Attachment 1

Additional Information Related to Application of Alternative Radiological Source Term – Dose Calculations

BRAIDWOOD STATION
UNITS 1 AND 2

Docket Nos. STN 50-456 and STN 50-457
License Nos. NPF-72 and NPF-77

and

BYRON STATION
UNITS 1 AND 2

Docket Nos. STN 50-454 and STN 50-455
License Nos. NPF-37 and NPF-66

BYR04-045 & BRW-04-0039-M, "Re-analysis of Control Rod Ejection Accident (CREA) Using Alternative Source Terms," Revision 1, dated November 30, 2004

Exelon Nuclear

ATTACHMENT 1
Design Analysis Cover Sheet

CC-AA-309-1001
Revision 1

Last Page No. 27

Analysis No.	BYR04-045 & BRW-04-0039-M	**Revision**	1
EC/ECR No.	Byron: 348720 Braidwood: 348697	**Revision**	0
Title:	Re-analysis of Control Rod Ejection Accident (CREA) Using Alternative Source Terms		

Station(s)	Byron/Braidwood
Unit No.:	00 (Common)
Discipline	M
Description Code/ Keyword	R02
Safety Class	S
System Code	Varies
Structure	N/A

Component(s)	
N/A	

CONTROLLED DOCUMENT REFERENCES

Document No.	From/To	Document No.	From/To
UFSAR	From/To	VC-400, "Control Room Volume"	From
BYR04-047 & BRW-04-0041-M, "Re-analysis of Fuel Handling Accident (FHA) Using Alternative Source Terms"	From	BYR04-050 & BRW-04-0044-M, "Calculation of Alternative Source Term Onsite and Offsite Atmospheric Dispersion Coefficients"	From
TODI No. BYR-04-020, BRW-2004-0029,	From	P&ID M-96-03 BYR, M-96-03 BRW, "Diagram of Control Room HVAC System"	From
TODI No. DIT-BRW-2004-0017	From		

Is this Design Analysis Safeguards? Yes ☐ No ☒

Does this Design Analysis Contain Unverified Assumptions? Yes ☐ No ☒ ATI/AR#

Is a Supplemental Review Required? Yes ☐ No ☒ If yes, complete Attachment 3

Preparer	Aleem E. Boatright	Aleem E. Boatright	11/16/2004
	Print Name	Sign Name	Date
Reviewer	Paul Reichert	Paul Reichert	11/16/2004
	Print Name	Sign Name	Date

Method of Review ☒ Detailed Review ☐ Alternate Calculations ☐ Testing

Review Notes:

Approver	Harold Rothstein	Harold Rothstein	11/16/2004
	Print Name	Sign Name	Date
(For External Analyses Only) Exelon Reviewer	T. J. Mysiak	T. J. Mysiak	11/26/04
	Print Name	Sign Name	Date
Approver	Wayne Lewis	Wayne Lewis	11/24/04
	Print Name	Sign Name	Date

Description of Revision (list affected pages for partials): All pages affected. Revision to incorporate Independent Third Party Review and Technical Verification Team comments.

THIS DESIGN ANALYSIS SUPERCEDES:

Exelon Nuclear

OWNER'S ACCEPTANCE REVIEW CHECKLIST FOR EXTERNAL DESIGN ANALYSIS

	Yes	No	N/A
1. Do assumptions have sufficient rationale?	☑	☐	☐
2. Are assumptions compatible with the way the plant is operated and with the licensing basis?	☑	☐	☐
3. Do the design inputs have sufficient rationale?	☑	☐	☐
4. Are design inputs correct and reasonable?	☑	☐	☐
5. Are design inputs compatible with the way the plant is operated and with the licensing basis?	☑	☐	☐
6. Are Engineering Judgments clearly documented and justified?	☑	☐	☐
7. Are Engineering Judgments compatible with the way the plant is operated and with the licensing basis?	☑	☐	☐
8. Do the results and conclusions satisfy the purpose and objective of the design analysis?	☑	☐	☐
9. Are the results and conclusions compatible with the way the plant is operated and with the licensing basis?	☑	☐	☐
10. Does the design analysis include the applicable design basis documentation?	☑	☐	☐
11. Have any limitations on the use of the results been identified and transmitted to the appropriate organizations?	☑	☐	☐
12. Are there any unverified assumptions?	☐	☑	☐
13. Do all unverified assumptions have a tracking and closure mechanism in place?	☐	☐	☑
14. Have all affected design analyses been documented on the Affected Documents List (ADL) for the associated Configuration Change?	☑	☐	☐
15. Do the sources of input and analysis methodology used meet current technical requirement and regulatory commitments? (If the input sources or analysis methodology are based on an out-of-date methodology or code, additional reconciliation may be required if the site had committed to a more recent code)	☑	☐	☐
16. Have vendor supporting technical documents and references (including GE DRFs) been reviewed when necessary?	☑	☐	☐

EXELON REVIEWER: T. S. Mistry DATE: 11/26/04

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ATTACHMENTS:

1. PURPOSE/OBJECTIVE

The objective of this calculation is to determine the radiological consequences of a Control Rod Ejection Accident (CREA) at the Byron and Braidwood Generating Stations, based on the use of Alternative Source Terms (AST) as defined in Regulatory Guide (RG) 1.183 (Ref. 1).

This re-analysis of the design basis rod ejection accident, using the RG 1.183 methodology, seeks to achieve an increase in existing operating margin that can be distributed to various plant systems. Specific design basis changes that are being sought include:

- An increase in the Containment leakage rate, from 0.1 percent per day to 0.2 percent per day,
- An increased allowance in the amount of time required for the Control Room (CR) to be isolated (i.e., Mode 2), to 30 minutes,
- Control Room Intake charcoal adsorber filter credit reduction from 99% to 95%, and
- An increase in the maximum allowable unfiltered inleakage into the Control Room, from 100 cfm to 1000 cfm.

Each of these new design basis assumptions will have the benefit of allowing for relaxation in the current plants licensing basis; in terms of testing, surveillance, and other requirements.

This analysis is performed using governing methodologies, assumptions, and inputs for both the Byron and Braidwood plants, and is therefore conservative and applicable to all four units.

2. METHODOLOGY AND ACCEPTANCE CRITERIA

2.1. General Description

2.1.1. Case 1: Containment Leakage CREA

For Case 1, the ejected control rod is postulated to breach the reactor pressure vessel (RPV), effectively causing the equivalent of a small break loss of coolant accident. In this case, all activity from damaged fuel that has been mixed with the primary coolant of the Reactor Coolant System (RCS) leaks directly to the containment volume. This flashed release will instantaneously and homogeneously mix with the containment atmosphere (Ref. 1), and subsequently, be available for release to the environment via a Containment leak rate limit, or L_a, conservatively increased from 0.1% per day to 0.2% per day for this accident analysis. As is historically the case at Byron and Braidwood (B/B), and as per RG 1.183 (Ref. 1) guidance, the leak rate is conservatively reduced by 50% after 24 hours, based on the Containment pressure decreasing over time.

2.1.2. Case 2: Steam Generator PORV Release CREA

For Case 2, no breach of the RPV is postulated following the rod ejection. In this case, reactor coolant system (RCS) integrity is maintained and all activity from damaged fuel that has been mixed with the RCS leaks to the secondary side coolant through the Steam Generator (SG) tubes via the Tech. Spec. primary to secondary coolant leakage rate of 1.0 gpm. From here, activity is available for release to the environment by steaming of the SG Power-Operated Relief Valves (PORVs). An average rate of release is used, and has been calculated in reference 7. In addition to the activity released from the primary to secondary coolant, pre-existing Tech. Spec. iodine activity in the secondary coolant system is postulated to also be released.

The doses from either accident scenario should not exceed the acceptance shown in Section 2.9.

2.2. Fuel Damage and Core Source Term

For conservatism, the CREA core source terms are those associated with a DBA power level of 3658.3 MWth, as per reference 6, which includes an additional 2% power over that of the full licensed power to account for uncertainty.

The sudden rod ejection and localized temperature spike associated with the CREA results in the damage of less than 10% of the core (Ref. 6). The TODI No. BYR-04-020 & BRW-2004-0029 of reference 6 shows that only 2.5 % of the damaged core releases melted fuel activity, i.e., a 0.00375 fraction of the total core melts. Therefore for both cases, the source term available for release is associated with this fraction of melted fuel and the fraction of core activity existing in the gap.

In addition, to comply with the guidance of reference 1, peaking was addressed. Historically at B/B no peaking factor was applied to core activity for the CREA analysis; this was likely due to the conservative factors applied to fuel burnup and damage assumptions. As indicated in the B/B UFSAR Section 15.4.8.2.2 (Ref. 2), only 10% of the fuel rods enter into the DNB phase following a design basis CREA, therefore only 10% will be damaged. However, historical analyses assumed 15% of the fuel is damaged, thereby assuming a 1.5 factor of additional activity. As also stated in the B/B UFSAR (Section 15.4.8.3), the assumption of 15% damaged fuel was "to provide additional conservatism in the radiological consequence analysis". For this analysis, to satisfy the guidance of R.G. 1.183 (Ref. 1), the 1.7 radial peaking factor, used for the conservative single assembly B/B Fuel Handling Accident (FHA) analyses is added to the activity available for release during this

accident. This approach conservatively accounts for any radial peaking the core may have experienced.

2.3. Activity Release Fractions

Release fractions and transport fractions are per Regulatory Guide 1.183, Appendix H and Table 3 (Ref. 1). To comply with this regulatory guidance, 10% of the core inventory of iodine and noble gas is assumed to be in the fuel-clad gap. Additionally, Table 3 of reference 1 shows that 12% of the core cesium and rubidium should be assumed to be in the fuel-clad gap and postulated to be released in its entirety from the damaged 15% of the total core. However, to accommodate the consideration of extended fuel burnup, in excess of the reference 1 assumptions, the cesium and rubidium release fraction is doubled. Although analyses have shown that isotopic activity fractions in the fuel-clad gap may in fact decrease when "burning" the fuel longer than the 62 GWd/MTU specified in reference 1, this 100% increase in the gap fractions is used as an accepted and conservative means of bounding all extended burnup phenomena. With regard to the fraction released from melted fuel, it is assumed that 90% of the core inventory of iodine and noble gas, and 76% of the core cesium and rubidium remain available for release due to melting (these are the remaining fractions of activity that are not in the fuel-clad gap). Again in compliance with RG 1.183 (Ref. 1), it would be assumed that 100% of the noble gases, 25% of the iodines, and 50% of the cesium and rubidium (considered particulate/aerosol nuclides) released from the melted fuel would be available for release from containment. However, for this analysis the assumption of 25% of the iodines being available for release was increased to 50%. This was done to prevent a "double counting" of the iodine removal due to plate-out in containment, because this analysis credits Powers' Natural Deposition model for plateout (Ref. 15), as opposed to the historically assumed 50% plateout. See Attachment D for the detailed derivation of the release fraction values.

These activity release fractions are input to the RADTRAD code through the use of the Release Fractions and Timing (RFT) file.

2.4. Airborne Activity Removal Mechanisms in Containment

As discussed below only natural deposition, decay, and leakage are credited.

2.4.1. Natural Deposition

RG 1.183 (Ref. 1) guidance on this issue is:

> *"Reduction in airborne radioactivity in the containment by natural deposition within the containment may be credited. Acceptable models for removal of iodine and aerosols are described in NUREG/CR-6189, "A Simplified Model of Aerosol Removal by Natural Processes in Reactor Containments". The latter model is incorporated into the analysis code RADTRAD. The prior practice of deterministically assuming that a 50% plateout of iodine is released from the fuel is no longer acceptable to the NRC staff as it is inconsistent with the characteristics of the revised source terms."*

For B/B, the RADTRAD computer program, including the Powers Natural Deposition algorithm based on NUREG/CR-6189, is used for modeling aerosol deposition in Containment. No natural deposition is assumed for elemental or organic iodine. The lower bound (10%) level of deposition credit is used.

2.4.2. Decay Credited

Decay of radioactivity is credited in all compartments, prior to release. This is implemented in RADTRAD using the half-lives in the Nuclide Inventory File (NIF). The RADTRAD decay plus daughter option is used. In reality, daughter products such as xenon from iodines or iodines from tellurium are unlikely to readily escape from the matrix in which the parent iodine or tellurium is contained. Nevertheless, the RADTRAD feature to include daughter effects is selected for conservatism.

2.4.3. Depletion from Leakage Credited

For analyses of doses due to release from containment, the dose results from leakage. It is reasonable to credit the small amount of depletion from the containment inventory associated with this leakage. This is calculated inherently by the RADTRAD code.

2.5. Steaming Release Rates and Partitioning Factors

Activity that originates in the primary RCS is released to the secondary coolant by means of the primary-to-secondary coolant leak rate. This design basis leak rate value is a total of 1.0 gpm (Ref. 6). For input into RADTRAD this rate is converted from gallons per minute to cubic feet per minute, making it equal to 0.1337 cfm, as shown in Section 4.2.

For Case 2, the release to the environment is associated with the secondary coolant steaming from the Steam Generators. Because of this release dynamic, RG 1.183 (Ref. 1) allows for a reduction in the amount of activity released to the environment based on partitioning of nuclides between the liquid and gas states of water. For Iodine, the partitioning factor of 0.01 was taken directly from the suggested guidance of reference 1. However, there is no explicit guidance with regard to other particulate nuclides. Reviewing the specified AST release fractions of reference 1, it is concluded that the only nuclides other than Iodines to be released from the core source term are Cesiums, Rubidium, and Noble Gases. For cesiums and rubidium, a partitioning factor of 0.0055 is used, bounding the applicable ANSI Standard, ANS/ANSI-18.1-1999 (Ref. 14). This value bounds the actual 0.00529 factor that is shown for Cs-134 in reference 14, which has the largest partitioning factor of these such isotopes. Because of the volatility of noble gases, no partitioning is postulated for any such isotopes.

Based on the extensive derivation of mass releases from this accident for the recent power uprate calculation effort, and because these releases are unaffected by any of the reference 1 AST assumptions, the bounding power uprate calculation releases for this accident are utilized directly.

The methodology used to model steaming of activity through PORVs, following the postulated CREA event of Case 2, uses an average cumulative release rate through the SG valves that, for simplicity and conservatism, is reduced in steps. The above discussed partitioning factors are applied to these release rates, which were derived from the total time increment mass releases in reference 7. The following table shows the time steps, isotopic partitioning factors, and associated release rates; conversion of this data was performed using a basis of cooled liquid conditions (i.e., 62.4 lbm/ft^3 density), as specified by the applicable guidance of RG 1.183 (Ref. 1).:

Time Interval (hrs)	Total Steam Mass Release (lbm)	Iodine Partitioning Factor	Cesium Partitioning Factor	Noble Gas Partitioning Factor	Steam Release Rate for Iodines (cfm)	Steam Release Rate for Cesiums (cfm)	Steam Release Rate for Noble Gases (cfm)
0 – 0.0556	600,000	0.01	0.0055	1	2.8833e+01	1.5858e+01	2.8833e+03
0.0556 – 1.1111	1,900,000	0.01	0.0055	1	4.8055e+00	2.6430e+00	4.8055e+02
1.1111 – 720	0	0.01	0.0055	1	0	0	0

2.6. Dose Conversion Factors

The revised Dose Conversion Factors (DCFs) from the U.S. Federal Guidance Report 11 & 12 (Ref. 16, 17) are used for this analysis. The RADTRAD code inputs these values directly from its internal database.

2.7. Control Room Dose Model

For this analysis, as performed using the RADTRAD code, the air volumes characterizing the Control Rooms (CR) at the Byron and Braidwood plants are found to be 230,630 ft^3 and 232,872 ft^3 (Refs. 5, 8), respectively. These volumes exclude the Upper Cable Spreading Rooms, which do not have return air flow, and do not require occupancy during post-accident conditions (Ref. 5). For conservatism and simplicity, these volumes are conservatively modeled as one characteristic 200,000-ft^3 volume applied universally for AST analyses.

Using this smaller value, associated with the high flow rates discussed below, is conservative because it leads to the CR reaching its maximum activity concentration faster than if the actual, substantially larger, volume were used. This volume is also well above the 70,275 ft^3 Main Control Room shield volume. Therefore, internal cloud shine dose remains conservatively calculated.

As seen in reference 6, Byron and Braidwood plants have a recirculation flow of 43,500 cfm and make-up airflow of 6000 cfm (± 10%), totaling 49,500 cfm of total combined flow to the Control Room volume. However, as per reference 12, there could be a failure scenario where open inlet and outlet dampers on the unused CR make-up train result in an additional 1500 cfm of filtered intake into the CR during Mode 2 operation. Therefore, for conservatism, as stated in reference 12, this 1500 cfm was rounded up to 2000 cfm, and is added to the 49,500 cfm total combined flow during Mode 2. Of this 51,500 cfm, a separate volume designated as the "upper cable spreading room", or upper CSR, receives an un-recirculated intake flow of 1319 cfm at Byron, and 2430 cfm at Braidwood (Ref. 10). Because they are un-recirculated, these flows are subtracted from the 51,500 cfm total combined flow, making the Mode 2 adjusted combined flows to the Byron and Braidwood Control Rooms 50,181 cfm and 49,070 cfm, respectively. To then calculate the Mode 2 adjusted make-up flow to the CR volume, the ratios of these adjusted combined flows to the CR volume, over the total combined flow, are multiplied by the 8000 cfm make-up flow. This respectively results in Mode 2 make-up flows of 7795 cfm (±10%) and 7623 cfm (±10%) to the Byron and Braidwood Control Rooms.

Following CR Mode 2 isolation, the credited CR filtration is 99% for the HEPA and 95% for the charcoal filters, and the intake flow rate is 8575 cfm, which is the upper 10% bound of the Byron 7795 cfm make-up flow shown above. The charcoal filtration efficiency of 95% reflects a reduction (from the Ref. 5 value of 99%) in the filter credit taken. This intake rate is used because, with the specified intake, inleakage, and recirculation flow rates, filter efficiencies, and CR volume, sensitivity analyses have shown for this analysis that it is conservative to maximize the Mode 2 airflow into the Control Room.

The CR intake is assumed to be unfiltered for the Mode 1 first 30 minutes of the accident, to simulate a newly analyzed allowance for manual CR Mode 2 isolation. During this 30-minute period, it is conservative to assume that the possible 2000 cfm of filtered intake does not flow through the Control Room. This is because this filtered flow would act to "clean" the unfiltered air being brought in by the other unfiltered flows (i.e., normal intake and unfiltered inleakage) during these 30 minutes. Sensitivity analyses using RADTRAD confirmed that such additional filtered intake during Mode 1 would lower the CR dose consequences. Therefore, before CR emergency Mode 2 isolation the adjusted combined flows to the Byron and Braidwood Control Rooms become

48,181 cfm and 47,070 cfm, respectively, and subsequently actual make-up flows become 5840 cfm (±10%) and 5705 cfm (±10%) to Byron and Braidwood, respectively. So, the unfiltered intake flow rate into the CR during this initial 30-minute period is assumed to be 6424 cfm; the upper 10% bound of the Byron 5840 cfm make-up flow shown above.

As the B/B Control Rooms are modeled, a conservatively reduced (by the - 10% lower bound) recirculation train flow rate of 39,150 cfm is used (Refs. 6,10). This recirculation train is filtered by an 80% aerosol particulate (pre-filter) and 90% elemental and organic iodine (charcoal) filters. No reduction in the efficiency of these filters was sought.

For additional conservatism and to allow for margin in future analyses, an unfiltered inleakage rate allowance of 1000 cfm is modeled for the accident duration.

Any air that enters the CR originates from a source that is characterized by a dispersion factor, calculated using ARCON96, in reference 11. The total dose in the Control Room over the 720-hour period is the result of the released activities that enter through the air intake, either filtered or unfiltered.

2.8. EAB and LPZ Dose Model

Between the Byron and Braidwood plants, the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) χ/Q's have been determined in reference 11, and at worst-case, are respectively located 445m and 1810m from the postulated release locations.

2.9. Acceptance Criteria

Radiological doses resulting from a design basis CREA for a control room operator and a person located at EAB or LPZ are to be less than the regulatory dose limits as given in Table 2.

Table 2. Regulatory Dose Limits

Dose Type	Control Room (rem)	EAB and LPZ (rem)
TEDE Dose	5[a]	6.3[b]

Notes:

[a] 10 CFR 50.67 (Ref. 4)

[b] Regulatory Guide 1.183 (Ref. 1)

3. ASSUMPTIONS

1. Core inventory was based on a DBA power level of 3658.3 MWth, which is 102% of the Rated Thermal Power Level of 3586.6 MWth, to account for measurement uncertainty.

2. 10% of the fuel is damaged during the initiation of this accident, and is assumed to have failed (Ref. 6).

3. 10% of the core inventory of noble gases and iodines are released from the fuel gap (Appendix H of Ref. 1). Release fractions of other nuclide groups contained in the fuel gap are detailed in Table 3 of Regulatory Guide 1.183 (Ref. 1), and to account for gap fraction uncertainty due to expected extended fuel burnup, fractions from the referenced table are doubled.

4. 2.5% of the failed fuel rods will melt during the CREA, as per reference 6.

5. 100% of noble gases and 50% of the iodines contained in the melted fuel fraction are assumed to be released to the reactor coolant (Appendix C of Ref. 1). Fractions of other nuclides released from the melted fuel are used from Table 1 of Regulatory Guide 1.183 (Ref. 1). Though these are described as LOCA values for fuel melt release, they are used to conservatively supplement for "silent" guidance in regards to the other nuclide groups.

6. The activity released from the fuel from either the gap or from fuel pellets is assumed to be instantaneously mixed with the reactor coolant within the pressure vessel (Ref. 1).

7. All iodine released from the SGs is assumed to be of the elemental species. This is done for RADTRAD simulation considerations, and is consistent with the RG 1.183 specification of 97% elemental and 3% organic, because elemental and organic iodine are identically treated by the computer model (Ref. 1).

8. The Control Room HVAC emergency Mode 2 at B/B is initiated 30 minutes after the start of this design basis accident.

9. For the Containment leakage case, all leakage is assumed to be at an increased L_a of 0.2% per day for the first 24 hours and 0.1% per day thereafter.

10. For conservatism, a peaking factor of 1.7, based on the FHA single fuel assembly radial peaking factor, is added to the activity available for release, in order to account for any operational radial peaking the core may have experienced.

4. DESIGN INPUT

4.1. χ/Q Calculations (Meteorology)

The CR χ/Q values input to RADTRAD were taken from the ARCON96 results of the B/B Design Analyses BYR04-050 & BRW-04-0044-M, as performed by Washington Group International (Ref. 11). The χ/Q's used are, conservatively, the worst-case combination of values from each Unit of each respective plant; whether it be Byron or Braidwood.

All releases from PORVs to the Environment utilize the χ/Q associated with releases from the PORV/Safety Valve house to either the normal Control Room Fresh Air Intake or the Control Room Turbine Building Emergency Air Intake. Releases from Containment utilize a "diffuse" source χ/Q from the Containment Building to the respective CR intakes, as described in reference 11. Activity released during the initial 30 minutes of the accident goes to the normal CR fresh air intake; after this period, when the CR is assumed to have been isolated, the emergency air intake located in the Turbine Building is used.

All releases from the PORV/Safety Valve house are considered elevated releases due to the high steaming rates, therefore per regulatory guidance, the associated χ/Q's have been reduced by a factor of 5, as justified below.

4.1.1. Justification for Application of Elevated Release Credit

Regulatory guidance of RG 1.194 (Ref. 5), indicates a factor of 5 reduction in the ground level X/Q value calculated with ARCON96 is justified for energetic releases from steam relief valves or atmospheric dump valves, if (1) the release point is uncapped and vertically oriented and (2) the time-dependent vertical velocity exceeds the 95th-percentile wind speed (at the release point height) by a factor of 5.

As a precedent for such a factor of 5 credit applied to a plant similar to Byron and Braidwood, the Virginia Electric and Power Company letter to the NRC of November 20, 2003 (Ref. 13) was reviewed. This letter shows PORV steam exhaust releases are uncapped, vertically oriented, and have vertical velocities about an order of magnitude above the threshold needed to qualify for the factor of 5 reduction, for the bounding choked sonic flow conditions of the saturated steam release.

Like North Anna, the Byron and Braidwood PORVs are uncapped and vertically oriented. The 95th-percentile wind speeds for Byron are 7.61 meters per second at Byron or 6.89 meters per second at Braidwood for the 30 foot tower level, and 11.26 meters per second at Byron and 10.92 meters per second at Braidwood for the 250 foot tower level. These wind speeds are comparable to those provided for North Anna in the referenced letter. The Byron and Braidwood PORV release rates for all steam release accidents are greater than those developed for North Anna in the referenced letter.

Therefore, it is concluded that the factor of 5 reduction is acceptable at Byron and Braidwood for all steam release accidents involving PORV release from the steam generators.

The CR atmospheric relative concentrations used for PORV releases are as follows:

χ/Q =1.77E-03 sec/m^3 (0-0.5 hours) (2-hr limiting CR Fresh Air Intake χ/Q)
χ/Q =8.14E-04 sec/m^3 (0.5-2 hours) (2-hr limiting CR Emergency Air Intake χ/Q)
χ/Q =6.98E-04 sec/m^3 (2-8 hours) (6-hr limiting CR Emergency Air Intake χ/Q)
χ/Q =3.12E-04 sec/m^3 (8-24 hours) (16-hr limiting CR Emergency Air Intake χ/Q)

χ/Q =1.95E-04 sec/m^3 (24-96 hours) (72-hr limiting CR Emergency Air Intake χ/Q)
χ/Q =1.67E-04 sec/m^3 (96-720 hours) (624-hr limiting CR Emergency Air Intake χ/Q)

The CR atmospheric relative concentrations used for Containment leakage releases are as follows:

χ/Q =1.73E-03 sec/m^3 (0-0.5 hours) (2-hr limiting CR Fresh Air Intake χ/Q)
χ/Q =1.01E-03 sec/m^3 (0.5-2 hours) (2-hr limiting CR Emergency Air Intake χ/Q)
χ/Q =7.25E-04 sec/m^3 (2-8 hours) (6-hr limiting CR Emergency Air Intake χ/Q)
χ/Q =3.07E-04 sec/m^3 (8-24 hours) (16-hr limiting CR Emergency Air Intake χ/Q)
χ/Q =2.07E-04 sec/m^3 (24-96 hours) (72-hr limiting CR Emergency Air Intake χ/Q)
χ/Q =1.46E-04 sec/m^3 (96-720 hours) (624-hr limiting CR Emergency Air Intake χ/Q)

The EAB and LPZ PAVAN calculated χ/Q values input to RADTRAD were also taken from the results of the B/B Design Analyses BYR04-050 & BRW-04-0044-M, (Ref. 11). The EAB and LPZ χ/Q's used are as follows:

EAB χ/Q =5.36E-04 sec/m^3 (0-2 hours) (8-hr EAB χ/Q)

LPZ χ/Q =9.32E-05 sec/m^3 (0-2 hours) (2-hr limiting LPZ χ/Q)
χ/Q =4.50E-05 sec/m^3 (2-8 hours) (8-hr limiting LPZ χ/Q)
χ/Q =3.12E-05 sec/m^3 (8-24 hours) (16-hr limiting LPZ χ/Q)
χ/Q =1.41E-05 sec/m^3 (24-96 hours) (72-hr limiting LPZ χ/Q)
χ/Q =4.54E-06 sec/m^3 (96-720 hours) (624-hr limiting LPZ χ/Q)

4.2. Plant Data

Note: All volumes and volumetric flow rates are shown here in ft^3 and cfm, and the method of conversion described in reference 1 and Section 2.5 of this analysis was used when needed.

- DBA Power Level (Ref. 6) — 3658.3 MWth
- RCS Primary Coolant Volume (Ref. 6) — 7285 ft^3
- Secondary Coolant Volume (4 SGs Combined) (Ref. 6) — 4789 ft^3
- Containment Volume (Ref. 6) — 2,850,000 ft^3
- Primary to Secondary Coolant Leak Rate (Ref. 6) — 0.1337 cfm
- Containment Leak Rate, L_a (New Design Commitment) — 0.2 % / day
- Core Failed Fuel Rod Percentage (Ref. 6) — 15 %
- Core Melted Fuel Percentage (Ref. 6) — 0.375 %
- Isotopic Release Fractions, as per Reg. Guide 1.183 (Ref. 1) — See Section 2.3

4.3. Control Room Data

- Volume of Control Room, ft^3 (Ref. 9,6) 200,000
- Control Room Normal Intake Flow, scfm (Ref. 6) 8575
- Control Room Recirculation Flow, scfm (Ref. 6) 39,150
- Maximum Allowable Unfiltered In-leakage, scfm (New Design Commitment, Ref. 6) 1000

4.4. Source Terms

The AST values used in this analysis were derived using guidance outlined in Reg. Guide 1.183. A list of 60 core isotopic nuclides and their curie per megawatt activities was extracted from Attachment A of B/B Design Analyses BYR04-047 & BRW-04-0041-M, Rev. 1 (Ref. 8) for input into the RADTRAD NIF (see Attachment B). The release fractions associated with all of these nuclide groups, as detailed in Regulatory Guide 1.183, were applied to their given groups, and input into the RADTRAD "RTF" files, as seen in Attachment C. RADTRAD uses these two files combined with the power of 3658.3 MWth (Ref. 6) to develop the source terms for this CRDA.

5. REFERENCES

1. USNRC Regulatory Guide 1.183, "Alternative Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors", July 2000.

2. Byron/Braidwood UFSAR Section 15.4, Rev. 9 (December 2002).

3. Byron/Braidwood Technical Specifications

4. 10 CFR 50.67, as published in 64 FR (Federal Register) 72001, December 3, 1999.

5. USNRC Regulatory Guide 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants", June 2003.

6. B/B Transmittal of Design Information (TODI) No. BYR-04-020, BRW-2004-0029, "Transmittal of Byron and Braidwood input parameters for use in dose calculations for Alternative Source Term (AST) implementation", Rev. 0, modified for Item 7.1 by Attachment G E-Mail to reflect acceptability of a 10% damaged fuel value.

7. B/B Design Analysis CN-CRA-00-04, "Byron/Braidwood Small Break LOCA Radiation Dose Analysis", Rev. 0, 5/3/00.

8. B/B Design Analyses BYR04-047 & BRW-04-0041-M, "Re-analysis of Fuel Handling Accident (FHA) Using Alternative Source Terms", Rev. 1.

9. B/B Design Analysis VC-400, "Control Room Volume", Rev. 3.

10. B/B P&ID M-96-03 BYR, Rev. T & M-96-03 BRW, Rev. U, "Diagram of Control Room HVAC System".

11. B/B Design Analyses BYR04-050 & BRW-04-0044-M, "Calculation of Alternative Source Term Onsite and Offsite Atmospheric Dispersion Coefficients", Rev. 1.

12. B/B Transmittal of Design Information (TODI) No. DIT-BRW-2004-0017, "Effects of increased filtered intake into the control room", Rev. 0, 6/10/04.

13. Letter from Leslie N. Hartz to USNRC, Serial No. 03-464A, "Virginia Electric and Power Company North Anna Power Station Units 1 and 2 - Proposed Technical Specification Changes Implementation of Alternative Source Term RAI", 11/20/03.

14. American Nuclear Society ANS/ANSI-18.1-1999, "American National Standard Radioactive Source Term for Normal Operation of Light Water Reactors", 9/21/1999.

15. NUREG/CR-6604, "RADTRAD: A Simplified Model for RADionuclide Transport and Removal And Dose Estimation", April1998, and Supplements 1, June 1999, and 2, October 2002.

16. U.S. Federal Guidance Report No.11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion", 1988.

17. U.S. Federal Guidance Report No.12, "External Exposure to Radionuclides in Air, Water, and Soil", 1993.

6. CALCULATIONS

6.1. Source Term Calculation

For the RADTRAD calculation, a list of 60 core isotopic nuclides and their activities were extracted from Attachment A of B/B Design Analyses BYR04-047 & BRW-04-0041-M, Rev. 1 (Ref. 8) for input into the RADTRAD NIF (see Attachment B). RADTRAD uses these activities, in curies per megawatt, then applies nuclide release fractions and a specified core power to calculate a core source term. The AST release fractions associated with all of these nuclide groups are derived using guidance outlined in Regulatory Guide 1.183, as described in Section 2.3 above. The final gap release and fuel melt release fractions are then input into the RADTRAD "RTF", as seen in Attachment C. RADTRAD applies the input core power of 3658.3 MWth (Ref. 6) to these two input files to develop the core source term activities for this CREA.

6.2. Dose Calculations

The RADTRAD v. 3.03 computer code is used to determine B/B Units 1 & 2 CREA doses at the three dose points cited in Reg. Guide 1.183 (Ref. 1); the Exclusion Area Boundary (EAB), Low Population Zone (LPZ), and Control Room. RADTRAD is a simplified model of RADionuclide Transport and Removal And Dose Estimation developed for, and endorsed by, the NRC as an acceptable methodology for reanalysis of the radiological consequences of design basis accidents.

RADTRAD estimates the releases using the reference Alternative Source Term source terms and assumptions. The RADTRAD code uses a combination of tables and/or numerical models of source term reduction phenomena to determine the time-dependent dose at user-specified locations for a given accident scenario. The code system also provides the inventory, decay chain, and dose conversion factor tables needed for the dose calculation. The technical basis for the RADTRAD code is documented in NUREG/CR-6604 (Ref. 15).

See Section 2 and subsequent sections for descriptions of the calculational simulations detailed in the tables that follow.

6.2.1. Case 1: Doses from Containment Leakage

6.2.1.1. RADTRAD Run Compartment Information

CREA Case 1: Doses from Containment Leakage RADTRAD Compartments				
Compartment Number	1	2	3	4
Name	Primary Loop - Reactor Coolant System (RCS)	Secondary Loop - Steam Generator Volumes (4 SGs)	Containment	Control Room
Type	Other	Other	Other	Control Room
Volume (ft^3)	7285	4789	2,850,000	200,000
Source Term Fraction	0.000	0.000	1.000	0.000

Compartment Features	None	None	Natural Deposition: See Section 2.4.1	Recirculating Filters: 39,150cfm Flow Rate 0-0.5 hrs - No Filtration (30-minute initiation time) 0.5-720 hrs - 80% Aerosol, 90% Elemental & Organic
Comments	This compartment is not used for this Containment leakage Case, therefore the source term fraction is 0.	This compartment is not used for this Containment leakage Case, therefore the source term fraction is 0.	Powers PWR – Design Basis Accident 10% deposition used. No elemental iodine removal coefficient.	Actual Control Room proper volume is smaller, therefore this value is conservative.

CREA Case 1: Doses from Containment Leakage RADTRAD Compartments (con't)				
Compartment Number	5			
Name	Environment			
Type	Environment			
Volume (ft^3)	N/A			
Source Term Fraction	0.000			
Compartment Features	N/A			
Comments				

6.2.1.2. RADTRAD Run Transfer Pathway Information

CREA Case 1: Doses from Containment Leakage RADTRAD Transfer Pathways				
Pathway Number	1	2	3	4
Name	Primary Loop to Secondary Loop Leakage	Secondary Loop - Steam Generator Volumes (4 SGs) to Environment	Containment Leak to the Environment	(Filtered Intake) Environment to Control Room
From - To	1 - 2	2 - 5	3 - 5	5 - 4
Transfer Mechanism	Filter	Filter	Air Leakage	Filter
Transfer Mechanism Details	Filter Panel – Flow rate - 0-1.1111hrs, 1.337E-01cfm, equal to 1.0 gpm leak rate ending in 4000 sec when equilibrium is reached; 1.1111-720hrs, 0.0cfm. Filter Efficiency - Efficiency is entered as 0.0% for all chemical forms of iodine, for the accident duration because there is no credited filtration removal mechanism for Primary Loop to Secondary Loop leakage.	Filter Panel – Flow rate - 0-0.0556hrs, 2.883E+03cfm; 0.0556-1.1111hrs, 4.806E+02cfm; 1.1111-720hrs, 0.0cfm. Filter Efficiency - Efficiency is entered as 0.0% for all chemical forms of iodine, for the accident duration because there is no credited filtration removal mechanism from the Secondary Loop to the environment.	Air Leakage Panel – Leak rate - 0-24hrs, 0.2%/day; 24-720hrs, 0.1%/day.	Filter Panel – Flow rate - 0-0.5hrs, 6.424E+03cfm; 0.5-720hrs, 8.575E+03cfm. Filter Efficiency - Efficiency is entered as 99% for aerosol activity, and 95% for elemental and organic forms of iodine, after CR Mode 2 is initiated in 30 min, and then for the duration of the accident. This corresponds to the presence of the HEPA filter, and relaxed charcoal testing requirements analyzed as acceptable by this calculation, respectively.

Comments	This Pathway does not contribute to dose for this Case, and is only included for completeness.	This Pathway does not contribute to dose for this Case, and is only included for completeness.	Increased Tech. Spec. Containment leak rate limit, L_a, from 1@ per day to 2% per day. Reduced leakage to 50% after the first day.	See Section 2.7.

CREA Case 1: Doses from Containment Leakage RADTRAD Transfer Pathways (con't)				
Pathway Number	5	6		
Name	(Unfiltered Inleakage) Environment to Control Room	(Control Room Exhaust) Control Room to Environment		
From - To	5 - 4	4 - 5		
Transfer Mechanism	Filter	Filter		
Transfer Mechanism Details	Filter Panel – Flow rate - 0-0.5hrs, 1.000E+03cfm; 0.5-720hrs, 1.000E+03cfm. Filter Efficiency - Efficiency is entered as 0.0% for all chemical forms of iodine, for the accident duration, because this is an unfiltered path.	Filter Panel – Flow rate - 0-0.5hrs, 7.424E+03cfm; 0.5-720hrs, 9.575E+03cfm. Filter Efficiency - Efficiency is entered as 100.0% for all chemical forms of iodine, for all time periods. This is the exhaust from the control room to the environment; the filtration prevents a double counting of the iodine release. Although RADTRAD 3.03 documentation indicates that this effect has been eliminated, this was still done for completeness.		
Comments	See Section 2.7.	See Section 2.7.		

6.2.1.3. RADTRAD Run Dose Location Information

CREA Case 1: Doses from Containment Leakage RADTRAD Dose Locations			
Dose Location Number	1	2	3
Name	Control Room	Exclusion Area Boundary (EAB)	Low Population Zone (LPZ)
In Compartment	Control Room (4)	Environment (5)	Environment (5)
Breathing Rate (m^3/sec)	0 - 720 hrs: 3.5E-04	0 - 8 hrs: 3.5E-04 8 - 24 hrs: 1.8E-04 24 - 720 hrs: 2.3E-04	0 - 8 hrs: 3.5E-04 8 - 24 hrs: 1.8E-04 24 - 720 hrs: 2.3E-04
Occupancy Fractions	0 - 8 hrs: 1.0 8 - 24 hrs: 0.6 24 - 720 hrs: 0.4	Worst 2-hour Period: 1.0	0 - 720 hrs: 1.0
Dispersion Factors	See Section 4.1	See Section 4.1	See Section 4.1

6.2.1.4. RADTRAD Run Source Term & Dose Conversion Factor Information

CREA Case 1: Doses from Containment Leakage RADTRAD Source Term & Dose Conversion Factors			
Core Power	3658.3 MWth		See Section 2.2 and reference 6.
Nuclide Inventory	ORIGEN calculated specific B/B core inventory for 60 MACCS isotopes. Inventory is calculated at DBA power shown above, and input into the NIF file.		See Attachment B, Section 4.4, and reference 8.
Release Fractions & Timing	User defined Release Fractions calculated from B/B CREA specific fuel damage and RG 1.183 specified isotopic inventory fractions. Release timing is not delayed, consistent with RG 1.183 guidance. Fractions and timing are shown in RFT file.		See Section 2.2 and 2.3, Attachment C, and references 1 and 6.
Dose Conversion Factors	RADTRAD Library of FGR 11 & 12 values for 60 MACCS isotopes.		References 16 and 17.
Decay & Daughter Products	Enabled - Therefore Decay and Daughter products are considered.		
Iodine Chemical Fractions	Aerosol: Elemental: Organic:	0.0000 1.0000 0.0000	User defined iodine chemical fractions, consistent with RG 1.183 guidance, as manipulated in calculation.

6.2.2. Case 2: Doses from Steam Generator PORV Releases

6.2.2.1. RADTRAD Run Compartment Information

CREA Case 2: Doses from Release through Steam Generator PORVs RADTRAD Compartments				
Compartment Number	1	2	3	4
Name	Primary Loop 1 - Reactor Coolant System (RCS)	Primary Loop 2 - Reactor Coolant System (RCS)	Primary Loop 3 - Reactor Coolant System (RCS)	Secondary Loop 1 - Steam Generator Volume (4 SGs)
Type	Other	Other	Other	Other
Volume (ft^3)	7285	7285	7285	4789
Source Term Fraction	1.000	1.000	1.000	0.000
Compartment Features	None	None	None	None
Comments	Compartment used for Iodine Transport only. Separated from fission products and noble gas in order to apply specific partitioning factors to the steaming flows.	Compartment used for Noble Gas Transport only. Separated from iodine and fission products in order to apply un-partitioned steaming flows.	Compartment used for Fission Product Transport only. Separated from iodine products and noble gas in order to apply specific partitioning factors to the steaming flows.	Compartment used for Iodine Transport only. Separated from fission products and noble gas in order to apply specific partitioning factors to the steaming flows.

CREA Case 2: Doses from Release through Steam Generator PORVs RADTRAD Compartments (con't)				
Compartment Number	5	6	7	8
Name	Secondary Loop 2 - Steam Generator Volumes (4 SGs)	Secondary Loop 3 - Steam Generator Volumes (4 SGs)	Control Room	Environment
Type	Other	Other	Control Room	Environment
Volume (ft^3)	4789	4789	200,000	N/A
Source Term Fraction	0.000	0.000	0.000	0.000
Compartment Features	None	None	Recirculating Filters: 39,150cfm Flow Rate 0-0.5 hrs - No Filtration (30-minute initiation time) 0.5-720 hrs - 80% Aerosol, 90% Elemental & Organic	N/A
Comments	Compartment used for Noble Gas Transport only. Separated from iodine and fission products in order to apply un-partitioned steaming flows.	Compartment used for Fission Product Transport only. Separated from iodine products and noble gas in order to apply specific partitioning factors to the steaming flows.	Actual Control Room proper volume is smaller, therefore this value is conservative.	

6.2.2.2. *RADTRAD Run Transfer Pathway Information*

CREA Case 2: Doses from Release through Steam Generator PORVs RADTRAD Transfer Pathways				
Pathway Number	1	2	3	4
Name	(Iodine Activity Leakage Path) Primary Loop 1 - Reactor Coolant System (RCS) to Secondary Loop 1 - Steam Generator Volume (4 SGs)	(Noble Gas Activity Leakage Path) Primary Loop 2 - Reactor Coolant System (RCS) to Secondary Loop 2 - Steam Generator Volumes (4 SGs)	(Fission Product Activity Leakage Path) Primary Loop 3 - Reactor Coolant System (RCS) to Secondary Loop 3 - Steam Generator Volumes (4 SGs)	(Iodine Activity Release Path) Secondary Loop 1 - Steam Generator Volume (4 SGs) to Environment
From - To	1 - 2	2 - 5	3 - 6	4 - 8
Transfer Mechanism	Filter	Filter	Filter	Filter

Transfer Mechanism Details	Filter Panel – Flow rate - 0-1.1111hrs, 1.337E-01cfm, equal to 1.0 gpm leak rate ending in 4000 sec when equilibrium is reached; 1.1111-720hrs, 0.0cfm. Filter Efficiency - Efficiency is entered as 0.0% for all chemical forms of iodine, for the accident duration because there is no credited filtration removal mechanism for Primary Loop to Secondary Loop leakage.	Filter Panel – Flow rate - 0-1.1111hrs, 1.337E-01cfm, equal to 1.0 gpm leak rate ending in 4000 sec when equilibrium is reached; 1.1111-720hrs, 0.0cfm. Filter Efficiency - Efficiency is entered as 0.0% for all chemical forms of iodine, for the accident duration because there is no credited filtration removal mechanism for Primary Loop to Secondary Loop leakage.	Filter Panel – Flow rate - 0-1.1111hrs, 1.337E-01cfm, equal to 1.0 gpm leak rate ending in 4000 sec when equilibrium is reached; 1.1111-720hrs, 0.0cfm. Filter Efficiency - Efficiency is entered as 0.0% for all chemical forms of iodine, for the accident duration because there is no credited filtration removal mechanism for Primary Loop to Secondary Loop leakage.	0-0.0556hrs, 2.883E+01cfm; 0.0556-1.1111hrs, 4.806E+00cfm; 1.1111-720hrs, 0.0cfm. Filter Efficiency - Efficiency is entered as 100% for aerosol and organic chemical forms, to ensure that only the activity from iodine isotopes is transferred at these specific partitioned flow rates through the SG PORVs via this pathway. Because all iodine has been defined as being in the elemental chemical form for this RADTRAD run, this is an acceptable calculational means for activity transport.
Comments	See reference 6.	See reference 6.	See reference 6.	Partitioning factor applied to steaming rate through SG PORVs for iodine isotopes is based on regulatory guidance. See Section 2.5 (Ref. 1, 6).

CREA Case 2: Doses from Release through Steam Generator PORVs RADTRAD Transfer Pathways (con't)

Pathway Number	5	6	7	8
Name	(Noble Gas Activity Release Path) Secondary Loop 2 - Steam Generator Volumes (4 SGs) to Environment	(Fission Product Activity Release Path) Secondary Loop 3 - Steam Generator Volumes (4 SGs) to Environment	(Filtered Intake) Environment to Control Room	(Unfiltered Inleakage) Environment to Control Room
From - To	5 - 8	6 - 8	8 - 7	8 - 7
Transfer Mechanism	Filter	Filter	Filter	Filter
Transfer Mechanism Details	0-0.0556hrs, 2.883E+03cfm; 0.0556-1.1111hrs, 4.806E+02cfm; 1.1111-720hrs, 0.0cfm. Filter Efficiency - Efficiency is entered as 100% for all chemical forms, in order to ensure that only the activity from noble gas isotopes is transferred at these un-partitioned flow rates through the SG PORVs via this pathway.	0-0.0556hrs, 1.586E+01cfm; 0.0556-1.1111hrs, 2.643E+00cfm; 1.1111-720hrs, 0.0cfm. Filter Efficiency - Efficiency is entered as 100% for elemental and organic chemical forms, to ensure that only the activity from fission product isotopes is transferred at these specific partitioned flow rates through the SG PORVs via this pathway. Because RADTRAD treats all non-iodine and non-noble gas isotopes as being in the aerosol chemical form, this is an acceptable calculational means for activity transport.	Filter Panel – Flow rate - 0-0.5hrs, 6.424E+03cfm; 0.5-720hrs, 8.575E+03cfm. Filter Efficiency - Efficiency is entered as 99% for aerosol activity, and 95% for elemental and organic forms of iodine, after CR Mode 2 is initiated in 30 min, and then for the duration of the accident. This corresponds to the presence of the HEPA filter, and relaxed charcoal testing requirements analyzed as acceptable by this calculation, respectively.	Filter Panel – Flow rate - 0-0.5hrs, 1.000E+03cfm; 0.5-720hrs, 1.000E+03cfm. Filter Efficiency - Efficiency is entered as 0.0% for all chemical forms of iodine, for the accident duration, because this is an unfiltered path.
Comments	No partitioning factor is applied to the steaming rate associated with noble gas isotopes. See Section 2.5 and reference 6.	Partitioning factor applied to steaming rate through SG PORVs for fission product isotopes is conservatively calculated from ANSI data. See Section 2.5 (Ref. 14, 6).	See Section 2.7.	See Section 2.7.

CREA Case 2: Doses from Release through Steam Generator PORVs RADTRAD Transfer Pathways (con't)	
Pathway Number	9
Name	(Control Room Exhaust) Control Room to Environment
From - To	7 - 8
Transfer Mechanism	Filter
Transfer Mechanism Details	Filter Panel – Flow rate - 0-0.5hrs, 7.424E+03cfm; 0.5-720hrs, 9.575E+03cfm. Filter Efficiency - Efficiency is entered as 100.0% for all chemical forms of iodine, for all time periods. This is the exhaust from the control room to the environment; the filtration prevents a double counting of the iodine release. Although RADTRAD 3.03 documentation indicates that this effect has been eliminated, this was still done for completeness.
Comments	See Section 2.7.

6.2.2.3. RADTRAD Run Dose Location Information

CREA Case 2: Doses from Release through Steam Generator PORVs RADTRAD Dose Locations			
Dose Location Number	1	2	3
Name	Control Room	Exclusion Area Boundary (EAB)	Low Population Zone (LPZ)
In Compartment	Control Room (7)	Environment (8)	Environment (8)
Breathing Rate (m^3/sec)	0 - 720 hrs: 3.5E-04	0 - 8 hrs: 3.5E-04 8 - 24 hrs: 1.8E-04 24 - 720 hrs: 2.3E-04	0 - 8 hrs: 3.5E-04 8 - 24 hrs: 1.8E-04 24 - 720 hrs: 2.3E-04
Occupancy Fractions	0 - 8 hrs: 1.0 8 - 24 hrs: 0.6 24 - 720 hrs: 0.4	Worst 2-hour Period: 1.0	0 - 720 hrs: 1.0
Dispersion Factors	See Section 4.1.	See Section 4.1.	See Section 4.1.

6.2.2.4. RADTRAD Run Source Term & Dose Conversion Factor Information

CREA Case 2: Doses from Release through Steam Generator PORVs RADTRAD Source Term & Dose Conversion Factors		
Core Power	3658.3 MWth	See Section 2.2 and reference 6.
Nuclide Inventory	ORIGEN calculated specific B/B core inventory for 60 MACCS isotopes. Inventory is calculated at DBA power shown above, and input into the NIF file.	See Attachment B, Section 4.4, and reference 8.

Release Fractions & Timing	User defined Release Fractions calculated from B/B CREA specific fuel damage and RG 1.183 specified isotopic inventory fractions. Release timing is not delayed, consistent with RG 1.183 guidance. Fractions and timing are shown in RFT file.	See Section 2.2 and 2.3, Attachment C, and references 1 and 6.
Dose Conversion Factors	RADTRAD Library of FGR 11 & 12 values for 60 MACCS isotopes.	References 16 and 17.
Decay & Daughter Products	Enabled - Therefore Decay and Daughter products are considered.	
Iodine Chemical Fractions	Aerosol: 0.0000 Elemental: 1.0000 Organic: 0.0000	User defined iodine chemical fractions, consistent with RG 1.183 guidance, as manipulated in calculation.

WGII has pre-qualified RADTRAD for application to perform such calculations, as documented in the Computer Disclosure Sheet of Attachment F. The new design basis RADTRAD simulations utilized the design input parameters as provided in Section 4.

7. SUMMARY AND CONCLUSIONS

Table 7.1 provides the results from the simulations modeled using the RADTRAD 3.03 code.

Table 7.1. RADTRAD Analysis Results

Case 1: Containment Leakage CREA RADTRAD Dose Assessment Results		
Control Room (rem TEDE)	**EAB (rem TEDE)**	**LPZ (rem TEDE)**
2.549	4.647	1.983
Case 2: Steam Generator PORV Release CREA RADTRAD Dose Assessment Results		
Control Room (rem TEDE)	**EAB (rem TEDE)**	**LPZ (rem TEDE)**
0.369	1.480	0.257

For the cases analyzed in this calculation, it is shown that a Case 1 CREA that breaches the RPV, and causes a containment leakage release, would be the bounding CREA scenario. Using the design basis assumptions, described methodology, and credited margin relaxation of this analysis, the limiting CR dose is **2.55 rem TEDE**. This limiting dose, and all other doses, are well below their respective acceptance criteria, so it is verified that this design basis Control Rod Ejection Accident is sufficiently mitigated at both Byron and Braidwood Generating Stations.

```
 ##############################################################################
    RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:08:44
 ##############################################################################

 ##############################################################################
                     File information
 ##############################################################################

 Plant file           = C:\Documents and Settings\Aleem Boatright\My
Documents\My Work\Exelon\Byron & Braidwood\CREA\RADTRAD\Rev 1\B-B CREA Case 1
- Large CR Volume 1000cfm Inleak - 95 percent Intake Filt - Cont Leak Rate
Increase.psf
 Inventory file       = c:\program files\radtrad3-03\defaults\byron-braidwood
ast source terms.nif
 Release file         = C:\Program Files\radtrad3-03\Defaults\Byron-Braidwood
CREA-Release Fractions (Rev 1).rft
 Dose Conversion file = c:\program files\radtrad3-03\defaults\fgr11&12.inp



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


 Radtrad 3.03 4/15/2001
 Byron/Braidwood CREA - Case 1 - Small Break LOCA Containment Leakage
(0.2%/day) - Control Room @ 200,000 cu. ft. CR Volume with 8575cfm Intake -
1000cfm Unfilt Inleakage - 95% CR Intake Fiters - 80% Aerosol, 90% Elemental
& Organic Recirc Filtration
 Nuclide Inventory File:
 c:\program files\radtrad3-03\defaults\byron-braidwood ast source terms.nif
 Plant Power Level:
  3.6583E+03
 Compartments:
   5
 Compartment 1:
 Primary Loop - Reactor Coolant System (RCS)
   3
  7.2850E+03
   0
   0
   0
   0
   0
 Compartment 2:
 Secondary Loop - Steam Generator Volumes (4 SGs)
   3
  4.7890E+03
   0
   0
```

```
  0
  0
  0
Compartment 3:
Containment
  3
 2.8500E+06
  0
  0
  0
  1
  0
Compartment 4:
Control Room
  1
 2.0000E+05
  0
  0
  1
  0
  0
Compartment 5:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Pathways:
  6
Pathway 1:
Primary Loop to Secondary Loop Leakage
  1
  2
  2
Pathway 2:
Secondary Loop - Steam Generator Volumes (4 SGs) to  Environment
  2
  5
  2
Pathway 3:
Containment Leak to the Environment
  3
  5
  4
Pathway 4:
(Filtered Intake) Environment to Control Room
  5
  4
  2
Pathway 5:
(Unfiltered Inleakage) Environment to Control Room
  5
  4
  2
Pathway 6:
```

```
 (Control Room Exhaust) Control Room to Environment
   4
   5
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   3   1.0000E+00
 c:\program files\radtrad3-03\defaults\fgr11&12.inp
 C:\Program Files\radtrad3-03\Defaults\Byron-Braidwood CREA-Release Fractions
(Rev 1).rft
   0.0000E+00
   1
   9.5000E-01   4.8500E-02   1.5000E-03   1.0000E+00
 Overlying Pool:
   0
   0.0000E+00
   0
   0
   0
   0
 Compartments:
   5
 Compartment 1:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 2:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 3:
   1
   1
   0
   0
   0
   0
   0
   3
   1
   1.0000E+01
```

```
  1
  1
  0.0000E+00   0.0000E+00
Compartment 4:
  0
  1
  0
  0
  0
  0
  1
  3.9150E+04
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   8.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Compartment 5:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Pathways:
  6
Pathway 1:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.3370E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+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
  4
  0.0000E+00   2.8830E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.5600E-02   4.8060E+02   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
```

```
 7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E-01
  2.4000E+01   1.0000E-01
  7.2000E+02   0.0000E+00
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   6.4240E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   8.5750E+03   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   1.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
```

```
Pathway 6:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   7.4240E+03   1.0000E+02   1.0000E+02   1.0000E+02
  5.0000E-01   9.5750E+03   1.0000E+02   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary (EAB)
  5
  1
  3
  0.0000E+00   5.3600E-04
  5.0000E-01   5.3600E-04
  2.0000E+00   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone (LPZ)
  5
  1
  7
  0.0000E+00   9.3200E-05
  5.0000E-01   9.3200E-05
  2.0000E+00   4.5000E-05
  8.0000E+00   3.1200E-05
  2.4000E+01   1.4100E-05
  9.6000E+01   4.5400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  4
  0
  1
```

```
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  7
  0.0000E+00   1.7300E-03
  5.0000E-01   1.0100E-03
  2.0000E+00   7.2500E-04
  8.0000E+00   3.0700E-04
  2.4000E+01   2.0700E-04
  9.6000E+01   1.4600E-04
  7.2000E+02   0.0000E+00
Simulation Parameters:
  1
  0.0000E+00   0.0000E+00
Output Filename:
C:\Documents and Settings\Aleem Boatright\My Documents\My Work\Exelon\Byron
& Braidwood\CREA\RADTRAD\Rev 1\B-B CREA Case 1 - Large CR Volume 1000cfm
Inleak - 95 percent Intake Filt - Cont Leak Rate Increase.o0
  1
  1
  1
  0
  0
End of Scenario File
```

```
 ##########################################################################
    RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:08:44
 ##########################################################################

 ##########################################################################
                      Plant Description
 ##########################################################################

 Number of Nuclides =  60

 Inventory Power =   1.0000E+00 MWth
 Plant Power Level =   3.6583E+03 MWth

 Number of compartments    =   5

 Compartment information

 Compartment number  1
 Name: Primary Loop - Reactor Coolant System (R
 Compartment volume =   7.2850E+03 (Cubic feet)
 Compartment type is Normal
 Pathways into and out of compartment  1
    Exit Pathway Number    1: Primary Loop to Secondary Loop Leakage

 Compartment number  2
 Name: Secondary Loop - Steam Generator Volumes
 Compartment volume =   4.7890E+03 (Cubic feet)
 Compartment type is Normal
 Pathways into and out of compartment  2
    Inlet Pathway Number   1: Primary Loop to Secondary Loop Leakage
    Exit Pathway Number    2: Secondary Loop - Steam Generator Volumes (4
SGs) t

 Compartment number  3  (Source term fraction =   1.0000E+00
 )
 Name: Containment
 Compartment volume =   2.8500E+06 (Cubic feet)
 Compartment type is Normal
 Removal devices within compartment:
      Deposition
 Pathways into and out of compartment  3
    Exit Pathway Number    3: Containment Leak to the Environment

 Compartment number  4
 Name: Control Room
 Compartment volume =   2.0000E+05 (Cubic feet)
 Compartment type is Control Room
 Removal devices within compartment:
      Filter(s)
 Pathways into and out of compartment  4
    Inlet Pathway Number   4: (Filtered Intake) Environment to Control Room
    Inlet Pathway Number   5: (Unfiltered Inleakage) Environment to Control
Room
    Exit Pathway Number    6: (Control Room Exhaust) Control Room to
Environment

 Compartment number  5
```

```
 Name: Environment
 Compartment type is Environment
 Pathways into and out of compartment  5
    Inlet Pathway Number   2: Secondary Loop - Steam Generator Volumes (4
SGs) t
    Inlet Pathway Number   3: Containment Leak to the Environment
    Inlet Pathway Number   6: (Control Room Exhaust) Control Room to
Environment
    Exit Pathway Number    4: (Filtered Intake) Environment to Control Room
    Exit Pathway Number    5: (Unfiltered Inleakage) Environment to Control
Room

 Total number of pathways =   6
```

RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004 at 7:08:44

Scenario Description

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.000010 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	1.7000E-02	3.8250E-03	0.0000E+00	7.805E+01
IODINE	1.7000E-02	1.9125E-03	0.0000E+00	1.972E+01
CESIUM	4.0800E-02	1.6150E-03	0.0000E+00	6.129E+03
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 = 3658. 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)
Kr-85	1	2.851E+02	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	8.592E+03	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	1.696E+04	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	2.392E+04	1.022E+04	1.020E-13	0.000E+00	0.000E+00
Rb-86	3	6.480E+01	1.612E+06	4.810E-15	1.330E-09	1.790E-09
I-131	2	2.671E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.863E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.529E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.143E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.159E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Xe-133	1	5.396E+04	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-135	1	1.532E+04	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Cs-134	3	5.306E+03	6.507E+07	7.570E-14	1.110E-08	1.250E-08
Cs-136	3	1.503E+03	1.132E+06	1.060E-13	1.730E-09	1.980E-09
Cs-137	3	3.077E+03	9.467E+08	2.725E-14	7.930E-09	8.630E-09

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
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
Sr-90	Y-90	1.00	none	0.00	none	0.00
Sr-91	Y-91m	0.58	Y-91	0.42	none	0.00
Sr-92	Y-92	1.00	none	0.00	none	0.00
Y-93	Zr-93	1.00	none	0.00	none	0.00
Zr-95	Nb-95m	0.01	Nb-95	0.99	none	0.00
Zr-97	Nb-97m	0.95	Nb-97	0.05	none	0.00
Mo-99	Tc-99m	0.88	Tc-99	0.12	none	0.00
Tc-99m	Tc-99	1.00	none	0.00	none	0.00

Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00
Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	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 Loop - Reactor Coolant System (R

Compartment number 2: Secondary Loop - Steam Generator Volumes

Compartment number 3: Containment
Natural Deposition (Powers' model): Aerosol data
Reactor type: 1
Percentile = 10 (%)

Natural Deposition: Elemental Removal Data

Time (hr)	Removal Coef. (hr^-1)
0.0000E+00	0.0000E+00

Compartment number 4: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.9150E+04	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	3.9150E+04	8.0000E+01	9.0000E+01	9.0000E+01
7.2000E+02	3.9150E+04	0.0000E+00	0.0000E+00	0.0000E+00

Compartment number 5: Environment

PATHWAY DATA

Pathway number 1: Primary Loop to Secondary Loop Leakage

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.3370E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Secondary Loop - Steam Generator Volumes (4 SGs) t

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.8830E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.5600E-02	4.8060E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Containment Leak to the Environment

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	2.0000E-01
2.4000E+01	1.0000E-01
7.2000E+02	0.0000E+00

Pathway number 4: (Filtered Intake) Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	6.4240E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	8.5750E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: (Unfiltered Inleakage) Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	1.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 6: (Control Room Exhaust) Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	7.4240E+03	1.0000E+02	1.0000E+02	1.0000E+02
5.0000E-01	9.5750E+03	1.0000E+02	1.0000E+02	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary (EAB) is in compartment 5

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	5.3600E-04
5.0000E-01	5.3600E-04
2.0000E+00	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
8.0000E+00	1.8000E-04
2.4000E+01	2.3000E-04
7.2000E+02	0.0000E+00

Location Low Population Zone (LPZ) is in compartment 5

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	9.3200E-05
5.0000E-01	9.3200E-05
2.0000E+00	4.5000E-05
8.0000E+00	3.1200E-05
2.4000E+01	1.4100E-05
9.6000E+01	4.5400E-06
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
8.0000E+00	1.8000E-04
2.4000E+01	2.3000E-04
7.2000E+02	0.0000E+00

Location Control Room is in compartment 4

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	1.7300E-03
5.0000E-01	1.0100E-03
2.0000E+00	7.2500E-04
8.0000E+00	3.0700E-04
2.4000E+01	2.0700E-04
9.6000E+01	1.4600E-04
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
7.2000E+02	0.0000E+00

Location Occupancy Factor Data

Time (hr)	Occupancy Factor

0.0000E+00	1.0000E+00
2.4000E+01	6.0000E-01
9.6000E+01	4.0000E-01
7.2000E+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 11/17/2004  at  7:08:44
##########################################################################
```

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

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

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2190E-06	2.0171E-04	1.1623E-05
Accumulated dose (rem)	1.2190E-06	2.0171E-04	1.1623E-05

Low Population Zone (LPZ) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.1196E-07	3.5073E-05	2.0210E-06
Accumulated dose (rem)	2.1196E-07	3.5073E-05	2.0210E-06

Control Room Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.3123E-12	7.2498E-09	3.7626E-10
Accumulated dose (rem)	2.3123E-12	7.2498E-09	3.7626E-10

Containment Compartment Nuclide Inventory:

Time (h) = 0.0000	Ci	kg	Atoms	Decay
Kr-85	1.7731E+04	4.5193E-02	3.2018E+23	2.3617E+13
Kr-85m	5.3435E+05	6.4930E-05	4.6002E+20	7.1175E+14
Kr-87	1.0548E+06	3.7237E-05	2.5775E+20	1.4049E+15
Kr-88	1.4876E+06	1.1864E-04	8.1187E+20	1.9815E+15
Rb-86	9.6720E+03	1.1887E-04	8.3237E+20	1.2883E+13
I-131	1.6611E+06	1.3399E-02	6.1595E+22	2.2126E+15
I-132	2.4024E+06	2.3275E-04	1.0618E+21	3.2000E+15
I-133	3.4385E+06	3.0354E-03	1.3744E+22	4.5801E+15
I-134	3.8204E+06	1.4321E-04	6.4360E+20	5.0888E+15
I-135	3.2084E+06	9.1360E-04	4.0754E+21	4.2736E+15
Xe-133	3.3558E+06	1.7928E-02	8.1178E+22	4.4700E+15
Xe-135	9.5277E+05	3.7309E-04	1.6643E+21	1.2691E+15
Cs-134	7.9197E+05	6.1211E-01	2.7509E+24	1.0549E+15
Cs-136	2.2434E+05	3.0609E-03	1.3554E+22	2.9882E+14
Cs-137	4.5927E+05	5.2801E+00	2.3210E+25	6.1174E+14

Containment Transport Group Inventory:

Time (h) = 0.0000	Atmosphere	Sump	
Noble gases (atoms)	4.0456E+23	0.0000E+00	
Elemental I (atoms)	3.9343E+21	0.0000E+00	
Organic I (atoms)	1.2168E+20	0.0000E+00	
Aerosols (kg)	5.9122E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		2.9051E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.7161E-05
Total I (Ci)			1.4531E+07

Time (h) = 0.0000	Deposition Surfaces	Recirculating Filter
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)	8.9055E-07	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 0.0000	Leakage Transport
Noble gases (atoms)	1.6857E+14
Elemental I (atoms)	1.6393E+12
Organic I (atoms)	5.0700E+10
Aerosols (kg)	2.4634E-09

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5894E-06	4.2583E-04	2.4266E-05
Accumulated dose (rem)	3.8084E-06	6.2754E-04	3.5889E-05

Low Population Zone (LPZ) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.5025E-07	7.4044E-05	4.2194E-06
Accumulated dose (rem)	6.6222E-07	1.0912E-04	6.2404E-06

Control Room Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.5364E-12	2.9805E-08	1.5365E-09
Accumulated dose (rem)	1.1849E-11	3.7055E-08	1.9128E-09

Containment Compartment Nuclide Inventory:

Time (h) = 0.0000	Ci	kg	Atoms	Decay
Kr-85	2.1720E+04	5.5361E-02	3.9223E+23	5.2548E+13
Kr-85m	6.5457E+05	7.9539E-05	5.6353E+20	1.5836E+15
Kr-87	1.2921E+06	4.5615E-05	3.1575E+20	3.1260E+15
Kr-88	1.8223E+06	1.4533E-04	9.9454E+20	4.4088E+15
Rb-86	1.0055E+04	1.2357E-04	8.6532E+20	2.6276E+13
I-131	1.8480E+06	1.4906E-02	6.8525E+22	4.6742E+15
I-132	2.6727E+06	2.5893E-04	1.1813E+21	6.7601E+15
I-133	3.8254E+06	3.3769E-03	1.5290E+22	9.6755E+15
I-134	4.2501E+06	1.5932E-04	7.1600E+20	1.0750E+16
I-135	3.5694E+06	1.0164E-03	4.5339E+21	9.0281E+15
Xe-133	4.1109E+06	2.1962E-02	9.9442E+22	9.9457E+15

Xe-135	1.1671E+06	4.5704E-04	2.0388E+21	2.8237E+15
Cs-134	8.2331E+05	6.3634E-01	2.8598E+24	2.1516E+15
Cs-136	2.3322E+05	3.1821E-03	1.4090E+22	6.0946E+14
Cs-137	4.7745E+05	5.4891E+00	2.4128E+25	1.2477E+15

Containment Transport Group Inventory:

Time (h) = 0.0000	Atmosphere	Sump	
Noble gases (atoms)	4.9558E+23	0.0000E+00	
Elemental I (atoms)	4.3770E+21	0.0000E+00	
Organic I (atoms)	1.3537E+20	0.0000E+00	
Aerosols (kg)	6.1474E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.2319E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.1341E-05
Total I (Ci)			1.6166E+07

Time (h) = 0.0000	Deposition Surfaces	Recirculating Filter
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)	2.7071E-06	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 0.0000	Leakage Transport
Noble gases (atoms)	5.4362E+14
Elemental I (atoms)	5.1023E+12
Organic I (atoms)	1.5780E+11
Aerosols (kg)	7.4882E-09

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.5223E-02	2.4894E+00	1.4043E-01
Accumulated dose (rem)	1.5227E-02	2.4900E+00	1.4046E-01

Low Population Zone (LPZ) Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6470E-03	4.3286E-01	2.4417E-02
Accumulated dose (rem)	2.6477E-03	4.3297E-01	2.4423E-02

Control Room Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.5103E-04	4.6799E-01	2.3688E-02
Accumulated dose (rem)	1.5103E-04	4.6799E-01	2.3688E-02

Containment Compartment Nuclide Inventory:

Time (h) = 0.0556	Ci	kg	Atoms	Decay
Kr-85	2.1720E+04	5.5361E-02	3.9223E+23	1.6085E+17
Kr-85m	6.4896E+05	7.8858E-05	5.5870E+20	4.8267E+18
Kr-87	1.2535E+06	4.4253E-05	3.0632E+20	9.4252E+18
Kr-88	1.7978E+06	1.4337E-04	9.8113E+20	1.3404E+19
Rb-86	1.0037E+04	1.2335E-04	8.6379E+20	7.4336E+16
I-131	1.8447E+06	1.4880E-02	6.8402E+22	1.3663E+19
I-132	2.6241E+06	2.5422E-04	1.1598E+21	1.9597E+19

I-133	3.8122E+06	3.3653E-03	1.5238E+22	2.8259E+19
I-134	4.0609E+06	1.5223E-04	6.8413E+20	3.0745E+19
I-135	3.5430E+06	1.0089E-03	4.5004E+21	2.6315E+19
Xe-133	4.1107E+06	2.1961E-02	9.9439E+22	3.0439E+19
Xe-135	1.1750E+06	4.6011E-04	2.0525E+21	8.6252E+18
Cs-134	8.2193E+05	6.3527E-01	2.8550E+24	6.0871E+18
Cs-136	2.3280E+05	3.1763E-03	1.4065E+22	1.7242E+18
Cs-137	4.7665E+05	5.4798E+00	2.4088E+25	3.5300E+18

Containment Transport Group Inventory:

Time (h) = 0.0556	Atmosphere	Sump	
Noble gases (atoms)	4.9556E+23	0.0000E+00	
Elemental I (atoms)	4.3712E+21	0.0000E+00	
Organic I (atoms)	1.3519E+20	0.0000E+00	
Aerosols (kg)	6.1371E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.2235E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.1168E-05
Total I (Ci)			1.5885E+07

Time (h) = 0.0556	Deposition Surfaces	Recirculating Filter
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)	1.0287E-02	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 0.0556	Leakage Transport
Noble gases (atoms)	2.2959E+18
Elemental I (atoms)	2.0278E+16
Organic I (atoms)	6.2714E+14
Aerosols (kg)	2.8456E-05

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1126E-01	1.9683E+01	1.1017E+00
Accumulated dose (rem)	1.2649E-01	2.2173E+01	1.2422E+00

Low Population Zone (LPZ) Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9347E-02	3.4226E+00	1.9157E-01
Accumulated dose (rem)	2.1994E-02	3.8555E+00	2.1599E-01

Control Room Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.1609E-03	2.7807E+01	1.4076E+00
Accumulated dose (rem)	8.3119E-03	2.8275E+01	1.4313E+00

Containment Compartment Nuclide Inventory:

Time (h) = 0.5000	Ci	kg	Atoms	Decay
Kr-85	2.1720E+04	5.5360E-02	3.9222E+23	1.4465E+18
Kr-85m	6.0582E+05	7.3615E-05	5.2156E+20	4.1950E+19
Kr-87	9.8381E+05	3.4732E-05	2.4042E+20	7.5321E+19

Kr-88	1.6129E+06	1.2863E-04	8.8025E+20	1.1425E+20
Rb-86	9.8964E+03	1.2163E-04	8.5169E+20	6.6346E+17
I-131	1.8184E+06	1.4668E-02	6.7428E+22	1.2193E+20
I-132	2.2661E+06	2.1954E-04	1.0016E+21	1.6388E+20
I-133	3.7086E+06	3.2738E-03	1.4823E+22	2.5054E+20
I-134	2.8216E+06	1.0577E-04	4.7534E+20	2.3195E+20
I-135	3.3388E+06	9.5073E-04	4.2410E+21	2.2966E+20
Xe-133	4.1095E+06	2.1954E-02	9.9408E+22	2.7368E+20
Xe-135	1.2334E+06	4.8299E-04	2.1546E+21	7.9321E+19
Cs-134	8.1096E+05	6.2679E-01	2.8169E+24	5.4346E+19
Cs-136	2.2947E+05	3.1309E-03	1.3864E+22	1.5386E+19
Cs-137	4.7029E+05	5.4068E+00	2.3767E+25	3.1516E+19

Containment Transport Group Inventory:

Time (h) = 0.5000	Atmosphere	Sump	
Noble gases (atoms)	4.9542E+23	0.0000E+00	
Elemental I (atoms)	4.3280E+21	0.0000E+00	
Organic I (atoms)	1.3385E+20	0.0000E+00	
Aerosols (kg)	6.0550E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.1581E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.9866E-05
Total I (Ci)			1.3953E+07

Time (h) = 0.5000	Deposition Surfaces	Recirculating Filter
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)	9.1901E-02	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 0.5000	Leakage Transport
Noble gases (atoms)	2.0646E+19
Elemental I (atoms)	1.8151E+17
Organic I (atoms)	5.6138E+15
Aerosols (kg)	2.5421E-04

Exclusion Area Boundary (EAB) Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2572E-01	2.6186E+01	1.4449E+00
Accumulated dose (rem)	2.5221E-01	4.8360E+01	2.6871E+00

Low Population Zone (LPZ) Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.1861E-02	4.5533E+00	2.5124E-01
Accumulated dose (rem)	4.3855E-02	8.4088E+00	4.6723E-01

Control Room Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.5020E-03	9.8262E+00	4.9975E-01
Accumulated dose (rem)	1.2814E-02	3.8101E+01	1.9311E+00

Containment Compartment Nuclide Inventory:

Time (h) = 1.1111	Ci	kg	Atoms	Decay
Kr-85	2.1719E+04	5.5358E-02	3.9221E+23	3.2144E+18
Kr-85m	5.5114E+05	6.6971E-05	4.7448E+20	8.9002E+19
Kr-87	7.0507E+05	2.4891E-05	1.7230E+20	1.4343E+20
Kr-88	1.3894E+06	1.1080E-04	7.5825E+20	2.3621E+20
Rb-86	9.5221E+03	1.1703E-04	8.1947E+20	1.4512E+18
I-131	1.7508E+06	1.4122E-02	6.4922E+22	2.6675E+20
I-132	1.8189E+06	1.7621E-04	8.0392E+20	3.2898E+20
I-133	3.5065E+06	3.0954E-03	1.4016E+22	5.4324E+20
I-134	1.6794E+06	6.2954E-05	2.8292E+20	4.1059E+20
I-135	3.0218E+06	8.6046E-04	3.8384E+21	4.8755E+20
Xe-133	4.1072E+06	2.1942E-02	9.9352E+22	6.0801E+20
Xe-135	1.3002E+06	5.0915E-04	2.2713E+21	1.8172E+20
Cs-134	7.8100E+05	6.0363E-01	2.7128E+24	1.1893E+20
Cs-136	2.2070E+05	3.0113E-03	1.3334E+22	3.3648E+19
Cs-137	4.5293E+05	5.2071E+00	2.2889E+25	6.8969E+19

Containment Transport Group Inventory:

Time (h) = 1.1111	Atmosphere	Sump	
Noble gases (atoms)	4.9523E+23	0.0000E+00	
Elemental I (atoms)	4.2756E+21	0.0000E+00	
Organic I (atoms)	1.3223E+20	0.0000E+00	
Aerosols (kg)	5.8313E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.0166E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.7591E-05
Total I (Ci)			1.1777E+07

Time (h) = 1.1111	Deposition Surfaces	Recirculating Filter
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)	3.1513E-01	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 1.1111	Leakage Transport
Noble gases (atoms)	4.5871E+19
Elemental I (atoms)	4.0076E+17
Organic I (atoms)	1.2395E+16
Aerosols (kg)	5.5681E-04

Exclusion Area Boundary (EAB) Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.4274E-01	3.6007E+01	1.9599E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.4819E-02	6.2610E+00	3.4079E-01
Accumulated dose (rem)	6.8674E-02	1.4670E+01	8.0802E-01

Control Room Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.9395E-03	1.8345E+00	9.5165E-02

Accumulated dose (rem) 1.5753E-02 3.9936E+01 2.0262E+00

Containment Compartment Nuclide Inventory:

Time (h) = 2.0000	Ci	kg	Atoms	Decay
Kr-85	2.1718E+04	5.5356E-02	3.9219E+23	5.7859E+18
Kr-85m	4.8028E+05	5.8361E-05	4.1348E+20	1.4997E+20
Kr-87	4.3429E+05	1.5332E-05	1.0613E+20	2.0959E+20
Kr-88	1.1183E+06	8.9184E-05	6.1032E+20	3.8409E+20
Rb-86	8.9367E+03	1.0983E-04	7.6910E+20	2.5430E+18
I-131	1.6457E+06	1.3275E-02	6.1025E+22	4.6766E+20
I-132	1.3121E+06	1.2711E-04	5.7993E+20	5.1260E+20
I-133	3.2100E+06	2.8337E-03	1.2831E+22	9.4039E+20
I-134	7.8420E+05	2.9396E-05	1.3211E+20	5.4969E+20
I-135	2.5959E+06	7.3918E-04	3.2974E+21	8.1931E+20
Xe-133	4.1027E+06	2.1918E-02	9.9244E+22	1.0939E+21
Xe-135	1.3715E+06	5.3705E-04	2.3957E+21	3.3911E+20
Cs-134	7.3398E+05	5.6729E-01	2.5495E+24	2.0854E+20
Cs-136	2.0701E+05	2.8245E-03	1.2507E+22	5.8946E+19
Cs-137	4.2567E+05	4.8938E+00	2.1512E+25	1.2094E+20

Containment Transport Group Inventory:

Time (h) = 2.0000	Atmosphere	Sump	
Noble gases (atoms)	4.9496E+23	0.0000E+00	
Elemental I (atoms)	4.2095E+21	0.0000E+00	
Organic I (atoms)	1.3019E+20	0.0000E+00	
Aerosols (kg)	5.4801E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		2.8051E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.4452E-05
Total I (Ci)			9.5480E+06

Time (h) = 2.0000	Deposition Surfaces	Recirculating Filter
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)	6.6561E-01	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 2.0000 Leakage Transport	
Noble gases (atoms)	8.2547E+19
Elemental I (atoms)	7.1524E+17
Organic I (atoms)	2.2121E+16
Aerosols (kg)	9.7683E-04

Exclusion Area Boundary (EAB) Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.7396E-02	1.4371E+01	7.6618E-01
Accumulated dose (rem)	1.0607E-01	2.9041E+01	1.5742E+00

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.3739E-03	6.3369E+00	3.2707E-01
Accumulated dose (rem)	2.3127E-02	4.6273E+01	2.3533E+00

Containment Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
Kr-85	2.1709E+04	5.5333E-02	3.9203E+23	2.3139E+19
Kr-85m	1.8972E+05	2.3054E-05	1.6333E+20	3.9998E+20
Kr-87	1.6491E+04	5.8218E-07	4.0298E+18	3.1167E+20
Kr-88	2.5844E+05	2.0611E-05	1.4105E+20	8.5320E+20
Rb-86	4.5798E+03	5.6285E-05	3.9414E+20	7.8200E+18
I-131	8.7640E+05	7.0692E-03	3.2497E+22	1.4528E+21
I-132	1.1705E+05	1.1340E-05	5.1734E+19	9.1187E+20
I-133	1.4301E+06	1.2625E-03	5.7163E+21	2.7169E+21
I-134	3.7140E+03	1.3922E-07	6.2569E+17	6.6723E+20
I-135	7.5290E+05	2.1439E-04	9.5636E+20	2.0213E+21
Xe-133	4.0373E+06	2.1569E-02	9.7662E+22	4.3499E+21
Xe-135	1.3170E+06	5.1571E-04	2.3005E+21	1.4548E+21
Cs-134	3.7956E+05	2.9336E-01	1.3184E+24	6.4368E+20
Cs-136	1.0567E+05	1.4418E-03	6.3842E+21	1.8097E+20
Cs-137	2.2017E+05	2.5313E+00	1.1127E+25	3.7332E+20

Containment Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump	
Noble gases (atoms)	4.9230E+23	0.0000E+00	
Elemental I (atoms)	3.8950E+21	0.0000E+00	
Organic I (atoms)	1.2046E+20	0.0000E+00	
Aerosols (kg)	2.8338E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.4088E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.6425E-05
Total I (Ci)			3.1802E+06

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
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)	3.3087E+00	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 8.0000	Leakage Transport
Noble gases (atoms)	3.2943E+20
Elemental I (atoms)	2.7365E+18
Organic I (atoms)	8.4633E+16
Aerosols (kg)	3.0204E-03

Exclusion Area Boundary (EAB) Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.4602E-02	4.7132E+00	2.4984E-01
Accumulated dose (rem)	1.2067E-01	3.3754E+01	1.8240E+00

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.1991E-03	2.5374E+00	1.2725E-01
Accumulated dose (rem)	2.5326E-02	4.8810E+01	2.4805E+00

Containment Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
Kr-85	2.1679E+04	5.5257E-02	3.9149E+23	6.9373E+19
Kr-85m	1.5938E+04	1.9367E-06	1.3721E+19	5.4951E+20
Kr-87	2.6861E+00	9.4829E-11	6.5641E+14	3.1570E+20
Kr-88	5.1981E+03	4.1454E-07	2.8369E+18	9.9136E+20
Rb-86	1.1169E+03	1.3726E-05	9.6117E+19	1.2395E+19
I-131	2.7027E+05	2.1800E-03	1.0022E+22	2.4148E+21
I-132	3.0783E+02	2.9822E-08	1.3605E+17	9.5037E+20
I-133	2.7407E+05	2.4194E-04	1.0955E+21	4.0290E+21
I-134	3.8888E-03	1.4578E-13	6.5514E+11	6.6778E+20
I-135	4.5934E+04	1.3080E-05	5.8346E+19	2.5009E+21
Xe-133	3.7417E+06	1.9989E-02	9.0511E+22	1.2648E+22
Xe-135	4.9234E+05	1.9279E-04	8.6002E+20	3.3009E+21
Cs-134	9.4825E+04	7.3291E-02	3.2938E+23	1.0263E+21
Cs-136	2.5500E+04	3.4793E-04	1.5406E+21	2.8612E+20
Cs-137	5.5037E+04	6.3275E-01	2.7814E+24	5.9533E+20

Containment Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	4.8288E+23	0.0000E+00	
Elemental I (atoms)	3.3932E+21	0.0000E+00	
Organic I (atoms)	1.0494E+20	0.0000E+00	
Aerosols (kg)	7.0807E-01	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.9307E-06
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.3042E-06
Total I (Ci)			5.9058E+05

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
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)	5.4320E+00	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 24.0000	Leakage Transport
Noble gases (atoms)	9.7982E+20
Elemental I (atoms)	7.5782E+18
Organic I (atoms)	2.3438E+17
Aerosols (kg)	4.8493E-03

Exclusion Area Boundary (EAB) Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00

Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.2477E-03	2.2306E+00	1.1408E-01
Accumulated dose (rem)	1.2392E-01	3.5985E+01	1.9381E+00

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.8507E-04	8.7196E-01	4.2626E-02
Accumulated dose (rem)	2.5811E-02	4.9682E+01	2.5232E+00

Containment Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
Kr-85	2.1603E+04	5.5063E-02	3.9011E+23	2.7692E+20
Kr-85m	2.3075E-01	2.8039E-11	1.9866E+14	5.6322E+20
Kr-88	1.2100E-04	9.6499E-15	6.6037E+10	9.9420E+20
Rb-86	4.8485E+02	5.9588E-06	4.1726E+19	1.9623E+19
I-131	1.3469E+05	1.0865E-03	4.9945E+21	4.2573E+21
I-132	7.4926E-08	7.2588E-18	3.3116E+07	9.5051E+20
I-133	1.6059E+04	1.4176E-05	6.4189E+19	4.8905E+21
I-135	1.5596E+01	4.4409E-09	1.9810E+16	2.5556E+21
Xe-133	2.5357E+06	1.3547E-02	6.1338E+22	4.2431E+22
Xe-135	2.3586E+03	9.2359E-07	4.1200E+18	4.2027E+21
Cs-134	4.5891E+04	3.5469E-02	1.5940E+23	1.6697E+21
Cs-136	1.0559E+04	1.4406E-04	6.3792E+20	4.4781E+20
Cs-137	2.6704E+04	3.0701E-01	1.3495E+24	9.6918E+20

Containment Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump	
Noble gases (atoms)	4.5145E+23	0.0000E+00	
Elemental I (atoms)	2.3725E+21	0.0000E+00	
Organic I (atoms)	7.3375E+19	0.0000E+00	
Aerosols (kg)	3.4320E-01	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.7021E-06
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.7222E-06
Total I (Ci)			1.5077E+05

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
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)	5.7947E+00	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 96.0000	Leakage Transport
Noble gases (atoms)	2.3787E+21
Elemental I (atoms)	1.6016E+19
Organic I (atoms)	4.9535E+17
Aerosols (kg)	6.3606E-03

Exclusion Area Boundary (EAB) Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1210E-03	1.0119E+00	4.4695E-02
Accumulated dose (rem)	1.2504E-01	3.6997E+01	1.9828E+00

Control Room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.4295E-04	6.0598E-01	2.5447E-02
Accumulated dose (rem)	2.6154E-02	5.0288E+01	2.5486E+00

Containment Compartment Nuclide Inventory:

Time (h) = 720.0000	Ci	kg	Atoms	Decay
Kr-85	2.0952E+04	5.3403E-02	3.7835E+23	2.0453E+21
Rb-86	3.5065E-01	4.3095E-09	3.0177E+16	2.5163E+19
I-131	6.7588E+03	5.4517E-05	2.5062E+20	7.0733E+21
I-133	7.0602E-06	6.2325E-15	2.8220E+10	4.9469E+21
Xe-133	7.9620E+04	4.2536E-04	1.9260E+21	1.0145E+23
Cs-134	8.5124E+01	6.5792E-05	2.9568E+20	2.2720E+21
Cs-136	5.0682E+00	6.9151E-08	3.0620E+17	5.6203E+20
Cs-137	5.0650E+01	5.8230E-04	2.5596E+21	1.3209E+21

Containment Transport Group Inventory:

Time (h) = 720.0000	Atmosphere	Sump	
Noble gases (atoms)	3.8028E+23	0.0000E+00	
Elemental I (atoms)	2.4259E+20	0.0000E+00	
Organic I (atoms)	7.5029E+18	0.0000E+00	
Aerosols (kg)	6.4828E-04	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		8.3748E-08
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		8.3748E-08
Total I (Ci)			6.7588E+03

Time (h) = 720.0000	Deposition Surfaces	Recirculating Filter
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)	6.1354E+00	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 720.0000	Leakage Transport
Noble gases (atoms)	1.2816E+22
Elemental I (atoms)	4.0174E+19
Organic I (atoms)	1.2425E+18
Aerosols (kg)	7.7803E-03

##
I-131 Summary
##

Time (hr)	Primary Loop - Reacto I-131 (Curies)	Secondary Loop - Stea I-131 (Curies)	Containment I-131 (Curies)
0.000	0.0000E+00	0.0000E+00	1.6611E+06
0.000	0.0000E+00	0.0000E+00	1.8480E+06
0.056	0.0000E+00	0.0000E+00	1.8447E+06
0.356	0.0000E+00	0.0000E+00	1.8269E+06
0.500	0.0000E+00	0.0000E+00	1.8184E+06
0.900	0.0000E+00	0.0000E+00	1.7737E+06
1.111	0.0000E+00	0.0000E+00	1.7508E+06
1.511	0.0000E+00	0.0000E+00	1.7089E+06
1.811	0.0000E+00	0.0000E+00	1.6736E+06
2.000	0.0000E+00	0.0000E+00	1.6457E+06
2.300	0.0000E+00	0.0000E+00	1.6025E+06
2.600	0.0000E+00	0.0000E+00	1.5605E+06
2.900	0.0000E+00	0.0000E+00	1.5197E+06
3.200	0.0000E+00	0.0000E+00	1.4800E+06
3.500	0.0000E+00	0.0000E+00	1.4413E+06
3.800	0.0000E+00	0.0000E+00	1.4038E+06
4.100	0.0000E+00	0.0000E+00	1.3566E+06
4.400	0.0000E+00	0.0000E+00	1.3110E+06
4.700	0.0000E+00	0.0000E+00	1.2671E+06
5.000	0.0000E+00	0.0000E+00	1.2248E+06
5.300	0.0000E+00	0.0000E+00	1.1839E+06
5.600	0.0000E+00	0.0000E+00	1.1446E+06
5.900	0.0000E+00	0.0000E+00	1.1066E+06
6.200	0.0000E+00	0.0000E+00	1.0700E+06
6.500	0.0000E+00	0.0000E+00	1.0347E+06
6.800	0.0000E+00	0.0000E+00	1.0007E+06
7.100	0.0000E+00	0.0000E+00	9.6792E+05
7.400	0.0000E+00	0.0000E+00	9.3629E+05
7.700	0.0000E+00	0.0000E+00	9.0580E+05
8.000	0.0000E+00	0.0000E+00	8.7640E+05
8.300	0.0000E+00	0.0000E+00	8.4805E+05
8.600	0.0000E+00	0.0000E+00	8.2071E+05
8.900	0.0000E+00	0.0000E+00	7.9436E+05
9.200	0.0000E+00	0.0000E+00	7.6894E+05
9.500	0.0000E+00	0.0000E+00	7.4444E+05
9.800	0.0000E+00	0.0000E+00	7.2081E+05
10.100	0.0000E+00	0.0000E+00	6.9803E+05
10.400	0.0000E+00	0.0000E+00	6.7606E+05
24.000	0.0000E+00	0.0000E+00	2.7027E+05
96.000	0.0000E+00	0.0000E+00	1.3469E+05
720.000	0.0000E+00	0.0000E+00	6.7588E+03

Time (hr)	Control Room I-131 (Curies)	Environment I-131 (Curies)
0.000	4.1953E-06	6.9214E-04
0.000	1.3058E-05	2.1543E-03
0.056	4.8761E-02	8.5529E+00
0.356	2.2767E-01	5.4439E+01
0.500	2.7862E-01	7.6369E+01
0.900	8.3008E-03	1.3622E+02
1.111	6.3957E-03	1.6722E+02
1.511	6.1012E-03	2.2486E+02
1.811	5.9851E-03	2.6717E+02
2.000	5.8902E-03	2.9330E+02
2.300	4.1596E-03	3.3389E+02

2.600	4.0127E-03	3.7342E+02
2.900	3.9078E-03	4.1191E+02
3.200	3.8068E-03	4.4940E+02
3.500	3.7086E-03	4.8590E+02
3.800	3.6131E-03	5.2146E+02
4.100	3.5002E-03	5.5595E+02
4.400	3.3843E-03	5.8929E+02
4.700	3.2724E-03	6.2151E+02
5.000	3.1644E-03	6.5265E+02
5.300	3.0604E-03	6.8275E+02
5.600	2.9600E-03	7.1184E+02
5.900	2.8633E-03	7.3998E+02
6.200	2.7700E-03	7.6718E+02
6.500	2.6800E-03	7.9348E+02
6.800	2.5933E-03	8.1891E+02
7.100	2.5097E-03	8.4352E+02
7.400	2.4290E-03	8.6731E+02
7.700	2.3513E-03	8.9033E+02
8.000	2.2763E-03	9.1260E+02
8.300	9.6518E-04	9.3415E+02
8.600	9.0457E-04	9.5501E+02
8.900	8.7535E-04	9.7519E+02
9.200	8.4789E-04	9.9472E+02
9.500	8.2144E-04	1.0136E+03
9.800	7.9592E-04	1.0319E+03
10.100	7.7132E-04	1.0497E+03
10.400	7.4760E-04	1.0668E+03
24.000	3.0712E-04	1.5250E+03
96.000	5.3256E-05	2.1021E+03
720.000	2.0616E-06	2.9825E+03

##

Cumulative Dose Summary

##

	Exclusion Area Bounda		Low Population Zone (		Control Room	
Time (hr)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.000	6.2754E-04	3.5889E-05	1.0912E-04	6.2404E-06	3.7055E-08	1.9128E-09
0.056	2.4900E+00	1.4046E-01	4.3297E-01	2.4423E-02	4.6799E-01	2.3688E-02
0.356	1.5822E+01	8.8844E-01	2.7512E+00	1.5448E-01	1.5678E+01	7.9358E-01
0.500	2.2173E+01	1.2422E+00	3.8555E+00	2.1599E-01	2.8275E+01	1.4313E+00
0.900	3.9449E+01	2.1977E+00	6.8594E+00	3.8213E-01	3.7592E+01	1.9046E+00
1.111	4.8360E+01	2.6871E+00	8.4088E+00	4.6723E-01	3.8101E+01	1.9311E+00
1.511	6.4871E+01	3.5890E+00	1.1280E+01	6.2405E-01	3.8944E+01	1.9748E+00
1.811	7.6939E+01	4.2446E+00	1.3378E+01	7.3806E-01	3.9557E+01	2.0066E+00
2.000	8.4367E+01	4.6470E+00	1.4670E+01	8.0802E-01	3.9936E+01	2.0262E+00
2.300	8.4367E+01	4.6470E+00	1.5636E+01	8.6023E-01	4.0406E+01	2.0507E+00
2.600	8.4367E+01	4.6470E+00	1.6574E+01	9.1075E-01	4.0816E+01	2.0719E+00
2.900	8.4367E+01	4.6470E+00	1.7485E+01	9.5968E-01	4.1213E+01	2.0925E+00
3.200	8.4367E+01	4.6470E+00	1.8368E+01	1.0071E+00	4.1598E+01	2.1124E+00
3.500	8.4367E+01	4.6470E+00	1.9226E+01	1.0530E+00	4.1972E+01	2.1317E+00
3.800	8.4367E+01	4.6470E+00	2.0059E+01	1.0975E+00	4.2335E+01	2.1505E+00
4.100	8.4367E+01	4.6470E+00	2.0865E+01	1.1405E+00	4.2687E+01	2.1687E+00
4.400	8.4367E+01	4.6470E+00	2.1641E+01	1.1819E+00	4.3027E+01	2.1862E+00
4.700	8.4367E+01	4.6470E+00	2.2389E+01	1.2217E+00	4.3354E+01	2.2031E+00
5.000	8.4367E+01	4.6470E+00	2.3110E+01	1.2601E+00	4.3669E+01	2.2193E+00

5.300	8.4367E+01	4.6470E+00	2.3804E+01	1.2970E+00	4.3974E+01	2.2350E+00
5.600	8.4367E+01	4.6470E+00	2.4474E+01	1.3326E+00	4.4267E+01	2.2501E+00
5.900	8.4367E+01	4.6470E+00	2.5120E+01	1.3668E+00	4.4550E+01	2.2647E+00
6.200	8.4367E+01	4.6470E+00	2.5742E+01	1.3998E+00	4.4823E+01	2.2788E+00
6.500	8.4367E+01	4.6470E+00	2.6343E+01	1.4316E+00	4.5087E+01	2.2923E+00
6.800	8.4367E+01	4.6470E+00	2.6922E+01	1.4623E+00	4.5341E+01	2.3054E+00
7.100	8.4367E+01	4.6470E+00	2.7480E+01	1.4918E+00	4.5586E+01	2.3180E+00
7.400	8.4367E+01	4.6470E+00	2.8019E+01	1.5203E+00	4.5823E+01	2.3302E+00
7.700	8.4367E+01	4.6470E+00	2.8539E+01	1.5477E+00	4.6052E+01	2.3420E+00
8.000	8.4367E+01	4.6470E+00	2.9041E+01	1.5742E+00	4.6273E+01	2.3533E+00
8.300	8.4367E+01	4.6470E+00	2.9213E+01	1.5836E+00	4.6400E+01	2.3599E+00
8.600	8.4367E+01	4.6470E+00	2.9380E+01	1.5927E+00	4.6488E+01	2.3644E+00
8.900	8.4367E+01	4.6470E+00	2.9541E+01	1.6015E+00	4.6572E+01	2.3687E+00
9.200	8.4367E+01	4.6470E+00	2.9697E+01	1.6099E+00	4.6653E+01	2.3729E+00
9.500	8.4367E+01	4.6470E+00	2.9847E+01	1.6180E+00	4.6732E+01	2.3769E+00
9.800	8.4367E+01	4.6470E+00	2.9992E+01	1.6259E+00	4.6808E+01	2.3808E+00
10.100	8.4367E+01	4.6470E+00	3.0132E+01	1.6335E+00	4.6882E+01	2.3846E+00
10.400	8.4367E+01	4.6470E+00	3.0267E+01	1.6408E+00	4.6953E+01	2.3882E+00
24.000	8.4367E+01	4.6470E+00	3.3754E+01	1.8240E+00	4.8810E+01	2.4805E+00
96.000	8.4367E+01	4.6470E+00	3.5985E+01	1.9381E+00	4.9682E+01	2.5232E+00
720.000	8.4367E+01	4.6470E+00	3.6997E+01	1.9828E+00	5.0288E+01	2.5486E+00

##
Worst Two-Hour Doses
##

Exclusion Area Boundary (EAB)

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	3.9495E-01	8.4367E+01	4.6470E+00

```
 ##########################################################################
    RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:15:32
 ##########################################################################

 ##########################################################################
                      File information
 ##########################################################################

 Plant file           = C:\Documents and Settings\Aleem Boatright\My
Documents\My Work\Exelon\Byron & Braidwood\CREA\RADTRAD\Rev 1\B-B CREA Case 2
- Large CR Volume 1000cfm Inleak - 95 percent Intake Filt.psf
 Inventory file       = c:\program files\radtrad3-03\defaults\byron-braidwood
ast source terms.nif
 Release file         = C:\Program Files\radtrad3-03\Defaults\Byron-Braidwood
CREA-Release Fractions (Rev 1).rft
 Dose Conversion file = c:\program files\radtrad3-03\defaults\fgr11&12.inp



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


 Radtrad 3.03 4/15/2001
 Byron/Braidwood CREA - Case 2 - Secondary Loop Leakage - Control Room @
200,000 cu. ft. CR Volume with 8575cfm Intake - 1000cfm Unfilt Inleakage -
95% CR Intake Fiters - 80% Aerosol, 90% Elemental & Organic Recirc Filtration
 Nuclide Inventory File:
 c:\program files\radtrad3-03\defaults\byron-braidwood ast source terms.nif
 Plant Power Level:
  3.6583E+03
 Compartments:
   8
 Compartment 1:
 Primary Loop 1 - Reactor Coolant System (RCS)
   3
  7.2850E+03
   0
   0
   0
   0
   0
 Compartment 2:
 Primary Loop 2 - Reactor Coolant System (RCS)
   3
  7.2850E+03
   0
   0
   0
   0
```

```
  0
Compartment 3:
Primary Loop 3 - Reactor Coolant System (RCS)
  3
 7.2850E+03
  0
  0
  0
  0
  0
Compartment 4:
Secondary Loop 1 - Steam Generator Volume (4 SGs)
  3
 4.7890E+03
  0
  0
  0
  0
  0
Compartment 5:
Secondary Loop 2 - Steam Generator Volumes (4 SGs)
  3
 4.7890E+03
  0
  0
  0
  0
  0
Compartment 6:
Secondary Loop 3 - Steam Generator Volumes (4 SGs)
  3
 4.7890E+03
  0
  0
  0
  0
  0
Compartment 7:
Control Room
  1
 2.0000E+05
  0
  0
  1
  0
  0
Compartment 8:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Pathways:
  9
Pathway 1:
```

```
 (Iodine Activity Leakage Path) Primary Loop 1 - Reactor Coolant System (RCS)
to Secondary Loop 1 - Steam Generator Volume (4 SGs)
   1
   4
   2
 Pathway 2:
 (Noble Gas Activity Leakage Path) Primary Loop 2 - Reactor Coolant System
(RCS) to Secondary Loop 2 - Steam Generator Volumes (4 SGs)
   2
   5
   2
 Pathway 3:
 (Fission Product Activity Leakage Path) Primary Loop 3 - Reactor Coolant
System (RCS) to Secondary Loop 3 - Steam Generator Volumes (4 SGs)
   3
   6
   2
 Pathway 4:
 (Iodine Activity Release Path) Secondary Loop 1 - Steam Generator Volume (4
SGs) to Environment
   4
   8
   2
 Pathway 5:
 (Noble Gas Activity Release Path) Secondary Loop 2 - Steam Generator Volumes
(4 SGs) to Environment
   5
   8
   2
 Pathway 6:
 (Fission Product Activity Release Path) Secondary Loop 3 - Steam Generator
Volumes (4 SGs) to Environment
   6
   8
   2
 Pathway 7:
 (Filtered Intake) Environment to Control Room
   8
   7
   2
 Pathway 8:
 (Unfiltered Inleakage) Environment to Control Room
   8
   7
   2
 Pathway 9:
 (Control Room Exhaust) Control Room to Environment
   7
   8
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   3
   1   1.0000E+00
```

```
   2   1.0000E+00
   3   1.0000E+00
 c:\program files\radtrad3-03\defaults\fgr11&12.inp
 C:\Program Files\radtrad3-03\Defaults\Byron-Braidwood CREA-Release Fractions
(Rev 1).rft
   0.0000E+00
   1
   0.0000E+00   1.0000E+00   0.0000E+00   1.0000E+00
 Overlying Pool:
   0
   0.0000E+00
   0
   0
   0
   0
 Compartments:
   8
 Compartment 1:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 2:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 3:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 4:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 5:
```

```
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 6:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 7:
  0
  1
  0
  0
  0
  0
  1
  3.9150E+04
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   8.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Compartment 8:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Pathways:
  9
Pathway 1:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.3370E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+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
  3
  0.0000E+00   1.3370E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.3370E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   2.8830E+01   1.0000E+02   0.0000E+00   1.0000E+02
  5.5600E-02   4.8060E+00   1.0000E+02   0.0000E+00   1.0000E+02
  1.1111E+00   0.0000E+00   1.0000E+02   0.0000E+00   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
```

```
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   2.8830E+03   1.0000E+02   1.0000E+02   1.0000E+02
  5.5600E-02   4.8060E+02   1.0000E+02   1.0000E+02   1.0000E+02
  1.1111E+00   0.0000E+00   1.0000E+02   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   1.5860E+01   0.0000E+00   1.0000E+02   1.0000E+02
  5.5600E-02   2.6430E+00   0.0000E+00   1.0000E+02   1.0000E+02
  1.1111E+00   0.0000E+00   0.0000E+00   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   6.4240E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   8.5750E+03   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
  0
  0
  0
  0
  0
```

```
  1
  3
  0.0000E+00   1.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   1.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 9:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   7.4240E+03   1.0000E+02   1.0000E+02   1.0000E+02
  5.0000E-01   9.5750E+03   1.0000E+02   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary (EAB)
  8
  1
  3
  0.0000E+00   5.3600E-04
  5.0000E-01   5.3600E-04
  2.0000E+00   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone (LPZ)
  8
  1
  7
  0.0000E+00   9.3200E-05
  5.0000E-01   9.3200E-05
  2.0000E+00   4.5000E-05
  8.0000E+00   3.1200E-05
  2.4000E+01   1.4100E-05
  9.6000E+01   4.5400E-06
  7.2000E+02   0.0000E+00
  1
```

```
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
 Location 3:
 Control Room
  7
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
 Effective Volume Location:
  1
  7
  0.0000E+00   1.7700E-03
  5.0000E-01   8.1400E-04
  2.0000E+00   6.9800E-04
  8.0000E+00   3.1200E-04
  2.4000E+01   1.9500E-04
  9.6000E+01   1.6700E-04
  7.2000E+02   0.0000E+00
 Simulation Parameters:
  1
  0.0000E+00   0.0000E+00
 Output Filename:
 C:\Documents and Settings\Aleem Boatright\My Documents\My Work\Exelon\Byron
& Braidwood\CREA\RADTRAD\Rev 1\B-B CREA Case 2 - Large CR Volume 1000cfm
Inleak - 95 percent Intake Filt.o0
  1
  1
  1
  0
  0
 End of Scenario File
```

```
 ##########################################################################
    RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:15:32
 ##########################################################################

 ##########################################################################
                      Plant Description
 ##########################################################################

 Number of Nuclides =  60

 Inventory Power =   1.0000E+00 MWth
 Plant Power Level =   3.6583E+03 MWth

 Number of compartments    =   8

 Compartment information

 Compartment number  1  (Source term fraction =   1.0000E+00
 )
 Name: Primary Loop 1 - Reactor Coolant System
 Compartment volume =   7.2850E+03 (Cubic feet)
 Compartment type is Normal
 Pathways into and out of compartment  1
    Exit Pathway Number    1: (Iodine Activity Leakage Path) Primary Loop 1 -
Re

 Compartment number  2  (Source term fraction =   1.0000E+00
 )
 Name: Primary Loop 2 - Reactor Coolant System
 Compartment volume =   7.2850E+03 (Cubic feet)
 Compartment type is Normal
 Pathways into and out of compartment  2
    Exit Pathway Number    2: (Noble Gas Activity Leakage Path) Primary Loop
2 -

 Compartment number  3  (Source term fraction =   1.0000E+00
 )
 Name: Primary Loop 3 - Reactor Coolant System
 Compartment volume =   7.2850E+03 (Cubic feet)
 Compartment type is Normal
 Pathways into and out of compartment  3
    Exit Pathway Number    3: (Fission Product Activity Leakage Path) Primary
Lo

 Compartment number  4
 Name: Secondary Loop 1 - Steam Generator Volum
 Compartment volume =   4.7890E+03 (Cubic feet)
 Compartment type is Normal
 Pathways into and out of compartment  4
    Inlet Pathway Number   1: (Iodine Activity Leakage Path) Primary Loop 1 -
Re
    Exit Pathway Number    4: (Iodine Activity Release Path) Secondary Loop 1
-

 Compartment number  5
 Name: Secondary Loop 2 - Steam Generator Volum
 Compartment volume =   4.7890E+03 (Cubic feet)
```

```
 Compartment type is Normal
 Pathways into and out of compartment  5
    Inlet Pathway Number   2: (Noble Gas Activity Leakage Path) Primary Loop
2 -
    Exit Pathway Number    5: (Noble Gas Activity Release Path) Secondary
Loop 2

 Compartment number  6
 Name: Secondary Loop 3 - Steam Generator Volum
 Compartment volume =   4.7890E+03 (Cubic feet)
 Compartment type is Normal
 Pathways into and out of compartment  6
    Inlet Pathway Number   3: (Fission Product Activity Leakage Path) Primary
Lo
    Exit Pathway Number    6: (Fission Product Activity Release Path)
Secondary

 Compartment number  7
 Name: Control Room
 Compartment volume =   2.0000E+05 (Cubic feet)
 Compartment type is Control Room
 Removal devices within compartment:
      Filter(s)
 Pathways into and out of compartment  7
    Inlet Pathway Number   7: (Filtered Intake) Environment to Control Room
    Inlet Pathway Number   8: (Unfiltered Inleakage) Environment to Control
Room
    Exit Pathway Number    9: (Control Room Exhaust) Control Room to
Environment

 Compartment number  8
 Name: Environment
 Compartment type is Environment
 Pathways into and out of compartment  8
    Inlet Pathway Number   4: (Iodine Activity Release Path) Secondary Loop 1
-
    Inlet Pathway Number   5: (Noble Gas Activity Release Path) Secondary
Loop 2
    Inlet Pathway Number   6: (Fission Product Activity Release Path)
Secondary
    Inlet Pathway Number   9: (Control Room Exhaust) Control Room to
Environment
    Exit Pathway Number    7: (Filtered Intake) Environment to Control Room
    Exit Pathway Number    8: (Unfiltered Inleakage) Environment to Control
Room

 Total number of pathways =   9
```

```
##########################################################################
   RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:15:32
##########################################################################

##########################################################################
                     Scenario Description
##########################################################################

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings
                GAP          EARLY IN-VESSEL   LATE RELEASE     RELEASE MASS
             0.000010 hr       0.0000 hrs       0.0000 hrs          (gm)
NOBLES       1.7000E-02        3.8250E-03       0.0000E+00        7.805E+01
IODINE       1.7000E-02        1.9125E-03       0.0000E+00        1.972E+01
CESIUM       4.0800E-02        1.6150E-03       0.0000E+00        6.129E+03
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 =      3658. MWt

Nuclide  Group  Specific      half      Whole Body   Inhaled     Inhaled
 Name           Inventory     life        DCF       Thyroid     Effective
                (Ci/MWt)      (s)     (Sv-m3/Bq-s)  (Sv/Bq)     (Sv/Bq)
 Kr-85     1   2.851E+02  3.383E+08   1.190E-16   0.000E+00   0.000E+00
 Kr-85m    1   8.592E+03  1.613E+04   7.480E-15   0.000E+00   0.000E+00
 Kr-87     1   1.696E+04  4.578E+03   4.120E-14   0.000E+00   0.000E+00
 Kr-88     1   2.392E+04  1.022E+04   1.020E-13   0.000E+00   0.000E+00
 Rb-86     3   6.480E+01  1.612E+06   4.810E-15   1.330E-09   1.790E-09
 I-131     2   2.671E+04  6.947E+05   1.820E-14   2.920E-07   8.890E-09
 I-132     2   3.863E+04  8.280E+03   1.120E-13   1.740E-09   1.030E-10
 I-133     2   5.529E+04  7.488E+04   2.940E-14   4.860E-08   1.580E-09
 I-134     2   6.143E+04  3.156E+03   1.300E-13   2.880E-10   3.550E-11
 I-135     2   5.159E+04  2.380E+04   8.294E-14   8.460E-09   3.320E-10
 Xe-133    1   5.396E+04  4.532E+05   1.560E-15   0.000E+00   0.000E+00
 Xe-135    1   1.532E+04  3.272E+04   1.190E-14   0.000E+00   0.000E+00
 Cs-134    3   5.306E+03  6.507E+07   7.570E-14   1.110E-08   1.250E-08
 Cs-136    3   1.503E+03  1.132E+06   1.060E-13   1.730E-09   1.980E-09
 Cs-137    3   3.077E+03  9.467E+08   2.725E-14   7.930E-09   8.630E-09

Nuclide    Daughter  Fraction   Daughter  Fraction   Daughter  Fraction
 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
 Sr-90     Y-90        1.00       none      0.00       none      0.00
 Sr-91     Y-91m       0.58       Y-91      0.42       none      0.00
 Sr-92     Y-92        1.00       none      0.00       none      0.00
 Y-93      Zr-93       1.00       none      0.00       none      0.00
 Zr-95     Nb-95m      0.01       Nb-95     0.99       none      0.00
 Zr-97     Nb-97m      0.95       Nb-97     0.05       none      0.00
 Mo-99     Tc-99m      0.88       Tc-99     0.12       none      0.00
 Tc-99m    Tc-99       1.00       none      0.00       none      0.00
```

Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00
Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol	=	0.0000E+00
Elemental	=	1.0000E+00
Organic	=	0.0000E+00

COMPARTMENT DATA

Compartment number 1: Primary Loop 1 - Reactor Coolant System

Compartment number 2: Primary Loop 2 - Reactor Coolant System

Compartment number 3: Primary Loop 3 - Reactor Coolant System

Compartment number 4: Secondary Loop 1 - Steam Generator Volum

Compartment number 5: Secondary Loop 2 - Steam Generator Volum

Compartment number 6: Secondary Loop 3 - Steam Generator Volum

Compartment number 7: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.9150E+04	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	3.9150E+04	8.0000E+01	9.0000E+01	9.0000E+01
7.2000E+02	3.9150E+04	0.0000E+00	0.0000E+00	0.0000E+00

Compartment number 8: Environment

PATHWAY DATA

Pathway number 1: (Iodine Activity Leakage Path) Primary Loop 1 - Re

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.3370E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: (Noble Gas Activity Leakage Path) Primary Loop 2 -

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.3370E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: (Fission Product Activity Leakage Path) Primary Lo

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.3370E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: (Iodine Activity Release Path) Secondary Loop 1 -

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.8830E+01	1.0000E+02	0.0000E+00	1.0000E+02
5.5600E-02	4.8060E+00	1.0000E+02	0.0000E+00	1.0000E+02
1.1111E+00	0.0000E+00	1.0000E+02	0.0000E+00	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: (Noble Gas Activity Release Path) Secondary Loop 2

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.8830E+03	1.0000E+02	1.0000E+02	1.0000E+02
5.5600E-02	4.8060E+02	1.0000E+02	1.0000E+02	1.0000E+02
1.1111E+00	0.0000E+00	1.0000E+02	1.0000E+02	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 6: (Fission Product Activity Release Path) Secondary

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.5860E+01	0.0000E+00	1.0000E+02	1.0000E+02
5.5600E-02	2.6430E+00	0.0000E+00	1.0000E+02	1.0000E+02
1.1111E+00	0.0000E+00	0.0000E+00	1.0000E+02	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 7: (Filtered Intake) Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	6.4240E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	8.5750E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 8: (Unfiltered Inleakage) Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	1.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 9: (Control Room Exhaust) Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	7.4240E+03	1.0000E+02	1.0000E+02	1.0000E+02
5.0000E-01	9.5750E+03	1.0000E+02	1.0000E+02	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary (EAB) is in compartment 8

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	5.3600E-04
5.0000E-01	5.3600E-04
2.0000E+00	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
8.0000E+00	1.8000E-04
2.4000E+01	2.3000E-04
7.2000E+02	0.0000E+00

Location Low Population Zone (LPZ) is in compartment 8

Location X/Q Data

Time (hr)	X/Q (s * m^-3)

0.0000E+00	9.3200E-05
5.0000E-01	9.3200E-05
2.0000E+00	4.5000E-05
8.0000E+00	3.1200E-05
2.4000E+01	1.4100E-05
9.6000E+01	4.5400E-06
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
8.0000E+00	1.8000E-04
2.4000E+01	2.3000E-04
7.2000E+02	0.0000E+00

Location Control Room is in compartment 7

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	1.7700E-03
5.0000E-01	8.1400E-04
2.0000E+00	6.9800E-04
8.0000E+00	3.1200E-04
2.4000E+01	1.9500E-04
9.6000E+01	1.6700E-04
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
7.2000E+02	0.0000E+00

Location Occupancy Factor Data

Time (hr)	Occupancy Factor
0.0000E+00	1.0000E+00
2.4000E+01	6.0000E-01
9.6000E+01	4.0000E-01
7.2000E+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 11/17/2004  at  7:15:32
##########################################################################
```

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

```
##########################################################################
                              Dose Output
##########################################################################
```

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.0402E-10	3.1825E-09	4.3989E-10
Accumulated dose (rem)	3.0402E-10	3.1825E-09	4.3989E-10

Low Population Zone (LPZ) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.2863E-11	5.5338E-10	7.6489E-11
Accumulated dose (rem)	5.2863E-11	5.5338E-10	7.6489E-11

Control Room Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.9002E-16	1.1703E-13	5.5866E-15
Accumulated dose (rem)	5.9002E-16	1.1703E-13	5.5866E-15

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.8905E-09	1.9451E-08	2.7183E-09
Accumulated dose (rem)	2.1945E-09	2.2633E-08	3.1582E-09

Low Population Zone (LPZ) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.2872E-10	3.3821E-09	4.7267E-10
Accumulated dose (rem)	3.8158E-10	3.9355E-09	5.4916E-10

Control Room Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.8489E-15	9.4933E-13	4.5286E-14
Accumulated dose (rem)	5.4389E-15	1.0664E-12	5.0872E-14

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0384E-02	3.2588E-01	3.4073E-02
Accumulated dose (rem)	2.0384E-02	3.2588E-01	3.4073E-02

Low Population Zone (LPZ) Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.5444E-03	5.6664E-02	5.9246E-03
Accumulated dose (rem)	3.5444E-03	5.6664E-02	5.9246E-03

Control Room Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0997E-04	6.3936E-02	2.8957E-03
Accumulated dose (rem)	2.0997E-04	6.3936E-02	2.8957E-03

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9286E-01	4.2954E+00	3.7337E-01
Accumulated dose (rem)	2.1325E-01	4.6213E+00	4.0745E-01

Low Population Zone (LPZ) Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.3535E-02	7.4688E-01	6.4922E-02
Accumulated dose (rem)	3.7079E-02	8.0355E-01	7.0847E-02

Control Room Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2394E-02	4.7135E+00	2.1044E-01
Accumulated dose (rem)	1.2604E-02	4.7775E+00	2.1333E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.6763E-01	1.6742E+01	1.0725E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.3924E-02	2.9111E+00	1.8649E-01
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5582E-02	2.6710E+00	1.3812E-01
Accumulated dose (rem)	3.8186E-02	7.4485E+00	3.5145E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00

Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1338E-02	1.4426E-01	1.7252E-02
Accumulated dose (rem)	4.9524E-02	7.5928E+00	3.6870E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.4826E-04	9.3455E-07	7.4832E-04
Accumulated dose (rem)	5.0272E-02	7.5928E+00	3.6945E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.9514E-12	2.5829E-40	6.9514E-12
Accumulated dose (rem)	5.0272E-02	7.5928E+00	3.6945E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.5661E-32	4.6032-125	1.5661E-32
Accumulated dose (rem)	5.0272E-02	7.5928E+00	3.6945E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.7950-123	0.0000E+00	6.7950-123
Accumulated dose (rem)	5.0272E-02	7.5928E+00	3.6945E-01

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##
I-131 Summary
##

Time (hr)	Primary Loop 1 - Reac I-131 (Curies)	Primary Loop 2 - Reac I-131 (Curies)	Primary Loop 3 - Reac I-131 (Curies)
0.000	1.6611E+06	1.6611E+06	1.6611E+06
0.000	1.8480E+06	1.8480E+06	1.8480E+06
0.056	1.8475E+06	1.8475E+06	1.8475E+06
0.356	1.8449E+06	1.8449E+06	1.8449E+06
0.500	1.8437E+06	1.8437E+06	1.8437E+06
0.900	1.8402E+06	1.8402E+06	1.8402E+06
1.111	1.8384E+06	1.8384E+06	1.8384E+06
1.511	1.8357E+06	1.8357E+06	1.8357E+06
1.811	1.8338E+06	1.8338E+06	1.8338E+06
2.000	1.8325E+06	1.8325E+06	1.8325E+06
2.300	1.8306E+06	1.8306E+06	1.8306E+06
2.600	1.8286E+06	1.8286E+06	1.8286E+06
2.900	1.8266E+06	1.8266E+06	1.8266E+06
3.200	1.8246E+06	1.8246E+06	1.8246E+06
3.500	1.8227E+06	1.8227E+06	1.8227E+06
3.800	1.8207E+06	1.8207E+06	1.8207E+06
4.100	1.8188E+06	1.8188E+06	1.8188E+06
4.400	1.8168E+06	1.8168E+06	1.8168E+06
4.700	1.8148E+06	1.8148E+06	1.8148E+06
5.000	1.8129E+06	1.8129E+06	1.8129E+06
5.300	1.8109E+06	1.8109E+06	1.8109E+06
5.600	1.8090E+06	1.8090E+06	1.8090E+06

5.900	1.8070E+06	1.8070E+06	1.8070E+06
6.200	1.8051E+06	1.8051E+06	1.8051E+06
6.500	1.8031E+06	1.8031E+06	1.8031E+06
6.800	1.8012E+06	1.8012E+06	1.8012E+06
7.100	1.7993E+06	1.7993E+06	1.7993E+06
7.400	1.7973E+06	1.7973E+06	1.7973E+06
7.700	1.7954E+06	1.7954E+06	1.7954E+06
8.000	1.7935E+06	1.7935E+06	1.7935E+06
8.300	1.7915E+06	1.7915E+06	1.7915E+06
8.600	1.7896E+06	1.7896E+06	1.7896E+06
8.900	1.7877E+06	1.7877E+06	1.7877E+06
9.200	1.7857E+06	1.7857E+06	1.7857E+06
9.500	1.7838E+06	1.7838E+06	1.7838E+06
9.800	1.7819E+06	1.7819E+06	1.7819E+06
10.100	1.7800E+06	1.7800E+06	1.7800E+06
10.400	1.7781E+06	1.7781E+06	1.7781E+06
24.000	1.6933E+06	1.6933E+06	1.6933E+06
96.000	1.3074E+06	1.3074E+06	1.3074E+06
720.000	1.3897E+05	1.3897E+05	1.3897E+05

Time (hr)	Secondary Loop 1 - St I-131 (Curies)	Secondary Loop 2 - St I-131 (Curies)	Secondary Loop 3 - St I-131 (Curies)
0.000	9.1459E-03	9.1448E-03	9.1459E-03
0.000	2.8466E-02	2.8459E-02	2.8466E-02
0.056	1.1198E+02	4.8763E+01	1.1248E+02
0.356	7.1395E+02	2.9001E+02	7.1780E+02
0.500	9.9931E+02	3.1735E+02	1.0065E+03
0.900	1.7752E+03	3.3481E+02	1.7972E+03
1.111	2.1761E+03	3.3576E+02	2.2092E+03
1.511	2.1730E+03	3.3528E+02	2.2061E+03
1.811	2.1707E+03	3.3492E+02	2.2037E+03
2.000	2.1692E+03	3.3469E+02	2.2022E+03
2.300	2.1668E+03	3.3433E+02	2.1998E+03
2.600	2.1645E+03	3.3397E+02	2.1975E+03
2.900	2.1622E+03	3.3361E+02	2.1951E+03
3.200	2.1598E+03	3.3325E+02	2.1927E+03
3.500	2.1575E+03	3.3289E+02	2.1904E+03
3.800	2.1552E+03	3.3254E+02	2.1880E+03
4.100	2.1529E+03	3.3218E+02	2.1856E+03
4.400	2.1506E+03	3.3182E+02	2.1833E+03
4.700	2.1482E+03	3.3146E+02	2.1809E+03
5.000	2.1459E+03	3.3111E+02	2.1786E+03
5.300	2.1436E+03	3.3075E+02	2.1762E+03
5.600	2.1413E+03	3.3039E+02	2.1739E+03
5.900	2.1390E+03	3.3004E+02	2.1716E+03
6.200	2.1367E+03	3.2968E+02	2.1692E+03
6.500	2.1344E+03	3.2933E+02	2.1669E+03
6.800	2.1321E+03	3.2897E+02	2.1645E+03
7.100	2.1298E+03	3.2862E+02	2.1622E+03
7.400	2.1275E+03	3.2826E+02	2.1599E+03
7.700	2.1252E+03	3.2791E+02	2.1576E+03
8.000	2.1229E+03	3.2756E+02	2.1552E+03
8.300	2.1206E+03	3.2720E+02	2.1529E+03
8.600	2.1184E+03	3.2685E+02	2.1506E+03
8.900	2.1161E+03	3.2650E+02	2.1483E+03
9.200	2.1138E+03	3.2615E+02	2.1460E+03
9.500	2.1115E+03	3.2580E+02	2.1437E+03
9.800	2.1092E+03	3.2545E+02	2.1413E+03

10.100	2.1070E+03	3.2509E+02	2.1390E+03
10.400	2.1047E+03	3.2474E+02	2.1367E+03
24.000	2.0044E+03	3.0926E+02	2.0349E+03
96.000	1.5476E+03	2.3878E+02	1.5711E+03
720.000	1.6450E+02	2.5382E+01	1.6701E+02

Time (hr)	Control Room I-131 (Curies)	Environment I-131 (Curies)
0.000	6.8290E-11	1.1012E-08
0.000	4.8571E-10	7.8321E-08
0.056	6.7153E-03	1.1281E+00
0.356	3.9971E-02	8.6052E+00
0.500	6.8817E-02	1.6054E+01
0.900	4.3195E-03	4.9503E+01
1.111	5.0201E-03	7.4618E+01
1.511	2.3163E-05	7.4618E+01
1.811	4.1007E-07	7.4618E+01
2.000	3.2338E-08	7.4618E+01
2.300	5.7251E-10	7.4618E+01
2.600	1.0135E-11	7.4618E+01
2.900	1.7943E-13	7.4618E+01
3.200	3.1766E-15	7.4618E+01
3.500	5.6237E-17	7.4618E+01
3.800	9.9560E-19	7.4618E+01
4.100	1.7626E-20	7.4618E+01
4.400	3.1204E-22	7.4618E+01
4.700	5.5242E-24	7.4618E+01
5.000	9.7798E-26	7.4618E+01
5.300	1.7314E-27	7.4618E+01
5.600	3.0651E-29	7.4618E+01
5.900	5.4264E-31	7.4618E+01
6.200	9.6066E-33	7.4618E+01
6.500	1.7007E-34	7.4618E+01
6.800	3.0109E-36	7.4618E+01
7.100	5.3303E-38	7.4618E+01
7.400	9.4366E-40	7.4618E+01
7.700	1.6706E-41	7.4618E+01
8.000	2.9576E-43	7.4618E+01
8.300	5.2360E-45	7.4618E+01
8.600	9.2695E-47	7.4618E+01
8.900	1.6410E-48	7.4618E+01
9.200	2.9052E-50	7.4618E+01
9.500	5.1433E-52	7.4618E+01
9.800	9.1055E-54	7.4618E+01
10.100	1.6120E-55	7.4618E+01
10.400	2.8538E-57	7.4618E+01
24.000	1.0799-136	7.4618E+01
96.000	0.0000E+00	7.4618E+01
720.000	0.0000E+00	7.4618E+01

##

Cumulative Dose Summary

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Time (hr)	Exclusion Area Bounda Thyroid (rem)	TEDE (rem)	Low Population Zone (Thyroid (rem)	TEDE (rem)	Control Room Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

0.000	2.2633E-08	3.1582E-09	3.9355E-09	5.4916E-10	1.0664E-12	5.0872E-14
0.056	3.2588E-01	3.4073E-02	5.6664E-02	5.9246E-03	6.3936E-02	2.8957E-03
0.356	2.4806E+00	2.3732E-01	4.3133E-01	4.1266E-02	2.1167E+00	9.5181E-02
0.500	4.6213E+00	4.0745E-01	8.0355E-01	7.0847E-02	4.7775E+00	2.1333E-01
0.900	1.4199E+01	1.0498E+00	2.4689E+00	1.8254E-01	7.1188E+00	3.2991E-01
1.111	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.4485E+00	3.5145E-01
1.511	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5921E+00	3.6598E-01
1.811	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6810E-01
2.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6870E-01
2.300	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6916E-01
2.600	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6934E-01
2.900	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6941E-01
3.200	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6943E-01
3.500	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
3.800	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
4.100	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
4.400	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
4.700	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
5.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
5.300	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
5.600	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
5.900	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
6.200	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
6.500	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
6.800	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
7.100	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
7.400	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
7.700	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
8.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
8.300	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
8.600	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
8.900	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
9.200	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
9.500	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
9.800	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
10.100	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
10.400	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
24.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
96.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01
720.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.5928E+00	3.6945E-01

##
Worst Two-Hour Doses
##

Exclusion Area Boundary (EAB)

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	5.8087E-01	2.1363E+01	1.4799E+00

RADTRAD CREA Nuclide Inventory File

```
Nuclide Inventory Name:  Source Terms per this calculation
Byron and Braidwood Plants (B-B) AST - in Ci/MW
Power Level:
 0.1000E+01
Nuclides:
 60
Nuclide 001:
Co-58
  7
 0.6117120000E+07
 0.5800E+02
 0.2553E+03
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 002:
Co-60
  7
 0.1663401096E+09
 0.6000E+02
 0.1953E+03
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 003:
Kr-85
  1
 0.3382974720E+09
 0.8500E+02
 0.2851E+03
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 004:
Kr-85m
  1
 0.1612800000E+05
 0.8500E+02
 0.8592E+04
Kr-85     0.2100E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 005:
Kr-87
  1
 0.4578000000E+04
 0.8700E+02
 0.1696E+05
Rb-87     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 006:
Kr-88
```

```
  1
 0.1022400000E+05
 0.8800E+02
 0.2392E+05
Rb-88     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 007:
Rb-86
  3
 0.1612224000E+07
 0.8600E+02
 0.6480E+02
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 008:
Sr-89
  5
 0.4363200000E+07
 0.8900E+02
 0.2907E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 009:
Sr-90
  5
 0.9189573120E+09
 0.9000E+02
 0.2242E+04
Y-90      0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 010:
Sr-91
  5
 0.3420000000E+05
 0.9100E+02
 0.3930E+05
Y-91m     0.5800E+00
Y-91      0.4200E+00
none      0.0000E+00
Nuclide 011:
Sr-92
  5
 0.9756000000E+04
 0.9200E+02
 0.4136E+05
Y-92      0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 012:
Y-90
  9
 0.2304000000E+06
 0.9000E+02
```

```
 0.2347E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 013:
Y-91
  9
 0.5055264000E+07
 0.9100E+02
 0.3553E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 014:
Y-92
  9
 0.1274400000E+05
 0.9200E+02
 0.4150E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 015:
Y-93
  9
 0.3636000000E+05
 0.9300E+02
 0.4624E+05
Zr-93     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 016:
Zr-95
  9
 0.5527872000E+07
 0.9500E+02
 0.4560E+05
Nb-95m    0.7000E-02
Nb-95     0.9900E+00
none      0.0000E+00
Nuclide 017:
Zr-97
  9
 0.6084000000E+05
 0.9700E+02
 0.4663E+05
Nb-97m    0.9500E+00
Nb-97     0.5300E-01
none      0.0000E+00
Nuclide 018:
Nb-95
  9
 0.3036960000E+07
 0.9500E+02
 0.4593E+05
none      0.0000E+00
none      0.0000E+00
```

```
none      0.0000E+00
Nuclide 019:
Mo-99
  7
 0.2376000000E+06
 0.9900E+02
 0.5058+05
Tc-99m    0.8800E+00
Tc-99     0.1200E+00
none      0.0000E+00
Nuclide 020:
Tc-99m
  7
 0.2167200000E+05
 0.9900E+02
 0.4429E+05
Tc-99     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 021:
Ru-103
  7
 0.3393792000E+07
 0.1030E+03
 0.4094E+05
Rh-103m   0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 022:
Ru-105
  7
 0.1598400000E+05
 0.1050E+03
 0.2798E+05
Rh-105    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 023:
Ru-106
  7
 0.3181248000E+08
 0.1060E+03
 0.1387E+05
Rh-106    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 024:
Rh-105
  7
 0.1272960000E+06
 0.1050E+03
 0.2552E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 025:
Sb-127
```

```
  4
 0.3326400000E+06
 0.1270E+03
 0.2848E+04
Te-127m  0.1800E+00
Te-127   0.8200E+00
none     0.0000E+00
Nuclide 026:
Sb-129
  4
 0.1555200000E+05
 0.1290E+03
 0.8523E+04
Te-129m  0.2200E+00
Te-129   0.7700E+00
none     0.0000E+00
Nuclide 027:
Te-127
  4
 0.3366000000E+05
 0.1270E+03
 0.2812E+04
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 028:
Te-127m
  4
 0.9417600000E+07
 0.1270E+03
 0.3668E+03
Te-127   0.9800E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 029:
Te-129
  4
 0.4176000000E+04
 0.1290E+03
 0.8389E+04
I-129    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 030:
Te-129m
  4
 0.2903040000E+07
 0.1290E+03
 0.1249E+04
Te-129   0.6500E+00
I-129    0.3500E+00
none     0.0000E+00
Nuclide 031:
Te-131m
  4
 0.1080000000E+06
 0.1310E+03
```

```
 0.3838E+04
Te-131    0.2200E+00
I-131     0.7800E+00
none      0.0000E+00
Nuclide 032:
Te-132
  4
 0.2815200000E+06
 0.1320E+03
 0.3804E+05
I-132     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 033:
I-131
  2
 0.6946560000E+06
 0.1310E+03
 0.2671E+05
Xe-131m   0.1100E-01
none      0.0000E+00
none      0.0000E+00
Nuclide 034:
I-132
  2
 0.8280000000E+04
 0.1320E+03
 0.3863E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 035:
I-133
  2
 0.7488000000E+05
 0.1330E+03
 0.5529E+05
Xe-133m   0.2900E-01
Xe-133    0.9700E+00
none      0.0000E+00
Nuclide 036:
I-134
  2
 0.3156000000E+04
 0.1340E+03
 0.6143E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 037:
I-135
  2
 0.2379600000E+05
 0.1350E+03
 0.5159E+05
Xe-135m   0.1500E+00
Xe-135    0.8500E+00
```

```
none      0.0000E+00
Nuclide 038:
Xe-133
  1
 0.4531680000E+06
 0.1330E+03
 0.5396E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 039:
Xe-135
  1
 0.3272400000E+05
 0.1350E+03
 0.1532E+05
Cs-135    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 040:
Cs-134
  3
 0.6507177120E+08
 0.1340E+03
 0.5306E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 041:
Cs-136
  3
 0.1131840000E+07
 0.1360E+03
 0.1503E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 042:
Cs-137
  3
 0.9467280000E+09
 0.1370E+03
 0.3077E+04
Ba-137m   0.9500E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 043:
Ba-139
  6
 0.4962000000E+04
 0.1390E+03
 0.5089E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 044:
Ba-140
```

```
  6
 0.1100736000E+07
 0.1400E+03
 0.4922E+05
La-140    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 045:
La-140
  9
 0.1449792000E+06
 0.1400E+03
 0.5036E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 046:
La-141
  9
 0.1414800000E+05
 0.1410E+03
 0.4646E+05
Ce-141    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 047:
La-142
  9
 0.5550000000E+04
 0.1420E+03
 0.4557E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 048:
Ce-141
  8
 0.2808086400E+07
 0.1410E+03
 0.4498E+05
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 049:
Ce-143
  8
 0.1188000000E+06
 0.1430E+03
 0.4468E+05
Pr-143    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 050:
Ce-144
  8
 0.2456352000E+08
 0.1440E+03
```

```
 0.3414E+05
Pr-144m  0.1800E-01
Pr-144   0.9800E+00
none     0.0000E+00
Nuclide 051:
Pr-143
  9
 0.1171584000E+07
 0.1430E+03
 0.4350E+05
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 052:
Nd-147
  9
 0.9486720000E+06
 0.1470E+03
 0.1836E+05
Pm-147   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 053:
Np-239
  8
 0.2034720000E+06
 0.2390E+03
 0.5178E+06
Pu-239   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 054:
Pu-238
  8
 0.2768863824E+10
 0.2380E+03
 0.1027E+03
U-234    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 055:
Pu-239
  8
 0.7594336440E+12
 0.2390E+03
 0.7698E+01
U-235    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 056:
Pu-240
  8
 0.2062920312E+12
 0.2400E+03
 0.8971E+01
U-236    0.1000E+01
none     0.0000E+00
```

```
none      0.0000E+00
Nuclide 057:
Pu-241
  8
 0.4544294400E+09
 0.2410E+03
 0.3548E+04
U-237     0.2400E-04
Am-241    0.1000E+01
none      0.0000E+00
Nuclide 058:
Am-241
  9
 0.1363919472E+11
 0.2410E+03
 0.3921E+01
Np-237    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 059:
Cm-242
  9
 0.1406592000E+08
 0.2420E+03
 0.1110E+04
Pu-238    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 060:
Cm-244
  9
 0.5715081360E+09
 0.2440E+03
 0.1209E+03
Pu-240    0.1000E+01
none      0.0000E+00
none      0.0000E+00
End of Nuclear Inventory File
```

RADTRAD CREA Release Fraction/Timing File

```
Release Fraction and Timing Name:
B-B Plants AST CREA , RG 1.183,
Duration (h):  Design Basis Accident
 0.1000E-04  0.1000E-04  0.0000E+00  0.0000E+00
Noble Gases:
 0.1700E-01  0.3825E-02  0.0000E+00  0.0000E+00
Iodine:
 0.1700E-01  1.9125E-03  0.0000E+00  0.0000E+00
Cesium:
 0.4080E-01  0.1615E-02  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
```

	A	B	C	D	E	F	G	H	I
1									
2	**CREA Release Fraction Derivation**								
3									
4	0.10	Damaged Fuel Fraction							
5	0.0025	Melted Fuel Fraction							
6	1.7	Assumed Peaking Correction Factor							
7									
8					[1]Reg. Guide 1.183				Melted Fuel
9			Gap	Remaining Fraction	Available Melted Fuel	Melted Fuel		Gap Activity	Activity
10		Gap	Activity	of Activity Available	Fractions that are	Activity		Release Fraction	Release Fraction
11		Activity	Release	for Release from	Actually Released	Release		with Assumed	with Assumed
12		Fraction	Fraction	Melted Fuel	for Transport	Fraction		Peaking Factor	Peaking Factor
13	KR-85	0.1	0.01	0.9	1	0.00225		0.017	0.003825
14	KR-85m	0.1	0.01	0.9	1	0.00225		0.017	0.003825
15	KR-87	0.1	0.01	0.9	1	0.00225		0.017	0.003825
16	KR-88	0.1	0.01	0.9	1	0.00225		0.017	0.003825
17	XE-133	0.1	0.01	0.9	1	0.00225		0.017	0.003825
18	XE-135	0.1	0.01	0.9	1	0.00225		0.017	0.003825
19	I-131	0.1	0.01	0.9	0.5	0.001125		0.017	0.0019125
20	I-132	0.1	0.01	0.9	0.5	0.001125		0.017	0.0019125
21	I-133	0.1	0.01	0.9	0.5	0.001125		0.017	0.0019125
22	I-134	0.1	0.01	0.9	0.5	0.001125		0.017	0.0019125
23	I-135	0.1	0.01	0.9	0.5	0.001125		0.017	0.0019125
24	RB-86	0.24	0.024	0.76	0.5	0.00095		0.0408	0.001615
25	CS-134	0.24	0.024	0.76	0.5	0.00095		0.0408	0.001615
26	CS-136	0.24	0.024	0.76	0.5	0.00095		0.0408	0.001615
27	CS-137	0.24	0.024	0.76	0.5	0.00095		0.0408	0.001615

	A	B	C	D	E	F	G	H	I
1									
2	**CREA Release Fraction Derivation**								
3									
4	0.1	Damaged F							
5	=$A$4*0.025	Melted Fue							
6	=1.7	Assumed P							
7									
8					[1]Reg. Guide 1.183				Melted Fuel
9			Gap	Remaining Fraction	Available Melted Fuel	Melted Fuel		Gap Activity	Activity
10		Gap	Activity	of Activity Available	Fractions that are	Activity		Release Fraction	Release Fraction
11		Activity	Release	for Release from	Actually Released	Release		with Assumed	with Assumed
12		Fraction	Fraction	Melted Fuel	for Transport	Fraction		Peaking Factor	Peaking Factor
13	KR-85	0.1	=$A$4*B13	=1-B13	=1	=$A$5*D13*E13		=$A$6*C13	=$A$6*F13
14	KR-85m	0.1	=$A$4*B14	=1-B14	=1	=$A$5*D14*E14		=$A$6*C14	=$A$6*F14
15	KR-87	0.1	=$A$4*B15	=1-B15	=1	=$A$5*D15*E15		=$A$6*C15	=$A$6*F15
16	KR-88	0.1	=$A$4*B16	=1-B16	=1	=$A$5*D16*E16		=$A$6*C16	=$A$6*F16
17	XE-133	0.1	=$A$4*B17	=1-B17	=1	=$A$5*D17*E17		=$A$6*C17	=$A$6*F17
18	XE-135	0.1	=$A$4*B18	=1-B18	=1	=$A$5*D18*E18		=$A$6*C18	=$A$6*F18
19	I-131	0.1	=$A$4*B19	=1-B19	0.5	=$A$5*D19*E19		=$A$6*C19	=$A$6*F19
20	I-132	0.1	=$A$4*B20	=1-B20	0.5	=$A$5*D20*E20		=$A$6*C20	=$A$6*F20
21	I-133	0.1	=$A$4*B21	=1-B21	0.5	=$A$5*D21*E21		=$A$6*C21	=$A$6*F21
22	I-134	0.1	=$A$4*B22	=1-B22	0.5	=$A$5*D22*E22		=$A$6*C22	=$A$6*F22
23	I-135	0.1	=$A$4*B23	=1-B23	0.5	=$A$5*D23*E23		=$A$6*C23	=$A$6*F23
24	RB-86	=0.12*2	=$A$4*B24	=1-B24	0.5	=$A$5*D24*E24		=$A$6*C24	=$A$6*F24
25	CS-134	=0.12*2	=$A$4*B25	=1-B25	0.5	=$A$5*D25*E25		=$A$6*C25	=$A$6*F25
26	CS-136	=0.12*2	=$A$4*B26	=1-B26	0.5	=$A$5*D26*E26		=$A$6*C26	=$A$6*F26
27	CS-137	=0.12*2	=$A$4*B27	=1-B27	0.5	=$A$5*D27*E27		=$A$6*C27	=$A$6*F27

Attachment E
Demonstration that Smaller Control Room Volume Used in Analysis Bounds Actual Byron and Braidwood Control Room Volumes

I. Purpose

The purpose of this attachment is to demonstrate that using a smaller value of 200,000 ft^3 to bound both the Byron and Braidwood Control Room (CR) volumes of 230,830 ft^3 and 232,872 ft^3, respectively, provides the conservative approach to modeling of CR doses in this accident analysis.

II. Approach

Shown in this attachment is a re-evaluation of this worst-case design basis accident using a Control Room volume of 240,000 ft^3 instead of the 200,000 ft^3 volume used in the analysis. It is intended to show that the implementation of the larger Control Room volume leads to a lower end-of-accident dose consequence than that which is calculated when using the smaller volume.

III. Results

Shown below is a table comparing the dose from the bounding design basis accident case as compared to the test case of this attachment that uses the larger Control Room volume.

It is clearly shown that the CR dose assessment using a smaller volume of 200,000 ft^3 is more conservative than that using the larger volume of 240,000 ft^3.

Sensitivity Run Description	Control Room Dose (rem TEDE)
DBA-CREA Case 1 using a CR Volume of 200,000 ft^3 for Dose Analysis	2.5486
DBA-CREA Case 1 using a CR Volume of 240,000 ft^3 for Dose Analysis	2.3960
DBA-CREA Case 2 using a CR Volume of 200,000 ft^3 for Dose Analysis	0.36945
DBA-CREA Case 2 using a CR Volume of 240,000 ft^3 for Dose Analysis	0.34689

```
 ##########################################################################
    RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:19:36
 ##########################################################################

 ##########################################################################
                     File information
 ##########################################################################

 Plant file           = C:\Documents and Settings\Aleem Boatright\My Documents\My
Work\Exelon\Byron & Braidwood\CREA\RADTRAD\Rev 1\(Large CR Volume Conservatism
Test) B-B CREA Case 1 - Large CR Volume 1000cfm Inleak - 95 percent Intake Filt -
Cont Leak Rate Increase.psf
 Inventory file       = c:\program files\radtrad3-03\defaults\byron-braidwood ast
source terms.nif
 Release file         = c:\program files\radtrad3-03\defaults\byron-braidwood crea-
release fractions (rev 1).rft
 Dose Conversion file = c:\program files\radtrad3-03\defaults\fgr11&12.inp



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


 Radtrad 3.03 4/15/2001
 Byron/Braidwood CREA - Case 1 - Small Break LOCA Containment Leakage (0.2%/day) -
Control Room @ 240,000 cu. ft. CR Volume with 8575cfm Intake - 1000cfm Unfilt
Inleakage - 95% CR Intake Fiters - 80% Aerosol, 90% Elemental & Organic Recirc
Filtration
 Nuclide Inventory File:
 c:\program files\radtrad3-03\defaults\byron-braidwood ast source terms.nif
 Plant Power Level:
  3.6583E+03
 Compartments:
   5
 Compartment 1:
 Primary Loop - Reactor Coolant System (RCS)
   3
  7.2850E+03
   0
   0
   0
   0
   0
 Compartment 2:
 Secondary Loop - Steam Generator Volumes (4 SGs)
   3
  4.7890E+03
   0
```

```
  0
  0
  0
  0
Compartment 3:
Containment
  3
 2.8500E+06
  0
  0
  0
  1
  0
Compartment 4:
Control Room
  1
 2.4000E+05
  0
  0
  1
  0
  0
Compartment 5:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Pathways:
  6
Pathway 1:
Primary Loop to Secondary Loop Leakage
  1
  2
  2
Pathway 2:
Secondary Loop - Steam Generator Volumes (4 SGs) to  Environment
  2
  5
  2
Pathway 3:
Containment Leak to the Environment
  3
  5
  4
Pathway 4:
(Filtered Intake) Environment to Control Room
  5
  4
  2
Pathway 5:
(Unfiltered Inleakage) Environment to Control Room
  5
  4
```

```
   2
 Pathway 6:
 (Control Room Exhaust) Control Room to Environment
   4
   5
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   3   1.0000E+00
 c:\program files\radtrad3-03\defaults\fgr11&12.inp
 c:\program files\radtrad3-03\defaults\byron-braidwood crea-release fractions (rev
1).rft
   0.0000E+00
   1
   9.5000E-01   4.8500E-02   1.5000E-03   1.0000E+00
 Overlying Pool:
   0
   0.0000E+00
   0
   0
   0
   0
 Compartments:
   5
 Compartment 1:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 2:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 3:
   1
   1
   0
   0
   0
   0
   0
```

```
  3
  1
  1.0000E+01
  1
  1
  0.0000E+00   0.0000E+00
Compartment 4:
  0
  1
  0
  0
  0
  0
  1
  3.9150E+04
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   8.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Compartment 5:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Pathways:
  6
Pathway 1:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.3370E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+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
```

```
  4
  0.0000E+00   2.8830E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.5600E-02   4.8060E+02   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E-01
  2.4000E+01   1.0000E-01
  7.2000E+02   0.0000E+00
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   6.4240E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   8.5750E+03   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   1.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
```

```
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   7.4240E+03   1.0000E+02   1.0000E+02   1.0000E+02
  5.0000E-01   9.5750E+03   1.0000E+02   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary (EAB)
  5
  1
  3
  0.0000E+00   5.3600E-04
  5.0000E-01   5.3600E-04
  2.0000E+00   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone (LPZ)
  5
  1
  7
  0.0000E+00   9.3200E-05
  5.0000E-01   9.3200E-05
  2.0000E+00   4.5000E-05
  8.0000E+00   3.1200E-05
  2.4000E+01   1.4100E-05
  9.6000E+01   4.5400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
```

```
  0
Location 3:
Control Room
  4
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  7
  0.0000E+00   1.7300E-03
  5.0000E-01   1.0100E-03
  2.0000E+00   7.2500E-04
  8.0000E+00   3.0700E-04
  2.4000E+01   2.0700E-04
  9.6000E+01   1.4600E-04
  7.2000E+02   0.0000E+00
Simulation Parameters:
  1
  0.0000E+00   0.0000E+00
Output Filename:
C:\Documents and Settings\Aleem Boatright\My Documents\My Work\Exelon\Byron &
Braidwood\CREA\RADTRAD\Rev 1\(Large CR Volume Conservatism Test) B-B CREA Case 1 -
Large CR Volume 1000cfm Inleak - 95 percent Intake Filt - Cont Leak Rate
Increase.o0
  1
  1
  1
  0
  0
End of Scenario File
```

```
##########################################################################
   RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:19:36
##########################################################################

##########################################################################
                    Plant Description
##########################################################################

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   3.6583E+03 MWth

Number of compartments    =   5

Compartment information

Compartment number  1
Name: Primary Loop - Reactor Coolant System (R
Compartment volume =   7.2850E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: Primary Loop to Secondary Loop Leakage

Compartment number  2
Name: Secondary Loop - Steam Generator Volumes
Compartment volume =   4.7890E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  2
   Inlet Pathway Number   1: Primary Loop to Secondary Loop Leakage
   Exit Pathway Number    2: Secondary Loop - Steam Generator Volumes (4 SGs) t

Compartment number  3  (Source term fraction =   1.0000E+00
)
Name: Containment
Compartment volume =   2.8500E+06 (Cubic feet)
Compartment type is Normal
Removal devices within compartment:
     Deposition
Pathways into and out of compartment  3
   Exit Pathway Number    3: Containment Leak to the Environment

Compartment number  4
Name: Control Room
Compartment volume =   2.4000E+05 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  4
   Inlet Pathway Number   4: (Filtered Intake) Environment to Control Room
   Inlet Pathway Number   5: (Unfiltered Inleakage) Environment to Control Room
   Exit Pathway Number    6: (Control Room Exhaust) Control Room to Environment

Compartment number  5
Name: Environment
Compartment type is Environment
```

```
Pathways into and out of compartment  5
   Inlet Pathway Number    2: Secondary Loop - Steam Generator Volumes (4 SGs) t
   Inlet Pathway Number    3: Containment Leak to the Environment
   Inlet Pathway Number    6: (Control Room Exhaust) Control Room to Environment
   Exit Pathway Number     4: (Filtered Intake) Environment to Control Room
   Exit Pathway Number     5: (Unfiltered Inleakage) Environment to Control Room

Total number of pathways =    6
```

```
##########################################################################
   RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:19:36
##########################################################################

##########################################################################
                    Scenario Description
##########################################################################

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings
                GAP          EARLY IN-VESSEL   LATE RELEASE     RELEASE MASS
              0.000010 hr      0.0000 hrs       0.0000 hrs          (gm)
NOBLES        1.7000E-02       3.8250E-03       0.0000E+00        7.805E+01
IODINE        1.7000E-02       1.9125E-03       0.0000E+00        1.972E+01
CESIUM        4.0800E-02       1.6150E-03       0.0000E+00        6.129E+03
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 =       3658. MWt

Nuclide  Group  Specific     half      Whole Body   Inhaled     Inhaled
 Name           Inventory    life        DCF       Thyroid     Effective
                (Ci/MWt)     (s)     (Sv-m3/Bq-s)  (Sv/Bq)     (Sv/Bq)
 Kr-85     1   2.851E+02  3.383E+08   1.190E-16   0.000E+00   0.000E+00
 Kr-85m    1   8.592E+03  1.613E+04   7.480E-15   0.000E+00   0.000E+00
 Kr-87     1   1.696E+04  4.578E+03   4.120E-14   0.000E+00   0.000E+00
 Kr-88     1   2.392E+04  1.022E+04   1.020E-13   0.000E+00   0.000E+00
 Rb-86     3   6.480E+01  1.612E+06   4.810E-15   1.330E-09   1.790E-09
 I-131     2   2.671E+04  6.947E+05   1.820E-14   2.920E-07   8.890E-09
 I-132     2   3.863E+04  8.280E+03   1.120E-13   1.740E-09   1.030E-10
 I-133     2   5.529E+04  7.488E+04   2.940E-14   4.860E-08   1.580E-09
 I-134     2   6.143E+04  3.156E+03   1.300E-13   2.880E-10   3.550E-11
 I-135     2   5.159E+04  2.380E+04   8.294E-14   8.460E-09   3.320E-10
 Xe-133    1   5.396E+04  4.532E+05   1.560E-15   0.000E+00   0.000E+00
 Xe-135    1   1.532E+04  3.272E+04   1.190E-14   0.000E+00   0.000E+00
 Cs-134    3   5.306E+03  6.507E+07   7.570E-14   1.110E-08   1.250E-08
 Cs-136    3   1.503E+03  1.132E+06   1.060E-13   1.730E-09   1.980E-09
 Cs-137    3   3.077E+03  9.467E+08   2.725E-14   7.930E-09   8.630E-09

Nuclide    Daughter  Fraction  Daughter  Fraction  Daughter  Fraction
 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
 Sr-90     Y-90        1.00    none        0.00    none        0.00
 Sr-91     Y-91m       0.58    Y-91        0.42    none        0.00
 Sr-92     Y-92        1.00    none        0.00    none        0.00
 Y-93      Zr-93       1.00    none        0.00    none        0.00
 Zr-95     Nb-95m      0.01    Nb-95       0.99    none        0.00
 Zr-97     Nb-97m      0.95    Nb-97       0.05    none        0.00
 Mo-99     Tc-99m      0.88    Tc-99       0.12    none        0.00
```

Tc-99m	Tc-99	1.00	none	0.00	none	0.00
Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00
Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	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 Loop - Reactor Coolant System (R

Compartment number 2: Secondary Loop - Steam Generator Volumes

Compartment number 3: Containment
Natural Deposition (Powers' model): Aerosol data
Reactor type: 1
Percentile = 10 (%)

Natural Deposition: Elemental Removal Data

Time (hr)	Removal Coef. (hr^-1)
0.0000E+00	0.0000E+00

Compartment number 4: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.9150E+04	0.0000E+00	0.0000E+00	0.0000E+00

5.0000E-01	3.9150E+04	8.0000E+01	9.0000E+01	9.0000E+01
7.2000E+02	3.9150E+04	0.0000E+00	0.0000E+00	0.0000E+00

Compartment number 5: Environment

PATHWAY DATA

Pathway number 1: Primary Loop to Secondary Loop Leakage

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.3370E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Secondary Loop - Steam Generator Volumes (4 SGs) t

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.8830E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.5600E-02	4.8060E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Containment Leak to the Environment

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	2.0000E-01
2.4000E+01	1.0000E-01
7.2000E+02	0.0000E+00

Pathway number 4: (Filtered Intake) Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	6.4240E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	8.5750E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: (Unfiltered Inleakage) Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	1.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 6: (Control Room Exhaust) Control Room to Environment

```
      Pathway Filter: Removal Data

        Time (hr)       Flow Rate          Filter Efficiencies (%)
                          (cfm)          Aerosol     Elemental     Organic
        0.0000E+00    7.4240E+03    1.0000E+02    1.0000E+02    1.0000E+02
        5.0000E-01    9.5750E+03    1.0000E+02    1.0000E+02    1.0000E+02
        7.2000E+02    0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00

LOCATION DATA
      Location Exclusion Area Boundary (EAB)      is in compartment    5

      Location X/Q Data
       Time (hr)          X/Q (s * m^-3)
        0.0000E+00           5.3600E-04
        5.0000E-01           5.3600E-04
        2.0000E+00           0.0000E+00

      Location Breathing Rate Data
       Time (hr)          Breathing Rate (m^3 * sec^-1)
        0.0000E+00                  3.5000E-04
        8.0000E+00                  1.8000E-04
        2.4000E+01                  2.3000E-04
        7.2000E+02                  0.0000E+00
      Location Low Population Zone (LPZ)      is in compartment    5

      Location X/Q Data
       Time (hr)          X/Q (s * m^-3)
        0.0000E+00           9.3200E-05
        5.0000E-01           9.3200E-05
        2.0000E+00           4.5000E-05
        8.0000E+00           3.1200E-05
        2.4000E+01           1.4100E-05
        9.6000E+01           4.5400E-06
        7.2000E+02           0.0000E+00

      Location Breathing Rate Data
       Time (hr)          Breathing Rate (m^3 * sec^-1)
        0.0000E+00                  3.5000E-04
        8.0000E+00                  1.8000E-04
        2.4000E+01                  2.3000E-04
        7.2000E+02                  0.0000E+00
      Location Control Room     is in compartment    4

      Location X/Q Data
       Time (hr)          X/Q (s * m^-3)
        0.0000E+00           1.7300E-03
        5.0000E-01           1.0100E-03
        2.0000E+00           7.2500E-04
        8.0000E+00           3.0700E-04
        2.4000E+01           2.0700E-04
        9.6000E+01           1.4600E-04
        7.2000E+02           0.0000E+00

      Location Breathing Rate Data
       Time (hr)          Breathing Rate (m^3 * sec^-1)
        0.0000E+00                  3.5000E-04
```

```
     7.2000E+02                    0.0000E+00

   Location Occupancy Factor Data
    Time (hr)          Occupancy Factor
     0.0000E+00             1.0000E+00
     2.4000E+01             6.0000E-01
     9.6000E+01             4.0000E-01
     7.2000E+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 11/17/2004  at  7:19:36
##########################################################################
```

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

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

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2190E-06	2.0171E-04	1.1623E-05
Accumulated dose (rem)	1.2190E-06	2.0171E-04	1.1623E-05

Low Population Zone (LPZ) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.1196E-07	3.5073E-05	2.0210E-06
Accumulated dose (rem)	2.1196E-07	3.5073E-05	2.0210E-06

Control Room Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0494E-12	6.0415E-09	3.1367E-10
Accumulated dose (rem)	2.0494E-12	6.0415E-09	3.1367E-10

Containment Compartment Nuclide Inventory:

Time (h) = 0.0000	Ci	kg	Atoms	Decay
Kr-85	1.7731E+04	4.5193E-02	3.2018E+23	2.3617E+13
Kr-85m	5.3435E+05	6.4930E-05	4.6002E+20	7.1175E+14
Kr-87	1.0548E+06	3.7237E-05	2.5775E+20	1.4049E+15
Kr-88	1.4876E+06	1.1864E-04	8.1187E+20	1.9815E+15
Rb-86	9.6720E+03	1.1887E-04	8.3237E+20	1.2883E+13
I-131	1.6611E+06	1.3399E-02	6.1595E+22	2.2126E+15
I-132	2.4024E+06	2.3275E-04	1.0618E+21	3.2000E+15
I-133	3.4385E+06	3.0354E-03	1.3744E+22	4.5801E+15
I-134	3.8204E+06	1.4321E-04	6.4360E+20	5.0888E+15
I-135	3.2084E+06	9.1360E-04	4.0754E+21	4.2736E+15
Xe-133	3.3558E+06	1.7928E-02	8.1178E+22	4.4700E+15
Xe-135	9.5277E+05	3.7309E-04	1.6643E+21	1.2691E+15
Cs-134	7.9197E+05	6.1211E-01	2.7509E+24	1.0549E+15
Cs-136	2.2434E+05	3.0609E-03	1.3554E+22	2.9882E+14

Cs-137	4.5927E+05	5.2801E+00	2.3210E+25	6.1174E+14

Containment Transport Group Inventory:

Time (h) = 0.0000	Atmosphere	Sump	
Noble gases (atoms)	4.0456E+23	0.0000E+00	
Elemental I (atoms)	3.9343E+21	0.0000E+00	
Organic I (atoms)	1.2168E+20	0.0000E+00	
Aerosols (kg)	5.9122E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		2.9051E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.7161E-05
Total I (Ci)			1.4531E+07

Time (h) = 0.0000	Deposition Surfaces	Recirculating Filter
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)	8.9055E-07	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 0.0000	Leakage Transport
Noble gases (atoms)	1.6857E+14
Elemental I (atoms)	1.6393E+12
Organic I (atoms)	5.0700E+10
Aerosols (kg)	2.4634E-09

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5894E-06	4.2583E-04	2.4266E-05
Accumulated dose (rem)	3.8084E-06	6.2754E-04	3.5889E-05

Low Population Zone (LPZ) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.5025E-07	7.4044E-05	4.2194E-06
Accumulated dose (rem)	6.6222E-07	1.0912E-04	6.2404E-06

Control Room Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.4521E-12	2.4837E-08	1.2809E-09
Accumulated dose (rem)	1.0502E-11	3.0879E-08	1.5946E-09

Containment Compartment Nuclide Inventory:

Time (h) = 0.0000	Ci	kg	Atoms	Decay
Kr-85	2.1720E+04	5.5361E-02	3.9223E+23	5.2548E+13
Kr-85m	6.5457E+05	7.9539E-05	5.6353E+20	1.5836E+15
Kr-87	1.2921E+06	4.5615E-05	3.1575E+20	3.1260E+15
Kr-88	1.8223E+06	1.4533E-04	9.9454E+20	4.4088E+15
Rb-86	1.0055E+04	1.2357E-04	8.6532E+20	2.6276E+13
I-131	1.8480E+06	1.4906E-02	6.8525E+22	4.6742E+15
I-132	2.6727E+06	2.5893E-04	1.1813E+21	6.7601E+15
I-133	3.8254E+06	3.3769E-03	1.5290E+22	9.6755E+15
I-134	4.2501E+06	1.5932E-04	7.1600E+20	1.0750E+16

I-135	3.5694E+06	1.0164E-03	4.5339E+21	9.0281E+15
Xe-133	4.1109E+06	2.1962E-02	9.9442E+22	9.9457E+15
Xe-135	1.1671E+06	4.5704E-04	2.0388E+21	2.8237E+15
Cs-134	8.2331E+05	6.3634E-01	2.8598E+24	2.1516E+15
Cs-136	2.3322E+05	3.1821E-03	1.4090E+22	6.0946E+14
Cs-137	4.7745E+05	5.4891E+00	2.4128E+25	1.2477E+15

Containment Transport Group Inventory:

Time (h) = 0.0000	Atmosphere	Sump	
Noble gases (atoms)	4.9558E+23	0.0000E+00	
Elemental I (atoms)	4.3770E+21	0.0000E+00	
Organic I (atoms)	1.3537E+20	0.0000E+00	
Aerosols (kg)	6.1474E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.2319E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.1341E-05
Total I (Ci)			1.6166E+07

Time (h) = 0.0000	Deposition Surfaces	Recirculating Filter
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)	2.7071E-06	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 0.0000	Leakage Transport
Noble gases (atoms)	5.4362E+14
Elemental I (atoms)	5.1023E+12
Organic I (atoms)	1.5780E+11
Aerosols (kg)	7.4882E-09

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.5223E-02	2.4894E+00	1.4043E-01
Accumulated dose (rem)	1.5227E-02	2.4900E+00	1.4046E-01

Low Population Zone (LPZ) Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6470E-03	4.3286E-01	2.4417E-02
Accumulated dose (rem)	2.6477E-03	4.3297E-01	2.4423E-02

Control Room Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3522E-04	3.9396E-01	1.9949E-02
Accumulated dose (rem)	1.3522E-04	3.9396E-01	1.9949E-02

Containment Compartment Nuclide Inventory:

Time (h) = 0.0556	Ci	kg	Atoms	Decay
Kr-85	2.1720E+04	5.5361E-02	3.9223E+23	1.6085E+17
Kr-85m	6.4896E+05	7.8858E-05	5.5870E+20	4.8267E+18
Kr-87	1.2535E+06	4.4253E-05	3.0632E+20	9.4252E+18
Kr-88	1.7978E+06	1.4337E-04	9.8113E+20	1.3404E+19

Rb-86	1.0037E+04	1.2335E-04	8.6379E+20	7.4336E+16
I-131	1.8447E+06	1.4880E-02	6.8402E+22	1.3663E+19
I-132	2.6241E+06	2.5422E-04	1.1598E+21	1.9597E+19
I-133	3.8122E+06	3.3653E-03	1.5238E+22	2.8259E+19
I-134	4.0609E+06	1.5223E-04	6.8413E+20	3.0745E+19
I-135	3.5430E+06	1.0089E-03	4.5004E+21	2.6315E+19
Xe-133	4.1107E+06	2.1961E-02	9.9439E+22	3.0439E+19
Xe-135	1.1750E+06	4.6011E-04	2.0525E+21	8.6252E+18
Cs-134	8.2193E+05	6.3527E-01	2.8550E+24	6.0871E+18
Cs-136	2.3280E+05	3.1763E-03	1.4065E+22	1.7242E+18
Cs-137	4.7665E+05	5.4798E+00	2.4088E+25	3.5300E+18

Containment Transport Group Inventory:

Time (h) = 0.0556	Atmosphere	Sump	
Noble gases (atoms)	4.9556E+23	0.0000E+00	
Elemental I (atoms)	4.3712E+21	0.0000E+00	
Organic I (atoms)	1.3519E+20	0.0000E+00	
Aerosols (kg)	6.1371E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.2235E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.1168E-05
Total I (Ci)			1.5885E+07

Time (h) = 0.0556	Deposition Surfaces	Recirculating Filter
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)	1.0287E-02	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 0.0556	Leakage Transport
Noble gases (atoms)	2.2959E+18
Elemental I (atoms)	2.0278E+16
Organic I (atoms)	6.2714E+14
Aerosols (kg)	2.8456E-05

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1126E-01	1.9683E+01	1.1017E+00
Accumulated dose (rem)	1.2649E-01	2.2173E+01	1.2422E+00

Low Population Zone (LPZ) Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9347E-02	3.4226E+00	1.9157E-01
Accumulated dose (rem)	2.1994E-02	3.8555E+00	2.1599E-01

Control Room Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.6259E-03	2.4448E+01	1.2381E+00
Accumulated dose (rem)	7.7612E-03	2.4842E+01	1.2580E+00

Containment Compartment Nuclide Inventory:

Time (h) = 0.5000	Ci	kg	Atoms	Decay
Kr-85	2.1720E+04	5.5360E-02	3.9222E+23	1.4465E+18
Kr-85m	6.0582E+05	7.3615E-05	5.2156E+20	4.1950E+19
Kr-87	9.8381E+05	3.4732E-05	2.4042E+20	7.5321E+19
Kr-88	1.6129E+06	1.2863E-04	8.8025E+20	1.1425E+20
Rb-86	9.8964E+03	1.2163E-04	8.5169E+20	6.6346E+17
I-131	1.8184E+06	1.4668E-02	6.7428E+22	1.2193E+20
I-132	2.2661E+06	2.1954E-04	1.0016E+21	1.6388E+20
I-133	3.7086E+06	3.2738E-03	1.4823E+22	2.5054E+20
I-134	2.8216E+06	1.0577E-04	4.7534E+20	2.3195E+20
I-135	3.3388E+06	9.5073E-04	4.2410E+21	2.2966E+20
Xe-133	4.1095E+06	2.1954E-02	9.9408E+22	2.7368E+20
Xe-135	1.2334E+06	4.8299E-04	2.1546E+21	7.9321E+19
Cs-134	8.1096E+05	6.2679E-01	2.8169E+24	5.4346E+19
Cs-136	2.2947E+05	3.1309E-03	1.3864E+22	1.5386E+19
Cs-137	4.7029E+05	5.4068E+00	2.3767E+25	3.1516E+19

Containment Transport Group Inventory:

Time (h) = 0.5000	Atmosphere	Sump	
Noble gases (atoms)	4.9542E+23	0.0000E+00	
Elemental I (atoms)	4.3280E+21	0.0000E+00	
Organic I (atoms)	1.3385E+20	0.0000E+00	
Aerosols (kg)	6.0550E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.1581E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.9866E-05
Total I (Ci)			1.3953E+07

Time (h) = 0.5000	Deposition Surfaces	Recirculating Filter
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)	9.1901E-02	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 0.5000	Leakage Transport
Noble gases (atoms)	2.0646E+19
Elemental I (atoms)	1.8151E+17
Organic I (atoms)	5.6138E+15
Aerosols (kg)	2.5421E-04

Exclusion Area Boundary (EAB) Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2572E-01	2.6186E+01	1.4449E+00
Accumulated dose (rem)	2.5221E-01	4.8360E+01	2.6871E+00

Low Population Zone (LPZ) Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.1861E-02	4.5533E+00	2.5124E-01
Accumulated dose (rem)	4.3855E-02	8.4088E+00	4.6723E-01

Control Room Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE

Delta dose (rem)	4.7375E-03	1.0171E+01	5.1745E-01
Accumulated dose (rem)	1.2499E-02	3.5013E+01	1.7755E+00

Containment Compartment Nuclide Inventory:

Time (h) = 1.1111	Ci	kg	Atoms	Decay
Kr-85	2.1719E+04	5.5358E-02	3.9221E+23	3.2144E+18
Kr-85m	5.5114E+05	6.6971E-05	4.7448E+20	8.9002E+19
Kr-87	7.0507E+05	2.4891E-05	1.7230E+20	1.4343E+20
Kr-88	1.3894E+06	1.1080E-04	7.5825E+20	2.3621E+20
Rb-86	9.5221E+03	1.1703E-04	8.1947E+20	1.4512E+18
I-131	1.7508E+06	1.4122E-02	6.4922E+22	2.6675E+20
I-132	1.8189E+06	1.7621E-04	8.0392E+20	3.2898E+20
I-133	3.5065E+06	3.0954E-03	1.4016E+22	5.4324E+20
I-134	1.6794E+06	6.2954E-05	2.8292E+20	4.1059E+20
I-135	3.0218E+06	8.6046E-04	3.8384E+21	4.8755E+20
Xe-133	4.1072E+06	2.1942E-02	9.9352E+22	6.0801E+20
Xe-135	1.3002E+06	5.0915E-04	2.2713E+21	1.8172E+20
Cs-134	7.8100E+05	6.0363E-01	2.7128E+24	1.1893E+20
Cs-136	2.2070E+05	3.0113E-03	1.3334E+22	3.3648E+19
Cs-137	4.5293E+05	5.2071E+00	2.2889E+25	6.8969E+19

Containment Transport Group Inventory:

Time (h) = 1.1111	Atmosphere	Sump	
Noble gases (atoms)	4.9523E+23	0.0000E+00	
Elemental I (atoms)	4.2756E+21	0.0000E+00	
Organic I (atoms)	1.3223E+20	0.0000E+00	
Aerosols (kg)	5.8313E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.0166E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.7591E-05
Total I (Ci)			1.1777E+07

Time (h) = 1.1111	Deposition Surfaces	Recirculating Filter
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)	3.1513E-01	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 1.1111	Leakage Transport
Noble gases (atoms)	4.5871E+19
Elemental I (atoms)	4.0076E+17
Organic I (atoms)	1.2395E+16
Aerosols (kg)	5.5681E-04

Exclusion Area Boundary (EAB) Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.4274E-01	3.6007E+01	1.9599E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.4819E-02	6.2610E+00	3.4079E-01

Accumulated dose (rem)	6.8674E-02	1.4670E+01	8.0802E-01

Control Room Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.1102E-03	1.8483E+00	9.6043E-02
Accumulated dose (rem)	1.5609E-02	3.6862E+01	1.8715E+00

Containment Compartment Nuclide Inventory:

Time (h) = 2.0000	Ci	kg	Atoms	Decay
Kr-85	2.1718E+04	5.5356E-02	3.9219E+23	5.7859E+18
Kr-85m	4.8028E+05	5.8361E-05	4.1348E+20	1.4997E+20
Kr-87	4.3429E+05	1.5332E-05	1.0613E+20	2.0959E+20
Kr-88	1.1183E+06	8.9184E-05	6.1032E+20	3.8409E+20
Rb-86	8.9367E+03	1.0983E-04	7.6910E+20	2.5430E+18
I-131	1.6457E+06	1.3275E-02	6.1025E+22	4.6766E+20
I-132	1.3121E+06	1.2711E-04	5.7993E+20	5.1260E+20
I-133	3.2100E+06	2.8337E-03	1.2831E+22	9.4039E+20
I-134	7.8420E+05	2.9396E-05	1.3211E+20	5.4969E+20
I-135	2.5959E+06	7.3918E-04	3.2974E+21	8.1931E+20
Xe-133	4.1027E+06	2.1918E-02	9.9244E+22	1.0939E+21
Xe-135	1.3715E+06	5.3705E-04	2.3957E+21	3.3911E+20
Cs-134	7.3398E+05	5.6729E-01	2.5495E+24	2.0854E+20
Cs-136	2.0701E+05	2.8245E-03	1.2507E+22	5.8946E+19
Cs-137	4.2567E+05	4.8938E+00	2.1512E+25	1.2094E+20

Containment Transport Group Inventory:

Time (h) = 2.0000	Atmosphere	Sump	
Noble gases (atoms)	4.9496E+23	0.0000E+00	
Elemental I (atoms)	4.2095E+21	0.0000E+00	
Organic I (atoms)	1.3019E+20	0.0000E+00	
Aerosols (kg)	5.4801E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		2.8051E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.4452E-05
Total I (Ci)			9.5480E+06

Time (h) = 2.0000	Deposition Surfaces	Recirculating Filter
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)	6.6561E-01	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 2.0000	Leakage Transport
Noble gases (atoms)	8.2547E+19
Elemental I (atoms)	7.1524E+17
Organic I (atoms)	2.2121E+16
Aerosols (kg)	9.7683E-04

Exclusion Area Boundary (EAB) Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.7396E-02	1.4371E+01	7.6618E-01
Accumulated dose (rem)	1.0607E-01	2.9041E+01	1.5742E+00

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.8830E-03	6.3552E+00	3.2852E-01
Accumulated dose (rem)	2.3492E-02	4.3217E+01	2.2000E+00

Containment Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
Kr-85	2.1709E+04	5.5333E-02	3.9203E+23	2.3139E+19
Kr-85m	1.8972E+05	2.3054E-05	1.6333E+20	3.9998E+20
Kr-87	1.6491E+04	5.8218E-07	4.0298E+18	3.1167E+20
Kr-88	2.5844E+05	2.0611E-05	1.4105E+20	8.5320E+20
Rb-86	4.5798E+03	5.6285E-05	3.9414E+20	7.8200E+18
I-131	8.7640E+05	7.0692E-03	3.2497E+22	1.4528E+21
I-132	1.1705E+05	1.1340E-05	5.1734E+19	9.1187E+20
I-133	1.4301E+06	1.2625E-03	5.7163E+21	2.7169E+21
I-134	3.7140E+03	1.3922E-07	6.2569E+17	6.6723E+20
I-135	7.5290E+05	2.1439E-04	9.5636E+20	2.0213E+21
Xe-133	4.0373E+06	2.1569E-02	9.7662E+22	4.3499E+21
Xe-135	1.3170E+06	5.1571E-04	2.3005E+21	1.4548E+21
Cs-134	3.7956E+05	2.9336E-01	1.3184E+24	6.4368E+20
Cs-136	1.0567E+05	1.4418E-03	6.3842E+21	1.8097E+20
Cs-137	2.2017E+05	2.5313E+00	1.1127E+25	3.7332E+20

Containment Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump	
Noble gases (atoms)	4.9230E+23	0.0000E+00	
Elemental I (atoms)	3.8950E+21	0.0000E+00	
Organic I (atoms)	1.2046E+20	0.0000E+00	
Aerosols (kg)	2.8338E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.4088E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.6425E-05
Total I (Ci)			3.1802E+06

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
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)	3.3087E+00	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:

Time (h) = 8.0000	Leakage Transport
Noble gases (atoms)	3.2943E+20
Elemental I (atoms)	2.7365E+18
Organic I (atoms)	8.4633E+16
Aerosols (kg)	3.0204E-03

Exclusion Area Boundary (EAB) Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.4602E-02	4.7132E+00	2.4984E-01
Accumulated dose (rem)	1.2067E-01	3.3754E+01	1.8240E+00

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.3610E-03	2.5467E+00	1.2790E-01
Accumulated dose (rem)	2.5853E-02	4.5764E+01	2.3279E+00

Containment Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
Kr-85	2.1679E+04	5.5257E-02	3.9149E+23	6.9373E+19
Kr-85m	1.5938E+04	1.9367E-06	1.3721E+19	5.4951E+20
Kr-87	2.6861E+00	9.4829E-11	6.5641E+14	3.1570E+20
Kr-88	5.1981E+03	4.1454E-07	2.8369E+18	9.9136E+20
Rb-86	1.1169E+03	1.3726E-05	9.6117E+19	1.2395E+19
I-131	2.7027E+05	2.1800E-03	1.0022E+22	2.4148E+21
I-132	3.0783E+02	2.9822E-08	1.3605E+17	9.5037E+20
I-133	2.7407E+05	2.4194E-04	1.0955E+21	4.0290E+21
I-134	3.8888E-03	1.4578E-13	6.5514E+11	6.6778E+20
I-135	4.5934E+04	1.3080E-05	5.8346E+19	2.5009E+21
Xe-133	3.7417E+06	1.9989E-02	9.0511E+22	1.2648E+22
Xe-135	4.9234E+05	1.9279E-04	8.6002E+20	3.3009E+21
Cs-134	9.4825E+04	7.3291E-02	3.2938E+23	1.0263E+21
Cs-136	2.5500E+04	3.4793E-04	1.5406E+21	2.8612E+20
Cs-137	5.5037E+04	6.3275E-01	2.7814E+24	5.9533E+20

Containment Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	4.8288E+23	0.0000E+00	
Elemental I (atoms)	3.3932E+21	0.0000E+00	
Organic I (atoms)	1.0494E+20	0.0000E+00	
Aerosols (kg)	7.0807E-01	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.9307E-06
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.3042E-06
Total I (Ci)			5.9058E+05

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
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)	5.4320E+00	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:
Time (h) = 24.0000 Leakage Transport

Noble gases (atoms)	9.7982E+20
Elemental I (atoms)	7.5782E+18
Organic I (atoms)	2.3438E+17
Aerosols (kg)	4.8493E-03

Exclusion Area Boundary (EAB) Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.2477E-03	2.2306E+00	1.1408E-01
Accumulated dose (rem)	1.2392E-01	3.5985E+01	1.9381E+00

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.1691E-04	8.7204E-01	4.2663E-02
Accumulated dose (rem)	2.6370E-02	4.6636E+01	2.3706E+00

Containment Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
Kr-85	2.1603E+04	5.5063E-02	3.9011E+23	2.7692E+20
Kr-85m	2.3075E-01	2.8039E-11	1.9866E+14	5.6322E+20
Kr-88	1.2100E-04	9.6499E-15	6.6037E+10	9.9420E+20
Rb-86	4.8485E+02	5.9588E-06	4.1726E+19	1.9623E+19
I-131	1.3469E+05	1.0865E-03	4.9945E+21	4.2573E+21
I-132	7.4926E-08	7.2588E-18	3.3116E+07	9.5051E+20
I-133	1.6059E+04	1.4176E-05	6.4189E+19	4.8905E+21
I-135	1.5596E+01	4.4409E-09	1.9810E+16	2.5556E+21
Xe-133	2.5357E+06	1.3547E-02	6.1338E+22	4.2431E+22
Xe-135	2.3586E+03	9.2359E-07	4.1200E+18	4.2027E+21
Cs-134	4.5891E+04	3.5469E-02	1.5940E+23	1.6697E+21
Cs-136	1.0559E+04	1.4406E-04	6.3792E+20	4.4781E+20
Cs-137	2.6704E+04	3.0701E-01	1.3495E+24	9.6918E+20

Containment Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump	
Noble gases (atoms)	4.5145E+23	0.0000E+00	
Elemental I (atoms)	2.3725E+21	0.0000E+00	
Organic I (atoms)	7.3375E+19	0.0000E+00	
Aerosols (kg)	3.4320E-01	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.7021E-06
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.7222E-06
Total I (Ci)			1.5077E+05

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
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)	5.7947E+00	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:
Time (h) = 96.0000 Leakage Transport

Noble gases (atoms)	2.3787E+21
Elemental I (atoms)	1.6016E+19
Organic I (atoms)	4.9535E+17
Aerosols (kg)	6.3606E-03

Exclusion Area Boundary (EAB) Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	3.9495E-01	8.4367E+01	4.6470E+00

Low Population Zone (LPZ) Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1210E-03	1.0119E+00	4.4695E-02
Accumulated dose (rem)	1.2504E-01	3.6997E+01	1.9828E+00

Control Room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.6478E-04	6.0600E-01	2.5471E-02
Accumulated dose (rem)	2.6735E-02	4.7242E+01	2.3960E+00

Containment Compartment Nuclide Inventory:

Time (h) = 720.0000	Ci	kg	Atoms	Decay
Kr-85	2.0952E+04	5.3403E-02	3.7835E+23	2.0453E+21
Rb-86	3.5065E-01	4.3095E-09	3.0177E+16	2.5163E+19
I-131	6.7588E+03	5.4517E-05	2.5062E+20	7.0733E+21
I-133	7.0602E-06	6.2325E-15	2.8220E+10	4.9469E+21
Xe-133	7.9620E+04	4.2536E-04	1.9260E+21	1.0145E+23
Cs-134	8.5124E+01	6.5792E-05	2.9568E+20	2.2720E+21
Cs-136	5.0682E+00	6.9151E-08	3.0620E+17	5.6203E+20
Cs-137	5.0650E+01	5.8230E-04	2.5596E+21	1.3209E+21

Containment Transport Group Inventory:

Time (h) = 720.0000	Atmosphere	Sump	
Noble gases (atoms)	3.8028E+23	0.0000E+00	
Elemental I (atoms)	2.4259E+20	0.0000E+00	
Organic I (atoms)	7.5029E+18	0.0000E+00	
Aerosols (kg)	6.4828E-04	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		8.3748E-08
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		8.3748E-08
Total I (Ci)			6.7588E+03

Time (h) = 720.0000	Deposition Surfaces	Recirculating Filter
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)	6.1354E+00	0.0000E+00

Containment Leak to the Environment Transport Group Inventory:
Time (h) = 720.0000 Leakage Transport

Noble gases (atoms)	1.2816E+22
Elemental I (atoms)	4.0174E+19
Organic I (atoms)	1.2425E+18
Aerosols (kg)	7.7803E-03

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I-131 Summary

Time (hr)	Primary Loop - Reacto I-131 (Curies)	Secondary Loop - Stea I-131 (Curies)	Containment I-131 (Curies)
0.000	0.0000E+00	0.0000E+00	1.6611E+06
0.000	0.0000E+00	0.0000E+00	1.8480E+06
0.056	0.0000E+00	0.0000E+00	1.8447E+06
0.356	0.0000E+00	0.0000E+00	1.8269E+06
0.500	0.0000E+00	0.0000E+00	1.8184E+06
0.900	0.0000E+00	0.0000E+00	1.7737E+06
1.111	0.0000E+00	0.0000E+00	1.7508E+06
1.511	0.0000E+00	0.0000E+00	1.7089E+06
1.811	0.0000E+00	0.0000E+00	1.6736E+06
2.000	0.0000E+00	0.0000E+00	1.6457E+06
2.300	0.0000E+00	0.0000E+00	1.6025E+06
2.600	0.0000E+00	0.0000E+00	1.5605E+06
2.900	0.0000E+00	0.0000E+00	1.5197E+06
3.200	0.0000E+00	0.0000E+00	1.4800E+06
3.500	0.0000E+00	0.0000E+00	1.4413E+06
3.800	0.0000E+00	0.0000E+00	1.4038E+06
4.100	0.0000E+00	0.0000E+00	1.3566E+06
4.400	0.0000E+00	0.0000E+00	1.3110E+06
4.700	0.0000E+00	0.0000E+00	1.2671E+06
5.000	0.0000E+00	0.0000E+00	1.2248E+06
5.300	0.0000E+00	0.0000E+00	1.1839E+06
5.600	0.0000E+00	0.0000E+00	1.1446E+06
5.900	0.0000E+00	0.0000E+00	1.1066E+06
6.200	0.0000E+00	0.0000E+00	1.0700E+06
6.500	0.0000E+00	0.0000E+00	1.0347E+06
6.800	0.0000E+00	0.0000E+00	1.0007E+06
7.100	0.0000E+00	0.0000E+00	9.6792E+05
7.400	0.0000E+00	0.0000E+00	9.3629E+05
7.700	0.0000E+00	0.0000E+00	9.0580E+05
8.000	0.0000E+00	0.0000E+00	8.7640E+05
8.300	0.0000E+00	0.0000E+00	8.4805E+05
8.600	0.0000E+00	0.0000E+00	8.2071E+05
8.900	0.0000E+00	0.0000E+00	7.9436E+05
9.200	0.0000E+00	0.0000E+00	7.6894E+05
9.500	0.0000E+00	0.0000E+00	7.4444E+05
9.800	0.0000E+00	0.0000E+00	7.2081E+05
10.100	0.0000E+00	0.0000E+00	6.9803E+05
10.400	0.0000E+00	0.0000E+00	6.7606E+05
24.000	0.0000E+00	0.0000E+00	2.7027E+05
96.000	0.0000E+00	0.0000E+00	1.3469E+05
720.000	0.0000E+00	0.0000E+00	6.7588E+03

Control Room Environment

Time (hr)	I-131 (Curies)	I-131 (Curies)
0.000	4.1953E-06	6.9214E-04
0.000	1.3058E-05	2.1543E-03
0.056	4.9258E-02	8.5529E+00
0.356	2.4131E-01	5.4439E+01
0.500	3.0106E-01	7.6369E+01
0.900	1.2428E-02	1.3622E+02
1.111	8.0592E-03	1.6722E+02
1.511	7.3361E-03	2.2486E+02
1.811	7.1901E-03	2.6717E+02
2.000	7.0776E-03	2.9330E+02
2.300	5.0404E-03	3.3389E+02
2.600	4.8249E-03	3.7342E+02
2.900	4.6960E-03	4.1191E+02
3.200	4.5745E-03	4.4940E+02
3.500	4.4564E-03	4.8590E+02
3.800	4.3416E-03	5.2146E+02
4.100	4.2075E-03	5.5595E+02
4.400	4.0684E-03	5.8929E+02
4.700	3.9338E-03	6.2151E+02
5.000	3.8041E-03	6.5265E+02
5.300	3.6789E-03	6.8275E+02
5.600	3.5583E-03	7.1184E+02
5.900	3.4420E-03	7.3998E+02
6.200	3.3298E-03	7.6718E+02
6.500	3.2217E-03	7.9348E+02
6.800	3.1174E-03	8.1891E+02
7.100	3.0169E-03	8.4352E+02
7.400	2.9199E-03	8.6731E+02
7.700	2.8264E-03	8.9033E+02
8.000	2.7363E-03	9.1260E+02
8.300	1.1930E-03	9.3415E+02
8.600	1.0896E-03	9.5501E+02
8.900	1.0523E-03	9.7519E+02
9.200	1.0192E-03	9.9472E+02
9.500	9.8738E-04	1.0136E+03
9.800	9.5670E-04	1.0319E+03
10.100	9.2712E-04	1.0497E+03
10.400	8.9860E-04	1.0668E+03
24.000	3.6858E-04	1.5250E+03
96.000	6.3913E-05	2.1021E+03
720.000	2.4740E-06	2.9825E+03

##

Cumulative Dose Summary

##

	Exclusion Area Bounda		Low Population Zone (		Control Room	
Time (hr)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.000	6.2754E-04	3.5889E-05	1.0912E-04	6.2404E-06	3.0879E-08	1.5946E-09
0.056	2.4900E+00	1.4046E-01	4.3297E-01	2.4423E-02	3.9396E-01	1.9949E-02
0.356	1.5822E+01	8.8844E-01	2.7512E+00	1.5448E-01	1.3599E+01	6.8864E-01
0.500	2.2173E+01	1.2422E+00	3.8555E+00	2.1599E-01	2.4842E+01	1.2580E+00
0.900	3.9449E+01	2.1977E+00	6.8594E+00	3.8213E-01	3.4432E+01	1.7453E+00
1.111	4.8360E+01	2.6871E+00	8.4088E+00	4.6723E-01	3.5013E+01	1.7755E+00

1.511	6.4871E+01	3.5890E+00	1.1280E+01	6.2405E-01	3.5869E+01	1.8200E+00
1.811	7.6939E+01	4.2446E+00	1.3378E+01	7.3806E-01	3.6483E+01	1.8518E+00
2.000	8.4367E+01	4.6470E+00	1.4670E+01	8.0802E-01	3.6862E+01	1.8715E+00
2.300	8.4367E+01	4.6470E+00	1.5636E+01	8.6023E-01	3.7340E+01	1.8964E+00
2.600	8.4367E+01	4.6470E+00	1.6574E+01	9.1075E-01	3.7751E+01	1.9178E+00
2.900	8.4367E+01	4.6470E+00	1.7485E+01	9.5968E-01	3.8149E+01	1.9384E+00
3.200	8.4367E+01	4.6470E+00	1.8368E+01	1.0071E+00	3.8534E+01	1.9584E+00
3.500	8.4367E+01	4.6470E+00	1.9226E+01	1.0530E+00	3.8909E+01	1.9778E+00
3.800	8.4367E+01	4.6470E+00	2.0059E+01	1.0975E+00	3.9273E+01	1.9966E+00
4.100	8.4367E+01	4.6470E+00	2.0865E+01	1.1405E+00	3.9625E+01	2.0148E+00
4.400	8.4367E+01	4.6470E+00	2.1641E+01	1.1819E+00	3.9965E+01	2.0324E+00
4.700	8.4367E+01	4.6470E+00	2.2389E+01	1.2217E+00	4.0293E+01	2.0493E+00
5.000	8.4367E+01	4.6470E+00	2.3110E+01	1.2601E+00	4.0609E+01	2.0657E+00
5.300	8.4367E+01	4.6470E+00	2.3804E+01	1.2970E+00	4.0914E+01	2.0814E+00
5.600	8.4367E+01	4.6470E+00	2.4474E+01	1.3326E+00	4.1208E+01	2.0966E+00
5.900	8.4367E+01	4.6470E+00	2.5120E+01	1.3668E+00	4.1492E+01	2.1112E+00
6.200	8.4367E+01	4.6470E+00	2.5742E+01	1.3998E+00	4.1765E+01	2.1253E+00
6.500	8.4367E+01	4.6470E+00	2.6343E+01	1.4316E+00	4.2029E+01	2.1389E+00
6.800	8.4367E+01	4.6470E+00	2.6922E+01	1.4623E+00	4.2284E+01	2.1520E+00
7.100	8.4367E+01	4.6470E+00	2.7480E+01	1.4918E+00	4.2530E+01	2.1647E+00
7.400	8.4367E+01	4.6470E+00	2.8019E+01	1.5203E+00	4.2767E+01	2.1769E+00
7.700	8.4367E+01	4.6470E+00	2.8539E+01	1.5477E+00	4.2996E+01	2.1887E+00
8.000	8.4367E+01	4.6470E+00	2.9041E+01	1.5742E+00	4.3217E+01	2.2000E+00
8.300	8.4367E+01	4.6470E+00	2.9213E+01	1.5836E+00	4.3349E+01	2.2069E+00
8.600	8.4367E+01	4.6470E+00	2.9380E+01	1.5927E+00	4.3439E+01	2.2115E+00
8.900	8.4367E+01	4.6470E+00	2.9541E+01	1.6015E+00	4.3523E+01	2.2158E+00
9.200	8.4367E+01	4.6470E+00	2.9697E+01	1.6099E+00	4.3605E+01	2.2200E+00
9.500	8.4367E+01	4.6470E+00	2.9847E+01	1.6180E+00	4.3683E+01	2.2241E+00
9.800	8.4367E+01	4.6470E+00	2.9992E+01	1.6259E+00	4.3760E+01	2.2280E+00
10.100	8.4367E+01	4.6470E+00	3.0132E+01	1.6335E+00	4.3833E+01	2.2317E+00
10.400	8.4367E+01	4.6470E+00	3.0267E+01	1.6408E+00	4.3904E+01	2.2354E+00
24.000	8.4367E+01	4.6470E+00	3.3754E+01	1.8240E+00	4.5764E+01	2.3279E+00
96.000	8.4367E+01	4.6470E+00	3.5985E+01	1.9381E+00	4.6636E+01	2.3706E+00
720.000	8.4367E+01	4.6470E+00	3.6997E+01	1.9828E+00	4.7242E+01	2.3960E+00

```
########################################################################
                        Worst Two-Hour Doses
########################################################################
```

Exclusion Area Boundary (EAB)

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	3.9495E-01	8.4367E+01	4.6470E+00

```
 ##########################################################################
    RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:19:46
 ##########################################################################

 ##########################################################################
                      File information
 ##########################################################################

 Plant file           = C:\Documents and Settings\Aleem Boatright\My Documents\My
Work\Exelon\Byron & Braidwood\CREA\RADTRAD\Rev 1\(Large CR Volume Conservatism
Test) B-B CREA Case 2 - Large CR Volume 1000cfm Inleak - 95 percent Intake Filt.psf
 Inventory file       = c:\program files\radtrad3-03\defaults\byron-braidwood ast
source terms.nif
 Release file         = C:\Program Files\radtrad3-03\Defaults\Byron-Braidwood CREA-
Release Fractions (Rev 1).rft
 Dose Conversion file = c:\program files\radtrad3-03\defaults\fgr11&12.inp



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

 Radtrad 3.03 4/15/2001
 Byron/Braidwood CREA - Case 2 - Secondary Loop Leakage - Control Room @ 240,000
cu. ft. CR Volume with 8575cfm Intake - 1000cfm Unfilt Inleakage - 95% CR Intake
Fiters - 80% Aerosol, 90% Elemental & Organic Recirc Filtration
 Nuclide Inventory File:
 c:\program files\radtrad3-03\defaults\byron-braidwood ast source terms.nif
 Plant Power Level:
  3.6583E+03
 Compartments:
   8
 Compartment 1:
 Primary Loop 1 - Reactor Coolant System (RCS)
   3
  7.2850E+03
   0
   0
   0
   0
   0
 Compartment 2:
 Primary Loop 2 - Reactor Coolant System (RCS)
   3
  7.2850E+03
   0
   0
   0
```

```
  0
  0
Compartment 3:
Primary Loop 3 - Reactor Coolant System (RCS)
  3
 7.2850E+03
  0
  0
  0
  0
  0
Compartment 4:
Secondary Loop 1 - Steam Generator Volume (4 SGs)
  3
 4.7890E+03
  0
  0
  0
  0
  0
Compartment 5:
Secondary Loop 2 - Steam Generator Volumes (4 SGs)
  3
 4.7890E+03
  0
  0
  0
  0
  0
Compartment 6:
Secondary Loop 3 - Steam Generator Volumes (4 SGs)
  3
 4.7890E+03
  0
  0
  0
  0
  0
Compartment 7:
Control Room
  1
 2.4000E+05
  0
  0
  1
  0
  0
Compartment 8:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Pathways:
```

```
   9
 Pathway 1:
 (Iodine Activity Leakage Path) Primary Loop 1 - Reactor Coolant System (RCS) to
Secondary Loop 1 - Steam Generator Volume (4 SGs)
   1
   4
   2
 Pathway 2:
 (Noble Gas Activity Leakage Path) Primary Loop 2 - Reactor Coolant System (RCS) to
Secondary Loop 2 - Steam Generator Volumes (4 SGs)
   2
   5
   2
 Pathway 3:
 (Fission Product Activity Leakage Path) Primary Loop 3 - Reactor Coolant System
(RCS) to Secondary Loop 3 - Steam Generator Volumes (4 SGs)
   3
   6
   2
 Pathway 4:
 (Iodine Activity Release Path) Secondary Loop 1 - Steam Generator Volume (4 SGs)
to Environment
   4
   8
   2
 Pathway 5:
 (Noble Gas Activity Release Path) Secondary Loop 2 - Steam Generator Volumes (4
SGs) to Environment
   5
   8
   2
 Pathway 6:
 (Fission Product Activity Release Path) Secondary Loop 3 - Steam Generator Volumes
(4 SGs) to Environment
   6
   8
   2
 Pathway 7:
 (Filtered Intake) Environment to Control Room
   8
   7
   2
 Pathway 8:
 (Unfiltered Inleakage) Environment to Control Room
   8
   7
   2
 Pathway 9:
 (Control Room Exhaust) Control Room to Environment
   7
   8
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:
```

```
 Source Term:
   3
   1   1.0000E+00
   2   1.0000E+00
   3   1.0000E+00
 c:\program files\radtrad3-03\defaults\fgr11&12.inp
 C:\Program Files\radtrad3-03\Defaults\Byron-Braidwood CREA-Release Fractions (Rev
1).rft
   0.0000E+00
   1
   0.0000E+00   1.0000E+00   0.0000E+00   1.0000E+00
 Overlying Pool:
   0
   0.0000E+00
   0
   0
   0
   0
 Compartments:
   8
 Compartment 1:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 2:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 3:
   0
   1
   0
   0
   0
   0
   0
   0
   0
 Compartment 4:
   0
   1
   0
   0
   0
   0
```

```
  0
  0
  0
Compartment 5:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 6:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 7:
  0
  1
  0
  0
  0
  0
  1
  3.9150E+04
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   8.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Compartment 8:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Pathways:
  9
Pathway 1:
  0
  0
  0
  0
  0
  1
```

```
  3
  0.0000E+00   1.3370E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+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
  3
  0.0000E+00   1.3370E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.3370E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.1111E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   2.8830E+01   1.0000E+02   0.0000E+00   1.0000E+02
  5.5600E-02   4.8060E+00   1.0000E+02   0.0000E+00   1.0000E+02
  1.1111E+00   0.0000E+00   1.0000E+02   0.0000E+00   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
```

```
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   2.8830E+03   1.0000E+02   1.0000E+02   1.0000E+02
  5.5600E-02   4.8060E+02   1.0000E+02   1.0000E+02   1.0000E+02
  1.1111E+00   0.0000E+00   1.0000E+02   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  4
  0.0000E+00   1.5860E+01   0.0000E+00   1.0000E+02   1.0000E+02
  5.5600E-02   2.6430E+00   0.0000E+00   1.0000E+02   1.0000E+02
  1.1111E+00   0.0000E+00   0.0000E+00   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   6.4240E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   8.5750E+03   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
```

```
  0
Pathway 8:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  5.0000E-01   1.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 9:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   7.4240E+03   1.0000E+02   1.0000E+02   1.0000E+02
  5.0000E-01   9.5750E+03   1.0000E+02   1.0000E+02   1.0000E+02
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary (EAB)
  8
  1
  3
  0.0000E+00   5.3600E-04
  5.0000E-01   5.3600E-04
  2.0000E+00   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone (LPZ)
  8
  1
  7
```

```
   0.0000E+00   9.3200E-05
   5.0000E-01   9.3200E-05
   2.0000E+00   4.5000E-05
   8.0000E+00   3.1200E-05
   2.4000E+01   1.4100E-05
   9.6000E+01   4.5400E-06
   7.2000E+02   0.0000E+00
   1
   4
   0.0000E+00   3.5000E-04
   8.0000E+00   1.8000E-04
   2.4000E+01   2.3000E-04
   7.2000E+02   0.0000E+00
   0
 Location 3:
 Control Room
   7
   0
   1
   2
   0.0000E+00   3.5000E-04
   7.2000E+02   0.0000E+00
   1
   4
   0.0000E+00   1.0000E+00
   2.4000E+01   6.0000E-01
   9.6000E+01   4.0000E-01
   7.2000E+02   0.0000E+00
 Effective Volume Location:
   1
   7
   0.0000E+00   1.7700E-03
   5.0000E-01   8.1400E-04
   2.0000E+00   6.9800E-04
   8.0000E+00   3.1200E-04
   2.4000E+01   1.9500E-04
   9.6000E+01   1.6700E-04
   7.2000E+02   0.0000E+00
 Simulation Parameters:
   1
   0.0000E+00   0.0000E+00
 Output Filename:
 C:\Documents and Settings\Aleem Boatright\My Documents\My Work\Exelon\Byron &
Braidwood\CREA\RADTRAD\Rev 1\(Large CR Volume Conservatism Test) B-B CREA Case 2 -
Large CR Volume 1000cfm Inleak - 95 percent Intake Filt.o0
   1
   1
   1
   0
   0
 End of Scenario File
```

```
##########################################################################
   RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:19:46
##########################################################################

##########################################################################
                    Plant Description
##########################################################################

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   3.6583E+03 MWth

Number of compartments    =   8

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: Primary Loop 1 - Reactor Coolant System
Compartment volume =   7.2850E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: (Iodine Activity Leakage Path) Primary Loop 1 - Re

Compartment number  2  (Source term fraction =   1.0000E+00
)
Name: Primary Loop 2 - Reactor Coolant System
Compartment volume =   7.2850E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  2
   Exit Pathway Number    2: (Noble Gas Activity Leakage Path) Primary Loop 2 -

Compartment number  3  (Source term fraction =   1.0000E+00
)
Name: Primary Loop 3 - Reactor Coolant System
Compartment volume =   7.2850E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  3
   Exit Pathway Number    3: (Fission Product Activity Leakage Path) Primary Lo

Compartment number  4
Name: Secondary Loop 1 - Steam Generator Volum
Compartment volume =   4.7890E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  4
   Inlet Pathway Number   1: (Iodine Activity Leakage Path) Primary Loop 1 - Re
   Exit Pathway Number    4: (Iodine Activity Release Path) Secondary Loop 1 -

Compartment number  5
Name: Secondary Loop 2 - Steam Generator Volum
Compartment volume =   4.7890E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  5
   Inlet Pathway Number   2: (Noble Gas Activity Leakage Path) Primary Loop 2 -
   Exit Pathway Number    5: (Noble Gas Activity Release Path) Secondary Loop 2
```

```
Compartment number  6
Name: Secondary Loop 3 - Steam Generator Volum
Compartment volume =   4.7890E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  6
   Inlet Pathway Number   3: (Fission Product Activity Leakage Path) Primary Lo
   Exit Pathway Number    6: (Fission Product Activity Release Path) Secondary

Compartment number  7
Name: Control Room
Compartment volume =   2.4000E+05 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  7
   Inlet Pathway Number   7: (Filtered Intake) Environment to Control Room
   Inlet Pathway Number   8: (Unfiltered Inleakage) Environment to Control Room
   Exit Pathway Number    9: (Control Room Exhaust) Control Room to Environment

Compartment number  8
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  8
   Inlet Pathway Number   4: (Iodine Activity Release Path) Secondary Loop 1 -
   Inlet Pathway Number   5: (Noble Gas Activity Release Path) Secondary Loop 2
   Inlet Pathway Number   6: (Fission Product Activity Release Path) Secondary
   Inlet Pathway Number   9: (Control Room Exhaust) Control Room to Environment
   Exit Pathway Number    7: (Filtered Intake) Environment to Control Room
   Exit Pathway Number    8: (Unfiltered Inleakage) Environment to Control Room

Total number of pathways =   9
```

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##########################################################################
   RADTRAD Version 3.03 (Spring 2001) run on 11/17/2004  at  7:19:46
##########################################################################

##########################################################################
                     Scenario Description
##########################################################################

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings
                GAP          EARLY IN-VESSEL   LATE RELEASE     RELEASE MASS
              0.000010 hr      0.0000 hrs       0.0000 hrs          (gm)
NOBLES        1.7000E-02       3.8250E-03       0.0000E+00        7.805E+01
IODINE        1.7000E-02       1.9125E-03       0.0000E+00        1.972E+01
CESIUM        4.0800E-02       1.6150E-03       0.0000E+00        6.129E+03
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 =      3658. MWt

Nuclide  Group  Specific      half      Whole Body   Inhaled      Inhaled
 Name           Inventory     life        DCF       Thyroid     Effective
                (Ci/MWt)      (s)     (Sv-m3/Bq-s)  (Sv/Bq)     (Sv/Bq)
 Kr-85     1   2.851E+02  3.383E+08   1.190E-16   0.000E+00   0.000E+00
 Kr-85m    1   8.592E+03  1.613E+04   7.480E-15   0.000E+00   0.000E+00
 Kr-87     1   1.696E+04  4.578E+03   4.120E-14   0.000E+00   0.000E+00
 Kr-88     1   2.392E+04  1.022E+04   1.020E-13   0.000E+00   0.000E+00
 Rb-86     3   6.480E+01  1.612E+06   4.810E-15   1.330E-09   1.790E-09
 I-131     2   2.671E+04  6.947E+05   1.820E-14   2.920E-07   8.890E-09
 I-132     2   3.863E+04  8.280E+03   1.120E-13   1.740E-09   1.030E-10
 I-133     2   5.529E+04  7.488E+04   2.940E-14   4.860E-08   1.580E-09
 I-134     2   6.143E+04  3.156E+03   1.300E-13   2.880E-10   3.550E-11
 I-135     2   5.159E+04  2.380E+04   8.294E-14   8.460E-09   3.320E-10
 Xe-133    1   5.396E+04  4.532E+05   1.560E-15   0.000E+00   0.000E+00
 Xe-135    1   1.532E+04  3.272E+04   1.190E-14   0.000E+00   0.000E+00
 Cs-134    3   5.306E+03  6.507E+07   7.570E-14   1.110E-08   1.250E-08
 Cs-136    3   1.503E+03  1.132E+06   1.060E-13   1.730E-09   1.980E-09
 Cs-137    3   3.077E+03  9.467E+08   2.725E-14   7.930E-09   8.630E-09

Nuclide    Daughter  Fraction   Daughter  Fraction   Daughter  Fraction
 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
 Sr-90     Y-90        1.00     none        0.00     none        0.00
 Sr-91     Y-91m       0.58     Y-91        0.42     none        0.00
 Sr-92     Y-92        1.00     none        0.00     none        0.00
 Y-93      Zr-93       1.00     none        0.00     none        0.00
 Zr-95     Nb-95m      0.01     Nb-95       0.99     none        0.00
 Zr-97     Nb-97m      0.95     Nb-97       0.05     none        0.00
 Mo-99     Tc-99m      0.88     Tc-99       0.12     none        0.00
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Tc-99m	Tc-99	1.00	none	0.00	none	0.00
Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00
Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol	=	0.0000E+00
Elemental	=	1.0000E+00
Organic	=	0.0000E+00

COMPARTMENT DATA

Compartment number 1: Primary Loop 1 - Reactor Coolant System

Compartment number 2: Primary Loop 2 - Reactor Coolant System

Compartment number 3: Primary Loop 3 - Reactor Coolant System

Compartment number 4: Secondary Loop 1 - Steam Generator Volum

Compartment number 5: Secondary Loop 2 - Steam Generator Volum

Compartment number 6: Secondary Loop 3 - Steam Generator Volum

Compartment number 7: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.9150E+04	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	3.9150E+04	8.0000E+01	9.0000E+01	9.0000E+01

7.2000E+02	3.9150E+04	0.0000E+00	0.0000E+00	0.0000E+00

Compartment number 8: Environment

PATHWAY DATA

Pathway number 1: (Iodine Activity Leakage Path) Primary Loop 1 - Re

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.3370E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: (Noble Gas Activity Leakage Path) Primary Loop 2 -

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.3370E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: (Fission Product Activity Leakage Path) Primary Lo

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.3370E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.1111E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: (Iodine Activity Release Path) Secondary Loop 1 -

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.8830E+01	1.0000E+02	0.0000E+00	1.0000E+02
5.5600E-02	4.8060E+00	1.0000E+02	0.0000E+00	1.0000E+02
1.1111E+00	0.0000E+00	1.0000E+02	0.0000E+00	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: (Noble Gas Activity Release Path) Secondary Loop 2

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.8830E+03	1.0000E+02	1.0000E+02	1.0000E+02
5.5600E-02	4.8060E+02	1.0000E+02	1.0000E+02	1.0000E+02
1.1111E+00	0.0000E+00	1.0000E+02	1.0000E+02	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 6: (Fission Product Activity Release Path) Secondary

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.5860E+01	0.0000E+00	1.0000E+02	1.0000E+02
5.5600E-02	2.6430E+00	0.0000E+00	1.0000E+02	1.0000E+02
1.1111E+00	0.0000E+00	0.0000E+00	1.0000E+02	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 7: (Filtered Intake) Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	6.4240E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	8.5750E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 8: (Unfiltered Inleakage) Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
5.0000E-01	1.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 9: (Control Room Exhaust) Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	7.4240E+03	1.0000E+02	1.0000E+02	1.0000E+02
5.0000E-01	9.5750E+03	1.0000E+02	1.0000E+02	1.0000E+02
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary (EAB) is in compartment 8

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	5.3600E-04
5.0000E-01	5.3600E-04
2.0000E+00	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
8.0000E+00	1.8000E-04
2.4000E+01	2.3000E-04
7.2000E+02	0.0000E+00

```
Location Low Population Zone (LPZ)     is in compartment   8

Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00          9.3200E-05
  5.0000E-01          9.3200E-05
  2.0000E+00          4.5000E-05
  8.0000E+00          3.1200E-05
  2.4000E+01          1.4100E-05
  9.6000E+01          4.5400E-06
  7.2000E+02          0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                  3.5000E-04
  8.0000E+00                  1.8000E-04
  2.4000E+01                  2.3000E-04
  7.2000E+02                  0.0000E+00
Location Control Room     is in compartment   7

Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00          1.7700E-03
  5.0000E-01          8.1400E-04
  2.0000E+00          6.9800E-04
  8.0000E+00          3.1200E-04
  2.4000E+01          1.9500E-04
  9.6000E+01          1.6700E-04
  7.2000E+02          0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                  3.5000E-04
  7.2000E+02                  0.0000E+00

Location Occupancy Factor Data
 Time (hr)          Occupancy Factor
  0.0000E+00            1.0000E+00
  2.4000E+01            6.0000E-01
  9.6000E+01            4.0000E-01
  7.2000E+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 11/17/2004  at  7:19:46
##########################################################################
```

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

```
##########################################################################
                              Dose Output
##########################################################################
```

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.0402E-10	3.1825E-09	4.3989E-10
Accumulated dose (rem)	3.0402E-10	3.1825E-09	4.3989E-10

Low Population Zone (LPZ) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.2863E-11	5.5338E-10	7.6489E-11
Accumulated dose (rem)	5.2863E-11	5.5338E-10	7.6489E-11

Control Room Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.2294E-16	9.7527E-14	4.6867E-15
Accumulated dose (rem)	5.2294E-16	9.7527E-14	4.6867E-15

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.8905E-09	1.9451E-08	2.7183E-09
Accumulated dose (rem)	2.1945E-09	2.2633E-08	3.1582E-09

Low Population Zone (LPZ) Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.2872E-10	3.3821E-09	4.7267E-10
Accumulated dose (rem)	3.8158E-10	3.9355E-09	5.4916E-10

Control Room Doses:

Time (h) = 0.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.2976E-15	7.9111E-13	3.7995E-14
Accumulated dose (rem)	4.8206E-15	8.8864E-13	4.2682E-14

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0384E-02	3.2588E-01	3.4073E-02
Accumulated dose (rem)	2.0384E-02	3.2588E-01	3.4073E-02

Low Population Zone (LPZ) Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.5444E-03	5.6664E-02	5.9246E-03
Accumulated dose (rem)	3.5444E-03	5.6664E-02	5.9246E-03

Control Room Doses:

Time (h) = 0.0556	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.8752E-04	5.3641E-02	2.4408E-03
Accumulated dose (rem)	1.8752E-04	5.3641E-02	2.4408E-03

Exclusion Area Boundary (EAB) Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9286E-01	4.2954E+00	3.7337E-01
Accumulated dose (rem)	2.1325E-01	4.6213E+00	4.0745E-01

Low Population Zone (LPZ) Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.3535E-02	7.4688E-01	6.4922E-02
Accumulated dose (rem)	3.7079E-02	8.0355E-01	7.0847E-02

Control Room Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1515E-02	4.1073E+00	1.8409E-01
Accumulated dose (rem)	1.1702E-02	4.1609E+00	1.8653E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.6763E-01	1.6742E+01	1.0725E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.3924E-02	2.9111E+00	1.8649E-01
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 1.1111	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5649E-02	2.6819E+00	1.3880E-01
Accumulated dose (rem)	3.7351E-02	6.8428E+00	3.2532E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3359E-02	1.6562E-01	2.0171E-02
Accumulated dose (rem)	5.0711E-02	7.0084E+00	3.4549E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3994E-03	7.8323E-06	1.3999E-03
Accumulated dose (rem)	5.2110E-02	7.0084E+00	3.4689E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.3070E-10	4.2764E-34	2.3070E-10
Accumulated dose (rem)	5.2110E-02	7.0084E+00	3.4689E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.9653E-28	9.7857-105	9.9653E-28
Accumulated dose (rem)	5.2110E-02	7.0084E+00	3.4689E-01

Exclusion Area Boundary (EAB) Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.8087E-01	2.1363E+01	1.4799E+00

Low Population Zone (LPZ) Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.0100E-01	3.7147E+00	2.5733E-01

Control Room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0513-103	0.0000E+00	4.0513-103
Accumulated dose (rem)	5.2110E-02	7.0084E+00	3.4689E-01

839

##
I-131 Summary
##

Time (hr)	Primary Loop 1 - Reac I-131 (Curies)	Primary Loop 2 - Reac I-131 (Curies)	Primary Loop 3 - Reac I-131 (Curies)
0.000	1.6611E+06	1.6611E+06	1.6611E+06
0.000	1.8480E+06	1.8480E+06	1.8480E+06
0.056	1.8475E+06	1.8475E+06	1.8475E+06
0.356	1.8449E+06	1.8449E+06	1.8449E+06
0.500	1.8437E+06	1.8437E+06	1.8437E+06
0.900	1.8402E+06	1.8402E+06	1.8402E+06
1.111	1.8384E+06	1.8384E+06	1.8384E+06
1.511	1.8357E+06	1.8357E+06	1.8357E+06
1.811	1.8338E+06	1.8338E+06	1.8338E+06
2.000	1.8325E+06	1.8325E+06	1.8325E+06
2.300	1.8306E+06	1.8306E+06	1.8306E+06
2.600	1.8286E+06	1.8286E+06	1.8286E+06
2.900	1.8266E+06	1.8266E+06	1.8266E+06
3.200	1.8246E+06	1.8246E+06	1.8246E+06
3.500	1.8227E+06	1.8227E+06	1.8227E+06
3.800	1.8207E+06	1.8207E+06	1.8207E+06
4.100	1.8188E+06	1.8188E+06	1.8188E+06
4.400	1.8168E+06	1.8168E+06	1.8168E+06

4.700	1.8148E+06	1.8148E+06	1.8148E+06
5.000	1.8129E+06	1.8129E+06	1.8129E+06
5.300	1.8109E+06	1.8109E+06	1.8109E+06
5.600	1.8090E+06	1.8090E+06	1.8090E+06
5.900	1.8070E+06	1.8070E+06	1.8070E+06
6.200	1.8051E+06	1.8051E+06	1.8051E+06
6.500	1.8031E+06	1.8031E+06	1.8031E+06
6.800	1.8012E+06	1.8012E+06	1.8012E+06
7.100	1.7993E+06	1.7993E+06	1.7993E+06
7.400	1.7973E+06	1.7973E+06	1.7973E+06
7.700	1.7954E+06	1.7954E+06	1.7954E+06
8.000	1.7935E+06	1.7935E+06	1.7935E+06
8.300	1.7915E+06	1.7915E+06	1.7915E+06
8.600	1.7896E+06	1.7896E+06	1.7896E+06
8.900	1.7877E+06	1.7877E+06	1.7877E+06
9.200	1.7857E+06	1.7857E+06	1.7857E+06
9.500	1.7838E+06	1.7838E+06	1.7838E+06
9.800	1.7819E+06	1.7819E+06	1.7819E+06
10.100	1.7800E+06	1.7800E+06	1.7800E+06
10.400	1.7781E+06	1.7781E+06	1.7781E+06
24.000	1.6933E+06	1.6933E+06	1.6933E+06
96.000	1.3074E+06	1.3074E+06	1.3074E+06
720.000	1.3897E+05	1.3897E+05	1.3897E+05

Time (hr)	Secondary Loop 1 - St I-131 (Curies)	Secondary Loop 2 - St I-131 (Curies)	Secondary Loop 3 - St I-131 (Curies)
0.000	9.1459E-03	9.1448E-03	9.1459E-03
0.000	2.8466E-02	2.8459E-02	2.8466E-02
0.056	1.1198E+02	4.8763E+01	1.1248E+02
0.356	7.1395E+02	2.9001E+02	7.1780E+02
0.500	9.9931E+02	3.1735E+02	1.0065E+03
0.900	1.7752E+03	3.3481E+02	1.7972E+03
1.111	2.1761E+03	3.3576E+02	2.2092E+03
1.511	2.1730E+03	3.3528E+02	2.2061E+03
1.811	2.1707E+03	3.3492E+02	2.2037E+03
2.000	2.1692E+03	3.3469E+02	2.2022E+03
2.300	2.1668E+03	3.3433E+02	2.1998E+03
2.600	2.1645E+03	3.3397E+02	2.1975E+03
2.900	2.1622E+03	3.3361E+02	2.1951E+03
3.200	2.1598E+03	3.3325E+02	2.1927E+03
3.500	2.1575E+03	3.3289E+02	2.1904E+03
3.800	2.1552E+03	3.3254E+02	2.1880E+03
4.100	2.1529E+03	3.3218E+02	2.1856E+03
4.400	2.1506E+03	3.3182E+02	2.1833E+03
4.700	2.1482E+03	3.3146E+02	2.1809E+03
5.000	2.1459E+03	3.3111E+02	2.1786E+03
5.300	2.1436E+03	3.3075E+02	2.1762E+03
5.600	2.1413E+03	3.3039E+02	2.1739E+03
5.900	2.1390E+03	3.3004E+02	2.1716E+03
6.200	2.1367E+03	3.2968E+02	2.1692E+03
6.500	2.1344E+03	3.2933E+02	2.1669E+03
6.800	2.1321E+03	3.2897E+02	2.1645E+03
7.100	2.1298E+03	3.2862E+02	2.1622E+03
7.400	2.1275E+03	3.2826E+02	2.1599E+03
7.700	2.1252E+03	3.2791E+02	2.1576E+03
8.000	2.1229E+03	3.2756E+02	2.1552E+03
8.300	2.1206E+03	3.2720E+02	2.1529E+03

8.600	2.1184E+03	3.2685E+02	2.1506E+03
8.900	2.1161E+03	3.2650E+02	2.1483E+03
9.200	2.1138E+03	3.2615E+02	2.1460E+03
9.500	2.1115E+03	3.2580E+02	2.1437E+03
9.800	2.1092E+03	3.2545E+02	2.1413E+03
10.100	2.1070E+03	3.2509E+02	2.1390E+03
10.400	2.1047E+03	3.2474E+02	2.1367E+03
24.000	2.0044E+03	3.0926E+02	2.0349E+03
96.000	1.5476E+03	2.3878E+02	1.5711E+03
720.000	1.6450E+02	2.5382E+01	1.6701E+02

Time (hr)	Control Room I-131 (Curies)	Environment I-131 (Curies)
0.000	6.8290E-11	1.1012E-08
0.000	4.8571E-10	7.8321E-08
0.056	6.7609E-03	1.1281E+00
0.356	4.1806E-02	8.6052E+00
0.500	7.2783E-02	1.6054E+01
0.900	5.5243E-03	4.9503E+01
1.111	5.9933E-03	7.4618E+01
1.511	6.7759E-05	7.4618E+01
1.811	2.3493E-06	7.4618E+01
2.000	2.8289E-07	7.4618E+01
2.300	9.8082E-09	7.4618E+01
2.600	3.4007E-10	7.4618E+01
2.900	1.1791E-11	7.4618E+01
3.200	4.0880E-13	7.4618E+01
3.500	1.4174E-14	7.4618E+01
3.800	4.9144E-16	7.4618E+01
4.100	1.7039E-17	7.4618E+01
4.400	5.9077E-19	7.4618E+01
4.700	2.0483E-20	7.4618E+01
5.000	7.1018E-22	7.4618E+01
5.300	2.4623E-23	7.4618E+01
5.600	8.5373E-25	7.4618E+01
5.900	2.9600E-26	7.4618E+01
6.200	1.0263E-27	7.4618E+01
6.500	3.5584E-29	7.4618E+01
6.800	1.2337E-30	7.4618E+01
7.100	4.2776E-32	7.4618E+01
7.400	1.4831E-33	7.4618E+01
7.700	5.1422E-35	7.4618E+01
8.000	1.7829E-36	7.4618E+01
8.300	6.1816E-38	7.4618E+01
8.600	2.1433E-39	7.4618E+01
8.900	7.4311E-41	7.4618E+01
9.200	2.5765E-42	7.4618E+01
9.500	8.9332E-44	7.4618E+01
9.800	3.0973E-45	7.4618E+01
10.100	1.0739E-46	7.4618E+01
10.400	3.7234E-48	7.4618E+01
24.000	2.4155-114	7.4618E+01
96.000	0.0000E+00	7.4618E+01
720.000	0.0000E+00	7.4618E+01

##

Cumulative Dose Summary

##

Time (hr)	Exclusion Area Bounda Thyroid (rem)	TEDE (rem)	Low Population Zone (Thyroid (rem)	TEDE (rem)	Control Room Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.000	2.2633E-08	3.1582E-09	3.9355E-09	5.4916E-10	8.8864E-13	4.2682E-14
0.056	3.2588E-01	3.4073E-02	5.6664E-02	5.9246E-03	5.3641E-02	2.4408E-03
0.356	2.4806E+00	2.3732E-01	4.3133E-01	4.1266E-02	1.8268E+00	8.2494E-02
0.500	4.6213E+00	4.0745E-01	8.0355E-01	7.0847E-02	4.1609E+00	1.8653E-01
0.900	1.4199E+01	1.0498E+00	2.4689E+00	1.8254E-01	6.5064E+00	3.0320E-01
1.111	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	6.8428E+00	3.2532E-01
1.511	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0065E+00	3.4171E-01
1.811	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0083E+00	3.4459E-01
2.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4549E-01
2.300	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4626E-01
2.600	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4661E-01
2.900	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4676E-01
3.200	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4684E-01
3.500	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4687E-01
3.800	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4688E-01
4.100	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
4.400	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
4.700	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
5.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
5.300	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
5.600	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
5.900	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
6.200	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
6.500	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
6.800	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
7.100	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
7.400	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
7.700	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
8.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
8.300	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
8.600	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
8.900	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
9.200	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
9.500	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
9.800	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
10.100	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
10.400	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
24.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
96.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01
720.000	2.1363E+01	1.4799E+00	3.7147E+00	2.5733E-01	7.0084E+00	3.4689E-01

##

Worst Two-Hour Doses

##

Exclusion Area Boundary (EAB)

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	5.8087E-01	2.1363E+01	1.4799E+00

Computer Disclosure Sheet

Discipline Nuclear

Client: Exelon Corporation
Project: Byron/Braidwood Stations CREA AST

Date: November 2004
Job No. 26760-NCS0023.CALC

Program(s) used:	Rev No.	Rev Date	Calculation Set No.: BYR04-045 & BRW-04-0039-M, Rev. 1
Attachment D Spreadsheets	1	11/2004	Status [ ] Prelim. [X] Final [ ] Void

WGI Prequalification [X] Yes [ ] No

Run No. Description:

Analysis Description: Spreadsheets used to perform release fraction development for dose assessment of CREA, as described in calculation.

The attached computer output has been reviewed, the input data checked, And the results approved for release. Input criteria for this analysis were established.

By: Alan E. Boatright On: 11/2004

Run by: A. Boatright Alan E. Boatright

Checked by: P. Reichert Paul Reichert

Approved by: H. Rothstein Hank Rothstein

Remarks: This spreadsheet is relatively straight-forward and was hand checked. Attachment D includes the spreadsheet in both normal and formula display mode so it is completely documented.

Computer Disclosure Sheet

Discipline Nuclear

Client: Exelon Corporation
Project: Byron/Braidwood Stations CREA AST

Date: November 2004
Job No. 26760-NCS0023.CALC

Program(s) used: RADTRAD 3.03 (Attachments A&E)
Rev No. 0
Rev Date 12/23/2002

Calculation Set No.: BYR04-045 & BRW-04-0039-M, Rev. 1
Status [ ] Prelim.
[X] Final
[ ] Void

WGI Prequalification [X] Yes
[ ] No

Run No. Description:

Analysis Description: RADTRAD output files, where applied to calculations of CREA dose assessments, as described in calculation.

The attached computer output has been reviewed, the input data checked,
And the results approved for release. Input criteria for this analysis were established.

By: On: 11/2004

Run by: A. Boatright

Checked by: P. Reichert

Approved by: H. Rothstein

Remarks: The RADTRAD computer code is applied in a manner fitting its intended purpose, and well within its operating parameters. All outputs were hand checked. Attachments B & C included the Nuclide Information File and Release Fraction and Timing File used by the RADTRAD code and generated specifically for the Byron/Braidwood Station CREA analyses. Both were also hand checked for accuracy.