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10 CFR 50.90
10 CFR 50.67

2130-05-20040
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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Oyster Creek Generating Station
Facility Operating License No. DPR-16
NRC Docket No. 50-219

Subject: License Amendment Request No. 315 - Application of Alternative Source Term

References:

(1) U. S. Nuclear Regulatory Commission, Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000

(2) U. S. Nuclear Regulatory Commission Standard Review Plan 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms," Revision 0, July 2000

(3) Exelon/AmerGen 180-Day Response to Generic Letter 2003-01, Control Room Habitability, December 9, 2003

Pursuant to 10 CFR 50.67, "Accident source term," and 10 CFR 50.90, "Application for amendment of license or construction permit," AmerGen Energy Company, LLC (AmerGen) hereby requests an amendment to the Facility Operating License listed above. The proposed change is requested to support application of an alternative source term (AST) methodology, with the exception that Technical Information Document (TID) 14844, "Calculation of Distance Factors for Power and Test Reactor Sites," will continue to be used as the radiation dose basis for equipment qualification. This submittal has used the methods described in Regulatory Guide 1.183 (Reference 1) except for the few instances where alternative methods of compliance have been proposed as allowed by the guidance in this reference. These alternative methods have been fully discussed in Tables A and B in Attachment 1 of this License Amendment Request (LAR).

On December 23, 1999, the NRC published regulation 10 CFR 50.67 in the Federal Register. This regulation provides a mechanism for operating license holders to revise the current accident source term used in design-basis radiological analyses with an AST. Regulatory guidance for the implementation of AST is provided in Reference 1. This regulatory guide provides guidance on acceptable applications of ASTs. The use of AST changes only the regulatory assumptions regarding the analytical treatment of the design basis accidents (DBAs). AmerGen has performed radiological consequence analysis for the most limiting Oyster Creek Generating Station (Oyster Creek) DBA that results in offsite and control room operator exposure (i.e., Loss of Coolant Accident (LOCA)) to support a full-scope implementation of AST, as described in Reference 1.

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The proposed changes to the Technical Specifications for Oyster Creek involve Technical Specification Bases revisions to incorporate revised dose values reflecting the revised DBA consequence analysis, and extension of the existing Standby Liquid Control (SLC) system Technical Specification operability requirement applicability to include hot shutdown conditions and the associated SLC system Bases to describe the post-LOCA function to maintain the suppression pool pH value above 7. Other than changing Emergency Operating Procedures (EOPs) to require SLC system injection for pH control, no changes to the plant design or operation are proposed at this time. The Oyster Creek Updated Final Safety Analysis Report (UFSAR) will be updated to reflect the enclosed reanalysis upon NRC approval.

This License Amendment Request also addresses the commitment contained in Reference 3 to submit a license amendment request to implement AST to resolve the control room operator thyroid dose issue related to control room habitability. The reanalysis using AST demonstrates that the Oyster Creek control room operator dose exposure for the most limiting design basis accident remains within the limits of 10 CFR 50, Appendix A, General Design Criterion (GDC)-19, and 10 CFR 50.67.

This request is subdivided as follows.

1. Attachment 1 provides a Description of Proposed Changes, Technical Analysis, and Regulatory Analysis.
2. Attachment 2 provides the Markup of Technical Specification pages.
3. Attachment 3 provides a discussion of the technical parameters and methodologies used in the AST calculations.
4. Attachment 4 provides a list of the regulatory commitments contained in this submittal.

The proposed changes have been reviewed by the Oyster Creek Plant Operations Review Committee and approved by the Nuclear Safety Review Board in accordance with the requirements of the AmerGen Quality Assurance Program.

Using the standards in 10 CFR 50.92, AmerGen has concluded that these proposed changes do not constitute a significant hazards consideration, as described in the enclosed analysis performed in accordance with 10 CFR 50.91(a)(1). Pursuant to 10 CFR 50.91(b)(1), a copy of this License Amendment Request is provided to the designated official of the State of New Jersey, Bureau of Nuclear Engineering.

AmerGen requests approval of the proposed amendment by March 28, 2006. Once approved, the amendment shall be implemented within 90 days. This implementation period will provide adequate time for the affected station documents to be revised using the appropriate change control mechanisms.

If you have any questions or require additional information, please contact David J. Distel at (610) 765-5517.

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

Respectfully,

Executed on: 03/28/05

Pamela B Cowan
Pamela B. Cowan
Director - Licensing & Regulatory Affairs
AmerGen Energy Company, LLC

Attachments:
1. Description of Proposed Changes, Technical Analysis, and Regulatory Analysis
2. Markup of Technical Specification pages
3. Technical Input Parameters and Methodologies for AST Calculations
4. List of Commitments

cc:
S. J. Collins, Administrator, Region I, USNRC
R. J. Summers, USNRC Senior Resident Inspector, Oyster Creek
P. S. Tam, Senior Project Manager Oyster Creek, USNRC (by FedEx)
K. Tosch – State of New Jersey, Department of Environmental Protection & Energy, Bureau of Nuclear Engineering

ATTACHMENT 1

Oyster Creek Generating Station

License Amendment Request
"Oyster Creek Alternative Source Term Implementation"

1.0 DESCRIPTION

In accordance with 10 CFR 50.67, "Accident source term," and 10 CFR 50.90, "Application for amendment of license or construction permit," AmerGen Energy Company, LLC (AmerGen) requests a change to the Oyster Creek licensing basis and Appendix A, Technical Specifications (TS), of Facility Operating License No. DPR-16 for the Oyster Creek Generating Station (Oyster Creek). The proposed changes are requested to support application of an alternative source term (AST) methodology, with the exception that Technical Information Document (TID) 14844, "Calculation of Distance Factors for Power and Test Reactor Sites," will continue to be used as the radiation dose basis for the Main Steam Line Break (MSLB), Control Rod Drop Accident (CRDA), Fuel Handling Accident (FHA), and equipment qualification.

Radiological consequence analyses have been performed for the most limiting Design Basis Accident (DBA) that results in offsite and control room operator exposure (i.e., Loss of Coolant Accident (LOCA)) to support a full-scope implementation of AST. The AST analyses for Oyster Creek were performed following the guidance in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" and Standard Review Plan 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms". This analysis has also been performed by qualified consultants using methods and computer codes used previously in NRC-accepted AST applications, and has had extensive cross-functional reviews and challenges by AmerGen/Exelon personnel.

The proposed changes to the Oyster Creek licensing basis and TS will allow Oyster Creek to apply the results of the plant-specific AST analyses using the guidance in Regulatory Guide 1.183 and meet the requirements of 10 CFR 50.67. Approval of this change will provide a source term for Oyster Creek that will result in a more accurate assessment of the DBA radiological doses. The proposed changes to the Technical Specifications for Oyster Creek incorporate revised dose values reflecting the revised DBA consequence analysis, and extend the existing standby liquid control system Technical Specification operability requirement applicability to include hot shutdown conditions. Other than changing Emergency Operating Procedures (EOPs) to require Standby Liquid Control (SLC) system injection for pH control, no changes to the plant design or operation are proposed at this time.

To satisfy the condition of application of AST to control the suppression pool pH following a LOCA, Oyster Creek is proposing to use the Standby Liquid Control (SLC) System. This requires revising the Technical Specification applicability requirement for the SLC system to include hot shutdown conditions.

Adopting the AST methodology may support future evaluations and license amendments.

2.0 PROPOSED CHANGES

The proposed change only revises the Oyster Creek licensing basis accident analysis radiological source term to incorporate the AST methodology in accordance with 10 CFR 50.67. Other than changing Emergency Operating Procedures (EOPs) to require SLC system injection for pH control, no other changes to the plant design or operation are proposed at this time. The proposed TS changes are related to the offsite and control room operator dose values presently described in the Oyster Creek TS Bases and incorporation of shutdown condition operability requirements for the standby liquid control system. These changes are consistent with use of the proposed AST methodology. Proposed changes to the Technical Specifications resulting from this submittal are summarized below:

2.1 TS 3.2.C.1 and Bases – "Standby Liquid Control System"

The proposed change to TS pages 3.2-3 and 3.2-10 extends the existing operability requirements for the standby liquid control system to all plant operating conditions other than cold shutdown. This change ensures that the standby liquid control system is operable for all plant conditions when the reactor coolant system temperature is above 212° F, such that the system is available to maintain the suppression pool pH above 7.0, consistent with the AST methodology and analysis assumptions.

2.2 TS 3.17 and 4.17 Bases – "Control Room Heating, Ventilating, and Air-Conditioning System"

The proposed change to TS pages 3.17-2 and 4.17-1 revises the existing reference to control room operator allowable gamma and beta dose limits to TEDE limits, consistent with use of the AST methodology.

2.3 TS 4.5 Bases – "Containment System"

The proposed change to TS page 4.5-10 revises the Containment System Bases to reference dose criteria and analysis assumptions consistent with the use of the AST methodology.

3.0 BACKGROUND

On December 23, 1999, the NRC published regulation 10 CFR 50.67 (Reference 7.1) in the Federal Register. This regulation provides a mechanism for operating license holders to revise the current accident source term used in design-basis radiological analyses with an Alternative Source Term (AST). Regulatory guidance for the implementation of AST is provided in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors", July 2000 (Reference 7.2). This regulatory guide provides guidance on acceptable applications of ASTs. The use of AST changes only the regulatory assumptions regarding the analytical treatment of the design basis accidents (DBAs).

The fission product release from the reactor core into containment is referred to as the "source term", and it is characterized by the composition and magnitude of the radioactive material, the chemical and physical properties of the material, and the timing of the release from the reactor core. Since the publication of U.S. Atomic Energy Commission Technical Information Document, TID-14844, Calculation of Distance Factors for Power and Test Reactor Sites (Reference 7.3), significant advances have been made in understanding the composition and magnitude, chemical form, and timing of fission product releases from severe nuclear power plant accidents. Many of these insights developed out of the major research efforts started by the NRC and the nuclear industry after the accident at Three Mile Island. NUREG-1465 (Reference 7.4) was published in 1995 with revised ASTs for use in the licensing of future Light Water Reactors (LWRs). The NRC, in 10 CFR 50.67, later allowed the use of the ASTs described in NUREG-1465 at operating plants. This

NUREG represents the result of decades of research on fission product release and transport in LWRs under accident conditions. One of the major insights summarized in NUREG-1465 involves the timing and duration of fission product releases.

The five release phases representing the progress of a severe accident in a LWR are described in NUREG-1465 as:

1. Coolant Activity Release
2. Gap Activity Release
3. Early In-Vessel Release
4. Ex-Vessel Release
5. Late In-Vessel Release

Phases 1, 2, and 3 are considered in current DBA evaluations; however, they are all assumed to occur instantaneously. Phases 4 and 5 are related to severe accident evaluations. Under the AST, the coolant activity release is assumed to occur instantaneously and end with the onset of the gap activity release.

The requested license amendment involves a full-scope application of the AST, addressing the composition and magnitude of the radioactive material, its chemical and physical form, and the timing of its release as described in Regulatory Guide 1.183, Section 1.2.1.

AmerGen has performed radiological consequence analysis of the most limiting DBA that results in the most significant offsite and control room operator exposures (i.e., LOCA). This analysis was performed to support full scope implementation of AST, as defined in Regulatory Guide 1.183, Section 1.2.1. The AST analysis has been performed in accordance with the guidance in Regulatory Guide 1.183 and NRC Standard Review Plan 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms" (Reference 7.5). The implementation consisted of the following steps:

- Identification of the AST based on plant-specific analysis of core fission product inventory,

- Calculation of the release fractions for the most limiting DBA that results in the most significant control room and offsite doses (i.e., LOCA),

- Use of previously approved licensing basis atmospheric dispersion factors for the radiological propagation pathways,

- Calculation of fission product deposition rates and transport and removal mechanisms,

- Calculation of offsite and control room personnel Total Effective Dose Equivalent (TEDE) doses, and

- Evaluation of suppression pool pH to ensure that the iodine deposited into the suppression pool during a DBA LOCA does not re-evolve and become airborne as elemental iodine.

The analysis assumptions for the transport, reduction, and release of the radioactive material from the fuel and the reactor coolant are consistent with the guidance provided in applicable appendices of Regulatory Guide 1.183 for the DBA LOCA.

Accordingly, AmerGen, as a holder of an operating license issued prior to January 10, 1997, is requesting that the Oyster Creek licensing basis be revised to incorporate the use of AST.

4.0 TECHNICAL ANALYSIS

The AST analysis for Oyster Creek was performed following the guidance in Standard Review Plan 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms," and RG 1.183, except where alternate methods for complying with the specified portions of the NRC's regulations have been used as allowed by RG 1.183. Documentation of conformance to RG 1.183 and the allowed alternate methods are presented in Tables A and B of this Attachment. The input parameters to the radiological analysis are provided in Attachment 3, Tables 1 through 6.

Offsite exclusion area boundary (EAB) and low population zone (LPZ) atmospheric dispersion factors (X/Qs) used in the analysis are those currently approved for use. The control room X/Qs used were previously calculated using ARCON96 code and approved for Oyster Creek in NRC Safety Evaluation Report for Amendment No. 225, dated February 7, 2002 (Reference 7.6).

Airborne radioactivity drawn into the control room envelope results in both internal and external dose components that are used in the TEDE dose calculation. The noble gas inventory within the control room is the main contributor to the gamma ray whole body (i.e., external) dose component of the TEDE; the non-noble gas radionuclides, principally iodines, contribute to the internal organ dose component via the inhalation pathway.

Regulatory Guide 1.183, Section 4.1.1 states, the dose calculations should determine the TEDE and that TEDE is the sum of the committed effective dose equivalent (CEDE) from inhalation and the deep dose equivalent (DDE) from external exposure. Section 4.1.2 of the Regulatory Guide further explains that the exposure-to-CEDE factors for inhalation of radioactive material should be derived from the data provided in ICRP Publication 30, "Limits for Intakes of Radionuclides by Workers" (Reference 7.7) and that Table 2.1 of Federal Guidance Report 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion" (Reference 7.8) provides tables of conversion factors acceptable to the NRC staff. The factors in the column headed "effective" yield doses corresponding to the CEDE.

In a similar fashion, Section 4.1.4 of the Regulatory Guide emphasizes that the DDE should be calculated assuming submergence in semi-infinite cloud assumptions with appropriate credit for attenuation by body tissue. The DDE is nominally equivalent to the effective dose equivalent (EDE) from external exposure if the whole body is irradiated uniformly. Since this is a reasonable assumption for submergence exposure situations, EDE may be used in lieu of DDE in determining the contribution of external dose to the TEDE. Table III.1 of Federal Guidance Report 12, "External Exposure to Radionuclides in Air, Water, and Soil" (Reference 7.9), provides external EDE conversion factors acceptable to the NRC staff. The factors in the column headed "effective" yield doses corresponding to the EDE.

The Oyster Creek analysis uses the dose conversion factors (DCFs) consistent with Regulatory Guide 1.183, as described above. Specifically, the DCFs have been taken from the default files representing Federal Guidance Reports 11 and 12 in RADTRAD 3.03 (Reference 7.11).

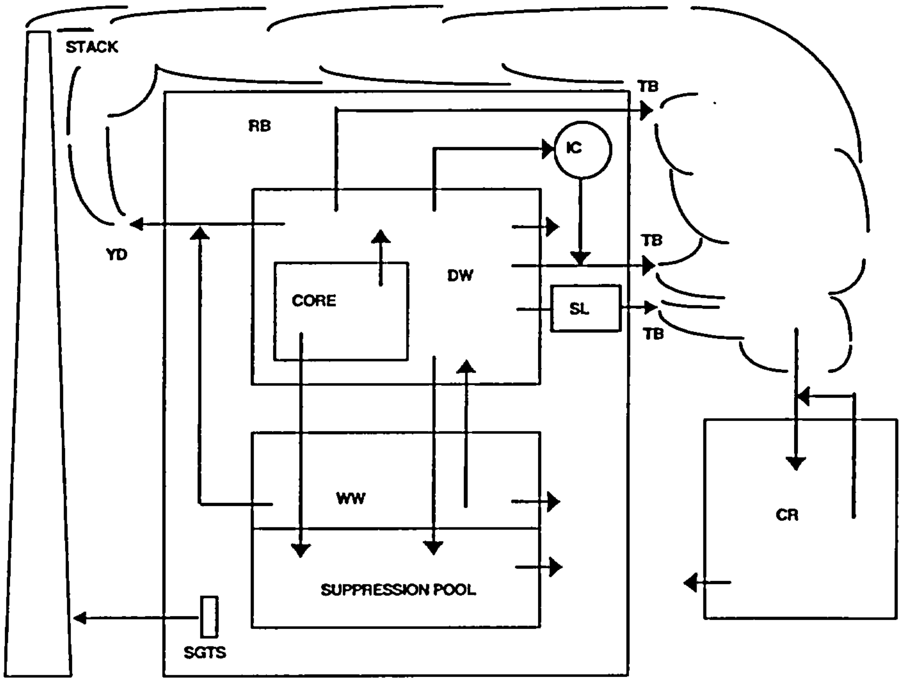
4.1 Dose Calculation Methodology

The overall dose calculation model consists of seven control volumes to represent the damaged core and reactor coolant system (CORE), the drywell portion of the primary containment (DW), the torus airspace or wetwell portion of the primary containment (WW), the suppression pool (SP), the reactor building or secondary containment (RB), the space between the two MSIVs in the one steam line wherein both MSIVs are assumed to successfully close (SL), and the control room itself (CR). These control volumes are arranged as shown on Figure 4.1-1 with the various junctions that connect them. These junctions are associated with volumetric flows which determine the rate at which radioactivity is exchanged between the control volumes. In addition, removal processes such as spray impaction, sedimentation, adsorption, filtration and others are modeled within and between control volumes, as appropriate.

The junctions related to containment transport and environmental release include:

- Drywell-to-wetwell flow,
- Wetwell-to-drywell vacuum breaker flow,
- SGTS exhaust flow (via plant stack as elevated release),
- Leakage flow to the reactor building from the drywell, the wetwell, and the suppression pool, and
- Bypass pathways (MSIV leakage, isolation condenser vent valve leakage, service air leakage, and containment spray test line leakage to the turbine building, and gaseous nitrogen leakage to the yard as ground level releases).

Figure 4.1-1
Control Room and Offsite Dose Model as Analyzed



The core junctions effect the release of radioactivity to both the drywell and the suppression pool in parallel. The drywell and suppression pool releases are an example of conservative "double-counting" in that the same amount of activity is assumed to be in both places at the same time. In fact, the release of radioactivity to the suppression pool is assumed in the analysis to be complete within the first two hours of the accident, even though it actually takes many hours for the sprays and other mechanisms to remove the radioactivity from the containment atmosphere and get it into the water of the suppression pool.

Control room junctions exist in the model to take activity out of the environment (after it has been diluted by the appropriate X/Q) and bring it into the control room. For Oyster Creek there are no credited filters in the control room ventilation; there are only redundant intakes and air-handling units and provision for recirculating the air so that intake can be minimized under accident conditions. As a practical matter, the concentration of radioactivity within the control room tracks very closely the concentration at the air intake, even on maximum recirculation flow.

The STARDOSE Computer Code (Reference 7.10) is used for the dose calculation. All input to this model is listed in Attachment 3, Tables 1 through 6. For plume shine, a factor is applied to the whole body gamma dose internal to the CR to account for this external contribution. With one foot of concrete shielding assumed, this factor is small (see Section 4.7 of this Attachment).

A check calculation using the RADTRAD version 3.03 computer code (Reference 7.11) is described in Attachment 3.

Maintaining the suppression pool pH above 7.0 for at least 30 days post-accident minimizes re-evolution of radioiodine from the suppression pool. Attachment 3 contains information regarding this evaluation.

For the strontium (Sr) isotopes, dose conversion factors (DCFs) are based on the oxide form (SrO) rather than the titanate ($SrTiO_3$) form consistent with the treatment of Sr used for NUREG-1150 (Reference 7.12) in the MACCS computer code.

The Oyster Creek design basis Loss of Coolant Accident (LOCA) currently described in the Oyster Creek Updated Final Safety Analysis Report (UFSAR) Section 15.6.5, represents the limiting calculated design basis accident (DBA) dose consequences for Oyster Creek. This is evident upon examination of the total curies of activity released for each accident analyzed in the UFSAR as compared to that of a LOCA. The total amounts of curies released during a LOCA are significantly higher than that for all other accidents. The main steam line break (MSLB) accident, the accident closest in severity to the LOCA, releases only a portion of the total activity of a LOCA resulting in a control room operator dose of approximately 25 Rem thyroid (approximately 0.75 Rem TEDE). This smaller release, coupled with the fact that the atmospheric dispersion factors (X/Qs) for other accident situations are similar, results in control room and offsite doses that are much less than that for the LOCA or MSLB. Therefore, it can be concluded that the LOCA is the limiting accident for control room and offsite doses (Reference 7.13). The Oyster Creek DBA LOCA has been reanalyzed using Alternative Source Term (AST) methodology.

The analysis was performed using the guidance in Regulatory Guide (RG) 1.183 to confirm compliance with the acceptance criteria presented in 10 CFR 50.67. Tables A and B of this Attachment describe conformance with the RG.

The source term associated with environmental qualification of equipment will remain consistent with previous commitments under 10 CFR 50.49.

4.2 Control Room Dose Model

The following is a description of the design and operation of the Oyster Creek Generating Station Control Room Heating, Ventilation, and Air Conditioning (HVAC) System. The overall system is safety-related, with the majority of components being augmented quality. The system is designed with redundancy to mitigate the effects of single active component failures. The control room envelope consists of the control room panel area, Shift Supervisor's office, toilet room, kitchen, and the adjacent lower cable spreading room.

The Control Room HVAC System consists of two independent Trains "A" and "B". Train "A" is the backup (LAG) system and Train "B" is the primary (LEAD) system. Train "A" consists of one supply fan with a rated capacity of 14,000 cfm, steam coils for heating and a three-stage refrigeration unit for cooling. Backup power for the Train "A" supply fan is provided from Emergency Diesel Generator 1. Train "B" consists of one supply fan with a rated capacity of 14,000 cfm, an electric heating coil for heating and a four-stage refrigeration unit for cooling. Train "B" heating and cooling is electric. Backup power for the Train "B" supply fan is provided from Emergency Diesel Generator 2. Both systems share a common supply and return duct contained within the control room envelope. The Control Room HVAC System does not contain High Efficiency Particulate Air (HEPA) filters or charcoal adsorbers.

Each system has four manual operating modes designated as normal, purge, partial recirculation, and full recirculation.

- The normal mode is designed to automatically maintain a comfortable temperature and a slightly higher than atmospheric pressure in the control room.
- The purge mode brings in 100% outside air in order to clear smoke or fumes from the control room. Intake temperature is not maintained in this mode.
- The partial recirculation mode minimizes the use of outside air while maintaining a positive pressure of at least 0.125 inches water gauge in the control room.
- The full recirculation mode closes all outside air dampers to minimize the intrusion of outside air into the control room.

All intake air into the OCNGS control room is unfiltered. Other than a "bag" type roughing filter (40% efficient for particulates by ASHRAE standards), there is no other air filtration associated with the control room (intake or recirculation). Therefore, no credit for filtration is assumed in the radiological analyses. Design basis radiological analyses are performed using the full 14,000 cfm flow seen during the purge mode. Sensitivity studies show that doses are lower if the system is placed in the partial recirculation mode. In both cases the radiation exposure to personnel occupying the control room is calculated to be less than regulatory limits.

The radionuclide concentration inside the CR is the same as that of the plume at the air intake. The CR volume is 27,500 ft^3. The volumetric exchange rate (with the environment) is assumed to be 14,000 cfm. Even on maximum recirculation flow, the volumetric flow is greater than 1/10 of the assumed 14,000 cfm; and therefore, the exchange rate will always be greater than 0.05 per minute or 3 per hour. Since the time to come to equilibrium is about three inverse exchanges, it requires only one hour for the CR to equilibrate with the environment. The total duration of the dose calculation is 720 hours with concentration changing slowly with time. Therefore, equilibrium can be assumed.

4.3 Offsite Dose Model

For Oyster Creek, the EAB and LPZ χ/Qs have previously been determined and approved for use. The EAB and LPZ are located 445 m and 1810 m respectively from the postulated release locations.

4.4 Fission Product Inventory

The core is comprised of three equal batches of fuel bundles with burnup histories of one, two, and three two-year cycles. Each cycle is 690 days in length. Plant operation for the 690 days is assumed to be at full power. Full power is 1930 MW(t). A 102% multiplier is applied in the analysis.

The computer code KORIGEN was used to calculate the fuel bundle radionuclide inventory. KORIGEN runs were made for one, two, and three cycle burnups. The nuclide inventory for each batch (in Curies/MWth) was averaged and multiplied by the core uranium loading in metric tons to obtain the core radionuclide inventory. The values extracted from the KORIGEN runs are for the standard 60-isotope RADTRAD library (less the activation products Co-58 and Co-60) but with BA-137m and seven additional noble gas isotopes (Kr-83m, Kr-89, XE-131m, XE-133m, XE-135m, XE-137, and XE-138) included. The resulting radionuclide inventory is provided in Attachment 3, Table 4.

4.5 Secondary Containment Bypass – MSIV Leakage

The MSIV leak rate as a function of containment pressure is based on a model identical to that from the current licensing basis (Reference 7.14) except that the MSIVs are assumed to be leaking at the rate of 15.975 scfh under a test pressure of at least 35 psig (Reference 7.15), which is slightly more limiting than the current TS limit of 11.9 scfh when tested at ≥ 20 psig. The leak rate model of Reference 7.14 assumed a frictionless leak path for MSIV leakage and an isentropic expansion through that path. The flow is modeled using the method described in Attachment 3.

4.6 Secondary Containment Bypass – Containment Leakage

There are several important containment leakage paths that have the potential to bypass the leakage collection, filtration, and elevated release features of the Oyster Creek SGTS. In order to exhibit "bypass" characteristics, a pathway must not include a water seal, and the pathway must be continuous through the RB and terminate at a point beyond the RB secondary containment boundary. Besides the MSIVs, there are RB bypass pathways for Oyster Creek terminating in the TB as well as on the East wall of the RB.

One potential RB bypass pathway that was evaluated but judged not to exhibit bypass characteristics is the drywell ventilation supply. This pathway terminates at the RB west wall very near the air intake for the CR, but it employs standard, fabricated sheet-metal ductwork in sections common to the RB ventilation supply outboard of the containment isolation valves (CIVs) V-27-3 and -4. With the SGTS in operation, the RB ventilation supply is isolated by twenty-two (22) secondary containment isolation valves, and the RB is maintained at a negative pressure. Under these conditions, the standard ductwork sections (which are not leak-tight) would be expected to transfer any leakage to the RB atmosphere for collection by the SGTS.

The other bypass pathways (which must be evaluated in parallel with the MSIV leakage into the main steamlines) are as follows:

8-inch N_2 pathway

This pathway is connected to the drywell ventilation supply inboard of the CIV V-27-4. It is isolated by CIVs V-23-14 (inboard) and V-23-13 (outboard). It is also connected to the torus via CIVs V-23-16 and -15.

2-inch N_2 pathway

This pathway is connected to the drywell ventilation supply inboard of CIV V-27-4, tapping off of the 8" N_2 pathway upstream of V-23-14. It is isolated by CIVs V-23-18 (inboard) and V-23-17 (outboard). There is also a run of this line that ties into the 8" N_2 pathway inboard of the torus CIV V-23-16. This extension of the 2" N_2 pathway is isolated from the containment by CIVs V-23-20 and -19. The total leakage evaluated for these pathways is

13 scfh in the 2" line and 8.5 scfh in the 8" line. Maximum leakage is assumed in the 2" line to minimize removal.

TIP Purge

This is a 1/2" flowpath that ultimately connects to the 2" N_2 line discussed above. With an administrative limit of only 0.05 scfh (for V-23-70) its impact is negligible (compared to the 13 scfh assumed in the 2" N_2 line).

Instrument Air

This is a straightforward bypass flowpath in that CIVs V-6-0393 (an inboard check valve) and V-6-0395 (an outboard pneumatic valve) serve to isolate the nitrogen supply to the drywell for pneumatically operated valves located inside the drywell. There is a back-up connection to the instrument air system that provides the bypass flowpath to the TB. The administrative leak rate limit for this flowpath is 2 scfh.

Isolation Condenser Vents

These are two parallel flowpaths from the isolation condensers to the main steamlines beyond the outboard MSIVs. Each flowpath includes two CIVs, V-14-1 (inboard, B), V-14-5 (inboard, A), V-14-19 (outboard, B), and V-14-20 (outboard, A). Most of the run to the steamlines is a common 3/4" line. Each flowpath accounts for one scfh; therefore, in the common piping the total flow would be 2 scfh.

Drywell Spray Test Line

With sprays in operation it is unlikely that this line would provide a RB bypass pathway. However, for conservatism, it is assumed to leak at the same rate as the other bypass pathways to the TB.

4.7 Containment Leakage

The TS allowable leak rate for the Oyster Creek containment is 1.0 %/day. In order to consistently account for the explicit treatment of MSIV leakage and other RB bypass leak paths discussed above, the summation of the leak rates for these bypass pathways is subtracted from the global 1.0 %/day primary containment leak rate used in the dose analysis model. Together, these RB bypass pathways account for approximately 10 % of the assumed containment leakage. Also, given that the Oyster Creek containment spray system is credited for primary containment pressure control as well as airborne radioactivity removal, it has been shown that the overall leak rate reduction of 50 % at 24 hours is applicable to Oyster Creek, as allowed by Regulatory Guide 1.183. This 50 % reduction is not applied to the RB bypass pathways since pressure-dependent leakage for these pathways is calculated explicitly using the isentropic expansion flow model discussed above.

ESF Leakage

For this AST evaluation an ESF liquid leak rate of 1 gpm is used consistent with the current licensing basis for Oyster Creek. This value is consistent with the administrative limit used as part of the Oyster Creek Technical Specification 6.15 Program for "Integrity of Systems Outside Containment."

The ESF leakage from systems attached to the containment atmosphere will be contained within the remaining 1%/day containment leak rate.

4.8 External Dose Contribution to Control Room

To calculate the external plume contribution to the inside dose, the assumption of equal activity concentrations inside and outside the CR is used. The STARDOSE code makes use of the following correction to the whole body dose inside the CR to account for the finite volume (also consistent with RG 1.183):

$$\text{Correction Factor} = (\text{VCR})^{0.338}/1173 = (27500)^{0.338}/1173 = 0.027$$

Considering one foot of concrete shielding and an "average" gamma energy of 0.7 MeV, the shielding effectiveness can be approximated as:

$$\text{Eff} = e^{-\mu d}$$

where the μ is the mass absorption coefficient and "d" is the thickness of the shield. The mass absorption coefficient for a 0.7 MeV gamma (normalized by density) is about 0.08 cm^2/g. Assuming a concrete density of 2.5 g/cc (2.5 that of water) and a "d" of 30 cm (one foot) thickness, the coefficient becomes 0.2 and the overall expression becomes 2.5E-3. Therefore, one foot of concrete thickness is about ten times more effective in reducing gamma dose to the operator than the finite volume of the CR. To account for the external plume contribution to the operator dose, the whole body dose calculated by STARDOSE for sources inside the CR are conservatively multiplied by a factor of 0.1.

4.9 Spray and Natural Removal

The dose analysis for Oyster Creek credits the use of containment sprays in removing airborne radioactivity from the containment atmosphere as well as in controlling the containment pressure. For conservatism, the two parallel capabilities of the spray system (airborne radioactivity and containment pressure control) have been taken into account in the dose analysis since the sprays do not operate continuously. Attachment 3 contains information regarding spray and natural removal, and additional conservatisms applied to this assumption.

4.10 Containment Thermal-Hydraulics

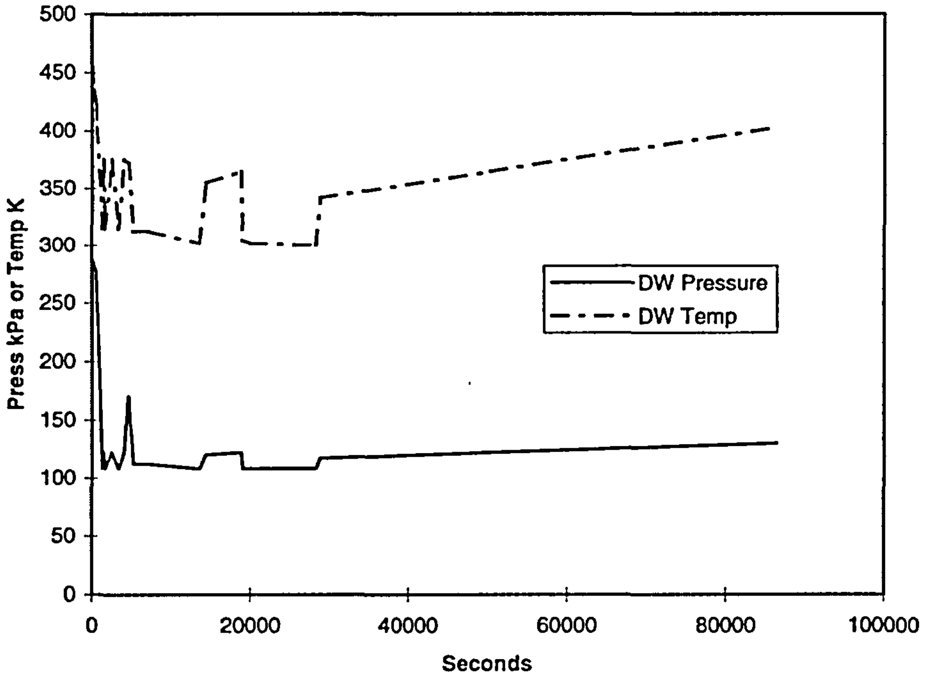
A MAAP4 analysis for a double-ended rupture of one of the five recirculation loops is used as the basis for the analysis of radioactivity transport through the Oyster Creek facility and for its release to the environment (Reference 7.16).

Attachment 3, Table 7 contains an event chronology. At the beginning of the postulated event there is a rapid increase in the containment pressure, but by the time the assumed release of radioactivity begins 30 seconds later, the reactor blowdown is complete and the containment pressure is already decreasing. The structural heat sink of the containment shell would be about one-third thermally saturated by this time, and complete saturation would require only about four to five minutes more. Therefore, beyond five minutes, the containment pressure would be decreasing only slowly, and the containment would become essentially quiescent.

At ten minutes the containment sprays are assumed to be actuated and the containment pressure decreases rapidly. Figure 4.10-1 below (which shows the drywell pressure and temperature response) shows this quite well. Following the rapid decrease in drywell pressure, the sprays are terminated at one psig by operator action as discussed above. For simplicity, only three subsequent actuations are included in the dose analysis model during the two-hour period of activity release, one during the gap release phase and two during the early in-vessel release phase. In making this simplification, however, the correct fraction of time that the sprays are running in each phase is preserved. This fraction is approximately two-thirds (average) during the two release phases. It is during the period of intermittent spray operation from 1345 seconds (when the sprays are first tripped) to 4065 seconds (when debris quench steaming begins) that most particulate radioactivity is leaked from the containment.

The moderate pressure spike, which occurs at about 4000 seconds on Figure 4.10-1, is the relocation of core debris to the lower plenum of the reactor vessel. At this time, about one half of the drywell non-condensables are purged into the torus airspace bringing about the modest increase in drywell pressure.

Figure 4.10-1 - Design Basis DW T/H



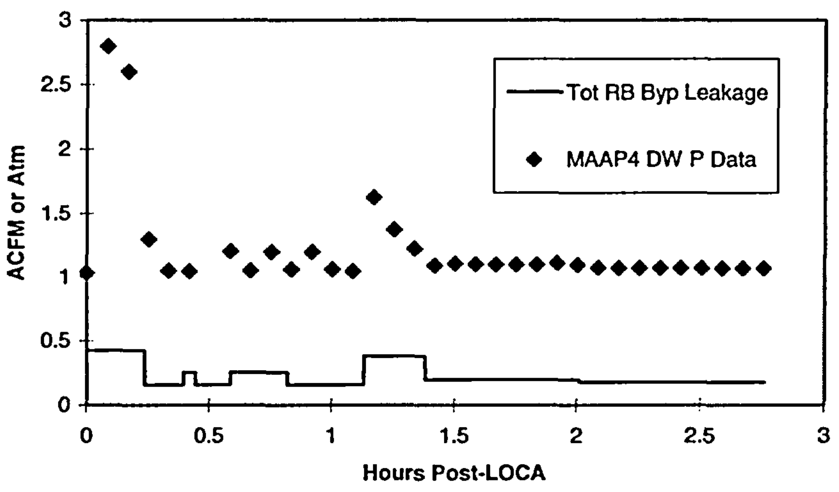
Of much greater importance is the spray actuation that begins at 4065 seconds when the drywell meets the pressure and temperature conditions for manual initiation. After this spray actuation the sprays remain on for a substantial period of time - until 13,600 seconds. It is this spray actuation that provides the bulk of the containment atmosphere "clean-up". When ECCS is restored at 7230 seconds the sprays are already running. Thus, the containment pressure response is not greatly affected.

Following spray shut-off at 13,600 seconds, the sprays are returned to operation at 18,800 seconds and then are not finally tripped off until nearly eight hours into the event. By 14 hours (50,400 seconds) into the event (when the MAAP4 analysis ends) the containment pressure has nearly reached 3 psig; but because the MAAP4 analysis has ended, containment pressure is conservatively extrapolated to continue to increase with no further spray actuations until 24 hours into the event. Beyond 24 hours, the containment pressure is conservatively extrapolated to one psig. This is in recognition of the fact that a combination of spray cooling, decreasing decay power, and assumed containment leakage of 0.5 %/day (15 % over 30 days) would be reducing the pressure continuously. Given the 30-day dose integration period for the CR habitability assessment, the tendency would be for the containment pressure to approach atmospheric or even sub-atmospheric over that period. However, maintenance of a minimum containment pressure of one psig is a goal of the emergency operating procedures to ensure that oxygen intrusion does not occur. A sub-atmospheric containment, although not advantageous for pump operation, would prevent containment outleakage, thereby reducing dose. This extrapolation of containment pressure is also conservative because plant procedures would direct operators to reduce containment pressure.

The timing of the spray actuations discussed above is representative of many kinds of events. The key feature is that up to the time of rapid steam production associated with core debris interaction with water in the vessel lower plenum and/or ECCS restart, the sprays have the potential (under unique conditions of containment and service water temperature) to be intermittent. Once any substantial coolant water interaction has occurred, however, the combination of steaming and hydrogen production will keep the sprays in operation for a long period of time.

In addition to establishing the conditions under which containment sprays may be assumed to operate, containment pressure and temperature also affect the containment volumetric leak rate. Figure 4.10-2 below focuses on this relationship for the bypass pathways for which the leak rate (in ACFM) is calculated using the isentropic expansion flow model as described above.

Figure 4.10-2 - DW Press and RB Bypass



The plot concentrates on the first 10,000 seconds of the event since that is the most radiologically significant period. The diamond-shaped data points are the drywell pressure plot file points from the MAAP4 analysis. The total RB bypass leakage, including MSIV leakage, (as modeled in this analysis) is shown as the solid line. For comparison, a one percent per day leak rate for the entire 308,000 ft^3 primary containment free volume would be about 2.1 ACFM; therefore, the bypass leakage is about 10 % (on average) of the overall containment leak rate.

4.11 Meteorological Dispersion

The ARCON-96 computer code (Reference 7.17) was used in evaluating the ground-level release onsite meteorological dispersion for this analysis. This was previously approved for use at Oyster Creek in NRC Safety Evaluation Report for License Amendment No. 225, dated February 7, 2002 (Reference 7.6). The X/Q values are listed in Attachment 3, Tables 2 (CR) and 3 (EAB, LPZ).

The N_2 bypass pathways are assumed to release on the East wall of the RB (RB/E) and are, therefore, closer to the "A" CR air intake than to "B" CR air intake. The isolation condenser, instrument air, and containment spray test bypass pathways are assumed to release from the same point as the MSIV leakage releases. This point is closer to the "B" CR air intake. In spite of the fact that both intakes would not be expected to operate at the same time, the most conservative dispersion characteristics are assumed for each point of release (RB/E) to the "A" intake and TB to the "B" intake).

The assumed RB/E release point bears 75° from the "A" CR air intake (i.e., ENE). For the TB release point the normal to the East wall of the TB is used as the direction from which the TB releases would approach the CR air intakes. This normal bears 255° (i.e., WSW) from the CR air intakes. Since the entire surface of the TB East wall is considered as the source of the TB release, the shortest distance to the wall along this normal is taken to be the separation distance between the source and the intake.

In connection with the question of which wind directions can affect the CR air intake, it should be noted that even though the assumed TB and RB/E release points are opposite, the contributions from each release point to the CR air intakes are applied simultaneously.

4.12 Suppression Pool pH Evaluation

Suppression Pool pH was evaluated over the 30-day duration of the DBA LOCA (Reference 7.18). It was demonstrated that pH would remain above 7 for the duration of the accident. Therefore, no iodine conversion to elemental with re-evolution is expected or considered in this calculation. This control of pH also significantly limits the potential for airborne release (always subcooled) from ECCS leakage inside and outside of Secondary Containment. The Standby Liquid Control (SLC) system injection of its sodium pentaborate solution is required for pH control during a LOCA. Additional information regarding pH control is contained in Attachment 3. To ensure that SLC is initiated in the event of a LBLOCA, the Oyster Creek Emergency Operating Procedures (EOPs) will be revised as required.

AST requires that the SLC system be available whenever the reactor coolant system is at temperatures above 212° F. This requirement is included in the proposed change to TS 3.2.C.1.

4.13 Dose Calculation

To perform operator dose calculations for radioactivity having entered the CR, the STARDOSE computer code is used as previously stated. Dose conversion factors are based on the FGR11&12 default file from RADTRAD (based, in turn, on Federal Guidance Reports 11 and 12). Radioactive decay rates are taken from TACT5 (Reference 7.19). All input data is presented in Attachment 3. The radionuclides considered are those from the MELCOR Accident Consequence Code System (MACCS) (Reference 7.20), except the cobalt isotopes which are not significant, plus additional Kr and Xe isotopes, in particular those included in TID-14844. Dose conversion factors (DCFs) for the strontium (Sr) isotopes are those applicable to SrO, as used in the MACCS code supporting NUREG-1150.

Note that the release rate of iodine to the suppression pool is twice that to the drywell atmosphere. By increasing the rate in this way and providing 100% filtration of the particulate in the pathway from the suppression pool to the RB, the gaseous iodine (elemental plus organic) corresponds to what 10% of the iodine in the stream would be if the two release rates were the same. Of the 10% ESF leakage iodine released to the RB via this pathway, 97% is elemental and 3% is organic as required by RG 1.183.

4.14 Dose Summary

Table 4.14-1

LOCA Dose Results Summary

Source	Control Room (Rem TEDE)	EAB (Rem TEDE)	LPZ (Rem TEDE)
Total Dose (STARDOSE)	3.61	1.01 (0.508 hours to 2.508 hours)	0.16
Limit	5.00	25.0	25.0

4.15 Conclusions

Based upon the results of these analyses, it has been conservatively demonstrated that the dose consequences of the design basis LOCA are within the regulatory limits provided by the NRC for use with the alternative source term approach (i.e., 10 CFR 50.67 and 10 CFR 50, Appendix A, GDC-19).

The EAB and LPZ doses are observed to be a very small fraction of the 25 Rem TEDE limit established by 10 CFR 50.67.

The STARDOSE results are confirmed by the RADTRAD results, which are listed below. The following RADTRAD doses agree well with the STARDOSE results listed above.

EAB TEDE (0.008 to 2.008 hours) = 0.890 Rem
LPZ TEDE (0 to 30 days) = 0.147 Rem
CR TEDE = 3.460 Rem (includes external exposures not calculated by RADTRAD)

The dose analysis contained in this report demonstrates that the Oyster Creek plant meets the radiological requirements of 10 CFR 50.67 and 10 CFR Part 50, GDC-19 with respect to the limiting dose to the most exposed CR operator. Under the conditions imposed by the DBA event for CR habitability, the most exposed CR operator would not be subjected to radiation exposure resulting in doses in excess of 5 Rem whole body or its equivalent to any part of the body for the duration of the accident (i.e., 5 Rem TEDE as established by 10 CFR 50.67 and GDC-19). By demonstrating compliance with GDC-19, NUREG-0737 Item III.D.3.4, is also satisfied.

REGULATORY GUIDE 1.183 COMPARISON

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
3.1	The inventory of fission products in the reactor core and available for release to the containment should be based on the maximum full power operation of the core with, as a minimum, current licensed values for fuel enrichment, fuel burnup, and an assumed core power equal to the current licensed rated thermal power times the ECCS evaluation uncertainty. The period of irradiation should be of sufficient duration to allow the activity of dose-significant radionuclides to reach equilibrium or to reach maximum values. The core inventory should be determined using an appropriate isotope generation and depletion computer code such as ORIGEN 2 or ORIGEN-ARP. Core inventory factors (Ci/MWt) provided in TID 14844 and used in some analysis computer codes were derived for low burnup, low enrichment fuel and should not be used with higher burnup and higher enrichment fuels.	Conforms	KORIGEN was used to determine core inventory. These source terms achieve equilibrium conditions resulting in the inventory used for the selected isotopes. These values were then converted to units of Ci/MWt. Accident analyses are based on a 1930 MWt power level, based on the current accident analysis design basis allowance for instrument uncertainty. Source terms are based on a 2-year fuel cycle with a nominal 690 EFPD per cycle. Any cycle extension past 690 EFPD would further increase the magnitude of the power coastdown, resulting in lower isotopic activities for short-lived isotopes compared to the source term utilized in the analysis.
3.1	For the DBA LOCA, all fuel assemblies in the core are assumed to be affected and the core average inventory should be used. For DBA events that do not involve the entire core, the fission product inventory of each of the damaged fuel rods is determined by dividing the total core inventory by the number of fuel rods in the core. To account for differences in power level across the core, radial peaking factors from the facility's core operating limits report (COLR) or technical specifications should be applied in determining the inventory of the damaged rods.	N/A	This evaluation only applies to the LOCA. DBA events that do not involve the entire core are not modeled here.
3.1	No adjustment to the fission product inventory should be made for events postulated to occur during power operations at less than full rated power or those postulated to occur at the beginning of core life. For events postulated to occur while the facility is shutdown, e.g., a fuel handling accident, radioactive decay from the time of	Conforms	No adjustments for less than full power are made in any analyses. A fuel handling accident is not addressed in this document.

<table>
<tr><th colspan="4">Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections</th></tr>
<tr><th>RG Section</th><th>RG Position</th><th>Oyster Creek Analysis</th><th>Comments</th></tr>
<tr><td></td><td>shutdown may be modeled.</td><td></td><td></td></tr>
<tr><td>3.2</td><td>The core inventory release fractions, by radionuclide groups, for the gap release and early in-vessel damage phases for DBA LOCAs are listed in Table 1 for BWRs and Table 2 for PWRs. These fractions are applied to the equilibrium core inventory described in Regulatory Position 3.1.
Table 1
BWR Core Inventory Fraction Released Into Containment
<table>
<tr><th>Group</th><th>Gap Release Phase</th><th>Early In-Vessel Phase</th><th>Total</th></tr>
<tr><td>Noble Gases</td><td>0.05</td><td>0.95</td><td>1.0</td></tr>
<tr><td>Halogens</td><td>0.05</td><td>0.25</td><td>0.3</td></tr>
<tr><td>Alkali Metals</td><td>0.05</td><td>0.20</td><td>0.25</td></tr>
<tr><td>Tellurium Metals</td><td>0.00</td><td>0.05</td><td>0.05</td></tr>
<tr><td>Ba, Sr</td><td>0.00</td><td>0.02</td><td>0.02</td></tr>
<tr><td>Noble Metals</td><td>0.00</td><td>0.0025</td><td>0.0025</td></tr>
<tr><td>Cerium Group</td><td>0.00</td><td>0.0005</td><td>0.0005</td></tr>
<tr><td>Lanthanides</td><td>0.00</td><td>0.0002</td><td>0.0002</td></tr>
</table>
Footnote 10:
<i>The release fractions listed here have been determined to be acceptable for use with currently approved LWR fuel with a peak rod burnup up to 62,000 MWD/MTU. The data in this section may not be applicable to cores containing mixed oxide (MOX) fuel.</i></td><td>Conforms</td><td>The fractions from Regulatory Position 3.2, Table 1 are used.

Footnote 10 criteria are met.</td></tr>
</table>

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
3.2	For non-LOCA events, the fractions of the core inventory assumed to be in the gap for the various radionuclides are given in Table 3. The release fractions from Table 3 are used in conjunction with the fission product inventory calculated with the maximum core radial peaking factor. **Table 3** **Non-LOCA Fraction of Fission Product Inventory in Gap** **Group** **Fraction** I-131 0.08 Kr-85 0.10 Other Noble Gases 0.05 Other Halogens 0.05 Alkali Metals 0.12 Footnote 11: *The release fractions listed here have been determined to be acceptable for use with currently approved LWR fuel with a peak burnup up to 62,000 MWD/MTU provided that the maximum linear heat generation rate does not exceed 6.3 kw/ft peak rod average power for rods with burnups that exceed 54 GWD/MTU. As an alternative, fission gas release calculations performed using NRC-approved methodologies may be considered on a case-by-case basis. To be acceptable, these calculations must use a projected power history that will bound the limiting projected plant-specific power history for the specific fuel load. For the BWR rod drop accident and the PWR rod ejection accident, the gap fractions are assumed to be 10% for iodines and noble gases.*	N/A	Non-LOCA events are not discussed in this document.
3.3	Table 4 tabulates the onset and duration of each sequential release phase for DBA LOCAs at PWRs and BWRs. The specified onset is the time following the initiation of the accident (i.e., time = 0). The early in-vessel phase immediately follows the gap release phase. The activity released from the core during each release phase should be modeled as increasing in a linear fashion over the	Conforms	The BWR durations from Table 4 are used with the exception that the onset of the gap release phase is 30 seconds for conservatism. LOCA is modeled in a linear fashion. Non-LOCA events are not modeled in this

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
	duration of the phase. For non-LOCA DBAs, in which fuel damage is projected, the release from the fuel gap and the fuel pellet should be assumed to occur instantaneously with the onset of the projected damage. **Table 4** **LOCA Release Phases** **PWRs** / **BWRs** **Phase** / **Onset** / **Duration** / **Onset** / **Duration** Gap Release / 30 sec / 0.5 hr / 2 min / 0.5 hr Early In-Vessel / 0.5 hr / 1.3 hr / 0.5 hr / 1.5 hr		document.
3.3	For facilities licensed with leak-before-break methodology, the onset of the gap release phase may be assumed to be 10 minutes. A licensee may propose an alternative time for the onset of the gap release phase, based on facility-specific calculations using suitable analysis codes or on an accepted topical report shown to be applicable for the specific facility. In the absence of approved alternatives, the gap release phase onsets in Table 4 should be used.	Not Applicable	Oyster Creek does not use leak-before-break methodology for DBA analyses.
3.4	Table 5 lists the elements in each radionuclide group that should be considered in design basis analyses. **Table 5** **Radionuclide Groups** **Group** / **Elements** Noble Gases / Xe, Kr Halogens / I, Br Alkali Metals / Cs, Rb Tellurium Group / Te, Sb, Se, Ba, Sr Noble Metals / Ru, Rh, Pd, Mo, Tc, Co Lanthanides / La, Zr, Nd, Eu, Nb, Pm, Pr, Sm, Y, Cm, Am Cerium / Ce, Pu, Np	Conforms	The RG is inconsistent between Tables 1 and 5. Barium and strontium have release fractions lower than the Te group (see Item 3.2), and these fractions are used in lieu of the 5% release for the Te group. - Mass The 2-phase mass release to the drywell accounts for fission product mass release and inert products release. Average densities are calculated based on presence of radionuclides from Table 5. - Activities The nuclides used for Oyster Creek are

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
			the 60 identified as being potentially important contributors to TEDE in NUREG/CR-4691 (MACCS User's Guide) [less the two cobalt isotopes which have minor impact] plus four additional noble gas isotopes from TID-14844, plus three other short-lived noble gas isotopes, plus Ba-137m for a total of 66.
3.5	Of the radioiodine released from the reactor coolant system (RCS) to the containment in a postulated accident, 95 percent of the iodine released should be assumed to be cesium iodide (CsI), 4.85 percent elemental iodine, and 0.15 percent organic iodide. This includes releases from the gap and the fuel pellets. With the exception of elemental and organic iodine and noble gases, fission products should be assumed to be in particulate form. The same chemical form is assumed in releases from fuel pins in FHAs and from releases from the fuel pins through the RCS in DBAs other than FHAs or LOCAs. However, the transport of these iodine species following release from the fuel may affect these assumed fractions. The accident-specific appendices to this regulatory guide provide additional details.	Conforms	For mass release, all iodine is assumed to be CsI. CsI is a major contributor in the total mass of fission products released to the drywell.
3.6	The amount of fuel damage caused by non-LOCA design basis events should be analyzed to determine, for the case resulting in the highest radioactivity release, the fraction of the fuel that reaches or exceeds the initiation temperature of fuel melt and the fraction of fuel elements for which the fuel clad is breached. Although the NRC staff has traditionally relied upon the departure from nucleate boiling ratio (DNBR) as a fuel damage criterion, licensees may propose other methods to the NRC staff, such as those based upon enthalpy deposition, for estimating fuel damage for the purpose of establishing radioactivity releases.	N/A	Non-LOCA events are not analyzed.
4.1.1	The dose calculations should determine the TEDE. TEDE is the sum of the committed effective dose equivalent (CEDE) from	Conforms	TEDE is calculated, with significant progeny included.

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
	inhalation and the deep dose equivalent (DDE) from external exposure. The calculation of these two components of the TEDE should consider all radionuclides, including progeny from the decay of parent radionuclides that are significant with regard to dose consequences and the released radioactivity.		
4.1.2	The exposure-to-CEDE factors for inhalation of radioactive material should be derived from the data provided in ICRP Publication 30, "Limits for Intakes of Radionuclides by Workers" (Ref. 19). Table 2.1 of Federal Guidance Report 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion" (Ref. 20), provides tables of conversion factors acceptable to the NRC staff. The factors in the column headed "effective" yield doses corresponding to the CEDE.	Conforms	Federal Guidance Report 11 dose conversion factors (DCFs) taken from the RADTRAD default FGR 11 & 12 library are used. The only exception is that SR DCFs based on the oxide form have been used directly from Federal Guidance Report 11.
4.1.3	For the first 8 hours, the breathing rate of persons offsite should be assumed to be 3.5 x 10^{-4} cubic meters per second. From 8 to 24 hours following the accident, the breathing rate should be assumed to be 1.8 x 10^{-4} cubic meters per second. After that and until the end of the accident, the rate should be assumed to be 2.3 x 10^{-4} cubic meters per second.	Conforms	The values from SRP 6.4 that correspond to the rounded values in Section 4.1.3 of RG 1.183 are used.
4.1.4	The DDE should be calculated assuming submergence in semi-infinite cloud assumptions with appropriate credit for attenuation by body tissue. The DDE is nominally equivalent to the effective dose equivalent (EDE) from external exposure if the whole body is irradiated uniformly. Since this is a reasonable assumption for submergence exposure situations, EDE may be used in lieu of DDE in determining the contribution of external dose to the TEDE. Table III.1 of Federal Guidance Report 12, "External Exposure to Radionuclides in Air, Water, and Soil" (Ref. 21), provides external EDE conversion factors acceptable to the NRC staff. The factors in the column headed "effective" yield doses corresponding to the EDE.	Conforms	Federal Guidance Report 12 dose conversion factors (DCFs) taken from the RADTRAD default FGR 11 & 12 library are used.

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
4.1.5	The TEDE should be determined for the most limiting person at the EAB. The maximum EAB TEDE for any two-hour period following the start of the radioactivity release should be determined and used in determining compliance with the dose criteria in 10 CFR 50.67. The maximum two-hour TEDE should be determined by calculating the postulated dose for a series of small time increments and performing a "sliding" sum over the increments for successive two-hour periods. The maximum TEDE obtained is submitted. The time increments should appropriately reflect the progression of the accident to capture the peak dose interval between the start of the event and the end of radioactivity release (see also Table 6). Footnote 14: *With regard to the EAB TEDE, the maximum two-hour value is the basis for screening and evaluation under 10 CFR 50.59. Changes to doses outside of the two-hour window are only considered in the context of their impact on the maximum two-hour EAB TEDE.*	Conforms	The maximum two-hour LOCA EAB dose starts at t=0.508 hours and ends at t=2.508 hours.
4.1.6	TEDE should be determined for the most limiting receptor at the outer boundary of the low population zone (LPZ) and should be used in determining compliance with the dose criteria in 10 CFR 50.67.	Conforms	This guidance is applied in the analyses.
4.1.7	No correction should be made for depletion of the effluent plume by deposition on the ground.	Conforms	No such corrections made in the analyses.
4.2.1	The TEDE analysis should consider all sources of radiation that will cause exposure to control room personnel. The applicable sources will vary from facility to facility, but typically will include: Contamination of the control room atmosphere by the intake or infiltration of the radioactive material contained in the radioactive plume released from the facility, Contamination of the control room atmosphere by the intake or infiltration of airborne radioactive material from areas and structures adjacent to the control room envelope, Radiation shine from the external radioactive plume released from	Conforms	The principal source of dose within the control room is due to airborne activity. The dose estimates from post LOCA primary containment and other fixed sources external to the control room (using TID-14844) have been evaluated and are shown to be conservative. The external dose from the plume has been obtained by applying a conservative factor to the dose due to activity inside the control room.

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
	the facility, Radiation shine from radioactive material in the reactor containment, Radiation shine from radioactive material in systems and components inside or external to the control room envelope, e.g., radioactive material buildup in recirculation filters.		
4.2.2	The radioactive material releases and radiation levels used in the control room dose analysis should be determined using the same source term, transport, and release assumptions used for determining the EAB and the LPZ TEDE values, unless these assumptions would result in non-conservative results for the control room.	Conforms	The source term, transport, and release methodology is the same for both the control room and offsite locations.
4.2.3	The models used to transport radioactive material into and through the control room, and the shielding models used to determine radiation dose rates from external sources, should be structured to provide suitably conservative estimates of the exposure to control room personnel.	Conforms	This guidance is applied in the analyses.
4.2.4	Credit for engineered safety features that mitigate airborne radioactive material within the control room may be assumed. Such features may include control room isolation or pressurization, or intake or recirculation filtration. Refer to Section 6.5.1, "ESF Atmospheric Cleanup System," of the SRP (Ref. 3) and Regulatory Guide 1.52, "Design, Testing, and Maintenance Criteria for Post-accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants" (Ref. 25), for guidance.	Conforms	For the LOCA, credit is taken for SGTS HEPA and charcoal adsorber filtration (90% each), which is conservative. Control Room intake and recirculation filtration is not credited in the LOCA accident analysis.
4.2.5	Credit should generally not be taken for the use of personal protective equipment or prophylactic drugs. Deviations may be considered on a case-by-case basis.	Conforms	Such credits are not taken.
4.2.6	The dose receptor for these analyses is the hypothetical maximum exposed individual who is present in the control room for 100% of the time during the first 24 hours after the event, 60% of the time	Conforms	Standard occupancy factors and breathing rate are used throughout the analyses.

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
	between 1 and 4 days, and 40% of the time from 4 days to 30 days. For the duration of the event, the breathing rate of this individual should be assumed to be 3.5 x 10^{-4} cubic meters per second.		
4.2.7	Control room doses should be calculated using dose conversion factors identified in Regulatory Position 4.1 above for use in offsite dose analyses. The DDE from photons may be corrected for the difference between finite cloud geometry in the control room and the semi-infinite cloud assumption used in calculating the dose conversion factors. The following expression may be used to correct the semi-infinite cloud dose, DDE_∞, to a finite cloud dose, DDE_{finite}, where the control room is modeled as a hemisphere that has a volume, V, in cubic feet, equivalent to that of the control room (Ref. 22). $DDE_{finite} = \frac{DDE_\infty V^{0.338}}{1173}$	Conforms	The equation given is utilized for finite cloud correction when calculating external doses due to the airborne activity inside the control room.
4.3	The guidance provided in Regulatory Positions 4.1 and 4.2 should be used, as applicable, in re-assessing the radiological analyses identified in Regulatory Position 1.3.1, such as those in NUREG-0737 (Ref. 2). Design envelope source terms provided in NUREG-0737 should be updated for consistency with the AST. In general, radiation exposures to plant personnel identified in Regulatory Position 1.3.1 should be expressed in terms of TEDE. Integrated radiation exposure of plant equipment should be determined using the guidance of Appendix I of this guide.	Conforms	Based on comparison of noble gas activities (the predominant contributor to dose), the existing TID-14844 based analyses described in Section 1.9 of the UFSAR are determined to be conservative and bounding. Therefore, the historically analyzed cases are sufficient and no additional analysis of vital areas of Oyster Creek is necessary.
5.1.1	The evaluations required by 10 CFR 50.67 are re-analyses of the design basis safety analyses and evaluations required by 10 CFR 50.34; they are considered to be a significant input to the evaluations required by 10 CFR 50.92 or 10 CFR 50.59. These analyses should be prepared, reviewed, and maintained in accordance with quality assurance programs that comply with Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50.	Conforms	These analyses were prepared as specified in the guidance.

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
5.1.2	Credit may be taken for accident mitigation features that are classified as safety-related, are required to be operable by technical specifications, are powered by emergency power sources, and are either automatically actuated or, in limited cases, have actuation requirements explicitly addressed in emergency operating procedures. The single active component failure that results in the most limiting radiological consequences should be assumed. Assumptions regarding the occurrence and timing of a loss of offsite power should be selected with the objective of maximizing the postulated radiological consequences.	Conforms based on acceptable risk assessments	RHR (drywell spray mode) and SLC systems are required by technical specifications, are powered by emergency power, and have actuation requirements explicitly addressed in emergency operating procedures and severe accident guidance as applicable. The analysis takes credit for SLC System operation. Due to having a common flow path with inline check valves located inside containment, SLC is not fully single-failure proof although it has a high level of redundancy regarding system flow paths and active components (e.g., multiple pumps, suction paths, and explosive injection valves).
5.1.3	The numeric values that are chosen as inputs to the analyses required by 10 CFR 50.67 should be selected with the objective of determining a conservative postulated dose. In some instances, a particular parameter may be conservative in one portion of an analysis but be non-conservative in another portion of the same analysis.	Conforms	Conservative assumptions are used.
5.1.4	Licensees should ensure that analysis assumptions and methods are compatible with the AST and the TEDE criteria.	Conforms	Analysis assumptions and methods were made per this guidance.
5.3	Atmospheric dispersion values (χ/Q) for the EAB, the LPZ, and the control room that were approved by the staff during initial facility licensing or in subsequent licensing proceedings may be used in performing the radiological analyses identified by this guide. Methodologies that have been used for determining χ/Q values are documented in Regulatory Guides 1.3 and 1.4, Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," and the	Conforms	Existing, approved atmospheric dispersion values (χ/Q) for the EAB, the LPZ, and the control room were used in the analysis.

Table A: Conformance with Regulatory Guide (RG) 1.183 Main Sections

RG Section	RG Position	Oyster Creek Analysis	Comments
	paper, "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Criterion 19". The NRC computer code PAVAN implements Regulatory Guide 1.145 and its use is acceptable to the NRC staff. The methodology of the NRC computer code ARCON96 is generally acceptable to the NRC staff for use in determining control room χ/Q values.		

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
1	Acceptable assumptions regarding core inventory and the release of radionuclides from the fuel are provided in Regulatory Position 3 of this guide.	Conforms	*Fission Product Inventory:* Core source terms are developed using KORIGEN. *Release Fractions:* Release fractions are per Table 1 of RG 1.183. *Timing of Release Phases:* Release Phases are per Table 4 of RG 1.183. However, the onset of the gap release is assumed to be 30 seconds instead of 2 minutes for conservatism. *Radionuclide Composition:* Radionuclide grouping is per Table 5 of RG 1.183. *Chemical Form:* Treatment of release chemical form is per RG 1.183, Section 3.5.
2	If the sump or suppression pool pH is controlled at values of 7 or greater, the chemical form of radioiodine released to the containment should be assumed to be 95% cesium iodide (CsI), 4.85 percent elemental iodine, and 0.15 percent organic iodide. Iodine species, including those from iodine re-evolution, for sump or suppression pool pH values less than 7 will be evaluated on a case-by-case basis. Evaluations of pH should consider the effect of acids and bases created during the LOCA event, e.g., radiolysis products. With the exception of elemental and organic iodine and noble gases, fission products should be assumed to be in particulate form.	Conforms	The stated distributions of iodine chemical forms are used. The post-LOCA suppression pool pH has been evaluated, including consideration of the effects of acids and bases created during the LOCA event, the effects of key fission product releases, and the impact of SLC injection. Suppression pool pH remains above 7 for at least 30 days.
3.1	The radioactivity released from the fuel should be assumed to mix instantaneously and homogeneously throughout the free air volume of the primary containment in PWRs or the drywell in BWRs as it is released. This distribution should be adjusted if there are internal compartments that have limited ventilation exchange. The suppression pool free air volume may be included provided there is a mechanism to	Conforms with justification	The radioactivity release from the fuel is assumed to instantaneously and homogeneously mix throughout the drywell air space. The suppression chamber free air volume is included (after 4065 seconds)

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
	ensure mixing between the drywell to the wetwell. The release into the containment or drywell should be assumed to terminate at the end of the early in-vessel phase.		based on expected steam flow from the drywell to the suppression chamber per the MAAP4 analysis, even after the initial blowdown, and from the suppression chamber to the drywell through vacuum breakers as steam condensing reduces drywell pressure relative to that in the suppression chamber.
3.2	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 Chapter 6.5.2, "Containment Spray as a Fission Product Cleanup System," of the Standard Review Plan (SRP), NUREG-0800 (Ref. A-1) and in NUREG/CR-6189, "A Simplified Model of Aerosol Removal by Natural Processes in Reactor Containments" (Ref. A-2). The latter model is incorporated into the analysis code RADTRAD (Ref. A-3).	Conforms	Credit is taken for natural deposition of aerosol at all times in the drywell (use of Polestar's STARNAUA computer code). Natural deposition is only noticeable when drywell sprays are not operating. Elemental iodine is assumed to be removed at the same rate as particulate.
3.3	Reduction in airborne radioactivity in the containment by containment spray systems that have been designed and are maintained in accordance with Chapter 6.5.2 of the SRP (Ref. A-1) may be credited. Acceptable models for the removal of iodine and aerosols are described in Chapter 6.5.2 of the SRP and NUREG/CR-5966, "A Simplified Model of Aerosol Removal by Containment Sprays"1 (Ref. A-4). This simplified model is incorporated into the analysis code RADTRAD (Refs. A-1 to A-3). The evaluation of the containment sprays should address areas within the primary containment that are not covered by the spray drops. The mixing rate attributed to natural convection between sprayed and unsprayed regions of the containment building, provided that adequate flow exists between these regions, is assumed to be two turnovers of the unsprayed regions per hour, unless other rates are justified. The containment building atmosphere may be considered a single, well-mixed volume if the spray covers at least 90% of the volume and if adequate mixing of unsprayed compartments can be shown.	Conforms using alternate methods	Spray removal by impaction credited using Polestar's STARNAUA computer code in drywell (makes use of a distribution of droplet sizes). Drywell congestion explicitly addressed by reduced spray flow and fall height. Sprays do not operate continuously. Elemental iodine assumed to be removed at the same rate as particulate. The drywell spray lambda is calculated using the STARNAUA code, which recalculates the airborne

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
	The SRP sets forth a maximum decontamination factor (DF) for elemental iodine based on the maximum iodine activity in the primary containment atmosphere when the sprays actuate, divided by the activity of iodine remaining at some time after decontamination. The SRP also states that the particulate iodine removal rate should be reduced by a factor of 10 when a DF of 50 is reached. The reduction in the removal rate is not required if the removal rate is based on the calculated time-dependent airborne aerosol mass. There is no specified maximum DF for aerosol removal by sprays. The maximum activity to be used in determining the DF is defined as the iodine activity in the columns labeled "Total" in Tables 1 and 2 of this guide multiplied by 0.05 for elemental iodine and by 0.95 for particulate iodine (i.e., aerosol treated as particulate in SRP methodology).		aerosol particulate size distribution at each time step. Removal coefficients set to zero after approximately 24 hours as there are essentially no aerosol particles remaining airborne that would be large enough to be removed by spray droplets. Elemental iodine removal DF is based on mechanistic models developed at ORNL.
3.4	Reduction in airborne radioactivity in the containment by in-containment recirculation filter systems may be credited if these systems meet the guidance of Regulatory Guide 1.52 and Generic Letter 99-02 (Refs. A-5 and A-6). The filter media loading caused by the increased aerosol release associated with the revised source term should be addressed.	Not Applicable	No in-containment recirculation filter systems exist at Oyster Creek.
3.5	Reduction in airborne radioactivity in the containment by suppression pool scrubbing in BWRs should generally not be credited. However, the staff may consider such reduction on an individual case basis. The evaluation should consider the relative timing of the blowdown and the fission product release from the fuel, the force driving the release through the pool, and the potential for any bypass of the suppression pool (Ref. 7). Analyses should consider iodine re-evolution if the suppression pool liquid pH is not maintained greater than 7.	Conforms	No credit is taken for suppression pool scrubbing in the LOCA AST reanalysis. Analyses have been performed that determined that the suppression pool liquid pH is maintained greater than 7, and that, therefore, iodine re-evolution is not expected.
3.6	Reduction in airborne radioactivity in the containment by retention in ice condensers, or other engineering safety features not addressed above, should be evaluated on an individual case basis. See Section 6.5.4 of the SRP (Ref. A-1).	Not Applicable	Oyster Creek does not have ice condensers. No other removal mechanisms are credited other than natural deposition.
3.7	The primary containment (i.e., drywell for Mark I and II containment designs) should be assumed to leak at the peak pressure technical	Conforms using	Primary containment leak rate is divided into secondary containment

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
	specification leak rate for the first 24 hours. For PWRs, the leak rate may be reduced after the first 24 hours to 50% of the technical specification leak rate. For BWRs, leakage may be reduced after the first 24 hours, if supported by plant configuration and analyses, to a value not less than 50% of the technical specification leak rate. Leakage from subatmospheric containments is assumed to terminate when the containment is brought to and maintained at a subatmospheric condition as defined by technical specifications. For BWRs with Mark III containments, the leakage from the drywell into the primary containment should be based on the steaming rate of the heated reactor core, with no credit for core debris relocation. This leakage should be assumed during the two-hour period between the initial blowdown and termination of the fuel radioactivity release (gap and early in-vessel release phases). After two hours, the radioactivity is assumed to be uniformly distributed throughout the drywell and the primary containment.	alternate methods and current licensing basis	bypass and non-secondary containment bypass contributions. Secondary containment bypass component (including MSIV) is coupled to the MAAP4 containment thermal-hydraulic analysis using the MAAP4-predicted drywell pressure. A nozzle model is used to calculate MSIV and other secondary containment bypass compressible flow. Non-secondary containment bypass component assumed to vary with time such that total containment leak rate = peak pressure technical specification leak rate for the first 24 hours and one-half that value after 24 hours. Primary containment pressure is not brought sub-atmospheric.
3.8	If the primary containment is routinely purged during power operations, releases via the purge system prior to containment isolation should be analyzed and the resulting doses summed with the postulated doses from other release paths. The purge release evaluation should assume that 100% of the radionuclide inventory in the reactor coolant system liquid is released to the containment at the initiation of the LOCA. This inventory should be based on the technical specification reactor coolant system equilibrium activity. Iodine spikes need not be considered. If the purge system is not isolated before the onset of the gap release phase, the release fractions associated with the gap release and early in-vessel phases should be considered as applicable.	Conforms	The Oyster Creek primary containment is not routinely purged during power operation. Purging is limited to inerting, de-inerting and occasional short pressure control activities.

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
4.1	Leakage from the primary containment should be considered to be collected, processed by engineered safety feature (ESF) filters, if any, and released to the environment via the secondary containment exhaust system during periods in which the secondary containment has a negative pressure as defined in technical specifications. Credit for an elevated release should be assumed only if the point of physical release is more than two and one-half times the height of any adjacent structure.	Conforms	The elevated release X/Qs used are those previously reviewed and approved by the NRC.
4.2	Leakage from the primary containment is assumed to be released directly to the environment as a ground-level release during any period in which the secondary containment does not have a negative pressure as defined in technical specifications.	Conforms	Primary containment leakage into the reactor building is released through SGTS via the stack as an elevated release. Oyster Creek has no secondary containment drawdown TS. Secondary containment bypass leakage is treated as ground level releases for CR, EAB, and LPZ doses.
4.3	The effect of high wind speeds on the ability of the secondary containment to maintain a negative pressure should be evaluated on an individual case basis. The wind speed to be assumed is the 1-hour average value that is exceeded only 5% of the total number of hours in the data set. Ambient temperatures used in these assessments should be the 1-hour average value that is exceeded only 5% or 95% of the total numbers of hours in the data set, whichever is conservative for the intended use (e.g., if high temperatures are limiting, use those exceeded only 5%).	Conforms	The wind speed exceeded only 5% of the time at Oyster Creek in the secondary containment vicinity is approximately 21.0 mph (175' elevation of meteorological tower 2). It has been determined that a wind speed of greater than 35 mph would be required before the secondary containment pressures would be positive relative to outside air pressures at the downwind side of the reactor enclosure.
4.4	Credit for dilution in the secondary containment may be allowed when adequate means to cause mixing can be demonstrated. Otherwise, the leakage from the primary containment should be assumed to be transported directly to exhaust systems without mixing. Credit for mixing, if found to be appropriate, should generally be limited to 50%. This evaluation should consider the magnitude of the containment	Alternate method used based on existing licensing basis	Full mixing credit is taken for dilution/mixing in secondary containment, per the current licensing basis.

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
	leakage in relation to contiguous building volume or exhaust rate, the location of exhaust plenums relative to projected release locations, the recirculation ventilation systems, and internal walls and floors that impede stream flow between the release and the exhaust.	accident analysis.	
4.5	Primary containment leakage that bypasses the secondary containment should be evaluated at the bypass leak rate incorporated in the technical specifications. If the bypass leakage is through water, e.g., via a filled piping run that is maintained full, credit for retention of iodine and aerosols may be considered on a case-by-case basis. Similarly, deposition of aerosol radioactivity in gas-filled lines may be considered on a case-by-case basis.	Conforms	Bypass leakage rates are included in the analysis.
4.6	Reduction in the amount of radioactive material released from the secondary containment because of ESF filter systems may be taken into account provided that these systems meet the guidance of Regulatory Guide 1.52 (Ref. A-5) and Generic Letter 99-02 (Ref. A-6).	Conforms	SGTS HEPA and charcoal adsorber filters are credited in the evaluation of a LOCA accident for onsite and offsite dose consequences. This system meets the guidance of Regulatory Guide 1.52 and Generic Letter 99-02.
5.1	With the exception of noble gases, all the fission products released from the fuel to the containment (as defined in Tables 1 and 2 of this guide) should be assumed to instantaneously and homogeneously mix in the primary containment sump water (in PWRs) or suppression pool (in BWRs) at the time of release from the core. In lieu of this deterministic approach, suitably conservative mechanistic models for the transport of airborne activity in containment to the sump water may be used. Note that many of the parameters that make spray and deposition models conservative with regard to containment airborne leakage are non-conservative with regard to the buildup of sump activity.	Conforms	With the exception of noble gases, all the fission products released from the fuel to the containment are assumed to instantaneously and homogeneously mix in the suppression pool at the time of release from the core.
5.2	The leakage should be taken as two times the sum of the simultaneous leakage from all components in the ESF recirculation systems above which the technical specifications, or licensee commitments to item III.D.1.1 of NUREG-0737 (Ref. A-8), would require declaring such systems inoperable. The leakage should be assumed to start at the	Alternate method used based on existing licensing	The 1-gpm leak rate is consistent with the current Oyster Creek licensing basis for the sum of the allowed simultaneous leakage from all ECCS components. ECCS

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
	earliest time the recirculation flow occurs in these systems and end at the latest time the releases from these systems are terminated. Consideration should also be given to design leakage through valves isolating ESF recirculation systems from tanks vented to atmosphere, e.g., emergency core cooling system (ECCS) pump minflow return to the refueling water storage tank.	basis accident analysis	leakage is minimized at Oyster Creek through implementation of the Program committed to in T.S. 6.15, "Integrity of Systems Outside Containment". This value is consistent with the limit specified in this Program. Since certain ECCS systems take suction immediately from the suppression pool, this leak path is assumed to start at time 0.
5.3	With the exception of iodine, all radioactive materials in the recirculating liquid should be assumed to be retained in the liquid phase.	Conforms	With the exception of iodine, all radioactive materials in ECCS liquids are assumed to be retained in the liquid phase except noble gas daughters generated by iodine decay.
5.4	If the temperature of the leakage exceeds 212°F, the fraction of total iodine in the liquid that becomes airborne should be assumed equal to the fraction of the leakage that flashes to vapor. This flash fraction, FF, should be determined using a constant enthalpy, h, process, based on the maximum time-dependent temperature of the sump water circulating outside the containment: $FF = \frac{h_{f1} - h_{f2}}{h_{fg}}$ *Where:* h_{f1} is the enthalpy of liquid at system design temperature and pressure; h_{f2} is the enthalpy of liquid at saturation conditions (14.7 psia, 212°F); and h_{fg} is the heat of vaporization at 212°F.	Not Applicable	The temperature of the leakage does not exceed 212°F.
5.5	If the temperature of the leakage is less than 212°F or the calculated flash fraction is less than 10%, the amount of iodine that becomes airborne should be assumed to be 10% of the total iodine activity in the leaked fluid, unless a smaller amount can be justified based on the actual sump pH history and area ventilation rates.	Conforms	An iodine release fraction of 10% is assumed.

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
5.6	The radioiodine that is postulated to be available for release to the environment is assumed to be 97% elemental and 3% organic. Reduction in release activity by dilution or holdup within buildings, or by ESF ventilation filtration systems, may be credited where applicable. Filter systems used in these applications should be evaluated against the guidance of Regulatory Guide 1.52 (Ref. A-5) and Generic Letter 99-02 (Ref. A-6).	Conforms	The credited SGTS charcoal and HEPA filters meet the requirements of RG 1.52 and Generic Letter 99-02. These are credited at 90% efficiency for elemental and organic iodines. Aerosol removal efficiencies are assumed to be 90% based on the HEPA/charcoal combination. This is conservative based on TS requirements.
6.1	For the purpose of this analysis, the activity available for release via MSIV leakage should be assumed to be that activity determined to be in the drywell for evaluating containment leakage (see Regulatory Position 3). No credit should be assumed for activity reduction by the steam separators or by iodine partitioning in the reactor vessel.	Conforms	The activity released through the MSIVs is the same concentration as that used for evaluating Primary to Secondary Containment leakage. No credit is assumed for activity reduction by the steam separators or by iodine partitioning in the reactor vessel.
6.2	All the MSIVs should be assumed to leak at the maximum leak rate above which the technical specifications would require declaring the MSIVs inoperable. The leakage should be assumed to continue for the duration of the accident. Postulated leakage may be reduced after the first 24 hours, if supported by site-specific analyses, to a value not less than 50% of the maximum leak rate.	Conforms in part	Secondary containment bypass component of containment leakage (including MSIV) is coupled to the MAAP4 containment thermal-hydraulic analysis using the MAAP4-predicted drywell pressure. A nozzle model is used to calculate MSIV and other secondary containment bypass compressible flow. The time-dependent, pressure-dependent modeling is consistent with the existing licensing basis.

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
6.3	Reduction of the amount of released radioactivity by deposition and plateout on steam system piping upstream of the outboard MSIVs may be credited, but the amount of reduction in concentration allowed will be evaluated on an individual case basis. Generally, the model should be based on the assumption of well-mixed volumes, but other models such as slug flow may be used if justified.	Conforms in part	The well-mixed sedimentation model included in Polestar's STARNAUA code has been applied for the steam line with all MSIVs assumed to be closed. Polestar impaction model has been applied for the steam line with one MSIV assumed to be failed open. 50% elemental iodine removal credited in steam lines consistent with assumed plateout on particulate and application of Polestar's (proprietary) impaction model.
6.4	In the absence of collection and treatment of releases by ESFs such as the MSIV leakage control system, or as described in paragraph 6.5 below, the MSIV leakage should be assumed to be released to the environment as an unprocessed, ground- level release. Holdup and dilution in the turbine building should not be assumed.	Conforms	MSIV leakage is unprocessed, ground level release.
6.5	A reduction in MSIV releases that is due to holdup and deposition in main steam piping downstream of the MSIVs and in the main condenser, including the treatment of air ejector effluent by offgas systems, may be credited if the components and piping systems used in the release path are capable of performing their safety function during and following a safe shutdown earthquake (SSE). The amount of reduction allowed will be evaluated on an individual case basis. References A-9 and A-10 provide guidance on acceptable models.	Conforms	No credit taken for qualified steam lines beyond outboard MSIVs.
7.0	The radiological consequences from post-LOCA primary containment purging as a combustible gas or pressure control measure should be analyzed. If the installed containment purging capabilities are maintained for purposes of severe accident management and are not credited in any design basis analysis, radiological consequences need not be evaluated. If the primary containment purging is required within 30 days of the LOCA, the results of this analysis should be combined with consequences postulated for other fission product release paths to determine the total calculated radiological consequences from the	Conforms	Containment purging as a combustible gas or pressure control measure is not required nor credited in any design basis analysis for 30 days following a design basis LOCA at Oyster Creek.

Table B: Conformance with RG 1.183 Appendix A (Loss-of-Coolant Accident)

RG Section	RG Position	Oyster Creek Analysis	Comments
	LOCA. Reduction in the amount of radioactive material released via ESF filter systems may be taken into account provided that these systems meet the guidance in Regulatory Guide 1.52 (Ref. A-5) and Generic Letter 99-02 (Ref. A-6).		

5.0 REGULATORY ANALYSIS

5.1 No Significant Hazards Consideration

AmerGen Energy Company, LLC (AmerGen) is requesting a revision to the Facility Operating License for Oyster Creek Generating Station. Specifically, AmerGen requests a revision to the Technical Specifications and licensing and design bases to reflect the application of alternative source term (AST) methodology.

The Oyster Creek AST analyses were performed in accordance with the guidance in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," dated July 2000, and Standard Review Plan Section 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms."

According to 10 CFR 50.92, "Issuance of amendment," paragraph (c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) Involve a significant reduction in a margin of safety.

In support of this determination, an evaluation of each of the three criteria set forth in 10 CFR 50.92 is provided below regarding the proposed license amendment.

5.1.1 The proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

The implementation of AST assumptions has been evaluated in revision to the analysis of the limiting design basis Loss of Coolant Accident (DBA LOCA) at Oyster Creek Generating Station.

Based upon the results of this analysis, it has been demonstrated that, with the requested changes, the dose consequences of this limiting event are within the regulatory requirements provided by the NRC for use with the AST. These requirements are specified in 10 CFR 50.67, and 10 CFR 50 Appendix A, General Design Criterion (GDC) 19. The AST is an input to calculations used to evaluate the consequences of an accident, and does not by itself affect the plant response, or the actual pathway of the radiation released from the fuel. It does, however, better represent the physical characteristics of the release, so that appropriate mitigation techniques may be applied.

The AST methodology follows the guidance provided in Regulatory Guide 1.183 except for noted exceptions where permitted, and conforms to the dose limits in 10 CFR 50.67. Even though these limits are not directly comparable to the previously specified whole body and thyroid requirements of GDC 19 and 10 CFR 100.11, the results of the AST analyses have demonstrated that the 10 CFR 50.67 limits are satisfied. Therefore, it is concluded that the proposed change does not involve a significant increase in the consequences of an accident previously evaluated.

The equipment affected by the proposed changes is mitigative in nature, and relied upon after an accident has been initiated. Application of the AST does not result in any changes to the safety functions of systems described in the Updated Final Safety Analysis Report (UFSAR). As a condition of application of AST, Oyster Creek is proposing to credit the function of the Standby Liquid Control (SLC) system to control the Suppression Pool pH following a LOCA. While the operability of the SLC system is extended to additional plant shutdown conditions, the SLC system is not an accident initiator. Application of the AST is not an initiator of a design basis accident. The proposed changes to the Technical Specifications (TS) do not require any physical changes to the plant.

As a result, the proposed change does not affect any of the parameters or conditions that could contribute to the initiation of any accidents. Since design basis accident initiators are not being altered by adoption of the AST, the probability of an accident previously evaluated is not affected.

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

5.1.2 The proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

The proposed change does not involve a physical change to the plant.

Similarly, the proposed change does not require any physical changes to any structures, systems or components involved in the mitigation of any accidents. Therefore, no new initiators or precursors of a new or different kind of accident are created. New equipment or personnel failure modes that might initiate a new type of accident are not created as a result of the proposed change.

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

5.1.3 The proposed changes do not involve a significant reduction in a margin of safety.

Safety margins and analytical conservatisms have been evaluated and have been found acceptable. The analyzed event has been carefully reviewed and margin has been retained to ensure that the analysis adequately bounds postulated event scenarios. The dose consequences due to design basis accidents comply with the requirements of 10 CFR 50.67, GDC-19, and the guidance of Regulatory Guide 1.183.

The proposed change is associated with the implementation of a new licensing basis radiological source term for the Oyster Creek Design Basis LOCA Accident (DBA LOCA). Approval of the change from the original source term to a new source term taken from Regulatory Guide 1.183 is being requested. The results of the accident analysis, revised in support of the proposed changes, are subject to revised acceptance criteria. The analysis has been performed using conservative methodologies, as specified in Regulatory Guide 1.183. The dose consequences of this DBA remain within the acceptance criteria specified in 10 CFR 50.67, "Accident source term", 10 CFR 50 Appendix A, GDC-19, and Regulatory Guide 1.183.

The proposed changes continue to ensure that the doses at the exclusion area boundary (EAB) and low population zone boundary (LPZ), as well as the Control Room, are within corresponding regulatory limits.

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

Conclusion

AmerGen concludes that the proposed change presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of no significant hazards consideration is justified.

5.2 Applicable Regulatory Requirements/Criteria

The NRC's traditional methods (prior to the AST) for calculating the radiological consequences of design basis accidents are described in a series of regulatory guides and Standard Review Plan (SRP) chapters. That guidance was developed to be consistent with the TID-14844 source term and the whole body and thyroid dose guidelines stated in 10 CFR 100.11. Many of those analysis assumptions and methods are inconsistent with the ASTs and with the Total Effective Dose Equivalent (TEDE) criteria provided in 10 CFR 50.67. Regulatory Guide 1.183 provides assumptions and methods that are acceptable to the NRC staff for performing design basis radiological analyses using an AST. This guidance supersedes corresponding radiological analysis assumptions provided in the older regulatory guides and SRP chapters when used in conjunction with an approved AST and the TEDE criteria provided in 10 CFR 50.67.

Due to the comprehensive nature of Regulatory Guide 1.183, Tables A and B in Section 4 of Attachment 1 of this License Amendment Request are provided to describe how each section of the new guidance is being addressed.

Also, the NRC published Standard Review Plan Section 15.0.1, Rev. 0, entitled "Radiological Consequence Analyses Using Alternative Source Terms" to address AST. This SRP provides guidance on which NRC branches will review various aspects of an AST license amendment request, but otherwise is consistent with the guidance found in Regulatory Guide 1.183. The plant-specific information provided in this license amendment request is consistent with the guidance found in SRP 15.0.1.

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

6.0 ENVIRONMENTAL CONSIDERATION

AmerGen has evaluated the proposed changes against the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments." AmerGen has determined that the proposed changes meet the criteria for a categorical exclusion as set forth in 10 CFR 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," paragraph (c)(9), and as such, has determined that no irreversible consequences exist in accordance with 10 CFR 50.92, "Issuance of amendment," paragraph (b). This determination is based on the fact that this change is being proposed as an amendment to a license issued pursuant to 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities," which changes a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20," Standards for Protection Against Radiation," or that changes an inspection or a surveillance requirement, and the amendment meets the following specific criteria.

(i) **The amendment involves no significant hazards consideration.**

As demonstrated in Section 5.1 above, the proposed changes do not involve a significant hazards consideration.

(ii) **There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.**

The following table demonstrates that AmerGen meets the radiological criteria described in 10 CFR 50.67 for the exclusion area boundary (EAB) and the low population zone (LPZ). The EAB and LPZ doses represent a small fraction of the dose limits.

LOCA Dose Results (rem TEDE)			
EAB Doses and Limits		**LPZ Doses and Limits**	
Dose	**Limit**	**Dose**	**Limit**
1.01	25	0.16	25

Adoption of the alternative source term and associated Technical Specification changes, which implement certain conservative assumptions in the alternative source term analyses, will not result in physical changes to the plant that could significantly alter the type or amounts of effluents that may be released offsite. No changes to operational parameters that could affect effluent releases have been proposed.

(iii) **There is no significant increase in individual or cumulative occupational radiation exposure.**

The following table demonstrates that AmerGen meets the radiological criteria described in 10 CFR 50.67 for the Control Room. Control Room exposure to operators is less than the five (5) Rem total effective dose equivalent (TEDE) over 30 days for all accidents.

Control Room Dose Results (rem TEDE)		
Accident	**Dose**	**Limit**
Loss of Coolant Accident	3.61	5.0

The implementation of the alternative source term has been evaluated in revisions to the analyses of the limiting design basis accidents at Oyster Creek Generating Station. This analysis includes the loss of coolant accident. Based upon the results of this analysis, it has been demonstrated that with the proposed change, the dose consequences of this limiting event are within the regulatory requirements specified by the NRC for use with alternative source term (i.e., 10 CFR 50.67 and 10 CFR 50, Appendix A, General Design Criterion 19). Thus, there will be no significant increase in either individual or cumulative occupational radiation exposure.

7.0 REFERENCES

7.1 10 CFR 50.67, "Accident source term," December 23, 1999

7.2 U. S. Nuclear Regulatory Commission Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000

7.3 U. S. Atomic Energy Commission, Technical Information Document (TID) 14844, "Calculation of Distance Factors for Power and Test Reactor Sites," March 23, 1962

7.4 NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," February 1995

7.5 U. S. Nuclear Regulatory Commission Standard Review Plan 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms," Revision 0, July 2000

7.6 Oyster Creek License Amendment No. 225, dated February 7, 2002

7.7 ICRP Publication 30, "Limits for Intakes of Radionuclides by Workers," 1979

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

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

7.10 PSAT CI09.03, Rev 0, "STARDOSE Model Report", January 31, 1997

7.11 S. L. Humphreys et al., "RADTRAD: A Simplified Model for Radionuclide Transport and Removal and Dose Estimation," NUREG/CR-6604, U. S. Nuclear Regulatory Commission, April 1998

7.12 NUREG-1150, "Severe Accident Risks: An Assessment For Five U. S. Nuclear Power Plants, Final Summary Report," dated December 1, 1990

7.13 Response to Request For Additional Information – Radiological Consequence Analysis For Control Room Operators at Oyster Creek Generating Station (TAC No. MA3465), dated February 9, 2001

7.14 GPUN Letter, Wilson to Zwolinski (NRC), dated June 17, 1985

7.15 Oyster Creek DCC File No. 20.1801.0005, "Primary Containment Leakage Rate Testing Program", Revision 0, October 11, 1996

7.16 GPUN Calculation C-1302-243-E610-074, "OC Thermal-Hydraulic Conditions Following a LOCA Using MAAP4"

7.17 J. V. Ramsdell and C. A. Simonen, "Atmospheric Relative Concentrations in Building Wakes," NUREG-6331, Revision 1, U. S. Nuclear Regulatory Commission, May 1997. (ARCON96)

7.18 PSAT 05201H.05, Rev 2, “Suppression Pool pH for OCNGS Control Room Habitability”, April 13, 2001

7.19 NUREG/CR-5106 (Manual for TACT5 - Version SAIC 9/23/87)

7.20 NUREG/CR-4691, “MELCOR Accident Consequence Code System (MACCS)”, February 1990

7.21 NUREG-0737, “Clarification of TMI Action Plan Requirements”, October 1980

7.22 10 CFR 50, Appendix A, General Design Criterion 19

7.23 PSAT 05201U.03, “Dose Calculation Data Base for Application of the Revised DBA Source Term to the Oyster Creek Nuclear Power Plant”, Revision 4, as input to PSAT 05201H.08, “Dose Assessment for Oyster Creek Control Room Habitability,” Revision 2

7.24 PSAT C101.02, Rev. 1.02, "STARNAUA - A Code for Evaluating Severe Accident Aerosol Behavior in Nuclear Power Plant Containments: A Validation and Verification Report", December 31, 1996

7.25 GPUN Letter, DeVine to USNRC Document Control Desk, dated June 20, 1991

7.26 Morewitz, H.A., “Leakage of Aerosols from Containment Buildings”, Health Physics, Volume 42, No.2, February 1982

7.27 Price, W.J., Nuclear Radiation Detection, McGraw-Hill, New York, 1958

ATTACHMENT 2

OYSTER CREEK GENERATING STATION

Docket No. 50-219

License No. DPR-16

License Amendment Request
"Oyster Creek Alternative Source Term Implementation"

Markup of Technical Specification Pages

3.2-3
3.2-10
3.17-2
4.5-10
4.17-1

The average of the scram insertion times for the three fastest control rods of all groups of four control rods in a two-by-two array shall be no greater than:

Rod Length Inserted (%)	Insertion Time (Seconds)
5	0.398
20	0.954
50	2.120
90	5.300

Any four rod group may contain a control rod which is valved out of service provided the above requirements and Specification 3.2.A are met. Time zero shall be taken as the de-energization of the pilot scram valve solenoids.

4. Control rods which cannot be moved with control rod drive pressure shall be considered inoperable. If a partially or fully withdrawn control rod drive cannot be moved with drive or scram pressure, the reactor shall be brought to a shutdown condition within 48 hours unless investigation demonstrates that the cause of the failure is not due to a failed control rod drive mechanism collet housing. Inoperable control rods shall be valved out of service, in such positions that Specification 3.2.A is met. In no case shall the number of rods valved out of service be greater than six during the power operation. If this specification is not met, the reactor shall be placed in the shutdown condition.

5. Control Rods shall not be withdrawn for approach to criticality unless at least two source range channels have an observed count rate equal to or greater than 3 counts per second.

C. Standby Liquid Control System

1. The standby liquid control system shall be operable at all times under the following conditions:
(a) when the reactor is not shut down by the control rods such that Specification 3.2.A is met, ~~and~~ except as provided in Specification 3.2.C.3, and
(b) when the reactor is >212°F, except during REACTOR VESSEL PRESSURE TESTING.

2. The standby liquid control solution shall have a Boron-10 isotopic enrichment equal to or greater than 35 atom %, be maintained within the cross-hatched volume-concentration requirement area in Figure 3.2-1 and at a temperature not less than the temperature presented in Figure 3.2-2 at all times when the standby liquid control system is required to be operable.

3. (a) If one standby liquid control system pumping circuit becomes inoperable during the RUN mode and Specification 3.2.A is met, the reactor may remain in operation for a period not to exceed 7 days, provided the pump in the other circuit is verified daily to be operable, otherwise be in the Shutdown condition within 24 hours.

The solution saturation temperature varies with the concentration of sodium pentaborate. The solution will be maintained at least 5°F above the saturation temperature to guard against precipitation. The 5°F margin is included in Figure 3.2-2. Temperature and liquid level alarms for the system are annunciated in the control room.

The acceptable time out of service for a standby liquid control system pumping circuit as well as other safety features is determined to be 10 days. However, the allotted time out of service for a standby liquid control system pumping circuit is conservatively set at 7 days in the specification. Systems are designed with redundancy to increase their availability and to provide backup if one of the components is temporarily out of service.

¶

During each fuel cycle, excess operating reactivity varies as fuel depletes and as any burnable poison in supplementary control is burned. The magnitude of this excess reactivity is indicated by the integrated worth of control rods inserted into the core, referred to as the control rod inventory in the core. As fuel burnup progresses, anomalous behavior in the excess reactivity may be detected by comparison of actual rod inventory with expected inventory based on appropriately corrected past data. Experience at Oyster Creek and other operating BWR's indicates that the control rod inventory should be predictable to the equivalent of one percent in reactivity. Deviations beyond this magnitude would not be expected and would require thorough evaluation. One percent reactivity limit is considered safe since an insertion of this reactivity into the core would not lead to transients exceeding design conditions of the reactor system.

References:
(1) FDSAR, Volume I, Section III-5.3.1
(2) FDSAR, Volume I, Section VI-3
(3) FDSAR, Volume I, Section III-5.2.1
(4) FDSAR, Volume I, Section VII-9
(5) NEDE-24011-P-A, General Electric Standard Application for Reactor Fuel (GESTAR II) (latest approved version as specified in the COLR).
(6) FDSAR, Volume I, Section III-5 and Volume II, Appendix B
(7) FDSAR, Volume I, Sections VII-4.2.2 and VII-4.3.1
(8) FDSAR, Volume I, Section VI-4
(9) FDSAR, Amendment No. 55, Section 2
(10) C. J. Paone, Banked Position Withdrawal Sequence, January 1988 (NEDO-21231)
(11) UFSAR, Volume 4, Section 4.3.2.4.1

The standby liquid control system also has a post-LOCA safety function to buffer suppression pool pH in order to maintain bulk pH above 7.0. This function is necessary to prevent Iodine re-evolution to satisfy the methodology for Alternative Source Term. Manual initiation is used, and the minimum amount of total boron required for suppression pool pH buffering is 1460 lbm. A single pump can satisfy the post-LOCA function which applies to power OPERATION and SHUTDOWN CONDITION.

Basis:

The operability of the control room HVAC system ensures that the control room will remain habitable for operations personnel during a postulated design basis accident. The control room envelope includes the control room panel area, the shift supervisor's office, toilet room, kitchen, and lower cable spreading room. Since Systems A and B do not have HEPA filters or charcoal absorbers, the supply fan and dampers for each system minimize the beta and gamma doses to the operators by providing positive pressurization and limiting the makeup and infiltration air into the control room envelope. For the supply of 100% outside air to the control room envelope, the radiation exposure to personnel occupying the control room is limited to less than a 30-day integrated ~~gamma~~ dose of 5 rem ~~and a 30-day integrated beta dose of 30 rem.~~

TEDE.

most limiting design basis accident

4.5 CONTAINMENT SYSTEM

Bases:

In the event of a loss-of-coolant accident, the peak drywell pressure would be 38 psig which would rapidly reduce to 20 psig within 100 seconds following the pipe break. The total time the drywell pressure would be above 35 psig is calculated to be about 7 seconds. Following the pipe break, absorption chamber pressure rises to 20 psig within 8 seconds, equalizes with drywell pressure at 25 psig within 60 seconds and thereafter rapidly decays with the drywell pressure decay.(1)

The design pressures of the drywell and absorption chamber are 62 psig and 35 psig, respectively.(2) The original calculated 38 psig peak drywell pressure was subsequently reconfirmed.(3) A 15% margin was applied to revise the drywell design pressure to 44 psig. The design leak rate is 0.5%/day at a pressure of 35 psig. As pointed out above, the pressure response of the drywell and absorption chamber following an accident would be the same after about 60 seconds. Based on the calculated primary containment pressure response discussed above and the absorption chamber design pressure, primary containment pre-operational test pressures were chosen. Also, based on the primary containment pressure response and the fact that the drywell and absorption chamber function as a unit, the primary containment will be tested as a unit rather than testing the individual components separately.

The design basis loss-of-coolant accident was evaluated at the primary containment maximum allowable accident leak rate of 1.0%/day at 35 psig. The analysis showed that with this leak rate and a standby gas treatment system filter efficiency of 90 percent for ~~halogens,~~ elemental and organic iodines ~~95%~~ 90% for particulates, and assuming the fission product release fractions stated in ~~TID-14844,~~ Regulatory Guide 1.183, the maximum ~~total whole body passing cloud~~ dose is ~~about 10~~ 1.01 rem TEDE ~~and the maximum total thyroid dose is about 139 rem~~ at the site boundary considering fumigation conditions over an exposure duration of two hours. The resultant doses that would occur for the duration of the accident at the low population distance of 2 miles are lower than those stated due to the variability of meteorological conditions that would be expected to occur over a 30-day period. Thus, the doses reported are the maximum that would be expected in the unlikely event of a design basis loss-of-coolant accident. These doses are also based on the assumption of no holdup in the secondary containment resulting in a direct release of fission product from the primary containment through the filters and stack to the environs. Therefore, the specified primary containment leak rate and filter efficiency are conservative and provide margin between expected offsite doses and 10 CFR 50.67 ~~100~~ guideline limits. The maximum dose to control room operators over the 30-day accident period is 3.61 rem TEDE.

Although the dose calculations suggest that the allowable test leak rate could be allowed to significantly increase ~~to about 2.0%/day~~ before the guideline ~~thyroid~~ dose limit given in 10 CFR ~~100~~ 50.67 would be exceeded, establishing the limit of 1.0%/day provides an adequate margin of safety to assure the health and safety of the general public. It is further considered that the allowable leak rate should not deviate significantly from the containment design value to take advantage of the design leak-tightness capability of the structure over its service lifetime. Additional margin to maintain the containment in the "as-built" condition is achieved by establishing the allowable operational leak rate. The operational limit is derived by multiplying the allowable test leak rate by 0.75 thereby providing a 25% margin to allow for leakage deterioration which may occur during the period between leak rate tests.

4.17 Control Room Heating, Ventilating, and Air-Conditioning System

Applicability: Applies to surveillance requirements for the control room heating, ventilating, and air conditioning (HVAC) systems.

Objective: To verify the capability of each control room HVAC system to minimize the amount of radioactivity from entering the control room in the event of an accident.

Specification: Surveillance of each control room HVAC system shall be as follows:

A. At least once monthly: by initiating, from the control room, the partial recirculation mode of operation, and by verifying that the system components are aligned such that the system is operating in this mode.

B. At least once every refueling outage: by verifying that in the partial recirculation mode of operation, the control room and lower cable spreading room are maintained at a positive pressure of ≥ 1/8 in. WG relative to the outside atmosphere.

Basis: Periodic surveillance of each control room HVAC system is required to ensure the operability of the system. The operability of the system in conjunction with control room design provisions is based upon limiting the radiation exposure to personnel occupying the control room to less than a 30-day integrated ~~gamma~~ dose of 5 rem TEDE ~~and a 30-day integrated beta dose of 30 rem.~~ for the most limiting design basis accident.

ATTACHMENT 3

OYSTER CREEK GENERATING STATION

Docket No. 50-219

License No. DPR-16

License Amendment Request
"Oyster Creek Alternative Source Term Implementation"

Technical Input Parameters and Methodologies for AST Calculations

ATTACHMENT 3

Technical Input Parameters and Methodologies for AST Calculations

This attachment serves as a supplement to provide additional technical information needed to fully understand the technical analyses that were performed.

Table of Contents

Containment Bypass Pathways - MSIVs

The MSIV leak rate as a function of containment pressure is based on a model identical to that in the existing licensing basis, except that the MSIVs are assumed to be leaking at the rate of 15.975 scfh under a test pressure of at least 35 psig, which is slightly more limiting than the current TS limit of 11.9 scfh when tested at $\geq$ 20 psig. The leak rate model assumed a frictionless leak path for MSIV leakage and an isentropic expansion through that path. The flow can be modeled with the following expression:

$$\text{Mass flow} = \rho AV = \rho A\{2c_pT_0[1-(P/P_0)^{(k-1)/k}]\}^{1/2}$$

where: V = velocity at the orifice

ρ = expanded density of the gas

A = orifice area

c_p = specific heat capacity of the gas at constant pressure

T_0 = source temperature of the gas

P = expanded pressure of the gas

P_0 = source pressure of the gas

k = ratio of specific heats for the gas

Since $T_0 = P_0/(R\rho_0)$ and since $M^2 = 2/(1-k)[1-(P_0/P)^{(k-1)/k}]$ (where M is the maximum local Mach Number), then:

$$1-(P/P_0)^{(k-1)/k} = 1 - 2/[2-(1-k)M^2]$$

$$\text{Mass flow} = \rho A\{2c_pT_0[1-(P/P_0)^{(k-1)/k}]\}^{1/2} = \rho A\{2c_pP_0/R\rho_0\}^{1/2}\{1 - 2/[2+(k-1)M^2]\}^{1/2}$$

Then, since $\rho = \rho_0/\{[2+(k-1)M^2]/2\}^{1/(k-1)}$, and defining $f(M,k) = [2+(k-1)M^2]/2$:

$$\text{Mass flow} = A\{2c_pP_0\rho_0/R\}^{1/2}\{1-1/f(M,k)\}^{1/2}/\{f(M,k)\}^{1/(k-1)}$$

$$\text{Mass flow} = A\{2c_pP_0\rho_0/R\}^{1/2}\{f(M,k)^{2/(1-k)}- f(M,k)^{(k+1)/(1-k)}\}^{1/2}$$

Thus, the mass flow rate can be determined from the area, A, the upstream state, $P_0\rho_0$, the gas composition, c_p/R and k, and the local Mach Number. The local Mach Number, in turn, is a function of k and P/P_0 except it cannot exceed unity. The Mach Number is:

$$M = [2/(k-1)]^{1/2}[(P/P_0)^{(1-k)/k}-1]^{1/2} \leq 1$$

The value of P/P_0 corresponding to $M = 1$ is the critical pressure ratio. Since P is always assumed to be 14.7 psia (the environment), there is a containment pressure that maximizes M to 1. Increasing the containment pressure beyond this point has no effect on P/P_0 as used in this expression.

The ratio c_p/R and the value of k are both determined by the nature of the gas. For steam k is approximately 1.3 and for nitrogen (or air) k is approximately 1.4. A linear interpolation is made between these two values for k in the drywell, based on the mole fractions of steam and air/nitrogen. The ratio c_p/R is simply k/(k-1).

As noted previously, this model is the same as that used for the current licensing basis. Based on this model, it is assumed that the orifice diameter corresponding to a single MSIV leaking at its maximum rate was 0.51 mm. At that time, the maximum allowable leak rate was approximately 12 scfh at 20 psig (34.7 psia).

For the assumed leak rate limit of approximately 16 scfh at 35 psig (49.7 psia), the orifice size is slightly smaller (i.e., the limit is more restrictive). The orifice size corresponding to the current test is 0.49 mm, i.e.:

$$\text{Mass flow} = [\pi(0.49\ \text{mm}/\ 305\ \text{mm/ft/})^2/4][\sqrt{g_c}(2)(3.5)(49.7\ \text{psia})(144\ \text{in}^2/\text{ft}^2)(3.38)(0.075\ \text{lbm/ft}^3)]$$

$$[(1.2)^{2/-0.4)} - (1.2)^{2.4/-0.4}]^{1/2}$$

$$= (2.03\text{E-}6\ \text{ft}^2)(639.5\ \text{lbm/ft}^2\text{-sec})(0.402 - 0.335)^{1/2} = 3.36\text{E-}4\ \text{lbm/sec} = 16\ \text{scfh}$$

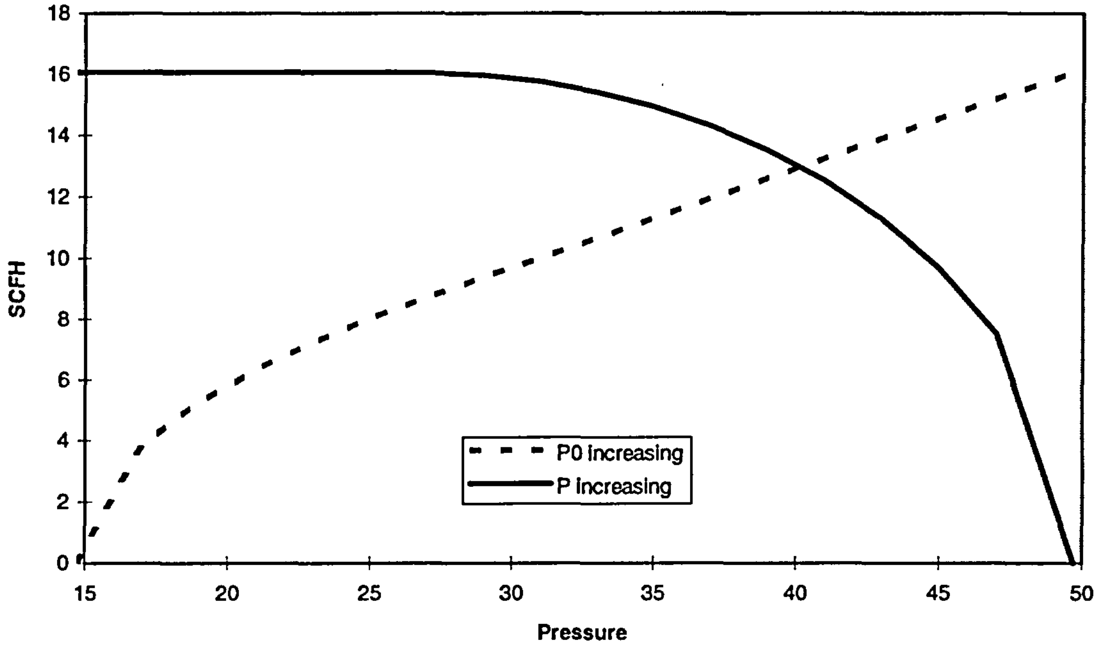
This orifice size is used with the above expression to determine the mass flow as a function of drywell absolute pressure and maximum local Mach Number (a function of the pressure ratio). The drywell density used to determine the mass flow is the sum of the steam and non-condensable gas masses divided by the volume of the drywell. The drywell volume leaked per unit time is the mass flow divided by the drywell density.

The only remaining question is the manner in which the leakages are affected by two closed isolation valves in series. If the Mach Number is very low (i.e., less than about 0.3, corresponding to a pressure difference of about 1 psi), the flow may be considered incompressible, and the pressure drop across two MSIVs in series leaking at the same rate would be the same for each valve. Such an assumption would be acceptable up to a total pressure difference of about 2 psi, 1 psi per valve. Under these conditions, the flow rate across each valve would be $\sqrt{2}/2$ times the flow rate for one valve. As the Mach Number increases and more and more of the pressure drop occurs across the second valve in series, the pressure between the valves becomes almost as great as P_0. This can be illustrated with the equation used above for the test case. For the fixed orifice area and gas properties, the expression reduces to:

$$\text{Mass flow (SCFH)} = 1.25P_0\{f(M,k)^{-6} - f(M,k)^{-5}\}^{1/2}$$

A plot of this equation is shown in Figure 2 below assuming P_0 remains constant and P is increased (solid line). At P = 49.7 psia the flow rate goes to zero while for P = 14.7 psia the flow rate is the test value of approximately 16 scfh. This is the leak rate through the inboard MSIV that would occur as the outboard MSIV becomes increasingly leak tight. One can also observe the result for the outboard valve as P_0 increases, where P_0 for the outboard valve is the pressure between the valves (the same pressure as P for the inboard valve). The outboard valve leak rate is the dashed line. Where the two lines cross the mass leak rate is the same. One can see that the leak rate is that corresponding to a P_0 (for the outboard valve) of about 40 psia, and the leak rate is about 13 scfh or 81% of the maximum 16 scfh.

Figure 2 - One Valve Leak Rate



Therefore, the following assumption is made for two valves in series: below a containment pressure of 16.7 psia (2 psig) it is assumed that the flowrate for two valves in series is 71% (√2/2) of that for a single valve. Between 2 psig and 35 psig (49.7 psia) the multiplier is assumed to increase linearly to 81%; i.e., an increase of 0.3% per psig.

The same isentropic expansion flow model is used for the other RB bypass pathways. However, for these other bypass pathways only a single closed valve is credited.

Spray and Natural Removal

The dose analysis for Oyster Creek credits the use of containment sprays in removing airborne radioactivity from the containment atmosphere as well as in controlling the containment pressure. For conservatism, the two parallel capabilities of the spray system (airborne radioactivity and containment pressure control) have been taken into account in the dose analysis, since the sprays do not operate continuously.

The design flowrate of 3000 gpm (one pump operation in spray mode) is used in calculating the radioactivity removal capability of the containment spray system. Moreover, it is conservatively assumed that only one containment spray loop ever operates in spray mode. The other containment spray loop is assumed to be immediately placed into operation in containment heat removal mode. This is a conservative assumption because it maximizes the removal of heat from the containment while minimizing credit for radioactivity removal by the drywell sprays. Since sprays are tripped by the operator based on containment pressure and temperature limits, maximum cooling results in intermittent spray operation for more than the first hour of the two-hour radioactivity release phase. To a point, cold service water exacerbates this problem; and therefore, a moderately low service water temperature of 45 F is assumed. Colder service water temperatures have been investigated, but because they also result in a lowering of the initial containment temperature (and an increasing of the initial mass of non-condensable gases in the containment), it was found that intermittent spray operation did not occur under extreme "winter" conditions.

Spray system flowrates considerably greater (i.e., > 50 %) than the design value of 3000 gpm appear in the MAAP4 analysis of the plant's thermal-hydraulic behavior, and these flowrates contribute to the heat removal and intermittent spray operation. However, a substantial fraction of the spray flow may be "lost" (in terms of droplet formation and the development of a full spray pattern) because of interference with the containment shell and/or the reactor shield wall. Therefore, no increase beyond the 3000 gpm design flow is credited.

The nozzles are Spraying System Company 1-7G25 multi-cap designs wherein seven "caps" are clustered on a single nozzle. One cap sprays along the axis of the nozzle connection, while the six remaining caps are located around the body of the nozzle spraying at an angle approximately 60° to the axis. The nozzles are located on independent, redundant headers at two elevations in the drywell (two headers per loop) and on a common header in the torus airspace.

The upper drywell header (located at approximately the elevation of the drywell knuckle) uses 32 nozzles and the lower header (about 30 feet below) uses 56. At 40 psid these high-capacity nozzles pass about 34 gpm; therefore, with a total of 88 nozzles per loop, the total flow would be 2992 gpm. At 3000 gpm the pressure across the nozzles would be somewhat greater than 40 psid. At this differential pressure the mass median spray droplet size is 2600 μm (2.6 mm), with a 5th and 95th percentile of 1000 and 5000 μm.

The spray removal rates for airborne particulate in the DW are calculated with the STARNAUA computer code. The thermal-hydraulic input for this analysis comes from the data discussed in the next section.

Polestar's STARNAUA computer code was used for the Oyster Creek aerosol removal rates in the drywell in the same way it was used for similar calculations for the Perry Nuclear Plant AST application. Two different aerosol removal processes were modeled:

- Sedimentation
- Spray removal

However, when comparing the STARNAUA input files that were used for Perry with those for Oyster Creek, some differences are noted. These pertain to:

- Specific Oyster Creek inputs related to spray flowrate, the volume of the sprayed region, spray coverage within the sprayed region, spray fall height, and the need to consider unsprayed regions and mixing within the containment.
- The calculation of the time-dependent ε/D ratio for the Oyster Creek sprays (i.e., the ration of removal efficiency to droplet size).

Spray Coverage, Interferences, and Effective Fall Height:

The basic expression for particulate removal by sprays is $\lambda = 1.5(Qh/V)(\varepsilon/D)$ where λ is the spray removal rate, Q is the volumetric spray flowrate, h is the fall height of the spray, V is the volume of the region being sprayed, ε is the removal efficiency, and D is the diameter of the spray droplet. The Q for the drywell is conservatively established to be the design value of 3000 gpm in spite of the fact that the MAAP4 model (which incorporates the actual pump curves) yields a flowrate approximately 50% higher. This higher flowrate contributes to the intermittent spray operation (because it depressurizes the containment more rapidly than would the design flowrate), so while the penalty of the higher flowrate on spray availability is taken, the credit for the higher flowrate in terms of removal rate is not. A key reason for the decision to ignore the potential for additional removal by the actual flowrate is the possibility that a fraction of the spray flow may be lost due to interferences near the spray nozzles. While this water would contribute to the containment depressurization (by exposure to the atmosphere from the surfaces upon which the impingement occurred), it would not contribute to activity removal.

By virtue of the spray nozzle header locations at the knuckle of the drywell and near the elevation of maximum diameter of the drywell, one would expect drywell spray coverage to be nearly complete. It is true that obstructions are located below the developed spray patterns, and these obstructions need to be accounted for in the determination of "h" (the effective fall height in the above expression for spray removal). However, the characteristic dimensions of most of these obstructions are small (piping, grating, etc.), and would not be expected to create an "unsprayed region" (i.e., by the minimal sheltering provided by these obstructions). It is important to note, also, that 3000 gpm of spray flow is typical for PWRs as well; and in the case of Oyster Creek that same spray flow is delivered to a volume that is perhaps one-tenth that of a typical PWR containment sprayed region. Therefore, one would expect spray-induced mixing to be considerably more intense in the confines of the Oyster Creek drywell than would be typically seen in a PWR containment or a BWR Mark III containment such as Perry in which the mixing between a sprayed region and an unsprayed region of the containment may need to be considered. For this reason, the Oyster Creek drywell is assumed to be well-mixed. However, the existence of obstructions is considered in establishing the effective fall height.

Calculation of the Effective Fall Height:

The effective fall height inside the Oyster Creek drywell was generated from a 3-D model of the drywell in which blocked areas were calculated at five-foot intervals from the spray header locations to the floor. This calculation of visible area at the drywell floor, which is at elevation 10' 3", was based on the following procedure.

First, two solid cylinders, representing the projection of the liner walls and the reactor vessel, were projected onto the drywell floor to limit the spray distribution to within those projections. Next, the projections of all of the obstructions from a particular elevation to the drywell floor were generated at five-foot intervals starting from the upper spray header (at the 65' 8" elevation). Each projection from the successive elevations only included obstructions from open areas from the elevation above (i.e., there is no double-counting of the obstructed area). A similar process from the lower spray headers (located at the 37' 3" elevation) was used to obtain the projections from the lower spray header. The resulting floor area projections are shown below.

Effective Fall Height Determination

			Upper Header			Lower Header			
Elevation ft	Visible Floor Area sq ft	Floor Area Shielded sq ft	Distance From Header	Fract. Floor Area Blocked in Interval	Fall Height ft	Floor Area Shielded sq ft	Distance From Header	Fract. Floor Area Blocked in Interval	Fall Height ft
65.75	77.1	17.09	0.0	0.0175	0				
60.75	94.19	14.16	5.0	0.0145	0.072				
55.75	108.35	14.35	10.0	0.0147	0.147				
50.75	122.7	54.97	15.0	0.0562	0.842				
45.75	177.67	56.00	20.0	0.0572	1.144				
40.75	233.67	57.69	25.0	0.0589	1.473				
37.25	291.36	5.30	28.5	0.0054	0.154	5.3	0	0.0054	0
35.75	296.66	12.52	30.0	0.0128	0.384	12.52	1.5	0.0128	0.019
32.25	309.18	35.25	33.5	0.0360	1.206	35.25	5.0	0.0360	0.180
30.75	344.43	14.04	35.0	0.0143	0.502	14.04	6.5	0.0143	0.093
27.25	358.47	2.80	38.5	0.0029	0.110	2.8	10.0	0.0029	0.029
25.75	361.27	53.28	40.0	0.0544	2.177	53.28	11.5	0.0544	0.626
22.25	414.55	164.68	43.5	0.1682	7.318	164.68	15.0	0.1682	2.524
20.75	579.23	77.08	45.0	0.0787	3.544	77.08	16.5	0.0787	1.299
17.25	656.31	144.89	48.5	0.1480	7.179	144.89	20.0	0.1480	2.960
15.75	801.2	106.14	50.0	0.1084	5.422	106.14	21.5	0.1084	2.331
12.25	907.34	71.50	53.5	0.0730	3.908	71.5	25.0	0.0730	1.826
10.75	978.84	77.10	55.0	0.0788	4.332	291.36	26.5	0.2977	7.889
				1.0000	39.92			1.0000	19.78

32	Nozzles @	39.92	ft / 88 Nozzles Total =	14.5
56	Nozzles @	19.78	ft / 88 Nozzles Total =	12.6
				27.1 ft

The tables show that the unobstructed area from the 65' 8" elevation to the drywell floor is 77.10 ft^2 out of a total floor area of 978.84 ft^2. The fraction of spray falling from the header to the floor is therefore 0.0788 (77.1 / 978.84 = 0.0788). The unobstructed area of the floor seen from the next cut is 94.19 ft^2. By inference, an area of 17.09 ft^2 (94.19 – 77.10 = 17.09) is obstructed in this five-foot interval. It is conservatively assumed that all of the obstructed area is at the top of the section, so that this fraction of spray is a zero fall height. However, this assumption accounts for ignoring the effect of floor grating. The calculation is continued for each interval in this fashion. The upper headers are approximately centered within the cylinder the represents the projected floor area. Therefore, this technique only accounts for the spray that remains within the cylindrical volume projected upward by that volume. The lower headers, however, are not symmetrically located about the longitudinal axis of the drywell. A substantial portion of the spray is within the "light bulb" region of the drywell. Nevertheless, the fall height calculation was performed for the inner annular region only. There are fewer obstructions in the outer region, so this simplification results in a conservatively low estimate of the fall height from the lower cylinder.

Contribution to the total fall height is calculated by multiplying the fraction of drops removed in each interval times the fall height for that fraction. The fraction of droplets from the lower header falling 26.5 feet to the floor is 0.2977. The contribution of this fraction to the total fall height is 0.2977*26.5 = 7.889 feet. Using this method for each interval gives an average fall height of 39.98 and 19.8 feet for the upper and lower headers, respectively. Finally, the results are weighted to account for the difference in nozzles from each other. There are a total of 88 nozzles in each containment spray system. Thirty-two (32) are located in the upper header, and 56 are located on the lower header.

32 nozzles / 88 nozzles at 39.9 feet total = 14.5 ft
56 nozzles / 88 nozzles at 19.8 feet total = 12.6 ft
Average fall height = 27.1 ft

Therefore, the average spray height used in the STARNAUA analysis was 27.1 feet.

It is assumed that elemental iodine is removed by the containment sprays at a rate equal to that of the particulate. It is believed that the elemental iodine, being reactive, will adhere to the aerosol. Even if this were not so, elemental iodine would be removed from the containment atmosphere at a rate greater than that of the particulate. Re-evolution of elemental iodine will not occur, as the pH of the suppression pool never falls below 7 during the accident.

In bypass flowpaths aerosol sedimentation is considered. For the one steamline in which two MSIVs are closed, the space between the two MSIVs is considered to be well-mixed, and STARNAUA is used to calculate the sedimentation. The elemental iodine is assumed to be deposited with the particulate. However, 50% of the deposited elemental iodine is assumed to be re-evolved.

For bypass pathways other than the MSIVs, plug-flow is calculated to exist (in the limiting cases), and an exponential particulate removal is calculated based on sedimentation velocity as the flow transits the line. Only horizontal lengths are considered. Here, too, 50% of the deposited elemental iodine is assumed to be re-evolved.

For the steamline with the outboard MSIV assumed to be failed open aerosol deposition due to impaction (as the flow enters the assumed 0.5 mm diameter leakpath of the closed inboard MSIV) is considered. It is expected that this deposition will conservatively exceed a factor of two (and actually, that the aerosol will plug the leak path, but this effect is neglected); and therefore, a factor of two removal is applied to both the particulate iodine and to the elemental iodine assumed to be adhered to it. For the steamline with both MSIVs closed, this effect is included in the STARNAUA sedimentation calculation.

Containment Thermal-Hydraulics

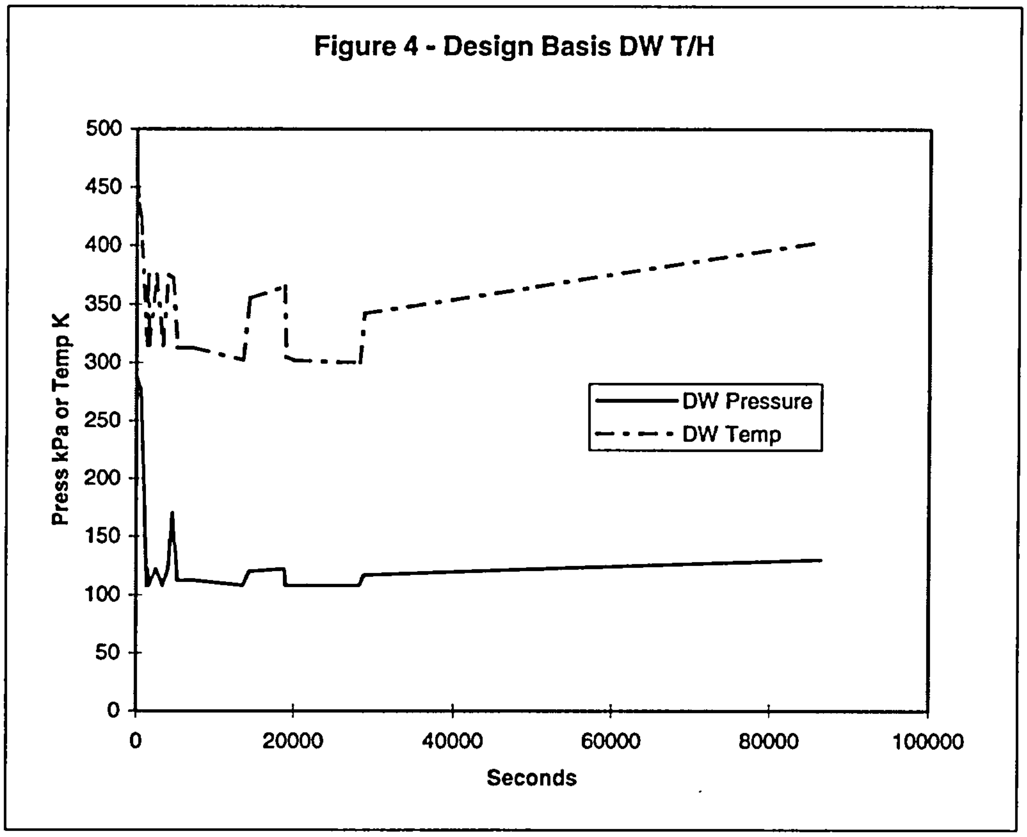
A MAAP4 analysis for a double-ended rupture of one of the five recirculation loops is used as the basis for the analysis of radioactivity transport through the Oyster Creek facility and for its release to the environment.

MAAP4 is a computer code that simulates light water reactor system response to accident initiation events. It includes models for important accident phenomena that might occur within the primary system, in the containment, and/or in the reactor building. For a specified reactor containment system, MAAP4 calculates the progression of the postulated accident sequence, including the disposition of the fission products, from a set of initiating events to either a safe, stable state or to an impaired containment condition and the possible release of fission products to the environment.

The Oyster Creek model uses the standard MAAP4 BWR model. It calculates the steam and hydrogen gas generation in the core, the generation of molten fuel and mobile fission products in the core, and their subsequent release to the containment. For this application, MAAP4 is not used to track the fission product release to their transport to containment. All important heat transfer processes are modeled among the fuel, clad, fuel channel, control blade, and coolant components in each core node. A chronology of the assumed DBA event is presented in Table 7 of this Attachment. The impacts of severe accident management response actions are not considered.

At the beginning of the postulated event there is a rapid increase in the containment pressure, but by the time the assumed release of radioactivity begins 30 seconds later, the reactor blowdown is complete and the containment pressure is already decreasing. The structural heat sink of the containment shell would be about one-third thermally saturated by this time, and complete saturation would require only about four to five minutes more. Therefore, beyond five minutes, the containment pressure would be decreasing only slowly, and the containment would become essentially quiescent.

At ten minutes the containment sprays are assumed to be actuated and the containment pressure decreases rapidly. Following the rapid decrease in drywell pressure, the sprays are terminated at one psig by operator action as discussed above. For simplicity, only three actuations are included in the dose analysis model during the two-hour period of activity release, one during the gap release phase and two during the early in-vessel release phase. In making this simplification, however, the correct fraction of time that the sprays are running in each phase is preserved. This fraction is approximately two-thirds (average) during the two release phases. It is during the period of intermittent spray operation from 1345 seconds (when the sprays are first tripped) to 4065 seconds (when debris quench steaming begins) that most particulate radioactivity is leaked from the containment.



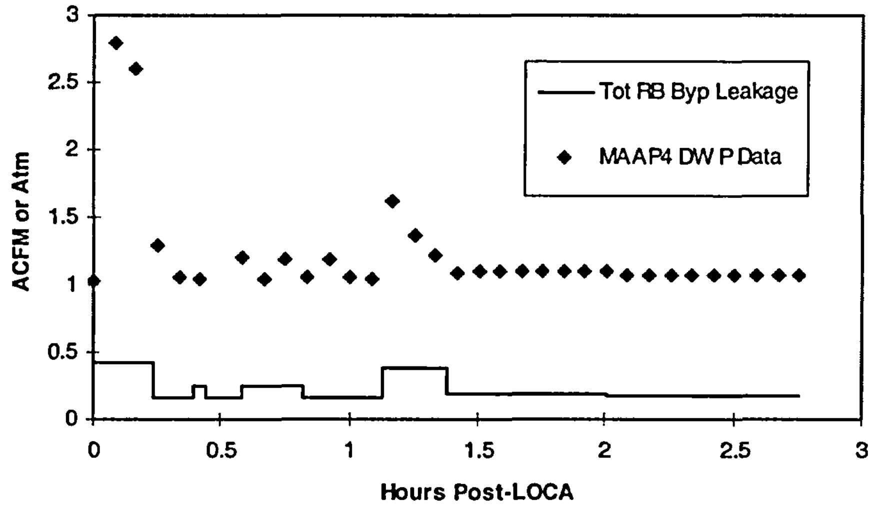
Of much greater importance is the spray actuation that begins at 4065 seconds when the drywell meets the pressure and temperature conditions for manual initiation. After this spray actuation the sprays remain on for a substantial period of time - until 13600 seconds. It is this spray actuation that provides the bulk of the containment atmosphere "clean-up". When ECCS is restored at 7230 seconds the sprays are already running. Thus, the containment pressure response is not greatly affected.

Following spray shut-off at 13,600 seconds, the sprays are returned to operation at 18,800 seconds and then are not finally tripped off until nearly eight hours into the event. By 14 hours (50,400 seconds) into the event (when the MAAP4 analysis ends) the containment pressure has nearly reached 3 psig; but because the MAAP4 analysis has ended, containment pressure is conservatively extrapolated to continue to increase with no further spray actuations until 24 hours into the event. Beyond 24 hours, the containment pressure is conservatively extrapolated to one psig. This is in recognition of the fact that a combination of spray cooling, decreasing decay power, and assumed containment leakage of 0.5 %/day (15 % over 30 days) would be reducing the pressure continuously. Given the 30-day dose integration period for the CR habitability assessment, the tendency would be for the containment pressure to approach atmospheric or even sub-atmospheric over that period. This extrapolation of containment pressure is also conservative because plant procedures would direct operators to reduce containment pressure.

The timing of the spray actuations discussed above is representative of many kinds of events. The key feature is that up to the time of rapid steam production associated with core debris interaction with water in the vessel lower plenum and/or ECCS restart, the sprays have the potential (under unique conditions of containment and service water temperature) to be intermittent. Once any substantial coolant water interaction has occurred, however, the combination of steaming and hydrogen production will keep the sprays in operation for a long period of time.

In addition to establishing the conditions under which containment sprays may be assumed to operate, containment pressure and temperature also affect the containment volumetric leak rate. Figure 5 below focuses on this relationship for the bypass pathways for which the leak rate (in ACFM) is calculated using the isentropic expansion flow model as described above.

Figure 5 - DW Press and RB Bypass



The plot concentrates on the first 10,000 seconds of the event since that is the most radiologically significant period. The diamond-shaped data points are the drywell pressure plot file points from the MAAP4 analysis. The total RB bypass leakage, including MSIV leakage, (as modeled in this analysis) is shown as the solid line. For comparison, a one percent per day leak rate for the entire 308,000 ft^3 primary containment free volume would be about 2.1 ACFM; therefore, the bypass leakage is about 10 % (on average) of the overall containment leak rate.

Determination of Suppression Pool pH at 30 Days Post-LOCA

In order to eliminate the concern of radioiodine re-evolution, Oyster Creek will credit the sodium pentaborate injected by the Standby Liquid Control System (SLC) as a means to buffer the suppression pool water. This injection will be part of the required operator response to a DBA LOCA. This buffering prevents the pH from falling to a value less than 7 during the 30-day dose calculation period. The impacts of severe accident management response actions are not considered.

The suppression pool pH is a function of the following:

- Time-dependent radiation level in the drywell
- Time-dependent radiation level in the suppression pool
- Drywell volume
- Suppression pool volume
- Mass and type of chloride-bearing materials used in electrical cables
- Cable dimensions
- Fraction of cable in conduit
- Mass of sodium pentaborate injected

The gamma and beta radiation levels used in the drywell and suppression pool for Oyster Creek correspond to a core power level of 1969 MWt and the Regulatory Guide 1.183 BWR release fractions for a DBA LOCA. The drywell volume is 180,000 ft^3 and the total gas + liquid torus volume is 210,000 ft^3. The suppression pool liquid volume is 82,000 to 92,000 ft^3 (minimum to maximum). The RCS inventory (assumed to be added to the suppression pool) is 7,600 ft^3.

Electrical cables are assumed to have the following characteristics. This breakdown is a conservative compilation of actual cable data.

Cable Category	Jacket OD (cm)	Jacket ID (cm)	Length (ft)	Material *	Mass (lbm)
1	2.956	2.54	4,635	PVC	762
2	0.851	0.622	17,654	PVC	440
3	0.688	0.49	11,782	PVC	179

* Conservative assumption

Although some of the cable is in conduit, the shielding provided by the conduit is ignored.

The minimum mass of sodium pentaborate injected is 1460 lbm (1125 moles). Conservatively ignoring the expected chemical form of fission product cesium introduced to the containment at the same time as the radioiodine (likely to be a base or a buffer), the suppression pool pH at 30 days is 7.9. This is substantially above the pH value of 7 at which re-evolution of radioiodine might become a concern.

RADTRAD Analysis to Check STARDOSE

RADTRAD Analysis

The purpose of this section is to show the results of an alternative calculation using RADTRAD version 3.03 to check the main calculation. In order to maintain consistency with the STARDOSE calculations, it was necessary to modify the RADTRAD default input files for the strontium inventory to compensate for the use of SrO dose conversion factors (DCFs), as described below.

The STARDOSE library file uses DCFs for the strontium isotopes (Sr-89, Sr-90, Sr-91, and Sr-92) that apply to the oxide SrO form. The default RADTRAD file (Fgr11&12.inp) uses DCFs applicable to $SrTiO_3$. To maintain dose equivalence it is necessary to change the Sr isotopes inventories by the ratio of the DCFs in order to construct the RADTRAD inventory file. The following table shows these changes.

Isotope	STARDOSE inventory, Ci	STARDOSE DCF, rem/Ci	RADTRAD DCF, rem/Ci[a]	RADTRAD inventory, Ci
		(SrO)	($SrTiO_3$)	
Sr-89	2.54E+04	6.512E+03	4.144E+04	3.99E+03
Sr-90	3.33E+03	2.3939E05	1.299E+06	6.12E+02
Sr-91	3.15E+04	9.324E+02	1.682E+03	1.75E+04
Sr-92	3.35E+04	6.29E+02	8.066E+02	2.61E+04

[a] DCF's in RADTRAD file are in Sv/Bq. DCF in rem/Ci = DCF in Sv/Bq x 3.7E+12

The revised RADTRAD inventory file is denoted oc60.nif.

An additional difference between the STARDOSE and RADTRAD inventory files is that the STARDOSE includes 66 nuclides (identified as 76 because the three chemical forms of iodine are listed separately) while the RADTRAD default .nif file includes 60 nuclides. The six nuclides that are not in the RADTRAD file are Xe-131m, Am-241, Cm-242, Cm-244, Pu-240, and Pu-242.

Multiple-Pathways-to-Environment Issue

Seven release pathways to the environment were identified, which are shown below. Each release pathway to the environment was treated separately and control room and offsite doses were added up in the end. Note that for each of these single leakage pathway runs, the other releases were not removed, but diverted to a "dummy" volume instead of the environment, so that the remaining activity in each of the actual control volumes was correctly evaluated.

There is one set of X/Qs for each of these pathways, and in RADTRAD the control room X/Qs are linked to the control room volume, unlike STARDOSE, where they are linked to the release pathway. In RADTRAD, only pathways with the same control room X/Qs can be combined into a single run with summed flow rates.

For each pathway, the STARDOSE input file lists 17 pairs of time and flow rate. The time entry is the end of the time interval. RADTRAD is limited to 9 pairs and the time entry is the beginning of the time interval. Thus the 17 STARDOSE entries have to be compressed to 9 for the RADTRAD inputs, with the appropriate change from end-of-interval to beginning-of-interval. The scheme chosen was to use the first 7 STARDOSE pairs as the first 7 RADTRAD entries. The eighth RADTRAD pair covered the time interval of the next four STARDOSE entries, with a time-weighted average flow rate during this time interval. The ninth RADTRAD pair covered the time interval of the next seven STARDOSE entries, again with a time-weighted average flow rate during this time interval.

The table below illustrates this conversion for one of the pathways (the time intervals are the same for all pathways).

time interval, hours	STARDOSE time entry	STARDOSE flow rate, cfm	time interval, hours	STARDOSE time entry	STARDOSE flow rate, cfm	time interval, hours	RADTRAD time entry	RADTRAD flow rate, cfm
0.008 – 0.236	0.236	0.17	3.778 - 4	4	0.076	0.008 – 0.236	0.008	0.17
0.236 – 0.394	0.394	0.059	4 – 5.222	5.222	0.096	0.236 – 0.394	0.236	0.0588
0.394 – 0.442	0.442	0.095	5.222 – 5.556	5.556	0.059	0.394 – 0.442	0.394	0.095
0.442 – 0.585	0.585	0.059	5.556 – 7.844	7.844	0.059	0.442 – 0.585	0.442	0.0588
0.585 – 0.819	0.819	0.095	7.844 – 8	8	0.072	0.585 – 0.819	0.585	0.095
0.819 – 1.129	1.129	0.059	8 – 14	14	0..092	0.819 – 1.129	0.819	0.0588
1.129 – 1.379	1.379	0.144	14 – 24	24	0.105	1.129 – 1.379	1.129	0.144
1.379 – 2.008	2.008	0.073	24 -720	720	0.059	1.379 - 4	1.379	0.0685
2.008 – 3.778	3.778	0.066				4 - 720	4	0.060

ESF Release

ESF leakage is treated in STARDOSE by putting twice as much iodine activity (but iodine only) in the suppression pool as in the drywell, and filtering out all the particulate form so that the iodine release from the suppression pool into the reactor building includes only gaseous iodine (elemental and organic), and amounts to 10% of the initial iodine inventory.

Unfortunately, it is not possible to do this in RADTRAD. Indeed, the only way to model a release from the core into a control volume is to direct a fraction of an entire core inventory file to that specific volume. Moreover, the code accepts only one inventory file at a time. One option would have been to double the initial core inventory and to direct 50% of it to the drywell and 50% of it to the suppression pool. However, this option would have put noble gases in the suppression pool control volume in addition to the iodine and other particle isotopes. While the latter isotopes can be filtered out when modeling the leakage to the reactor building, noble gases cannot be removed. Therefore, this option was abandoned, as it would have tripled the noble gas inventory in the problem. (Note that some noble gases are actually produced, resulting from decay of iodine isotopes in the suppression pool, but there should not be any noble gases in the suppression pool at the outset.)

Consequently, a specific nuclide inventory file (named ocesf.nif) was prepared. It includes iodine isotopes (with inventory doubled to reach the 10% release level) and all other isotopes to respect the parent-daughter relationships of the original file (but with inventories set to zero). The seventh RADTRAD run was then performed with this specific "ESF" inventory released to the suppression pool and leaking into the RB so as to take into account its impact on offsite and control room doses. As mentioned above, in the leak path from the suppression pool to the RB, the filter efficiencies for elemental and organic iodine were zero and particulate iodine was totally filtered out.

Edit Time Issue

In order to retrieve accurate dose results, it appeared essential to request a high number of time edits when preparing the RADTRAD input files, especially in the first few hours into the event. In similar calculations it has been found that for the failed steam line release pathway (biggest contributor to the control room dose) using different set of requested edit times in the first four hours into the event (during which most of the changes in input parameters take place) resulted in differences in dose results that appeared significant (several percent).

Since the RADTRAD output file size is not too big (except when requesting detailed information in control volumes), the choice was made to use one edit time every 0.05 hour in the first four hours of the analysis.

Edit Time Frequency chosen for the RADTRAD runs:

RADTRAD Edit Times

Time Frame	**Elapsed Time Between Edits**
0 – 4 hr	0.05 hr
4 – 8 hr	0.5 hr
8 – 24 hr	1 hr
24 – 48 hr	2 hr
48 – 720 hr	24 hr

To complete the check calculation, RADTRAD was run seven times as shown in the table below.

RADTRAD Cases

Run Number	Run Notation	STARDOSE path	Nuclide Inventory File	Initial Inventory Location	Release Pathways to the Environment								CR X/Q Set
					Failed SL		Intact SLs		RB Bypass		SGTS Release		
					From	To	From	To	From	To	From	To	
1	MSIV1	DW-ENV 1	oc60.nif	DW	DW	Enviro	DW	Dummy	DW	Dummy	RB	Dummy	TB
2	TB(DW)	DW-ENV 2	oc60.nif	DW	DW	Dummy	DW	Dummy	DW	Enviro	RB	Dummy	TB
3	SLOUT	SL-ENV	oc60.nif	DW	DW	Dummy	DW	Enviro	DW&WW	Dummy	RB	Dummy	TB
4	RB(DW)	DW-ENV 3	oc60.nif	DW	DW	Dummy	DW	Dummy	DW	Enviro	RB	Dummy	Yard
5	RB(WW)	WW-ENV	oc60.nif	DW	DW	Dummy	DW	Dummy	WW	Enviro	RB	Dummy	Yard
6	SGTS	RB-ENV	oc60.nif	DW	DW	Dummy	DW	Dummy	DW&WW	Dummy	RB	Enviro	Stack
7	SGTS(ESF)	RB-ENV	ocesf.nif	SP	DW	Dummy	DW	Dummy	DW&WW	Dummy	RB	Enviro	Stack

Results

To obtain the final control room and off-site TEDE doses, one needs to add up the TEDEs of all seven single runs.

The table below summarizes the 30-day (720 hours) integrated doses at the control room and site boundary from each of the seven runs (all doses in rem).

RADTRAD Results

Release Pathway	CR		EAB		LPZ	
	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
Steam Line with MSIV FO:	2.753E+01	1.209E+00	7.024E+00	5.949E-01	4.453E-01	6.155E-02
Bypass from DW Terminating in TB:	4.677E+00	1.754E-01	3.683E-01	1.041E-01	4.825E-02	1.713E-02
Bypass from DW Terminating at RB Wall:	3.285E+00	1.282E-01	4.041E-01	7.727E-02	3.937E-02	1.156E-02
Bypass from WW Terminating at RB Wall:	1.081E+01	3.950E-01	2.855E-01	6.769E-02	9.601E-02	3.630E-02
Steam Line with Both MSIVs Closed:	7.947E+00	2.903E-01	6.007E-01	4.343E-02	7.735E-02	1.290E-02
Containment Leakage Released via SGTS:	3.134E+00	2.025E-01	3.332E-03	5.238E-04	8.734E-03	4.506E-03
ESF Leakage Released via SGTS:	1.501E+01	4.654E-01	6.551E-04	2.811E-05	5.850E-02	2.193E-03
Total TEDE (rem):	N/A	2.87E+00	N/A	8.88E-01	N/A	1.46E-01

The total control room TEDE is 3.485 rem (including 0.621 rem due to external whole body dose), which agrees well with the STARDOSE-calculated value of 3.61 rem.

Conclusions

The two codes give comparable control room doses. It is concluded that the RADTRAD calculations serve as a satisfactory check on the STARDOSE results. Both calculations yield control room TEDEs that are below the limit of 5 rem.

RADTRAD Input Information
Oyster Creek RADTRAD input (.psf) files

File 128dw1_env.psf (Steam Line With MSIV Failed Open)

```
Radtrad 3.03 4/15/2001
 Oyster Creek - Path MSIV 1
 Nuclide Inventory File:
 E:\radtrad303\newrun\2004oc\oc60.nif
 Plant Power Level:
  1.9690E+03
 Compartments:
   8
 Compartment 1:
 DW
   3
  1.8000E+05
   1
   0
   0
   0
   0
 Compartment 2:
 WW
   3
  1.2800E+05
   0
   0
   0
   1
   0
 Compartment 3:
 RB
   3
  1.8000E+06
   0
   0
   0
   0
   0
 Compartment 4:
 SP
   3
  8.2000E+04
   0
   0
   0
   0
   0
 Compartment 5:
 CR
   1
  2.7500E+04
   0
   0
   0
```

```
  0
  0
Compartment 6:
Enviro
  2
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 7:
Dummy
  3
 1.0000E+06
  0
  0
  0
  0
  0
Compartment 8:
SL
  3
 32.36
  0
  0
  0
  1
  0
Pathways:
 14
Pathway 1:
DW to WW
  1
  2
  2
Pathway 2:
WW to DW
  2
  1
  2
Pathway 3:
Bypass DW 1 to Env
  1
  6
  2
Pathway 4:
DW to RB
  1
  3
  2
Pathway 5:
WW to RB
  2
  3
  2
Pathway 6:
SP to RB
```

```
    2
    3
    2
  Pathway 7:
  Bypass DW 3 to Dummy
    1
    7
    2
  Pathway 8:
  Bypass WW to Dummy
    2
    7
    2
  Pathway 9:
  RB SGTS to Dummy
    3
    7
    2
  Pathway 10:
  Enviro to CR
    6
    5
    2
  Pathway 11:
  CR to Enviro
    5
    6
    2
  Pathway 12:
   SL to Dummy
    8
    7
    2
 Pathway 13:
  DW to SL
    1
    8
    2
 Pathway 14:
  Bypass DW 2 to Dummy
    1
    7
    2
 End of Plant Model File
  Scenario Description Name:

  Plant Model Filename:

  Source Term:
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  E:\radtrad303\newrun\2004oc\oc.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:
  8
Compartment 1:
  0
  1
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
  1
  5
```

```
   1.1290E+00  1.5000E+00
   3.7780E+00  0.0000E+00
   5.2220E+00  1.5000E-01
   7.8440E+00  0.0000E+00
   7.2000E+02  0.0000E+00
 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
   0
   0
   0
Compartment 8:
   0
   1
```

```
  0
  0
  0
  0
  0
  1
  9
  0.0800E-01  1.3604E+00
  5.1170E-01  2.5427E+00
  1.0089E+00  2.4120E+00
  2.2385E+00  2.5895E+00
  2.8033E+00  2.1079E+00
  3.0875E+00  1.3937E+00
  5.0413E+00  0.6557E+00
  9.8705E+00  0.3799E+00
  2.4000E+01  0.0000E+00
  1
  9
  0.0800E-01  0.0000E+00
  5.1170E-01  0.0000E+00
  1.0089E+00  0.0000E+00
  2.2385E+00  0.0000E+00
  2.8033E+00  0.0000E+00
  3.0875E+00  0.0000E+00
  5.0413E+00  0.0000E+00
  9.8705E+00  0.0000E+00
  2.4000E+01  0.0000E+00
Pathways:
 14
Pathway 1:
  0
  0
  0
  0
  0
  1
  4
  1.1290E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.2960E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  1.2960E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.4630E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  9
  0.0080E+00   1.2000E-01   50.000E+00   5.0000E+01   0.0000E+00
  0.2360E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.3940E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.4420E+00   4.6000E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.5850E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.8190E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  1.1290E+00   1.0910E-01   50.000E+00   5.0000E+01   0.0000E+00
  1.3790E+00   5.3800E-02   50.000E+00   5.0000E+01   0.0000E+00
  4.0000E+00   4.6800E-02   50.000E+00   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  9
  0.0000E+00   9.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.9900E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   1.1259E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.5356E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
```

```
  0
  1
  9
  0.0080E+00   7.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.7700E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   0.8292E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.4017E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   3.0100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   2.7300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   1.3300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.1700E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
```

```
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   1.3200E-01   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   1.1940E-01   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   5.8400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   5.0900E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 9:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 10:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 11:
  0
  0
  0
```

```
   0
   0
   1
   2
   0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 12:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   1.7000E-01   0.0000E+00   5.0000E+01   0.0000E+00
   0.2360E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.3940E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.4420E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.5850E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.8190E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   1.1290E+00   1.4400E-01   0.0000E+00   5.0000E+01   0.0000E+00
   1.3790E+00   6.8500E-02   0.0000E+00   5.0000E+01   0.0000E+00
   4.0000E+00   6.0000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 13:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   9.5000E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.2360E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.3940E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.4420E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.5850E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.8190E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.1290E+00   8.0100E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.3790E+00   3.8400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   4.0000E+00   3.3500E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
```

```
 Pathway 14:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   4.5000E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.2360E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.3940E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.4420E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.5850E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.8190E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
   1.1290E+00   4.1000E-02   9.6500E+01   5.0000E+01   0.0000E+00
   1.3790E+00   2.0400E-02   9.6500E+01   5.0000E+01   0.0000E+00
   4.0000E+00   1.8300E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0
   0
   0
   0
   0
   0
Dose Locations:
   3
 Location 1:
 CR
   5
   0
   1
   2
   0.0080E+00   3.4700E-04
   7.2000E+02   3.4700E-04
   1
   4
   0.0080E+00   1.0000E+00
   2.4000E+01   6.0000E-01
   9.6000E+01   4.0000E-01
   7.2000E+02   4.0000E-01
 Location 2:
 EAB
   6
   1
   4
   0.0080E+00   1.1000E-03
   2.0080E+00   0.0000E+00
   8.0000e+00   0.0000E+00
   7.2000E+02   0.0000E+00
   1
   4
   0.0080E+00   3.4700E-04
   8.0000E+00   3.4700E-04
   2.4000E+01   0.0000E+00
   7.2000E+02   0.0000E+00
   0
 Location 3:
 LPZ
   6
```

```
  1
  5
  0.0080E+00   5.6000E-05
  8.0000E+00   9.0000E-06
  2.4000E+01   5.4000E-06
  9.6000E+01   1.9000E-06
  7.2000E+02   1.9000E-06
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   1.7500E-04
  2.4000E+01   2.3200E-04
  7.2000E+02   2.3200E-04
  0
Effective Volume Location:
  1
  5
  0.0080E+00   2.7100E-03
  8.0000E+00   8.7600E-04
  2.4000E+01   8.6300E-04
  9.6000E+01   8.4500E-04
  7.2000E+02   8.4500E-04
Simulation Parameters:
  6
  0.0000E+00   5.0000E-03
  4.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  4.8000E+01   2.4000E+01
  7.2000E+02   0.0000E+00
Output Filename:
E:\radtrad303\newrun\2004oc\oc3.o0
  1
  1
  1
  1
  1
End of Scenario File
```

File 128dw2_env.psf (Bypass From DW Terminating in TB)

```
Radtrad 3.03 4/15/2001
 Oyster Creek - Path TB(DW)
 Nuclide Inventory File:
 E:\radtrad303\newrun\2004oc\oc60.nif
 Plant Power Level:
  1.9690E+03
 Compartments:
   8
 Compartment 1:
 DW
   3
  1.8000E+05
   1
   0
   0
   0
   0
 Compartment 2:
 WW
   3
  1.2800E+05
   0
   0
   0
   1
   0
 Compartment 3:
 RB
   3
  1.8000E+06
   0
   0
   0
   0
   0
 Compartment 4:
 SP
   3
  8.2000E+04
   0
   0
   0
   0
   0
 Compartment 5:
 CR
   1
  2.7500E+04
   0
   0
   0
   0
   0
 Compartment 6:
 Enviro
   2
```

```
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 7:
Dummy
  3
 1.0000E+06
  0
  0
  0
  0
  0
Compartment 8:
SL
  3
 32.36
  0
  0
  0
  1
  0
Pathways:
 14
Pathway 1:
DW to WW
  1
  2
  2
Pathway 2:
WW to DW
  2
  1
  2
Pathway 3:
Bypass DW 1 to Dummy
  1
  7
  2
Pathway 4:
DW to RB
  1
  3
  2
Pathway 5:
WW to RB
  2
  3
  2
Pathway 6:
SP to RB
  2
  3
  2
Pathway 7:
Bypass DW 3 to Dummy
```

```
   1
   7
   2
 Pathway 8:
 Bypass WW to Dummy
   2
   7
   2
 Pathway 9:
 RB SGTS to Dummy
   3
   7
   2
 Pathway 10:
 Enviro to CR
   6
   5
   2
 Pathway 11:
 CR to Enviro
   5
   6
   2
 Pathway 12:
 Leaking SL to Dummy
   8
   7
   2
Pathway 13:
 DW to SL
   1
   8
   2
Pathway 14:
 Bypass DW 2 to Enviro
   1
   6
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   1   1.0000E+00
 E:\radtrad303\newrun\2004oc\oc60.inp
 E:\radtrad303\newrun\2004oc\oc.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:
  8
Compartment 1:
  0
  1
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
```

```
 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
   0
   0
   0
Compartment 8:
   0
   1
   0
   0
   0
   0
   0
```

```
  1
  9
  0.0800E-01  1.3604E+00
  5.1170E-01  2.5427E+00
  1.0089E+00  2.4120E+00
  2.2385E+00  2.5895E+00
  2.8033E+00  2.1079E+00
  3.0875E+00  1.3937E+00
  5.0413E+00  0.6557E+00
  9.8705E+00  0.3799E+00
  2.4000E+01  0.0000E+00
  1
  9
  0.0800E-01  0.0000E+00
  5.1170E-01  0.0000E+00
  1.0089E+00  0.0000E+00
  2.2385E+00  0.0000E+00
  2.8033E+00  0.0000E+00
  3.0875E+00  0.0000E+00
  5.0413E+00  0.0000E+00
  9.8705E+00  0.0000E+00
  2.4000E+01  0.0000E+00
Pathways:
 14
 Pathway 1:
  0
  0
  0
  0
  0
  1
  4
  1.1290E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.2960E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  1.2960E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.4630E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  9
  0.0080E+00   1.2000E-01   50.000E+00   5.0000E+01   0.0000E+00
  0.2360E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.3940E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.4420E+00   4.6000E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.5850E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.8190E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  1.1290E+00   1.0910E-01   50.000E+00   5.0000E+01   0.0000E+00
  1.3790E+00   5.3800E-02   50.000E+00   5.0000E+01   0.0000E+00
  4.0000E+00   4.6800E-02   50.000E+00   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  9
  0.0000E+00   9.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.9900E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   1.1259E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.5356E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   7.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  0.3940E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.7700E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   0.8292E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.4017E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   3.0100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   2.7300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   1.3300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.1700E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
  0
  0
  0
  0
  0
```

```
  1
  9
  0.0080E+00   1.3200E-01   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   1.1940E-01   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   5.8400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   5.0900E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 9:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 10:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 11:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
```

```
    7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
    0
    0
    0
    0
    0
    0
 Pathway 12:
    0
    0
    0
    0
    0
    1
    9
    0.0080E+00   1.7000E-01   0.0000E+00   5.0000E+01   0.0000E+00
    0.2360E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0.3940E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0.4420E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0.5850E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0.8190E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
    1.1290E+00   1.4400E-01   0.0000E+00   5.0000E+01   0.0000E+00
    1.3790E+00   6.8500E-02   0.0000E+00   5.0000E+01   0.0000E+00
    4.0000E+00   6.0000E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0
    0
    0
    0
    0
    0
 Pathway 13:
    0
    0
    0
    0
    0
    1
    9
    0.0080E+00   9.5000E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.2360E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.3940E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.4420E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.5850E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.8190E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
    1.1290E+00   8.0100E-02   0.0000E+00   0.0000E+00   0.0000E+00
    1.3790E+00   3.8400E-02   0.0000E+00   0.0000E+00   0.0000E+00
    4.0000E+00   3.3500E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0
    0
    0
    0
    0
    0
  Pathway 14:
    0
    0
    0
    0
```

```
    0
    1
    9
    0.0080E+00   4.5000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.2360E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.3940E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.4420E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.5850E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.8190E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    1.1290E+00   4.1000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    1.3790E+00   2.0400E-02   9.6500E+01   5.0000E+01   0.0000E+00
    4.0000E+00   1.8300E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0
    0
    0
    0
    0
    0
Dose Locations:
    3
Location 1:
CR
    5
    0
    1
    2
    0.0080E+00   3.4700E-04
    7.2000E+02   3.4700E-04
    1
    4
    0.0080E+00   1.0000E+00
    2.4000E+01   6.0000E-01
    9.6000E+01   4.0000E-01
    7.2000E+02   4.0000E-01
Location 2:
EAB
    6
    1
    4
    0.0080E+00   1.1000E-03
    2.0080E+00   0.0000E+00
    8.0000e+00   0.0000E+00
    7.2000E+02   0.0000E+00
    1
    4
    0.0080E+00   3.4700E-04
    8.0000E+00   3.4700E-04
    2.4000E+01   0.0000E+00
    7.2000E+02   0.0000E+00
    0
Location 3:
LPZ
    6
    1
    5
    0.0080E+00   5.6000E-05
    8.0000E+00   9.0000E-06
    2.4000E+01   5.4000E-06
```

```
  9.6000E+01   1.9000E-06
  7.2000E+02   1.9000E-06
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   1.7500E-04
  2.4000E+01   2.3200E-04
  7.2000E+02   2.3200E-04
  0
Effective Volume Location:
  1
  5
  0.0080E+00   2.7100E-03
  8.0000E+00   8.7600E-04
  2.4000E+01   8.6300E-04
  9.6000E+01   8.4500E-04
  7.2000E+02   8.4500E-04
Simulation Parameters:
  6
  0.0000E+00   5.0000E-03
  4.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  4.8000E+01   2.4000E+01
  7.2000E+02   0.0000E+00
Output Filename:
E:\radtrad303\newrun\2004oc\oc3.o0
  1
  1
  1
  1
  1
End of Scenario File
```

File 128dw3_env.psf (Bypass From DW Terminating at RB Wall)

```
Radtrad 3.03 4/15/2001
 Oyster Creek - Path RB(DW)
 Nuclide Inventory File:
 E:\radtrad303\newrun\2004oc\oc60.nif
 Plant Power Level:
  1.9690E+03
 Compartments:
   8
 Compartment 1:
 DW
   3
  1.8000E+05
   1
   0
   0
   0
   0
 Compartment 2:
 WW
   3
  1.2800E+05
   0
   0
   0
   1
   0
 Compartment 3:
 RB
   3
  1.8000E+06
   0
   0
   0
   0
   0
 Compartment 4:
 SP
   3
  8.2000E+04
   0
   0
   0
   0
   0
 Compartment 5:
 CR
   1
  2.7500E+04
   0
   0
   0
   0
   0
 Compartment 6:
 Enviro
   2
```

```
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 7:
Dummy
  3
 1.0000E+06
  0
  0
  0
  0
  0
Compartment 8:
SL
  3
 32.36
  0
  0
  0
  1
  0
Pathways:
 14
Pathway 1:
DW to WW
  1
  2
  2
Pathway 2:
WW to DW
  2
  1
  2
Pathway 3:
Bypass DW 1 to Dummy
  1
  7
  2
Pathway 4:
DW to RB
  1
  3
  2
Pathway 5:
WW to RB
  2
  3
  2
Pathway 6:
SP to RB
  2
  3
  2
Pathway 7:
Leakage DW 3 to Enviro
```

```
   1
   6
   2
 Pathway 8:
 Bypass WW to Dummy
   2
   7
   2
 Pathway 9:
 RB SGTS to Dummy
   3
   7
   2
 Pathway 10:
 Enviro to CR
   6
   5
   2
 Pathway 11:
 CR to Enviro
   5
   6
   2
 Pathway 12:
 Leaking SL to Dummy
   8
   7
   2
Pathway 13:
 DW to SL
   1
   8
   2
Pathway 14:
 Bypass DW 2 to Dummy
   1
   7
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   1   1.0000E+00
 E:\radtrad303\newrun\2004oc\oc60.inp
 E:\radtrad303\newrun\2004oc\oc.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:
  8
Compartment 1:
  0
  1
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
```

```
 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
   0
   0
   0
Compartment 8:
   0
   1
   0
   0
   0
   0
   0
```

```
  1
  9
  0.0800E-01  1.3604E+00
  5.1170E-01  2.5427E+00
  1.0089E+00  2.4120E+00
  2.2385E+00  2.5895E+00
  2.8033E+00  2.1079E+00
  3.0875E+00  1.3937E+00
  5.0413E+00  0.6557E+00
  9.8705E+00  0.3799E+00
  2.4000E+01  0.0000E+00
  1
  9
  0.0800E-01  0.0000E+00
  5.1170E-01  0.0000E+00
  1.0089E+00  0.0000E+00
  2.2385E+00  0.0000E+00
  2.8033E+00  0.0000E+00
  3.0875E+00  0.0000E+00
  5.0413E+00  0.0000E+00
  9.8705E+00  0.0000E+00
  2.4000E+01  0.0000E+00
Pathways:
 14
 Pathway 1:
  0
  0
  0
  0
  0
  1
  4
  1.1290E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.2960E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  1.2960E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.4630E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  9
  0.0080E+00   1.2000E-01   50.000E+00   5.0000E+01   0.0000E+00
  0.2360E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.3940E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.4420E+00   4.6000E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.5850E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.8190E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  1.1290E+00   1.0910E-01   50.000E+00   5.0000E+01   0.0000E+00
  1.3790E+00   5.3800E-02   50.000E+00   5.0000E+01   0.0000E+00
  4.0000E+00   4.6800E-02   50.000E+00   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  9
  0.0000E+00   9.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.9900E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   1.1259E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.5356E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   7.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  0.3940E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.7700E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   0.8292E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.4017E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   3.0100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   2.7300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   1.3300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.1700E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
  0
  0
  0
  0
  0
```

```
  1
  9
  0.0080E+00   1.3200E-01   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   1.1940E-01   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   5.8400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   5.0900E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 9:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 10:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 11:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
```

```
   7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 12:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   1.7000E-01   0.0000E+00   5.0000E+01   0.0000E+00
   0.2360E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.3940E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.4420E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.5850E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.8190E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   1.1290E+00   1.4400E-01   0.0000E+00   5.0000E+01   0.0000E+00
   1.3790E+00   6.8500E-02   0.0000E+00   5.0000E+01   0.0000E+00
   4.0000E+00   6.0000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 13:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   9.5000E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.2360E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.3940E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.4420E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.5850E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.8190E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.1290E+00   8.0100E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.3790E+00   3.8400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   4.0000E+00   3.3500E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
 Pathway 14:
   0
   0
   0
   0
```

```
  0
  1
  9
  0.0080E+00   4.5000E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.3940E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.5850E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
  1.1290E+00   4.1000E-02   9.6500E+01   5.0000E+01   0.0000E+00
  1.3790E+00   2.0400E-02   9.6500E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.8300E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
CR
  5
  0
  1
  2
  0.0080E+00   3.4700E-04
  7.2000E+02   3.4700E-04
  1
  4
  0.0080E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   4.0000E-01
Location 2:
EAB
  6
  1
  4
  0.0080E+00   1.1000E-03
  2.0080E+00   0.0000E+00
  8.0000e+00   0.0000E+00
  7.2000E+02   0.0000E+00
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   3.4700E-04
  2.4000E+01   0.0000E+00
  7.2000E+02   0.0000E+00
  0
Location 3:
LPZ
  6
  1
  5
  0.0080E+00   5.6000E-05
  8.0000E+00   9.0000E-06
  2.4000E+01   5.4000E-06
```

```
  9.6000E+01   1.9000E-06
  7.2000E+02   1.9000E-06
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   3.4700E-04
  2.4000E+01   1.7500E-04
  7.2000E+02   2.3200E-04
  0
Effective Volume Location:
  1
  5
  0.0080E+00   2.5900E-03
  8.0000E+00   1.1500E-03
  2.4000E+01   8.4400E-04
  9.6000E+01   7.1800E-04
  7.2000E+02   7.1800E-04
Simulation Parameters:
  6
  0.0000E+00   5.0000E-03
  4.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  4.8000E+01   2.4000E+01
  7.2000E+02   0.0000E+00
Output Filename:
E:\radtrad303\newrun\2004oc\oc3.o0
  1
  1
  1
  1
  1
End of Scenario File
```

File 128ww_env.psf **(Bypass From WW Terminating at RB Wall)**

```
Radtrad 3.03 4/15/2001
 Oyster Creek - Path RB(WW)
 Nuclide Inventory File:
 E:\radtrad303\newrun\2004oc\oc60.nif
 Plant Power Level:
  1.9690E+03
 Compartments:
   8
 Compartment 1:
 DW
   3
  1.8000E+05
   1
   0
   0
   0
   0
 Compartment 2:
 WW
   3
  1.2800E+05
   0
   0
   0
   1
   0
 Compartment 3:
 RB
   3
  1.8000E+06
   0
   0
   0
   0
   0
 Compartment 4:
 SP
   3
  8.2000E+04
   0
   0
   0
   0
   0
 Compartment 5:
 CR
   1
  2.7500E+04
   0
   0
   0
   0
   0
 Compartment 6:
 Enviro
   2
```

```
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 7:
Dummy
  3
 1.0000E+06
  0
  0
  0
  0
  0
Compartment 8:
SL
  3
 32.36
  0
  0
  0
  1
  0
Pathways:
 14
Pathway 1:
DW to WW
  1
  2
  2
Pathway 2:
WW to DW
  2
  1
  2
Pathway 3:
Bypass DW 1 to Dummy
  1
  7
  2
Pathway 4:
DW to RB
  1
  3
  2
Pathway 5:
WW to RB
  2
  3
  2
Pathway 6:
SP to RB
  2
  3
  2
Pathway 7:
Bypass DW 3 to Dummy
```

```
   1
   7
   2
 Pathway 8:
 Bypass WW to Enviro
   2
   6
   2
 Pathway 9:
 RB SGTS to Dummy
   3
   7
   2
 Pathway 10:
 Enviro to CR
   6
   5
   2
 Pathway 11:
 CR to Enviro
   5
   6
   2
 Pathway 12:
 Leaking SL to Dummy
   8
   7
   2
Pathway 13:
 DW to SL
   1
   8
   2
 Pathway 14:
 Bypass DW 2 to Dummy
   1
   7
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   1   1.0000E+00
 E:\radtrad303\newrun\2004oc\oc60.inp
 E:\radtrad303\newrun\2004oc\oc.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:
  8
Compartment 1:
  0
  1
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
```

```
 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
   0
   0
   0
Compartment 8:
   0
   1
   0
   0
   0
   0
   0
```

```
  1
  9
  0.0800E-01  1.3604E+00
  5.1170E-01  2.5427E+00
  1.0089E+00  2.4120E+00
  2.2385E+00  2.5895E+00
  2.8033E+00  2.1079E+00
  3.0875E+00  1.3937E+00
  5.0413E+00  0.6557E+00
  9.8705E+00  0.3799E+00
  2.4000E+01  0.0000E+00
  1
  9
  0.0800E-01  0.0000E+00
  5.1170E-01  0.0000E+00
  1.0089E+00  0.0000E+00
  2.2385E+00  0.0000E+00
  2.8033E+00  0.0000E+00
  3.0875E+00  0.0000E+00
  5.0413E+00  0.0000E+00
  9.8705E+00  0.0000E+00
  2.4000E+01  0.0000E+00
Pathways:
 14
Pathway 1:
  0
  0
  0
  0
  0
  1
  4
  1.1290E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.2960E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  1.2960E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.4630E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  9
  0.0080E+00   1.2000E-01   50.000E+00   5.0000E+01   0.0000E+00
  0.2360E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.3940E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.4420E+00   4.6000E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.5850E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.8190E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  1.1290E+00   1.0910E-01   50.000E+00   5.0000E+01   0.0000E+00
  1.3790E+00   5.3800E-02   50.000E+00   5.0000E+01   0.0000E+00
  4.0000E+00   4.6800E-02   50.000E+00   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  9
  0.0000E+00   9.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.9900E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   1.1259E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.5356E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   7.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  0.3940E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.7700E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   0.8292E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.4017E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   3.0100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   2.7300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   1.3300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.1700E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
  0
  0
  0
  0
  0
```

```
   1
   9
   0.0080E+00   1.3200E-01   9.1600E+01   5.0000E+01   0.0000E+00
   0.2360E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
   0.3940E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
   0.4420E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
   0.5850E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
   0.8190E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
   1.1290E+00   1.1940E-01   9.1600E+01   5.0000E+01   0.0000E+00
   1.3790E+00   5.8400E-02   9.1600E+01   5.0000E+01   0.0000E+00
   4.0000E+00   5.0900E-02   9.1600E+01   5.0000E+01   0.0000E+00
   0
   0
   0
   0
   0
   0

Pathway 9:
   0
   0
   0
   0
   0
   1
   2
   0.0080E+00   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
   7.2000E+02   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
   0
   0
   0
   0
   0
   0
Pathway 10:
   0
   0
   0
   0
   0
   1
   2
   0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 11:
   0
   0
   0
   0
   0
   1
   2
```

```
   0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 12:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   1.7000E-01   0.0000E+00   5.0000E+01   0.0000E+00
   0.2360E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.3940E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.4420E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.5850E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.8190E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   1.1290E+00   1.4400E-01   0.0000E+00   5.0000E+01   0.0000E+00
   1.3790E+00   6.8500E-02   0.0000E+00   5.0000E+01   0.0000E+00
   4.0000E+00   6.0000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 13:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   9.5000E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.2360E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.3940E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.4420E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.5850E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.8190E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.1290E+00   8.0100E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.3790E+00   3.8400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   4.0000E+00   3.3500E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
 Pathway 14:
   0
   0
   0
```

```
    0
    0
    1
    9
    0.0080E+00   4.5000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.2360E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.3940E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.4420E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.5850E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.8190E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    1.1290E+00   4.1000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    1.3790E+00   2.0400E-02   9.6500E+01   5.0000E+01   0.0000E+00
    4.0000E+00   1.8300E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0
    0
    0
    0
    0
    0
Dose Locations:
    3
Location 1:
CR
    5
    0
    1
    2
    0.0080E+00   3.4700E-04
    7.2000E+02   3.4700E-04
    1
    4
    0.0080E+00   1.0000E+00
    2.4000E+01   6.0000E-01
    9.6000E+01   4.0000E-01
    7.2000E+02   4.0000E-01
Location 2:
EAB
    6
    1
    4
    0.0080E+00   1.1000E-03
    2.0080E+00   0.0000E+00
    8.0000e+00   0.0000E+00
    7.2000E+02   0.0000E+00
    1
    4
    0.0080E+00   3.4700E-04
    8.0000E+00   3.4700E-04
    2.4000E+01   0.0000E+00
    7.2000E+02   0.0000E+00
    0
Location 3:
LPZ
    6
    1
    5
    0.0080E+00   5.6000E-05
    8.0000E+00   9.0000E-06
```

```
  2.4000E+01   5.4000E-06
  9.6000E+01   1.9000E-06
  7.2000E+02   1.9000E-06
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   3.4700E-04
  2.4000E+01   1.7500E-04
  7.2000E+02   2.3200E-04
  0
Effective Volume Location:
  1
  5
  0.0080E+00   2.5900E-03
  8.0000E+00   1.1500E-03
  2.4000E+01   8.4400E-04
  9.6000E+01   7.1800E-04
  7.2000E+02   7.1800E-04
Simulation Parameters:
  6
  0.0000E+00   5.0000E-03
  4.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  4.8000E+01   2.4000E+01
  7.2000E+02   0.0000E+00
Output Filename:
E:\radtrad303\newrun\2004oc\oc3.o0
  1
  1
  1
  1
  1
End of Scenario File
```

File 128sl_env.psf **(Steam Line With Both MSIVs Closed)**

```
Radtrad 3.03 4/15/2001
 Oyster Creek - Path SL Out
 Nuclide Inventory File:
 E:\radtrad303\newrun\2004oc\oc60.nif
 Plant Power Level:
  1.9690E+03
 Compartments:
   8
 Compartment 1:
 DW
   3
  1.8000E+05
   1
   0
   0
   0
   0
 Compartment 2:
 WW
   3
  1.2800E+05
   0
   0
   0
   1
   0
 Compartment 3:
 RB
   3
  1.8000E+06
   0
   0
   0
   0
   0
 Compartment 4:
 SP
   3
  8.2000E+04
   0
   0
   0
   0
   0
 Compartment 5:
 CR
   1
  2.7500E+04
   0
   0
   0
   0
   0
 Compartment 6:
 Enviro
   2
```

```
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 7:
Dummy
  3
 1.0000E+06
  0
  0
  0
  0
  0
Compartment 8:
SL
  3
 32.36
  0
  0
  0
  1
  0
Pathways:
 14
Pathway 1:
DW to WW
  1
  2
  2
Pathway 2:
WW to DW
  2
  1
  2
Pathway 3:
Bypass DW 1 to Dummy
  1
  7
  2
Pathway 4:
DW to RB
  1
  3
  2
Pathway 5:
WW to RB
  2
  3
  2
Pathway 6:
SP to RB
  2
  3
  2
Pathway 7:
Bypass DW 3 to Dummy
```

```
   1
   7
   2
 Pathway 8:
 Bypass WW to Dummy
   2
   7
   2
 Pathway 9:
 RB SGTS to Dummy
   3
   7
   2
 Pathway 10:
 Enviro to CR
   6
   5
   2
 Pathway 11:
 CR to Enviro
   5
   6
   2
 Pathway 12:
 Leaking SL to Enviro
   8
   6
   2
Pathway 13:
 DW to SL
   1
   8
   2
Pathway 14:
 Bypass DW 2 to Dummy
   1
   7
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   1   1.0000E+00
 E:\radtrad303\newrun\2004oc\oc60.inp
 E:\radtrad303\newrun\2004oc\oc.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:
  8
Compartment 1:
  0
  1
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
```

```
 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
   0
   0
   0
Compartment 8:
   0
   1
   0
   0
   0
   0
   0
```

```
   1
   9
   0.0800E-01  1.3604E+00
   5.1170E-01  2.5427E+00
   1.0089E+00  2.4120E+00
   2.2385E+00  2.5895E+00
   2.8033E+00  2.1079E+00
   3.0875E+00  1.3937E+00
   5.0413E+00  0.6557E+00
   9.8705E+00  0.3799E+00
   2.4000E+01  0.0000E+00
   1
   9
   0.0800E-01  0.0000E+00
   5.1170E-01  0.0000E+00
   1.0089E+00  0.0000E+00
   2.2385E+00  0.0000E+00
   2.8033E+00  0.0000E+00
   3.0875E+00  0.0000E+00
   5.0413E+00  0.0000E+00
   9.8705E+00  0.0000E+00
   2.4000E+01  0.0000E+00
Pathways:
 14
 Pathway 1:
   0
   0
   0
   0
   0
   1
   4
   1.1290E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
   1.2960E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
   2.0080E+00   3.0000E+04   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
   1.2960E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
   1.4630E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
   2.0080E+00   3.0000E+04   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
  9
  0.0080E+00   1.2000E-01   50.000E+00   5.0000E+01   0.0000E+00
  0.2360E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.3940E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.4420E+00   4.6000E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.5850E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.8190E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  1.1290E+00   1.0910E-01   50.000E+00   5.0000E+01   0.0000E+00
  1.3790E+00   5.3800E-02   50.000E+00   5.0000E+01   0.0000E+00
  4.0000E+00   4.6800E-02   50.000E+00   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  9
  0.0000E+00   9.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.9900E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   1.1259E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.5356E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   7.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  0.3940E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.7700E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   0.8292E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.4017E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   3.0100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   2.7300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   1.3300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.1700E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
  0
  0
  0
  0
  0
```

```
  1
  9
  0.0080E+00   1.3200E-01   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   1.1940E-01   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   5.8400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   5.0900E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0

Pathway 9:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 10:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 11:
  0
  0
  0
  0
  0
  1
  2
```

```
    0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
    7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
    0
    0
    0
    0
    0
    0
Pathway 12:
    0
    0
    0
    0
    0
    1
    9
    0.0080E+00   1.7000E-01   0.0000E+00   5.0000E+01   0.0000E+00
    0.2360E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0.3940E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0.4420E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0.5850E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0.8190E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
    1.1290E+00   1.4400E-01   0.0000E+00   5.0000E+01   0.0000E+00
    1.3790E+00   6.8500E-02   0.0000E+00   5.0000E+01   0.0000E+00
    4.0000E+00   6.0000E-02   0.0000E+00   5.0000E+01   0.0000E+00
    0
    0
    0
    0
    0
    0
Pathway 13:
    0
    0
    0
    0
    0
    1
    9
    0.0080E+00   9.5000E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.2360E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.3940E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.4420E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.5850E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0.8190E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
    1.1290E+00   8.0100E-02   0.0000E+00   0.0000E+00   0.0000E+00
    1.3790E+00   3.8400E-02   0.0000E+00   0.0000E+00   0.0000E+00
    4.0000E+00   3.3500E-02   0.0000E+00   0.0000E+00   0.0000E+00
    0
    0
    0
    0
    0
    0
 Pathway 14:
    0
    0
    0
```

```
   0
   0
   1
   9
   0.0080E+00   4.5000E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.2360E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.3940E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.4420E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.5850E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0.8190E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
   1.1290E+00   4.1000E-02   9.6500E+01   5.0000E+01   0.0000E+00
   1.3790E+00   2.0400E-02   9.6500E+01   5.0000E+01   0.0000E+00
   4.0000E+00   1.8300E-02   9.6500E+01   5.0000E+01   0.0000E+00
   0
   0
   0
   0
   0
   0
Dose Locations:
   3
Location 1:
CR
   5
   0
   1
   2
   0.0080E+00   3.4700E-04
   7.2000E+02   3.4700E-04
   1
   4
   0.0080E+00   1.0000E+00
   2.4000E+01   6.0000E-01
   9.6000E+01   4.0000E-01
   7.2000E+02   4.0000E-01
Location 2:
EAB
   6
   1
   4
   0.0080E+00   1.1000E-03
   2.0080E+00   0.0000E+00
   8.0000e+00   0.0000E+00
   7.2000E+02   0.0000E+00
   1
   4
   0.0080E+00   3.4700E-04
   8.0000E+00   3.4700E-04
   2.4000E+01   0.0000E+00
   7.2000E+02   0.0000E+00
   0
Location 3:
LPZ
   6
   1
   5
   0.0080E+00   5.6000E-05
   8.0000E+00   9.0000E-06
```

```
  2.4000E+01   5.4000E-06
  9.6000E+01   1.9000E-06
  7.2000E+02   1.9000E-06
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   1.7500E-04
  2.4000E+01   2.3200E-04
  7.2000E+02   2.3200E-04
  0
Effective Volume Location:
  1
  5
  0.0080E+00   2.7100E-03
  8.0000E+00   8.7600E-04
  2.4000E+01   8.6300E-04
  9.6000E+01   8.4500E-04
  7.2000E+02   8.4500E-04
Simulation Parameters:
  6
  0.0000E+00   5.0000E-03
  4.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  4.8000E+01   2.4000E+01
  7.2000E+02   0.0000E+00
Output Filename:
E:\radtrad303\newrun\2004oc\oc3.o0
  1
  1
  1
  1
  1
End of Scenario File
```

File 128rbsgts_env.psf **(Containment Leakage Released via SGTS)**

```
Radtrad 3.03 4/15/2001
 Oyster Creek - Path SGTS
 Nuclide Inventory File:
 E:\radtrad303\newrun\2004oc\oc60.nif
 Plant Power Level:
  1.9690E+03
 Compartments:
   8
 Compartment 1:
 DW
   3
  1.8000E+05
   1
   0
   0
   0
   0
 Compartment 2:
 WW
   3
  1.2800E+05
   0
   0
   0
   1
   0
 Compartment 3:
 RB
   3
  1.8000E+06
   0
   0
   0
   0
   0
 Compartment 4:
 SP
   3
  8.2000E+04
   0
   0
   0
   0
   0
 Compartment 5:
 CR
   1
  2.7500E+04
   0
   0
   0
   0
   0
 Compartment 6:
 Enviro
   2
```

```
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 7:
Dummy
  3
 1.0000E+06
  0
  0
  0
  0
  0
Compartment 8:
SL
  3
 32.36
  0
  0
  0
  1
  0
Pathways:
 14
Pathway 1:
DW to WW
  1
  2
  2
Pathway 2:
WW to DW
  2
  1
  2
Pathway 3:
Bypass DW 1 to Dummy
  1
  7
  2
Pathway 4:
DW to RB
  1
  3
  2
Pathway 5:
WW to RB
  2
  3
  2
Pathway 6:
SP to RB
  2
  3
  2
Pathway 7:
Bypass DW 3 to Dummy
```

```
   1
   7
   2
 Pathway 8:
 Bypass WW to Dummy
   2
   7
   2
 Pathway 9:
 RB SGTS to Enviro
   3
   6
   2
 Pathway 10:
 Enviro to CR
   6
   5
   2
 Pathway 11:
 CR to Enviro
   5
   6
   2
 Pathway 12:
 Leaking SL to Dummy
   8
   7
   2
Pathway 13:
 DW to SL
   1
   8
   2
Pathway 14:
 Bypass DW 2 to Dummy
   1
   7
   2
 End of Plant Model File
 Scenario Description Name:

 Plant Model Filename:

 Source Term:
   1
   1   1.0000E+00
 E:\radtrad303\newrun\2004oc\oc60.inp
 E:\radtrad303\newrun\2004oc\oc.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:
  8
Compartment 1:
  0
  1
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
```

```
 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
   0
   0
   0
Compartment 8:
   0
   1
   0
   0
   0
   0
   0
```

```
  1
  9
  0.0800E-01  1.3604E+00
  5.1170E-01  2.5427E+00
  1.0089E+00  2.4120E+00
  2.2385E+00  2.5895E+00
  2.8033E+00  2.1079E+00
  3.0875E+00  1.3937E+00
  5.0413E+00  0.6557E+00
  9.8705E+00  0.3799E+00
  2.4000E+01  0.0000E+00
  1
  9
  0.0800E-01  0.0000E+00
  5.1170E-01  0.0000E+00
  1.0089E+00  0.0000E+00
  2.2385E+00  0.0000E+00
  2.8033E+00  0.0000E+00
  3.0875E+00  0.0000E+00
  5.0413E+00  0.0000E+00
  9.8705E+00  0.0000E+00
  2.4000E+01  0.0000E+00
Pathways:
 14
 Pathway 1:
  0
  0
  0
  0
  0
  1
  4
  1.1290E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.2960E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  1.2960E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.4630E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  9
  0.0080E+00   1.2000E-01   50.000E+00   5.0000E+01   0.0000E+00
  0.2360E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.3940E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.4420E+00   4.6000E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.5850E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.8190E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  1.1290E+00   1.0910E-01   50.000E+00   5.0000E+01   0.0000E+00
  1.3790E+00   5.3800E-02   50.000E+00   5.0000E+01   0.0000E+00
  4.0000E+00   4.6800E-02   50.000E+00   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  9
  0.0000E+00   9.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.9900E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   1.1259E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.5356E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   7.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  0.3940E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.7700E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   0.8292E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.4017E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   0.1300E+00   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   3.0100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   2.7300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   1.3300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.1700E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
  0
  0
  0
  0
  0
```

```
  1
  9
  0.0080E+00   1.3200E-01   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   1.1940E-01   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   5.8400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   5.0900E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 9:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 10:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 11:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
```

```
   7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 12:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   1.7000E-01   0.0000E+00   5.0000E+01   0.0000E+00
   0.2360E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.3940E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.4420E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.5850E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.8190E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   1.1290E+00   1.4400E-01   0.0000E+00   5.0000E+01   0.0000E+00
   1.3790E+00   6.8500E-02   0.0000E+00   5.0000E+01   0.0000E+00
   4.0000E+00   6.0000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 13:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   9.5000E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.2360E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.3940E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.4420E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.5850E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.8190E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.1290E+00   8.0100E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.3790E+00   3.8400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   4.0000E+00   3.3500E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
 Pathway 14:
   0
   0
   0
   0
```

```
  0
  1
  9
  0.0080E+00   4.5000E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.3940E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.5850E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
  1.1290E+00   4.1000E-02   9.6500E+01   5.0000E+01   0.0000E+00
  1.3790E+00   2.0400E-02   9.6500E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.8300E-02   9.6500E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
CR
  5
  0
  1
  2
  0.0080E+00   3.4700E-04
  7.2000E+02   3.4700E-04
  1
  4
  0.0080E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   4.0000E-01
Location 2:
EAB
  6
  1
  4
  0.0080E+00   1.9000E-06
  2.0080E+00   0.0000E+00
  8.0000e+00   0.0000E+00
  7.2000E+02   0.0000E+00
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   3.4700E-04
  2.4000E+01   0.0000E+00
  7.2000E+02   0.0000E+00
  0
Location 3:
LPZ
  6
  1
  5
  0.0080E+00   5.3000E-07
  8.0000E+00   1.8000E-07
  2.4000E+01   1.1000E-07
```

```
  9.6000E+01   4.8000E-08
  7.2000E+02   4.8000E-08
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   3.4700E-04
  2.4000E+01   1.7500E-04
  7.2000E+02   2.3200E-04
  0
Effective Volume Location:
  1
  5
  0.0080E+00   1.8000E-04
  8.0000E+00   9.6700E-05
  2.4000E+01   2.5000E-05
  9.6000E+01   3.6000E-06
  7.2000E+02   3.6000E-06
Simulation Parameters:
  6
  0.0000E+00   5.0000E-03
  4.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  4.8000E+01   2.4000E+01
  7.2000E+02   0.0000E+00
Output Filename:
E:\radtrad303\newrun\2004oc\oc3.o0
  1
  1
  1
  1
  1
End of Scenario File
```

File 128esf_env.psf **(ESF Leakage Released via SGTS)**

```
Radtrad 3.03 4/15/2001
 Oyster Creek - Path SGTS(ESF Leakage)
 Nuclide Inventory File:
 E:\radtrad303\newrun\2004oc\ocesf.nif
 Plant Power Level:
  1.9690E+03
 Compartments:
   8
 Compartment 1:
 DW
   3
  1.8000E+05
   1
   0
   0
   0
   0
 Compartment 2:
 WW
   3
  1.2800E+05
   0
   0
   0
   1
   0
 Compartment 3:
 RB
   3
  1.8000E+06
   0
   0
   0
   0
   0
 Compartment 4:
 SP
   3
  8.2000E+04
   0
   0
   0
   0
   0
 Compartment 5:
 CR
   1
  2.7500E+04
   0
   0
   0
   0
   0
 Compartment 6:
 Enviro
   2
```

```
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 7:
Dummy
  3
 1.0000E+06
  0
  0
  0
  0
  0
Compartment 8:
SL
  3
 32.36
  0
  0
  0
  1
  0
Pathways:
 14
Pathway 1:
DW to WW
  1
  2
  2
Pathway 2:
WW to DW
  2
  1
  2
Pathway 3:
Bypass DW 1 to Dummy
  1
  7
  2
Pathway 4:
DW to RB
  1
  3
  2
Pathway 5:
WW to RB
  2
  3
  2
Pathway 6:
SP to RB
  4
  3
  2
Pathway 7:
Bypass DW 3 to Dummy
```

```
    1
    7
    2
  Pathway 8:
  Bypass WW to Dummy
    2
    7
    2
  Pathway 9:
  RB SGTS to Enviro
    3
    6
    2
  Pathway 10:
  Enviro to CR
    6
    5
    2
  Pathway 11:
  CR to Enviro
    5
    6
    2
  Pathway 12:
  Leaking SL to Dummy
    8
    7
    2
 Pathway 13:
  DW to SL
    1
    8
    2
 Pathway 14:
  Bypass DW 2 to Dummy
    1
    7
    2
  End of Plant Model File
  Scenario Description Name:

  Plant Model Filename:

  Source Term:
    2
    1   0.0000E+00
    4   1.0000E+00
  E:\radtrad303\newrun\2004oc\oc60.inp
  E:\radtrad303\newrun\2004oc\oc.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:
  8
Compartment 1:
  0
  1
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  9
  1.6630E-01     25.234E+00
  4.6450E-01     0.2725E+00
  7.0190E-01     43.141E+00
  9.3360E-01     0.3249E+00
  1.1291E+00     26.366E+00
  2.0073E+00     6.2487E+00
  3.7749E+00     6.4500E-02
  4.6334E+00     3.9924E+00
  7.7909E+00     1.9970E-01
  1
  0.0000E+00
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
  7.2000E+02  0.0000E+00
  1
  5
  1.1290E+00  1.5000E+00
  3.7780E+00  0.0000E+00
  5.2220E+00  1.5000E-01
  7.8440E+00  0.0000E+00
```

```
    7.2000E+02  0.0000E+00
 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
    0
    0
    0
Compartment 8:
    0
    1
    0
    0
    0
    0
```

```
  0
  1
  9
  0.0800E-01  1.3604E+00
  5.1170E-01  2.5427E+00
  1.0089E+00  2.4120E+00
  2.2385E+00  2.5895E+00
  2.8033E+00  2.1079E+00
  3.0875E+00  1.3937E+00
  5.0413E+00  0.6557E+00
  9.8705E+00  0.3799E+00
  2.4000E+01  0.0000E+00
  1
  9
  0.0800E-01  0.0000E+00
  5.1170E-01  0.0000E+00
  1.0089E+00  0.0000E+00
  2.2385E+00  0.0000E+00
  2.8033E+00  0.0000E+00
  3.0875E+00  0.0000E+00
  5.0413E+00  0.0000E+00
  9.8705E+00  0.0000E+00
  2.4000E+01  0.0000E+00
Pathways:
 14
 Pathway 1:
  0
  0
  0
  0
  0
  1
  4
  1.1290E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.2960E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  1.2960E+00   9.1800E+03   0.0000E+00   0.0000E+00   0.0000E+00
  1.4630E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.0080E+00   3.0000E+04   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
  9
  0.0080E+00   1.2000E-01   50.000E+00   5.0000E+01   0.0000E+00
  0.2360E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.3940E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.4420E+00   4.6000E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.5850E+00   7.4100E-02   50.000E+00   5.0000E+01   0.0000E+00
  0.8190E+00   4.5600E-02   50.000E+00   5.0000E+01   0.0000E+00
  1.1290E+00   1.0910E-01   50.000E+00   5.0000E+01   0.0000E+00
  1.3790E+00   5.3800E-02   50.000E+00   5.0000E+01   0.0000E+00
  4.0000E+00   4.6800E-02   50.000E+00   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  9
  0.0000E+00   9.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
  0.2360E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   1.0800E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   1.1400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.9900E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   1.1259E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.5356E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   7.6000E-01   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  0.2360E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.3940E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.4420E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.5850E+00   0.8100E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0.8190E+00   0.8400E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.1290E+00   0.7700E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.3790E+00   0.8292E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.0000E+00   0.4017E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   0.1300E+00   1.0000E+02   0.0000E+00   0.0000E+00
  7.2000E+02   0.1300E+00   1.0000E+02   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 7:
  0
  0
  0
  0
  0
  1
  9
  0.0080E+00   3.0100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   1.8500E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   1.1400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   2.7300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   1.3300E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   1.1700E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 8:
  0
  0
  0
  0
```

```
  0
  1
  9
  0.0080E+00   1.3200E-01   9.1600E+01   5.0000E+01   0.0000E+00
  0.2360E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.3940E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.4420E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.5850E+00   8.1100E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0.8190E+00   4.9800E-02   9.1600E+01   5.0000E+01   0.0000E+00
  1.1290E+00   1.1940E-01   9.1600E+01   5.0000E+01   0.0000E+00
  1.3790E+00   5.8400E-02   9.1600E+01   5.0000E+01   0.0000E+00
  4.0000E+00   5.0900E-02   9.1600E+01   5.0000E+01   0.0000E+00
  0

  0
  0
  0
  0
  0
Pathway 9:
  0
  0
  0
  0
  0
  1
  2
  0.0080E+00   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  7.2000E+02   2.6000E+03   9.0000E+01   9.0000E+01   9.0000E+01
  0
  0
  0
  0
  0
  0
Pathway 10:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 11:
  0
  0
  0
  0
  0
  1
```

```
   2
   0.0000E+00   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   7.2000E+02   1.4000E+04   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 12:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   1.7000E-01   0.0000E+00   5.0000E+01   0.0000E+00
   0.2360E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.3940E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.4420E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.5850E+00   9.5000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0.8190E+00   5.8800E-02   0.0000E+00   5.0000E+01   0.0000E+00
   1.1290E+00   1.4400E-01   0.0000E+00   5.0000E+01   0.0000E+00
   1.3790E+00   6.8500E-02   0.0000E+00   5.0000E+01   0.0000E+00
   4.0000E+00   6.0000E-02   0.0000E+00   5.0000E+01   0.0000E+00
   0
   0
   0
   0
   0
   0
Pathway 13:
   0
   0
   0
   0
   0
   1
   9
   0.0080E+00   9.5000E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.2360E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.3940E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.4420E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.5850E+00   5.2800E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0.8190E+00   3.2400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.1290E+00   8.0100E-02   0.0000E+00   0.0000E+00   0.0000E+00
   1.3790E+00   3.8400E-02   0.0000E+00   0.0000E+00   0.0000E+00
   4.0000E+00   3.3500E-02   0.0000E+00   0.0000E+00   0.0000E+00
   0
   0
   0
   0
   0
   0
 Pathway 14:
   0
   0
```

```
    0
    0
    0
    1
    9
    0.0080E+00   4.5000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.2360E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.3940E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.4420E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.5850E+00   2.8000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0.8190E+00   1.6600E-02   9.6500E+01   5.0000E+01   0.0000E+00
    1.1290E+00   4.1000E-02   9.6500E+01   5.0000E+01   0.0000E+00
    1.3790E+00   2.0400E-02   9.6500E+01   5.0000E+01   0.0000E+00
    4.0000E+00   1.8300E-02   9.6500E+01   5.0000E+01   0.0000E+00
    0
    0
    0
    0
    0
    0
Dose Locations:
    3
Location 1:
CR
    5
    0
    1
    2
    0.0080E+00   3.4700E-04
    7.2000E+02   3.4700E-04
    1
    4
    0.0080E+00   1.0000E+00
    2.4000E+01   6.0000E-01
    9.6000E+01   4.0000E-01
    7.2000E+02   4.0000E-01
Location 2:
EAB
    6
    1
    4
    0.0080E+00   1.9000E-06
    2.0080E+00   0.0000E+00
    8.0000e+00   0.0000E+00
    7.2000E+02   0.0000E+00
    1
    4
    0.0080E+00   3.4700E-04
    8.0000E+00   3.4700E-04
    2.4000E+01   0.0000E+00
    7.2000E+02   0.0000E+00
    0
Location 3:
LPZ
    6
    1
    5
    0.0080E+00   5.3000E-07
```

```
  8.0000E+00   1.8000E-07
  2.4000E+01   1.1000E-07
  9.6000E+01   4.8000E-08
  7.2000E+02   4.8000E-08
  1
  4
  0.0080E+00   3.4700E-04
  8.0000E+00   3.4700E-04
  2.4000E+01   1.7500E-04
  7.2000E+02   2.3200E-04
  0
Effective Volume Location:
  1
  5
  0.0080E+00   1.8000E-04
  8.0000E+00   9.6700E-05
  2.4000E+01   2.5000E-05
  9.6000E+01   3.6000E-06
  7.2000E+02   3.6000E-06
Simulation Parameters:
  6
  0.0000E+00   5.0000E-03
  4.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  4.8000E+01   2.4000E+01
  7.2000E+02   0.0000E+00
Output Filename:
E:\radtrad303\newrun\2004oc\oc3.o0
  1
  1
  1
  1
  1
End of Scenario File
```

Oyster Creek RADTRAD library (.inp) file

File oc60.inp

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FGRDCF 10/24/95   03:24:50   beta-test version 1.10, minor FORTRAN fixes 5/4/95
Implicit daughter halflives (m) less than  90 and less than 0.100 of parent
         9 ORGANS DEFINED IN THIS FILE:
GONADS
BREAST
LUNGS
RED MARR
BONE SUR
THYROID
REMAINDER
EFFECTIVE
SKIN(FGR)
        60 NUCLIDES DEFINED IN THIS FILE:
Kr-83m
Kr-85m
Kr-85
Kr-87
Kr-88
Kr-89
Rb-86     D
Sr-89     Y
Sr-90     Y
Sr-91     Y      Including:Y-91m
Sr-92     Y
Y-90      Y
Y-91      Y
Y-92      Y
Y-93      Y
Zr-95     D
Zr-97     Y      Including:Nb-97m , Including:Nb-97
Nb-95     Y
Mo-99     Y
Tc-99m    D
Ru-103    Y      Including:Rh-103m
Ru-105    Y
Ru-106    Y      Including:Rh-106
Rh-105    Y
Sb-127    W
Sb-129    W
Te-127    W
Te-127m   W
Te-129    W
Te-129m   W      Including:Te-129
Te-131m   W      Including:Te-131
Te-132    W
I-131     D
I-132     D
I-133     D
I-134     D
I-135     D      Including:Xe-135m
Xe-133
Xe-133m
Xe-135
Xe-135m
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Xe-137
Xe-138
Cs-134    D
Cs-136    D
Cs-137    D      Including:Ba-137m
Ba-137m
Ba-139    D
Ba-140    D
La-140    W
La-141    D
La-142    D
Ce-141    Y
Ce-143    Y
Ce-144    Y      Including:Pr-144m, Including:Pr-144
Pr-143    Y
Nd-147    Y
Np-239    W
Pu-238    Y
Pu-239    Y
          CLOUDSHINE  GROUND     GROUND     GROUND     INHALED    INHALED    INGESTION
                      SHINE 8HR  SHINE 7DAY SHINE RATE ACUTE      CHRONIC
Kr-83m
GONADS      7.310E-15 2.594E-12 3.653E-12 1.570E-16-1.000E+00 0.000E+00 0.000E+00
BREAST      8.410E-15 2.527E-12 3.560E-12 1.530E-16-1.000E+00 0.000E+00 0.000E+00
LUNGS       7.040E-15 2.379E-12 3.351E-12 1.440E-16-1.000E+00 0.000E+00 0.000E+00
RED MARR    6.430E-15 2.346E-12 3.304E-12 1.420E-16-1.000E+00 0.000E+00 0.000E+00
BONE SUR    1.880E-14 5.286E-12 7.446E-12 3.200E-16-1.000E+00 0.000E+00 0.000E+00
THYROID     7.330E-15 2.395E-12 3.374E-12 1.450E-16-1.000E+00 0.000E+00 0.000E+00
REMAINDER   6.640E-15 2.313E-12 3.257E-12 1.400E-16-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE   7.480E-15 2.511E-12 3.537E-12 1.520E-16-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)   2.240E-14 2.247E-11 3.164E-11 1.360E-15-1.000E+00 0.000E+00 0.000E+00
Kr-85m
GONADS      7.310E-15 2.594E-12 3.653E-12 1.570E-16-1.000E+00 0.000E+00 0.000E+00
BREAST      8.410E-15 2.527E-12 3.560E-12 1.530E-16-1.000E+00 0.000E+00 0.000E+00
LUNGS       7.040E-15 2.379E-12 3.351E-12 1.440E-16-1.000E+00 0.000E+00 0.000E+00
RED MARR    6.430E-15 2.346E-12 3.304E-12 1.420E-16-1.000E+00 0.000E+00 0.000E+00
BONE SUR    1.880E-14 5.286E-12 7.446E-12 3.200E-16-1.000E+00 0.000E+00 0.000E+00
THYROID     7.330E-15 2.395E-12 3.374E-12 1.450E-16-1.000E+00 0.000E+00 0.000E+00
REMAINDER   6.640E-15 2.313E-12 3.257E-12 1.400E-16-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE   7.480E-15 2.511E-12 3.537E-12 1.520E-16-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)   2.240E-14 2.247E-11 3.164E-11 1.360E-15-1.000E+00 0.000E+00 0.000E+00
Kr-85
GONADS      1.170E-16 8.121E-14 1.704E-12 2.820E-18-1.000E+00 0.000E+00 0.000E+00
BREAST      1.340E-16 7.891E-14 1.656E-12 2.740E-18-1.000E+00 0.000E+00 0.000E+00
LUNGS       1.140E-16 7.056E-14 1.481E-12 2.450E-18-1.000E+00 0.000E+00 0.000E+00
RED MARR    1.090E-16 6.998E-14 1.469E-12 2.430E-18-1.000E+00 0.000E+00 0.000E+00
BONE SUR    2.200E-16 1.287E-13 2.702E-12 4.470E-18-1.000E+00 0.000E+00 0.000E+00
THYROID     1.180E-16 7.459E-14 1.565E-12 2.590E-18-1.000E+00 0.000E+00 0.000E+00
REMAINDER   1.090E-16 6.941E-14 1.457E-12 2.410E-18-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE   1.190E-16 7.603E-14 1.596E-12 2.640E-18-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)   1.320E-14 2.304E-11 4.835E-10 8.000E-16-1.000E+00 0.000E+00 0.000E+00
Kr-87
GONADS      4.000E-14 4.962E-12 5.026E-12 7.610E-16-1.000E+00 0.000E+00 0.000E+00
BREAST      4.500E-14 4.740E-12 4.802E-12 7.270E-16-1.000E+00 0.000E+00 0.000E+00
LUNGS       4.040E-14 4.603E-12 4.663E-12 7.060E-16-1.000E+00 0.000E+00 0.000E+00
RED MARR    4.000E-14 4.708E-12 4.769E-12 7.220E-16-1.000E+00 0.000E+00 0.000E+00
BONE SUR    6.020E-14 6.514E-12 6.598E-12 9.990E-16-1.000E+00 0.000E+00 0.000E+00
THYROID     4.130E-14 4.473E-12 4.531E-12 6.860E-16-1.000E+00 0.000E+00 0.000E+00
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REMAINDER  3.910E-14 4.590E-12 4.650E-12 7.040E-16-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE  4.120E-14 4.773E-12 4.835E-12 7.320E-16-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)  1.370E-13 8.802E-11 8.916E-11 1.350E-14-1.000E+00 0.000E+00 0.000E+00
Kr-88
GONADS     9.900E-14 2.278E-11 2.655E-11 1.800E-15-1.000E+00 0.000E+00 0.000E+00
BREAST     1.110E-13 2.177E-11 2.537E-11 1.720E-15-1.000E+00 0.000E+00 0.000E+00
LUNGS      1.010E-13 2.139E-11 2.493E-11 1.690E-15-1.000E+00 0.000E+00 0.000E+00
RED MARR   1.000E-13 2.190E-11 2.552E-11 1.730E-15-1.000E+00 0.000E+00 0.000E+00
BONE SUR   1.390E-13 2.886E-11 3.363E-11 2.280E-15-1.000E+00 0.000E+00 0.000E+00
THYROID    1.030E-13 2.012E-11 2.345E-11 1.590E-15-1.000E+00 0.000E+00 0.000E+00
REMAINDER  9.790E-14 2.139E-11 2.493E-11 1.690E-15-1.000E+00 0.000E+00 0.000E+00

EFFECTIVE  1.020E-13 2.202E-11 2.567E-11 1.740E-15-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)  1.350E-13 5.607E-11 6.534E-11 4.430E-15-1.000E+00 0.000E+00 0.000E+00
Kr-89
GONADS     9.900E-14 2.278E-11 2.655E-11 1.800E-15-1.000E+00 0.000E+00 0.000E+00
BREAST     1.110E-13 2.177E-11 2.537E-11 1.720E-15-1.000E+00 0.000E+00 0.000E+00
LUNGS      1.010E-13 2.139E-11 2.493E-11 1.690E-15-1.000E+00 0.000E+00 0.000E+00
RED MARR   1.000E-13 2.190E-11 2.552E-11 1.730E-15-1.000E+00 0.000E+00 0.000E+00
BONE SUR   1.390E-13 2.886E-11 3.363E-11 2.280E-15-1.000E+00 0.000E+00 0.000E+00
THYROID    1.030E-13 2.012E-11 2.345E-11 1.590E-15-1.000E+00 0.000E+00 0.000E+00
REMAINDER  9.790E-14 2.139E-11 2.493E-11 1.690E-15-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE  1.020E-13 2.202E-11 2.567E-11 1.740E-15-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)  1.350E-13 5.607E-11 6.534E-11 4.430E-15-1.000E+00 0.000E+00 0.000E+00
Rb-86
GONADS     4.710E-15 2.788E-12 5.187E-11 9.740E-17-1.000E+00 1.340E-09 2.150E-09
BREAST     5.340E-15 2.662E-12 4.953E-11 9.300E-17-1.000E+00 1.330E-09 2.140E-09
LUNGS      4.710E-15 2.553E-12 4.750E-11 8.920E-17-1.000E+00 3.300E-09 2.140E-09
RED MARR   4.640E-15 2.619E-12 4.873E-11 9.150E-17-1.000E+00 2.320E-09 3.720E-09
BONE SUR   7.050E-15 3.635E-12 6.764E-11 1.270E-16-1.000E+00 4.270E-09 6.860E-09
THYROID    4.840E-15 2.599E-12 4.836E-11 9.080E-17-1.000E+00 1.330E-09 2.140E-09
REMAINDER  4.520E-15 2.542E-12 4.729E-11 8.880E-17-1.000E+00 1.380E-09 2.330E-09
EFFECTIVE  4.810E-15 2.665E-12 4.958E-11 9.310E-17-1.000E+00 1.790E-09 2.530E-09
SKIN(FGR)  4.850E-14 2.210E-10 4.111E-09 7.720E-15-1.000E+00 0.000E+00 0.000E+00
Sr-89
GONADS     7.730E-17 7.155E-14 1.436E-12 2.490E-18-1.000E+00 7.950E-12 8.050E-12
BREAST     9.080E-17 7.212E-14 1.447E-12 2.510E-18-1.000E+00 7.960E-12 7.980E-12
LUNGS      7.080E-17 5.689E-14 1.142E-12 1.980E-18-1.000E+00 8.350E-08 7.970E-12
RED MARR   6.390E-17 5.345E-14 1.073E-12 1.860E-18-1.000E+00 1.070E-10 1.080E-10
BONE SUR   1.940E-16 1.560E-13 3.131E-12 5.430E-18-1.000E+00 1.590E-10 1.610E-10
THYROID    7.600E-17 6.063E-14 1.217E-12 2.110E-18-1.000E+00 7.960E-12 7.970E-12
REMAINDER  6.710E-17 5.603E-14 1.124E-12 1.950E-18-1.000E+00 3.970E-09 8.250E-09
EFFECTIVE  7.730E-17 6.523E-14 1.309E-12 2.270E-18-1.000E+00 1.120E-08 2.500E-09
SKIN(FGR)  3.690E-14 1.914E-10 3.841E-09 6.660E-15-1.000E+00 0.000E+00 0.000E+00
Sr-90
GONADS     7.780E-18 9.590E-15 2.014E-13 3.330E-19-1.000E+00 2.690E-10 5.040E-11
BREAST     9.490E-18 1.008E-14 2.116E-13 3.500E-19-1.000E+00 2.690E-10 5.040E-11
LUNGS      6.440E-18 6.307E-15 1.324E-13 2.190E-19-1.000E+00 2.860E-06 5.040E-11
RED MARR   5.440E-18 5.558E-15 1.167E-13 1.930E-19-1.000E+00 3.280E-08 6.450E-09
BONE SUR   2.280E-17 2.393E-14 5.025E-13 8.310E-19-1.000E+00 7.090E-08 1.390E-08
THYROID    7.330E-18 7.171E-15 1.506E-13 2.490E-19-1.000E+00 2.690E-10 5.040E-11
REMAINDER  6.110E-18 6.422E-15 1.348E-13 2.230E-19-1.000E+00 5.730E-09 6.700E-09
EFFECTIVE  7.530E-18 8.179E-15 1.717E-13 2.840E-19-1.000E+00 3.510E-07 3.230E-09
SKIN(FGR)  9.200E-15 4.032E-12 8.465E-11 1.400E-16-1.000E+00 0.000E+00 0.000E+00
Sr-91
GONADS     4.819E-14 2.155E-11 5.062E-11 1.026E-15-1.000E+00 5.669E-11 2.520E-10
BREAST     5.477E-14 2.059E-11 4.838E-11 9.806E-16-1.000E+00 1.775E-11 3.676E-11
LUNGS      4.803E-14 1.970E-11 4.626E-11 9.376E-16-1.000E+00 2.170E-09 1.055E-11
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RED MARR   4.691E-14 2.011E-11 4.722E-11 9.570E-16-1.000E+00 2.275E-11 5.659E-11
BONE SUR   7.674E-14 2.852E-11 6.709E-11 1.360E-15-1.000E+00 1.306E-11 2.070E-11
THYROID    4.938E-14 2.035E-11 4.782E-11 9.693E-16-1.000E+00 9.930E-12 1.968E-12
REMAINDER  4.610E-14 1.948E-11 4.573E-11 9.268E-16-1.000E+00 5.802E-10 2.557E-09
EFFECTIVE  4.924E-14 2.057E-11 4.832E-11 9.793E-16-1.000E+00 4.547E-10 8.455E-10
SKIN(FGR)  9.938E-14 1.748E-10 3.987E-10 8.080E-15-1.000E+00 0.000E+00 0.000E+00
Sr-92
GONADS     6.610E-14 1.593E-11 1.830E-11 1.300E-15-1.000E+00 1.020E-11 8.180E-11
BREAST     7.480E-14 1.520E-11 1.745E-11 1.240E-15-1.000E+00 6.490E-12 1.700E-11
LUNGS      6.670E-14 1.483E-11 1.703E-11 1.210E-15-1.000E+00 1.050E-09 7.220E-12
RED MARR   6.620E-14 1.520E-11 1.745E-11 1.240E-15-1.000E+00 6.980E-12 2.290E-11
BONE SUR   9.490E-14 2.010E-11 2.308E-11 1.640E-15-1.000E+00 4.360E-12 8.490E-12
THYROID    6.820E-14 1.446E-11 1.661E-11 1.180E-15-1.000E+00 3.920E-12 1.300E-12
REMAINDER  6.450E-14 1.471E-11 1.689E-11 1.200E-15-1.000E+00 2.900E-10 1.720E-09
EFFECTIVE  6.790E-14 1.532E-11 1.759E-11 1.250E-15-1.000E+00 2.180E-10 5.430E-10
SKIN(FGR)  8.560E-14 2.280E-11 2.618E-11 1.860E-15-1.000E+00 0.000E+00 0.000E+00
Y-90
GONADS     1.890E-16 1.586E-13 1.601E-12 5.750E-18-1.000E+00 5.170E-13 1.430E-14
BREAST     2.200E-16 1.578E-13 1.593E-12 5.720E-18-1.000E+00 5.170E-13 1.270E-14
LUNGS      1.770E-16 1.313E-13 1.326E-12 4.760E-18-1.000E+00 9.310E-09 1.260E-14
RED MARR   1.620E-16 1.261E-13 1.273E-12 4.570E-18-1.000E+00 1.520E-11 3.700E-13
BONE SUR   4.440E-16 3.228E-13 3.259E-12 1.170E-17-1.000E+00 1.510E-11 3.670E-13
THYROID    1.870E-16 1.385E-13 1.398E-12 5.020E-18-1.000E+00 5.170E-13 1.260E-14
REMAINDER  1.680E-16 1.291E-13 1.303E-12 4.680E-18-1.000E+00 3.870E-09 9.680E-09
EFFECTIVE  1.900E-16 1.468E-13 1.482E-12 5.320E-18-1.000E+00 2.280E-09 2.910E-09
SKIN(FGR)  6.240E-14 2.897E-10 2.924E-09 1.050E-14-1.000E+00 0.000E+00 0.000E+00
Y-91
GONADS     2.560E-16 1.756E-13 3.546E-12 6.110E-18-1.000E+00 8.200E-12 3.540E-12
BREAST     2.930E-16 1.713E-13 3.459E-12 5.960E-18-1.000E+00 8.920E-12 5.540E-13
LUNGS      2.500E-16 1.526E-13 3.082E-12 5.310E-18-1.000E+00 9.870E-08 2.020E-13
RED MARR   2.410E-16 1.521E-13 3.070E-12 5.290E-18-1.000E+00 3.190E-10 6.590E-12
BONE SUR   4.560E-16 2.903E-13 5.862E-12 1.010E-17-1.000E+00 3.180E-10 6.130E-12
THYROID    2.600E-16 1.564E-13 3.157E-12 5.440E-18-1.000E+00 8.500E-12 1.290E-13
REMAINDER  2.390E-16 1.509E-13 3.047E-12 5.250E-18-1.000E+00 4.200E-09 8.570E-09
EFFECTIVE  2.600E-16 1.650E-13 3.332E-12 5.740E-18-1.000E+00 1.320E-08 2.570E-09
SKIN(FGR)  3.850E-14 1.989E-10 4.016E-09 6.920E-15-1.000E+00 0.000E+00 0.000E+00
Y-92
GONADS     1.270E-14 3.855E-12 4.872E-12 2.650E-16-1.000E+00 2.610E-12 1.960E-11
BREAST     1.440E-14 3.680E-12 4.652E-12 2.530E-16-1.000E+00 1.500E-12 3.550E-12
LUNGS      1.270E-14 3.535E-12 4.468E-12 2.430E-16-1.000E+00 1.240E-09 1.390E-12
RED MARR   1.250E-14 3.608E-12 4.560E-12 2.480E-16-1.000E+00 2.070E-12 4.910E-12
BONE SUR   1.950E-14 5.091E-12 6.435E-12 3.500E-16-1.000E+00 1.510E-12 1.750E-12
THYROID    1.300E-14 3.579E-12 4.523E-12 2.460E-16-1.000E+00 1.050E-12 1.770E-13
REMAINDER  1.220E-14 3.506E-12 4.431E-12 2.410E-16-1.000E+00 2.030E-10 1.700E-09
EFFECTIVE  1.300E-14 3.680E-12 4.652E-12 2.530E-16-1.000E+00 2.110E-10 5.150E-10
SKIN(FGR)  1.140E-13 2.022E-10 2.556E-10 1.390E-14-1.000E+00 0.000E+00 0.000E+00
Y-93
GONADS     4.670E-15 2.108E-12 4.989E-12 9.510E-17-1.000E+00 5.310E-12 2.200E-11
BREAST     5.300E-15 2.026E-12 4.794E-12 9.140E-17-1.000E+00 1.740E-12 3.130E-12
LUNGS      4.680E-15 1.937E-12 4.585E-12 8.740E-17-1.000E+00 2.520E-09 8.670E-13
RED MARR   4.580E-15 1.972E-12 4.669E-12 8.900E-17-1.000E+00 4.040E-12 4.930E-12
BONE SUR   7.580E-15 2.948E-12 6.977E-12 1.330E-16-1.000E+00 3.140E-12 1.730E-12
THYROID    4.790E-15 1.908E-12 4.516E-12 8.610E-17-1.000E+00 9.260E-13 1.260E-13
REMAINDER  4.510E-15 1.919E-12 4.543E-12 8.660E-17-1.000E+00 9.250E-10 4.090E-09
EFFECTIVE  4.800E-15 2.021E-12 4.784E-12 9.120E-17-1.000E+00 5.820E-10 1.230E-09
SKIN(FGR)  8.500E-14 2.726E-10 6.452E-10 1.230E-14-1.000E+00 0.000E+00 0.000E+00
Zr-95
GONADS     3.530E-14 2.182E-11 4.421E-10 7.590E-16-1.000E+00 1.880E-09 8.160E-10
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BREAST      4.010E-14 2.084E-11 4.223E-10 7.250E-16-1.000E+00 1.910E-09 1.050E-10
LUNGS       3.510E-14 1.989E-11 4.030E-10 6.920E-16-1.000E+00 2.170E-09 2.340E-11
RED MARR    3.430E-14 2.030E-11 4.112E-10 7.060E-16-1.000E+00 1.300E-08 2.140E-10
BONE SUR    5.620E-14 2.875E-11 5.824E-10 1.000E-15-1.000E+00 1.030E-07 4.860E-10
THYROID     3.610E-14 2.076E-11 4.205E-10 7.220E-16-1.000E+00 1.440E-09 8.270E-12
REMAINDER   3.360E-14 1.963E-11 3.978E-10 6.830E-16-1.000E+00 2.280E-09 2.530E-09
EFFECTIVE   3.600E-14 2.078E-11 4.211E-10 7.230E-16-1.000E+00 6.390E-09 1.020E-09
SKIN(FGR)   4.500E-14 2.561E-11 5.190E-10 8.910E-16-1.000E+00 0.000E+00 0.000E+00
Zr-97
GONADS      4.331E-14 2.179E-11 7.799E-11 9.253E-16-1.000E+00 1.840E-10 6.228E-10
BREAST      4.928E-14 2.083E-11 7.455E-11 8.846E-16-1.000E+00 4.706E-11 8.137E-11
LUNGS       4.322E-14 1.992E-11 7.127E-11 8.456E-16-1.000E+00 4.108E-09 1.770E-11
RED MARR    4.224E-14 2.034E-11 7.279E-11 8.634E-16-1.000E+00 6.376E-11 1.302E-10
BONE SUR    6.897E-14 2.881E-11 1.031E-10 1.224E-15-1.000E+00 3.504E-11 4.558E-11
THYROID     4.443E-14 2.061E-11 7.377E-11 8.755E-16-1.000E+00 2.315E-11 2.671E-12
REMAINDER   4.139E-14 1.966E-11 7.035E-11 8.345E-16-1.000E+00 2.041E-09 6.990E-09
EFFECTIVE   4.432E-14 2.078E-11 7.438E-11 8.824E-16-1.000E+00 1.171E-09 2.283E-09
SKIN(FGR)   9.835E-14 2.281E-10 8.148E-10 9.587E-15-1.000E+00 0.000E+00 0.000E+00
Nb-95
GONADS      3.660E-14 2.253E-11 4.435E-10 7.850E-16-1.000E+00 4.320E-10 8.050E-10
BREAST      4.160E-14 2.150E-11 4.231E-10 7.490E-16-1.000E+00 4.070E-10 1.070E-10
LUNGS       3.650E-14 2.055E-11 4.045E-10 7.160E-16-1.000E+00 8.320E-09 2.740E-11
RED MARR    3.560E-14 2.101E-11 4.135E-10 7.320E-16-1.000E+00 4.420E-10 1.990E-10
BONE SUR    5.790E-14 2.957E-11 5.819E-10 1.030E-15-1.000E+00 5.130E-10 2.940E-10
THYROID     3.750E-14 2.144E-11 4.220E-10 7.470E-16-1.000E+00 3.580E-10 1.180E-11
REMAINDER   3.490E-14 2.032E-11 4.000E-10 7.080E-16-1.000E+00 1.070E-09 1.470E-09
EFFECTIVE   3.740E-14 2.147E-11 4.226E-10 7.480E-16-1.000E+00 1.570E-09 6.950E-10
SKIN(FGR)   4.300E-14 2.598E-11 5.112E-10 9.050E-16-1.000E+00 0.000E+00 0.000E+00
Mo-99
GONADS      7.130E-15 4.282E-12 4.403E-11 1.550E-16-1.000E+00 9.510E-11 2.180E-10
BREAST      8.130E-15 4.116E-12 4.233E-11 1.490E-16-1.000E+00 2.750E-11 3.430E-11
LUNGS       7.060E-15 3.867E-12 3.977E-11 1.400E-16-1.000E+00 4.290E-09 1.510E-11
RED MARR    6.820E-15 3.923E-12 4.034E-11 1.420E-16-1.000E+00 5.240E-11 8.320E-11
BONE SUR    1.240E-14 6.105E-12 6.278E-11 2.210E-16-1.000E+00 4.130E-11 6.320E-11
THYROID     7.270E-15 4.033E-12 4.147E-11 1.460E-16-1.000E+00 1.520E-11 1.030E-11
REMAINDER   6.740E-15 3.812E-12 3.920E-11 1.380E-16-1.000E+00 1.740E-09 4.280E-09
EFFECTIVE   7.280E-15 4.061E-12 4.176E-11 1.470E-16-1.000E+00 1.070E-09 1.360E-09
SKIN(FGR)   3.140E-14 1.039E-10 1.068E-09 3.760E-15-1.000E+00 0.000E+00 0.000E+00
Tc-99m
GONADS      5.750E-15 2.334E-12 3.877E-12 1.240E-16-1.000E+00 2.770E-12 9.750E-12
BREAST      6.650E-15 2.258E-12 3.752E-12 1.200E-16-1.000E+00 2.150E-12 3.570E-12
LUNGS       5.490E-15 2.127E-12 3.533E-12 1.130E-16-1.000E+00 2.280E-11 3.140E-12
RED MARR    4.910E-15 2.070E-12 3.439E-12 1.100E-16-1.000E+00 3.360E-12 6.290E-12
BONE SUR    1.630E-14 5.383E-12 8.942E-12 2.860E-16-1.000E+00 2.620E-12 4.060E-12
THYROID     5.750E-15 2.145E-12 3.564E-12 1.140E-16-1.000E+00 5.010E-11 8.460E-11
REMAINDER   5.150E-15 2.070E-12 3.439E-12 1.100E-16-1.000E+00 1.020E-11 3.340E-11
EFFECTIVE   5.890E-15 2.277E-12 3.783E-12 1.210E-16-1.000E+00 8.800E-12 1.680E-11
SKIN(FGR)   7.140E-15 2.710E-12 4.502E-12 1.440E-16-1.000E+00 0.000E+00 0.000E+00
Ru-103
GONADS      2.191E-14 1.404E-11 2.783E-10 4.892E-16-1.000E+00 3.070E-10 5.720E-10
BREAST      2.512E-14 1.350E-11 2.677E-10 4.705E-16-1.000E+00 3.110E-10 1.200E-10
LUNGS       2.180E-14 1.273E-11 2.522E-10 4.432E-16-1.000E+00 1.561E-08 7.310E-11
RED MARR    2.100E-14 1.287E-11 2.551E-10 4.483E-16-1.000E+00 3.190E-10 1.660E-10
BONE SUR    3.892E-14 1.958E-11 3.882E-10 6.823E-16-1.000E+00 2.370E-10 9.631E-11
THYROID     2.241E-14 1.331E-11 2.639E-10 4.638E-16-1.000E+00 2.570E-10 6.250E-11
REMAINDER   2.080E-14 1.248E-11 2.472E-10 4.346E-16-1.000E+00 1.250E-09 2.110E-09
EFFECTIVE   2.251E-14 1.332E-11 2.641E-10 4.642E-16-1.000E+00 2.421E-09 8.271E-10
SKIN(FGR)   2.774E-14 1.785E-11 3.543E-10 6.229E-16-1.000E+00 0.000E+00 0.000E+00
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Ru-105						
GONADS	3.720E-14	1.327E-11	1.861E-11	8.070E-16-1.000E+00	1.590E-11	9.670E-11
BREAST	4.240E-14	1.271E-11	1.783E-11	7.730E-16-1.000E+00	6.610E-12	1.590E-11
LUNGS	3.700E-14	1.210E-11	1.697E-11	7.360E-16-1.000E+00	5.730E-10	6.210E-12
RED MARR	3.590E-14	1.230E-11	1.725E-11	7.480E-16-1.000E+00	7.700E-12	2.350E-11
BONE SUR	6.280E-14	1.809E-11	2.537E-11	1.100E-15-1.000E+00	4.620E-12	8.890E-12
THYROID	3.800E-14	1.260E-11	1.766E-11	7.660E-16-1.000E+00	4.150E-12	1.820E-12
REMAINDER	3.540E-14	1.189E-11	1.667E-11	7.230E-16-1.000E+00	1.610E-10	8.540E-10
EFFECTIVE	3.810E-14	1.265E-11	1.773E-11	7.690E-16-1.000E+00	1.230E-10	2.870E-10
SKIN(FGR)	6.730E-14	7.368E-11	1.033E-10	4.480E-15-1.000E+00	0.000E+00	0.000E+00
Ru-106						
GONADS	1.010E-14	6.411E-12	1.340E-10	2.230E-16-1.000E+00	1.300E-09	1.640E-09
BREAST	1.160E-14	6.152E-12	1.286E-10	2.140E-16-1.000E+00	1.780E-09	1.440E-09
LUNGS	1.010E-14	5.836E-12	1.220E-10	2.030E-16-1.000E+00	1.040E-06	1.420E-09
RED MARR	9.750E-15	5.893E-12	1.232E-10	2.050E-16-1.000E+00	1.760E-09	1.460E-09
BONE SUR	1.720E-14	8.883E-12	1.856E-10	3.090E-16-1.000E+00	1.610E-09	1.430E-09
THYROID	1.030E-14	6.066E-12	1.268E-10	2.110E-16-1.000E+00	1.720E-09	1.410E-09
REMAINDER	9.630E-15	5.721E-12	1.196E-10	1.990E-16-1.000E+00	1.200E-08	2.110E-08
EFFECTIVE	1.040E-14	6.095E-12	1.274E-10	2.120E-16-1.000E+00	1.290E-07	7.400E-09
SKIN(FGR)	1.090E-13	4.082E-10	8.531E-09	1.420E-14-1.000E+00	0.000E+00	0.000E+00
Rh-105						
GONADS	3.640E-15	2.127E-12	1.411E-11	7.980E-17-1.000E+00	2.110E-11	5.800E-11
BREAST	4.160E-15	2.063E-12	1.369E-11	7.740E-17-1.000E+00	5.610E-12	8.970E-12
LUNGS	3.570E-15	1.935E-12	1.284E-11	7.260E-17-1.000E+00	9.580E-10	3.860E-12
RED MARR	3.380E-15	1.946E-12	1.291E-11	7.300E-17-1.000E+00	7.770E-12	1.470E-11
BONE SUR	7.530E-15	3.332E-12	2.210E-11	1.250E-16-1.000E+00	4.460E-12	6.750E-12
THYROID	3.680E-15	1.983E-12	1.316E-11	7.440E-17-1.000E+00	2.880E-12	2.910E-12
REMAINDER	3.390E-15	1.885E-12	1.250E-11	7.070E-17-1.000E+00	4.530E-10	1.270E-09
EFFECTIVE	3.720E-15	2.031E-12	1.347E-11	7.620E-17-1.000E+00	2.580E-10	3.990E-10
SKIN(FGR)	1.070E-14	4.691E-12	3.112E-11	1.760E-16-1.000E+00	0.000E+00	0.000E+00
Sb-127						
GONADS	3.260E-14	1.985E-11	2.441E-10	7.100E-16-1.000E+00	2.520E-10	6.140E-10
BREAST	3.720E-14	1.904E-11	2.341E-10	6.810E-16-1.000E+00	9.120E-11	7.600E-11
LUNGS	3.240E-14	1.809E-11	2.224E-10	6.470E-16-1.000E+00	6.940E-09	1.570E-11
RED MARR	3.140E-14	1.834E-11	2.255E-10	6.560E-16-1.000E+00	1.610E-10	1.330E-10
BONE SUR	5.520E-14	2.720E-11	3.345E-10	9.730E-16-1.000E+00	1.340E-10	5.240E-11
THYROID	3.330E-14	1.884E-11	2.317E-10	6.740E-16-1.000E+00	6.150E-11	4.640E-12
REMAINDER	3.090E-14	1.775E-11	2.183E-10	6.350E-16-1.000E+00	2.330E-09	5.870E-09
EFFECTIVE	3.330E-14	1.890E-11	2.324E-10	6.760E-16-1.000E+00	1.630E-09	1.950E-09
SKIN(FGR)	5.580E-14	7.967E-11	9.799E-10	2.850E-15-1.000E+00	0.000E+00	0.000E+00
Sb-129						
GONADS	6.970E-14	2.336E-11	3.231E-11	1.440E-15-1.000E+00	2.150E-11	1.510E-10
BREAST	7.910E-14	2.222E-11	3.074E-11	1.370E-15-1.000E+00	1.280E-11	2.560E-11
LUNGS	6.980E-14	2.141E-11	2.962E-11	1.320E-15-1.000E+00	8.980E-10	9.390E-12
RED MARR	6.860E-14	2.190E-11	3.029E-11	1.350E-15-1.000E+00	1.700E-11	3.670E-11
BONE SUR	1.070E-13	3.033E-11	4.196E-11	1.870E-15-1.000E+00	1.460E-11	1.340E-11
THYROID	7.160E-14	2.174E-11	3.007E-11	1.340E-15-1.000E+00	9.720E-12	1.470E-12
REMAINDER	6.710E-14	2.125E-11	2.939E-11	1.310E-15-1.000E+00	1.870E-10	1.450E-09
EFFECTIVE	7.140E-14	2.238E-11	3.096E-11	1.380E-15-1.000E+00	1.740E-10	4.840E-10
SKIN(FGR)	1.050E-13	8.273E-11	1.144E-10	5.100E-15-1.000E+00	0.000E+00	0.000E+00
Te-127						
GONADS	2.370E-16	1.191E-13	2.661E-13	5.480E-18-1.000E+00	2.020E-12	4.020E-12
BREAST	2.730E-16	1.158E-13	2.588E-13	5.330E-18-1.000E+00	1.880E-12	3.000E-12
LUNGS	2.320E-16	1.060E-13	2.370E-13	4.880E-18-1.000E+00	4.270E-10	2.890E-12
RED MARR	2.210E-16	1.058E-13	2.365E-13	4.870E-18-1.000E+00	4.090E-12	6.570E-12
BONE SUR	4.650E-16	1.862E-13	4.162E-13	8.570E-18-1.000E+00	4.090E-12	6.460E-12
THYROID	2.400E-16	1.106E-13	2.472E-13	5.090E-18-1.000E+00	1.840E-12	2.860E-12
REMAINDER	2.210E-16	1.036E-13	2.316E-13	4.770E-18-1.000E+00	1.110E-10	6.130E-10

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EFFECTIVE  2.420E-16 1.125E-13 2.515E-13 5.180E-18-1.000E+00 8.600E-11 1.870E-10
SKIN(FGR)  1.140E-14 1.173E-11 2.622E-11 5.400E-16-1.000E+00 0.000E+00 0.000E+00
Te-127m
GONADS     1.900E-16 4.689E-13 9.642E-12 1.630E-17-1.000E+00 1.100E-10 1.250E-10
BREAST     2.690E-16 5.150E-13 1.059E-11 1.790E-17-1.000E+00 1.100E-10 9.740E-11
LUNGS      7.620E-17 1.602E-13 3.295E-12 5.570E-18-1.000E+00 3.340E-08 9.620E-11
RED MARR   6.430E-17 1.249E-13 2.567E-12 4.340E-18-1.000E+00 5.360E-09 5.430E-09
BONE SUR   3.940E-16 9.005E-13 1.852E-11 3.130E-17-1.000E+00 2.040E-08 2.070E-08
THYROID    1.500E-16 2.779E-13 5.714E-12 9.660E-18-1.000E+00 9.660E-11 9.430E-11
REMAINDER  8.640E-17 1.999E-13 4.111E-12 6.950E-18-1.000E+00 1.660E-09 2.980E-09
EFFECTIVE  1.470E-16 3.251E-13 6.684E-12 1.130E-17-1.000E+00 5.810E-09 2.230E-09
SKIN(FGR)  8.490E-16 1.496E-12 3.076E-11 5.200E-17-1.000E+00 0.000E+00 0.000E+00
Te-129
GONADS     2.710E-15 3.889E-13 3.922E-13 6.510E-17-1.000E+00 5.050E-13 1.590E-12
BREAST     3.120E-15 3.800E-13 3.832E-13 6.360E-17-1.000E+00 5.390E-13 6.050E-13
LUNGS      2.640E-15 3.298E-13 3.326E-13 5.520E-17-1.000E+00 1.530E-10 4.910E-13
RED MARR   2.540E-15 3.298E-13 3.326E-13 5.520E-17-1.000E+00 6.190E-13 7.640E-13
BONE SUR   4.880E-15 5.753E-13 5.802E-13 9.630E-17-1.000E+00 6.220E-13 5.400E-13
THYROID    2.740E-15 3.525E-13 3.555E-13 5.900E-17-1.000E+00 5.090E-13 3.360E-13
REMAINDER  2.520E-15 3.262E-13 3.289E-13 5.460E-17-1.000E+00 7.280E-12 1.790E-10
EFFECTIVE  2.750E-15 3.590E-13 3.621E-13 6.010E-17-1.000E+00 2.090E-11 5.450E-11
SKIN(FGR)  3.570E-14 3.429E-11 3.458E-11 5.740E-15-1.000E+00 0.000E+00 0.000E+00
Te-129m
GONADS     3.321E-15 2.206E-12 4.799E-11 8.561E-17-1.000E+00 1.783E-10 2.420E-10
BREAST     3.838E-15 2.181E-12 4.739E-11 8.454E-17-1.000E+00 1.694E-10 1.664E-10
LUNGS      3.176E-15 1.741E-12 3.815E-11 6.808E-17-1.000E+00 4.040E-08 1.593E-10
RED MARR   3.071E-15 1.729E-12 3.793E-11 6.768E-17-1.000E+00 3.100E-09 3.500E-09
BONE SUR   5.772E-15 3.287E-12 7.147E-11 1.275E-16-1.000E+00 7.050E-09 7.990E-09
THYROID    3.341E-15 1.923E-12 4.201E-11 7.495E-17-1.000E+00 1.563E-10 1.572E-10
REMAINDER  3.048E-15 1.746E-12 3.822E-11 6.819E-17-1.000E+00 3.275E-09 7.196E-09
EFFECTIVE  3.337E-15 1.974E-12 4.308E-11 7.686E-17-1.000E+00 6.484E-09 2.925E-09
SKIN(FGR)  3.811E-14 1.501E-10 3.360E-09 6.001E-15-1.000E+00 0.000E+00 0.000E+00
Te-131m
GONADS     7.292E-14 4.020E-11 2.343E-10 1.535E-15-1.000E+00 2.345E-10 7.415E-10
BREAST     8.286E-14 3.853E-11 2.246E-10 1.472E-15-1.000E+00 9.309E-11 1.361E-10
LUNGS      7.265E-14 3.657E-11 2.131E-10 1.397E-15-1.000E+00 2.296E-09 6.335E-11
RED MARR   7.097E-14 3.736E-11 2.178E-10 1.427E-15-1.000E+00 1.417E-10 2.435E-10
BONE SUR   1.174E-13 5.467E-11 3.189E-10 2.090E-15-1.000E+00 2.276E-10 3.248E-10
THYROID    7.471E-14 3.741E-11 2.181E-10 1.429E-15-1.000E+00 3.669E-08 4.383E-08
REMAINDER  6.965E-14 3.626E-11 2.113E-10 1.385E-15-1.000E+00 9.509E-10 3.153E-09
EFFECTIVE  7.463E-14 3.825E-11 2.229E-10 1.461E-15-1.000E+00 1.758E-09 2.514E-09
SKIN(FGR)  1.038E-13 1.033E-10 6.188E-10 4.056E-15-1.000E+00 0.000E+00 0.000E+00
Te-132
GONADS     1.020E-14 6.812E-12 7.706E-11 2.450E-16-1.000E+00 4.150E-10 5.410E-10
BREAST     1.180E-14 6.756E-12 7.643E-11 2.430E-16-1.000E+00 3.630E-10 3.500E-10
LUNGS      9.650E-15 5.727E-12 6.479E-11 2.060E-16-1.000E+00 1.670E-09 3.300E-10
RED MARR   8.950E-15 5.588E-12 6.322E-11 2.010E-16-1.000E+00 4.270E-10 4.440E-10
BONE SUR   2.420E-14 1.273E-11 1.441E-10 4.580E-16-1.000E+00 7.120E-10 8.300E-10
THYROID    1.020E-14 5.978E-12 6.762E-11 2.150E-16-1.000E+00 6.280E-08 5.950E-08
REMAINDER  9.160E-15 5.644E-12 6.385E-11 2.030E-16-1.000E+00 7.890E-10 1.490E-09
EFFECTIVE  1.030E-14 6.339E-12 7.171E-11 2.280E-16-1.000E+00 2.550E-09 2.540E-09
SKIN(FGR)  1.390E-14 8.313E-12 9.405E-11 2.990E-16-1.000E+00 0.000E+00 0.000E+00
I-131
GONADS     1.780E-14 1.119E-11 1.789E-10 3.940E-16-1.000E+00 2.530E-11 4.070E-11
BREAST     2.040E-14 1.082E-11 1.730E-10 3.810E-16-1.000E+00 7.880E-11 1.210E-10
LUNGS      1.760E-14 1.016E-11 1.626E-10 3.580E-16-1.000E+00 6.570E-10 1.020E-10
RED MARR   1.680E-14 1.022E-11 1.635E-10 3.600E-16-1.000E+00 6.260E-11 9.440E-11
BONE SUR   3.450E-14 1.675E-11 2.679E-10 5.900E-16-1.000E+00 5.730E-11 8.720E-11
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THYROID     1.810E-14 1.053E-11 1.685E-10 3.710E-16-1.000E+00 2.920E-07 4.760E-07
REMAINDER   1.670E-14 9.908E-12 1.585E-10 3.490E-16-1.000E+00 8.030E-11 1.570E-10
EFFECTIVE   1.820E-14 1.067E-11 1.707E-10 3.760E-16-1.000E+00 8.890E-09 1.440E-08
SKIN(FGR)   2.980E-14 1.825E-11 2.920E-10 6.430E-16-1.000E+00 0.000E+00 0.000E+00
I-132
GONADS      1.090E-13 2.523E-11 2.771E-11 2.320E-15-1.000E+00 9.950E-12 2.330E-11
BREAST      1.240E-13 2.414E-11 2.652E-11 2.220E-15-1.000E+00 1.410E-11 2.520E-11
LUNGS       1.090E-13 2.305E-11 2.532E-11 2.120E-15-1.000E+00 2.710E-10 2.640E-11
RED MARR    1.070E-13 2.360E-11 2.592E-11 2.170E-15-1.000E+00 1.400E-11 2.460E-11
BONE SUR    1.730E-13 3.327E-11 3.655E-11 3.060E-15-1.000E+00 1.240E-11 2.190E-11
THYROID     1.120E-13 2.381E-11 2.616E-11 2.190E-15-1.000E+00 1.740E-09 3.870E-09
REMAINDER   1.050E-13 2.283E-11 2.509E-11 2.100E-15-1.000E+00 3.780E-11 1.650E-10
EFFECTIVE   1.120E-13 2.403E-11 2.640E-11 2.210E-15-1.000E+00 1.030E-10 1.820E-10
SKIN(FGR)   1.580E-13 8.199E-11 9.007E-11 7.540E-15-1.000E+00 0.000E+00 0.000E+00
I-133
GONADS      2.870E-14 1.585E-11 6.748E-11 6.270E-16-1.000E+00 1.950E-11 3.630E-11
BREAST      3.280E-14 1.519E-11 6.468E-11 6.010E-16-1.000E+00 2.940E-11 4.680E-11
LUNGS       2.860E-14 1.446E-11 6.156E-11 5.720E-16-1.000E+00 8.200E-10 4.530E-11
RED MARR    2.770E-14 1.466E-11 6.242E-11 5.800E-16-1.000E+00 2.720E-11 4.300E-11
BONE SUR    4.870E-14 2.161E-11 9.202E-11 8.550E-16-1.000E+00 2.520E-11 4.070E-11
THYROID     2.930E-14 1.502E-11 6.393E-11 5.940E-16-1.000E+00 4.860E-08 9.100E-08
REMAINDER   2.730E-14 1.418E-11 6.038E-11 5.610E-16-1.000E+00 5.000E-11 1.550E-10
EFFECTIVE   2.940E-14 1.509E-11 6.425E-11 5.970E-16-1.000E+00 1.580E-09 2.800E-09
SKIN(FGR)   5.830E-14 1.150E-10 4.897E-10 4.550E-15-1.000E+00 0.000E+00 0.000E+00
I-134
GONADS      1.270E-13 1.200E-11 1.202E-11 2.640E-15-1.000E+00 4.250E-12 1.100E-11
BREAST      1.440E-13 1.145E-11 1.147E-11 2.520E-15-1.000E+00 6.170E-12 1.170E-11
LUNGS       1.270E-13 1.100E-11 1.102E-11 2.420E-15-1.000E+00 1.430E-10 1.260E-11
RED MARR    1.250E-13 1.127E-11 1.129E-11 2.480E-15-1.000E+00 6.080E-12 1.090E-11
BONE SUR    1.960E-13 1.568E-11 1.571E-11 3.450E-15-1.000E+00 5.310E-12 9.320E-12
THYROID     1.300E-13 1.127E-11 1.129E-11 2.480E-15-1.000E+00 2.880E-10 6.210E-10
REMAINDER   1.220E-13 1.091E-11 1.093E-11 2.400E-15-1.000E+00 2.270E-11 1.340E-10
EFFECTIVE   1.300E-13 1.150E-11 1.152E-11 2.530E-15-1.000E+00 3.550E-11 6.660E-11
SKIN(FGR)   1.870E-13 4.477E-11 4.485E-11 9.850E-15-1.000E+00 0.000E+00 0.000E+00
I-135
GONADS      8.078E-14 3.113E-11 5.489E-11 1.599E-15-1.000E+00 1.700E-11 3.610E-11
BREAST      9.143E-14 2.971E-11 5.240E-11 1.526E-15-1.000E+00 2.340E-11 3.850E-11
LUNGS       8.145E-14 2.886E-11 5.089E-11 1.482E-15-1.000E+00 4.410E-10 3.750E-11
RED MARR    8.054E-14 2.965E-11 5.228E-11 1.523E-15-1.000E+00 2.240E-11 3.650E-11
BONE SUR    1.184E-13 3.983E-11 7.024E-11 2.046E-15-1.000E+00 2.010E-11 3.360E-11
THYROID     8.324E-14 2.852E-11 5.030E-11 1.465E-15-1.000E+00 8.460E-09 1.790E-08
REMAINDER   7.861E-14 2.883E-11 5.084E-11 1.481E-15-1.000E+00 4.700E-11 1.540E-10
EFFECTIVE   8.294E-14 2.989E-11 5.271E-11 1.535E-15-1.000E+00 3.320E-10 6.080E-10
SKIN(FGR)   1.156E-13 9.826E-11 1.733E-10 5.047E-15-1.000E+00 0.000E+00 0.000E+00
Xe-133
GONADS      1.610E-15 1.465E-12 2.052E-11 5.200E-17-1.000E+00 0.000E+00 0.000E+00
BREAST      1.960E-15 1.505E-12 2.107E-11 5.340E-17-1.000E+00 0.000E+00 0.000E+00
LUNGS       1.320E-15 1.045E-12 1.464E-11 3.710E-17-1.000E+00 0.000E+00 0.000E+00
RED MARR    1.070E-15 8.791E-13 1.231E-11 3.120E-17-1.000E+00 0.000E+00 0.000E+00
BONE SUR    5.130E-15 4.254E-12 5.958E-11 1.510E-16-1.000E+00 0.000E+00 0.000E+00
THYROID     1.510E-15 1.181E-12 1.653E-11 4.190E-17-1.000E+00 0.000E+00 0.000E+00
REMAINDER   1.240E-15 1.042E-12 1.460E-11 3.700E-17-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE   1.560E-15 1.299E-12 1.819E-11 4.610E-17-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)   4.970E-15 1.953E-12 2.734E-11 6.930E-17-1.000E+00 0.000E+00 0.000E+00
Xe-133m
GONADS      1.610E-15 1.465E-12 2.052E-11 5.200E-17-1.000E+00 0.000E+00 0.000E+00
BREAST      1.960E-15 1.505E-12 2.107E-11 5.340E-17-1.000E+00 0.000E+00 0.000E+00
LUNGS       1.320E-15 1.045E-12 1.464E-11 3.710E-17-1.000E+00 0.000E+00 0.000E+00
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RED MARR   1.070E-15 8.791E-13 1.231E-11 3.120E-17-1.000E+00 0.000E+00 0.000E+00
BONE SUR   5.130E-15 4.254E-12 5.958E-11 1.510E-16-1.000E+00 0.000E+00 0.000E+00
THYROID    1.510E-15 1.181E-12 1.653E-11 4.190E-17-1.000E+00 0.000E+00 0.000E+00
REMAINDER  1.240E-15 1.042E-12 1.460E-11 3.700E-17-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE  1.560E-15 1.299E-12 1.819E-11 4.610E-17-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)  4.970E-15 1.953E-12 2.734E-11 6.930E-17-1.000E+00 0.000E+00 0.000E+00
Xe-135
GONADS     1.170E-14 5.455E-12 1.194E-11 2.530E-16-1.000E+00 0.000E+00 0.000E+00
BREAST     1.330E-14 5.325E-12 1.166E-11 2.470E-16-1.000E+00 0.000E+00 0.000E+00
LUNGS      1.130E-14 4.959E-12 1.086E-11 2.300E-16-1.000E+00 0.000E+00 0.000E+00
RED MARR   1.070E-14 4.959E-12 1.086E-11 2.300E-16-1.000E+00 0.000E+00 0.000E+00
BONE SUR   2.570E-14 9.120E-12 1.997E-11 4.230E-16-1.000E+00 0.000E+00 0.000E+00
THYROID    1.180E-14 5.023E-12 1.100E-11 2.330E-16-1.000E+00 0.000E+00 0.000E+00
REMAINDER  1.080E-14 4.829E-12 1.058E-11 2.240E-16-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE  1.190E-14 5.217E-12 1.142E-11 2.420E-16-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)  3.120E-14 4.506E-11 9.867E-11 2.090E-15-1.000E+00 0.000E+00 0.000E+00
Xe-135m
GONADS     1.170E-14 5.455E-12 1.194E-11 2.530E-16-1.000E+00 0.000E+00 0.000E+00
BREAST     1.330E-14 5.325E-12 1.166E-11 2.470E-16-1.000E+00 0.000E+00 0.000E+00
LUNGS      1.130E-14 4.959E-12 1.086E-11 2.300E-16-1.000E+00 0.000E+00 0.000E+00
RED MARR   1.070E-14 4.959E-12 1.086E-11 2.300E-16-1.000E+00 0.000E+00 0.000E+00
BONE SUR   2.570E-14 9.120E-12 1.997E-11 4.230E-16-1.000E+00 0.000E+00 0.000E+00
THYROID    1.180E-14 5.023E-12 1.100E-11 2.330E-16-1.000E+00 0.000E+00 0.000E+00
REMAINDER  1.080E-14 4.829E-12 1.058E-11 2.240E-16-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE  1.190E-14 5.217E-12 1.142E-11 2.420E-16-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)  3.120E-14 4.506E-11 9.867E-11 2.090E-15-1.000E+00 0.000E+00 0.000E+00
Xe-137
GONADS     1.170E-14 5.455E-12 1.194E-11 2.530E-16-1.000E+00 0.000E+00 0.000E+00
BREAST     1.330E-14 5.325E-12 1.166E-11 2.470E-16-1.000E+00 0.000E+00 0.000E+00
LUNGS      1.130E-14 4.959E-12 1.086E-11 2.300E-16-1.000E+00 0.000E+00 0.000E+00
RED MARR   1.070E-14 4.959E-12 1.086E-11 2.300E-16-1.000E+00 0.000E+00 0.000E+00
BONE SUR   2.570E-14 9.120E-12 1.997E-11 4.230E-16-1.000E+00 0.000E+00 0.000E+00
THYROID    1.180E-14 5.023E-12 1.100E-11 2.330E-16-1.000E+00 0.000E+00 0.000E+00
REMAINDER  1.080E-14 4.829E-12 1.058E-11 2.240E-16-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE  1.190E-14 5.217E-12 1.142E-11 2.420E-16-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)  3.120E-14 4.506E-11 9.867E-11 2.090E-15-1.000E+00 0.000E+00 0.000E+00
Xe-138
GONADS     1.170E-14 5.455E-12 1.194E-11 2.530E-16-1.000E+00 0.000E+00 0.000E+00
BREAST     1.330E-14 5.325E-12 1.166E-11 2.470E-16-1.000E+00 0.000E+00 0.000E+00
LUNGS      1.130E-14 4.959E-12 1.086E-11 2.300E-16-1.000E+00 0.000E+00 0.000E+00
RED MARR   1.070E-14 4.959E-12 1.086E-11 2.300E-16-1.000E+00 0.000E+00 0.000E+00
BONE SUR   2.570E-14 9.120E-12 1.997E-11 4.230E-16-1.000E+00 0.000E+00 0.000E+00
THYROID    1.180E-14 5.023E-12 1.100E-11 2.330E-16-1.000E+00 0.000E+00 0.000E+00
REMAINDER  1.080E-14 4.829E-12 1.058E-11 2.240E-16-1.000E+00 0.000E+00 0.000E+00
EFFECTIVE  1.190E-14 5.217E-12 1.142E-11 2.420E-16-1.000E+00 0.000E+00 0.000E+00
SKIN(FGR)  3.120E-14 4.506E-11 9.867E-11 2.090E-15-1.000E+00 0.000E+00 0.000E+00
Cs-134
GONADS     7.400E-14 4.607E-11 9.646E-10 1.600E-15-1.000E+00 1.300E-08 2.060E-08
BREAST     8.430E-14 4.406E-11 9.224E-10 1.530E-15-1.000E+00 1.080E-08 1.720E-08
LUNGS      7.370E-14 4.204E-11 8.802E-10 1.460E-15-1.000E+00 1.180E-08 1.760E-08
RED MARR   7.190E-14 4.262E-11 8.922E-10 1.480E-15-1.000E+00 1.180E-08 1.870E-08
BONE SUR   1.200E-13 6.105E-11 1.278E-09 2.120E-15-1.000E+00 1.100E-08 1.740E-08
THYROID    7.570E-14 4.377E-11 9.163E-10 1.520E-15-1.000E+00 1.110E-08 1.760E-08
REMAINDER  7.060E-14 4.147E-11 8.681E-10 1.440E-15-1.000E+00 1.390E-08 2.210E-08
EFFECTIVE  7.570E-14 4.377E-11 9.163E-10 1.520E-15-1.000E+00 1.250E-08 1.980E-08
SKIN(FGR)  9.450E-14 6.249E-11 1.308E-09 2.170E-15-1.000E+00 0.000E+00 0.000E+00
Cs-136
GONADS     1.040E-13 6.223E-11 1.102E-09 2.180E-15-1.000E+00 1.880E-09 3.040E-09
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BREAST	1.180E-13	5.966E-11	1.056E-09	2.090E-15-1.000E+00	1.670E-09	2.650E-09
LUNGS	1.040E-13	5.710E-11	1.011E-09	2.000E-15-1.000E+00	2.320E-09	2.620E-09
RED MARR	1.010E-13	5.824E-11	1.031E-09	2.040E-15-1.000E+00	1.860E-09	2.950E-09
BONE SUR	1.660E-13	8.422E-11	1.491E-09	2.950E-15-1.000E+00	1.700E-09	2.710E-09
THYROID	1.070E-13	5.852E-11	1.036E-09	2.050E-15-1.000E+00	1.730E-09	2.740E-09
REMAINDER	9.950E-14	5.652E-11	1.001E-09	1.980E-15-1.000E+00	2.190E-09	3.520E-09
EFFECTIVE	1.060E-13	5.966E-11	1.056E-09	2.090E-15-1.000E+00	1.980E-09	3.040E-09
SKIN(FGR)	1.250E-13	7.251E-11	1.284E-09	2.540E-15-1.000E+00	0.000E+00	0.000E+00
Cs-137						
GONADS	2.669E-14	1.669E-11	3.530E-10	5.840E-16-1.000E+00	8.760E-09	1.390E-08
BREAST	3.047E-14	1.596E-11	3.376E-10	5.585E-16-1.000E+00	7.840E-09	1.240E-08
LUNGS	2.649E-14	1.517E-11	3.209E-10	5.309E-16-1.000E+00	8.820E-09	1.270E-08
RED MARR	2.583E-14	1.542E-11	3.260E-10	5.394E-16-1.000E+00	8.300E-09	1.320E-08
BONE SUR	4.382E-14	2.238E-11	4.734E-10	7.832E-16-1.000E+00	7.940E-09	1.260E-08
THYROID	2.725E-14	1.588E-11	3.358E-10	5.556E-16-1.000E+00	7.930E-09	1.260E-08
REMAINDER	2.536E-14	1.490E-11	3.152E-10	5.215E-16-1.000E+00	9.120E-09	1.450E-08
EFFECTIVE	2.725E-14	1.585E-11	3.353E-10	5.546E-16-1.000E+00	8.630E-09	1.350E-08
SKIN(FGR)	4.392E-14	5.253E-11	1.110E-09	1.836E-15-1.000E+00	0.000E+00	0.000E+00
Ba-137m						
GONADS	2.669E-14	1.669E-11	3.530E-10	5.840E-16-1.000E+00	8.760E-09	1.390E-08
BREAST	3.047E-14	1.596E-11	3.376E-10	5.585E-16-1.000E+00	7.840E-09	1.240E-08
LUNGS	2.649E-14	1.517E-11	3.209E-10	5.309E-16-1.000E+00	8.820E-09	1.270E-08
RED MARR	2.583E-14	1.542E-11	3.260E-10	5.394E-16-1.000E+00	8.300E-09	1.320E-08
BONE SUR	4.382E-14	2.238E-11	4.734E-10	7.832E-16-1.000E+00	7.940E-09	1.260E-08
THYROID	2.725E-14	1.588E-11	3.358E-10	5.556E-16-1.000E+00	7.930E-09	1.260E-08
REMAINDER	2.536E-14	1.490E-11	3.152E-10	5.215E-16-1.000E+00	9.120E-09	1.450E-08
EFFECTIVE	2.725E-14	1.585E-11	3.353E-10	5.546E-16-1.000E+00	8.630E-09	1.350E-08
SKIN(FGR)	4.392E-14	5.253E-11	1.110E-09	1.836E-15-1.000E+00	0.000E+00	0.000E+00
Ba-139						
GONADS	2.130E-15	3.368E-13	3.429E-13	4.790E-17-1.000E+00	2.560E-12	1.560E-12
BREAST	2.450E-15	3.297E-13	3.357E-13	4.690E-17-1.000E+00	2.460E-12	5.170E-13
LUNGS	2.030E-15	3.002E-13	3.057E-13	4.270E-17-1.000E+00	2.530E-10	3.890E-13
RED MARR	1.870E-15	2.932E-13	2.985E-13	4.170E-17-1.000E+00	3.410E-12	8.590E-13
BONE SUR	5.290E-15	6.841E-13	6.965E-13	9.730E-17-1.000E+00	2.490E-12	4.380E-13
THYROID	2.130E-15	3.044E-13	3.100E-13	4.330E-17-1.000E+00	2.400E-12	2.660E-13
REMAINDER	1.920E-15	2.932E-13	2.985E-13	4.170E-17-1.000E+00	4.820E-11	3.570E-10
EFFECTIVE	2.170E-15	3.227E-13	3.286E-13	4.590E-17-1.000E+00	4.640E-11	1.080E-10
SKIN(FGR)	6.160E-14	7.241E-11	7.373E-11	1.030E-14-1.000E+00	0.000E+00	0.000E+00
Ba-140						
GONADS	8.410E-15	5.451E-12	9.607E-11	1.910E-16-1.000E+00	4.300E-10	9.960E-10
BREAST	9.640E-15	5.280E-12	9.305E-11	1.850E-16-1.000E+00	2.870E-10	1.590E-10
LUNGS	8.270E-15	4.852E-12	8.550E-11	1.700E-16-1.000E+00	1.660E-09	6.630E-11
RED MARR	7.930E-15	4.880E-12	8.601E-11	1.710E-16-1.000E+00	1.290E-09	4.390E-10
BONE SUR	1.550E-14	8.020E-12	1.413E-10	2.810E-16-1.000E+00	2.410E-09	5.530E-10
THYROID	8.530E-15	5.109E-12	9.003E-11	1.790E-16-1.000E+00	2.560E-10	5.250E-11
REMAINDER	7.890E-15	4.766E-12	8.399E-11	1.670E-16-1.000E+00	1.410E-09	7.370E-09
EFFECTIVE	8.580E-15	5.137E-12	9.053E-11	1.800E-16-1.000E+00	1.010E-09	2.560E-09
SKIN(FGR)	2.520E-14	5.565E-11	9.808E-10	1.950E-15-1.000E+00	0.000E+00	0.000E+00
La-140						
GONADS	1.140E-13	6.027E-11	4.425E-10	2.240E-15-1.000E+00	4.540E-10	1.340E-09
BREAST	1.290E-13	5.758E-11	4.228E-10	2.140E-15-1.000E+00	1.450E-10	1.800E-10
LUNGS	1.150E-13	5.596E-11	4.109E-10	2.080E-15-1.000E+00	4.210E-09	4.010E-11
RED MARR	1.140E-13	5.731E-11	4.208E-10	2.130E-15-1.000E+00	2.140E-10	2.810E-10
BONE SUR	1.690E-13	7.776E-11	5.709E-10	2.890E-15-1.000E+00	1.410E-10	9.770E-11
THYROID	1.180E-13	5.462E-11	4.010E-10	2.030E-15-1.000E+00	6.870E-11	6.400E-12
REMAINDER	1.110E-13	5.569E-11	4.089E-10	2.070E-15-1.000E+00	2.120E-09	6.260E-09
EFFECTIVE	1.170E-13	5.812E-11	4.267E-10	2.160E-15-1.000E+00	1.310E-09	2.280E-09
SKIN(FGR)	1.660E-13	2.217E-10	1.628E-09	8.240E-15-1.000E+00	0.000E+00	0.000E+00

La-141					
GONADS	2.330E-15	7.315E-13	9.675E-13	4.740E-17-1.000E+00	1.010E-11	3.770E-12
BREAST	2.640E-15	7.007E-13	9.267E-13	4.540E-17-1.000E+00	9.840E-12	7.070E-13
LUNGS	2.340E-15	6.713E-13	8.879E-13	4.350E-17-1.000E+00	6.460E-10	2.720E-13
RED MARR	2.310E-15	6.852E-13	9.063E-13	4.440E-17-1.000E+00	2.930E-11	1.070E-12
BONE SUR	3.490E-15	9.923E-13	1.312E-12	6.430E-17-1.000E+00	1.200E-10	6.060E-13
THYROID	2.390E-15	6.590E-13	8.716E-13	4.270E-17-1.000E+00	9.400E-12	5.290E-14
REMAINDER	2.260E-15	6.682E-13	8.838E-13	4.330E-17-1.000E+00	2.280E-10	1.240E-09
EFFECTIVE	2.390E-15	7.007E-13	9.267E-13	4.540E-17-1.000E+00	1.570E-10	3.740E-10
SKIN(FGR)	6.580E-14	1.667E-10	2.204E-10	1.080E-14-1.000E+00	0.000E+00	0.000E+00
La-142						
GONADS	1.400E-13	1.978E-11	2.034E-11	2.540E-15-1.000E+00	1.660E-11	6.990E-11
BREAST	1.570E-13	1.885E-11	1.938E-11	2.420E-15-1.000E+00	1.130E-11	1.540E-11
LUNGS	1.420E-13	1.846E-11	1.898E-11	2.370E-15-1.000E+00	3.010E-10	8.400E-12
RED MARR	1.420E-13	1.900E-11	1.954E-11	2.440E-15-1.000E+00	1.360E-11	1.930E-11
BONE SUR	1.950E-13	2.484E-11	2.554E-11	3.190E-15-1.000E+00	1.110E-11	7.400E-12
THYROID	1.450E-13	1.768E-11	1.818E-11	2.270E-15-1.000E+00	8.740E-12	1.160E-12
REMAINDER	1.380E-13	1.853E-11	1.906E-11	2.380E-15-1.000E+00	8.070E-11	5.200E-10
EFFECTIVE	1.440E-13	1.916E-11	1.970E-11	2.460E-15-1.000E+00	6.840E-11	1.790E-10
SKIN(FGR)	2.160E-13	9.111E-11	9.368E-11	1.170E-14-1.000E+00	0.000E+00	0.000E+00
Ce-141						
GONADS	3.380E-15	2.213E-12	4.332E-11	7.710E-17-1.000E+00	5.540E-11	1.080E-10
BREAST	3.930E-15	2.170E-12	4.247E-11	7.560E-17-1.000E+00	4.460E-11	1.110E-11
LUNGS	3.170E-15	1.951E-12	3.820E-11	6.800E-17-1.000E+00	1.670E-08	1.430E-12
RED MARR	2.830E-15	1.860E-12	3.641E-11	6.480E-17-1.000E+00	8.960E-11	3.390E-11
BONE SUR	9.410E-15	5.166E-12	1.011E-10	1.800E-16-1.000E+00	2.540E-10	2.300E-11
THYROID	3.350E-15	2.003E-12	3.922E-11	6.980E-17-1.000E+00	2.550E-11	1.800E-13
REMAINDER	2.980E-15	1.894E-12	3.708E-11	6.600E-17-1.000E+00	1.260E-09	2.500E-09
EFFECTIVE	3.430E-15	2.118E-12	4.146E-11	7.380E-17-1.000E+00	2.420E-09	7.830E-10
SKIN(FGR)	1.020E-14	3.788E-12	7.416E-11	1.320E-16-1.000E+00	0.000E+00	0.000E+00
Ce-143						
GONADS	1.280E-14	7.900E-12	4.958E-11	2.980E-16-1.000E+00	7.530E-11	2.120E-10
BREAST	1.470E-14	7.688E-12	4.825E-11	2.900E-16-1.000E+00	1.660E-11	2.320E-11
LUNGS	1.230E-14	6.893E-12	4.325E-11	2.600E-16-1.000E+00	3.880E-09	3.820E-12
RED MARR	1.170E-14	6.787E-12	4.259E-11	2.560E-16-1.000E+00	2.960E-11	5.070E-11
BONE SUR	2.520E-14	1.323E-11	8.302E-11	4.990E-16-1.000E+00	1.640E-11	1.610E-11
THYROID	1.280E-14	7.211E-12	4.525E-11	2.720E-16-1.000E+00	6.230E-12	4.350E-13
REMAINDER	1.170E-14	6.734E-12	4.226E-11	2.540E-16-1.000E+00	1.420E-09	3.890E-09
EFFECTIVE	1.290E-14	7.396E-12	4.642E-11	2.790E-16-1.000E+00	9.160E-10	1.230E-09
SKIN(FGR)	3.960E-14	1.058E-10	6.638E-10	3.990E-15-1.000E+00	0.000E+00	0.000E+00
Ce-144						
GONADS	2.725E-15	6.328E-13	1.319E-11	6.088E-17-1.000E+00	2.390E-10	6.987E-11
BREAST	3.129E-15	6.274E-13	1.307E-11	5.922E-17-1.000E+00	3.480E-10	1.223E-11
LUNGS	2.639E-15	5.228E-13	1.089E-11	5.362E-17-1.000E+00	7.911E-07	6.551E-12
RED MARR	2.507E-15	4.755E-13	9.907E-12	5.247E-17-1.000E+00	2.880E-09	8.923E-11
BONE SUR	5.441E-15	1.646E-12	3.429E-11	1.127E-16-1.000E+00	4.720E-09	1.280E-10
THYROID	2.753E-15	5.529E-13	1.152E-11	5.418E-17-1.000E+00	2.920E-10	5.154E-12
REMAINDER	2.534E-15	5.086E-13	1.060E-11	5.283E-17-1.000E+00	1.910E-08	1.890E-08
EFFECTIVE	2.773E-15	5.909E-13	1.231E-11	5.766E-17-1.000E+00	1.010E-07	5.711E-09
SKIN(FGR)	8.574E-14	7.648E-13	1.594E-11	1.250E-14-1.000E+00	0.000E+00	0.000E+00
Pr-143						
GONADS	2.130E-17	2.264E-14	4.032E-13	7.930E-19-1.000E+00	4.370E-18	8.990E-18
BREAST	2.550E-17	2.330E-14	4.149E-13	8.160E-19-1.000E+00	2.220E-18	1.090E-18
LUNGS	1.860E-17	1.642E-14	2.923E-13	5.750E-19-1.000E+00	1.330E-08	1.910E-19
RED MARR	1.620E-17	1.493E-14	2.659E-13	5.230E-19-1.000E+00	1.480E-11	1.030E-12
BONE SUR	5.930E-17	5.454E-14	9.711E-13	1.910E-18-1.000E+00	1.490E-11	1.030E-12
THYROID	2.050E-17	1.802E-14	3.208E-13	6.310E-19-1.000E+00	1.680E-18	2.660E-20
REMAINDER	1.760E-17	1.642E-14	2.923E-13	5.750E-19-1.000E+00	1.970E-09	4.220E-09

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EFFECTIVE  2.100E-17 2.002E-14 3.564E-13 7.010E-19-1.000E+00 2.190E-09 1.270E-09
SKIN(FGR)  1.760E-14 5.711E-11 1.017E-09 2.000E-15-1.000E+00 0.000E+00 0.000E+00
Nd-147
GONADS     6.130E-15 4.218E-12 7.235E-11 1.480E-16-1.000E+00 8.410E-11 1.790E-10
BREAST     7.120E-15 4.132E-12 7.088E-11 1.450E-16-1.000E+00 3.450E-11 1.870E-11
LUNGS      5.820E-15 3.648E-12 6.257E-11 1.280E-16-1.000E+00 1.060E-08 2.440E-12
RED MARR   5.400E-15 3.505E-12 6.013E-11 1.230E-16-1.000E+00 9.190E-11 5.050E-11
BONE SUR   1.320E-14 8.265E-12 1.418E-10 2.900E-16-1.000E+00 3.260E-10 2.220E-11
THYROID    6.120E-15 3.876E-12 6.648E-11 1.360E-16-1.000E+00 1.820E-11 2.640E-13
REMAINDER  5.530E-15 3.562E-12 6.111E-11 1.250E-16-1.000E+00 1.760E-09 3.760E-09
EFFECTIVE  6.190E-15 3.961E-12 6.795E-11 1.390E-16-1.000E+00 1.850E-09 1.180E-09
SKIN(FGR)  1.950E-14 3.135E-11 5.377E-10 1.100E-15-1.000E+00 0.000E+00 0.000E+00
Np-239
GONADS     7.530E-15 4.691E-12 4.380E-11 1.710E-16-1.000E+00 7.450E-11 1.620E-10
BREAST     8.730E-15 4.636E-12 4.329E-11 1.690E-16-1.000E+00 1.630E-11 1.720E-11
LUNGS      7.180E-15 4.115E-12 3.842E-11 1.500E-16-1.000E+00 2.360E-09 2.400E-12
RED MARR   6.500E-15 4.005E-12 3.740E-11 1.460E-16-1.000E+00 2.080E-10 4.660E-11
BONE SUR   2.000E-14 1.001E-11 9.349E-11 3.650E-16-1.000E+00 2.030E-09 3.590E-11
THYROID    7.520E-15 4.197E-12 3.919E-11 1.530E-16-1.000E+00 7.620E-12 2.070E-13
REMAINDER  6.760E-15 4.005E-12 3.740E-11 1.460E-16-1.000E+00 9.590E-10 2.770E-09
EFFECTIVE  7.690E-15 4.471E-12 4.175E-11 1.630E-16-1.000E+00 6.780E-10 8.820E-10
SKIN(FGR)  1.600E-14 7.215E-12 6.737E-11 2.630E-16-1.000E+00 0.000E+00 0.000E+00
Pu-238
GONADS     6.560E-18 4.291E-14 9.011E-13 1.490E-18-1.000E+00 1.040E-05 2.330E-09
BREAST     1.270E-17 5.558E-14 1.167E-12 1.930E-18-1.000E+00 4.400E-10 1.800E-13
LUNGS      1.060E-18 2.267E-15 4.759E-14 7.870E-20-1.000E+00 3.200E-04 8.640E-14
RED MARR   1.680E-18 5.587E-15 1.173E-13 1.940E-19-1.000E+00 5.800E-05 1.270E-08
BONE SUR   9.300E-18 3.514E-14 7.378E-13 1.220E-18-1.000E+00 7.250E-04 1.580E-07
THYROID    4.010E-18 9.792E-15 2.056E-13 3.400E-19-1.000E+00 3.860E-10 7.990E-14
REMAINDER  1.990E-18 9.216E-15 1.935E-13 3.200E-19-1.000E+00 2.740E-05 2.180E-08
EFFECTIVE  4.880E-18 2.413E-14 5.068E-13 8.380E-19-1.000E+00 7.790E-05 1.340E-08
SKIN(FGR)  4.090E-17 2.776E-13 5.830E-12 9.640E-18-1.000E+00 0.000E+00 0.000E+00
Pu-239
GONADS     4.840E-18 1.768E-14 3.713E-13 6.140E-19-1.000E+00 1.200E-05 2.640E-09
BREAST     7.550E-18 2.238E-14 4.699E-13 7.770E-19-1.000E+00 3.990E-10 1.210E-13
LUNGS      2.650E-18 2.267E-15 4.760E-14 7.870E-20-1.000E+00 3.230E-04 7.890E-14
RED MARR   2.670E-18 3.456E-15 7.258E-14 1.200E-19-1.000E+00 6.570E-05 1.410E-08
BONE SUR   9.470E-18 1.673E-14 3.514E-13 5.810E-19-1.000E+00 8.210E-04 1.760E-07
THYROID    3.880E-18 5.126E-15 1.077E-13 1.780E-19-1.000E+00 3.750E-10 7.500E-14
REMAINDER  2.860E-18 4.838E-15 1.016E-13 1.680E-19-1.000E+00 3.020E-05 2.120E-08
EFFECTIVE  4.240E-18 1.057E-14 2.220E-13 3.670E-19-1.000E+00 8.330E-05 1.400E-08
SKIN(FGR)  1.860E-17 1.057E-13 2.220E-12 3.670E-18-1.000E+00 0.000E+00 0.000E+00
```

Oyster Creek RADTRAD release fraction and timing (.rft) file

File oc.rft

```
Release Fraction and Timing Name:
Oyster Creek  NUREG-1465
 Duration (h): Design Basis Accident
  0.008E+00   0.5000E+00  0.1500E+01  0.0000E+00
 Noble Gases:
  0.0000E+00  0.5000E-01  0.9500E+00  0.0000E+00
 Iodine:
  0.0000E+00  0.5000E-01  0.2500E+00  0.0000E+00
 Cesium:
  0.0000E+00  0.5000E-01  0.2000E+00  0.0000E+00
 Tellurium:
  0.0000E+00  0.0000E+00  0.5000E-01  0.0000E+00
 Strontium:
  0.0000E+00  0.0000E+00  0.2000E-01  0.0000E+00
 Barium:
  0.0000E+00  0.0000E+00  0.2000E-01  0.0000E+00
 Ruthenium:
  0.0000E+00  0.0000E+00  0.2500E-02  0.0000E+00
 Cerium:
  0.0000E+00  0.0000E+00  0.5000E-03  0.0000E+00
 Lanthanum:
  0.0000E+00  0.0000E+00  0.2000E-03  0.0000E+00
 Non-Radioactive Aerosols (kg):
  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 End of Release File
```

Oyster Creek RADTRAD nuclide inventory (.nif) files

File oc60.nif **(General Leakage Inventory)**

```
Nuclide Inventory Name:
 OC general
 Power Level:
  0.1000E+01
 Nuclides:
  60
 Nuclide 001:
 Kr-83m
   1
  0.6696E+04
  0.8300E+02
  0.4150E+04
 none     0.0000E+00
 none     0.0000E+00
 none     0.0000E+00
 Nuclide 002:
 Kr-85m
   1
  0.1612800000E+05
  0.8500E+02
  6.94E+03
 Kr-85    0.2100E+00
 none     0.0000E+00
 none     0.0000E+00
Nuclide 003:
 Kr-85
   1
  0.338613048E+09
  0.8500E+02
  4.03E+02
 none     0.0000E+00
 none     0.0000E+00
 none     0.0000E+00
 Nuclide 004:
 Kr-87
   1
  0.4578000000E+04
  0.8700E+02
  1.29E+04
 Rb-87    0.1000E+01
 none     0.0000E+00
 none     0.0000E+00
 Nuclide 005:
 Kr-88
   1
  0.1022400000E+05
  0.8800E+02
  1.83E+04
 Rb-88    0.1000E+01
 none     0.0000E+00
 none     0.0000E+00
 Nuclide 006:
 Kr-89
```

```
  1
 0.1896E+03
 0.8900E+02
 3.98E+04
Sr-89    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 007:
Rb-86
  3
 0.1612224000E+07
 0.8600E+02
 0.403E+02
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 008:
Sr-89
  5
 0.4363200000E+07
 0.8900E+02
 3.99E+03
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 009:
Sr-90
  5
 0.9189573120E+09
 0.9000E+02
 6.12E+02
Y-90     0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 010:
Sr-91
  5
 0.3420000000E+05
 0.9100E+02
 1.75E+04
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
 2.61E+04
Y-92     0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 012:
Y-90
  9
 0.2304000000E+06
 0.9000E+02
 3.42E+03
```

```
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 013:
Y-91
  9
 0.5055264000E+07
 0.9100E+02
 3.27E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 014:
Y-92
  9
 0.1274400000E+05
 0.9200E+02
 3.37E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 015:
Y-93
  9
 0.3636000000E+05
 0.9300E+02
 3.87E+04
Zr-93     0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 016:
Zr-95
  9
 0.5527872000E+07
 0.9500E+02
 4.42E+04
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
 4.37E+04
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
 4.46E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 019:
```

```
Mo-99
  7
 0.2376000000E+06
 0.9900E+02
 4.70E+04
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
 4.11E+04
Tc-99    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 021:
Ru-103
  7
 0.3393792000E+07
 0.1030E+03
 3.98E+04
Rh-103m  0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 022:
Ru-105
  7
 0.1598400000E+05
 0.1050E+03
 2.57E+04
Rh-105   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 023:
Ru-106
  7
 0.3181248000E+08
 0.1060E+03
 1.41E+04
Rh-106   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 024:
Rh-105
  7
 0.1272960000E+06
 0.1050E+03
 2.49E+04
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 025:
Sb-127
  4
 0.3326400000E+06
 0.1270E+03
```

```
 2.33E+03
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
 0.803E+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
 2.32E+03
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 028:
Te-127m
  4
 0.9417600000E+07
 0.1270E+03
 3.12E+02
Te-127   0.9800E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 029:
Te-129
  4
 0.4176000000E+04
 0.1290E+03
 7.93E+03
I-129    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 030:
Te-129m
  4
 0.2903040000E+07
 0.1290E+03
 1.21E+03
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
 3.77E+03
Te-131   0.2200E+00
I-131    0.7800E+00
none     0.0000E+00
```

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Nuclide 032:
Te-132
  4
 0.2815200000E+06
 0.1320E+03
 3.60E+04
I-132    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 033:
I-131
  2
 0.6946560000E+06
 0.1310E+03
 2.51E+04
Xe-131m  0.1100E-01
none     0.0000E+00
none     0.0000E+00
Nuclide 034:
I-132
  2
 0.8280000000E+04
 0.1320E+03
 3.66E+04
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 035:
I-133
  2
 0.7488000000E+05
 0.1330E+03
 5.18E+04
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
 5.60E+04
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 037:
I-135
  2
 0.2379600000E+05
 0.1350E+03
 4.82E+04
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
  5.23E+04
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
Nuclide 039:
 Xe-133m
   1
  0.1926720000E+06
  0.1330E+03
  1.38E+03
 Xe-133    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
Nuclide 040:
 Xe-135
   1
  0.3272400000E+05
  0.1350E+03
  1.81E+04
 Cs-135    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 041:
 Xe-135m
   1
  0.91800000E+03
  0.1350E+03
  1.56E+04
 Xe-135    0.9940E+00
 Cs-135    0.6000E-03
 none      0.0000E+00
Nuclide 042:
 Xe-137
   1
  0.230400000E+03
  0.1370E+03
  5.10E+04
 Cs-137    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
Nuclide 043:
 Xe-138
   1
  0.85200000E+03
  0.1380E+03
  4.78E+04
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
Nuclide 044:
 Cs-134
   3
  0.6507177120E+08
  0.1340E+03
  4.83E+03
 none      0.0000E+00
 none      0.0000E+00
```

```
 none      0.0000E+00
 Nuclide 045:
 Cs-136
   3
  0.1131840000E+07
  0.1360E+03
  1.39E+03
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 046:
 Cs-137
   3
  0.9467280000E+09
  0.1370E+03
  4.56E+03
 Ba-137m  0.9500E+00
 none      0.0000E+00
 none      0.0000E+00
Nuclide 047:
 Ba-137m
   3
  0.15300000E+03
  0.1370E+03
  1.81E+03
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 048:
 Ba-139
   6
  0.4962000000E+04
  0.1390E+03
  4.61E+04
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 049:
 Ba-140
   6
  0.1100736000E+07
  0.1400E+03
  4.51E+04
 La-140   0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 050:
 La-140
   9
  0.1449792000E+06
  0.1400E+03
  4.63E+04
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 051:
 La-141
   9
```

```
 0.1414800000E+05
 0.1410E+03
 4.26E+04
Ce-141    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 052:
La-142
  9
 0.5550000000E+04
 0.1420E+03
 4.12E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 053:
Ce-141
  8
 0.2808086400E+07
 0.1410E+03
 4.31E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 054:
Ce-143
  8
 0.1188000000E+06
 0.1430E+03
 3.98E+04
Pr-143    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 055:
Ce-144
  8
 0.2456352000E+08
 0.1440E+03
 3.48E+04
Pr-144m   0.1800E-01
Pr-144    0.9800E+00
none      0.0000E+00
Nuclide 056:
Pr-143
  9
 0.1171584000E+07
 0.1430E+03
 3.97E+04
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 057:
Nd-147
  9
 0.9486720000E+06
 0.1470E+03
 1.68E+04
Pm-147    0.1000E+01
```

```
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 058:
 Np-239
   8
  0.2034720000E+06
  0.2390E+03
  5.07E+05
 Pu-239    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
Nuclide 059:
 Pu-238
   8
  0.2768863824E+10
  0.2380E+03
  1.04E+02
 U-234     0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 060:
 Pu-239
   8
  0.7594336440E+12
  0.2390E+03
  1.43E+01
 U-235     0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 End of Nuclear Inventory File
```

File ocesf.nif (**ESF Leakage Inventory**)

```
Nuclide Inventory Name:
 OC esf
 Power Level:
  0.1000E+01
 Nuclides:
  60
 Nuclide 001:
 Kr-83m
   1
  0.6696E+04
  0.8300E+02
  0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 002:
 Kr-85m
   1
  0.1612800000E+05
  0.8500E+02
  0.0000E+00
 Kr-85     0.2100E+00
 none      0.0000E+00
 none      0.0000E+00
Nuclide 003:
 Kr-85
   1
  0.338613048E+09
  0.8500E+02
  0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 004:
 Kr-87
   1
  0.4578000000E+04
  0.8700E+02
  0.0000E+00
 Rb-87     0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 005:
 Kr-88
   1
  0.1022400000E+05
  0.8800E+02
  0.0000E+00
 Rb-88     0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 006:
 Kr-89
   1
  0.1896E+03
  0.8900E+02
```

```
  0.0000E+00
Sr-89    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 007:
Rb-86
   3
  0.1612224000E+07
  0.8600E+02
  0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 008:
Sr-89
   5
  0.4363200000E+07
  0.8900E+02
  0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 009:
Sr-90
   5
  0.9189573120E+09
  0.9000E+02
  0.0000E+00
Y-90     0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 010:
Sr-91
   5
  0.3420000000E+05
  0.9100E+02
  0.0000E+00
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
  0.0000E+00
Y-92     0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 012:
Y-90
   9
  0.2304000000E+06
  0.9000E+02
  0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
```

```
Nuclide 013:
Y-91
  9
 0.5055264000E+07
 0.9100E+02
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 014:
Y-92
  9
 0.1274400000E+05
 0.9200E+02
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 015:
Y-93
  9
 0.3636000000E+05
 0.9300E+02
 0.0000E+00
Zr-93    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 016:
Zr-95
  9
 0.5527872000E+07
 0.9500E+02
 0.0000E+00
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
 0.0000E+00
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
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 019:
Mo-99
  7
 0.2376000000E+06
```

```
 0.9900E+02
 0.0000E+00
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
 0.0000E+00
Tc-99    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 021:
Ru-103
  7
 0.3393792000E+07
 0.1030E+03
 0.0000E+00
Rh-103m  0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 022:
Ru-105
  7
 0.1598400000E+05
 0.1050E+03
 0.0000E+00
Rh-105   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 023:
Ru-106
  7
 0.3181248000E+08
 0.1060E+03
 0.0000E+00
Rh-106   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 024:
Rh-105
  7
 0.1272960000E+06
 0.1050E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 025:
Sb-127
  4
 0.3326400000E+06
 0.1270E+03
 0.0000E+00
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
 0.0000E+00
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
 0.0000E+00
none      0.0000E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 028:
Te-127m
  4
 0.9417600000E+07
 0.1270E+03
 0.0000E+00
Te-127   0.9800E+00
none      0.0000E+00
none      0.0000E+00
Nuclide 029:
Te-129
  4
 0.4176000000E+04
 0.1290E+03
 0.0000E+00
I-129    0.1000E+01
none      0.0000E+00
none      0.0000E+00
Nuclide 030:
Te-129m
  4
 0.2903040000E+07
 0.1290E+03
 0.0000E+00
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
 0.0000E+00
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
 0.0000E+00
I-132    0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 033:
I-131
  2
 0.6946560000E+06
 0.1310E+03
 5.02E+04
Xe-131m  0.1100E-01
none     0.0000E+00
none     0.0000E+00
Nuclide 034:
I-132
  2
 0.8280000000E+04
 0.1320E+03
 7.32E+04
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 035:
I-133
  2
 0.7488000000E+05
 0.1330E+03
 1.04E+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
 1.12E+05
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 037:
I-135
  2
 0.2379600000E+05
 0.1350E+03
 9.64E+04
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
 0.0000E+00
none     0.0000E+00
```

```
 none      0.0000E+00
 none      0.0000E+00
Nuclide 039:
 Xe-133m
   1
  0.1926720000E+06
  0.1330E+03
  0.0000E+00
 Xe-133    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
Nuclide 040:
 Xe-135
   1
  0.3272400000E+05
  0.1350E+03
  0.0000E+00
 Cs-135    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 041:
 Xe-135m
   1
  0.91800000E+03
  0.1350E+03
  0.0000E+00
 Xe-135    0.9940E+00
 Cs-135    0.6000E-03
 none      0.0000E+00
Nuclide 042:
 Xe-137
   1
  0.230400000E+03
  0.1370E+03
  0.0000E+00
 Cs-137    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
Nuclide 043:
 Xe-138
   1
  0.85200000E+03
  0.1380E+03
  0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
Nuclide 044:
 Cs-134
   3
  0.6507177120E+08
  0.1340E+03
  0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 045:
 Cs-136
```

```
   3
  0.1131840000E+07
  0.1360E+03
  0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 046:
 Cs-137
   3
  0.9467280000E+09
  0.1370E+03
  0.0000E+00
 Ba-137m  0.9500E+00
 none      0.0000E+00
 none      0.0000E+00
Nuclide 047:
 Ba-137m
   3
  0.15300000E+03
  0.1370E+03
  0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 048:
 Ba-139
   6
  0.4962000000E+04
  0.1390E+03
  0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 049:
 Ba-140
   6
  0.1100736000E+07
  0.1400E+03
  0.0000E+00
 La-140    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 050:
 La-140
   9
  0.1449792000E+06
  0.1400E+03
  0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 051:
 La-141
   9
  0.1414800000E+05
  0.1410E+03
  0.0000E+00
```

```
Ce-141   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 052:
La-142
  9
 0.5550000000E+04
 0.1420E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 053:
Ce-141
  8
 0.2808086400E+07
 0.1410E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 054:
Ce-143
  8
 0.1188000000E+06
 0.1430E+03
 0.0000E+00
Pr-143   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 055:
Ce-144
  8
 0.2456352000E+08
 0.1440E+03
 0.0000E+00
Pr-144m  0.1800E-01
Pr-144   0.9800E+00
none     0.0000E+00
Nuclide 056:
Pr-143
  9
 0.1171584000E+07
 0.1430E+03
 0.0000E+00
none     0.0000E+00
none     0.0000E+00
none     0.0000E+00
Nuclide 057:
Nd-147
  9
 0.9486720000E+06
 0.1470E+03
 0.0000E+00
Pm-147   0.1000E+01
none     0.0000E+00
none     0.0000E+00
Nuclide 058:
```

```
 Np-239
   8
  0.2034720000E+06
  0.2390E+03
  0.0000E+00
 Pu-239    0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
Nuclide 059:
 Pu-238
   8
  0.2768863824E+10
  0.2380E+03
  0.0000E+00
 U-234     0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 Nuclide 060:
 Pu-239
   8
  0.7594336440E+12
  0.2390E+03
  0.0000E+00
 U-235     0.1000E+01
 none      0.0000E+00
 none      0.0000E+00
 End of Nuclear Inventory File
```

RADTRAD Output Information
Oyster Creek RADTRAD output (.out) files (excerpts)

File 128dw1_env.out = Steam Line With MSIV Failed Open

```
                           Cumulative Dose Summary
                      CR                         EAB                        LPZ
Time   Thyroid        TEDE       Thyroid       TEDE      Thyroid       TEDE
(hr)    (rem)         (rem)       (rem)        (rem)      (rem)        (rem)
 0.000 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
 0.008 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
 0.166 1.2049E+00 5.3695E-02 7.2848E-01 3.7599E-02 3.7086E-02 1.9141E-03
 0.236 2.3433E+00 1.0473E-01 1.1162E+00 5.8197E-02 5.6824E-02 2.9628E-03
 0.394 3.0616E+00 1.3699E-01 1.2744E+00 6.7717E-02 6.4877E-02 3.4474E-03
 0.442 3.2030E+00 1.4334E-01 1.3446E+00 7.2227E-02 6.8454E-02 3.6770E-03
 0.465 3.2708E+00 1.4639E-01 1.3651E+00 7.3557E-02 6.9494E-02 3.7447E-03
 0.508 3.3979E+00 1.5210E-01 1.4252E+00 7.7176E-02 7.2555E-02 3.9290E-03
 0.512 3.4108E+00 1.5268E-01 1.4323E+00 7.7587E-02 7.2918E-02 3.9499E-03
 0.585 3.8473E+00 1.7288E-01 1.6799E+00 9.1944E-02 8.5522E-02 4.6808E-03
 0.702 6.3223E+00 2.9170E-01 2.9783E+00 1.6735E-01 1.5162E-01 8.5196E-03
 0.819 8.3083E+00 3.8821E-01 3.4565E+00 2.0402E-01 1.7597E-01 1.0387E-02
 0.934 8.7017E+00 4.0777E-01 3.5666E+00 2.1889E-01 1.8157E-01 1.1144E-02
 1.009 9.0055E+00 4.2293E-01 3.7445E+00 2.3530E-01 1.9063E-01 1.1979E-02
 1.129 1.0417E+01 4.9288E-01 4.4566E+00 2.8572E-01 2.2688E-01 1.4546E-02
 1.129 1.0419E+01 4.9296E-01 4.4585E+00 2.8584E-01 2.2698E-01 1.4552E-02
 1.296 1.3342E+01 6.3815E-01 5.5438E+00 3.8264E-01 2.8223E-01 1.9480E-02
 1.379 1.4106E+01 6.7642E-01 5.8546E+00 4.1870E-01 2.9805E-01 2.1316E-02
 1.463 1.4647E+01 7.0352E-01 6.0164E+00 4.3927E-01 3.0629E-01 2.2363E-02
 1.715 1.5809E+01 7.6212E-01 6.4808E+00 5.0685E-01 3.2993E-01 2.5803E-02
 1.965 1.6948E+01 8.1975E-01 6.9440E+00 5.8141E-01 3.5351E-01 2.9599E-02
 2.007 1.7142E+01 8.2959E-01 7.0230E+00 5.9472E-01 3.5753E-01 3.0277E-02
 2.008 1.7145E+01 8.2975E-01 7.0243E+00 5.9494E-01 3.5760E-01 3.0288E-02
 2.239 1.7748E+01 8.6052E-01 7.0243E+00 5.9494E-01 3.6791E-01 3.2600E-02
 2.490 1.7997E+01 8.7359E-01 7.0243E+00 5.9494E-01 3.7259E-01 3.4496E-02
 2.740 1.8137E+01 8.8114E-01 7.0243E+00 5.9494E-01 3.7532E-01 3.6182E-02
 2.803 1.8165E+01 8.8267E-01 7.0243E+00 5.9494E-01 3.7588E-01 3.6587E-02
 3.055 1.8262E+01 8.8795E-01 7.0243E+00 5.9494E-01 3.7784E-01 3.8131E-02
 3.087 1.8274E+01 8.8857E-01 7.0243E+00 5.9494E-01 3.7807E-01 3.8323E-02
 3.340 1.8359E+01 8.9316E-01 7.0243E+00 5.9494E-01 3.7983E-01 3.9769E-02
 3.590 1.8440E+01 8.9742E-01 7.0243E+00 5.9494E-01 3.8149E-01 4.1123E-02
 3.775 1.8499E+01 9.0047E-01 7.0243E+00 5.9494E-01 3.8270E-01 4.2079E-02
 3.778 1.8500E+01 9.0052E-01 7.0243E+00 5.9494E-01 3.8273E-01 4.2094E-02
 4.000 1.8570E+01 9.0410E-01 7.0243E+00 5.9494E-01 3.8417E-01 4.3194E-02
 4.400 1.8681E+01 9.0966E-01 7.0243E+00 5.9494E-01 3.8642E-01 4.4828E-02
 4.633 1.8745E+01 9.1275E-01 7.0243E+00 5.9494E-01 3.8773E-01 4.5723E-02
 5.000 1.8843E+01 9.1749E-01 7.0243E+00 5.9494E-01 3.8977E-01 4.7050E-02
 5.041 1.8855E+01 9.1801E-01 7.0243E+00 5.9494E-01 3.9000E-01 4.7193E-02
 5.222 1.8903E+01 9.2029E-01 7.0243E+00 5.9494E-01 3.9100E-01 4.7809E-02
 5.500 1.8978E+01 9.2374E-01 7.0243E+00 5.9494E-01 3.9254E-01 4.8718E-02
 5.800 1.9058E+01 9.2738E-01 7.0243E+00 5.9494E-01 3.9420E-01 4.9649E-02
 6.100 1.9137E+01 9.3095E-01 7.0243E+00 5.9494E-01 3.9584E-01 5.0532E-02
 6.400 1.9217E+01 9.3445E-01 7.0243E+00 5.9494E-01 3.9748E-01 5.1370E-02
 6.700 1.9296E+01 9.3788E-01 7.0243E+00 5.9494E-01 3.9911E-01 5.2167E-02
 7.000 1.9374E+01 9.4126E-01 7.0243E+00 5.9494E-01 4.0074E-01 5.2925E-02
 7.300 1.9453E+01 9.4457E-01 7.0243E+00 5.9494E-01 4.0236E-01 5.3647E-02
 7.600 1.9531E+01 9.4784E-01 7.0243E+00 5.9494E-01 4.0398E-01 5.4335E-02
 7.791 1.9580E+01 9.4989E-01 7.0243E+00 5.9494E-01 4.0500E-01 5.4757E-02
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   7.844 1.9594E+01 9.5045E-01 7.0243E+00 5.9494E-01 4.0529E-01 5.4871E-02
   8.000 1.9635E+01 9.5211E-01 7.0243E+00 5.9494E-01 4.0612E-01 5.5204E-02
   8.300 1.9669E+01 9.5352E-01 7.0243E+00 5.9494E-01 4.0625E-01 5.5300E-02
   8.600 1.9694E+01 9.5452E-01 7.0243E+00 5.9494E-01 4.0638E-01 5.5391E-02
   8.900 1.9719E+01 9.5552E-01 7.0243E+00 5.9494E-01 4.0651E-01 5.5478E-02
   9.200 1.9744E+01 9.5649E-01 7.0243E+00 5.9494E-01 4.0664E-01 5.5562E-02
   9.500 1.9768E+01 9.5746E-01 7.0243E+00 5.9494E-01 4.0676E-01 5.5642E-02
   9.800 1.9793E+01 9.5841E-01 7.0243E+00 5.9494E-01 4.0689E-01 5.5719E-02
   9.871 1.9799E+01 9.5864E-01 7.0243E+00 5.9494E-01 4.0692E-01 5.5737E-02
  10.200 1.9826E+01 9.5967E-01 7.0243E+00 5.9494E-01 4.0706E-01 5.5817E-02
  24.000 2.0877E+01 9.9668E-01 7.0243E+00 5.9494E-01 4.1251E-01 5.7715E-02
  96.000 2.3304E+01 1.0755E+00 7.0243E+00 5.9494E-01 4.2942E-01 6.0019E-02
 720.000 2.7530E+01 1.2092E+00 7.0243E+00 5.9494E-01 4.4531E-01 6.1545E-02
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File 128dw2_env.out = Bypass From DW Terminating in TB

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                     Cumulative Dose Summary
                 CR                      EAB                     LPZ
  Time    Thyroid     TEDE      Thyroid     TEDE      Thyroid     TEDE
  (hr)     (rem)      (rem)      (rem)      (rem)      (rem)      (rem)
   0.000 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.008 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.166 5.2979E-02 2.1144E-03 3.2032E-02 2.0915E-03 1.6307E-03 1.0648E-04
   0.236 1.0348E-01 4.1368E-03 4.9465E-02 3.4156E-03 2.5182E-03 1.7389E-04
   0.394 1.3677E-01 5.4825E-03 5.7084E-02 4.3847E-03 2.9061E-03 2.2322E-04
   0.442 1.4406E-01 5.7810E-03 6.0823E-02 4.9514E-03 3.0965E-03 2.5207E-04
   0.465 1.4763E-01 5.9269E-03 6.1878E-02 5.1167E-03 3.1501E-03 2.6049E-04
   0.508 1.5409E-01 6.1907E-03 6.4801E-02 5.4880E-03 3.2989E-03 2.7939E-04
   0.512 1.5472E-01 6.2164E-03 6.5134E-02 5.5245E-03 3.3159E-03 2.8125E-04
   0.585 1.7471E-01 7.0430E-03 7.6168E-02 6.6534E-03 3.8776E-03 3.3872E-04
   0.702 2.8630E-01 1.1785E-02 1.3471E-01 1.2287E-02 6.8581E-03 6.2551E-04
   0.819 3.7994E-01 1.5884E-02 1.5893E-01 1.7796E-02 8.0910E-03 9.0596E-04
   0.934 4.0372E-01 1.7044E-02 1.6611E-01 2.1437E-02 8.4565E-03 1.0913E-03
   1.009 4.2093E-01 1.7880E-02 1.7541E-01 2.4424E-02 8.9297E-03 1.2434E-03
   1.129 4.8737E-01 2.0901E-02 2.0821E-01 3.0612E-02 1.0600E-02 1.5584E-03
   1.129 4.8744E-01 2.0905E-02 2.0830E-01 3.0626E-02 1.0604E-02 1.5592E-03
   1.296 6.3586E-01 2.7814E-02 2.6557E-01 4.8183E-02 1.3520E-02 2.4530E-03
   1.379 6.8131E-01 3.0057E-02 2.8431E-01 5.6481E-02 1.4474E-02 2.8754E-03
   1.463 7.1486E-01 3.1733E-02 2.9470E-01 6.1552E-02 1.5003E-02 3.1336E-03
   1.715 7.9482E-01 3.5833E-02 3.2714E-01 7.9487E-02 1.6655E-02 4.0466E-03
   1.965 8.7980E-01 4.0252E-02 3.6203E-01 1.0024E-01 1.8431E-02 5.1031E-03
   2.007 8.9487E-01 4.1039E-02 3.6821E-01 1.0402E-01 1.8745E-02 5.2955E-03
   2.008 8.9512E-01 4.1052E-02 3.6831E-01 1.0408E-01 1.8751E-02 5.2987E-03
   2.239 9.4999E-01 4.3977E-02 3.6831E-01 1.0408E-01 1.9757E-02 6.0204E-03
   2.490 9.8787E-01 4.6083E-02 3.6831E-01 1.0408E-01 2.0519E-02 6.6856E-03
   2.740 1.0208E+00 4.7926E-02 3.6831E-01 1.0408E-01 2.1192E-02 7.3055E-03
   2.803 1.0288E+00 4.8371E-02 3.6831E-01 1.0408E-01 2.1356E-02 7.4567E-03
   3.055 1.0599E+00 5.0085E-02 3.6831E-01 1.0408E-01 2.1997E-02 8.0367E-03
   3.087 1.0639E+00 5.0302E-02 3.6831E-01 1.0408E-01 2.2079E-02 8.1093E-03
   3.340 1.0945E+00 5.1950E-02 3.6831E-01 1.0408E-01 2.2711E-02 8.6557E-03
   3.590 1.1245E+00 5.3535E-02 3.6831E-01 1.0408E-01 2.3331E-02 9.1684E-03
   3.775 1.1466E+00 5.4682E-02 3.6831E-01 1.0408E-01 2.3788E-02 9.5307E-03
   3.778 1.1470E+00 5.4701E-02 3.6831E-01 1.0408E-01 2.3795E-02 9.5366E-03
   4.000 1.1734E+00 5.6050E-02 3.6831E-01 1.0408E-01 2.4342E-02 9.9535E-03
   4.400 1.2166E+00 5.8213E-02 3.6831E-01 1.0408E-01 2.5221E-02 1.0593E-02
   4.633 1.2413E+00 5.9421E-02 3.6831E-01 1.0408E-01 2.5732E-02 1.0942E-02
   5.000 1.2800E+00 6.1273E-02 3.6831E-01 1.0408E-01 2.6530E-02 1.1461E-02
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   5.041 1.2843E+00 6.1478E-02 3.6831E-01 1.0408E-01 2.6620E-02 1.1517E-02
   5.222 1.3033E+00 6.2368E-02 3.6831E-01 1.0408E-01 2.7012E-02 1.1758E-02
   5.500 1.3324E+00 6.3715E-02 3.6831E-01 1.0408E-01 2.7613E-02 1.2113E-02
   5.800 1.3637E+00 6.5139E-02 3.6831E-01 1.0408E-01 2.8260E-02 1.2478E-02
   6.100 1.3948E+00 6.6535E-02 3.6831E-01 1.0408E-01 2.8903E-02 1.2823E-02
   6.400 1.4259E+00 6.7903E-02 3.6831E-01 1.0408E-01 2.9545E-02 1.3151E-02
   6.700 1.4568E+00 6.9246E-02 3.6831E-01 1.0408E-01 3.0183E-02 1.3462E-02
   7.000 1.4876E+00 7.0565E-02 3.6831E-01 1.0408E-01 3.0819E-02 1.3758E-02
   7.300 1.5182E+00 7.1863E-02 3.6831E-01 1.0408E-01 3.1453E-02 1.4041E-02
   7.600 1.5488E+00 7.3139E-02 3.6831E-01 1.0408E-01 3.2084E-02 1.4310E-02
   7.791 1.5682E+00 7.3940E-02 3.6831E-01 1.0408E-01 3.2485E-02 1.4475E-02
   7.844 1.5735E+00 7.4162E-02 3.6831E-01 1.0408E-01 3.2596E-02 1.4520E-02
   8.000 1.5893E+00 7.4809E-02 3.6831E-01 1.0408E-01 3.2922E-02 1.4650E-02
   8.300 1.6029E+00 7.5361E-02 3.6831E-01 1.0408E-01 3.2973E-02 1.4687E-02
   8.600 1.6126E+00 7.5753E-02 3.6831E-01 1.0408E-01 3.3024E-02 1.4723E-02
   8.900 1.6224E+00 7.6141E-02 3.6831E-01 1.0408E-01 3.3074E-02 1.4757E-02
   9.200 1.6320E+00 7.6523E-02 3.6831E-01 1.0408E-01 3.3124E-02 1.4790E-02
   9.500 1.6417E+00 7.6901E-02 3.6831E-01 1.0408E-01 3.3174E-02 1.4821E-02
   9.800 1.6513E+00 7.7274E-02 3.6831E-01 1.0408E-01 3.3224E-02 1.4851E-02
   9.871 1.6536E+00 7.7362E-02 3.6831E-01 1.0408E-01 3.3236E-02 1.4858E-02
  10.200 1.6641E+00 7.7766E-02 3.6831E-01 1.0408E-01 3.3290E-02 1.4889E-02
  24.000 2.0751E+00 9.2238E-02 3.6831E-01 1.0408E-01 3.5420E-02 1.5631E-02
  96.000 3.0240E+00 1.2307E-01 3.6831E-01 1.0408E-01 4.2035E-02 1.6532E-02
 720.000 4.6766E+00 1.7535E-01 3.6831E-01 1.0408E-01 4.8246E-02 1.7129E-02
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File 128dw3_env.out = Bypass From DW Terminating at RB Wall

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                    Cumulative Dose Summary
                        CR                    EAB                   LPZ
  Time    Thyroid      TEDE     Thyroid      TEDE     Thyroid      TEDE
  (hr)     (rem)       (rem)     (rem)       (rem)     (rem)       (rem)
   0.000 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.008 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.166 6.0736E-02 2.5656E-03 3.8423E-02 2.2454E-03 1.9561E-03 1.1431E-04
   0.236 1.1838E-01 5.0115E-03 5.9103E-02 3.5822E-03 3.0089E-03 1.8237E-04
   0.394 1.5576E-01 6.6043E-03 6.7951E-02 4.4284E-03 3.4593E-03 2.2544E-04
   0.442 1.6351E-01 6.9353E-03 7.2010E-02 4.8820E-03 3.6660E-03 2.4854E-04
   0.465 1.6725E-01 7.0954E-03 7.3191E-02 5.0183E-03 3.7261E-03 2.5548E-04
   0.508 1.7418E-01 7.3914E-03 7.6557E-02 5.3409E-03 3.8975E-03 2.7190E-04
   0.512 1.7487E-01 7.4210E-03 7.6948E-02 5.3740E-03 3.9174E-03 2.7359E-04
   0.585 1.9750E-01 8.4100E-03 9.0193E-02 6.4426E-03 4.5916E-03 3.2799E-04
   0.702 3.2299E-01 1.4086E-02 1.5896E-01 1.1756E-02 8.0924E-03 5.9850E-04
   0.819 4.2583E-01 1.8828E-02 1.8585E-01 1.5977E-02 9.4616E-03 8.1339E-04
   0.934 4.4945E-01 1.9990E-02 1.9317E-01 1.8606E-02 9.8339E-03 9.4722E-04
   1.009 4.6719E-01 2.0862E-02 2.0356E-01 2.0874E-02 1.0363E-02 1.0627E-03
   1.129 5.4175E-01 2.4397E-02 2.4247E-01 2.6003E-02 1.2344E-02 1.3238E-03
   1.129 5.4183E-01 2.4401E-02 2.4258E-01 2.6015E-02 1.2349E-02 1.3244E-03
   1.296 7.0042E-01 3.2013E-02 3.0531E-01 3.9026E-02 1.5543E-02 1.9868E-03
   1.379 7.4556E-01 3.4254E-02 3.2467E-01 4.4920E-02 1.6529E-02 2.2868E-03
   1.463 7.7801E-01 3.5878E-02 3.3494E-01 4.8414E-02 1.7052E-02 2.4647E-03
   1.715 8.5154E-01 3.9624E-02 3.6597E-01 6.0634E-02 1.8631E-02 3.0868E-03
   1.965 9.2727E-01 4.3522E-02 3.9838E-01 7.4681E-02 2.0281E-02 3.8020E-03
   2.007 9.4050E-01 4.4205E-02 4.0404E-01 7.7232E-02 2.0570E-02 3.9318E-03
   2.008 9.4072E-01 4.4217E-02 4.0414E-01 7.7274E-02 2.0574E-02 3.9340E-03
   2.239 9.8631E-01 4.6613E-02 4.0414E-01 7.7274E-02 2.1430E-02 4.4152E-03
   2.490 1.0136E+00 4.8113E-02 4.0414E-01 7.7274E-02 2.1996E-02 4.8525E-03
   2.740 1.0355E+00 4.9328E-02 4.0414E-01 7.7274E-02 2.2460E-02 5.2580E-03
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   2.803 1.0406E+00 4.9614E-02 4.0414E-01 7.7274E-02 2.2570E-02 5.3567E-03
   3.055 1.0604E+00 5.0701E-02 4.0414E-01 7.7274E-02 2.2995E-02 5.7353E-03
   3.087 1.0629E+00 5.0837E-02 4.0414E-01 7.7274E-02 2.3049E-02 5.7826E-03
   3.340 1.0821E+00 5.1870E-02 4.0414E-01 7.7274E-02 2.3463E-02 6.1390E-03
   3.590 1.1008E+00 5.2860E-02 4.0414E-01 7.7274E-02 2.3868E-02 6.4733E-03
   3.775 1.1146E+00 5.3575E-02 4.0414E-01 7.7274E-02 2.4166E-02 6.7095E-03
   3.778 1.1148E+00 5.3587E-02 4.0414E-01 7.7274E-02 2.4171E-02 6.7134E-03
   4.000 1.1313E+00 5.4428E-02 4.0414E-01 7.7274E-02 2.4527E-02 6.9851E-03
   4.400 1.1578E+00 5.5754E-02 4.0414E-01 7.7274E-02 2.5090E-02 7.3937E-03
   4.633 1.1729E+00 5.6492E-02 4.0414E-01 7.7274E-02 2.5416E-02 7.6174E-03
   5.000 1.1965E+00 5.7624E-02 4.0414E-01 7.7274E-02 2.5927E-02 7.9491E-03
   5.041 1.1992E+00 5.7749E-02 4.0414E-01 7.7274E-02 2.5984E-02 7.9849E-03
   5.222 1.2108E+00 5.8293E-02 4.0414E-01 7.7274E-02 2.6235E-02 8.1389E-03
   5.500 1.2286E+00 5.9116E-02 4.0414E-01 7.7274E-02 2.6619E-02 8.3661E-03
   5.800 1.2477E+00 5.9986E-02 4.0414E-01 7.7274E-02 2.7033E-02 8.5989E-03
   6.100 1.2667E+00 6.0839E-02 4.0414E-01 7.7274E-02 2.7444E-02 8.8196E-03
   6.400 1.2857E+00 6.1675E-02 4.0414E-01 7.7274E-02 2.7854E-02 9.0291E-03
   6.700 1.3046E+00 6.2496E-02 4.0414E-01 7.7274E-02 2.8262E-02 9.2283E-03
   7.000 1.3234E+00 6.3302E-02 4.0414E-01 7.7274E-02 2.8669E-02 9.4177E-03
   7.300 1.3421E+00 6.4094E-02 4.0414E-01 7.7274E-02 2.9074E-02 9.5982E-03
   7.600 1.3608E+00 6.4874E-02 4.0414E-01 7.7274E-02 2.9478E-02 9.7704E-03
   7.791 1.3726E+00 6.5364E-02 4.0414E-01 7.7274E-02 2.9734E-02 9.8758E-03
   7.844 1.3759E+00 6.5499E-02 4.0414E-01 7.7274E-02 2.9805E-02 9.9045E-03
   8.000 1.3856E+00 6.5895E-02 4.0414E-01 7.7274E-02 3.0014E-02 9.9876E-03
   8.300 1.3957E+00 6.6306E-02 4.0414E-01 7.7274E-02 3.0078E-02 1.0013E-02
   8.600 1.4039E+00 6.6636E-02 4.0414E-01 7.7274E-02 3.0142E-02 1.0036E-02
   8.900 1.4120E+00 6.6961E-02 4.0414E-01 7.7274E-02 3.0206E-02 1.0059E-02
   9.200 1.4201E+00 6.7282E-02 4.0414E-01 7.7274E-02 3.0270E-02 1.0081E-02
   9.500 1.4282E+00 6.7599E-02 4.0414E-01 7.7274E-02 3.0333E-02 1.0102E-02
   9.800 1.4363E+00 6.7912E-02 4.0414E-01 7.7274E-02 3.0396E-02 1.0122E-02
   9.871 1.4382E+00 6.7985E-02 4.0414E-01 7.7274E-02 3.0411E-02 1.0127E-02
  10.200 1.4470E+00 6.8325E-02 4.0414E-01 7.7274E-02 3.0480E-02 1.0148E-02
  24.000 1.7920E+00 8.0471E-02 4.0414E-01 7.7274E-02 3.3180E-02 1.0664E-02
  96.000 2.3871E+00 9.9812E-02 4.0414E-01 7.7274E-02 3.6370E-02 1.1208E-02
 720.000 3.2852E+00 1.2822E-01 4.0414E-01 7.7274E-02 3.9365E-02 1.1560E-02
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File 128ww_env.out = Bypass From WW Terminating at RB Wall

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                          Cumulative Dose Summary
                     CR                         EAB                         LPZ
  Time     Thyroid       TEDE      Thyroid       TEDE      Thyroid       TEDE
  (hr)      (rem)        (rem)      (rem)        (rem)      (rem)        (rem)
   0.000 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.008 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.166 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.236 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.394 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.442 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.465 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.508 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.512 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.585 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.702 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.819 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.934 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   1.009 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   1.129 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   1.129 3.5267E-10 1.6575E-11 9.8171E-08 1.1316E-08 4.9978E-09 5.7606E-10
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   1.296 2.0123E-01 9.6439E-03 1.1577E-01 2.1753E-02 5.8938E-03 1.1074E-03
   1.379 3.7423E-01 1.8040E-02 1.8407E-01 3.7644E-02 9.3708E-03 1.9164E-03
   1.463 4.6230E-01 2.2328E-02 2.0532E-01 4.2912E-02 1.0453E-02 2.1846E-03
   1.715 5.7310E-01 2.7763E-02 2.4852E-01 5.5051E-02 1.2652E-02 2.8026E-03
   1.965 6.5181E-01 3.1666E-02 2.8077E-01 6.5916E-02 1.4294E-02 3.3557E-03
   2.007 6.6317E-01 3.2232E-02 2.8544E-01 6.7657E-02 1.4531E-02 3.4444E-03
   2.008 6.6335E-01 3.2242E-02 2.8551E-01 6.7685E-02 1.4535E-02 3.4458E-03
   2.239 7.9488E-01 3.9110E-02 2.8551E-01 6.7685E-02 1.7622E-02 5.1033E-03
   2.490 9.2217E-01 4.6029E-02 2.8551E-01 6.7685E-02 2.0255E-02 7.0295E-03
   2.740 1.0209E+00 5.1496E-02 2.8551E-01 6.7685E-02 2.2344E-02 8.8125E-03
   2.803 1.0439E+00 5.2769E-02 2.8551E-01 6.7685E-02 2.2836E-02 9.2464E-03
   3.055 1.1315E+00 5.7581E-02 2.8551E-01 6.7685E-02 2.4717E-02 1.0909E-02
   3.087 1.1425E+00 5.8181E-02 2.8551E-01 6.7685E-02 2.4955E-02 1.1117E-02
   3.340 1.2270E+00 6.2729E-02 2.8551E-01 6.7685E-02 2.6777E-02 1.2682E-02
   3.590 1.3094E+00 6.7079E-02 2.8551E-01 6.7685E-02 2.8558E-02 1.4150E-02
   3.775 1.3700E+00 7.0220E-02 2.8551E-01 6.7685E-02 2.9867E-02 1.5187E-02
   3.778 1.3710E+00 7.0272E-02 2.8551E-01 6.7685E-02 2.9889E-02 1.5204E-02
   4.000 1.4434E+00 7.3965E-02 2.8551E-01 6.7685E-02 3.1454E-02 1.6398E-02
   4.400 1.5588E+00 7.9742E-02 2.8551E-01 6.7685E-02 3.3900E-02 1.8175E-02
   4.633 1.6246E+00 8.2954E-02 2.8551E-01 6.7685E-02 3.5321E-02 1.9148E-02
   5.000 1.7273E+00 8.7877E-02 2.8551E-01 6.7685E-02 3.7543E-02 2.0592E-02
   5.041 1.7389E+00 8.8421E-02 2.8551E-01 6.7685E-02 3.7792E-02 2.0747E-02
   5.222 1.7893E+00 9.0789E-02 2.8551E-01 6.7685E-02 3.8882E-02 2.1417E-02
   5.500 1.8666E+00 9.4370E-02 2.8551E-01 6.7685E-02 4.0555E-02 2.2406E-02
   5.800 1.9498E+00 9.8156E-02 2.8551E-01 6.7685E-02 4.2352E-02 2.3418E-02
   6.100 2.0326E+00 1.0186E-01 2.8551E-01 6.7685E-02 4.4143E-02 2.4378E-02
   6.400 2.1151E+00 1.0550E-01 2.8551E-01 6.7685E-02 4.5926E-02 2.5290E-02
   6.700 2.1972E+00 1.0907E-01 2.8551E-01 6.7685E-02 4.7702E-02 2.6156E-02
   7.000 2.2790E+00 1.1258E-01 2.8551E-01 6.7685E-02 4.9472E-02 2.6981E-02
   7.300 2.3606E+00 1.1603E-01 2.8551E-01 6.7685E-02 5.1235E-02 2.7766E-02
   7.600 2.4418E+00 1.1942E-01 2.8551E-01 6.7685E-02 5.2991E-02 2.8515E-02
   7.791 2.4933E+00 1.2155E-01 2.8551E-01 6.7685E-02 5.4105E-02 2.8973E-02
   7.844 2.5076E+00 1.2214E-01 2.8551E-01 6.7685E-02 5.4414E-02 2.9098E-02
   8.000 2.5496E+00 1.2386E-01 2.8551E-01 6.7685E-02 5.5322E-02 2.9460E-02
   8.300 2.5936E+00 1.2565E-01 2.8551E-01 6.7685E-02 5.5601E-02 2.9568E-02
   8.600 2.6292E+00 1.2708E-01 2.8551E-01 6.7685E-02 5.5880E-02 2.9672E-02
   8.900 2.6647E+00 1.2850E-01 2.8551E-01 6.7685E-02 5.6158E-02 2.9771E-02
   9.200 2.7000E+00 1.2989E-01 2.8551E-01 6.7685E-02 5.6435E-02 2.9866E-02
   9.500 2.7353E+00 1.3127E-01 2.8551E-01 6.7685E-02 5.6710E-02 2.9957E-02
   9.800 2.7704E+00 1.3264E-01 2.8551E-01 6.7685E-02 5.6985E-02 3.0045E-02
   9.871 2.7786E+00 1.3295E-01 2.8551E-01 6.7685E-02 5.7050E-02 3.0065E-02
  10.200 2.8170E+00 1.3443E-01 2.8551E-01 6.7685E-02 5.7350E-02 3.0157E-02
  24.000 4.3179E+00 1.8727E-01 2.8551E-01 6.7685E-02 6.9096E-02 3.2401E-02
  96.000 6.9067E+00 2.7141E-01 2.8551E-01 6.7685E-02 8.2974E-02 3.4769E-02
 720.000 1.0814E+01 3.9502E-01 2.8551E-01 6.7685E-02 9.6005E-02 3.6299E-02
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File 128sl_env.out = Steam Line With Both MSIVs Closed

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                          Cumulative Dose Summary
                 CR                     EAB                     LPZ
  Time    Thyroid      TEDE     Thyroid      TEDE     Thyroid       TEDE
  (hr)     (rem)       (rem)     (rem)       (rem)     (rem)        (rem)
   0.000 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.008 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.166 2.5414E-02 1.1417E-03 1.7542E-02 8.9068E-04 8.9304E-04 4.5344E-05
   0.236 8.1079E-02 3.6535E-03 4.6285E-02 2.3520E-03 2.3563E-03 1.1974E-04
   0.394 1.6222E-01 7.3175E-03 7.0902E-02 3.6118E-03 3.6096E-03 1.8387E-04
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0.442	1.8532E-01	8.3599E-03	8.2483E-02	4.2097E-03	4.1991E-03	2.1431E-04
0.465	1.9646E-01	8.8624E-03	8.5820E-02	4.3828E-03	4.3690E-03	2.2313E-04
0.508	2.1445E-01	9.6733E-03	9.2207E-02	4.7152E-03	4.6942E-03	2.4005E-04
0.512	2.1587E-01	9.7375E-03	9.2752E-02	4.7437E-03	4.7219E-03	2.4150E-04
0.585	2.4320E-01	1.0970E-02	1.0372E-01	5.3198E-03	5.2801E-03	2.7082E-04
0.702	3.2358E-01	1.4682E-02	1.4431E-01	7.5192E-03	7.3467E-03	3.8280E-04
0.819	4.5452E-01	2.0873E-02	1.9944E-01	1.0623E-02	1.0153E-02	5.4081E-04
0.934	5.4033E-01	2.4947E-02	2.2712E-01	1.2287E-02	1.1563E-02	6.2555E-04
1.009	5.8094E-01	2.6874E-02	2.4273E-01	1.3287E-02	1.2357E-02	6.7642E-04
1.129	6.4434E-01	2.9902E-02	2.6927E-01	1.5049E-02	1.3708E-02	7.6612E-04
1.129	6.4440E-01	2.9905E-02	2.6933E-01	1.5053E-02	1.3711E-02	7.6633E-04
1.296	9.0346E-01	4.2485E-02	3.9066E-01	2.3463E-02	1.9888E-02	1.1945E-03
1.379	1.0487E+00	4.9562E-02	4.4871E-01	2.7895E-02	2.2844E-02	1.4201E-03
1.463	1.1422E+00	5.4115E-02	4.7477E-01	3.0023E-02	2.4170E-02	1.5284E-03
1.715	1.3103E+00	6.2289E-02	5.3979E-01	3.6143E-02	2.7480E-02	1.8400E-03
1.965	1.4425E+00	6.8699E-02	5.9232E-01	4.2320E-02	3.0155E-02	2.1545E-03
2.007	1.4631E+00	6.9692E-02	6.0053E-01	4.3408E-02	3.0572E-02	2.2099E-03
2.008	1.4634E+00	6.9708E-02	6.0066E-01	4.3426E-02	3.0579E-02	2.2108E-03
2.239	1.5640E+00	7.4562E-02	6.0066E-01	4.3426E-02	3.2591E-02	2.5132E-03
2.490	1.6449E+00	7.8420E-02	6.0066E-01	4.3426E-02	3.4190E-02	2.8284E-03
2.740	1.7032E+00	8.1140E-02	6.0066E-01	4.3426E-02	3.5349E-02	3.1326E-03
2.803	1.7156E+00	8.1712E-02	6.0066E-01	4.3426E-02	3.5597E-02	3.2091E-03
3.055	1.7597E+00	8.3717E-02	6.0066E-01	4.3426E-02	3.6490E-02	3.5141E-03
3.087	1.7649E+00	8.3954E-02	6.0066E-01	4.3426E-02	3.6596E-02	3.5537E-03
3.340	1.8039E+00	8.5701E-02	6.0066E-01	4.3426E-02	3.7397E-02	3.8636E-03
3.590	1.8407E+00	8.7331E-02	6.0066E-01	4.3426E-02	3.8153E-02	4.1741E-03
3.775	1.8672E+00	8.8494E-02	6.0066E-01	4.3426E-02	3.8698E-02	4.4055E-03
3.778	1.8676E+00	8.8513E-02	6.0066E-01	4.3426E-02	3.8707E-02	4.4094E-03
4.000	1.8988E+00	8.9876E-02	6.0066E-01	4.3426E-02	3.9351E-02	4.6886E-03
4.400	1.9485E+00	9.2032E-02	6.0066E-01	4.3426E-02	4.0358E-02	5.1326E-03
4.633	1.9769E+00	9.3249E-02	6.0066E-01	4.3426E-02	4.0945E-02	5.3895E-03
5.000	2.0216E+00	9.5147E-02	6.0066E-01	4.3426E-02	4.1870E-02	5.7890E-03
5.041	2.0267E+00	9.5360E-02	6.0066E-01	4.3426E-02	4.1975E-02	5.8334E-03
5.222	2.0489E+00	9.6295E-02	6.0066E-01	4.3426E-02	4.2435E-02	6.0279E-03
5.500	2.0834E+00	9.7736E-02	6.0066E-01	4.3426E-02	4.3149E-02	6.3241E-03
5.800	2.1211E+00	9.9296E-02	6.0066E-01	4.3426E-02	4.3929E-02	6.6393E-03
6.100	2.1592E+00	1.0086E-01	6.0066E-01	4.3426E-02	4.4718E-02	6.9494E-03
6.400	2.1978E+00	1.0243E-01	6.0066E-01	4.3426E-02	4.5516E-02	7.2541E-03
6.700	2.2367E+00	1.0400E-01	6.0066E-01	4.3426E-02	4.6322E-02	7.5532E-03
7.000	2.2761E+00	1.0558E-01	6.0066E-01	4.3426E-02	4.7136E-02	7.8464E-03
7.300	2.3158E+00	1.0716E-01	6.0066E-01	4.3426E-02	4.7959E-02	8.1339E-03
7.600	2.3559E+00	1.0874E-01	6.0066E-01	4.3426E-02	4.8788E-02	8.4154E-03
7.791	2.3816E+00	1.0975E-01	6.0066E-01	4.3426E-02	4.9320E-02	8.5914E-03
7.844	2.3888E+00	1.1003E-01	6.0066E-01	4.3426E-02	4.9469E-02	8.6398E-03
8.000	2.4099E+00	1.1085E-01	6.0066E-01	4.3426E-02	4.9906E-02	8.7812E-03
8.300	2.4282E+00	1.1156E-01	6.0066E-01	4.3426E-02	4.9975E-02	8.8222E-03
8.600	2.4415E+00	1.1208E-01	6.0066E-01	4.3426E-02	5.0044E-02	8.8622E-03
8.900	2.4549E+00	1.1259E-01	6.0066E-01	4.3426E-02	5.0114E-02	8.9013E-03
9.200	2.4685E+00	1.1310E-01	6.0066E-01	4.3426E-02	5.0184E-02	8.9395E-03
9.500	2.4821E+00	1.1362E-01	6.0066E-01	4.3426E-02	5.0254E-02	8.9768E-03
9.800	2.4958E+00	1.1413E-01	6.0066E-01	4.3426E-02	5.0325E-02	9.0132E-03
9.871	2.4990E+00	1.1425E-01	6.0066E-01	4.3426E-02	5.0342E-02	9.0216E-03
10.200	2.5142E+00	1.1482E-01	6.0066E-01	4.3426E-02	5.0421E-02	9.0605E-03
24.000	3.1856E+00	1.3819E-01	6.0066E-01	4.3426E-02	5.3901E-02	1.0173E-02
96.000	4.9147E+00	1.9437E-01	6.0066E-01	4.3426E-02	6.5956E-02	1.1807E-02
720.000	7.9465E+00	2.9028E-01	6.0066E-01	4.3426E-02	7.7350E-02	1.2902E-02

File 128rbstgs_env.out = Containment Leakage Released via SGTS

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                             Cumulative Dose Summary
                    CR                          EAB                          LPZ
 Time      Thyroid       TEDE      Thyroid       TEDE       Thyroid       TEDE
 (hr)       (rem)       (rem)       (rem)        (rem)        (rem)        (rem)
  0.000 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
  0.008 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
  0.166 5.0692E-04 2.2764E-05 9.1603E-06 5.5898E-07 2.5553E-06 1.5593E-07
  0.236 1.6622E-03 7.4844E-05 2.4939E-05 1.5104E-06 6.9568E-06 4.2131E-07
  0.394 6.1069E-03 2.7612E-04 7.6111E-05 4.9617E-06 2.1231E-05 1.3841E-06
  0.442 7.7888E-03 3.5259E-04 9.4848E-05 6.3585E-06 2.6458E-05 1.7737E-06
  0.465 8.6230E-03 3.9057E-04 1.0411E-04 7.0713E-06 2.9040E-05 1.9725E-06
  0.508 1.0324E-02 4.6813E-04 1.2311E-04 8.5740E-06 3.4342E-05 2.3917E-06
  0.512 1.0476E-02 4.7503E-04 1.2483E-04 8.7110E-06 3.4820E-05 2.4299E-06
  0.585 1.3852E-02 6.2951E-04 1.6460E-04 1.1918E-05 4.5913E-05 3.3246E-06
  0.702 2.2299E-02 1.0236E-03 2.6893E-04 2.0362E-05 7.5017E-05 5.6799E-06
  0.819 3.6044E-02 1.6782E-03 4.2509E-04 3.3780E-05 1.1858E-04 9.4230E-06
  0.934 5.1217E-02 2.4098E-03 5.8780E-04 5.0501E-05 1.6396E-04 1.4087E-05
  1.009 6.1652E-02 2.9183E-03 7.0055E-04 6.3841E-05 1.9542E-04 1.7808E-05
  1.129 8.0774E-02 3.8609E-03 9.1572E-04 9.0857E-05 2.5544E-04 2.5344E-05
  1.129 8.0792E-02 3.8618E-03 9.1593E-04 9.0884E-05 2.5550E-04 2.5352E-05
  1.296 1.1551E-01 5.5945E-03 1.2977E-03 1.4120E-04 3.6199E-04 3.9386E-05
  1.379 1.3468E-01 6.5594E-03 1.5041E-03 1.7111E-04 4.1955E-04 4.7731E-05
  1.463 1.5501E-01 7.5900E-03 1.7226E-03 2.0501E-04 4.8051E-04 5.7186E-05
  1.715 2.2093E-01 1.0976E-02 2.4282E-03 3.3045E-04 6.7733E-04 9.2178E-05
  1.965 2.9264E-01 1.4731E-02 3.1937E-03 4.9209E-04 8.9088E-04 1.3727E-04
  2.007 3.0535E-01 1.5403E-02 3.3293E-03 5.2327E-04 9.2869E-04 1.4596E-04
  2.008 3.0556E-01 1.5414E-02 3.3315E-03 5.2379E-04 9.2932E-04 1.4611E-04
  2.239 3.7707E-01 1.9235E-02 3.3315E-03 5.2379E-04 1.1412E-03 1.9898E-04
  2.490 4.5670E-01 2.3567E-02 3.3315E-03 5.2379E-04 1.3759E-03 2.6600E-04
  2.740 5.3549E-01 2.7927E-02 3.3315E-03 5.2379E-04 1.6077E-03 3.4063E-04
  2.803 5.5527E-01 2.9034E-02 3.3315E-03 5.2379E-04 1.6658E-03 3.6063E-04
  3.055 6.3312E-01 3.3428E-02 3.3315E-03 5.2379E-04 1.8947E-03 4.4400E-04
  3.087 6.4307E-01 3.3994E-02 3.3315E-03 5.2379E-04 1.9239E-03 4.5517E-04
  3.340 7.1957E-01 3.8379E-02 3.3315E-03 5.2379E-04 2.1487E-03 5.4479E-04
  3.590 7.9386E-01 4.2689E-02 3.3315E-03 5.2379E-04 2.3670E-03 6.3778E-04
  3.775 8.4790E-01 4.5853E-02 3.3315E-03 5.2379E-04 2.5258E-03 7.0881E-04
  3.778 8.4880E-01 4.5906E-02 3.3315E-03 5.2379E-04 2.5284E-03 7.1002E-04
  4.000 9.1265E-01 4.9674E-02 3.3315E-03 5.2379E-04 2.7160E-03 7.9742E-04
  4.400 1.0250E+00 5.6558E-02 3.3315E-03 5.2379E-04 3.0461E-03 9.5600E-04
  4.633 1.0888E+00 6.0519E-02 3.3315E-03 5.2379E-04 3.2336E-03 1.0460E-03
  5.000 1.1864E+00 6.6547E-02 3.3315E-03 5.2379E-04 3.5202E-03 1.1835E-03
  5.041 1.1972E+00 6.7209E-02 3.3315E-03 5.2379E-04 3.5519E-03 1.1986E-03
  5.222 1.2440E+00 7.0072E-02 3.3315E-03 5.2379E-04 3.6893E-03 1.2643E-03
  5.500 1.3146E+00 7.4430E-02 3.3315E-03 5.2379E-04 3.8965E-03 1.3632E-03
  5.800 1.3888E+00 7.9015E-02 3.3315E-03 5.2379E-04 4.1147E-03 1.4672E-03
  6.100 1.4612E+00 8.3495E-02 3.3315E-03 5.2379E-04 4.3273E-03 1.5681E-03
  6.400 1.5317E+00 8.7856E-02 3.3315E-03 5.2379E-04 4.5344E-03 1.6662E-03
  6.700 1.6005E+00 9.2101E-02 3.3315E-03 5.2379E-04 4.7364E-03 1.7613E-03
  7.000 1.6675E+00 9.6235E-02 3.3315E-03 5.2379E-04 4.9332E-03 1.8537E-03
  7.300 1.7328E+00 1.0026E-01 3.3315E-03 5.2379E-04 5.1251E-03 1.9434E-03
  7.600 1.7965E+00 1.0418E-01 3.3315E-03 5.2379E-04 5.3121E-03 2.0304E-03
  7.791 1.8362E+00 1.0662E-01 3.3315E-03 5.2379E-04 5.4287E-03 2.0845E-03
  7.844 1.8471E+00 1.0729E-01 3.3315E-03 5.2379E-04 5.4608E-03 2.0993E-03
  8.000 1.8789E+00 1.0922E-01 3.3315E-03 5.2379E-04 5.5543E-03 2.1424E-03
  8.300 1.9163E+00 1.1150E-01 3.3315E-03 5.2379E-04 5.6142E-03 2.1700E-03
  8.600 1.9478E+00 1.1343E-01 3.3315E-03 5.2379E-04 5.6726E-03 2.1968E-03
```

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   8.900 1.9785E+00 1.1531E-01 3.3315E-03 5.2379E-04 5.7296E-03 2.2228E-03
   9.200 2.0084E+00 1.1714E-01 3.3315E-03 5.2379E-04 5.7853E-03 2.2481E-03
   9.500 2.0377E+00 1.1892E-01 3.3315E-03 5.2379E-04 5.8395E-03 2.2727E-03
   9.800 2.0662E+00 1.2066E-01 3.3315E-03 5.2379E-04 5.8925E-03 2.2967E-03
   9.871 2.0728E+00 1.2106E-01 3.3315E-03 5.2379E-04 5.9048E-03 2.3022E-03
  10.200 2.1032E+00 1.2289E-01 3.3315E-03 5.2379E-04 5.9611E-03 2.3275E-03
  24.000 2.9122E+00 1.8887E-01 3.3315E-03 5.2379E-04 7.4636E-03 3.0468E-03
  96.000 3.0972E+00 2.0085E-01 3.3315E-03 5.2379E-04 8.1177E-03 3.8875E-03
 720.000 3.1344E+00 2.0248E-01 3.3315E-03 5.2379E-04 8.7341E-03 4.5062E-03
```

File 128esf_env.out = ESF Leakage Released via SGTS

```
                          Cumulative Dose Summary
                 CR                          EAB                          LPZ
  Time   Thyroid      TEDE      Thyroid      TEDE      Thyroid      TEDE
  (hr)    (rem)      (rem)       (rem)      (rem)       (rem)      (rem)
   0.000 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.008 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
   0.166 1.4901E-05 4.7301E-07 2.6927E-07 1.0050E-08 7.5113E-08 2.8034E-09
   0.236 5.1373E-05 1.6306E-06 8.0260E-07 3.0159E-08 2.2388E-07 8.4127E-09
   0.394 2.8822E-04 9.1456E-06 3.8733E-06 1.4715E-07 1.0804E-06 4.1046E-08
   0.442 4.1952E-04 1.3310E-05 5.4962E-06 2.0931E-07 1.5332E-06 5.8386E-08
   0.465 4.9281E-04 1.5635E-05 6.3912E-06 2.4363E-07 1.7828E-06 6.7961E-08
   0.508 6.5779E-04 2.0866E-05 8.3853E-06 3.2021E-07 2.3391E-06 8.9322E-08
   0.512 6.7331E-04 2.1358E-05 8.5717E-06 3.2737E-07 2.3911E-06 9.1320E-08
   0.585 1.0338E-03 3.2789E-05 1.2873E-05 4.9350E-07 3.5909E-06 1.3766E-07
   0.702 1.8582E-03 5.8929E-05 2.2591E-05 8.7711E-07 6.3017E-06 2.4467E-07
   0.819 3.0755E-03 9.7543E-05 3.6746E-05 1.4509E-06 1.0250E-05 4.0472E-07
   0.934 4.7387E-03 1.5031E-04 5.5856E-05 2.2409E-06 1.5581E-05 6.2508E-07
   1.009 6.1289E-03 1.9442E-04 7.1697E-05 2.9033E-06 2.0000E-05 8.0988E-07
   1.129 8.9048E-03 2.8250E-04 1.0310E-04 4.2281E-06 2.8759E-05 1.1794E-06
   1.129 8.9075E-03 2.8258E-04 1.0313E-04 4.2294E-06 2.8767E-05 1.1798E-06
   1.296 1.4072E-02 4.4643E-04 1.6104E-04 6.6951E-06 4.4922E-05 1.8676E-06
   1.379 1.7279E-02 5.4812E-04 1.9678E-04 8.2252E-06 5.4891E-05 2.2944E-06
   1.463 2.0998E-02 6.6609E-04 2.3810E-04 1.0000E-05 6.6416E-05 2.7895E-06
   1.715 3.5346E-02 1.1210E-03 3.9651E-04 1.6845E-05 1.1061E-04 4.6988E-06
   1.965 5.4960E-02 1.7425E-03 6.1162E-04 2.6214E-05 1.7061E-04 7.3122E-06
   2.007 5.8867E-02 1.8663E-03 6.5434E-04 2.8083E-05 1.8253E-04 7.8336E-06
   2.008 5.8933E-02 1.8684E-03 6.5507E-04 2.8114E-05 1.8273E-04 7.8424E-06
   2.239 8.3427E-02 2.6442E-03 6.5507E-04 2.8114E-05 2.5714E-04 1.1107E-05
   2.490 1.1622E-01 3.6824E-03 6.5507E-04 2.8114E-05 3.5614E-04 1.5450E-05
   2.740 1.5492E-01 4.9068E-03 6.5507E-04 2.8114E-05 4.7245E-04 2.0548E-05
   2.803 1.6566E-01 5.2466E-03 6.5507E-04 2.8114E-05 5.0468E-04 2.1959E-05
   3.055 2.1207E-01 6.7139E-03 6.5507E-04 2.8114E-05 6.4363E-04 2.8044E-05
   3.087 2.1849E-01 6.9168E-03 6.5507E-04 2.8114E-05 6.6282E-04 2.8884E-05
   3.340 2.7158E-01 8.5944E-03 6.5507E-04 2.8114E-05 8.2139E-04 3.5828E-05
   3.590 3.2968E-01 1.0429E-02 6.5507E-04 2.8114E-05 9.9462E-04 4.3419E-05
   3.775 3.7609E-01 1.1895E-02 6.5507E-04 2.8114E-05 1.1329E-03 4.9479E-05
   3.778 3.7690E-01 1.1920E-02 6.5507E-04 2.8114E-05 1.1353E-03 4.9584E-05
   4.000 4.3646E-01 1.3801E-02 6.5507E-04 2.8114E-05 1.3125E-03 5.7358E-05
   4.400 5.5393E-01 1.7507E-02 6.5507E-04 2.8114E-05 1.6616E-03 7.2717E-05
   4.633 6.2826E-01 1.9852E-02 6.5507E-04 2.8114E-05 1.8823E-03 8.2433E-05
   5.000 7.5331E-01 2.3794E-02 6.5507E-04 2.8114E-05 2.2533E-03 9.8777E-05
   5.041 7.6801E-01 2.4257E-02 6.5507E-04 2.8114E-05 2.2969E-03 1.0070E-04
   5.222 8.3380E-01 2.6331E-02 6.5507E-04 2.8114E-05 2.4919E-03 1.0929E-04
   5.500 9.3949E-01 2.9661E-02 6.5507E-04 2.8114E-05 2.8051E-03 1.2311E-04
   5.800 1.0595E+00 3.3440E-02 6.5507E-04 2.8114E-05 3.1606E-03 1.3879E-04
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  6.100 1.1854E+00 3.7405E-02 6.5507E-04 2.8114E-05 3.5334E-03 1.5525E-04
  6.400 1.3171E+00 4.1549E-02 6.5507E-04 2.8114E-05 3.9231E-03 1.7245E-04
  6.700 1.4543E+00 4.5867E-02 6.5507E-04 2.8114E-05 4.3291E-03 1.9037E-04
  7.000 1.5969E+00 5.0351E-02 6.5507E-04 2.8114E-05 4.7507E-03 2.0899E-04
  7.300 1.7446E+00 5.4996E-02 6.5507E-04 2.8114E-05 5.1875E-03 2.2827E-04
  7.600 1.8973E+00 5.9796E-02 6.5507E-04 2.8114E-05 5.6389E-03 2.4819E-04
  7.791 1.9970E+00 6.2929E-02 6.5507E-04 2.8114E-05 5.9335E-03 2.6119E-04
  7.844 2.0251E+00 6.3810E-02 6.5507E-04 2.8114E-05 6.0165E-03 2.6484E-04
  8.000 2.1084E+00 6.6427E-02 6.5507E-04 2.8114E-05 6.2626E-03 2.7570E-04
  8.300 2.2100E+00 6.9618E-02 6.5507E-04 2.8114E-05 6.4268E-03 2.8294E-04
  8.600 2.3003E+00 7.2454E-02 6.5507E-04 2.8114E-05 6.5954E-03 2.9037E-04
  8.900 2.3929E+00 7.5361E-02 6.5507E-04 2.8114E-05 6.7683E-03 2.9799E-04
  9.200 2.4877E+00 7.8336E-02 6.5507E-04 2.8114E-05 6.9453E-03 3.0578E-04
  9.500 2.5846E+00 8.1377E-02 6.5507E-04 2.8114E-05 7.1262E-03 3.1374E-04
  9.800 2.6836E+00 8.4482E-02 6.5507E-04 2.8114E-05 7.3110E-03 3.2186E-04
  9.871 2.7071E+00 8.5220E-02 6.5507E-04 2.8114E-05 7.3549E-03 3.2379E-04
 10.200 2.8186E+00 8.8717E-02 6.5507E-04 2.8114E-05 7.5630E-03 3.3292E-04
 24.000 8.7509E+00 2.7373E-01 6.5507E-04 2.8114E-05 1.8619E-02 8.0290E-04
 96.000 1.3678E+01 4.2497E-01 6.5507E-04 2.8114E-05 3.6452E-02 1.4774E-03
720.000 1.5005E+01 4.6543E-01 6.5507E-04 2.8114E-05 5.8495E-02 2.1925E-03
```

Release Pathway	CR		EAB		LPZ	
	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
Steam Line with MSIV FO:	2.753E+01	1.209E+00	7.024E+00	5.949E-01	4.453E-01	6.155E-02
Bypass from DW Terminating in TB:	4.677E+00	1.754E-01	3.683E-01	1.041E-01	4.825E-02	1.713E-02
Bypass from DW Terminating at RB Wall:	3.285E+00	1.282E-01	4.041E-01	7.727E-02	3.937E-02	1.156E-02
Bypass from WW Terminating at RB Wall:	1.081E+01	3.950E-01	2.855E-01	6.769E-02	9.601E-02	3.630E-02
Steam Line with Both MSIVs Closed:	7.947E+00	2.903E-01	6.007E-01	4.343E-02	7.735E-02	1.290E-02
Containment Leakage Released via SGTS:	3.134E+00	2.025E-01	3.332E-03	5.238E-04	8.734E-03	4.506E-03
ESF Leakage Released via SGTS:	1.501E+01	4.654E-01	6.551E-04	2.811E-05	5.850E-02	2.193E-03
Total TEDE (rem):	N/A	2.87E+00	N/A	8.88E-01	N/A	1.46E-01

<table>
<tr><th colspan="3">Table 1
Dose Analysis Inputs</th></tr>
<tr><th>Item</th><th>Parameter</th><th>Value</th></tr>
<tr><td>1</td><td>Onsite Breathing Rate</td><td>3.5E-04 m^3/sec</td></tr>
<tr><td>2</td><td>Offsite Breathing Rate</td><td>0-8 hours: 3.5E-04 m^3/sec
8-24 hours: 1.8E-04 m^3/sec
1-30 days: 2.3E-04 m^3/sec</td></tr>
<tr><td>3</td><td>Control Room Occupancy Factors</td><td>0-1 day: 1.0
1-4 days: 0.6
4-30 days: 0.4</td></tr>
<tr><td>4</td><td>Core Fission Product Inventory</td><td>Only the 60 nuclides considered by RADTRAD are utilized in the analysis
(See Table 4)</td></tr>
<tr><td>5</td><td>Core Power Level</td><td>1930 MWt
(1930 x 1.02 = 1969) – Used for analysis</td></tr>
<tr><td>6</td><td>Core Burnup</td><td>690 EFPD per 2-year cycle</td></tr>
<tr><td>7</td><td>Fission Product Release Fractions for LOCA</td><td>RG 1.183, Table 1
BWR Core Inventory Fraction Released Into Containment
<table>
<tr><th>Group</th><th>Gap Release Phase</th><th>Early In-vessel Phase</th><th>Total</th></tr>
<tr><td>Noble Gases</td><td>0.05</td><td>0.95</td><td>1.0</td></tr>
<tr><td>Halogens</td><td>0.05</td><td>0.25</td><td>0.3</td></tr>
<tr><td>Alkali Metals</td><td>0.05</td><td>0.20</td><td>0.25</td></tr>
<tr><td>Tellurium Metals</td><td>0.00</td><td>0.05</td><td>0.05</td></tr>
<tr><td>Ba, Sr</td><td>0.00</td><td>0.02</td><td>0.02</td></tr>
<tr><td>Noble Metals</td><td>0.00</td><td>0.0025</td><td>0.0025</td></tr>
<tr><td>Cerium Group</td><td>0.00</td><td>0.0005</td><td>0.0005</td></tr>
<tr><td>Lanthanides</td><td>0.00</td><td>0.0002</td><td>0.0002</td></tr>
</table></td></tr>
<tr><td>8</td><td>Fission Product Release Timing
(Per RG 1.183, the release phases are modeled sequentially)</td><td>RG 1.183, Table 4
LOCA Release Phases
<table>
<tr><th></th><th colspan="2">BWRs</th></tr>
<tr><th>Phase</th><th>Onset</th><th>Duration</th></tr>
<tr><td>Gap Release</td><td>2 min</td><td>0.5 hr</td></tr>
<tr><td>Early In-Vessel</td><td>0.5 hr</td><td>1.5 hr</td></tr>
</table>
Note: A gap release onset of 30 seconds is used for conservatism.</td></tr>
</table>

Table 1
Dose Analysis Inputs

Item	Parameter	Value	
9	Containment Free Volume		
	Drywell:	180,000 ft^3	
	Wetwell/Torus (including pool):	210,000 ft^3	
	Suppression Pool Volume:	92,000 ft^3 (max) 82,000 ft^3 (min)	
10	Reactor Coolant Volume	7,600 ft^3 at 552.6°F	
11	Volume of Steam Line between MSIVs	32.4 ft^3 Based on 12.77' stem-to-stem, 24" steam line, assumed Schedule 80 wall = (12.77')π(21.56")^2/4/144	
12	Primary Containment to RB Volumetric Flow Rates (cfm):	(cfm)	(cfm)
	Hours to:	**DW to RB**	**WW to RB**
	0.236	0.96	0.76
	0.394	1.14	0.84
	0.442	1.08	0.81
	0.585	1.14	0.84
	0.819	1.08	0.81
	1.129	1.14	0.84
	1.38	0.99	0.77
	2.01	1.12	0.83
	3.78	1.13	0.83
	4.00	1.11	0.82
	5.22	1.08	0.81
	5.56	1.14	0.84
	7.84	1.14	0.84
	8	1.12	0.83
	14	1.08	0.81
	24	1.06	0.80
	720	0.52	0.39
13	Volumetric Flowrate,		
	Drywell to Wetwell:	T = 0 to 1.129 hours	0 cfm
		T = 1.129 to 1.296 hours	9180 cfm
		T = 1.296 to 2.008 hours	0 cfm
		T = 2.008 to 720 hours	30,000 cfm (Assumed to be well-mixed at 10 DW volumes / hour)
14	Volumetric Flowrate,		
	Wetwell to Drywell:	T = 0 to 1.296 hours	0 cfm
		T = 1.296 to 1.463 hours	9180 cfm
		T = 1.463 to 2.008 hours	0 cfm
		T = 2.008 to 720 hours	30,000 cfm (Assumed to be well-mixed at 10 DW volumes / hour)
15	Total MSIV leak rate	32 scfh total for 2 steam lines; 16 scfh for any single line	

Table 1
Dose Analysis Inputs

Item	Parameter	Value
16	Drywell Sprays One loop, one pump/loop: Flow through one Nozzle:	 3000 gpm 34 gpm at 40 psid
17	Secondary Containment (Reactor Building) Volume	1.8E+06 ft^3
18	Fraction of Secondary Containment Available for Mixing	1.0
19	SGTS Flow Rate	2,600 cfm
20	SGTS Filter Efficiencies	HEPA: 90% Charcoal: 90%
21	Secondary Containment Drawdown Time	No drawdown time specified in Technical Specifications
22	ESF Systems Leak Rate Outside of Primary Containment (includes factor of 2)	1 gpm
23	Release Pathways ESF/Containment Leakage MSIV Leakage- Bypass Leakage-	Location: Elevated release via SGTS and Main Stack Ground level release Ground level release
24	Release Pathways ESF/Containment Leakage- MSIV Leakage-	Duration: 0 to 30 days 0 to 30 days
25	Control Room HVAC System Initiation	The Oyster Creek Control Room HVAC system does not credit any intake or recirculation filtration. Maximum (14,000 cfm) intake flow is assumed from the start of the accident for conservatism.
26	Control Room Free Volume	27,500 ft^3
27	Control Room Flow Rates Elemental and Organic Iodine Removal Efficiencies- Aerosols Removal Efficiency-	Normal mode: 14,000 cfm unfiltered intake Partial Recirc Mode: 2000 cfm unfiltered intake 0% 0%
28	Removal (Spray + Sedimentation) Lambdas in Drywell: For Particulates & Elemental Iodine: T = 0 to 0.166 hours- T = 0.166 to 0.371 hours- T = 0.371 to 0.414 hours- T = 0.414 to 0.465 hours- T = 0.465 to 0.702 hours- T = 0.702 to 0.934 hours- T = 0.934 to 1.129 hours- T = 1.129 to 1.294 hours- T = 1.294 to 1.434 hours- T = 1.434 to 1.500 hours-	 0.19 / hr 29.1 / hr 0.14 / hr 31.7 / hr 0.27 / hr 43.1 / hr 0.32 / hr 47.8 / hr 38.3 / hr 22.1 / hr

Table 1 Dose Analysis Inputs		
Item	**Parameter**	**Value**
	T = 1.500 to 1.570 hours-	18.8 / hr
	T = 1.570 to 1.657 hours-	17.4 / hr
	T = 1.657 to 1.754 hours-	16.7 / hr
	T = 1.754 to 2.007 hours-	16.5 / hr
	T = 2.007 to 2.339 hours-	5.62 / hr
	T = 2.339 to 3.775 hours-	6.4 / hr
	T = 3.775 to 4.633 hours-	0.06 / hr
	T = 4.633 to 5.933 hours-	2.36 / hr
	T = 5.933 to 6.353 hours-	3.48 / hr
	T = 6.353 to 6.804 hours-	4.49 / hr
	T = 6.804 to 7.244 hours-	5.49 / hr
	T = 7.244 to 7.675 hours-	6.49 / hr
	T = 7.675 to 7.791 hours-	7.44 / hr
	T = 7.791 to 24 hours-	0.2 / hr
	T = 24 to 720 hours-	0 / hr
	For Organic Iodine & Noble Gas:	
	T = 0 to 720 hours-	0 / hr
29	Design Basis Leak Rates:	
	Primary Containment:	1 %/day
	MSIV (V-1-0007 to -0010)-	15.975 scfh @ 35 psig (typical of 2)
	Instrument Air (V-6-0393 & V-6-0395)-	2 scfh (typical of 2) @ 35 psig
	Isolation Condenser Vents (V-14-0001/-0005 & V-14-0019/-0020)-	1 scfh (typical of 2) @ 35 psig
	2" N_2 / 8" N_2 (V-23-0014, V-23-0018, V-27-0004)-	3 scfh @ 35 psig
	2" N_2 / 8" N_2 (V-23-0016, V-23-0020, V-26-0016, V-26-0018)-	10 scfh 35 psig
	8" N_2 (V-23-0013)-	1 scfh @ 35 psig
	8" N_2 (V-23-0015)-	7.5 scfh @ 35 psig
	2" N_2 (V-23-0017)-	1.5 scfh @ 35 psig
	2" N_2 (V-23-0019)-	0.5 scfh @ 35 psig
	TIP Purge (V-23-0070)-	0.05 scfh @ 35 psig
	Multiplier on RB bypass to TB to account for spray test line-	1.5

Table 1
Dose Analysis Inputs

Item	Parameter	Value
30	Removal (Sedimentation) Lambdas in Closed Steam Line): For All Particulates: T = 0 to 0.512 hours T = 0.512 to 1.009 hours T = 1.009 to 2.239 hours T = 2.239 to 2.803 hours T = 2.803 to 3.088 hours T = 3.088 to 5.041 hours T = 5.041 to 9.871 hours T = 9.871 to 14.12 hours T = 14.12 to 24 hours T = 24 to 720 hours For Elemental, Organic, & Noble Gas: T = 0 to 720 hours	1.36 / hr 2.54 / hr 2.41 / hr 2.59 / hr 2.11 / hr 1.39 / hr 0.66 / hr 0.4 / hr 0.37 / hr 0 / hr 0 / hr
31	Filter Efficiency for MSIV1 (Line with one MSIV Failed Open) Particulates and Elemental Iodine- Organic Iodine & Noble Gases-	50% 0%
32	Filter Efficiency for MSIV2 (Closed Steam Line) Particulates- Elemental Iodine- Organic Iodine & Noble Gases-	0% 50% 0%
33	Filter Efficiency for Other Bypass Leak Paths: • For 2" N_2/8" N_2 (Releases from East Wall of RB) Particulates- Elemental Iodine- Organic Iodine & Noble Gases- • For Isolation Condenser Vent, Instrument Air, DW Spray Test (Releases for TB) Particulates- Elemental Iodine- Organic Iodine & Noble Gases-	91.6% 50% 0% 96.5% 50% 0%
34	Suppression Pool pH Time 1 hr - 2 hr -	Boron buffering via SLC injection to begin within 5 hours following a LOCA. Calculated pH >8 >8

Table 1
Dose Analysis Inputs

Item	Parameter	Value
	5 hr -	8.6
	12 hr -	8.5
	1 d -	8.5
	3 d -	8.4
	10 d -	8.2
	20 d -	8.0
	30 d -	7.9
35	Water Volume in Containment (including RCS):	82,000 ft^3 minimum in Suppression Pool +7,600 ft^3 RCS Volume 89,600 ft^3 Total
36	Minimum Suppression Pool pH throughout the 30-day accident duration (with SLC injection):	7.9
37	Spray Fall Height in Drywell	826 cm (approx 27'1")
38	Spray Nozzle Characteristics:	
	Number on Upper DW Headers-	32 per each of two
	Number on Lower DW Headers-	56 per each of two
	Mass Median Droplet Size @ 40 psid-	2600 µm
	16th Percentile Droplet Size @ 40 psid-	1500 µm
	84th Percentile Droplet Size @ 40 psid-	4100 µm
39	Spray Trip DW Pressure	0.6 psig
40	Minimum Torus Vent Submergence	3 ft
41	Normal Operating Steam Dome Pressure	1035 psia
42	Mid-plane Elevation of the Torus	(-)2'6"
43	Nominal Suppression Pool Depth	12'
44	Maximum Suppression Pool Temperature	140 F @ 1 hour, 105 F @ 24 hours (for $T_{initial}$ = 90 F)
45	Maximum Spray HX Cooling Water Temperature	85 F
46	Suppression Pool Bypass Area	10.5 in^2
47	DW Dimensions:	
	Diameter of Sphere-	70'
	Diameter of Cylindrical Extension-	33'
	Height of Extension-	23'
	Average DW Shell Thickness-	Approx 1"
48	Torus Dimensions:	
	Major Diameter-	101'
	Minor Diameter-	30'
49	RB Bypass Pathway Horizontal	

Table 1
Dose Analysis Inputs

Item	Parameter	Value
	Lengths and Diameters	
	2"N_2 Length-	3' + 2' + 10' + 4' + 20' + 20' + 40' + 38' + 40' + 12' + 13' + 4' + 34' = 240'
	2"N_2 Diameter-	2" nominal
	8"N_2 Length-	10' + 20' + 1' + 40' + 38' + 40' + 25' + 2' +34' = 210'
	8"N_2 Diameter-	8" nominal
	TIP Purge Length-	25' + 80' + 10' + 25' + 1' = 141'
	TIP Purge Diameter-	1/2" nominal
	Isolation Condenser Vents Length-	12.5' + 24.25' + 0.5' + 1.25' + 18' + 20.5' + 1' + 15.33' + 9.5' + 21.67' + 63.5' + 2.5' + 1' + 2.33' + 6' + 0.33' + 4.75' = 205'
	Isolation Condenser Vents Diameter-	3/4" nominal
	Instrument Air Length - 2" Diameter Part-	15' + 2' + 1' + 10' + 10' + 1' + 10' + 30' = 79'
	2.5" Diameter Part-	4' + 2' = 6'
	4" Diameter Part-	47' + 22' = 69'
	Instrument Air Piping Diameter-	$\{[(2'')^2(79')+(2.5'')^2(6')+(4'')^2(69')]/154\}^{1/2}$ = 3" effective
50	Bypass Pathway Minimum Plug-Flow Residence Times	
	2"N_2-	92.8 minutes
	8"N_2-	2472 minutes
	Isolation Condenser Vent-	74.8 minutes
	Instrument Air-	946.8 minutes

Table 2 Control Room X/Q Values (sec/m^3)			
Time Period	**Stack**	**Yard**	**Turbine Building**
t = 0 to 8 hours	1.80E-04	2.59E-03	2.71E-03
t = 8 to 24 hours	9.67E-05	1.15E-03	8.76E-04
t = 24 to 96 hours	2.50E-05	8.44E-04	8.63E-04
t = 96 to 720 hours	3.60E-06	7.18E-04	8.45E-04

Table 3 Offsite X/Q Values (sec/m^3)				
Time Period	**EAB - Elevated**	**EAB - Ground**	**LPZ - Elevated**	**LPZ – Ground**
t = 0 to 2 hours	1.9E-06	1.1E-3	5.3E-07	5.6E-05
t = 2 to 8 hours	-	-	5.3E-07	5.6E-05
t = 8 to 24 hours	-	-	1.8E-07	9.0E-06
t = 24 to 96 hours	-	-	1.1E-07	5.4E-06
t = 96 to 720 hours	-	-	4.8E-08	1.9E-06

Table 4
Oyster Creek Nuclide Inventory (@ t = 0)

Isotope	Curies / MWt	Isotope	Curies / MWt	Isotope	Curies / MWt
Kr-83m	4.15E+03	Ru-103	3.98E+04	Xe-135m	1.56E+04
Kr-85m	6.94E+03	Ru-105	2.57E+04	Xe-137	5.10E+04
Kr-85	4.03E+02	Ru-106	1.41E+04	Xe-138	4.78E+04
Kr-87	1.29E+04	Rh-105	2.49E+04	Cs-134	4.83E+03
Kr-88	1.83E+04	Sb-127	2.33E+03	Cs-136	1.39E+03
Kr-89	3.98E+04	Sb-129	8.03E+03	Cs-137	4.56E+03
Rb-86	4.03E+01	Te-127	2.32E+03	Ba-137m	1.81E+03
Sr-89	2.54E+04	Te-127m	3.12E+02	Ba-139	4.61E+04
Sr-90	3.33E+03	Te-129	7.93E+03	Ba-140	4.51E+04
Sr-91	3.15E+04	Te-129m	1.21E+03	La-140	4.63E+04
Sr-92	3.35E+04	Te-131m	3.77E+03	La-141	4.26E+04
Y-90	3.42E+03	Te-132	3.60E+04	La-142	4.12E+04
Y-91	3.27E+04	I-131	2.51E+04	Ce-141	4.31E+04
Y-92	3.37E+04	I-132	3.66E+04	Ce-143	3.98E+04
Y-93	3.87E+04	I-133	5.18E+04	Ce-144	3.48E+04
Zr-95	4.42E+04	I-134	5.60E+04	Pr-143	3.97E+04
Zr-97	4.37E+04	I-135	4.82E+04	Nd-147	1.68E+04
Nb-95	4.46E+04	Xe-133	5.23E+04	Np-239	5.07E+05
Mo-99	4.70E+04	Xe-133m	1.38E+03	Pu-238	1.04E+02
Tc-99m	4.11E+04	Xe-135	1.81E+04	Pu-239	1.43E+01
Am-241	8.50E+00	Xe-131m	2.60E+02	Cm-242	1.78E+03
Cm-244	7.10E+01	Pu-240	2.10E+01	Pu-241	4.99E+03

Table 5
Oyster Creek Bypass Pathway Flow Rates (cfm)

Up to t (hrs)	MSIV 1	MSIV 2	SL Out	2" N2	ICV	TB	RB (DW)	RB (WW)
0.236	0.1204	0.0946	0.1700	0.0980	0.0150	0.0450	0.0301	0.1317
0.394	0.0456	0.0324	0.0588	0.0370	0.0064	0.0166	0.0114	0.0498
0.442	0.0741	0.0528	0.0950	0.0600	0.0090	0.0280	0.0185	0.0811
0.585	0.0456	0.0324	0.0588	0.0370	0.0064	0.0166	0.0114	0.0498
0.819	0.0741	0.0528	0.0950	0.0600	0.0090	0.0280	0.0185	0.0811
1.129	0.0456	0.0324	0.0588	0.0370	0.0064	0.0166	0.0114	0.0498
1.379	0.1091	0.0801	0.1440	0.0890	0.0140	0.0410	0.0273	0.1194
2.008	0.0571	0.0405	0.0730	0.0460	0.0070	0.0210	0.0143	0.0625
3.778	0.0516	0.0366	0.0664	0.0421	0.0066	0.0199	0.0128	0.0564
4	0.0595	0.0423	0.0764	0.0480	0.0076	0.0218	0.0148	0.0651
5.222	0.0747	0.0532	0.0960	0.0610	0.0090	0.0280	0.0187	0.0817
5.556	0.0460	0.0327	0.0594	0.0374	0.0055	0.0176	0.0116	0.0504
7.844	0.0458	0.0325	0.0591	0.0378	0.0059	0.0177	0.0115	0.0501
8	0.0566	0.0402	0.0724	0.0461	0.0077	0.0208	0.0141	0.0619
14	0.0718	0.0511	0.0920	0.0580	0.0090	0.0270	0.0180	0.0786
24	0.0818	0.0585	0.1050	0.0660	0.0100	0.0310	0.0204	0.0895
720	0.0459	0.0326	0.0588	0.0370	0.0064	0.0179	0.0115	0.0503

"MSIV1" = one valve from DW, "MSIV2" = first valve into closed SL, "SL Out" = out of closed SL, "2"N2" = for deposition in 2"N2 line, "ICV" = for deposition in ICV line, "TB" = DW to TB, "RB(DW)" = DW to East wall of RB, "RB(WW)" = WW to East wall of RB.

Table 6
Thermal-Hydraulic Data (STARNAUA Input)

t (NAUA)	Cond Rate	Spray Rate/Temp		DW Temp / R/H / Press			Leak
seconds*	g/sec	g/sec	deg C	deg C	%	Atmospheres	%/day
0	9090	0	n/a	182	20	2.834467	0
270	0	0	n/a	162	45	2.785172	0
570	0	1.90E+05	30	150	60	2.730947	0
610	0	1.90E+05	30	130	100	2.60278	0
1315	0	0	29	42	100	1.040126	0
1465	0	1.90E+05	29	102	10	1.2028	0
1650	0	0	29	42	100	1.040126	0
2500	0	1.90E+05	28	102	10	1.2028	0
3340	0	0	28	42	100	1.040126	0
4035	0	1.90E+05	28	102	10	1.2028	7344
4635	0	1.90E+05	29	99	100	1.676033	0
5235	0	1.90E+05	30	40	100	1.109139	0
7200	0	1.90E+05	29	40	100	1.109139	0
13570	0	0	27	29	100	1.040126	0
14370	0	0	n/a	82	8	1.183082	0
18770	0	1.90E+05	29	92	5	1.2028	0
18970	0	1.90E+05	29	32	100	1.054915	0
19970	0	1.90E+05	29	29	100	1.054915	0
28210	0	0	24	27	100	1.040126	0
28770	0	0	n/a	69	15	1.153505	0
50370	0	0	n/a	92	3	1.2028	0
86370	0	0	n/a	130	1	1.281672	0

* NAUA t=0 is actually t=30 seconds (since STARNAUA analysis begins with gap release)

Table 7
Event Chronology

Time (sec)	Comment
0	DER of recirc loop – coolant activity released – containment leak rate 1% per day
30	Release from damaged fuel begins (gap release phase)
600	First spray actuation
1345	Sprays stop
1495	Second spray actuation
1680	Sprays stop
1830	Release from damaged fuel accelerates (gap release ends, early in-vessel release phase begins
2530	Third spray actuation
3370	Sprays stop
3930	Core collapse
4065	Vessel water saturated – steam flow to pool begins – fourth spray actuation
4665	Steam flow to pool ends (vessel dryout)
5265	Return flow of non-condensables from wetwell air space ends
7230	Release from damaged fuel ends (end of early in-vessel release phase) – well-mixed containment assumption begins – two-hour EAB dose calculated
13,600	Sprays stop
18,800	Fifth spray actuation
28,240	Sprays stop
28,800 (8 hr)	X/Qs reduced for LPZ and CR
86,400 (24 hr)	X/Qs reduced for LPZ and CR – Containment leak rate becomes 0.5%/day
345,600 (96 hr)	X/Qs reduced for LPZ and CR
2,592,000	30-day LPZ and CR doses calculated

ATTACHMENT 4

OYSTER CREEK GENERATING STATION

Docket No. 50-219

License No. DPR-16

License Amendment Request
"Oyster Creek Alternative Source Term Implementation"

List of Commitments

SUMMARY OF AMERGEN COMMITMENTS

The following table identifies commitments made in this document by AmerGen. (Any other actions discussed in the submittal represent intended or planned actions by AmerGen. They are described to the NRC for the NRC's information and are not regulatory commitments.)

COMMITMENT	COMMITTED DATE OR "OUTAGE"
To ensure that the Standby Liquid Control System is initiated in the event of a LBLOCA, the Oyster Creek Emergency Operating Procedures (EOPs) will be revised as required.	Within 90 days of NRC issuance of license amendment.