357E-03	2.6026E+02	3.4676E+16	9.6815E+02
Xe-135	1.8717E+03	1.6866E-01	2.3661E+03	3.1566E+17	8.8239E+03
Xe-135m	2.4610E+01	8.8053E-03	7.2059E+01	1.0143E+16	2.9776E+02
Total	9.4594E+03	1.0000E+00	0.0000E+00	0.0000E+00	4.3972E+04

Dose Equivalent (Ci/cc)	I-131 (Thyroid)	1.3410E-09
Dose Equivalent (Ci/cc)	I-131 (CEDE)	1.3551E-09
Dose Equivalent (Ci/cc)	I-131 (ICRP2 Thyroid)	1.4479E-09
Total I (Ci)		6.5555E+01
Dose Equivalent (Ci/cc)	Xe-133 (EDE)	9.9546E-07

containment Compartment Group Inventory Distribution:

Time (h) =	24.5000	Atmosphere	Sump
Noble gases (Ci)		9.3936E+03	0.0000E+00
Elemental I (Ci)		3.1924E+00	0.0000E+00
Organic I (Ci)		9.8735E-02	0.0000E+00
Aerosol I (Ci)		6.2532E+01	0.0000E+00
All Aerosols (Ci)		6.2532E+01	0.0000E+00
All Aerosols (kg)		2.2516E-07	0.0000E+00

environment Integral Nuclide Release (Ci): at Time (h) = 24.5000

Nuclide	Compartment	Dose Fract	Pathway 1
	Atmosphere		
Br-82	3.6169E-01	0.00014	
Br-83	9.1228E-03	0.00000	

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Xe-133	8.0445E+01	1.4206E-01	3.0545E+01	4.0691E+15	6.8234E+01	
2.3800E+01	1.7160E+01					
Xe-133m	2.3751E+00	3.6887E-03	9.0313E-01	1.2033E+14	2.0203E+00	7.0456E-
01	5.0754E-01					
Xe-135	2.1202E+01	2.8930E-01	8.1546E+00	1.0881E+15	1.8439E+01	
6.4221E+00	4.5944E+00					
Xe-135m	2.7885E-01	1.1252E-02	1.8500E-01	2.6233E+13	6.6350E-01	2.1766E-
01	1.1601E-01					
Total	1.0669E+02	1.0000E+00	0.0000E+00	0.0000E+00	9.1291E+01	
3.2001E+01	2.2902E+01					

control room Compartment Group Inventory Distribution:

Time (h) = 24.5000	Atmosphere	Sump
Noble gases (Ci)	1.0641E+02	0.0000E+00
Elemental I (Ci)	1.3848E-02	0.0000E+00
Organic I (Ci)	4.2828E-04	0.0000E+00
Aerosol I (Ci)	2.7124E-01	0.0000E+00
All Aerosols (Ci)	2.7124E-01	0.0000E+00
All Aerosols (kg)	9.7667E-10	0.0000E+00

containment to environment Pathway Nuclide Inventory (Ci) at Time (h) = 24.5000

Nuclide	Filter	Decays	Transported
Br-82	0.0000E+00	0.00E+00	3.6242E-01
Br-83	0.0000E+00	0.00E+00	9.1411E-03
Kr-83m	0.0000E+00	0.00E+00	7.0640E+00
Kr-85	0.0000E+00	0.00E+00	5.3069E+02
Kr-85m	0.0000E+00	0.00E+00	1.0007E+02
Kr-87	0.0000E+00	0.00E+00	1.5246E-02
Kr-88	0.0000E+00	0.00E+00	3.0994E+01
I-130	0.0000E+00	0.00E+00	8.8381E-01
I-131	0.0000E+00	0.00E+00	1.2521E+02
I-132	0.0000E+00	0.00E+00	9.6219E+01
I-133	0.0000E+00	0.00E+00	7.8031E+01
I-135	0.0000E+00	0.00E+00	1.2757E+01
Xe-129m	0.0000E+00	0.00E+00	1.2731E-01
Xe-131m	0.0000E+00	0.00E+00	1.9482E+02
Xe-133	0.0000E+00	0.00E+00	3.2705E+04
Xe-133m	0.0000E+00	0.00E+00	9.6815E+02
Xe-135	0.0000E+00	0.00E+00	8.8239E+03
Xe-135m	0.0000E+00	0.00E+00	2.9776E+02

containment to environment Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	4.3658E+04
Elemental I (Ci)	0.0000E+00	1.5203E+01
Organic I (Ci)	0.0000E+00	4.7021E-01
Aerosol I (Ci)	0.0000E+00	2.9780E+02
All Aerosols (Ci)	0.0000E+00	2.9780E+02
All Aerosols (kg)	0.0000E+00	1.0380E-06

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 24.5000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	6.0319E-04	2.65E+10	1.4930E-04	7.525E-04
Br-83	1.3874E-05	6.41E+08	3.9248E-06	1.780E-05
Br-84	3.5244E-16	2.00E-02	1.6481E-16	5.393E-16
Kr-83m	0.0000E+00	0.00E+00	1.4865E-02	1.487E-02

Attachment J

Kr-85	0.0000E+00	0.00E+00	1.1071E+00	1.107E+00
Kr-85m	0.0000E+00	0.00E+00	2.0949E-01	2.095E-01
Kr-88	0.0000E+00	0.00E+00	6.5017E-02	6.502E-02
I-130	1.4529E-03	6.42E+10	3.6615E-04	1.819E-03
I-131	2.0953E-01	9.17E+12	5.1452E-02	2.610E-01
I-132	1.4547E-01	6.74E+12	4.1382E-02	1.869E-01
I-133	1.2927E-01	5.69E+12	3.2213E-02	1.615E-01
I-134	4.7623E-09	2.43E+05	1.7250E-09	6.487E-09
I-135	2.0626E-02	9.20E+11	5.3249E-03	2.595E-02
Xe-129m	0.0000E+00	0.00E+00	2.6561E-04	2.656E-04
Xe-131m	0.0000E+00	0.00E+00	4.0644E-01	4.064E-01
Xe-133	0.0000E+00	0.00E+00	6.8234E+01	6.823E+01
Xe-133m	0.0000E+00	0.00E+00	2.0203E+00	2.020E+00
Xe-135	0.0000E+00	0.00E+00	1.8439E+01	1.844E+01
Xe-135m	0.0000E+00	0.00E+00	6.6350E-01	6.635E-01

environment to control room Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	9.1160E+01
Elemental I (Ci)	2.4588E-02	6.3482E-03
Organic I (Ci)	7.6045E-04	1.9634E-04
Aerosol I (Ci)	4.8162E-01	1.2435E-01
All Aerosols (Ci)	4.8162E-01	1.2435E-01
All Aerosols (kg)	1.7342E-09	4.2684E-10

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 24.5000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	0.0000E+00	0.00E+00	2.6375E-04	2.638E-04
Kr-83m	0.0000E+00	0.00E+00	5.1438E-03	5.144E-03
Kr-85	0.0000E+00	0.00E+00	3.8620E-01	3.862E-01
Kr-85m	0.0000E+00	0.00E+00	7.2842E-02	7.284E-02
Kr-88	0.0000E+00	0.00E+00	2.2564E-02	2.256E-02
I-130	0.0000E+00	0.00E+00	6.4322E-04	6.432E-04
I-131	0.0000E+00	0.00E+00	9.1119E-02	9.112E-02
I-132	0.0000E+00	0.00E+00	7.0055E-02	7.005E-02
I-133	0.0000E+00	0.00E+00	5.6788E-02	5.679E-02
I-135	0.0000E+00	0.00E+00	9.2850E-03	9.285E-03
Xe-131m	0.0000E+00	0.00E+00	1.4177E-01	1.418E-01
Xe-133	0.0000E+00	0.00E+00	2.3800E+01	2.380E+01
Xe-133m	0.0000E+00	0.00E+00	7.0456E-01	7.046E-01
Xe-135	0.0000E+00	0.00E+00	6.4221E+00	6.422E+00
Xe-135m	0.0000E+00	0.00E+00	2.1766E-01	2.177E-01

environment to control room Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	3.1773E+01
Elemental I (Ci)	0.0000E+00	1.1066E-02
Organic I (Ci)	0.0000E+00	3.4224E-04
Aerosol I (Ci)	0.0000E+00	2.1675E-01
All Aerosols (Ci)	0.0000E+00	2.1675E-01
All Aerosols (kg)	0.0000E+00	7.5536E-10

control room to environment Pathway Nuclide Inventory (Ci) at Time (h) = 24.5000

Nuclide	Filter	Decays	Transported
Br-82	8.3854E-05	0.00E+00	0.0000E+00

Attachment J

Br-83	2.0636E-06	0.00E+00	0.0000E+00
Br-84	6.8435E-17	0.00E+00	0.0000E+00
Kr-83m	3.5548E-03	0.00E+00	1.9682E-07
Kr-85	2.7862E-01	0.00E+00	1.8278E-08
Kr-85m	5.1636E-02	0.00E+00	0.0000E+00
Kr-87	7.5300E-06	0.00E+00	0.0000E+00
Kr-88	1.5834E-02	0.00E+00	0.0000E+00
I-130	2.0381E-04	0.00E+00	0.0000E+00
I-131	2.9012E-02	0.00E+00	0.0000E+00
I-132	2.1699E-02	0.00E+00	0.0000E+00
I-133	1.8032E-02	0.00E+00	0.0000E+00
I-134	8.0561E-10	0.00E+00	0.0000E+00
I-135	2.9287E-03	0.00E+00	0.0000E+00
Xe-129m	6.6813E-05	0.00E+00	0.0000E+00
Xe-131m	1.0225E-01	0.00E+00	1.9138E-07
Xe-133	1.7160E+01	0.00E+00	6.5675E-04
Xe-133m	5.0754E-01	0.00E+00	1.7089E-06
Xe-135	4.5944E+00	0.00E+00	2.4000E-03
Xe-135m	1.1601E-01	0.00E+00	2.9724E-04

control room to environment Transport Group Inventory:

	Pathway	
Time (h) = 24.5000	Filtered	Transported
Noble gases (Ci)	2.2830E+01	3.3561E-03
Elemental I (Ci)	3.4901E-03	0.0000E+00
Organic I (Ci)	1.0794E-04	0.0000E+00
Aerosol I (Ci)	6.8363E-02	0.0000E+00
All Aerosols (Ci)	6.8363E-02	0.0000E+00
All Aerosols (kg)	2.4040E-10	0.0000E+00

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Exclusion Area Boundary Doses:

Time (h) = 25.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.9733E-02	4.8765E+00	2.0976E-01
Accumulated dose (rem)	4.1308E-01	3.2193E+01	1.4040E+00

Low Population Zone Doses:

Time (h) = 25.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.3312E-02	2.7196E+00	1.1698E-01
Accumulated dose (rem)	2.3037E-01	1.7954E+01	7.8302E-01

control room Doses:

Time (h) = 25.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	3.0708E-02	2.1078E+01	6.7915E-01	1.8409E+00
Accumulated dose (rem)	5.4491E-02	3.9405E+01	1.2671E+00	3.2449E+00

containment Compartment Nuclide Inventory (Ci) at Time (h) = 25.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Outflow
Br-82	Atmosphere	1.4364E-04	1.1441E-01	1.5246E+13	4.2677E-01
Br-83		1.2207E-07	2.7999E-03	3.7531E+11	1.0561E-02

Attachment J

Kr-83m	1.9880E-01	1.6420E-08	2.1435E+00	2.8787E+14	8.1142E+00
Kr-85	2.0532E+01	1.0204E-04	1.6792E+02	2.2366E+16	6.2584E+02
Kr-85m	3.4001E+00	1.1883E-03	3.1109E+01	4.1577E+15	1.1669E+02
Kr-87	3.7259E-04	9.5688E-07	4.5479E-03	6.1298E+11	1.7333E-02
Kr-88	9.7680E-01	4.9697E-03	9.5407E+00	1.2776E+15	3.5919E+01
I-130	3.2623E-02	5.0212E-04	2.7783E-01	3.7053E+13	1.0379E+00
I-131	4.8297E+00	6.3292E-01	3.9601E+01	5.2752E+15	1.4762E+02
I-132	2.8894E+00	2.2255E-02	2.9436E+01	3.9466E+15	1.1108E+02
I-133	2.9358E+00	7.3147E-02	2.4594E+01	3.2783E+15	9.1792E+01
I-134	7.4061E-08	7.9103E-10	1.0876E-06	1.4735E+08	4.1859E-06
I-135	4.5198E-01	4.0556E-03	3.9880E+00	5.3242E+14	1.4928E+01
Xe-129m	4.9108E-03	2.1796E-07	4.0266E-02	5.3638E+12	1.5010E-01
Xe-131m	7.5222E+00	1.2242E-04	6.1624E+01	8.2088E+15	2.2970E+02
Xe-133	1.2597E+03	8.2386E-02	1.0342E+04	1.3777E+18	3.8553E+04
Xe-133m	3.7046E+01	2.1399E-03	3.0586E+02	4.0752E+16	1.1406E+03
Xe-135	3.2055E+02	1.6821E-01	2.7680E+03	3.6929E+17	1.0348E+04
Xe-135m	1.1760E+00	7.8489E-03	7.5341E+01	1.0611E+16	3.1192E+02
Total	1.6622E+03	1.0000E+00	0.0000E+00	0.0000E+00	5.1737E+04
Dose Equivalent (Ci/cc) I-131 (Thyroid)				2.3759E-10	
Dose Equivalent (Ci/cc) I-131 (CEDE)				2.3996E-10	
Dose Equivalent (Ci/cc) I-131 (ICRP2 Thyroid)				2.5570E-10	
Total I (Ci)				1.1107E+01	
Dose Equivalent (Ci/cc) Xe-133 (EDE)				1.7042E-07	

containment Compartment Group Inventory Distribution:

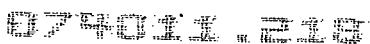
Time (h) = 25.0000	Atmosphere	Sump
Noble gases (Ci)	1.6511E+03	0.0000E+00
Elemental I (Ci)	5.4095E-01	0.0000E+00
Organic I (Ci)	1.6730E-02	0.0000E+00
Aerosol I (Ci)	1.0596E+01	0.0000E+00
All Aerosols (Ci)	1.0596E+01	0.0000E+00
All Aerosols (kg)	3.9888E-08	0.0000E+00

environment Integral Nuclide Release (Ci): at Time (h) = 25.0000

Nuclide	Compartment	Dose Fract
	Atmosphere	Pathway 1
Br-82	4.2588E-01	0.00014
Br-83	1.0539E-02	0.00000
Kr-83m	8.0975E+00	0.00000
Kr-85	6.2454E+02	0.00010
Kr-85m	1.1645E+02	0.00119
Kr-87	1.7297E-02	0.00000
Kr-88	3.5844E+01	0.00501
I-130	1.0358E+00	0.00050
I-131	1.4731E+02	0.63178
I-132	1.1085E+02	0.02249
I-133	9.1601E+01	0.07311
I-134	4.1774E-06	0.00000
I-135	1.4897E+01	0.00407
Xe-129m	1.4978E-01	0.00000
Xe-131m	2.2923E+02	0.00012
Xe-133	3.8472E+04	0.08224
Xe-133m	1.1382E+03	0.00214
Xe-135	1.0327E+04	0.16840
Xe-135m	3.1132E+02	0.00870

environment Compartment Group Inventory Distribution:

Time (h) = 25.0000	Total Release	Release Rate/s
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Attachment J

Noble gases (Ci)	5.1263E+04	1.4240E+01
Elemental I (Ci)	1.7757E+01	4.9326E-03
Organic I (Ci)	5.4920E-01	1.5255E-04
Aerosol I (Ci)	3.4782E+02	9.6618E-02
All Aerosols (Ci)	3.4782E+02	9.6618E-02

control room Compartment Nuclide Inventory (Ci) at Time (h) = 25.0000

Nuclide 3 Pathway	Compartment 4 Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 2 Inflow	Pathway Inflow
Outflow						
Br-82	2.9227E-04	1.0334E-04	3.0472E-04	4.0609E+10	1.4930E-04	3.0982E-
04 1.7843E-04						
Br-83	5.8726E-06	8.1784E-08	6.9447E-06	9.3152E+08	3.9248E-06	7.6717E-
06 4.1158E-06						
Kr-83m	1.1519E-02	2.6840E-08	1.2971E-02	1.7437E+12	1.6729E-02	5.8957E-
03 7.6114E-03						
Kr-85	1.1896E+00	1.8605E-04	1.1334E+00	1.5096E+14	1.2757E+00	4.5432E-
01 6.5504E-01						
Kr-85m	1.9699E-01	2.0712E-03	2.0073E-01	2.6837E+13	2.3894E-01	8.4740E-
02 1.1674E-01						
Kr-87	2.1587E-05	1.4921E-06	2.6254E-05	3.5436E+09	3.5900E-05	1.2599E-
05 1.5508E-05						
Kr-88	5.6594E-02	8.4414E-03	5.9994E-02	8.0386E+12	7.3743E-02	2.6090E-
02 3.5016E-02						
I-130	6.9127E-04	3.5776E-04	7.3284E-04	9.7746E+10	3.6615E-04	7.5357E-
04 4.2982E-04						
I-131	1.0234E-01	4.5731E-01	1.0593E-01	1.4111E+13	5.1452E-02	1.0716E-
01 6.1981E-02						
I-132	6.1226E-02	1.4867E-02	7.2796E-02	9.7670E+12	4.1382E-02	8.0694E-
02 4.3164E-02						
I-133	6.2208E-02	5.2434E-02	6.5266E-02	8.7004E+12	3.2213E-02	6.6640E-
02 3.8240E-02						
I-135	9.5773E-03	2.8525E-03	1.0384E-02	1.3866E+12	5.3249E-03	1.0840E-
02 6.1034E-03						
Xe-129m	2.8452E-04	3.9698E-07	2.7149E-04	3.6166E+10	3.0599E-04	1.0896E-
04 1.5693E-04						
Xe-131m	4.3582E-01	2.2304E-04	4.1565E-01	5.5368E+13	4.6826E-01	1.6675E-
01 2.4025E-01						
Xe-133	7.2983E+01	1.4998E-01	6.9693E+01	9.2843E+15	7.8598E+01	
2.7987E+01	4.0288E+01					
Xe-133m	2.1464E+00	3.8865E-03	2.0565E+00	2.7402E+14	2.3259E+00	8.2803E-
01 1.1892E+00						
Xe-135	1.8572E+01	3.0007E-01	1.8280E+01	2.4393E+15	2.1141E+01	
7.5136E+00	1.0597E+01					
Xe-135m	6.8689E-02	7.2156E-03	2.5641E-01	3.6389E+13	6.9322E-01	2.2780E-
01 1.6402E-01						
Total	9.5897E+01	1.0000E+00	0.0000E+00	0.0000E+00	1.0496E+02	
3.7561E+01	5.3443E+01					

control room Compartment Group Inventory Distribution:

Time (h) = 25.0000	Atmosphere	Sump
Noble gases (Ci)	9.5661E+01	0.0000E+00
Elemental I (Ci)	1.1463E-02	0.0000E+00
Organic I (Ci)	3.5451E-04	0.0000E+00
Aerosol I (Ci)	2.2452E-01	0.0000E+00
All Aerosols (Ci)	2.2452E-01	0.0000E+00
All Aerosols (kg)	8.4521E-10	0.0000E+00

containment to environment Pathway Nuclide Inventory (Ci) at Time (h) = 25.0000

Attachment J			
Nuclide	Filter	Decays	Transported
Br-82	0.0000E+00	0.00E+00	4.2677E-01
Br-83	0.0000E+00	0.00E+00	1.0561E-02
Kr-83m	0.0000E+00	0.00E+00	8.1142E+00
Kr-85	0.0000E+00	0.00E+00	6.2584E+02
Kr-85m	0.0000E+00	0.00E+00	1.1669E+02
Kr-87	0.0000E+00	0.00E+00	1.7333E-02
Kr-88	0.0000E+00	0.00E+00	3.5919E+01
I-130	0.0000E+00	0.00E+00	1.0379E+00
I-131	0.0000E+00	0.00E+00	1.4762E+02
I-132	0.0000E+00	0.00E+00	1.1108E+02
I-133	0.0000E+00	0.00E+00	9.1792E+01
I-135	0.0000E+00	0.00E+00	1.4928E+01
Xe-129m	0.0000E+00	0.00E+00	1.5010E-01
Xe-131m	0.0000E+00	0.00E+00	2.2970E+02
Xe-133	0.0000E+00	0.00E+00	3.8553E+04
Xe-133m	0.0000E+00	0.00E+00	1.1406E+03
Xe-135	0.0000E+00	0.00E+00	1.0348E+04
Xe-135m	0.0000E+00	0.00E+00	3.1192E+02

containment to environment Transport Group Inventory:

Pathway		
Time (h) = 25.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	5.1370E+04
Elemental I (Ci)	0.0000E+00	1.7794E+01
Organic I (Ci)	0.0000E+00	5.5034E-01
Aerosol I (Ci)	0.0000E+00	3.4855E+02
All Aerosols (Ci)	0.0000E+00	3.4855E+02
All Aerosols (kg)	0.0000E+00	1.2233E-06

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 25.0000

Nuclide	Filter	Decays	Transported	Activity
Pathway 1				
Br-82	7.1056E-04	7.16E+10	1.4930E-04	8.599E-04
Br-83	1.4277E-05	1.61E+09	3.9248E-06	1.890E-05
Br-84	2.1802E-16	3.93E-02	1.6481E-16	6.737E-16
Kr-83m	0.0000E+00	0.00E+00	1.6729E-02	1.673E-02
Kr-85	0.0000E+00	0.00E+00	1.2757E+00	1.276E+00
Kr-85m	0.0000E+00	0.00E+00	2.3894E-01	2.389E-01
Kr-88	0.0000E+00	0.00E+00	7.3743E-02	7.374E-02
I-130	1.6806E-03	1.72E+11	3.6615E-04	2.047E-03
I-131	2.4881E-01	2.49E+13	5.1452E-02	3.003E-01
I-132	1.4885E-01	1.69E+13	4.1382E-02	1.984E-01
I-133	1.5124E-01	1.53E+13	3.2213E-02	1.835E-01
I-134	3.8154E-09	5.38E+05	1.7250E-09	7.434E-09
I-135	2.3284E-02	2.43E+12	5.3249E-03	2.861E-02
Xe-129m	0.0000E+00	0.00E+00	3.0599E-04	3.060E-04
Xe-131m	0.0000E+00	0.00E+00	4.6826E-01	4.683E-01
Xe-133	0.0000E+00	0.00E+00	7.8598E+01	7.860E+01
Xe-133m	0.0000E+00	0.00E+00	2.3259E+00	2.326E+00
Xe-135	0.0000E+00	0.00E+00	2.1141E+01	2.114E+01
Xe-135m	0.0000E+00	0.00E+00	6.9322E-01	6.932E-01

environment to control room Transport Group Inventory:

Pathway		
Time (h) = 25.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	1.0483E+02
Elemental I (Ci)	2.7868E-02	6.3482E-03
Organic I (Ci)	8.6189E-04	1.9634E-04

Attachment J

Aerosol I (Ci)	5.4586E-01	1.2435E-01
All Aerosols (Ci)	5.4586E-01	1.2435E-01
All Aerosols (kg)	2.0549E-09	4.2684E-10

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 25.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	0.0000E+00	0.00E+00	3.0982E-04	3.098E-04
Kr-83m	0.0000E+00	0.00E+00	5.8957E-03	5.896E-03
Kr-85	0.0000E+00	0.00E+00	4.5432E-01	4.543E-01
Kr-85m	0.0000E+00	0.00E+00	8.4740E-02	8.474E-02
Kr-88	0.0000E+00	0.00E+00	2.6090E-02	2.609E-02
I-130	0.0000E+00	0.00E+00	7.5357E-04	7.536E-04
I-131	0.0000E+00	0.00E+00	1.0716E-01	1.072E-01
I-132	0.0000E+00	0.00E+00	8.0694E-02	8.069E-02
I-133	0.0000E+00	0.00E+00	6.6640E-02	6.664E-02
I-135	0.0000E+00	0.00E+00	1.0840E-02	1.084E-02
Xe-129m	0.0000E+00	0.00E+00	1.0896E-04	1.090E-04
Xe-131m	0.0000E+00	0.00E+00	1.6675E-01	1.668E-01
Xe-133	0.0000E+00	0.00E+00	2.7987E+01	2.799E+01
Xe-133m	0.0000E+00	0.00E+00	8.2803E-01	8.280E-01
Xe-135	0.0000E+00	0.00E+00	7.5136E+00	7.514E+00
Xe-135m	0.0000E+00	0.00E+00	2.2780E-01	2.278E-01

environment to control room Transport Group Inventory:

	Pathway Filtered	Transported
Time (h) = 25.0000		
Noble gases (Ci)	0.0000E+00	3.7294E+01
Elemental I (Ci)	0.0000E+00	1.2921E-02
Organic I (Ci)	0.0000E+00	3.9961E-04
Aerosol I (Ci)	0.0000E+00	2.5309E-01
All Aerosols (Ci)	0.0000E+00	2.5309E-01
All Aerosols (kg)	0.0000E+00	8.8806E-10

control room to environment Pathway Nuclide Inventory (Ci) at Time (h) = 25.0000

Nuclide	Filter	Decays	Transported
Br-82	1.7843E-04	0.00E+00	0.0000E+00
Br-83	4.1158E-06	0.00E+00	0.0000E+00
Br-84	1.1084E-16	0.00E+00	0.0000E+00
Kr-83m	7.6114E-03	0.00E+00	8.0919E-07
Kr-85	6.5504E-01	0.00E+00	8.6658E-08
Kr-85m	1.1674E-01	0.00E+00	0.0000E+00
Kr-87	1.5508E-05	0.00E+00	0.0000E+00
Kr-88	3.5016E-02	0.00E+00	0.0000E+00
I-130	4.2982E-04	0.00E+00	0.0000E+00
I-131	6.1981E-02	0.00E+00	0.0000E+00
I-132	4.3164E-02	0.00E+00	0.0000E+00
I-133	3.8240E-02	0.00E+00	0.0000E+00
I-134	1.4403E-09	0.00E+00	0.0000E+00
I-135	6.1034E-03	0.00E+00	0.0000E+00
Xe-129m	1.5693E-04	0.00E+00	0.0000E+00
Xe-131m	2.4025E-01	0.00E+00	8.2603E-07
Xe-133	4.0288E+01	0.00E+00	3.1815E-03
Xe-133m	1.1892E+00	0.00E+00	7.3376E-06
Xe-135	1.0597E+01	0.00E+00	8.0620E-03
Xe-135m	1.6402E-01	0.00E+00	1.2606E-03

control room to environment Transport Group Inventory:

Attachment J

	Pathway	
Time (h) = 25.0000	Filtered	Transported
Noble gases (Ci)	5.3293E+01	1.2513E-02
Elemental I (Ci)	7.2799E-03	0.0000E+00
Organic I (Ci)	2.2515E-04	0.0000E+00
Aerosol I (Ci)	1.4260E-01	0.0000E+00
All Aerosols (Ci)	1.4260E-01	0.0000E+00
All Aerosols (kg)	5.1301E-10	0.0000E+00

ALION RADTRAD Version 3.10 Rev 2 run on 6/16/2011 at 13:31:55

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Exclusion Area Boundary Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1959E-02	1.0171E+00	4.3230E-02
Accumulated dose (rem)	4.2504E-01	3.3210E+01	1.4473E+00

Low Population Zone Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.6692E-03	5.6724E-01	2.4109E-02
Accumulated dose (rem)	2.3704E-01	1.8521E+01	8.0713E-01

control room Doses:

Time (h) = 26.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	4.2522E-02	2.9772E+01	9.5771E-01	2.5732E+00
Accumulated dose (rem)	9.7013E-02	6.9178E+01	2.2248E+00	5.8181E+00

containment Compartment Nuclide Inventory (Ci) at Time (h) = 26.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Outflow
Br-82	4.2782E-04	1.4370E-04	1.1793E-01	1.5716E+13	4.4010E-01
Br-83	6.5596E-06	1.2124E-07	2.8656E-03	3.8413E+11	1.0813E-02
Kr-83m	4.3081E-03	1.6278E-08	2.1896E+00	2.9406E+14	8.2915E+00
Kr-85	6.4947E-01	1.0214E-04	1.7319E+02	2.3069E+16	6.4577E+02
Kr-85m	9.2134E-02	1.1843E-03	3.1945E+01	4.2696E+15	1.1988E+02
Kr-87	6.8334E-06	9.4552E-07	4.6306E-03	6.2413E+11	1.7654E-02
Kr-88	2.4207E-02	4.9416E-03	9.7753E+00	1.3090E+15	3.6816E+01
I-130	9.7565E-04	5.0178E-04	2.8608E-01	3.8153E+13	1.0692E+00
I-131	1.5223E-01	6.3348E-01	4.0840E+01	5.4403E+15	1.5230E+02
I-132	6.7617E-02	2.2100E-02	3.0119E+01	4.0383E+15	1.1370E+02
I-133	8.9821E-02	7.3146E-02	2.5341E+01	3.3779E+15	9.4620E+01
I-134	1.0625E-09	7.7859E-10	1.1030E-06	1.4945E+08	4.2466E-06
I-135	1.2874E-02	4.0472E-03	4.1007E+00	5.4747E+14	1.5357E+01
Xe-129m	1.5478E-04	2.1815E-07	4.1526E-02	5.5317E+12	1.5486E-01
Xe-131m	2.3737E-01	1.2253E-04	6.3555E+01	8.4660E+15	2.3700E+02
Xe-133	3.9634E+01	8.2454E-02	1.0665E+04	1.4207E+18	3.9774E+04
Xe-133m	1.1565E+00	2.1411E-03	3.1534E+02	4.2016E+16	1.1765E+03
Xe-135	9.3969E+00	1.6801E-01	2.8486E+03	3.8005E+17	1.0654E+04
Xe-135m	4.3546E-03	7.6345E-03	7.5512E+01	1.0635E+16	3.1265E+02
Total	5.1524E+01	1.0000E+00	0.0000E+00	0.0000E+00	5.3343E+04

Dose Equivalent (Ci/cc)	I-131 (Thyroid)	7.4606E-12
Dose Equivalent (Ci/cc)	I-131 (CEDE)	7.5274E-12
Dose Equivalent (Ci/cc)	I-131 (ICRP2 Thyroid)	7.9845E-12

Attachment J

Total I (Ci) 3.2254E-01
Dose Equivalent (Ci/cc) Xe-133 (EDE) 5.0872E-09

containment Compartment Group Inventory Distribution:

Time (h) = 26.0000	Atmosphere	Sump
Noble gases (Ci)	5.1200E+01	0.0000E+00
Elemental I (Ci)	1.5712E-02	0.0000E+00
Organic I (Ci)	4.8592E-04	0.0000E+00
Aerosol I (Ci)	3.0775E-01	0.0000E+00
All Aerosols (Ci)	3.0775E-01	0.0000E+00
All Aerosols (kg)	1.2524E-09	0.0000E+00

environment Integral Nuclide Release (Ci): at Time (h) = 26.0000

Nuclide	Compartment	Dose Fract
	Atmosphere	Pathway 1
Br-82	4.3918E-01	0.00014
Br-83	1.0790E-02	0.00000
Kr-83m	8.2744E+00	0.00000
Kr-85	6.4442E+02	0.00010
Kr-85m	1.1963E+02	0.00119
Kr-87	1.7617E-02	0.00000
Kr-88	3.6739E+01	0.00498
I-130	1.0669E+00	0.00050
I-131	1.5198E+02	0.63235
I-132	1.1346E+02	0.02233
I-133	9.4422E+01	0.07311
I-134	4.2380E-06	0.00000
I-135	1.5324E+01	0.00406
Xe-129m	1.5454E-01	0.00000
Xe-131m	2.3651E+02	0.00012
Xe-133	3.9691E+04	0.08231
Xe-133m	1.1740E+03	0.00214
Xe-135	1.0632E+04	0.16820
Xe-135m	3.1205E+02	0.00846

environment Compartment Group Inventory Distribution:

Time (h) = 26.0000	Total	Release
	Release	Rate/s
Noble gases (Ci)	5.2854E+04	7.3409E+00
Elemental I (Ci)	1.8271E+01	2.5376E-03
Organic I (Ci)	5.6507E-01	7.8482E-05
Aerosol I (Ci)	3.5788E+02	4.9705E-02
All Aerosols (Ci)	3.5788E+02	4.9705E-02

control room Compartment Nuclide Inventory (Ci) at Time (h) = 26.0000

Nuclide	Compartment	Dose Fract	Exposure	Decays	Pathway 2	Pathway
3 Pathway 4	Atmosphere		(Ci-hr)	(Bq-s)	Inflow	Inflow
Outflow						
Br-82	1.6588E-04	1.0233E-04	5.2674E-04	7.0195E+10	1.4930E-04	3.1937E-
04 3.1088E-04						
Br-83	2.5435E-06	7.3373E-08	1.0877E-05	1.4591E+09	3.9248E-06	7.8522E-
06 6.4932E-06						
Kr-83m	4.6190E-03	2.4224E-08	2.0438E-02	2.7476E+12	1.7048E-02	6.0226E-
03 1.2144E-02						
Kr-85	6.9609E-01	1.9300E-04	2.0525E+00	2.7340E+14	1.3110E+00	4.6859E-
01 1.2027E+00						
Kr-85m	9.8748E-02	2.0225E-03	3.4218E-01	4.5752E+13	2.4459E-01	8.7021E-
02 2.0167E-01						

containment to environment Transport Group Inventory:

Attachment J

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	5.2965E+04
Elemental I (Ci)	0.0000E+00	1.8309E+01
Organic I (Ci)	0.0000E+00	5.6625E-01
Aerosol I (Ci)	0.0000E+00	3.5863E+02
All Aerosols (Ci)	0.0000E+00	3.5863E+02
All Aerosols (kg)	0.0000E+00	1.2620E-06

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 26.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	7.2001E-04	1.68E+11	1.4930E-04	8.764E-04
Br-83	1.1040E-05	3.30E+09	3.9248E-06	2.214E-05
Br-84	6.0923E-17	5.59E-02	1.6481E-16	8.308E-16
Kr-83m	0.0000E+00	0.00E+00	1.7048E-02	1.705E-02
Kr-85	0.0000E+00	0.00E+00	1.3110E+00	1.311E+00
Kr-85m	0.0000E+00	0.00E+00	2.4459E-01	2.446E-01
Kr-88	0.0000E+00	0.00E+00	7.5333E-02	7.533E-02
I-130	1.6420E-03	3.95E+11	3.6615E-04	2.105E-03
I-131	2.5620E-01	5.89E+13	5.1452E-02	3.076E-01
I-132	1.1380E-01	3.44E+13	4.1382E-02	2.334E-01
I-133	1.5117E-01	3.57E+13	3.2213E-02	1.872E-01
I-134	1.7882E-09	8.97E+05	1.7250E-09	9.461E-09
I-135	2.1666E-02	5.45E+12	5.3249E-03	3.024E-02
Xe-129m	0.0000E+00	0.00E+00	3.1443E-04	3.144E-04
Xe-131m	0.0000E+00	0.00E+00	4.8120E-01	4.812E-01
Xe-133	0.0000E+00	0.00E+00	8.0763E+01	8.076E+01
Xe-133m	0.0000E+00	0.00E+00	2.3895E+00	2.390E+00
Xe-135	0.0000E+00	0.00E+00	2.1684E+01	2.168E+01
Xe-135m	0.0000E+00	0.00E+00	7.0376E-01	7.038E-01

environment to control room Transport Group Inventory:

	Pathway	
Time (h) = 26.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	1.0767E+02
Elemental I (Ci)	2.6442E-02	6.3482E-03
Organic I (Ci)	8.1780E-04	1.9634E-04
Aerosol I (Ci)	5.1794E-01	1.2435E-01
All Aerosols (Ci)	5.1794E-01	1.2435E-01
All Aerosols (kg)	2.1077E-09	4.2684E-10

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 26.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	0.0000E+00	0.00E+00	3.1937E-04	3.194E-04
Kr-83m	0.0000E+00	0.00E+00	6.0226E-03	6.023E-03
Kr-85	0.0000E+00	0.00E+00	4.6859E-01	4.686E-01
Kr-85m	0.0000E+00	0.00E+00	8.7021E-02	8.702E-02
Kr-88	0.0000E+00	0.00E+00	2.6732E-02	2.673E-02
I-130	0.0000E+00	0.00E+00	7.7595E-04	7.759E-04
I-131	0.0000E+00	0.00E+00	1.1052E-01	1.105E-01
I-132	0.0000E+00	0.00E+00	8.2570E-02	8.257E-02
I-133	0.0000E+00	0.00E+00	6.8665E-02	6.867E-02
I-135	0.0000E+00	0.00E+00	1.1146E-02	1.115E-02
Xe-129m	0.0000E+00	0.00E+00	1.1237E-04	1.124E-04
Xe-131m	0.0000E+00	0.00E+00	1.7198E-01	1.720E-01
Xe-133	0.0000E+00	0.00E+00	2.8862E+01	2.886E+01
Xe-133m	0.0000E+00	0.00E+00	8.5370E-01	8.537E-01

Item	Quantity	Unit	Value
1. 1000	1000	1000	1000
2. 1000	1000	1000	1000
3. 1000	1000	1000	1000
4. 1000	1000	1000	1000
5. 1000	1000	1000	1000
6. 1000	1000	1000	1000
7. 1000	1000	1000	1000
8. 1000	1000	1000	1000
9. 1000	1000	1000	1000
10. 1000	1000	1000	1000
11. 1000	1000	1000	1000
12. 1000	1000	1000	1000
13. 1000	1000	1000	1000
14. 1000	1000	1000	1000
15. 1000	1000	1000	1000
16. 1000	1000	1000	1000
17. 1000	1000	1000	1000
18. 1000	1000	1000	1000
19. 1000	1000	1000	1000
20. 1000	1000	1000	1000
21. 1000	1000	1000	1000
22. 1000	1000	1000	1000
23. 1000	1000	1000	1000
24. 1000	1000	1000	1000
25. 1000	1000	1000	1000
26. 1000	1000	1000	1000
27. 1000	1000	1000	1000
28. 1000	1000	1000	1000
29. 1000	1000	1000	1000
30. 1000	1000	1000	1000
31. 1000	1000	1000	1000
32. 1000	1000	1000	1000
33. 1000	1000	1000	1000
34. 1000	1000	1000	1000
35. 1000	1000	1000	1000
36. 1000	1000	1000	1000
37. 1000	1000	1000	1000
38. 1000	1000	1000	1000
39. 1000	1000	1000	1000
40. 1000	1000	1000	1000
41. 1000	1000	1000	1000
42. 1000	1000	1000	1000
43. 1000	1000	1000	1000
44. 1000	1000	1000	1000
45. 1000	1000	1000	1000
46. 1000	1000	1000	1000
47. 1000	1000	1000	1000
48. 1000	1000	1000	1000
49. 1000	1000	1000	1000
50. 1000	1000	1000	1000
51. 1000	1000	1000	1000
52. 1000	1000	1000	1000
53. 1000	1000	1000	1000
54. 1000	1000	1000	1000
55. 1000	1000	1000	1000
56. 1000	1000	1000	1000
57. 1000	1000	1000	1000
58. 1000	1000	1000	1000
59. 1000	1000	1000	1000
60. 1000	1000	1000	1000
61. 1000	1000	1000	1000
62. 1000	1000	1000	1000
63. 1000	1000	1000	1000
64. 1000	1000	1000	1000
65. 1000	1000	1000	1000
66. 1000	1000	1000	1000
67. 1000	1000	1000	1000
68. 1000	1000	1000	1000
69. 1000	1000	1000	1000
70. 1000	1000	1000	1000
71. 1000	1000	1000	1000
72. 1000	1000	1000	1000
73. 1000	1000	1000	1000
74. 1000	1000	1000	1000
75. 1000	1000	1000	1000
76. 1000	1000	1000	1000
77. 1000	1000	1000	1000
78. 1000	1000	1000	1000
79. 1000	1000	1000	1000
80. 1000	1000		

Attachment J

Time (h) = 32.0000 Whole Body Thyroid TEDE
Delta dose (rem) 2.0360E-04 1.8390E-02 7.6848E-04
Accumulated dose (rem) 2.3724E-01 1.8539E+01 8.0790E-01

control room Doses:

Time (h) = 32.0000 Whole Body Thyroid TEDE Skin
Delta dose (rem) 4.6993E-02 3.6138E+01 1.1561E+00 2.8863E+00
Accumulated dose (rem) 1.4401E-01 1.0532E+02 3.3809E+00 8.7044E+00

containment Compartment Nuclide Inventory (Ci) at Time (h) = 32.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Outflow
Br-82	3.8094E-13	1.4370E-04	1.1805E-01	1.5731E+13	4.4053E-01
Br-83	1.1532E-15	1.2120E-07	2.8672E-03	3.8434E+11	1.0819E-02
Kr-83m	4.4674E-13	1.6270E-08	2.1906E+00	2.9420E+14	8.2955E+00
Kr-85	6.5058E-10	1.0215E-04	1.7336E+02	2.3092E+16	6.4642E+02
Kr-85m	3.6477E-11	1.1840E-03	3.1969E+01	4.2727E+15	1.1996E+02
Kr-87	2.6006E-16	9.4494E-07	4.6321E-03	6.2434E+11	1.7660E-02
Kr-88	5.6069E-12	4.9400E-03	9.7812E+00	1.3098E+15	3.6839E+01
I-130	6.9812E-13	5.0175E-04	2.8634E-01	3.8187E+13	1.0701E+00
I-131	1.4924E-10	6.3351E-01	4.0881E+01	5.4457E+15	1.5246E+02
I-132	1.1105E-11	2.2091E-02	3.0135E+01	4.0405E+15	1.1376E+02
I-133	7.3673E-11	7.3145E-02	2.5365E+01	3.3811E+15	9.4709E+01
I-134	9.2645E-21	7.7802E-10	1.1032E-06	1.4948E+08	4.2475E-06
I-135	6.8741E-12	4.0467E-03	4.1040E+00	5.4792E+14	1.5369E+01
Xe-129m	1.5173E-13	2.1816E-07	4.1567E-02	5.5371E+12	1.5502E-01
Xe-131m	2.3437E-10	1.2254E-04	6.3618E+01	8.4744E+15	2.3724E+02
Xe-133	3.8452E-08	8.2457E-02	1.0675E+04	1.4221E+18	3.9814E+04
Xe-133m	1.0705E-09	2.1412E-03	3.1565E+02	4.2056E+16	1.1776E+03
Xe-135	5.9608E-09	1.6799E-01	2.8511E+03	3.8037E+17	1.0663E+04
Xe-135m	1.0970E-12	7.6274E-03	7.5512E+01	1.0635E+16	3.1266E+02
Total	4.6654E-08	1.0000E+00	0.0000E+00	0.0000E+00	5.3394E+04

environment Integral Nuclide Release (Ci): at Time (h) = 32.0000

Nuclide	Compartment	Dose Fract
	Atmosphere	Pathway 1
Br-82	4.3960E-01	0.00014
Br-83	1.0796E-02	0.00000
Kr-83m	8.2783E+00	0.00000
Kr-85	6.4507E+02	0.00010
Kr-85m	1.1971E+02	0.00119
Kr-87	1.7623E-02	0.00000
Kr-88	3.6762E+01	0.00498
I-130	1.0679E+00	0.00050
I-131	1.5214E+02	0.63239
I-132	1.1353E+02	0.02232
I-133	9.4511E+01	0.07311
I-134	4.2388E-06	0.00000
I-135	1.5337E+01	0.00406
Xe-129m	1.5469E-01	0.00000
Xe-131m	2.3674E+02	0.00012
Xe-133	3.9730E+04	0.08232
Xe-133m	1.1751E+03	0.00214
Xe-135	1.0641E+04	0.16818
Xe-135m	3.1209E+02	0.00845

environment Compartment Group Inventory Distribution:

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	Total	Release
Time (h) = 32.0000	Release	Rate/s
Noble gases (Ci)	5.2906E+04	1.8370E+00
Elemental I (Ci)	1.8286E+01	6.3493E-04
Organic I (Ci)	5.6554E-01	1.9637E-05
Aerosol I (Ci)	3.5818E+02	1.2437E-02
All Aerosols (Ci)	3.5818E+02	1.2437E-02

control room Compartment Nuclide Inventory (Ci) at Time (h) = 32.0000

Nuclide	Compartment	Dose Fract	Exposure	Decays	Pathway 2	Pathway
3 Pathway	4		(Ci-hr)	(Bq-s)	Inflow	Inflow
Atmosphere						
Outflow						
Br-82	4.3404E-06	1.0256E-04	7.8904E-04	1.0515E+11	1.4930E-04	3.1960E-
04 4.6754E-04						
Br-83	1.3140E-08	6.1839E-08	1.3700E-05	1.8379E+09	3.9248E-06	7.8556E-
06 8.2026E-06						
Kr-83m	1.5126E-05	1.9913E-08	2.5108E-02	3.3756E+12	1.7066E-02	6.0248E-
03 1.4984E-02						
Kr-85	2.0500E-02	2.0053E-04	3.1872E+00	4.2454E+14	1.3119E+00	4.6895E-
01 1.8797E+00						
Kr-85m	1.1494E-03	1.8644E-03	4.7143E-01	6.3035E+13	2.4471E-01	8.7071E-
02 2.7938E-01						
Kr-87	8.1944E-09	9.9192E-07	4.5536E-05	6.1471E+09	3.6477E-05	1.2832E-
05 2.7317E-05						
Kr-88	1.7667E-04	6.9769E-03	1.2937E-01	1.7336E+13	7.5365E-02	2.6745E-
02 7.6883E-02						
I-130	7.9542E-06	3.3974E-04	1.8157E-03	2.4219E+11	3.6615E-04	7.7649E-
04 1.0774E-03						
I-131	1.7005E-03	4.6318E-01	2.7991E-01	3.7287E+13	5.1452E-02	1.1060E-
01 1.6576E-01						
I-132	1.2653E-04	1.1140E-02	1.4231E-01	1.9097E+13	4.1382E-02	8.2605E-
02 8.5242E-02						
I-133	8.3942E-04	5.1167E-02	1.6617E-01	2.2152E+13	3.2213E-02	6.8715E-
02 9.8511E-02						
I-135	7.8323E-05	2.5640E-03	2.4352E-02	3.2521E+12	5.3249E-03	1.1153E-
02 1.4477E-02						
Xe-129m	4.7809E-06	4.2586E-07	7.5987E-04	1.0122E+11	3.1464E-04	1.1246E-
04 4.4819E-04						
Xe-131m	7.3958E-03	2.3966E-04	1.1652E+00	1.5522E+14	4.8157E-01	1.7211E-
01 6.8725E-01						
Xe-133	1.2127E+00	1.6053E-01	1.9463E+02	2.5928E+16	8.0822E+01	
2.8884E+01	1.1480E+02					
Xe-133m	3.3810E-02	4.1179E-03	5.6851E+00	7.5750E+14	2.3914E+00	8.5434E-
01 3.3542E+00						
Xe-135	1.8927E-01	2.9442E-01	4.6795E+01	6.2447E+15	2.1703E+01	
7.7377E+00	2.7663E+01					
Xe-135m	1.5402E-03	3.1569E-03	2.9269E-01	4.1311E+13	7.4316E-01	2.2832E-
01 1.8702E-01						
Total	1.4694E+00	1.0000E+00	0.0000E+00	0.0000E+00	1.0792E+02	
3.8739E+01	1.4931E+02					

control room Compartment Group Inventory Distribution:

Time (h) = 32.0000	Atmosphere	Sump
Noble gases (Ci)	1.4666E+00	0.0000E+00
Elemental I (Ci)	1.3372E-04	0.0000E+00
Organic I (Ci)	4.1356E-06	0.0000E+00
Aerosol I (Ci)	2.6192E-03	0.0000E+00
All Aerosols (Ci)	2.6192E-03	0.0000E+00
All Aerosols (kg)	1.3775E-11	0.0000E+00

Nuclide	Filter	Decays	Transported
Br-82	0.0000E+00	0.00E+00	4.4053E-01
Br-83	0.0000E+00	0.00E+00	1.0819E-02
Kr-83m	0.0000E+00	0.00E+00	8.2955E+00
Kr-85	0.0000E+00	0.00E+00	6.4642E+02
Kr-85m	0.0000E+00	0.00E+00	1.1996E+02
Kr-87	0.0000E+00	0.00E+00	1.7660E-02
Kr-88	0.0000E+00	0.00E+00	3.6839E+01
I-130	0.0000E+00	0.00E+00	1.0701E+00
I-131	0.0000E+00	0.00E+00	1.5246E+02
I-132	0.0000E+00	0.00E+00	1.1376E+02
I-133	0.0000E+00	0.00E+00	9.4709E+01
I-135	0.0000E+00	0.00E+00	1.5369E+01
Xe-129m	0.0000E+00	0.00E+00	1.5502E-01
Xe-131m	0.0000E+00	0.00E+00	2.3724E+02
Xe-133	0.0000E+00	0.00E+00	3.9814E+04
Xe-133m	0.0000E+00	0.00E+00	1.1776E+03
Xe-135	0.0000E+00	0.00E+00	1.0663E+04
Xe-135m	0.0000E+00	0.00E+00	3.1266E+02

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	5.3016E+04
Elemental I (Ci)	0.0000E+00	1.8324E+01
Organic I (Ci)	0.0000E+00	5.6673E-01
Aerosol I (Ci)	0.0000E+00	3.5893E+02
All Aerosols (Ci)	0.0000E+00	3.5893E+02
All Aerosols (kg)	0.0000E+00	1.2632E-06

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	6.4052E-04	7.11E+11	1.4930E-04	9.559E-04
Br-83	1.9391E-06	7.49E+09	3.9248E-06	3.124E-05
Br-84	2.3837E-20	6.21E-02	1.6481E-16	8.917E-16
Kr-83m	0.0000E+00	0.00E+00	1.7066E-02	1.707E-02
Kr-85	0.0000E+00	0.00E+00	1.3119E+00	1.312E+00
Kr-85m	0.0000E+00	0.00E+00	2.4471E-01	2.447E-01
Kr-88	0.0000E+00	0.00E+00	7.5365E-02	7.536E-02
I-130	1.1738E-03	1.51E+12	3.6615E-04	2.573E-03
I-131	2.5094E-01	2.62E+14	5.1452E-02	3.129E-01
I-132	1.8672E-02	7.65E+13	4.1382E-02	3.285E-01
I-133	1.2387E-01	1.45E+14	3.2213E-02	2.145E-01
I-134	1.5577E-11	1.20E+06	1.7250E-09	1.123E-08
I-135	1.1558E-02	1.83E+13	5.3249E-03	4.034E-02
Xe-129m	0.0000E+00	0.00E+00	3.1464E-04	3.146E-04
Xe-131m	0.0000E+00	0.00E+00	4.8157E-01	4.816E-01
Xe-133	0.0000E+00	0.00E+00	8.0822E+01	8.082E+01
Xe-133m	0.0000E+00	0.00E+00	2.3914E+00	2.391E+00
Xe-135	0.0000E+00	0.00E+00	2.1703E+01	2.170E+01
Xe-135m	0.0000E+00	0.00E+00	7.4316E-01	7.432E-01

Time (h) = 32.0000	Pathway	
	Filtered	Transported

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Noble gases (Ci)	0.0000E+00	1.0779E+02
Elemental I (Ci)	1.9733E-02	6.3482E-03
Organic I (Ci)	6.1029E-04	1.9634E-04
Aerosol I (Ci)	3.8652E-01	1.2435E-01
All Aerosols (Ci)	3.8652E-01	1.2435E-01
All Aerosols (kg)	2.0328E-09	4.2684E-10

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 32.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	0.0000E+00	0.00E+00	3.1960E-04	3.196E-04
Kr-83m	0.0000E+00	0.00E+00	6.0248E-03	6.025E-03
Kr-85	0.0000E+00	0.00E+00	4.6895E-01	4.690E-01
Kr-85m	0.0000E+00	0.00E+00	8.7071E-02	8.707E-02
Kr-88	0.0000E+00	0.00E+00	2.6745E-02	2.674E-02
I-130	0.0000E+00	0.00E+00	7.7649E-04	7.765E-04
I-131	0.0000E+00	0.00E+00	1.1060E-01	1.106E-01
I-132	0.0000E+00	0.00E+00	8.2605E-02	8.261E-02
I-133	0.0000E+00	0.00E+00	6.8715E-02	6.872E-02
I-135	0.0000E+00	0.00E+00	1.1153E-02	1.115E-02
Xe-129m	0.0000E+00	0.00E+00	1.1246E-04	1.125E-04
Xe-131m	0.0000E+00	0.00E+00	1.7211E-01	1.721E-01
Xe-133	0.0000E+00	0.00E+00	2.8884E+01	2.888E+01
Xe-133m	0.0000E+00	0.00E+00	8.5434E-01	8.543E-01
Xe-135	0.0000E+00	0.00E+00	7.7377E+00	7.738E+00
Xe-135m	0.0000E+00	0.00E+00	2.2832E-01	2.283E-01

environment to control room Transport Group Inventory:

Time (h) = 32.0000	Pathway Filtered	Transported
Noble gases (Ci)	0.0000E+00	3.8465E+01
Elemental I (Ci)	0.0000E+00	1.3298E-02
Organic I (Ci)	0.0000E+00	4.1127E-04
Aerosol I (Ci)	0.0000E+00	2.6047E-01
All Aerosols (Ci)	0.0000E+00	2.6047E-01
All Aerosols (kg)	0.0000E+00	9.1643E-10

control room to environment Pathway Nuclide Inventory (Ci) at Time (h) = 32.0000

Nuclide	Filter	Decays	Transported
Br-82	4.6754E-04	0.00E+00	0.0000E+00
Br-83	8.2026E-06	0.00E+00	0.0000E+00
Br-84	1.4034E-16	0.00E+00	0.0000E+00
Kr-83m	1.4984E-02	0.00E+00	2.0794E-05
Kr-85	1.8797E+00	0.00E+00	2.7865E-06
Kr-85m	2.7938E-01	0.00E+00	0.0000E+00
Kr-87	2.7317E-05	0.00E+00	0.0000E+00
Kr-88	7.6883E-02	0.00E+00	0.0000E+00
I-130	1.0774E-03	0.00E+00	0.0000E+00
I-131	1.6576E-01	0.00E+00	0.0000E+00
I-132	8.5242E-02	0.00E+00	0.0000E+00
I-133	9.8511E-02	0.00E+00	0.0000E+00
I-134	2.1433E-09	0.00E+00	0.0000E+00
I-135	1.4477E-02	0.00E+00	0.0000E+00
Xe-129m	4.4819E-04	0.00E+00	0.0000E+00
Xe-131m	6.8725E-01	0.00E+00	2.7474E-05
Xe-133	1.1480E+02	0.00E+00	1.1724E-01
Xe-133m	3.3542E+00	0.00E+00	2.3658E-04
Xe-135	2.7663E+01	0.00E+00	1.0898E-01
Xe-135m	1.8702E-01	0.00E+00	3.7885E-02

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control room to environment Transport Group Inventory:

	Pathway	
Time (h) = 32.0000	Filtered	Transported
Noble gases (Ci)	1.4894E+02	2.6439E-01
Elemental I (Ci)	1.7729E-02	0.0000E+00
Organic I (Ci)	5.4831E-04	0.0000E+00
Aerosol I (Ci)	3.4726E-01	0.0000E+00
All Aerosols (Ci)	3.4726E-01	0.0000E+00
All Aerosols (kg)	1.3655E-09	0.0000E+00

ALION RADTRAD Version 3.10 Rev 2 run on 6/16/2011 at 13:31:55

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Exclusion Area Boundary Doses:

Time (h) = 48.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2504E-01	3.3210E+01	1.4473E+00

Low Population Zone Doses:

Time (h) = 48.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.7428E-14	2.2935E-12	1.0767E-13
Accumulated dose (rem)	2.3724E-01	1.8539E+01	8.0790E-01

control room Doses:

Time (h) = 48.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	1.1226E-03	1.0526E+00	3.3349E-02	7.0210E-02
Accumulated dose (rem)	1.4513E-01	1.0637E+02	3.4142E+00	8.7746E+00

containment Compartment Nuclide Inventory (Ci) at Time (h) = 48.0000

Nuclide	Compartment	Dose Fract	Exposure	Decays	Pathway 1
	Atmosphere		(Ci-hr)	(Bq-s)	Outflow
Br-82	2.7953E-37	1.4370E-04	1.1805E-01	1.5731E+13	4.4053E-01
Br-83	1.1186E-41	1.2120E-07	2.8672E-03	3.8434E+11	1.0819E-02
Kr-83m	1.0837E-39	1.6270E-08	2.1906E+00	2.9420E+14	8.2955E+00
Kr-85	6.5353E-34	1.0215E-04	1.7336E+02	2.3092E+16	6.4642E+02
Kr-85m	3.0827E-36	1.1840E-03	3.1969E+01	4.2727E+15	1.1996E+02
Kr-87	4.2614E-44	9.4494E-07	4.6321E-03	6.2434E+11	1.7660E-02
Kr-88	1.1345E-37	4.9400E-03	9.7812E+00	1.3098E+15	3.6839E+01
I-130	2.8593E-37	5.0175E-04	2.8634E-01	3.8187E+13	1.0701E+00
I-131	1.4156E-34	6.3351E-01	4.0881E+01	5.4457E+15	1.5246E+02
I-132	8.9829E-38	2.2091E-02	3.0135E+01	4.0405E+15	1.1376E+02
I-133	4.3427E-35	7.3145E-02	2.5365E+01	3.3811E+15	9.4709E+01
I-134	2.9837E-50	7.7802E-10	1.1032E-06	1.4948E+08	4.2475E-06
I-135	1.2899E-36	4.0467E-03	4.1040E+00	5.4792E+14	1.5369E+01
Xe-129m	1.4388E-37	2.1816E-07	4.1567E-02	5.5371E+12	1.5502E-01
Xe-131m	2.2655E-34	1.2254E-04	6.3618E+01	8.4744E+15	2.3724E+02
Xe-133	3.5460E-32	8.2457E-02	1.0675E+04	1.4221E+18	3.9814E+04
Xe-133m	8.7104E-34	2.1412E-03	3.1565E+02	4.2056E+16	1.1776E+03
Xe-135	1.7699E-33	1.6799E-01	2.8511E+03	3.8037E+17	1.0663E+04
Xe-135m	2.0585E-37	7.6274E-03	7.5512E+01	1.0635E+16	3.1266E+02
Total	3.9171E-32	1.0000E+00	0.0000E+00	0.0000E+00	5.3394E+04

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environment Integral Nuclide Release (Ci): at Time (h) = 48.0000

Nuclide	Compartment	Dose Fract
	Atmosphere	Pathway 1
Br-82	4.3960E-01	0.00014
Br-83	1.0796E-02	0.00000
Kr-83m	8.2784E+00	0.00000
Kr-85	6.4507E+02	0.00010
Kr-85m	1.1971E+02	0.00119
Kr-87	1.7623E-02	0.00000
Kr-88	3.6762E+01	0.00498
I-130	1.0679E+00	0.00050
I-131	1.5214E+02	0.63239
I-132	1.1353E+02	0.02232
I-133	9.4511E+01	0.07311
I-134	4.2388E-06	0.00000
I-135	1.5337E+01	0.00406
Xe-129m	1.5469E-01	0.00000
Xe-131m	2.3674E+02	0.00012
Xe-133	3.9731E+04	0.08232
Xe-133m	1.1751E+03	0.00214
Xe-135	1.0642E+04	0.16818
Xe-135m	3.1218E+02	0.00845

environment Compartment Group Inventory Distribution:

	Total	Release
Time (h) = 48.0000	Release	Rate/s
Noble gases (Ci)	5.2906E+04	6.1234E-01
Elemental I (Ci)	1.8286E+01	2.1164E-04
Organic I (Ci)	5.6554E-01	6.5456E-06
Aerosol I (Ci)	3.5818E+02	4.1456E-03
All Aerosols (Ci)	3.5818E+02	4.1456E-03

control room Compartment Nuclide Inventory (Ci) at Time (h) = 48.0000

Nuclide	Compartment	Dose Fract	Exposure	Decays	Pathway 2	Pathway
3 Pathway	4					
	Atmosphere		(Ci-hr)	(Bq-s)	Inflow	Inflow
Outflow						
Br-82	2.6056E-10	1.0257E-04	7.9604E-04	1.0608E+11	1.4930E-04	3.1960E-
04 4.7174E-04						
Br-83	1.0427E-14	6.1367E-08	1.3715E-05	1.8399E+09	3.9248E-06	7.8556E-
06 8.2114E-06						
Kr-83m	1.1575E-08	1.9754E-08	2.5126E-02	3.3780E+12	1.7068E-02	6.0248E-
03 1.4995E-02						
Kr-85	1.6847E-06	2.0092E-04	3.2213E+00	4.2908E+14	1.3119E+00	4.6895E-
01 1.9002E+00						
Kr-85m	7.9466E-09	1.8542E-03	4.7295E-01	6.3238E+13	2.4471E-01	8.7071E-
02 2.8030E-01						
Kr-87	1.0985E-16	9.8345E-07	4.5543E-05	6.1481E+09	3.6477E-05	1.2832E-
05 2.7321E-05						
Kr-88	2.9245E-10	6.9274E-03	1.2958E-01	1.7364E+13	7.5365E-02	2.6745E-
02 7.7009E-02						
I-130	2.6653E-10	3.3903E-04	1.8278E-03	2.4380E+11	3.6615E-04	7.7649E-
04 1.0846E-03						
I-131	1.3196E-07	4.6377E-01	2.8272E-01	3.7662E+13	5.1452E-02	1.1060E-
01 1.6745E-01						
I-132	8.3733E-11	1.1054E-02	1.4245E-01	1.9116E+13	4.1382E-02	8.2605E-
02 8.5327E-02						
I-133	4.0480E-08	5.1126E-02	1.6749E-01	2.2328E+13	3.2213E-02	6.8715E-
02 9.9307E-02						

Transported

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	4.6783E-04	1.88E+12	1.4930E-04	9.824E-04
Br-83	1.8721E-08	8.37E+09	3.9248E-06	3.188E-05
Br-84	1.9479E-29	6.21E-02	1.6481E-16	8.917E-16
Kr-83m	0.0000E+00	0.00E+00	1.7068E-02	1.707E-02
Kr-85	0.0000E+00	0.00E+00	1.3119E+00	1.312E+00
Kr-85m	0.0000E+00	0.00E+00	2.4471E-01	2.447E-01
Kr-88	0.0000E+00	0.00E+00	7.5365E-02	7.536E-02
I-130	4.7854E-04	3.16E+12	3.6615E-04	2.698E-03
I-131	2.3692E-01	7.81E+14	5.1452E-02	3.148E-01
I-132	1.5034E-04	8.47E+13	4.1382E-02	3.351E-01
I-133	7.2681E-02	3.50E+14	3.2213E-02	2.229E-01
I-134	4.9936E-17	1.20E+06	1.7250E-09	1.124E-08
I-135	2.1589E-03	3.03E+13	5.3249E-03	4.238E-02
Xe-129m	0.0000E+00	0.00E+00	3.1464E-04	3.146E-04
Xe-131m	0.0000E+00	0.00E+00	4.8167E-01	4.816E-01
Xe-133	0.0000E+00	0.00E+00	8.0830E+01	8.082E+01
Xe-133m	0.0000E+00	0.00E+00	2.3920E+00	2.392E+00
Xe-135	0.0000E+00	0.00E+00	2.1709E+01	2.170E+01
Xe-135m	0.0000E+00	0.00E+00	7.7973E-01	7.457E-01

environment to control room Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	1.0784E+02
Elemental I (Ci)	1.5174E-02	6.3482E-03
Organic I (Ci)	4.6929E-04	1.9634E-04
Aerosol I (Ci)	2.9722E-01	1.2435E-01
All Aerosols (Ci)	2.9722E-01	1.2435E-01
All Aerosols (kg)	1.8777E-09	4.2684E-10

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 48.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	0.0000E+00	0.00E+00	3.1960E-04	3.196E-04
Kr-83m	0.0000E+00	0.00E+00	6.0248E-03	6.025E-03
Kr-85	0.0000E+00	0.00E+00	4.6895E-01	4.690E-01
Kr-85m	0.0000E+00	0.00E+00	8.7071E-02	8.707E-02
Kr-88	0.0000E+00	0.00E+00	2.6745E-02	2.674E-02
I-130	0.0000E+00	0.00E+00	7.7649E-04	7.765E-04
I-131	0.0000E+00	0.00E+00	1.1060E-01	1.106E-01
I-132	0.0000E+00	0.00E+00	8.2605E-02	8.261E-02
I-133	0.0000E+00	0.00E+00	6.8715E-02	6.872E-02
I-135	0.0000E+00	0.00E+00	1.1153E-02	1.115E-02
Xe-129m	0.0000E+00	0.00E+00	1.1246E-04	1.125E-04
Xe-131m	0.0000E+00	0.00E+00	1.7211E-01	1.721E-01
Xe-133	0.0000E+00	0.00E+00	2.8884E+01	2.888E+01
Xe-133m	0.0000E+00	0.00E+00	8.5434E-01	8.543E-01
Xe-135	0.0000E+00	0.00E+00	7.7377E+00	7.738E+00
Xe-135m	0.0000E+00	0.00E+00	2.2832E-01	2.283E-01

environment to control room Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	3.8465E+01
Elemental I (Ci)	0.0000E+00	1.3298E-02
Organic I (Ci)	0.0000E+00	4.1127E-04
Aerosol I (Ci)	0.0000E+00	2.6047E-01
All Aerosols (Ci)	0.0000E+00	2.6047E-01

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All Aerosols (kg) 0.0000E+00 9.1643E-10

control room to environment Pathway Nuclide Inventory (Ci) at Time (h) = 48.0000

Nuclide	Filter	Decays	Transported
Br-82	4.7174E-04	0.00E+00	0.0000E+00
Br-83	8.2114E-06	0.00E+00	0.0000E+00
Br-84	1.4034E-16	0.00E+00	0.0000E+00
Kr-83m	1.4995E-02	0.00E+00	7.0434E-05
Kr-85	1.9002E+00	0.00E+00	9.7225E-06
Kr-85m	2.8030E-01	0.00E+00	0.0000E+00
Kr-87	2.7321E-05	0.00E+00	0.0000E+00
Kr-88	7.7009E-02	0.00E+00	0.0000E+00
I-130	1.0846E-03	0.00E+00	0.0000E+00
I-131	1.6745E-01	0.00E+00	0.0000E+00
I-132	8.5327E-02	0.00E+00	0.0000E+00
I-133	9.9307E-02	0.00E+00	0.0000E+00
I-134	2.1434E-09	0.00E+00	0.0000E+00
I-135	1.4543E-02	0.00E+00	0.0000E+00
Xe-129m	4.5294E-04	0.00E+00	0.0000E+00
Xe-131m	6.9471E-01	0.00E+00	9.8922E-05
Xe-133	1.1601E+02	0.00E+00	4.2383E-01
Xe-133m	3.3878E+00	0.00E+00	8.4415E-04
Xe-135	2.7837E+01	0.00E+00	3.5236E-01
Xe-135m	1.9391E-01	0.00E+00	1.3270E-01

control room to environment Transport Group Inventory:

	Pathway	
Time (h) = 48.0000	Filtered	Transported
Noble gases (Ci)	1.5040E+02	9.0992E-01
Elemental I (Ci)	1.7857E-02	0.0000E+00
Organic I (Ci)	5.5228E-04	0.0000E+00
Aerosol I (Ci)	3.4978E-01	0.0000E+00
All Aerosols (Ci)	3.4978E-01	0.0000E+00
All Aerosols (kg)	1.3791E-09	0.0000E+00

ALION RADTRAD Version 3.10 Rev 2 run on 6/16/2011 at 13:31:56

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Exclusion Area Boundary Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2504E-01	3.3210E+01	1.4473E+00

Low Population Zone Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.5408E-39	9.2399E-37	3.5769E-38
Accumulated dose (rem)	2.3724E-01	1.8539E+01	8.0790E-01

control room Doses:

Time (h) = 120.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	1.1275E-05	4.7790E-05	1.2734E-05	5.5879E-04
Accumulated dose (rem)	1.4514E-01	1.0637E+02	3.4142E+00	8.7752E+00

Attachment J

containment Compartment Nuclide Inventory (Ci) at Time (h) = 120.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Outflow
Br-82	6.9413-146	1.4370E-04	1.1805E-01	1.5731E+13	4.4053E-01
Br-83	9.7499-159	1.2120E-07	2.8672E-03	3.8434E+11	1.0819E-02
Kr-83m	4.3258-158	1.6270E-08	2.1906E+00	2.9420E+14	8.2955E+00
Kr-85	6.6689-142	1.0215E-04	1.7336E+02	2.3092E+16	6.4642E+02
Kr-85m	4.5705-149	1.1840E-03	3.1969E+01	4.2727E+15	1.1996E+02
Kr-87	3.9325-169	9.4494E-07	4.6321E-03	6.2434E+11	1.7660E-02
Kr-88	2.7044-153	4.9400E-03	9.7812E+00	1.3098E+15	3.6839E+01
I-130	5.1488-147	5.0175E-04	2.8634E-01	3.8187E+13	1.0701E+00
I-131	1.1159-142	6.3351E-01	4.0881E+01	5.4457E+15	1.5246E+02
I-132	3.4585-155	2.2091E-02	3.0135E+01	4.0405E+15	1.1376E+02
I-133	4.0249-144	7.3145E-02	2.5365E+01	3.3811E+15	9.4709E+01
I-134	5.7596-183	7.7802E-10	1.1032E-06	1.4948E+08	4.2475E-06
I-135	6.9277-148	4.0467E-03	4.1040E+00	5.4792E+14	1.5369E+01
Xe-129m	1.1327-145	2.1816E-07	4.1567E-02	5.5371E+12	1.5502E-01
Xe-131m	1.9445-142	1.2254E-04	6.3618E+01	8.4744E+15	2.3724E+02
Xe-133	2.4541-140	8.2457E-02	1.0675E+04	1.4221E+18	3.9814E+04
Xe-133m	3.4405-142	2.1412E-03	3.1565E+02	4.2056E+16	1.1776E+03
Xe-135	7.4698-144	1.6799E-01	2.8511E+03	3.8037E+17	1.0663E+04
Xe-135m	1.1055-148	7.6274E-03	7.5512E+01	1.0635E+16	3.1266E+02
Total	2.5870-140	1.0000E+00	0.0000E+00	0.0000E+00	5.3394E+04

environment Integral Nuclide Release (Ci): at Time (h) = 120.0000

Nuclide	Compartment	Dose Fract
	Atmosphere	Pathway 1
Br-82	4.3960E-01	0.00014
Br-83	1.0796E-02	0.00000
Kr-83m	8.2786E+00	0.00000
Kr-85	6.4507E+02	0.00010
Kr-85m	1.1971E+02	0.00119
Kr-87	1.7623E-02	0.00000
Kr-88	3.6762E+01	0.00498
I-130	1.0679E+00	0.00050
I-131	1.5214E+02	0.63239
I-132	1.1353E+02	0.02232
I-133	9.4511E+01	0.07311
I-134	4.2388E-06	0.00000
I-135	1.5337E+01	0.00406
Xe-129m	1.5469E-01	0.00000
Xe-131m	2.3674E+02	0.00012
Xe-133	3.9732E+04	0.08232
Xe-133m	1.1751E+03	0.00214
Xe-135	1.0643E+04	0.16818
Xe-135m	3.1261E+02	0.00845

environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 120.0000		
Noble gases (Ci)	5.2909E+04	1.5309E-01
Elemental I (Ci)	1.8286E+01	5.2911E-05
Organic I (Ci)	5.6554E-01	1.6364E-06
Aerosol I (Ci)	3.5818E+02	1.0364E-03
All Aerosols (Ci)	3.5818E+02	1.0364E-03

control room Compartment Nuclide Inventory (Ci) at Time (h) = 120.0000

		Attachment J					
3	Nuclide	Compartment	Dose Fract	Exposure	Decays	Pathway 2	Pathway
	Pathway	4		(Ci-hr)	(Bq-s)	Inflow	Inflow
	Outflow	Atmosphere					
	Br-82	2.6220E-29	1.0257E-04	7.9604E-04	1.0608E+11	1.4930E-04	3.1960E-
04	4.7174E-04						
	Br-83	3.6829E-42	6.1363E-08	1.3715E-05	1.8399E+09	3.9248E-06	7.8556E-
06	8.2114E-06						
	Kr-83m	9.8815E-18	1.9753E-08	2.5126E-02	3.3780E+12	1.7068E-02	6.0248E-
03	1.4995E-02						
	Kr-85	6.9665E-25	2.0091E-04	3.2213E+00	4.2908E+14	1.3119E+00	4.6895E-
01	1.9002E+00						
	Kr-85m	4.7745E-32	1.8540E-03	4.7295E-01	6.3238E+13	2.4471E-01	8.7071E-
02	2.8030E-01						
	Kr-87	4.1080E-52	9.8339E-07	4.5543E-05	6.1481E+09	3.6477E-05	1.2832E-
05	2.7321E-05						
	Kr-88	2.8250E-36	6.9270E-03	1.2958E-01	1.7364E+13	7.5365E-02	2.6745E-
02	7.7009E-02						
	I-130	1.9449E-30	3.3901E-04	1.8278E-03	2.4380E+11	3.6615E-04	7.7649E-
04	1.0846E-03						
	I-131	4.2153E-26	4.6374E-01	2.8272E-01	3.7662E+13	5.1452E-02	1.1060E-
01	1.6745E-01						
	I-132	1.3064E-38	1.1053E-02	1.4245E-01	1.9116E+13	4.1382E-02	8.2605E-
02	8.5327E-02						
	I-133	1.5203E-27	5.1123E-02	1.6749E-01	2.2328E+13	3.2213E-02	6.8715E-
02	9.9307E-02						
	I-135	2.6169E-31	2.5531E-03	2.4463E-02	3.2669E+12	5.3249E-03	1.1153E-
02	1.4543E-02						
	Xe-129m	1.1833E-28	4.2653E-07	7.6778E-04	1.0228E+11	3.1464E-04	1.1246E-
04	4.5294E-04						
	Xe-131m	9.1740E-06	2.4025E-04	1.1784E+00	1.5696E+14	4.8208E-01	1.7211E-
01	6.9512E-01						
	Xe-133	6.9420E-05	1.6079E-01	1.9666E+02	2.6198E+16	8.0841E+01	
	2.8884E+01	1.1602E+02					
	Xe-133m	4.9043E-06	4.1232E-03	5.7425E+00	7.6513E+14	2.3928E+00	8.5434E-
01	3.3886E+00						
	Xe-135	1.6697E-07	2.9367E-01	4.7087E+01	6.2835E+15	2.1711E+01	
	7.7377E+00	2.7838E+01					
	Xe-135m	1.5935E-07	3.2902E-03	3.0774E-01	4.3176E+13	7.8813E-01	2.2832E-
01	1.9549E-01						
	Total	8.3825E-05	1.0000E+00	0.0000E+00	0.0000E+00	1.0799E+02	
	3.8739E+01	1.5078E+02					

control room Compartment Group Inventory Distribution:

Time (h) = 120.0000	Atmosphere	Sump
Noble gases (Ci)	8.3825E-05	0.0000E+00
Elemental I (Ci)	2.1196E-27	0.0000E+00
Organic I (Ci)	6.5553E-29	0.0000E+00
Aerosol I (Ci)	4.1517E-26	0.0000E+00
All Aerosols (Ci)	4.1517E-26	0.0000E+00
All Aerosols (kg)	3.2431E-34	0.0000E+00

containment to environment Pathway Nuclide Inventory (Ci) at Time (h) = 120.0000

Nuclide	Filter	Decays	Transported
Br-82	0.0000E+00	0.00E+00	4.4053E-01
Br-83	0.0000E+00	0.00E+00	1.0819E-02
Kr-83m	0.0000E+00	0.00E+00	8.2955E+00
Kr-85	0.0000E+00	0.00E+00	6.4642E+02
Kr-85m	0.0000E+00	0.00E+00	1.1996E+02
Kr-87	0.0000E+00	0.00E+00	1.7660E-02

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Kr-88	0.0000E+00	0.00E+00	3.6839E+01
I-130	0.0000E+00	0.00E+00	1.0701E+00
I-131	0.0000E+00	0.00E+00	1.5246E+02
I-132	0.0000E+00	0.00E+00	1.1376E+02
I-133	0.0000E+00	0.00E+00	9.4709E+01
I-135	0.0000E+00	0.00E+00	1.5369E+01
Xe-129m	0.0000E+00	0.00E+00	1.5502E-01
Xe-131m	0.0000E+00	0.00E+00	2.3724E+02
Xe-133	0.0000E+00	0.00E+00	3.9814E+04
Xe-133m	0.0000E+00	0.00E+00	1.1776E+03
Xe-135	0.0000E+00	0.00E+00	1.0663E+04
Xe-135m	0.0000E+00	0.00E+00	3.1266E+02

containment to environment Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	5.3016E+04
Elemental I (Ci)	0.0000E+00	1.8324E+01
Organic I (Ci)	0.0000E+00	5.6673E-01
Aerosol I (Ci)	0.0000E+00	3.5893E+02
All Aerosols (Ci)	0.0000E+00	3.5893E+02
All Aerosols (kg)	0.0000E+00	1.2632E-06

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 120.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	1.1379E-04	4.28E+12	1.4930E-04	9.824E-04
Br-83	1.5983E-17	8.38E+09	3.9248E-06	3.188E-05
Br-84	2.4827E-70	6.21E-02	1.6481E-16	8.917E-16
Kr-83m	0.0000E+00	0.00E+00	1.7068E-02	1.707E-02
Kr-85	0.0000E+00	0.00E+00	1.3119E+00	1.312E+00
Kr-85m	0.0000E+00	0.00E+00	2.4471E-01	2.447E-01
Kr-88	0.0000E+00	0.00E+00	7.5365E-02	7.536E-02
I-130	8.4401E-06	4.28E+12	3.6615E-04	2.698E-03
I-131	1.8293E-01	2.78E+15	5.1452E-02	3.148E-01
I-132	5.6693E-14	8.48E+13	4.1382E-02	3.351E-01
I-133	6.5977E-03	6.14E+14	3.2213E-02	2.229E-01
I-134	9.4414E-42	1.20E+06	1.7250E-09	1.124E-08
I-135	1.1356E-06	3.30E+13	5.3249E-03	4.238E-02
Xe-129m	0.0000E+00	0.00E+00	3.1464E-04	3.146E-04
Xe-131m	0.0000E+00	0.00E+00	4.8208E-01	4.816E-01
Xe-133	0.0000E+00	0.00E+00	8.0841E+01	8.082E+01
Xe-133m	0.0000E+00	0.00E+00	2.3928E+00	2.392E+00
Xe-135	0.0000E+00	0.00E+00	2.1711E+01	2.170E+01
Xe-135m	0.0000E+00	0.00E+00	7.8813E-01	7.457E-01

environment to control room Transport Group Inventory:

	Pathway	
Time (h) = 120.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	1.0786E+02
Elemental I (Ci)	9.1981E-03	6.3482E-03
Organic I (Ci)	2.8448E-04	1.9634E-04
Aerosol I (Ci)	1.8017E-01	1.2435E-01
All Aerosols (Ci)	1.8017E-01	1.2435E-01
All Aerosols (kg)	1.4074E-09	4.2684E-10

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 120.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
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Br-82	0.0000E+00	0.00E+00	3.1960E-04	3.196E-04
Kr-83m	0.0000E+00	0.00E+00	6.0248E-03	6.025E-03
Kr-85	0.0000E+00	0.00E+00	4.6895E-01	4.690E-01
Kr-85m	0.0000E+00	0.00E+00	8.7071E-02	8.707E-02
Kr-88	0.0000E+00	0.00E+00	2.6745E-02	2.674E-02
I-130	0.0000E+00	0.00E+00	7.7649E-04	7.765E-04
I-131	0.0000E+00	0.00E+00	1.1060E-01	1.106E-01
I-132	0.0000E+00	0.00E+00	8.2605E-02	8.261E-02
I-133	0.0000E+00	0.00E+00	6.8715E-02	6.872E-02
I-135	0.0000E+00	0.00E+00	1.1153E-02	1.115E-02
Xe-129m	0.0000E+00	0.00E+00	1.1246E-04	1.125E-04
Xe-131m	0.0000E+00	0.00E+00	1.7211E-01	1.721E-01
Xe-133	0.0000E+00	0.00E+00	2.8884E+01	2.888E+01
Xe-133m	0.0000E+00	0.00E+00	8.5434E-01	8.543E-01
Xe-135	0.0000E+00	0.00E+00	7.7377E+00	7.738E+00
Xe-135m	0.0000E+00	0.00E+00	2.2832E-01	2.283E-01

environment to control room Transport Group Inventory:

Pathway		
Time (h) = 120.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	3.8465E+01
Elemental I (Ci)	0.0000E+00	1.3298E-02
Organic I (Ci)	0.0000E+00	4.1127E-04
Aerosol I (Ci)	0.0000E+00	2.6047E-01
All Aerosols (Ci)	0.0000E+00	2.6047E-01
All Aerosols (kg)	0.0000E+00	9.1643E-10

control room to environment Pathway Nuclide Inventory (Ci) at Time (h) = 120.0000

Nuclide	Filter	Decays	Transported
Br-82	4.7174E-04	0.00E+00	0.0000E+00
Br-83	8.2114E-06	0.00E+00	0.0000E+00
Br-84	1.4034E-16	0.00E+00	0.0000E+00
Kr-83m	1.4995E-02	0.00E+00	2.9383E-04
Kr-85	1.9002E+00	0.00E+00	4.0943E-05
Kr-85m	2.8030E-01	0.00E+00	0.0000E+00
Kr-87	2.7321E-05	0.00E+00	0.0000E+00
Kr-88	7.7009E-02	0.00E+00	0.0000E+00
I-130	1.0846E-03	0.00E+00	0.0000E+00
I-131	1.6745E-01	0.00E+00	0.0000E+00
I-132	8.5327E-02	0.00E+00	0.0000E+00
I-133	9.9307E-02	0.00E+00	0.0000E+00
I-134	2.1434E-09	0.00E+00	0.0000E+00
I-135	1.4543E-02	0.00E+00	0.0000E+00
Xe-129m	4.5294E-04	0.00E+00	0.0000E+00
Xe-131m	6.9512E-01	0.00E+00	4.2077E-04
Xe-133	1.1602E+02	0.00E+00	1.8052E+00
Xe-133m	3.3886E+00	0.00E+00	3.5804E-03
Xe-135	2.7838E+01	0.00E+00	1.4683E+00
Xe-135m	1.9549E-01	0.00E+00	5.5956E-01

control room to environment Transport Group Inventory:

Pathway		
Time (h) = 120.0000	Filtered	Transported
Noble gases (Ci)	1.5041E+02	3.8374E+00
Elemental I (Ci)	1.7857E-02	0.0000E+00
Organic I (Ci)	5.5228E-04	0.0000E+00
Aerosol I (Ci)	3.4978E-01	0.0000E+00
All Aerosols (Ci)	3.4978E-01	0.0000E+00
All Aerosols (kg)	1.3791E-09	0.0000E+00

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Exclusion Area Boundary Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.2504E-01	3.3210E+01	1.4473E+00

Low Population Zone Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.9123-148	1.4498-145	5.2071-147
Accumulated dose (rem)	2.3724E-01	1.8539E+01	8.0790E-01

control room Doses:

Time (h) = 744.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	2.5024E-07	9.7560E-24	2.5024E-07	2.7841E-05
Accumulated dose (rem)	1.4514E-01	1.0637E+02	3.4142E+00	8.7752E+00

containment Compartment Nuclide Inventory (Ci) at Time (h) = 744.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Outflow
Br-82	0.0000E+00	1.4370E-04	1.1805E-01	1.5731E+13	4.4053E-01
Br-83	0.0000E+00	1.2120E-07	2.8672E-03	3.8434E+11	1.0819E-02
Kr-83m	0.0000E+00	1.6270E-08	2.1906E+00	2.9420E+14	8.2955E+00
Kr-85	0.0000E+00	1.0215E-04	1.7336E+02	2.3092E+16	6.4642E+02
Kr-85m	0.0000E+00	1.1840E-03	3.1969E+01	4.2727E+15	1.1996E+02
Kr-87	0.0000E+00	9.4494E-07	4.6321E-03	6.2434E+11	1.7660E-02
Kr-88	0.0000E+00	4.9400E-03	9.7812E+00	1.3098E+15	3.6839E+01
I-130	0.0000E+00	5.0175E-04	2.8634E-01	3.8187E+13	1.0701E+00
I-131	0.0000E+00	6.3351E-01	4.0881E+01	5.4457E+15	1.5246E+02
I-132	0.0000E+00	2.2091E-02	3.0135E+01	4.0405E+15	1.1376E+02
I-133	0.0000E+00	7.3145E-02	2.5365E+01	3.3811E+15	9.4709E+01
I-134	0.0000E+00	7.7802E-10	1.1032E-06	1.4948E+08	4.2475E-06
I-135	0.0000E+00	4.0467E-03	4.1040E+00	5.4792E+14	1.5369E+01
Xe-129m	0.0000E+00	2.1816E-07	4.1567E-02	5.5371E+12	1.5502E-01
Xe-131m	0.0000E+00	1.2254E-04	6.3618E+01	8.4744E+15	2.3724E+02
Xe-133	0.0000E+00	8.2457E-02	1.0675E+04	1.4221E+18	3.9814E+04
Xe-133m	0.0000E+00	2.1412E-03	3.1565E+02	4.2056E+16	1.1776E+03
Xe-135	0.0000E+00	1.6799E-01	2.8511E+03	3.8037E+17	1.0663E+04
Xe-135m	0.0000E+00	7.6274E-03	7.5512E+01	1.0635E+16	3.1266E+02
Total	0.0000E+00	1.0000E+00	0.0000E+00	0.0000E+00	5.3394E+04

environment Integral Nuclide Release (Ci): at Time (h) = 744.0000

Nuclide	Compartment	Dose Fract
	Atmosphere	Pathway 1
Br-82	4.3960E-01	0.00014
Br-83	1.0796E-02	0.00000
Kr-83m	8.2805E+00	0.00000
Kr-85	6.4507E+02	0.00010
Kr-85m	1.1971E+02	0.00119
Kr-87	1.7623E-02	0.00000
Kr-88	3.6762E+01	0.00498

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I-130	1.0679E+00	0.00050
I-131	1.5214E+02	0.63239
I-132	1.1353E+02	0.02232
I-133	9.4511E+01	0.07311
I-134	4.2388E-06	0.00000
I-135	1.5337E+01	0.00406
Xe-129m	1.5469E-01	0.00000
Xe-131m	2.3675E+02	0.00012
Xe-133	3.9744E+04	0.08232
Xe-133m	1.1752E+03	0.00214
Xe-135	1.0652E+04	0.16818
Xe-135m	3.1631E+02	0.00845

environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 744.0000		
Noble gases (Ci)	5.2935E+04	2.0422E-02
Elemental I (Ci)	1.8286E+01	7.0548E-06
Organic I (Ci)	5.6554E-01	2.1819E-07
Aerosol I (Ci)	3.5818E+02	1.3819E-04
All Aerosols (Ci)	3.5818E+02	1.3819E-04

control room Compartment Nuclide Inventory (Ci) at Time (h) = 744.0000

Nuclide 3 Pathway	Compartment 4 Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 2 Inflow	Pathway Inflow
Outflow						
Br-82	5.9647-194	1.0257E-04	7.9604E-04	1.0608E+11	1.4930E-04	3.1960E-
04 4.7174E-04						
Br-83	4.4585-280	6.1363E-08	1.3715E-05	1.8399E+09	3.9248E-06	7.8556E-
06 8.2114E-06						
Kr-83m	2.5137E-96	1.9753E-08	2.5126E-02	3.3780E+12	1.7068E-02	6.0248E-
03 1.4995E-02						
Kr-85	3.3059-184	2.0090E-04	3.2213E+00	4.2908E+14	1.3119E+00	4.6895E-
01 1.9002E+00						
Kr-85m	2.6793-233	1.8540E-03	4.7295E-01	6.3238E+13	2.4471E-01	8.7071E-
02 2.8030E-01						
Kr-87	0.0000E+00	9.8338E-07	4.5543E-05	6.1481E+09	3.6477E-05	1.2832E-
05 2.7321E-05						
Kr-88	9.7163-262	6.9269E-03	1.2958E-01	1.7364E+13	7.5365E-02	2.6745E-
02 7.7009E-02						
I-130	5.8822-205	3.3901E-04	1.8278E-03	2.4380E+11	3.6615E-04	7.7649E-
04 1.0846E-03						
I-131	2.1361-186	4.6374E-01	2.8272E-01	3.7662E+13	5.1452E-02	1.1060E-
01 1.6745E-01						
I-132	1.3292-279	1.1053E-02	1.4245E-01	1.9116E+13	4.1382E-02	8.2605E-
02 8.5327E-02						
I-133	6.7502-196	5.1123E-02	1.6749E-01	2.2328E+13	3.2213E-02	6.8715E-
02 9.9307E-02						
I-135	4.7654-219	2.5531E-03	2.4463E-02	3.2669E+12	5.3249E-03	1.1153E-
02 1.4543E-02						
Xe-129m	5.9294-189	4.2653E-07	7.6778E-04	1.0228E+11	3.1464E-04	1.1246E-
04 4.5294E-04						
Xe-131m	9.7669E-07	2.4071E-04	1.1807E+00	1.5724E+14	4.8329E-01	1.7211E-
01 6.9634E-01						
Xe-133	6.4750E-14	1.6079E-01	1.9666E+02	2.6199E+16	8.0842E+01	
2.8884E+01	1.1602E+02					
Xe-133m	4.5744E-15	4.1233E-03	5.7427E+00	7.6514E+14	2.3928E+00	8.5434E-
01 3.3887E+00						
Xe-135	6.3867E-36	2.9367E-01	4.7087E+01	6.2835E+15	2.1711E+01	
7.7377E+00	2.7839E+01					

containment to environment Pathway Nuclide Inventory (Ci) at Time (h) = 744.0000

Nuclide	Filter	Decays	Transported
Br-82	0.0000E+00	0.00E+00	4.4053E-01
Br-83	0.0000E+00	0.00E+00	1.0819E-02
Kr-83m	0.0000E+00	0.00E+00	8.2955E+00
Kr-85	0.0000E+00	0.00E+00	6.4642E+02
Kr-85m	0.0000E+00	0.00E+00	1.1996E+02
Kr-87	0.0000E+00	0.00E+00	1.7660E-02
Kr-88	0.0000E+00	0.00E+00	3.6839E+01
I-130	0.0000E+00	0.00E+00	1.0701E+00
I-131	0.0000E+00	0.00E+00	1.5246E+02
I-132	0.0000E+00	0.00E+00	1.1376E+02
I-133	0.0000E+00	0.00E+00	9.4709E+01
I-135	0.0000E+00	0.00E+00	1.5369E+01
Xe-129m	0.0000E+00	0.00E+00	1.5502E-01
Xe-131m	0.0000E+00	0.00E+00	2.3724E+02
Xe-133	0.0000E+00	0.00E+00	3.9814E+04
Xe-133m	0.0000E+00	0.00E+00	1.1776E+03
Xe-135	0.0000E+00	0.00E+00	1.0663E+04
Xe-135m	0.0000E+00	0.00E+00	3.1266E+02

containment to environment Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (Ci)	0.0000E+00	5.3016E+04
Elemental I (Ci)	0.0000E+00	1.8324E+01
Organic I (Ci)	0.0000E+00	5.6673E-01
Aerosol I (Ci)	0.0000E+00	3.5893E+02
All Aerosols (Ci)	0.0000E+00	3.5893E+02
All Aerosols (kg)	0.0000E+00	1.2632E-06

environment to control room Pathway Nuclide Inventory (Ci) at Time (h) = 744.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 1
Br-82	5.4295E-10	5.06E+12	1.4930E-04	9.824E-04
Br-83	4.0585E-96	8.38E+09	3.9248E-06	3.188E-05
Br-84	0.0000E+00	6.21E-02	1.6481E-16	8.917E-16
Kr-83m	0.0000E+00	0.00E+00	1.7068E-02	1.707E-02
Kr-85	0.0000E+00	0.00E+00	1.3119E+00	1.312E+00
Kr-85m	0.0000E+00	0.00E+00	2.4471E-01	2.447E-01
Kr-88	0.0000E+00	0.00E+00	7.5365E-02	7.536E-02
I-130	5.3545E-21	4.30E+12	3.6615E-04	2.698E-03
I-131	1.9445E-02	8.85E+15	5.1452E-02	3.148E-01
I-132	1.2100E-95	8.48E+13	4.1382E-02	3.351E-01
I-133	6.1446E-12	6.40E+14	3.2213E-02	2.229E-01
I-134	5.0790E-256	1.20E+06	1.7250E-09	1.124E-08
I-135	4.3378E-35	3.30E+13	5.3249E-03	4.238E-02
Xe-129m	0.0000E+00	0.00E+00	3.1464E-04	3.146E-04
Xe-131m	0.0000E+00	0.00E+00	4.8329E-01	4.816E-01
Xe-133	0.0000E+00	0.00E+00	8.0842E+01	8.082E+01
Xe-133m	0.0000E+00	0.00E+00	2.3928E+00	2.392E+00
Xe-135	0.0000E+00	0.00E+00	2.1711E+01	2.170E+01
Xe-135m	0.0000E+00	0.00E+00	7.8813E-01	7.457E-01

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Xe-133	1.1602E+02	0.00E+00	1.3778E+01
Xe-133m	3.3887E+00	0.00E+00	2.7295E-02
Xe-135	2.7839E+01	0.00E+00	1.1149E+01
Xe-135m	1.9549E-01	0.00E+00	4.2589E+00

control room to environment Transport Group Inventory:

	Pathway	
Time (h) = 744.0000	Filtered	Transported
Noble gases (Ci)	1.5042E+02	2.9220E+01
Elemental I (Ci)	1.7857E-02	0.0000E+00
Organic I (Ci)	5.5228E-04	0.0000E+00
Aerosol I (Ci)	3.4978E-01	0.0000E+00
All Aerosols (Ci)	3.4978E-01	0.0000E+00
All Aerosols (kg)	1.3791E-09	0.0000E+00

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I-131 Summary
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Time (hr)	containment I-131 (Curies)	environment I-131 (Curies)	control room I-131 (Curies)
24.000	2.3478E+01	2.2530E-02	1.6036E-04
24.004	1.5134E+02	9.4275E-01	6.6994E-03
24.017	1.4449E+02	7.7868E+00	5.4784E-02
24.249	6.4729E+01	8.7470E+01	1.0555E-01
24.250	6.4565E+01	8.7633E+01	1.0563E-01
24.450	3.2338E+01	1.1983E+02	1.1747E-01
24.500	2.7205E+01	1.2496E+02	1.1800E-01
24.700	1.3626E+01	1.3852E+02	1.1479E-01
24.900	6.8245E+00	1.4532E+02	1.0697E-01
25.000	4.8297E+00	1.4731E+02	1.0234E-01
25.200	2.4190E+00	1.4972E+02	9.2690E-02
25.400	1.2116E+00	1.5093E+02	8.3234E-02
25.600	6.0683E-01	1.5153E+02	7.4391E-02
25.800	3.0393E-01	1.5183E+02	6.6313E-02
26.000	1.5223E-01	1.5198E+02	5.9026E-02
26.200	7.6244E-02	1.5206E+02	5.2484E-02
26.400	3.8187E-02	1.5210E+02	4.6650E-02
26.600	1.9126E-02	1.5212E+02	4.1456E-02
26.800	9.5796E-03	1.5213E+02	3.6836E-02
27.000	4.7980E-03	1.5213E+02	3.2729E-02
27.200	2.4031E-03	1.5213E+02	2.9079E-02
27.400	1.2036E-03	1.5214E+02	2.5835E-02
27.600	6.0284E-04	1.5214E+02	2.2953E-02
27.800	3.0193E-04	1.5214E+02	2.0393E-02
28.000	1.5123E-04	1.5214E+02	1.8117E-02
28.200	7.5742E-05	1.5214E+02	1.6096E-02
28.400	3.7936E-05	1.5214E+02	1.4300E-02
28.600	1.9001E-05	1.5214E+02	1.2705E-02
28.800	9.5165E-06	1.5214E+02	1.1287E-02
29.000	4.7664E-06	1.5214E+02	1.0028E-02
29.200	2.3873E-06	1.5214E+02	8.9092E-03
29.400	1.1957E-06	1.5214E+02	7.9152E-03
29.600	5.9887E-07	1.5214E+02	7.0321E-03

Attachment J

29.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0012E+02	3.2154E+00
29.200	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0082E+02	3.2378E+00
29.400	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0144E+02	3.2576E+00
29.600	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0199E+02	3.2752E+00
29.800	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0248E+02	3.2908E+00
30.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0292E+02	3.3047E+00
30.200	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0330E+02	3.3170E+00
30.400	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0365E+02	3.3279E+00
30.600	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0395E+02	3.3376E+00
30.800	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0422E+02	3.3462E+00
31.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0446E+02	3.3538E+00
31.200	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0468E+02	3.3606E+00
31.400	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0487E+02	3.3666E+00
31.600	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0503E+02	3.3719E+00
31.800	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0518E+02	3.3767E+00
32.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0532E+02	3.3809E+00
32.200	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0543E+02	3.3846E+00
32.400	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0554E+02	3.3879E+00
32.600	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0563E+02	3.3909E+00
32.800	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0571E+02	3.3935E+00
33.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0579E+02	3.3958E+00
33.200	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0585E+02	3.3979E+00
33.400	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0591E+02	3.3997E+00
33.600	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0596E+02	3.4013E+00
33.800	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0601E+02	3.4028E+00
34.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0605E+02	3.4041E+00
34.200	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0608E+02	3.4052E+00
48.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0637E+02	3.4142E+00
120.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0637E+02	3.4142E+00
744.000	3.3210E+01	1.4473E+00	1.8539E+01	8.0790E-01	1.0637E+02	3.4142E+00

Attachment J

ALION RADTRAD Version 3.10 Rev 2 run on 6/16/2011 at 13:31:58

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#####

Worst Two-Hour Doses
#####

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
24.0	4.2504E-01	3.3210E+01	1.4473E+00

Final Doses
#####

Low Population Zone

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
744.0	2.3724E-01	1.8539E+01	8.0790E-01

control room

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
744.0	1.4514E-01	1.0637E+02	3.4142E+00

Attachment K

Attachment K Microshield Files, Cloud Shine, .MX5, Output - .txt

Time Point 0.25 Hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm², or cm³)

68 : Number of nuclides in file.

Nuclide Index Ci Nuclide Name

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	5.33E+01	Br-82
62	1.35E+00	Br-83
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	1.30E+02	I-130
175	1.84E+04	I-131
176	1.42E+04	I-132
177	1.15E+04	I-133
178	5.55E-04	I-134
179	1.88E+03	I-135
202	1.05E+03	Kr-83m
203	7.80E+04	Kr-85
204	1.47E+04	Kr-85m
205	2.25E+00	Kr-87
206	4.56E+03	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129

418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132
469	1.87E+01	Xe-129m
470	2.86E+04	Xe-131m
471	4.81E+06	Xe-133
472	1.42E+05	Xe-133m
473	1.30E+06	Xe-135
474	4.47E+04	Xe-135m
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 0.5 Hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

```
1 : Geometry factor (point, cm, cm^2, or cm^3)
```

68 : Number of nuclides in file.

Nuclide Index Ci	Nuclide Name
------------------	--------------

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	2.26E+01	Br-82
62	5.32E-01	Br-83
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5

Nuclide Index	Ci	Nuclide Name
13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	6.73E+00	Br-82
62	1.46E-01	Br-83
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	1.61E+01	I-130
175	2.35E+03	I-131
176	1.54E+03	I-132
177	1.44E+03	I-133
178	4.58E-05	I-134
179	2.26E+02	I-135
202	1.08E+02	Kr-83m
203	9.97E+03	Kr-85
204	1.72E+03	Kr-85m
205	2.12E-01	Kr-87
206	5.08E+02	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Attachment K

Time Point 2 Hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm², or cm³)

68 : Number of nuclides in file.

Nuclide Index Ci Nuclide Name

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	6.96E-01	Br-82
62	1.25E-02	Br-83
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	1.62E+00	I-130
175	2.42E+02	I-131
176	1.31E+02	I-132
177	1.47E+02	I-133
178	2.65E-06	I-134
179	2.21E+01	I-135
202	8.72E+00	Kr-83m
203	1.04E+03	Kr-85
204	1.63E+02	Kr-85m
205	1.50E-02	Kr-87
206	4.51E+01	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132

Attachment K

469	2.49E-01	Xe-129m
470	3.82E+02	Xe-131m
471	6.40E+04	Xe-133
472	1.87E+03	Xe-133m
472	1.59E+04	Xe-135
473	-4.52E+01	Xe-135m
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 8 Hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm^2, or cm^3)

68 : Number of nuclides in file.

Nuclide Index	Ci	Nuclide Name
---------------	----	--------------

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	2.94E-03	Br-82
62	4.10E-05	Br-83
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8

Attachment K

0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Output Files 0.25 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

Filename Run Date Run Time Duration
1CLP25.MS5 June 20, 2011 3:52:16 PM 00:00:00
Project Info
Case Title 1Cloud FHA 0.25
Description AST FHA Outside Cloud Shine 0.25h
Geometry 8 - Cylinder Volume - End Shields

Source Dimensions
Height 2.4e+4 cm (800 ft)
Radius 2.4e+4 cm (800 ft)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 2.5e+4 cm (811 ft 6.0 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density
Source 4.55e+13 cm³ Air 0.00122
Shield 1 60.96 cm Concrete 2.35
Shield 2 289.56 cm Air 0.00122
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 $\mu\text{Ci}/\text{cm}^3$ Bq/cm³
Am-241
Ba-139
Ba-140
Br-82 5.3300e+001 1.9721e+012 1.1702e-006 4.3298e-002
Br-83 1.3500e+000 4.9950e+010 2.9639e-008 1.0967e-003
Ce-141
Ce-143
Ce-144
Cm-242
Cm-244
Co-58
Co-60

SECRET

Attachment K

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 1.183e+16 0.000e+00 4.887e-22 0.000e+00 4.192e-23
0.03 9.161e+16 3.732e-69 1.317e-20 3.699e-71 1.305e-22
0.04 5.203e+10 3.913e-39 1.983e-26 1.730e-41 8.771e-29
0.08 6.533e+16 3.167e-09 1.800e-07 5.012e-12 2.848e-10
0.1 3.469e+11 1.898e-12 2.018e-10 2.903e-15 3.087e-13
0.15 5.771e+14 5.049e-07 9.308e-05 8.315e-10 1.533e-07
0.2 4.396e+16 5.168e-04 1.018e-01 9.120e-07 1.796e-04
0.3 1.390e+14 4.059e-05 5.813e-03 7.699e-08 1.103e-05
0.4 8.557e+14 2.107e-03 2.047e-01 4.105e-06 3.989e-04
0.5 1.868e+15 2.262e-02 1.561e+00 4.440e-05 3.064e-03
0.6 2.229e+15 9.504e-02 4.894e+00 1.855e-04 9.552e-03
0.8 5.795e+14 1.677e-01 5.434e+00 3.189e-04 1.034e-02
1.0 2.074e+14 2.487e-01 5.690e+00 4.585e-04 1.049e-02
1.5 1.596e+14 2.134e+00 2.720e+01 3.590e-03 4.576e-02
2.0 1.275e+14 7.851e+00 7.034e+01 1.214e-02 1.088e-01
3.0 1.313e+12 5.251e-01 3.055e+00 7.124e-04 4.145e-03
Totals 2.195e+17 1.105e+01 1.185e+02 1.746e-02 1.927e-01

Output File 0.5 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

Filename Run Date Run Time Duration
1CLP5.MS5 June 20, 2011 3:53:33 PM 00:00:00
Project Info
Case Title lCloud FHA 0.5
Description AST FHA Outside Cloud Shine 0.5h
Geometry 8 - Cylinder Volume - End Shields

Source Dimensions
Height 2.4e+4 cm (800 ft)
Radius 2.4e+4 cm (800 ft)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 2.5e+4 cm (811 ft 6.0 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density
Source 4.55e+13 cm³ Air 0.00122
Shield 1 60.96 cm Concrete 2.35
Shield 2 289.56 cm Air 0.00122
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 μ Ci/cm³ Bq/cm³
Am-241
Ba-139
Ba-140
Br-82 2.2600e+001 8.3620e+011 4.9619e-007 1.8359e-002

Attachment K

Br-83 5.3200e-001 1.9684e+010 1.1680e-008 4.3216e-004
Ce-141
Ce-143
Ce-144
Cm-242
Cm-244
Co-58
Co-60
Cs-134
Cs-136
Cs-137
I-130 5.4600e+001 2.0202e+012 1.1987e-006 4.4354e-002
I-131 7.8300e+003 2.8971e+014 1.7191e-004 6.3606e+000
I-132 5.6100e+003 2.0757e+014 1.2317e-004 4.5572e+000
I-133 4.8500e+003 1.7945e+014 1.0648e-004 3.9398e+000
I-134 1.9200e-004 7.1040e+006 4.2154e-012 1.5597e-007
I-135 7.7800e+002 2.8786e+013 1.7081e-005 6.3200e-001
Kr-83m 4.0400e+002 1.4948e+013 8.8699e-006 3.2818e-001
Kr-85 3.3200e+004 1.2284e+015 7.2891e-004 2.6970e+001
Kr-85m 6.0300e+003 2.2311e+014 1.3239e-004 4.8984e+000
Kr-87 8.3000e-001 3.0710e+010 1.8223e-008 6.7424e-004
Kr-88 1.8200e+003 6.7340e+013 3.9958e-005 1.4785e+000
La-140
La-141
La-142
Mo-99
Nb-95
Nd-147
Np-239
Pr-143
Pu-238
Pu-239
Pu-240
Pu-241
Rb-86
Rh-105
Ru-103
Ru-105
Ru-106
Sb-127
Sb-129
Sr-89
Sr-90
Sr-91
Sr-92
Tc-99m
Te-127
Te-127m
Te-129
Te-129m
Te-131m
Te-132
Xe-129m 7.9700e+000 2.9489e+011 1.7498e-007 6.4743e-003
Xe-131m 1.2200e+004 4.5140e+014 2.6785e-004 9.9105e+000
Xe-133 2.0500e+006 7.5850e+016 4.5008e-002 1.6653e+003
Xe-133m 6.0500e+004 2.2385e+015 1.3283e-003 4.9146e+001
Xe-133m 5.4300e+005 2.0091e+016 1.1922e-002 4.4110e+002
Xe-135 9.3000e+003 3.4410e+014 2.0418e-004 7.5547e+000
Y-90
Y-91
Y-92
Y-93
Zr-95

Attachment K

Zr-97

Buildup: The material reference is Shield 1

Integration Parameters

Radial 20

Circumferential 10

Y Direction (axial) 10

Results

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	6.455e+15	0.000e+00	2.667e-22	0.000e+00	2.287e-23
0.03	4.923e+16	2.005e-69	7.076e-21	1.987e-71	7.013e-23
0.04	2.218e+10	1.668e-39	8.452e-27	7.375e-42	3.738e-29
0.08	2.784e+16	1.350e-09	7.672e-08	2.136e-12	1.214e-10
0.1	1.388e+11	7.593e-13	8.074e-11	1.162e-15	1.235e-13
0.15	1.810e+14	1.584e-07	2.920e-05	2.608e-10	4.808e-08
0.2	2.683e+15	3.154e-05	6.210e-03	5.566e-08	1.096e-05
0.3	5.754e+13	1.680e-05	2.406e-03	3.187e-08	4.565e-06
0.4	2.472e+14	6.087e-04	5.915e-02	1.186e-06	1.153e-04
0.5	2.196e+14	2.659e-03	1.835e-01	5.219e-06	3.601e-04
0.6	3.033e+14	1.293e-02	6.659e-01	2.524e-05	1.300e-03
0.8	2.306e+14	6.671e-02	2.162e+00	1.269e-04	4.112e-03
1.0	8.286e+13	9.934e-02	2.273e+00	1.831e-04	4.189e-03
1.5	6.420e+13	8.582e-01	1.094e+01	1.444e-03	1.840e-02
2.0	5.093e+13	3.136e+00	2.810e+01	4.850e-03	4.345e-02
3.0	5.239e+11	2.094e-01	1.218e+00	2.841e-04	1.653e-03
Totals	8.765e+16	4.386e+00	4.560e+01	6.920e-03	7.360e-02

Output File 1 Hour

MicroShield 8.03

NPPD (8.03-0000)

Date By Checked

Filename Run Date Run Time Duration

1CLP5.MS5 June 20, 2011 4:05:15 PM 00:00:00

Project Info

Case Title 1Cloud FHA 1

Description AST FHA Outside Cloud Shine 1 h

Geometry 8 - Cylinder Volume - End Shields

Source Dimensions

Height 2.4e+4 cm (800 ft)

Radius 2.4e+4 cm (800 ft)

Dose Points

A X Y Z

#1 0.0 cm (0 in) 2.5e+4 cm (811 ft 6.0 in) 0.0 cm (0 in)

Shields

Shield N Dimension Material Density

Source 4.55e+13 cm³ Air 0.00122

Shield 1 60.96 cm Concrete 2.35

Shield 2 289.56 cm Air 0.00122

Air Gap Air 0.00122

Source Input: Grouping Method - Standard Indices

Number of Groups: 25

Xe-133 6.1200e+005 2.2644e+016 1.3437e-002 4.9715e+002

Attachment K

Xe-133m 1.8000e+004 6.6600e+014 3.9519e-004 1.4622e+001
Xe-135 1.5900e+005 5.8830e+015 3.4909e-003 1.2916e+002
Xe-135m 1.4200e+003 5.2540e+013 3.1176e-005 1.1535e+000
Y-90
Y-91
Y-92
Y-93
Zr-95
Zr-97
Buildup: The material reference is Shield 1
Integration Parameters
Radial 20
Circumferential 10
Y Direction (axial) 10
Results
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 1.500e+15 0.000e+00 6.197e-23 0.000e+00 5.315e-24
0.03 1.162e+16 4.734e-70 1.670e-21 4.692e-72 1.655e-23
0.04 6.650e+09 5.001e-40 2.535e-27 2.212e-42 1.121e-29
0.08 8.313e+15 4.030e-10 2.290e-08 6.377e-13 3.624e-11
0.1 3.885e+10 2.126e-13 2.260e-11 3.252e-16 3.458e-14
0.15 6.844e+13 5.988e-08 1.104e-05 9.861e-11 1.818e-08
0.2 5.379e+15 6.323e-05 1.245e-02 1.116e-07 2.198e-05
0.3 1.666e+13 4.863e-06 6.965e-04 9.225e-09 1.321e-06
0.4 1.074e+14 2.645e-04 2.570e-02 5.154e-07 5.008e-05
0.5 1.066e+14 1.291e-03 8.910e-02 2.535e-06 1.749e-04
0.6 2.636e+14 1.124e-02 5.788e-01 2.194e-05 1.130e-03
0.8 6.388e+13 1.848e-02 5.990e-01 3.515e-05 1.139e-03
1.0 2.307e+13 2.766e-02 6.327e-01 5.098e-05 1.166e-03
1.5 1.804e+13 2.411e-01 3.073e+00 4.056e-04 5.170e-03
2.0 1.422e+13 8.757e-01 7.845e+00 1.354e-03 1.213e-02
3.0 1.461e+11 5.842e-02 3.399e-01 7.925e-05 4.611e-04
Totals 2.750e+16 1.234e+00 1.320e+01 1.950e-03 2.145e-02

Output File 2 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

Filename Run Date Run Time Duration
1CLP5.MS5 June 20, 2011 4:41:23 PM 00:00:00
Project Info
Case Title 1Cloud FHA 2
Description AST FHA Outside Cloud Shine 2 h
Geometry 8 - Cylinder Volume - End Shields

Source Dimensions
Height 2.4e+4 cm (800 ft)
Radius 2.4e+4 cm (800 ft)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 2.5e+4 cm (811 ft 6.0 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density

Attachment K

Source 4.55e+13 cm³ Air 0.00122
Shield 1 60.96 cm Concrete 2.35
Shield 2 289.56 cm Air 0.00122
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 μ Ci/cm³ Bq/cm³

Am-241

Ba-139

Ba-140

Br-82 6.9600e-001 2.5752e+010 1.5281e-008 5.6539e-004

Br-83 1.2500e-002 4.6250e+008 2.7444e-010 1.0154e-005

Ce-141

Ce-143

Ce-144

Cm-242

Cm-244

Co-58

Co-60

Cs-134

Cs-136

Cs-137

I-130 1.6200e+000 5.9940e+010 3.5567e-008 1.3160e-003

I-131 2.4200e+002 8.9540e+012 5.3131e-006 1.9659e-001

I-132 1.3100e+002 4.8470e+012 2.8761e-006 1.0642e-001

I-133 1.4700e+002 5.4390e+012 3.2274e-006 1.1941e-001

I-134 2.6500e-006 9.8050e+004 5.8181e-014 2.1527e-009

I-135 2.2100e+001 8.1770e+011 4.8521e-007 1.7953e-002

Kr-83m 8.7200e+000 3.2264e+011 1.9145e-007 7.0836e-003

Kr-85 1.0400e+003 3.8480e+013 2.2833e-005 8.4483e-001

Kr-85m 1.6300e+002 6.0310e+012 3.5787e-006 1.3241e-001

Kr-87 1.5000e-002 5.5500e+008 3.2933e-010 1.2185e-005

Kr-88 4.5100e+001 1.6687e+012 9.9017e-007 3.6636e-002

La-140

La-141

La-142

Mo-99

Nb-95

Nd-147

Np-239

Pr-143

Pu-238

Pu-239

Pu-240

Pu-241

Rb-86

Rh-105

Ru-103

Ru-105

Ru-106

Sb-127

Sb-129

Sr-89

Sr-90

Sr-91

Sr-92

Tc-99m

Te-127

Attachment K

Te-127m
Te-129
Te-129m
Te-131m
Te-132
Xe-129m 2.4900e-001 9.2130e+009 5.4668e-009 2.0227e-004
Xe-131m 3.8200e+002 1.4134e+013 8.3868e-006 3.1031e-001
Xe-133 6.4000e+004 2.3680e+015 1.4051e-003 5.1990e+001
Xe-133m 1.8700e+003 6.9190e+013 4.1056e-005 1.5191e+000
Xe-133m 1.5900e+004 5.8830e+014 3.4909e-004 1.2916e+001
Xe-135 -4.5200e+001 -1.6724e+012 -9.9237e-007 -3.6718e-002
Y-90
Y-91
Y-92
Y-93
Zr-95
Zr-97
Buildup: The material reference is Shield 1
Integration Parameters
Radial 20
Circumferential 10
Y Direction (axial) 10
Results
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 1.983e+14 0.000e+00 8.189e-24 0.000e+00 7.024e-25
0.03 1.514e+15 6.167e-71 2.176e-22 6.112e-73 2.157e-24
0.04 6.928e+08 5.210e-41 2.641e-28 2.304e-43 1.168e-30
0.08 8.693e+14 4.214e-11 2.395e-09 6.669e-14 3.790e-12
0.1 3.476e+09 1.901e-14 2.022e-12 2.909e-17 3.093e-15
0.15 4.894e+12 4.281e-09 7.893e-07 7.050e-12 1.300e-09
0.2 6.839e+13 8.040e-07 1.583e-04 1.419e-09 2.794e-07
0.3 1.614e+12 4.713e-07 6.751e-05 8.940e-10 1.281e-07
0.4 7.516e+12 1.850e-05 1.798e-03 3.606e-08 3.504e-06
0.5 6.311e+12 7.641e-05 5.273e-03 1.500e-07 1.035e-05
0.6 6.983e+12 2.977e-04 1.533e-02 5.811e-07 2.992e-05
0.8 5.564e+12 1.610e-03 5.217e-02 3.062e-06 9.923e-05
1.0 2.036e+12 2.441e-03 5.585e-02 4.500e-06 1.029e-04
1.5 1.629e+12 2.177e-02 2.775e-01 3.663e-05 4.668e-04
2.0 1.264e+12 7.783e-02 6.972e-01 1.203e-04 1.078e-03
3.0 1.295e+10 5.178e-03 3.013e-02 7.025e-06 4.087e-05
Totals 2.688e+15 1.092e-01 1.135e+00 1.723e-04 1.832e-03

Output File 8 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

Filename Run Date Run Time Duration
1CLP5.MS5 June 20, 2011 4:07:06 PM 00:00:00
Project Info
Case Title 1Cloud FHA 8
Description AST FHA Outside Cloud Shine 8 h
Geometry 8 - Cylinder Volume - End Shields

Attachment K

Source Dimensions

Height 2.4e+4 cm (800 ft)

Radius 2.4e+4 cm (800 ft)

Dose Points

A X Y Z

#1 0.0 cm (0 in) 2.5e+4 cm (811 ft 6.0 in) 0.0 cm (0 in)

Shields

Shield N Dimension Material Density

Source 4.55e+13 cm³ Air 0.00122

Shield 1 60.96 cm Concrete 2.35

Shield 2 289.56 cm Air 0.00122

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

Am-241

Ba-139

Ba-140

Br-82 2.9400e-003 1.0878e+008 6.4548e-011 2.3883e-006

Br-83 4.1000e-005 1.5170e+006 9.0016e-013 3.3306e-008

Ce-141

Ce-143

Ce-144

Cm-242

Cm-244

Co-58

Co-60

Cs-134

Cs-136

Cs-137

I-130 6.1500e-003 2.2755e+008 1.3502e-010 4.9959e-006

I-131 1.0200e+000 3.7740e+010 2.2394e-008 8.2859e-004

I-132 4.1000e-001 1.5170e+010 9.0016e-009 3.3306e-004

I-133 6.0800e-001 2.2496e+010 1.3349e-008 4.9390e-004

I-134 5.4700e-009 2.0239e+002 1.2009e-016 4.4435e-012

I-135 8.8800e-002 3.2856e+009 1.9496e-009 7.2136e-005

Kr-83m 2.6000e-002 9.6200e+008 5.7083e-010 2.1121e-005

Kr-85 4.4400e+000 1.6428e+011 9.7481e-008 3.6068e-003

Kr-85m 6.1500e-001 2.2755e+010 1.3502e-008 4.9959e-004

Kr-87 4.1000e-005 1.5170e+006 9.0016e-013 3.3306e-008

Kr-88 1.5000e-001 5.5500e+009 3.2933e-009 1.2185e-004

La-140

La-141

La-142

Mo-99

Nb-95

Nd-147

Np-239

Pr-143

Pu-238

Pu-239

Pu-240

Pu-241

Rb-86

Rh-105

Ru-103

Ru-105

Ru-106

Attachment K

Sb-127
Sb-129
Sr-89
Sr-90
Sr-91
Sr-92
Tc-99m
Te-127
Te-127m
Te-129
Te-129m
Te-131m
Te-132
Xe-129m 1.0200e-003 3.7740e+007 2.2394e-011 8.2859e-007
Xe-131m 1.5700e+000 5.8090e+010 3.4469e-008 1.2754e-003
Xe-133 2.6600e+002 9.8420e+012 5.8401e-006 2.1608e-001
Xe-133m 8.2000e+000 3.0340e+011 1.8003e-007 6.6612e-003
Xe-133m 6.1500e+001 2.2755e+012 1.3502e-006 4.9959e-002
Xe-135 6.8300e-002 2.5271e+009 1.4995e-009 5.5483e-005
Y-90
Y-91
Y-92
Y-93
Zr-95
Zr-97
Buildup: The material reference is Shield 1
Integration Parameters
Radial 20
Circumferential 10
Y Direction (axial) 10
Results
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 8.117e+11 0.000e+00 3.353e-26 0.000e+00 2.876e-27
0.03 6.206e+12 2.528e-73 8.920e-25 2.506e-75 8.840e-27
0.04 2.838e+06 2.134e-43 1.082e-30 9.439e-46 4.784e-33
0.08 3.613e+12 1.752e-13 9.954e-12 2.772e-16 1.575e-14
0.1 1.173e+07 6.414e-17 6.821e-15 9.813e-20 1.044e-17
0.15 1.855e+10 1.623e-11 2.992e-09 2.673e-14 4.927e-12
0.2 2.766e+11 3.251e-09 6.402e-07 5.738e-12 1.130e-09
0.3 6.288e+09 1.836e-09 2.630e-07 3.483e-12 4.988e-10
0.4 3.154e+10 7.767e-08 7.547e-06 1.513e-10 1.471e-08
0.5 2.493e+10 3.019e-07 2.083e-05 5.925e-10 4.089e-08
0.6 2.297e+10 9.796e-07 5.044e-05 1.912e-09 9.845e-08
0.8 1.818e+10 5.260e-06 1.705e-04 1.001e-08 3.243e-07
1.0 6.844e+09 8.205e-06 1.877e-04 1.512e-08 3.460e-07
1.5 5.696e+09 7.614e-05 9.704e-04 1.281e-07 1.633e-06
2.0 4.235e+09 2.608e-04 2.336e-03 4.032e-07 3.612e-06
3.0 4.303e+07 1.720e-05 1.001e-04 2.334e-08 1.358e-07
Totals 1.105e+13 3.689e-04 3.844e-03 5.825e-07 6.207e-06

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

NEDC 05-031
CCN 3C1
Page L-1 of L-30

Attachment L Microshield Files, CREFS Shines, .MX5, Output - .txt

Time point 0.25 hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm², or cm³)

64 : Number of nuclides in file.

Nuclide Index	Ci	Nuclide Name
---------------	----	--------------

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	4.12E-04	Br-82
62	1.01E-05	Br-83
63	3.32E-16	Br-84
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	1.00E-03	I-130
175	1.43E-01	I-131
176	1.07E-01	I-132
177	8.87E-02	I-133
178	3.95E-09	I-134
179	1.44E-02	I-135
203	0.00E+00	Kr-85
204	0.00E+00	Kr-85m
205	0.00E+00	Kr-87
206	0.00E+00	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

NEDC 05-031
CCN 3C1
Page L-2 of L-30

420	0.00E+00	Te-131m
421	0.00E+00	Te-132
471	0.00E+00	Xe-133
473	0.00E+00	Xe-135
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 0.5 hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm^2, or cm^3)

64 : Number of nuclides in file.

Nuclide Index	Ci	Nuclide Name
---------------	----	--------------

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	6.03E-04	Br-82
62	1.39E-05	Br-83
63	3.52E-16	Br-84
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134

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118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	1.45E-03	I-130
175	2.09E-01	I-131
176	1.45E-01	I-132
177	1.29E-01	I-133
178	4.76E-09	I-134
179	2.06E-02	I-135
203	0.00E+00	Kr-85
204	0.00E+00	Kr-85m
205	0.00E+00	Kr-87
206	0.00E+00	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132
471	0.00E+00	Xe-133
473	0.00E+00	Xe-135
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8

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0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 1 Hour

```
5.00 Description: MicroShield Source file
```

1

1 : Indicator for Ci or Photons/sec

```
1 : Geometry factor (point, cm, cm^2, or cm^3)
```

64 : Number of nuclides in file.

Nuclide Index Ci	Nuclide Name
------------------	--------------

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	7.11E-04	Br-82
62	1.43E-05	Br-83
63	2.18E-16	Br-84
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	1.68E-03	I-130
175	2.49E-01	I-131
176	1.49E-01	I-132
177	1.51E-01	I-133
178	3.82E-09	I-134
179	2.33E-02	I-135
203	0.00E+00	Kr-85
204	0.00E+00	Kr-85m
205	0.00E+00	Kr-87
206	0.00E+00	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-244

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316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132
471	0.00E+00	Xe-133
473	0.00E+00	Xe-135
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 2 Hours
5.00 Description: MicroShield Source file
1
1 : Indicator for Ci or Photons/sec

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1 : Geometry factor (point, cm, cm², or cm³)

64 : Number of nuclides in file.

Nuclide Index	Ci	Nuclide Name
13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	7.20E-04	Br-82
62	1.10E-05	Br-83
63	6.09E-17	Br-84
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	4.79E-04	I-130
175	2.56E-01	I-131
176	1.14E-01	I-132
177	1.51E-01	I-133
178	1.79E-09	I-134
179	2.17E-02	I-135
203	0.00E+00	Kr-85
204	0.00E+00	Kr-85m
205	0.00E+00	Kr-87
206	0.00E+00	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132
471	0.00E+00	Xe-133
473	0.00E+00	Xe-135
480	0.00E+00	Y-90
482	0.00E+00	Y-91

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484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 8 Hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm^2, or cm^3)

64 : Number of nuclides in file.

Nuclide Index	Ci	Nuclide Name
---------------	----	--------------

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	6.41E-04	Br-82
62	1.94E-06	Br-83
63	2.38E-20	Br-84
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	0.00E+00	I-130
175	2.51E-01	I-131
176	1.87E-02	I-132
177	1.24E-01	I-133

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178	1.56E-11	I-134
179	1.16E-02	I-135
203	0.00E+00	Kr-85
204	0.00E+00	Kr-85m
205	0.00E+00	Kr-87
206	0.00E+00	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132
471	0.00E+00	Xe-133
473	0.00E+00	Xe-135
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14

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Microshield Files .MX5 First for 8 Time Points
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0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 24 Hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm², or cm³)

64 : Number of nuclides in file.

Nuclide Index	Ci	Nuclide Name
---------------	----	--------------

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	4.68E-04	Br-82
62	1.87E-08	Br-83
63	1.95E-29	Br-84
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	0.00E+00	I-130
175	2.37E-01	I-131
176	1.50E-04	I-132
177	7.27E-02	I-133
178	4.99E-17	I-134
179	2.16E-03	I-135
203	0.00E+00	Kr-85
204	0.00E+00	Kr-85m
205	0.00E+00	Kr-87
206	0.00E+00	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106

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Microshield Files .MX5 First for 8 Time Points
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365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132
471	0.00E+00	Xe-133
473	0.00E+00	Xe-135
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 96 Hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm^2, or cm^3)

64 : Number of nuclides in file.

Nuclide Index	Ci	Nuclide Name
---------------	----	--------------

13	0.00E+00	Am-241
----	----------	--------

41	0.00E+00	Ba-139
----	----------	--------

42	0.00E+00	Ba-140
----	----------	--------

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61	1.14E-04	Br-82
62	1.60E-17	Br-83
63	2.48E-70	Br-84
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	0.00E+00	I-130
175	1.83E-01	I-131
176	5.67E-14	I-132
177	6.60E-03	I-133
178	9.44E-42	I-134
179	1.14E-06	I-135
203	0.00E+00	Kr-85
204	0.00E+00	Kr-85m
205	0.00E+00	Kr-87
206	0.00E+00	Kr-88
209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132
471	0.00E+00	Xe-133
473	0.00E+00	Xe-135
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20
0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Time Point 720 Hours

5.00 Description: MicroShield Source file

1

1 : Indicator for Ci or Photons/sec

1 : Geometry factor (point, cm, cm^2, or cm^3)

64 : Number of nuclides in file.

Nuclide Index	Ci	Nuclide Name
---------------	----	--------------

13	0.00E+00	Am-241
41	0.00E+00	Ba-139
42	0.00E+00	Ba-140
61	5.43E-10	Br-82
62	4.06E-96	Br-83
63	0.00E+00	Br-84
81	0.00E+00	Ce-141
82	0.00E+00	Ce-143
83	0.00E+00	Ce-144
93	0.00E+00	Cm-242
95	0.00E+00	Cm-244
104	0.00E+00	Co-58
106	0.00E+00	Co-60
115	0.00E+00	Cs-134
118	0.00E+00	Cs-136
119	0.00E+00	Cs-137
174	0.00E+00	I-130
175	1.94E-02	I-131
176	1.21E-95	I-132
177	6.14E-12	I-133
178	5.08E-25	I-134
179	4.34E-35	I-135
203	0.00E+00	Kr-85
204	0.00E+00	Kr-85m
205	0.00E+00	Kr-87
206	0.00E+00	Kr-88

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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209	0.00E+00	La-140
210	0.00E+00	La-141
211	0.00E+00	La-142
224	0.00E+00	Mo-99
238	0.00E+00	Nb-95
243	0.00E+00	Nd-147
255	0.00E+00	Np-239
302	0.00E+00	Pr-143
313	0.00E+00	Pu-238
314	0.00E+00	Pu-239
315	0.00E+00	Pu-240
316	0.00E+00	Pu-241
332	0.00E+00	Rb-86
347	0.00E+00	Rh-105
355	0.00E+00	Ru-103
356	0.00E+00	Ru-105
357	0.00E+00	Ru-106
365	0.00E+00	Sb-127
366	0.00E+00	Sb-129
391	0.00E+00	Sr-89
392	0.00E+00	Sr-90
393	0.00E+00	Sr-91
394	0.00E+00	Sr-92
408	0.00E+00	Tc-99m
415	0.00E+00	Te-127
416	0.00E+00	Te-127m
417	0.00E+00	Te-129
418	0.00E+00	Te-129m
420	0.00E+00	Te-131m
421	0.00E+00	Te-132
471	0.00E+00	Xe-133
473	0.00E+00	Xe-135
480	0.00E+00	Y-90
482	0.00E+00	Y-91
484	0.00E+00	Y-92
485	0.00E+00	Y-93
496	0.00E+00	Zr-95
497	0.00E+00	Zr-97

Energy	Activity (Photons/sec)		
0	0	Energy #	1
0	0	Energy #	2
0	0	Energy #	3
0	0	Energy #	4
0	0	Energy #	5
0	0	Energy #	6
0	0	Energy #	7
0	0	Energy #	8
0	0	Energy #	9
0	0	Energy #	10
0	0	Energy #	11
0	0	Energy #	12
0	0	Energy #	13
0	0	Energy #	14
0	0	Energy #	15
0	0	Energy #	16
0	0	Energy #	17
0	0	Energy #	18
0	0	Energy #	19
0	0	Energy #	20

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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0	0	Energy #	21
0	0	Energy #	22
0	0	Energy #	23
0	0	Energy #	24
0	0	Energy #	25

Microshield Output 0.25 Hours
 MicroShield 8.03
 NPPD (8.03-0000)
 Date By Checked

Filename Run Date Run Time Duration
 5CRP5_24.MS5 June 16, 2011 11:43:39 AM 00:00:00
 Project Info
 Case Title 5CRP5_24
 Description AST LOCA CREFS Filter Shine 0.25h
 Geometry 8 - Cylinder Volume - End Shields

Source Dimensions
 Height 47.963 cm (1 ft 6.9 in)
 Radius 23.982 cm (9.4 in)
 Dose Points
 A X Y Z
 #1 0.0 cm (0 in) 1.1e+3 cm (37 ft 0.4 in) 0.0 cm (0 in)
 Shields
 Shield N Dimension Material Density
 Source 8.67e+04 cm³ Carbon 0.305
 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 μ Ci/cm³ Bq/cm³
 Am-241
 Ba-139
 Ba-140
 Br-82 4.1200e-004 1.5244e+007 4.7542e-003 1.7591e+002
 Br-83 1.0100e-005 3.7370e+005 1.1655e-004 4.3123e+000
 Br-84 3.3200e-016 1.2284e-005 3.8311e-015 1.4175e-010
 Ce-141
 Ce-143
 Ce-144
 Cm-242
 Cm-244
 Co-58
 Co-60
 Cs-134
 Cs-136
 Cs-137
 I-130 1.0000e-003 3.7000e+007 1.1539e-002 4.2696e+002
 I-131 1.4300e-001 5.2910e+009 1.6501e+000 6.1055e+004
 I-132 1.0700e-001 3.9590e+009 1.2347e+000 4.5684e+004
 I-133 8.8700e-002 3.2819e+009 1.0235e+000 3.7871e+004
 I-134 3.9500e-009 1.4615e+002 4.5581e-008 1.6865e-003
 I-135 1.4400e-002 5.3280e+008 1.6617e-001 6.1482e+003
 Kr-85
 Kr-85m
 Kr-87
 Kr-88

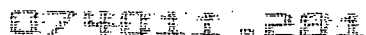
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La-140
La-141
La-142
Mo-99
Nb-95
Nd-147
Np-239
Pr-143
Pu-238
Pu-239
Pu-240
Pu-241
Rb-86
Rh-105
Ru-103
Ru-105
Ru-106
Sb-127
Sb-129
Sr-89
Sr-90
Sr-91
Sr-92
Tc-99m
Te-127
Te-127m
Te-129
Te-129m
Te-131m
Te-132
Xe-133
Xe-135
Y-90
Y-91
Y-92
Y-93
Zr-95
Zr-97

Buildup: The material reference is Source
Integration Parameters
Radial 20
Circumferential 10
Y Direction (axial) 10

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm ² /sec	No Buildup Fluence Rate MeV/cm ² /sec	With Buildup Exposure Rate mR/hr	No Buildup Exposure Rate mR/hr	With Buildup
0.015	3.348e+07	4.176e-04	7.340e-04	3.582e-05	6.296e-05	
0.03	2.937e+08	1.069e-01	4.689e-01	1.060e-03	4.647e-03	
0.08	1.385e+08	2.310e-01	1.724e+00	3.656e-04	2.728e-03	
0.1	1.092e+05	2.402e-04	1.489e-03	3.675e-07	2.279e-06	
0.15	9.400e+06	3.418e-02	1.415e-01	5.628e-05	2.331e-04	
0.2	3.036e+07	1.584e-01	5.183e-01	2.795e-04	9.149e-04	
0.3	4.822e+08	4.193e+00	1.053e+01	7.955e-03	1.997e-02	
0.4	4.446e+09	5.556e+01	1.186e+02	1.082e-01	2.311e-01	
0.5	3.949e+09	6.533e+01	1.261e+02	1.282e-01	2.476e-01	
0.6	5.555e+09	1.155e+02	2.081e+02	2.254e-01	4.061e-01	



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0.8	4.193e+09	1.247e+02	1.961e+02	2.372e-01	3.731e-01
1.0	1.469e+09	5.755e+01	8.450e+01	1.061e-01	1.558e-01
1.5	9.877e+08	6.345e+01	8.481e+01	1.068e-01	1.427e-01
2.0	1.888e+08	1.710e+01	2.167e+01	2.645e-02	3.352e-02
3.0	1.225e-06	1.784e-13	2.119e-13	2.420e-16	2.875e-16
4.0	8.792e-07	1.777e-13	2.039e-13	2.198e-16	2.522e-16
Totals	2.178e+10	5.039e+02	8.533e+02	9.481e-01	1.618e+00

Microshield Output 0.5 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

```

Filename Run Date Run Time Duration
5CRP5_24.MS5 June 16, 2011 11:40:06 AM 00:00:00
Project Info
Case Title 5CRP5_24
Description AST LOCA CREFS Filter Shine 0.5h
Geometry 8 - Cylinder Volume - End Shields

```

```
Source Dimensions
Height 47.963 cm (1 ft 6.9 in)
Radius 23.982 cm (9.4 in)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 1.1e+3 cm (37 ft 0.4 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density
Source 8.67e+04 cm³ Carbon 0.305
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
Am-241
Ba-139
Ba-140
Br-82 6.0300e-004 2.2311e+007 6.9582e-003 2.5745e+002
Br-83 1.3900e-005 5.1430e+005 1.6040e-004 5.9347e+000
Br-84 3.5200e-016 1.3024e-005 4.0619e-015 1.5029e-010
Ce-141
Ce-143
Ce-144
Cm-242
Cm-244
Co-58
Co-60
Cs-134
Cs-136
Cs-137
I-130 1.4500e-003 5.3650e+007 1.6732e-002 6.1909e+002
I-131 2.0900e-001 7.7330e+009 2.4117e+000 8.9234e+004
I-132 1.4500e-001 5.3650e+009 1.6732e+000 6.1909e+004
I-133 1.2900e-001 4.7730e+009 1.4886e+000 5.5077e+004
I-134 4.7600e-009 1.7612e+002 5.4927e-008 2.0323e-003
I-135 2.0600e-002 7.6220e+008 2.3771e-001 8.7953e+003
Kr-85
Kr-85m

```

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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Kr-87
Kr-88
La-140
La-141
La-142
Mo-99
Nb-95
Nd-147
Np-239
Pr-143
Pu-238
Pu-239
Pu-240
Pu-241
Rb-86
Rh-105
Ru-103
Ru-105
Ru-106
Sb-127
Sb-129
Sr-89
Sr-90
Sr-91
Sr-92
Tc-99m
Te-127
Te-127m
Te-129
Te-129m
Te-131m
Te-132
Xe-133
Xe-135
Y-90
Y-91
Y-92
Y-93
Zr-95
Zr-97

Buildup: The material reference is Source
Integration Parameters

Radial 20

Circumferential 10

Y Direction (axial) 10

Results

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	4.865e+07	6.069e-04	1.067e-03	5.205e-05	9.150e-05
0.03	4.265e+08	1.553e-01	6.809e-01	1.539e-03	6.749e-03
0.08	2.025e+08	3.376e-01	2.520e+00	5.343e-04	3.987e-03
0.1	1.599e+05	3.516e-04	2.180e-03	5.379e-07	3.335e-06
0.15	1.274e+07	4.632e-02	1.918e-01	7.628e-05	3.159e-04
0.2	4.347e+07	2.268e-01	7.421e-01	4.002e-04	1.310e-03
0.3	6.936e+08	6.031e+00	1.514e+01	1.144e-02	2.872e-02
0.4	6.487e+09	8.106e+01	1.730e+02	1.579e-01	3.371e-01

**Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points**

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0.5	5.649e+09	9.345e+01	1.804e+02	1.834e-01	3.542e-01
0.6	7.580e+09	1.576e+02	2.839e+02	3.076e-01	5.542e-01
0.8	5.726e+09	1.703e+02	2.678e+02	3.239e-01	5.094e-01
1.0	2.016e+09	7.898e+01	1.160e+02	1.456e-01	2.138e-01
1.5	1.369e+09	8.795e+01	1.176e+02	1.480e-01	1.978e-01
2.0	2.602e+08	2.358e+01	2.988e+01	3.646e-02	4.620e-02
3.0	1.299e-06	1.891e-13	2.247e-13	2.566e-16	3.048e-16
4.0	9.321e-07	1.884e-13	2.162e-13	2.331e-16	2.674e-16
Totals	3.051e+10	6.997e+02	1.188e+03	1.317e+00	2.254e+00

Microshield Output 1 Hour
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

Filename Run Date Run Time Duration
5CRP5_24.MS5 June 16, 2011 11:46:15 AM 00:00:00
Project Info
Case Title 5CR1_24
Description AST LOCA CREFS Filter Shine 1h
Geometry 8 - Cylinder Volume - End Shields

Source Dimensions
Height 47.963 cm (1 ft 6.9 in)
Radius 23.982 cm (9.4 in)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 1.1e+3 cm (37 ft 0.4 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density
Source 8.67e+04 cm³ Carbon 0.305
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 $\mu\text{Ci}/\text{cm}^3$ Bq/cm³
Am-241
Ba-139
Ba-140
Br-82 7.1100e-004 2.6307e+007 8.2045e-003 3.0357e+002
Br-83 1.4300e-005 5.2910e+005 1.6501e-004 6.1055e+000
Br-84 2.1800e-016 8.0660e-006 2.5156e-015 9.3077e-011
Ce-141
Ce-143
Ce-144
Cm-242
Cm-244
Co-58
Co-60
Cs-134
Cs-136
Cs-137
I-130 1.6800e-003 6.2160e+007 1.9386e-002 7.1729e+002
I-131 2.4900e-001 9.2130e+009 2.8733e+000 1.0631e+005
I-132 1.4900e-001 5.5130e+009 1.7194e+000 6.3617e+004
I-133 1.5100e-001 5.5870e+009 1.7424e+000 6.4470e+004
I-134 3.8200e-009 1.4134e+002 4.4080e-008 1.6310e-003
I-135 2.3300e-002 8.6210e+008 2.6887e-001 9.9481e+003

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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Kr-85
Kr-85m
Kr-87
Kr-88
La-140
La-141
La-142
Mo-99
Nb-95
Nd-147
Np-239
Pr-143
Pu-238
Pu-239
Pu-240
Pu-241
Rb-86
Rh-105
Ru-103
Ru-105
Ru-106
Sb-127
Sb-129
Sr-89
Sr-90
Sr-91
Sr-92
Tc-99m
Te-127
Te-127m
Te-129
Te-129m
Te-131m
Te-132
Xe-133
Xe-135
Y-90
Y-91
Y-92
Y-93
Zr-95
Zr-97
Buildup: The material reference is Source
Integration Parameters
Radial 20
Circumferential 10
Y Direction (axial) 10
Results
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 5.736e+07 7.155e-04 1.258e-03 6.137e-05 1.079e-04
0.03 5.022e+08 1.829e-01 8.017e-01 1.812e-03 7.946e-03
0.08 2.412e+08 4.023e-01 3.002e+00 6.366e-04 4.751e-03
0.1 1.885e+05 4.145e-04 2.570e-03 6.342e-07 3.932e-06
0.15 1.310e+07 4.762e-02 1.972e-01 7.842e-05 3.247e-04
0.2 4.965e+07 2.590e-01 8.478e-01 4.572e-04 1.496e-03

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0.3	8.023e+08	6.976e+00	1.751e+01	1.323e-02	3.322e-02
0.4	7.704e+09	9.627e+01	2.055e+02	1.876e-01	4.004e-01
0.5	6.428e+09	1.063e+02	2.053e+02	2.087e-01	4.030e-01
0.6	7.905e+09	1.643e+02	2.961e+02	3.208e-01	5.779e-01
0.8	5.976e+09	1.777e+02	2.795e+02	3.380e-01	5.316e-01
1.0	2.122e+09	8.315e+01	1.221e+02	1.533e-01	2.251e-01
1.5	1.468e+09	9.431e+01	1.261e+02	1.587e-01	2.121e-01
2.0	2.761e+08	2.501e+01	3.170e+01	3.868e-02	4.902e-02
3.0	8.047e-07	1.171e-13	1.391e-13	1.589e-16	1.888e-16
4.0	5.773e-07	1.167e-13	1.339e-13	1.444e-16	1.656e-16
Totals	3.354e+10	7.550e+02	1.289e+03	1.422e+00	2.447e+00

Microshield Output 2 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

```

Filename Run Date Run Time Duration
5CRP5_24.MS5 June 16, 2011 11:52:25 AM 00:00:00
Project Info
Case Title 5CR2_24
Description AST LOCA CREFS Filter Shine 2h
Geometry 8 - Cylinder Volume - End Shields

```

```
Source Dimensions
Height 47.963 cm (1 ft 6.9 in)
Radius 23.982 cm (9.4 in)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 1.1e+3 cm (37 ft 0.4 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density
Source 8.67e+04 cm³ Carbon 0.305
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
Am-241
Ba-139
Ba-140
Br-82 7.2000e-004 2.6640e+007 8.3083e-003 3.0741e+002
Br-83 1.1000e-005 4.0700e+005 1.2693e-004 4.6965e+000
Br-84 6.0900e-017 2.2533e-006 7.0275e-016 2.6002e-011
Ce-141
Ce-143
Ce-144
Cm-242
Cm-244
Co-58
Co-60
Cs-134
Cs-136
Cs-137
I-130 4.7900e-004 1.7723e+007 5.5274e-003 2.0451e+002
I-131 2.5600e-001 9.4720e+009 2.9541e+000 1.0930e+005
I-132 1.1400e-001 4.2180e+009 1.3155e+000 4.8673e+004
I-133 1.5100e-001 5.5870e+009 1.7424e+000 6.4470e+004

```

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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I-134 1.7900e-009 6.6230e+001 2.0655e-008 7.6425e-004
I-135 2.1700e-002 8.0290e+008 2.5040e-001 9.2650e+003

Kr-85
Kr-85m
Kr-87
Kr-88
La-140
La-141
La-142
Mo-99
Nb-95
Nd-147
Np-239
Pr-143
Pu-238
Pu-239
Pu-240
Pu-241
Rb-86
Rh-105
Ru-103
Ru-105
Ru-106
Sb-127
Sb-129
Sr-89
Sr-90
Sr-91
Sr-92
Tc-99m
Te-127
Te-127m
Te-129
Te-129m
Te-131m
Te-132
Xe-133
Xe-135
Y-90
Y-91
Y-92
Y-93
Zr-95
Zr-97

Buildup: The material reference is Source
Integration Parameters

Radial 20

Circumferential 10

Y Direction (axial) 10

Results

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 5.791e+07 7.223e-04 1.270e-03 6.196e-05 1.089e-04
0.03 5.058e+08 1.842e-01 8.075e-01 1.825e-03 8.003e-03
0.08 2.480e+08 4.136e-01 3.086e+00 6.545e-04 4.884e-03
0.1 1.909e+05 4.198e-04 2.603e-03 6.422e-07 3.982e-06

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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```

0.15 1.003e+07 3.647e-02 1.510e-01 6.005e-05 2.487e-04
0.2 4.739e+07 2.472e-01 8.091e-01 4.363e-04 1.428e-03
0.3 7.849e+08 6.825e+00 1.713e+01 1.295e-02 3.250e-02
0.4 7.866e+09 9.829e+01 2.098e+02 1.915e-01 4.088e-01
0.5 6.071e+09 1.004e+02 1.939e+02 1.972e-01 3.807e-01
0.6 6.225e+09 1.294e+02 2.332e+02 2.526e-01 4.551e-01
0.8 4.711e+09 1.401e+02 2.204e+02 2.665e-01 4.192e-01
1.0 1.712e+09 6.710e+01 9.853e+01 1.237e-01 1.816e-01
1.5 1.236e+09 7.939e+01 1.061e+02 1.336e-01 1.786e-01
2.0 2.270e+08 2.057e+01 2.606e+01 3.180e-02 4.031e-02
3.0 2.248e-07 3.272e-14 3.887e-14 4.439e-17 5.274e-17
4.0 1.613e-07 3.260e-14 3.740e-14 4.033e-17 4.627e-17
Totals 2.970e+10 6.430e+02 1.110e+03 1.213e+00 2.111e+00

```

Microshield Output 8 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

Filename Run Date Run Time Duration
5CRP5_24.MS5 June 16, 2011 11:54:44 AM 00:00:00
Project Info
Case Title 5CR8_24
Description AST LOCA CREFS Filter Shine 8h
Geometry 8 - Cylinder Volume - End Shields

Source Dimensions
Height 47.963 cm (1 ft 6.9 in)
Radius 23.982 cm (9.4 in)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 1.1e+3 cm (37 ft 0.4 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density
Source 8.67e+04 cm³ Carbon 0.305
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
Am-241
Ba-139
Ba-140
Br-82 6.4100e-004 2.3717e+007 7.3967e-003 2.7368e+002
Br-83 1.9400e-006 7.1780e+004 2.2386e-005 8.2830e-001
Br-84 2.3800e-020 8.8060e-010 2.7464e-019 1.0162e-014
Ce-141
Ce-143
Ce-144
Cm-242
Cm-244
Co-58
Co-60
Cs-134
Cs-136
Cs-137
I-130
I-131 2.5100e-001 9.2870e+009 2.8964e+000 1.0717e+005

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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I-132 1.8700e-002 6.9190e+008 2.1579e-001 7.9841e+003
I-133 1.2400e-001 4.5880e+009 1.4309e+000 5.2943e+004
I-134 1.5600e-011 5.7720e-001 1.8001e-010 6.6605e-006
I-135 1.1600e-002 4.2920e+008 1.3386e-001 4.9527e+003

Kr-85

Kr-85m

Kr-87

Kr-88

La-140

La-141

La-142

Mo-99

Nb-95

Nd-147

Np-239

Pr-143

Pu-238

Pu-239

Pu-240

Pu-241

Rb-86

Rh-105

Ru-103

Ru-105

Ru-106

Sb-127

Sb-129

Sr-89

Sr-90

Sr-91

Sr-92

Tc-99m

Te-127

Te-127m

Te-129

Te-129m

Te-131m

Te-132

Xe-133

Xe-135

Y-90

Y-91

Y-92

Y-93

Zr-95

Zr-97

Buildup: The material reference is Source

Integration Parameters

Radial 20

Circumferential 10

Y Direction (axial) 10

Results

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 5.408e+07 6.745e-04 1.186e-03 5.786e-05 1.017e-04

0.03 4.692e+08 1.709e-01 7.491e-01 1.693e-03 7.425e-03

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0.08	2.432e+08	4.055e-01	3.026e+00	6.417e-04	4.789e-03
0.1	1.699e+05	3.737e-04	2.317e-03	5.718e-07	3.545e-06
0.15	1.673e+06	6.082e-03	2.518e-02	1.001e-05	4.147e-05
0.2	3.457e+07	1.804e-01	5.903e-01	3.183e-04	1.042e-03
0.3	6.659e+08	5.791e+00	1.454e+01	1.098e-02	2.757e-02
0.4	7.602e+09	9.499e+01	2.028e+02	1.851e-01	3.951e-01
0.5	4.301e+09	7.116e+01	1.374e+02	1.397e-01	2.697e-01
0.6	1.670e+09	3.472e+01	6.255e+01	6.776e-02	1.221e-01
0.8	1.240e+09	3.688e+01	5.801e+01	7.015e-02	1.103e-01
1.0	4.973e+08	1.949e+01	2.862e+01	3.592e-02	5.275e-02
1.5	4.634e+08	2.977e+01	3.979e+01	5.008e-02	6.695e-02
2.0	6.999e+07	6.341e+00	8.036e+00	9.806e-03	1.243e-02
3.0	8.785e-11	1.279e-17	1.519e-17	1.735e-20	2.061e-20
4.0	6.303e-11	1.274e-17	1.462e-17	1.576e-20	1.808e-20
Totals	1.731e+10	2.999e+02	5.561e+02	5.722e-01	1.070e+00

Microshield Output 24 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

```

Filename Run Date Run Time Duration
5CRP5_24.MS5 June 16, 2011 11:56:53 AM 00:00:00
Project Info
Case Title 5CR24_24
Description AST LOCA CREFS Filter Shine 24h
Geometry 8 - Cylinder Volume - End Shields

```

```

Source Dimensions
Height 47.963 cm (1 ft 6.9 in)
Radius 23.982 cm (9.4 in)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 1.1e+3 cm (37 ft 0.4 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density
Source 8.67e+04 cm³ Carbon 0.305
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  $\mu\text{Ci}/\text{cm}^3$   $\text{Bq}/\text{cm}^3$ 
Am-241
Ba-139
Ba-140
Br-82 4.6800e-004 1.7316e+007 5.4004e-003 1.9982e+002
Br-83 1.8700e-008 6.9190e+002 2.1579e-007 7.9841e-003
Br-84 1.9500e-029 7.2150e-019 2.2502e-028 8.3257e-024
Ce-141
Ce-143
Ce-144
Cm-242
Cm-244
Co-58
Co-60
Cs-134
Cs-136
Cs-137
```

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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I-130
I-131 2.3700e-001 8.7690e+009 2.7348e+000 1.0119e+005
I-132 1.5000e-004 5.5500e+006 1.7309e-003 6.4044e+001
I-133 7.2700e-002 2.6899e+009 8.3891e-001 3.1040e+004
I-134 4.9900e-017 1.8463e-006 5.7581e-016 2.1305e-011
I-135 2.1600e-003 7.9920e+007 2.4925e-002 9.2223e+002

Kr-85
Kr-85m
Kr-87
Kr-88
La-140
La-141
La-142
Mo-99
Nb-95
Nd-147
Np-239
Pr-143
Pu-238
Pu-239
Pu-240
Pu-241
Rb-86
Rh-105
Ru-103
Ru-105
Ru-106
Sb-127
Sb-129
Sr-89
Sr-90
Sr-91
Sr-92
Tc-99m
Te-127
Te-127m
Te-129
Te-129m
Te-131m
Te-132
Xe-133
Xe-135
Y-90
Y-91
Y-92
Y-93
Zr-95
Zr-97

Buildup: The material reference is Source

Integration Parameters

Radial 20

Circumferential 10

Y Direction (axial) 10

Results

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

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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```

0.015 4.970e+07 6.200e-04 1.090e-03 5.318e-05 9.347e-05
0.03 4.296e+08 1.564e-01 6.859e-01 1.550e-03 6.798e-03
0.08 2.296e+08 3.829e-01 2.857e+00 6.059e-04 4.522e-03
0.1 1.241e+05 2.729e-04 1.692e-03 4.174e-07 2.588e-06
0.15 3.767e+04 1.370e-04 5.672e-04 2.256e-07 9.341e-07
0.2 2.520e+07 1.315e-01 4.303e-01 2.321e-04 7.594e-04
0.3 5.915e+08 5.144e+00 1.291e+01 9.757e-03 2.449e-02
0.4 7.137e+09 8.918e+01 1.904e+02 1.738e-01 3.709e-01
0.5 2.426e+09 4.013e+01 7.749e+01 7.878e-02 1.521e-01
0.6 7.202e+08 1.497e+01 2.698e+01 2.922e-02 5.265e-02
0.8 3.982e+08 1.184e+01 1.863e+01 2.253e-02 3.543e-02
1.0 1.043e+08 4.085e+00 5.999e+00 7.530e-03 1.106e-02
1.5 1.185e+08 7.612e+00 1.018e+01 1.281e-02 1.712e-02
2.0 8.996e+06 8.150e-01 1.033e+00 1.260e-03 1.597e-03
3.0 7.198e-20 1.048e-26 1.245e-26 1.421e-29 1.689e-29
4.0 5.164e-20 1.044e-26 1.198e-26 1.291e-29 1.482e-29
Totals 1.224e+10 1.745e+02 3.476e+02 3.381e-01 6.775e-01

```

Microshield Output 96 Hours
MicroShield 8.03
NPPD (8.03-0000)
Date By Checked

Filename Run Date Run Time Duration
5CRP5_24.MS5 June 16, 2011 11:59:14 AM 00:00:00
Project Info
Case Title 5CR96_24
Description AST LOCA CREFS Filter Shine 96h
Geometry 8 - Cylinder Volume - End Shields

Source Dimensions
Height 47.963 cm (1 ft 6.9 in)
Radius 23.982 cm (9.4 in)
Dose Points
A X Y Z
#1 0.0 cm (0 in) 1.1e+3 cm (37 ft 0.4 in) 0.0 cm (0 in)
Shields
Shield N Dimension Material Density
Source 8.67e+04 cm³ Carbon 0.305
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 $\mu\text{Ci}/\text{cm}^3$ Bq/cm³
Am-241
Ba-139
Ba-140
Br-82 1.1400e-004 4.2180e+006 1.3155e-003 4.8673e+001
Br-83 1.6000e-017 5.9200e-007 1.8463e-016 6.8313e-012
Br-84 2.4800e-070 9.1760e-060 2.8618e-069 1.0589e-064
Ce-141
Ce-143
Ce-144
Cm-242
Cm-244
Co-58
Co-60
Cs-134

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CCN 3C1
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```
Buildup: The material reference is Source
Integration Parameters
Radial 20
Circumferential 10
Y Direction (axial) 10
Results
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
```

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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mR/hr

With Buildup

0.015	3.737e+07	4.662e-04	8.194e-04	3.998e-05	7.028e-05
0.03	3.218e+08	1.172e-01	5.138e-01	1.161e-03	5.092e-03
0.08	1.773e+08	2.956e-01	2.206e+00	4.678e-04	3.491e-03
0.1	3.022e+04	6.647e-05	4.121e-04	1.017e-07	6.305e-07
0.15	5.974e+03	2.172e-05	8.995e-05	3.577e-08	1.481e-07
0.2	1.803e+07	9.405e-02	3.078e-01	1.660e-04	5.432e-04
0.3	4.438e+08	3.859e+00	9.687e+00	7.321e-03	1.838e-02
0.4	5.497e+09	6.869e+01	1.466e+02	1.338e-01	2.857e-01
0.5	2.411e+08	3.989e+00	7.702e+00	7.830e-03	1.512e-02
0.6	5.154e+08	1.071e+01	1.931e+01	2.091e-02	3.768e-02
0.8	1.457e+08	4.332e+00	6.814e+00	8.241e-03	1.296e-02
1.0	7.113e+06	2.787e-01	4.093e-01	5.137e-04	7.544e-04
1.5	7.947e+06	5.105e-01	6.824e-01	8.589e-04	1.148e-03
2.0	9.420e+03	8.535e-04	1.082e-03	1.320e-06	1.673e-06
3.0	9.154e-61	1.332e-67	1.583e-67	1.808e-70	2.148e-70
4.0	6.567e-61	1.327e-67	1.523e-67	1.642e-70	1.884e-70
Totals	7.413e+09	9.288e+01	1.943e+02	1.814e-01	3.809e-01

Microshield Output 720 Hours

MicroShield 8.03

NPPD (8.03-0000)

Date By Checked

Filename Run Date Run Time Duration

5CRP5_24.MS5 June 16, 2011 1:10:26 PM 00:00:00

Project Info

Case Title 5CR720_24

Description AST LOCA CREFS Filter Shine 720h

Geometry 8 - Cylinder Volume - End Shields

Source Dimensions

Height 47.963 cm (1 ft 6.9 in)

Radius 23.982 cm (9.4 in)

Dose Points

A X Y Z

#1 0.0 cm (0 in) 1.1e+3 cm (37 ft 0.4 in) 0.0 cm (0 in)

Shields

Shield N Dimension Material Density

Source 8.67e+04 cm³ Carbon 0.305

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 μ Ci/cm³ Bq/cm³

Am-241

Ba-139

Ba-140

Br-82 5.4300e-010 2.0091e+001 6.2659e-009 2.3184e-004

Br-83 4.0600e-096 1.5022e-085 4.6850e-095 1.7334e-090

Br-84

Ce-141

Ce-143

Ce-144

Cm-242

Cm-244

Co-58

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```
Buildup: The material reference is Source
Integration Parameters
Radial 20
Circumferential 10
Y Direction (axial) 10
Results
Energy (MeV) Activity (Photons/sec) Fluence Rate
MeV/cm2/sec
No Buildup Fluence Rate
MeV/cm2/sec
With Buildup Exposure Rate
```

Attachment L
Microshield Files .MX5 First for 8 Time Points
.txt for Output 8 Time Points

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mR/hr

No Buildup Exposure Rate

mR/hr

With Buildup

0.015	3.948e+06	4.925e-05	8.656e-05	4.224e-06	7.425e-06
0.03	3.398e+07	1.237e-02	5.425e-02	1.226e-04	5.376e-04
0.08	1.879e+07	3.134e-02	2.339e-01	4.960e-05	3.701e-04
0.1	1.439e-01	3.166e-10	1.963e-09	4.843e-13	3.003e-12
0.15	2.845e-02	1.035e-10	4.285e-10	1.704e-13	7.056e-13
0.2	1.901e+06	9.918e-03	3.246e-02	1.750e-05	5.728e-05
0.3	4.690e+07	4.078e-01	1.024e+00	7.735e-04	1.942e-03
0.4	5.826e+08	7.280e+00	1.554e+01	1.418e-02	3.028e-02
0.5	2.588e+06	4.281e-02	8.266e-02	8.403e-05	1.623e-04
0.6	5.369e+07	1.116e+00	2.011e+00	2.179e-03	3.925e-03
0.8	1.294e+07	3.848e-01	6.052e-01	7.319e-04	1.151e-03
1.0	5.949e+00	2.331e-07	3.423e-07	4.297e-10	6.310e-10
1.5	8.913e+00	5.726e-07	7.654e-07	9.634e-10	1.288e-09
2.0	2.276e-02	2.062e-09	2.614e-09	3.189e-12	4.042e-12
Totals	7.573e+08	9.285e+00	1.958e+01	1.815e-02	3.843e-02