STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION TITLE PAGE

CLIENT & PROJECT **Private Fuel Storage LLC / Private Fuel Storage Facility**	PAGE 1 OF ~~28~~ 46 JRJ and 30 pgs of Appendices
CALCULATION TITLE **Accident Dose Calculations at 500m and 3219m Downwind for Canister Leakage Under Hypothetical Accident Conditions for the Holtec MPC-68 and SNC TranStor Canisters**	QA CATEGORY I

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TABLE OF CONTENTS

ATTACHMENTS

LIST OF TABLES

None

LIST OF FIGURES

None

1.0 OBJECTIVE

At the request of Private Fuel Storage, LLC, Dade Moeller & Associates, Inc. was requested to perform calculations necessary to respond to questions raised by the U.S. Nuclear Regulatory Commission (NRC) during the licensing process for the Private Fuel Storage Facility proposed to be built in Tooele County, Utah. Specifically, the questions were associated with the accident analysis and the development of an estimate of the dose to members of the public from environmental pathways following deposition of radioactive material from the plume created by the accidental release of radioactive materials to the air. To support the response to comments, calculations were performed using the Excel® spreadsheet software. Three sets of 30-day canister leakage accidents, as defined in the U.S. Nuclear Regulatory Commission Interim Staff Guidance – 5 (ISG-5, Reference 1) were performed: 1) for the Holtec HI-STAR Canister, 2) for the Sierra Nuclear Corporation (SNC) TranStor storage canister with initial assumptions and release fractions, and 3) for the SNC TranStor canister using a modified canister release fraction, and a modified respirable fraction. The accident analyses involve BWR fuel, providing the largest radionuclide inventory (and therefore producing the largest source term), to obtain bounding dose estimates. A description of the revisions to the calculation is provided below.

1A REASON FOR REVISION 1:

Four changes were made to the original calculation to expand the information obtained from the spreadsheets, and for the SNC TransStor Cask changes to reflect a different volume for the canister and the inclusion of an accident analysis that took credit for canister holdup and respirable fraction. As a result of the extensive changes, Revision 1 of this calculation supercedes the original calculation (Revision 0) in its entirety.

Change 1
The calculation was revised to include an expanded analysis of organ doses for both the Holtec Hi-Star Canister and the SNC TranStor Canister. This change was made to provide a more complete comparison with the regulations.

Sections Affected by Change 1

As a result of this change, modifications were made to Tables 1, 5, 1a and 5a to include the calculations needed for the additional organs. Tables of the type previously shown in 4, 8, 4a and 8a, conducting calculations for thyroid doses, were no longer needed since this information is included in Tables 1, 5, 1a and 5a. New Tables 4, 8, 4a and 8a were developed to show a summary of the internal and external doses, by radionuclide. In addition to the changes in Attachments A and B, the descriptions of the calculations for these tables in Sections 6 and 7 were modified to reflect these changes.

Change 2
The calculation of external doses was expanded to include skin doses, using the dose conversion

factors by radionuclide from Federal Guidance Report No. 12 (Reference 7). This revision was made to provide a more complete comparison with the regulations.

Sections Affected by Change 2

Modifications were made to Tables 2, 6, 2a and 6a to include the calculations needed for skin dose. The calculated skin doses were included in the new summary Tables 4, 8, 4a and 8a. In addition to the changes in Attachments A and B, the descriptions of the calculations for these tables found in Sections 6 and 7 were modified to reflect these changes.

Change 3

The additional calculations for the SNC TranStor Storage Cask used different release fractions and modified respirable fractions, consistent with information provided in Reference 12. The modifications reflected a TranStor canister internal volume of 5.63 m^3 (Reference 10); canister release fractions of 1.0 for gases and 0.1 for all other radionuclides; and a respirable fraction of 1.0 for gases, Co-60 and volatiles and 0.05 for particulates. Sr-90 is considered to be a particulate after it escapes from the canister. (Reference 12).

Sections Affected by Change 3

Change 3 required the addition of new information in a calculation parallel to the calculations in Section 7 for the generation of Tables 1b through 8b, as shown in Section 8 of this revision. In addition to Section 8, Attachment C was also included to support this addition.

Change 4

The initial and revised calculations for the SNC TranStor Storage Cask reflect a modified canister internal volume consistent with information provided for the TranStor Storage Cask System (Reference 10).

Section Affected by Change 4

Change 4 required a change in canister volume from 5.71 m^3 to 5.63 m^3 for the SNC TransStor canister. This change was made to Table 1a through 8a, as shown in Section 7 of this revision. In addition to the changes to Section 7, Attachment B was also modified. This volume was also used in the additional calculations identified as Table 1b through 8b described in Section 8.

2.0 METHOD

Based on the input information provided for both types of canisters, releases and potential doses to members of the public and radionuclide deposition to soil were estimated using Excel®

spreadsheets. Eight spreadsheets were produced for each accident scenario considered (for a total of 24). This report provides a detailed description of the calculations that were performed, including a description of each calculation and the units of each parameter in each equation. This calculation sheet also documents the process used to verify and validate the spreadsheet results that were produced. This calculation is divided into three parts: Development of Doses and Soil Deposition for the Holtec HI-STAR Canister, Development of Initial Doses and Deposition for the SNC TranStor Storage Canister, and Development of Revised Doses and Deposition for the SNC TranStor Storage Canister.

3.0 INPUT - HI-STAR CANISTER

The results for the HI-STAR MPC-68 canister are shown in Tables 1 through 8 in Attachment A at the end of this report. An explanation of the calculations is in Section 6.0. The following discussion provides the input details required in the calculations.

1. In responding to the NRC questions, the information found in Chapter 7 of the HI-STAR TSAR Report HI-941184 (Reference 2) regarding the accident analysis provides initial input for the radionuclides, inventory (Ci/assembly), number of BWR assemblies per canister (68) internal volume (5.99 m^3), and leak rate under hypothetical accident conditions (1.58E-5 cm^3/s).

2. The fuel release fractions used are those in Table 4-1 of NUREG-1617 (Reference 3), as described in U.S. NRC Interim Staff Guidance-5 (Reference 1). This information, and information from Item 1 above, serves as input to the first seven columns of MPC-68 spreadsheet Tables 1, 2, 5, and 6. The input to these columns has been verified against Chapter 7 of the HI-STAR TSAR Report (Reference 2) and the release fractions that are consistent with ISG-5 (Reference 1) guidance.

3. The canister leakage accident duration is assumed to be 30 days, as defined in the U.S. Nuclear Regulatory Commission Interim Staff Guidance – 5 (Reference 1).

4. Reference 4 and the PFSF Environmental Report (Reference 5) identify two downwind distances of interest to this calculation: 500 m (identified as the nearest distance from a canister to the site owner controlled area fence), and 3,219 m (about 2 miles, as identified in the PFSF Environmental Report) as the distance to the nearest resident.

5. Atmospheric dispersion factors (X/Qs) at these downwind distances are: 1.94E-3 s/m^3 at 500m downwind and 9.42E-5 s/m^3 at 3,219 m downwind (Reference 4). These x/Qs are based on a wind speed of 1.0 m/s and atmospheric stability Class F, consistent with the guidance in ISG-5 (Reference 1), with no consideration for plume meander.

6. A breathing rate of 3.30E-4 m^3/s is used, consistent with guidance provided in Federal Guidance Report No. 11 (Reference 6).

7. Inhalation dose conversion factors (DCF) are obtained from Federal Guidance Report No. 11 (Reference 6) based on NRC guidance found in ISG-5 (Reference 1). The most conservative DCF for a given radionuclide and organ combination was used in calculating dose.

8. External dose conversion factors are obtained from Federal Guidance Report No. 12 (Reference 7) based on NRC guidance found in ISG-5 (Reference 1). The most conservative DCF for a given radionuclide and organ combination was used in calculating dose.

9. Deposition estimates for material in the plume produced by the accident were made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (Reference 8). To estimate deposition, this approach requires that the relative deposition rate be divided by the arc length of the sector at the given downwind distance being considered. The relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111 (Reference 8), 8.0 E-5 m^{-1} at 500 m downwind and as 2.3E-5 m^{-1} at 3,219 m downwind.

4.0 INPUT – TRANSTOR STORAGE CANISTER

The initial analysis results for the SNC TranStor storage canister are shown in Tables 1a through 8a in Attachment B. For these tables, a change was made in the canister volume for this revision. The tables were also expanded to include organ doses and skin dose. An explanation of these calculations is found in Section 7.0. Additional analysis of this canister is contained in Tables 1b through 8b in Attachment C. Additional parameters, respirable fraction and canister release fraction, were included in the calculations contained in these tables. An explanation of these additions to the calculations is found in Section 8.0 and is identified as the "revised analysis" in the text. The table titles associated with these changes identify the additional parameters used (e.g. canister holdup and respirable fraction). The following discussion provides the input details required in the calculations described in Sections 7.0 and 8.0.

1. Information regarding the number of BWR assemblies per canister (61) was obtained from the TranStor Safety Analysis Report (Reference 9) provided by Sierra Nuclear Corporation. The internal canister volume (5.63 m^3) (Reference 10) was also provided. Additional information provided by Sierra Nuclear Corporation included input for the radionuclide inventory (Ci/assembly) (Reference 11).

2. For the revised analysis, a canister release fraction of 1.0 for gases and 0.1 for all other radionuclides (volatiles and particulates) was used. These values are based on Table XIX of Reference 12.

3. The fuel release fractions used are those in Table 4-1 of NUREG-1617, as described in U.S. NRC in Interim Staff Guidance-5 (Reference 1). The fuel release fractions are consistent with ISG-5 guidance.

4. The canister leakage accident duration for both cases is assumed to be 30 days, as defined in the U.S. Nuclear Regulatory Commission Interim Staff Guidance – 5 (Reference 1).

5. Reference 4 and the PFSF Environmental Report (Reference 5) identify two downwind distances of interest for both cases - 500 m (identified as the nearest distance from a canister to the site owner controlled area fence) and 3,219 m (about 2 miles as identified in the PFSF Environmental Report as the distance to the nearest residence).

6. Atmospheric dispersion factors (X/Qs) used for both cases at these downwind distances are : 1.93E-3 s/m^3 at 500 m downwind and 9.42E-5 s/m^3 at 3,219 m downwind (Reference 4). These X/Qs are based on a wind speed of 1.0 m/s and atmospheric stability Class F, consistent with the guidance in ISG-5 (Reference 1), with no consideration for plume meander.

7. A breathing rate of 3.30E-4 m^3/s is used, consistent with guidance provided in Federal Guidance Report No. 11 (Reference 6).

8. A respirable fraction of 1 for gases, Co-60 and volatiles, 0.05 for all other radionuclides (particulates released from inside the fuel rods) was used. These values are based on Table XX of Reference 12.

9. Inhalation dose conversion factors for both cases are obtained from Federal Guidance Report No. 11 (Reference 6) based on NRC guidance found in ISG-5 (Reference 1). The most conservative DCF for a given radionuclide and organ combination was used in calculating dose.

10. External dose conversion factors for both cases are obtained from Federal Guidance Report No. 12 (Reference 7) based on NRC guidance found in ISG-5 (Reference 1). The most conservative DCF for a given radionuclide and organ combination was used in calculating dose.

11. Deposition estimates for material in the plume produced by the accident for both cases were made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (Reference 8). To estimate the deposition, this approach requires that the relative deposition rate be divided by the arc length of the sector at the given downwind distance being considered. The relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111 (Reference 8), 8.0 E-5 m^{-1} at 500 m downwind and as 2.3E-5 m^{-1} at 3,219 m downwind.

5.0 ASSUMPTIONS

The following assumptions are used in this analysis.

- The deposition, in units of pCi/g, is calculated to produce input to the RESRAD computer program. It is assumed that the deposited material is mixed in the top 1 cm of soil, and that the soil density is 1.5E+6 g/m^3.
- It is assumed that the wind blows in the same direction continuously over the entire 30 day duration of the accidental release.
- For inhalation and submersion doses, it is assumed that an individual is continuously present at the locations of interest (nearest point at the site owner-controlled area fence and nearest residence) over the entire 30-day duration of the accidental release.
- For the SNC calculations, a TranStor canister leak rate under hypothetical accident conditions of 1.0E-4 cm^3/s is assumed.

6.0 CALCULATION/RESULTS - HOLTEC HI-STAR CANISTER ACCIDENT

The following sections describe the calculations that were performed for the 30-day canister leakage accident for the Holtec HI-STAR canister. Details are provided for each of the eight tables of spreadsheet results, on a column-by-column basis.

Table 1 - MPC-68 Accident Conditions: Committed Effective Dose Equivalent and Dose to Organs from Inhalation plus Deposition Estimates (Ci/m^2) at 500 m Downwind

As previously described, the first seven columns are entered from data contained in Chapter 7 of the HI-STAR TSAR Report (Reference 2) and the fuel release fractions that are consistent with ISG-5 guidance (Reference 1). Column 6, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The exposure duration for this accident is 30 days, in accordance with guidance in ISG-5 (Reference 1), converted to seconds as follows:

$$30 \text{ d} \times 24 \text{ h/d} \times 3600 \text{ s/h} = 2.59\text{E}6 \text{ s}$$

This value compares to the value entered in the eighth column of Table 1.

The ninth column of Table 1 contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Fuel Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.50E+1 (Ci/Assembly) x 68 (Assemblies) x (1.58E-5 (cm^3/s)/ 5.99E+6 (cm^3)) x 1 = 1.17E-8 (Ci/s)

This value compares to the value calculated for Co-60 shown in the ninth column of Table 1.

The tenth column of Table 1 contains the X/Q at a distance of 500 m downwind. As previously defined in the Input Section, this value is 1.94E-3 s/m^3. The eleventh column of Table 1 contains the breathing rate of 3.30E-4 m^3/s, consistent with guidance provided in Federal Guidance Report No. 11 (Reference 6).

Columns 12, 15, 18, 21, 24, 27 and 30 all contain organ dose conversion factors (DCF) for inhalation in units of Sv/Bq inhaled. The thirty-third column of Table 1 contains the committed effective dose conversion factor from inhalation, in units of Sv/Bq inhaled. These conversion factors were obtained from Federal Guidance Report No. 11 (Reference 6). Columns 13, 16, 19, 22, 25, 28, 31 and 34 of Table 1 contain the dose conversion factors in units of mrem/μCi . These values were calculated by multiplying columns 12, 15, 18, 21, 24, 27, 30 and 33 by a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 11 (Reference 6). A check of this conversion calculation for Co-60 produces:

Gonad DCF (mrem/μCi) = 4.76E-9 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq = 1.76E+1 mrem/μCi (Column 13)

Breast DCF (mrem/μCi) = 1.84E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq = 6.81E+1 mrem/μCi (Column 16)

Lung DCF (mrem/μCi) = 3.45E-7 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq = 1.28E+3 mrem/μCi (Column 19)

R. Marrow DCF (mrem/μCi) = 1.72E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq = 6.36E+1 mrem/μCi (Column 22)

B Surface DCF (mrem/μCi) = 1.35E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq = 5.00E+1 mrem/μCi (Column 25)

Thyroid DCF (mrem/μCi) = 1.62E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq = 5.99E+1 mrem/μCi (Column 28)

Remainder DCF (mrem/μCi) = 3.60E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq = 1.33E+2 mrem/μCi (Column 31)

Effective DCF (mrem/μCi) = 5.91E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq = 2.19E2 mrem/μCi (Column 34)

These values compare to the values calculated for Co-60 in Table 1.

The committed dose equivalent (CDE) for the organs and the committed effective dose equivalent (CEDE) are found as:

CDE and CEDE (mrem) = DCF (mrem/μCi) x Release Rate (Ci/s) x Duration (s) x X/Q s/m^3) x Breathing Rate (m^3/s) x 1E6 μCi/Ci

This equation is used to calculate the dose to each of the organs identified in Federal Guidance Report No. 11, and the CEDE. The calculated values of the respective doses to organs and the CEDE are found in columns 14, 17, 20, 23, 26, 29, 32 and 35.

Substituting the values for Co-60:

Gonad CDE (mrem/uCi) = 1.76E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 3.41E-1 mrem (Column 14)
Breast CDE (mrem/μCi) = 6.81E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.32E+0 mrem (Column 17)
Lung CDE (mrem/μCi) = 1.28E+3 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 2.47E+1 mrem (Column 20)
Red Marrow CDE (mrem/μCi) = 6.36E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.23E+0 mrem (Column 23)
Bone Surface CDE (mrem/μCi) = 5.00E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 9.66E-1 mrem (Column 26)
Thyroid CDE (mrem/μCi) = 5.99E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.16E+0 mrem (Column 29)
Remainder CDE (mrem/μCi) = 1.33E+2 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 2.58E+0 mrem (Column 32)
Effective = 2.19E+2 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 4.2 mrem (Column 35)

These calculations confirm the operation of the spreadsheet to obtain organ CDEs and CEDE.

The final two columns of Table 1 contain deposition estimates. As previously described in the Input Section, this estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (Reference 8). The relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111 (Reference 8), 8.0 E-5 m^{-1} at 500 m downwind. The calculation performed in the next to last column of Table 1 is as follows:

Deposition at 500 m (Ci/m^2) = Relative Deposition (m^{-1}) x Release Rate (Ci/s) x Accident Exposure Duration (s) / ((π x 2 x 500 m)/16)

Substituting values for Co-60:

Deposition at 500 m (Ci/m^2) = 8E-5 m^{-1} x 1.17E-8 (Ci/s) x
2.59E+6 (s) /(196) = 1.23E-8 (Ci/m^2)

This value compares to the value calculated for Co-60 in Column 36 of Table 1.

Finally, the deposition in units of pCi/g is calculated to produce input to the RESRAD computer program. For this calculation, it is assumed that the deposited activity is mixed in the top 1 cm of soil, with an assumed soil density of 1.5E+6 g/m^3. This calculation is in the last column of Table 1 and is as follows:

Deposition at 500 m (pCi/g) = Deposition at 500 m (Ci/m^2) x Unit Conversion (pCi/Ci) /
(Effective Soil Depth (m) x soil density (g/m^3))

Substituting values for Co-60:

Deposition at 500 m (pCi/g) = 1.23E-8 (Ci/m2) x 1E12 pCi/Ci / ((0.01 m x 1.5E6 g/m^3))
= 8.2E-1pCi/g

This value compares to the value calculated for Co-60 in Column 37 of Table 1, completing the verification of the spreadsheet calculations used to produce Table 1.

Table 2 - MPC-68 Accident Conditions: Effective Dose - External Exposure from Submersion at 500 m Downwind

Again, the first seven columns of Table 2 are entered from data contained in Chapter 7 of the HI-STAR TSAR Report (Reference 2) and the fuel release fractions that are consistent with ISG-5 guidance. Column 6, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The eighth column of Table 2 contains the exposure duration for this accident, 30 days, as expressed in seconds as follows:

30 d x 24 h/d x 3600 s/h = 2.59E6 s

The ninth column of Table 2 contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x
Fuel Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.50E+1 (Ci/Assembly) x 68 (Assemblies) x
(1.58E-5 (cm^3/s)/ 5.99E+6 (cm^3)) x 1 = 1.17E-8 (Ci/s)

This value compares to the value calculated for Co-60 shown in the ninth column of Table 2.

The tenth column of Table 2 shows the total release in Ci over the 30 day accident duration. This value is found as follows:

Release (Ci) = Release Rate (Ci/s) x Accident Duration (s)

A check of this calculation for Co-60 produces:

Release (Ci) = 1.17E-08 (Ci/s) x 2.59E+6 (s) = 3.03E-2 Ci

This value compares to the calculated value for Co-60 in the tenth column of Table 2.

The eleventh column of Table 2 contains the X/Q at a distance of 500 m downwind. This value is 1.94E-3 s/m^3.

The twelfth column of Table 2 contains the dose conversion factor for skin from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No.12 (Reference 7). The thirteenth column of Table 2 contains the dose conversion factor for skin from submersion in the plume, in units of (mrem m^3/μCi s), and is the product of the entry in column 12 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7).

A check of this calculation for skin using Co-60 produces:

1.45E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 5.37E-4 (mrem m^3/μCi s)

This is comparable to the value found in column 13 of Table 2.

The skin dose from submersion in the plume is found in the fourteenth column of Table 2 using the equation:

Dose (mrem) = DCF (mrem m^3/μCi s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3)
x 1E6 μCi/Ci

A check of this calculation for skin using Co-60:

Skin Dose = 5.37E-4 (mrem m^3/μCi s) x 1.17E-8 (Ci/s) x 2.59E+6 (s) x 1.94E-3 (s/m^3) x 1E6 μCi/Ci =3.14E-2 (mrem)

This value compares to the value calculated for Co-60 in the fourteenth column of Table 2.

The fifteenth column of Table 2 contains the effective dose equivalent factor from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No. 12 (Reference 7). The sixteenth column of Table 2 contains the effective dose equivalent factor for submersion in the plume, in units of (mrem m^3/μCi s), and is obtained as the product of the entry in Column 15 times a conversion factor of 3.7E+9 found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for Co-60 produces:

1.26E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 4.66E-4 (mrem m^3/μCi s)

This value is comparable to the value calculated for Co-60 in the sixteenth column of Table 2.

The effective dose equivalent from submersion in the plume is found in the seventeenth column of Table 2 as:

EDE (mrem/y) = DCF (mrem m^3/μCi s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 μCi/Ci

Substituting the values for Co-60:

EDE (mrem/y) = 4.66E-4 (mrem m^3/μCi s) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 1E6 μCi/Ci = 2.73E-2 mrem

This value compares to the value calculated for Co-60 in the seventeenth column of Table 2, completing the verification of the spreadsheet calculations used to produce Table 2.

Table 3 - MPC-68 Accident Total Effective Dose Equivalent at 500 m Downwind

Table 3 contains the total effective dose equivalent for the accident involving the MPC-68 Cask at a distance of 500 m downwind, and is calculated using the following equation:

Total Effective Dose Equivalent (mrem/y) = Effective Dose Equivalent from Submersion in the Plume Totaled over all Radionuclides in the Plume (mrem/y) + Inhalation Committed Effective Dose Equivalent Totaled over all Radionuclides in the Plume (mrem/y)

The dose results are obtained from Tables 1 and 2 and inserted in Columns 1 and 3 of Table 3. Substituting the values for Inhalation Committed Effective Dose Equivalent and the Effective Dose Equivalent from Submersion for this accident at 500 m in the equation above:

2.79E-2 (mrem/y) + 1.34E+1 (mrem/y) = 1.34E+1 (mrem/y)

This value compares to the value calculated for this accident at 500 m shown in the last column of Table 3, completing the verification of the spreadsheet calculations used to produce Table 3.

Table 4 MPC-68 Accident Conditions: Summary of Inhalation Doses at 500 m Downwind

Table 4 summarizes the information in Tables 1, 2 and 3. Each of the radionuclides of interest are listed with the internal doses to organs and committed effective inhalation dose from Table 1 and the external dose to skin and effective dose from Table 2. The information on internal dose was transferred from Table 1 columns 14, 17, 20, 23, 26, 29, 32 and 35 to columns 2, 3, 4, 5, 6, 7, 8, and 9 of Table 4. The external dose was transferred from Table 2 columns 14 and 17 to columns 10 and 11 of Table 4.

The information on deposition in the soil, was transferred from Table 1 columns 36 and 37 into columns 12 and 13 of Table 4. The total effective dose equivalent (TEDE) is the total found in Table 3.

Table 5 - MPC-68 Accident Conditions: Committed Effective Dose Equivalent and Dose to Organs From Inhalation Plus Deposition Estimates (Ci/m^2) at 3,219 m Downwind

As previously described, the first seven columns are entered from data contained in Chapter 7 of the HI-STAR TSAR Report (Reference 2) and the fuel release fractions that are consistent with ISG-5 guidance (Reference 1). Column 6, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume.

The exposure duration for this accident is 30 days, in accordance with guidance in ISG-5 (Reference 1), converted to seconds as follows:

30 d x 24 h/d x 3600 s/h = 2.59E6 s

This value compares to the value entered in the eighth column of Table 5.

The ninth column of Table 5 contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Fuel Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.50E+1 (Ci/Assembly) x 68 (Assemblies) x
(1.58E-5 (cm^3/s)/ 5.99E+6 (cm^3)) x 1 = 1.17E-8 (Ci/s)

This value compares to the value calculated for Co-60 shown in the ninth column of Table 5.

The tenth column of Table 5 contains the X/Q at a distance of 3,219 m downwind. This value is 9.42E-5 s/m^3. The eleventh column of Table 5 contains the breathing rate of 3.30E-4 m^3/s, consistent with guidance provided in Federal Guidance Report No. 11 (Reference 6).

Columns 12, 15, 18, 21, 24, 27 and 30 all contain organ dose conversion factors for inhalation in units of Sv/Bq inhaled. The thirty-third column of Table 5 contains the committed effective dose conversion factor from inhalation, in units of Sv/Bq inhaled. These conversion factors were obtained from Federal Guidance Report No. 11 (Reference 6). Columns 13, 16, 19, 22, 25, 28, 31 and 34 of Table 5 contain the dose conversion factors in units of mrem/μCi .These values were calculated by multiplying columns 12, 15, 18, 21, 24, 27, 30 and 33 by a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 11 (Reference 6). A check of this calculation for Dose Conversion Factors from inhalation using the nuclide Co-60 produces:

Gonad DCF (mrem/μCi) = 4.76E-9 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq =
1.76E+1 mrem/μCi (Column 13)
Breast DCF (mrem/μCi) = 1.84E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq =
6.81E+1 mrem/μCi (Column 16)
Lung DCF (mrem/μCi) = 3.45E-7 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq =
1.28E+3 mrem/μCi (Column 19)
R. Marrow DCF (mrem/μCi) = 1.72E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq =
6.36E+1 mrem/μCi Column 22)
B Surface DCF (mrem/μCi) = 1.35E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq =
5.00E+1 mrem/μCi (Column 25)
Thyroid DCF (mrem/μCi) = 1.62E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq =
5.99E+1 mrem/μCi (Column 28)
Remainder DCF (mrem/μCi) = 3.60E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq =
1.33E+2 mrem/μCi (Column 31)
Effective DCF (mrem/μCi) = 5.91E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq =
2.19E2 mrem/μCi (Column 34)

These calculations confirm the operation of the spreadsheet to obtain DCFs in units of mrem/μCi.

The committed dose equivalent for the organs and the CEDE are is found as:

CDE and CEDE (mrem) = DCF (mrem/μCi) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x Breathing Rate (m^3/s) x 1E6 μCi/Ci

This equation is used to calculate the dose to each of the organs identified in Federal Guidance Report No. 11, as well as the CEDE. The calculated values of the respective doses to organs are found in columns 14, 17, 20, 23, 26, 29 and 32. The CEDE is found in column 35.

Substituting the values for Co-60:

Gonad CDE (mrem) = 1.76E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.65E-2 mrem (Column 14)

Breast CDE (mrem) = 6.81E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 6.40E-2 mrem (Column 17)

Lung CDE (mrem) = 1.28E+3 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.20E+0 mrem (Column 20)

Red Marrow CDE (mrem) = 6.36E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 5.98E-2 mrem (Column 23)

Bone Surface CDE (mrem) = 5.00E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 4.69E-2 mrem (Column 26)

Thyroid CDE (mrem) = 5.99E+1 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 5.63E-2 mrem (Column 29)

Remainder CDE (mrem) = 1.33E+2 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.25E-1 mrem (Column 32)

Effective CDE (mrem) = 2.19E+2 (mrem/μCi) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 2.05E-1 mrem/y (Column 35)

These calculations confirm the operation of the spreadsheet to obtain organ CDEs and the CEDE.

The final two columns of Table 5 contain deposition estimates. As described in the Input Section, this estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (Reference 8). The relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111 as 2.3E-5 m^{-1} at 3,219 m downwind. The calculation performed in Column 36 of Table 5 is as follows:

Deposition at 3,219 m (Ci/m^2) = Relative Deposition (m^{-1}) x Release Rate (Ci/s) x Accident Duration (s) / (π x 2 x 3,219 m)/16

Substituting values for Co-60:

Deposition at 3,219 m (Ci/m^2) = 2.3E-5 m^{-1} x 1.17E-8 (Ci/s)
x 2.59E+6 (s) / (1264) = 5.51E-10 (Ci/m^2)

This value compares to the value calculated for Co-60 in Column 36 of Table 5.

Finally, the deposition in units of pCi/g is calculated to produce input to the RESRAD computer program. It is assumed that the deposited radioactive material is mixed in the top 1 cm of soil and that the soil density is 1.5E+6 g/m^3. This calculation is in Column 37 of Table 5 and is as follows:

Deposition at 3,219 m (pCi/g) = Deposition at 3,219 m (Ci/m^2) x Unit Conversion (pCi/Ci) /
(Effective Soil Depth (m) x soil density (g/m^3))

Substituting values for Co-60:

Deposition at 3,219 m (pCi/g) = 5.51E-10 (Ci/m2) x 1E12 pCi/Ci / (0.01 (m) x 1.5E6 (g/m^3))
= 3.68E-2 pCi/g

This value compares to the value calculated for Co-60 in Column 37 of Table 5, completing the verification of the spreadsheet calculations used to produce Table 5.

Table 6 - MPC-68 Accident Conditions: Effective Dose - External Exposure from Submersion at 3,219 m Downwind

Again, the first seven columns of Table 6 are entered from data contained in Chapter 7 of the HI-STAR TSAR Report (Reference 2) and the fuel release fractions that are consistent with ISG-5 guidance (Reference 1). Column 6, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The eighth column of Table 6 contains the exposure duration for this accident, 30 days, as expressed in seconds: 2.59E6 s. The ninth column of Table 6 contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x
Fuel Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.50E+1 (Ci/Assembly) x 68 (Assemblies) x
(1.58E-5 (cm^3/s)/ 5.99E+6 (cm^3)) x 1 = 1.17E-8 (Ci/s)

This value compares to the value calculated for Co-60 shown in the ninth column of Table 6.

The tenth column of Table 6 shows the total release in Ci over the 30 day accident duration. This value is found as follows:

Release (Ci) = Release Rate (Ci/s) x Accident Duration (s)

A check of this calculation for Co-60 produces:

Release (Ci) = 1.17E-08 (Ci/s) x 2.59E+6 (s) = 3.03E-2 Ci

This value compares to the calculated value for Co-60 in the tenth column of Table 6.

The eleventh column of Table 6 contains the X/Q at a distance of 3,219 m downwind. This value is 9.42E-5 s/m^3.

The twelfth column of Table 6 contains the dose conversion factor for skin from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No.12 (Reference 7). The thirteenth column of Table 6 contains the dose conversion factor for skin from submersion in the plume, in units of (mrem m^3/μCi s), and is the product of the entry in column 12 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7).

A check of this calculation for skin using Co-60 produces:

1.45E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 5.37E-4 (mrem m^3/μCi s)

This is comparable to the value found in column 13 of Table 6.

The skin dose from submersion in the plume is found in the fourteenth column of Table 6 using the equation:

Dose (mrem) = DCF (mrem m^3/μCi s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 μCi/Ci

A check of this calculation for skin using Co-60 produces:

Skin Dose (mrem) = 5.37E-4 (mrem m^3/μCi s) x1.17E-08 (Ci/s) x 2.59E+6 (s) x 9.42E-5 (s/m^3) x 1E6 μCi/Ci = 1.53E-3 (mrem)

This is comparable to the value for Co-60, found in the fourteenth column of Table 6

The fifteenth column of Table 6 contains the effective dose equivalent factor from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No. 12 (Reference 7). The sixteenth column of Table 6 contains the effective dose equivalent factor for submersion in the plume, in units of (mrem m^3/μCi s), and is obtained as the product of the entry in Column 15 times a conversion factor of 3.7E+9 found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for Co-60 produces:

1.26E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 4.66E-4 (mrem m^3/μCi s)

This value compares to the value calculated for Co-60 in the sixteenth column of Table 6.

The effective dose equivalent from submersion in the plume is found as:

EDE (mrem/y) = DCF (mrem m^3/μCi s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 μCi/Ci

Substituting the values for Co-60:

EDE (mrem/y) = 4.66E-4 (mrem m^3/μCi s) x 1.17E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 1E6 μCi/Ci = 1.33E-3 mrem/y

This value compares to the value calculated for Co-60 in the seventeenth column of Table 6, completing the verification of the spreadsheet calculations used to produce Table 6.

Table 7 - MPC-68 Accident Total Effective Dose Equivalent at 3,219 m Downwind

Table 7 contains the total effective dose equivalent for the accident involving the MPC-68 Cask at a distance of 3,219 m downwind, and is calculated using the following equation:

Total Effective Dose Equivalent (mrem/y) = Effective Dose Equivalent from Submersion in the Plume Totaled over all Radionuclides in the Plume (mrem/y) + Inhalation Committed Effective Dose Equivalent Totaled over all Radionuclides in the Plume (mrem/y)

The dose results are obtained from Tables 5 and 6 and inserted in Columns 1 and 3 of Table 7. Substituting the values for Inhalation Committed Effective Dose Equivalent and the Effective Dose Equivalent from Submersion for this accident at 3219 m in the equation above:

1.36E-3 (mrem/y) + 6.52E-1 (mrem/y) = 6.53E-1 (mrem/y)

This value compares to the value calculated for this accident at 3,219 m shown in the last column of Table 7, completing the verification of the spreadsheet calculations used to produce Table 7.

Table 8 MPC-68 Accident Conditions: Summary of Inhalation Doses at 3,219 m Downwind

Table 8 summarizes the information in Tables 5, 6 and 7. Each of the radionuclides of interest are listed with the internal doses to organs and committed effective inhalation dose from Table 5 and the external dose to skin and effective dose from Table 6. The information on internal dose was transferred from Table 5 columns 14, 17, 20, 23, 26, 29, 32 and 35 to columns 2, 3, 4, 5, 6, 7, 8, and 9 of Table 8. The external dose was transferred from Table 6 columns 14 and 17 to columns 10 and 11 of Table 8.

The information on deposition in the soil, was transferred from Table 5 columns 36 and 37 into columns 12 and 13 of Table 8. The total effective dose equivalent (TEDE) is the total found in Table 7.

7.0 CALCULATION/RESULTS – SNC INITIAL ASSESSMENT

The following sections describe the calculations that were performed for the 30-day canister leakage accident for the SNC TranStor storage canister. Details are provided for each of the eight tables of spreadsheet results, on a column-by-column basis.

Table 1a - SNC TranStor Cask with BWR Fuel - Accident Analysis: Committed Effective Dose Equivalent and Dose to Organs From Inhalation Plus Deposition Estimates (Ci/m^2) at 500 m Downwind

The first seven columns are entered from data supporting the SNC TranStor Storage Canister that can be found in Section 4.0, Input and Section 5.0, Assumptions. Column 6, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The fuel release fractions are consistent with ISG-5 guidance (Reference 1).).

The exposure duration for this accident is 30 days, in accordance with guidance in ISG-5 (Reference 1), converted to seconds as follows:

$$30 \text{ d} \times 24 \text{ h/d} \times 3600 \text{ s/h} = 2.59\text{E+6 s}$$

This value compares to the value entered in the eighth column of Table 1a.

The ninth column of Table 1a contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Fuel Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.00E+1 (Ci/Assembly) x 61(Assemblies) x (1.00E-4 (cm^3/s)/ 5.63E+6 (cm^3)) x 1 = 6.50E-8 (Ci/s)

This value compares to the value calculated for Co-60 shown in the ninth column of Table 1a.

The tenth column of Table 1a contains the X/Q at a distance of 500 m downwind. As previously defined in the Input Section, this value is 1.94E-3 s/m^3. The eleventh column of Table 1a contains the breathing rate of 3.30E-4 m^3/s, consistent with guidance provided in Federal Guidance Report No. 11 (Reference 6).

Columns 12, 15, 18, 21, 24, 27 and 30 all contain organ dose conversion factors (DCF) for inhalation in units of Sv/Bq inhaled. The thirty-third column of Table 1a contains the committed effective dose conversion factor from inhalation, in units of Sv/Bq inhaled. These conversion factors were obtained from Federal Guidance Report No. 11 (Reference 6). Columns 13, 16, 19, 22, 25, 28, 31 and 34 of Table 1a contain the dose conversion factors in units of mrem/μCi . These values were calculated by multiplying columns 12, 15, 18, 21, 24, 27, 30 and 33 by a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 11 (Reference 6). A check of this conversion calculation for Co-60 produces:

Gonad DCF (mrem/μCi) = 4.76E-9 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.76E+1 mrem/μCi (Column 13)
Breast DCF (mrem/μCi) = 1.84E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 6.81E+1 mrem/μCi (Column 16)
Lung DCF (mrem/μCi) = 3.45E-7 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.28E+3 mrem/μCi (Column 19)
R. Marrow DCF (mrem/μCi) = 1.72E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 6.36E+1 mrem/μCi Column 22)
B Surface DCF (mrem/μCi) = 1.35E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 5.00E+1 mrem/μCi (Column 25)
Thyroid DCF (mrem/μCi) = 1.62E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 5.99E+1 mrem/μCi (Column 28)
Remainder DCF (mrem/μCi) = 3.60E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.33E+2 mrem/μCi (Column 31)
Effective DCF (mrem/μCi) = 5.91E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 2.19E2 mrem/μCi (Column 34)

These values compare to the values calculated for Co-60 in Table 1a.

The committed dose equivalent for the organs and the CEDE are found as:

CDE and CEDE (mrem) = DCF (mrem/μCi) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x Breathing Rate (m^3/s) x 1E6 μCi/Ci

This equation is used to calculate the dose to each of the organs identified in Federal Guidance Report No. 11, and the CEDE. The calculated values of the respective doses to organs are found in columns 14, 17, 20, 23, 26, 29 and 32. The CEDE is found in column 35.

Substituting the values for Co-60:

Gonad CDE (mrem/uCi) = 1.76E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.90E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.90E+0 mrem (Column 14)

Breast CDE (mrem/μCi) = 6.81E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 7.34E+0 mrem (Column 17)

Lung CDE (mrem/μCi) = 1.28E+3 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.38E+2 mrem (Column 20)

Red Marrow CDE (mrem/μCi) = 6.36E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 6.87E+0 mrem (Column 23)

Bone Surface CDE (mrem/μCi) = 5.00E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 5.39E+0 mrem (Column 26)

Thyroid CDE (mrem/μCi) = 5.99E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 6.47E+0 mrem (Column 29)

Remainder CDE (mrem/μCi) = 1.33E+2 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.44E+1 mrem (Column 32)

Effective = 2.19E+2 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 2.36E+1 mrem/y (Column 35)

These calculations confirm the operation of the spreadsheet to obtain organ CDEs and the CEDE.

The final two columns of Table 1a contain deposition estimates. As previously described in the Input Section, this estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (Reference 8). The relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111 (Reference 8), 8.0 E-5 m^{-1} at 500 m downwind. The calculation performed in the next to last column of Table 1 is as follows:

Deposition at 500 m (Ci/m^2) = Relative Deposition (m^{-1}) x Release Rate (Ci/s) x Accident Exposure Duration (s) / ((π x 2 x 500 m)/16)

Substituting values for Co-60:

Deposition at 500 m (Ci/m^2) = 8E-5 m^{-1} x 6.50E-8 (Ci/s) x 2.59E+6 (s) /(196) = 6.87E-8 (Ci/m^2)

This value compares to the value calculated for Co-60 in Column 36 of Table 1a.

Finally, the deposition in units of pCi/g is calculated to produce input to the RESRAD computer program. For this calculation, it is assumed that the deposited activity is mixed in the top 1 cm of soil, with an assumed soil density of 1.5E+6 g/m^3. This calculation is in the last column of Table 1a and is as follows:

Deposition at 500 m (pCi/g) = Deposition at 500 m (Ci/m^2) x Unit Conversion (pCi/Ci) / (Effective Soil Depth (m) x soil density (g/m^3))

Substituting values for Co-60:

Deposition at 500 m (pCi/g) =6.87E-8 (Ci/m2) x 1E12 pCi/Ci / ((0.01 m x 1.5E6 g/m^3)) = 4.58E+0 pCi/g

This value compares to the value calculated for Co-60 in Column 37 of Table 1a, completing the verification of the spreadsheet calculations used to produce Table 1a.

Table 2a - SNC TranStor Cask with BWR Fuel - Accident Analysis: Effective Dose - External Exposure from Submersion at 500 m Downwind

The first seven columns are entered from data supporting the SNC TranStor Storage Canister that can be found in Section 4.0, Input and Section 5.0, Assumptions. Column 6, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The fuel release fractions are consistent with ISG-5 guidance (Reference 1).

The eighth column of Table 2a contains the exposure duration for this accident, 30 days, as expressed in seconds as follows:

30 d x 24 h/d x 3600 s/h = 2.59E6 s

The ninth column of Table 2a contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.00E+1 (Ci/Assembly) x 61 (Assemblies) x
(1.00-4 (cm^3/s)/ 5.63E+6 (cm^3)) x 1 = 6.50E-8 (Ci/s)

This value compares to the value calculated for Co-60 shown in the ninth column of Table 2a.

The tenth column of Table 2a shows the total release in Ci over the 30 day accident duration. This value is found as follows:

Release (Ci) = Release Rate (Ci/s) x Accident Duration (s)

A check of this calculation for Co-60 produces:

Release (Ci) = 6.50E-8 (Ci/s) x 2.59E+6 (s) = 1.68E-1 Ci

This value compares to the calculated value for Co-60 in the tenth column of Table 2a.

The eleventh column of Table 2a contains the X/Q at a distance of 500 m downwind. This value is 1.94E-3 s/m^3.

The twelfth column of Table 2a contains the dose conversion factor for skin from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No.12 (Reference 7). The thirteenth column of Table 2a contains the dose conversion factor for skin from submersion in the plume, in units of (mrem $m^3/\mu Ci$ s), and is the product of the entry in column 12 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for skin using Co-60 produces:

1.45E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 5.37E-4 (mrem $m^3/\mu Ci$ s)

This is comparable to the value found in column 13 of Table 2a.

The skin dose from submersion in the plume is found in the fourteenth column of Table 2a using the equation:

Dose (mrem) = DCF (mrem $m^3/\mu Ci$ s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 μCi/Ci

A check of this calculation for skin using Co-60:

Skin Dose = 5.37E-4 (mrem $m^3/\mu Ci$ s) x 6.50E-8 (Ci/s) x 2.59E+6 (s) x 1.94E-3 (s/m^3) x 1E6 $\mu Ci/Ci$ =1.75E-1 (mrem)

This value compares to the value calculated for Co-60 in the fourteenth column of Table 2a.

The sixteenth column of Table 2a contains the effective dose equivalent factor for submersion in the plume, in units of (mrem $m^3/\mu Ci$ s), and is obtained as the product of the entry in Column 15 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for Co-60 produces:

1.26E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 4.66E-4 (mrem $m^3/\mu Ci$ s)

This value compares to the value calculated for Co-60 in the sixteenth column of Table 2a.

The effective dose equivalent from submersion in the plume is found in the seventeenth column of Table 2a as:

EDE (mrem/y) = DCF (mrem $m^3/\mu Ci$ s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 $\mu Ci/Ci$

Substituting the values for Co-60:

EDE (mrem/y) = 4.66E-4 (mrem $m^3/\mu Ci$ s) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 1E6 $\mu Ci/Ci$ = 1.52E-1mrem

This value compares to the value calculated for Co-60 in the seventeenth column of Table 2a, completing the verification of the spreadsheet calculations used to produce Table 2a.

Table 3a - SNC TranStor Cask with BWR Fuel - Accident Analysis: Total Effective Dose Equivalent at 500 m Downwind

Table 3a contains the total effective dose equivalent for the accident involving the SNC TranStor Storage Canister at a distance of 500 m downwind, and is calculated using the following equation:

Total Effective Dose Equivalent (mrem/y) = Effective Dose Equivalent from Submersion in the Plume Totaled over all Radionuclides in the Plume (mrem/y) + Inhalation Committed Effective Dose Equivalent Totaled over all Radionuclides in the Plume (mrem/y)

The dose results are obtained from Tables 1a and 2a and inserted in Columns 1 and 3 of Table 3a. Substituting the values for Inhalation Committed Effective Dose Equivalent and the Effective Dose Equivalent from Submersion for this accident at 500 m in the equation above:

$$7.57E+1 \text{ (mrem/y)} + 1.55E-1 \text{ (mrem/y)} = 7.59E+1 \text{ (mrem/y)}$$

This value compares to the value calculated for this accident at 500 m shown in the last column of Table 3a, completing the verification of the spreadsheet calculations used to produce Table 3a.

Table 4a SNC TranStor Cask with BWR Fuel - Accident Analysis: Summary of Inhalation Doses at 500 m Downwind

Table 4a summarizes the information in Tables 1a, 2a and 3a. Each of the radionuclides of interest are listed with the internal doses to organs and committed effective inhalation dose from Table 1a and the external dose to skin and effective dose from Table 2a. The information on internal dose was transferred from Table 1a columns 14, 17, 20, 23, 26, 29, 32 and 35 to columns 2, 3, 4, 5, 6, 7, 8, and 9 of Table 4a. The external doses were transferred from Table 2a columns 14 and 17 to columns 10 and 11 of Table 4a.

The information on deposition in the soil, was transferred from Table 1a columns 36 and 37 into columns 12 and 13 of Table 4a. The total effective dose equivalent (TEDE) is the total found in Table 3a.

Table 5a - SNC TranStor Cask with BWR Fuel - Accident Analysis: Committed Effective Dose Equivalent and Dose to Organs From Inhalation Plus Deposition Estimates (Ci/m^2) at 3,219 m Downwind

The first seven columns are entered from data supporting the SNC TranStor Storage Canister that can be found in Section 4.0, Input and Section 5.0, Assumptions. Column 6, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The fuel release fractions are consistent with ISG-5 guidance (Reference 1).

The exposure duration for this accident is 30 days, in accordance with guidance in ISG-5 (Reference 1), converted to seconds as follows:

$$30 \text{ d} \times 24 \text{ h/d} \times 3600 \text{ s/h} = 2.59E6 \text{ s}$$

This value compares to the value entered in the eighth column of Table 5a.

The ninth column of Table 5a contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Fuel Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.00E+1 (Ci/Assembly) x 61 (Assemblies) x
(1.00E-4 (cm^3/s)/ 5.63E+6 (cm^3)) x 1 = 6.50E-8 (Ci/s)

This value compares to the value calculated for Co-60 shown in the ninth column of Table 5a.

The tenth column of Table 5a contains the X/Q at a distance of 3,219 m downwind. This value is 9.42E-5 s/m^3. The eleventh column of Table 5a contains the breathing rate of 3.30E-4 m^3/s, consistent with guidance provided in Federal Guidance Report No. 11 (Reference 6).

Columns 12, 15, 18, 21, 24, 27 and 30 all contain organ dose conversion factors for inhalation in units of Sv/Bq inhaled. The thirty-third column of Table 5a contains the committed effective dose conversion factor from inhalation, in units of Sv/Bq inhaled. These conversion factors were obtained from Federal Guidance Report No. 11 (Reference 6). Columns 13, 16, 19, 22, 25, 28, 31 and 34 of Table 5a contain the dose conversion factors in units of mrem/μCi. These values were calculated by multiplying columns 12, 15, 18, 21, 24, 27, 30 and 33 by a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 11 (Reference 6). A check of this calculation for Dose Conversion Factors from inhalation using the nuclide Co-60 produces:

Gonad DCF (mrem/μCi) = 4.76E-9 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.76E+1 mrem/μCi (Column 13)
Breast DCF (mrem/μCi) = 1.84E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 6.81E+1 mrem/μCi (Column 16)
Lung DCF (mrem/μCi) = 3.45E-7 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.28E+3 mrem/μCi (Column 19)
R. Marrow DCF (mrem/μCi) = 1.72E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 6.36E+1 mrem/μCi Column 22)
B Surface DCF (mrem/μCi) = 1.35E-8 Sv/Bq x3.7E+9 mrem/μCi per Sv/Bq = 5.00E+1 mrem/μCi (Column 25)
Thyroid DCF (mrem/μCi) = 1.62E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 5.99E+1 mrem/μCi (Column 28)
Remainder DCF (mrem/μCi) = 3.60E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.33E+2 mrem/μCi (Column 31)
Effective DCF (mrem/μCi) = 5.91E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 2.19E2 mrem/μCi (Column 34)

These calculations confirm the operation of the spreadsheet to obtain DCFs in units of mrem/μCi.

The committed dose equivalent for the organs and the CEDE are found as:

CDE and CEDE (mrem) = DCF (mrem/μCi) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x Breathing Rate (m^3/s) x 1E6 μCi/Ci

This equation is used to calculate the dose to each of the organs identified in Federal Guidance Report No. 11 and the CEDE. The calculated values of the respective doses to organs are found in columns 14, 17, 20, 23, 26, 29 and 32. The CEDE is found in column 35

Substituting the values for Co-60:

Gonad CDE (mrem) = 1.76E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 9.23E-2 mrem (Column 14)
Breast CDE (mrem) = 6.81E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 3.57E-1 mrem (Column 17)
Lung CDE (mrem) = 1.28E+3 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 6.69E+0 mrem (Column 20)
Red Marrow CDE (mrem) = 6.36E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 3.33E-1 mrem (Column 23)

Bone Surface CDE (mrem) = 5.00E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 2.62E-1 mrem (Column 26)
Thyroid CDE (mrem) = 5.99E+1 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 3.14E-1 mrem (Column 29)
Remainder CDE (mrem) = 1.33E+2 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 6.98E-1 mrem (Column 32)
Effective CDE (mrem) = 2.19E+2 (mrem/μCi) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.15E+0 mrem/y (Column 35)

These calculations confirm the operation of the spreadsheet to obtain organ CDEs and the CEDE.

The final two columns of Table 5a contain deposition estimates. As described in the Input Section, this estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (Reference 8). The relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111 as 2.3E-5 m^{-1} at 3,219 m downwind. The calculation performed in Column 36 of Table 5a is as follows:

Deposition at 3,219 m (Ci/m^2) = Relative Deposition (m^{-1}) x Release Rate (Ci/s) x Accident Duration (s) / (π x 2 x 3,219 m)/16

Substituting values for Co-60:

Deposition at 3,219 m (Ci/m^2) = 2.3E-5 m^{-1} x 6.50E-8 (Ci/s) x 2.59E+6 (s) / (1264) = 3.07E-9 (Ci/m^2)

This value compares to the value calculated for Co-60 in Column 36 of Table 5a.

Finally, the deposition in units of pCi/g is calculated to produce input to the RESRAD computer program. It is assumed that the deposited radioactive material is mixed in the top 1 cm of soil and that the soil density is 1.5E+6 g/m^3. This calculation is in Column 37 of Table 5a and is as follows:

Deposition at 3,219 m (pCi/g) = Deposition at 3,219 m (Ci/m^2) x Unit Conversion (pCi/Ci) / (Effective Soil Depth (m) x soil density (g/m^3))

Substituting values for Co-60:

Deposition at 3,219 m (pCi/g) = 3.07E-9 (Ci/m^2) x 1E12 pCi/Ci / (0.01 (m) x 1.5E6 (g/m^3)) = 2.04E-1pCi/g

This value compares to the value calculated for Co-60 in Column 37 of Table 5a, completing the verification of the spreadsheet calculations used to produce Table 5a.

Table 6a - SNC TranStor Cask with BWR Fuel - Accident Analysis: Effective Dose - External Exposure from Submersion at 3,219 m Downwind

As previously described, the first seven columns are entered from data supporting the SNC TranStor Storage Canister that can be found in Section 4.0, Input and Section 5.0, Assumptions. Column 6, the Fraction Released per Second is obtained by dividing the Leak Rate by the Canister Volume. The fuel release fractions are consistent with ISG-5 guidance (Reference 1).

The eighth column of Table 6a contains the exposure duration for this accident, 30 days, as expressed in seconds: 2.59E6 s. The ninth column of Table 6a contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.00E+1 (Ci/Assembly) x 61 (Assemblies) x
(1.58E-5 (cm^3/s)/ 5.63E+6 (cm^3)) x 1 = 6.50E-8 (Ci/s)

This value compares to the value calculated for Co-60 shown in the ninth column of Table 6a.

The tenth column of Table 6a shows the total release in Ci over the 30-day accident duration. This value is found as follows:

Release (Ci) = Release Rate (Ci/s) x Accident Duration (s)

A check of this calculation for Co-60 produces:

Release (Ci) = 6.41E-08 (Ci/s) x 2.60E+6 (s) = 1.68E-1 Ci

This value compares to the calculated value for Co-60 in the tenth column of Table 6a.

The eleventh column of Table 6a contains the X/Q at a distance of 3,219 m downwind. This value is 9.42E-5 s/m^3.

The twelfth column of Table 6a contains the dose conversion factor for skin from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No.12 (Reference 7). The thirteenth column of Table 6a contains the dose conversion factor for skin from submersion in the plume, in units of (mrem m^3/μCi s), and is the product of the entry in column 12 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7).

A check of this calculation for skin using Co-60 produces:

1.45E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 5.37E-4 (mrem m^3/μCi s)

This is comparable to the value found in column 13 of Table 6a.

The skin dose from submersion in the plume is found in the fourteenth column of Table 6a using the equation:

Dose (mrem) = DCF (mrem m^3/μCi s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3)
x 1E6 μCi/Ci

A check of this calculation for skin using Co-60 produces:

Skin Dose (mrem) = 5.37E-4 (mrem $m^3/\mu Ci$ s) x6.50E-08 (Ci/s) x 2.59E+6 (s) x 9.42E-5 (s/m^3) x 1E6 μCi/Ci = 8.51E-3 (mrem)

This is comparable to the value for Co-60, found in the fourteenth column of Table 6a.

The fifteenth column of Table 6a contains the effective dose equivalent factor from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No. 12 (Reference 7). The sixteenth column of Table 6a contains the effective dose equivalent factor for submersion in the plume, in units of (mrem $m^3/\mu Ci$ s), and is obtained as the product of the entry in Column 15 times a conversion factor of 3.7E+9 found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for Co-60 produces:

1.26E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 4.66E-4 (mrem $m^3/\mu Ci$ s)

This value compares to the value calculated for Co-60 in the sixteenth column of Table 6a.

The effective dose equivalent from submersion in the plume is found as:

EDE (mrem/y) = DCF (mrem $m^3/\mu Ci$ s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 μCi/Ci

Substituting the values for Co-60:

EDE (mrem/y) = 4.66E-4 (mrem $m^3/\mu Ci$ s) x 6.50E-8 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 1E6 μCi/Ci = 7.39E-3 mrem/y

This value compares to the value calculated for Co-60 in the seventeenth column of Table 6a, completing the verification of the spreadsheet calculations used to produce Table 6a.

Table 7a - SNC TranStor Cask with BWR Fuel - Accident Analysis: Total Effective Dose Equivalent at 3,219 m Downwind

Table 7a contains the total effective dose equivalent for the accident involving the SNC TranStor Storage Canister at a distance of 3,219 m downwind, and is calculated using the following equation:

Total Effective Dose Equivalent (mrem/y) = Effective Dose Equivalent from Submersion in the Plume Totaled over all Radionuclides in the Plume (mrem/y) + Inhalation Committed Effective Dose Equivalent Totaled over all Radionuclides in the Plume (mrem/y)

The dose results are obtained from Tables 5a and 6a and inserted in Columns 1 and 3 of Table 7a. Substituting the values for Inhalation Committed Effective Dose Equivalent and the Effective Dose Equivalent from Submersion for this accident at 3219 m in the equation above:

$$3.68E+0 \text{ (mrem/y)} + 7.53E-3 \text{ (mrem/y)} = 3.69E+0 \text{ (mrem/y)}$$

This value compares to the value calculated for this accident at 3,219 m shown in the last column of Table 7a, completing the verification of the spreadsheet calculations used to produce Table 7a.

Table 8a SNC TranStor Cask with BWR Fuel - Accident Analysis: Summary of Inhalation Doses at 3,219 m Downwind

Table 8a summarizes the information in Tables 5a, 6a and 7a. Each of the radionuclides of interest are listed with the internal doses to organs and committed effective inhalation dose from Table 5a and the external dose to skin and effective dose from Table 6a. The information on internal dose was transferred from Table 5 columns 14, 17, 20, 23, 26, 29, 32 and 35 to columns 2, 3, 4, 5, 6, 7, 8, and 9 of Table 8a. The external dose was transferred from Table 6a columns 14 and 17 to columns 10 and 11 of Table 8a.

The information on deposition in the soil, was transferred from Table 5a columns 36 and 37 into columns 12 and 13 of Table 8a. The total effective dose equivalent (TEDE) is the total found in Table 7a.

8.0 CALCULATION/RESULTS – SNC TRANSTOR STORAGE CANISTER REVISED ACCIDENT ASSESSMENT (with credit for Canister Holdup and Respirable Fraction)

The following sections describe the revised calculations that were performed for the 30-day canister leakage accident for the SNC TranStor storage canister with credit for a canister release fraction and respirable fraction. Details are provided for each of the eight tables of spreadsheet results, on a column-by-column basis.

Table 1b - SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Committed Effective Dose Equivalent and Dose to Organs From Inhalation Plus Deposition Estimates (Ci/m^2) at 500 m Downwind

The first eight columns are entered from data supporting the SNC TranStor Storage Canister that can be found in Section 4.0, Input and Section 5.0, Assumptions. Column 7, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The fuel release fractions are consistent with ISG-5 guidance (Reference 1).

The exposure duration for this accident is 30 days in accordance with ISG-5, converted to seconds as follows:

30 d x 24 h/d x 3600 s/h = 2.59E6 s

This value compares to the value entered in the ninth column of Table 1b.

The tenth column of Table 1b contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Canister Release Fraction x Fuel Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.00E+1 (Ci/Assembly) x 61 (Assemblies) x (1.0E-4 (cm^3/s)/ 5.63E+6 (cm^3)) x 1.0E-1x 1 = 6.50E-9(Ci/s)

This value compares to the value calculated for Co-60 shown in the tenth column of Table 1b.

The eleventh column of Table 1b contains the X/Q at a distance of 500 m downwind. This value is 1.94E-3 s/m^3. The twelfth column of Table 1b contains the breathing rate of 3.30E-4 m^3/s, consistent with guidance provided in Federal Guidance Report No. 11 (Reference 6). The thirteenth column of Table 1b is the respirable fraction.

Columns 14, 17, 20, 23, 26, 29 and 32 all contain organ dose factors for inhalation in units of Sv/Bq inhaled. The thirty-fifth column of Table 1b contains the committed effective dose conversion factor from inhalation, in units of Sv/Bq inhaled. These dose factors were obtained from Federal Guidance Report No. 11 (Reference 6). Columns 15, 18, 21, 24, 27, 30, 33, and 36 of Table 1b contain the dose conversion factors for inhalation, in units of mrem/μCi, and is obtained as the product of the entry in Columns 14, 17, 20, 23, 26, 29 , 32 and 35 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 11 (Reference 6).

A check of this conversion calculation for Co-60 produces:

Gonad DCF (mrem/μCi) = 4.76E-9 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.76E+1 mrem/μCi (Column 15)
Breast DCF (mrem/μCi) = 1.84E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 6.81E+1 mrem/μCi (Column 18)
Lung DCF (mrem/μCi) = 3.45E-7 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.28E+3 mrem/μCi (Column 21)
R. Marrow DCF (mrem/μCi) = 1.72E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 6.36E+1 mrem/μCi (Column 24)

B Surface DCF (mrem/μCi) = 1.35E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 5.00E+1 mrem/μCi (Column 27)

Thyroid DCF (mrem/μCi) = 1.62E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 5.99E+1 mrem/μCi (Column 30)

Remainder DCF (mrem/μCi) = 3.60E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 1.33E+2 mrem/μCi (Column 33)

Effective DCF (mrem/μCi) = 5.91E-8 Sv/Bq x 3.7E+9 mrem/μCi per Sv/Bq = 2.19E2 mrem/μCi (Column 36)

These calculations confirm the operation of the spreadsheet to obtain DCFs in units of mrem/μCi.

The committed dose equivalent for the organs and CEDE are found using the following equation:

CDE and CEDE (mrem) = DCF (mrem/μCi) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x Breathing Rate (m^3/s) x Respirable Fraction x 1E6 μCi/Ci

This equation is used to calculate the dose to each of the organs identified in Federal Guidance Report No. 11 and the CEDE. The calculated values of the respective doses to organs are found in columns 16, 19, 22, 25, 28, 31, 34. The CEDE is found in column 37.

Substituting the values for Co-60:

Gonad CDE (mrem/uCi) = 1.76E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1 x 1E6 μCi/Ci = 1.90E-1 mrem (Column 16)

Breast CDE (mrem/μCi) = 6.81E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1 x 1E6 μCi/Ci = 7.35E-1 mrem (Column 19)

Lung CDE (mrem/μCi) = 1.28E+3 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1 x 1E6 μCi/Ci = 1.38E+1 mrem (Column 22)

Red Marrow CDE (mrem/μCi) = 6.36E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1 x 1E6 μCi/Ci = 6.87E-1 mrem (Column 25)

Bone Surface CDE (mrem/μCi) = 5.00E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1 x 1E6 μCi/Ci = 5.39E-1 mrem (Column 28)

Thyroid CDE (mrem/μCi) = 5.99E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1 x 1E6 μCi/Ci = 6.47E-1 mrem (Column 31)

Remainder CDE (mrem/μCi) = 1.33E+2 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1 x 1E6 μCi/Ci = 1.44E+0 mrem (Column 34)

CEDE (mrem/y) = 2.19E+2 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 3.30E-4 (m^3/s) x 1 x 1E6 μCi/Ci = 2.36E+0 mrem/y (Column 37)

These calculations confirm the operation of the spreadsheet to obtain organ CDEs and the CEDE.

The final two columns (38 and 39) of Table 1b contain deposition estimates. This estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (Reference 8). The relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111, 8.0 E-5 m^{-1} at 500 m downwind. The calculation performed in column 38 of Table 1b is as follows:

Deposition at 500 m (Ci/m^2) = Relative Deposition (m^{-1}) x Release Rate (Ci/s) x Accident Exposure Duration (s) / (π x 2 x 500 (m)/16)

Substituting values for Co-60:

Deposition at 500 m (Ci/m^2) = 8.0E-5 m^{-1} x 6.50E-9 (Ci/s) x 2.59E+6 (s) /(196) = 6.87E-9 (Ci/m^2)

This value compares to the value calculated for Co-60 in the next to last column of Table 1b.

Finally, the deposition in units of pCi/g is calculated to produce input to the RESRAD computer program. It is assumed that the deposited material is mixed in the top 1 cm of soil, and that the soil density is 1.5E+6 g/m^3. This calculation is in the last column of Table 1b and is as follows:

Deposition at 500 m (pCi/g) = Deposition at 500 m (Ci/m^2) x Unit Conversion (pCi/Ci) / (Effective Soil Depth (m) x soil density (g/m^3))

Substituting values for Co-60:

Deposition at 500 m (pCi/g) = 6.87E-9(Ci/m^2) x 1E12 pCi/Ci / (0.01 (m) x 1.5E6 (g/m^3))= 4.58E-1 pCi/g

This value compares to the value calculated for Co-60 in column 39 of Table 1b, completing the verification of the spreadsheet calculations used to produce Table 1b.

Table 2b - SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Effective Dose - External Exposure from Submersion at 500 m Downwind

The first eight columns of Table 2b are entered from data supporting the SNC TranStor Storage Canister that can be found in Section 4.0, Input and Section 5.0, Assumptions. Column 7, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The fuel release fractions are consistent with ISG-5 guidance (Reference 1).

The ninth column of Table 2b contains the exposure duration for this accident, 30 days, as expressed in seconds as: 2.59E+6 s. The tenth column of Table 2a contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Canister Release Fraction x Fuel Release Fraction = Release Rate (Ci/s)

An independent calculation for Co-60 produces:

6.00E+1 (Ci/Assembly) x 61 (Assemblies) x (1.0E-4 (cm^3/s)/ 5.63E+6 (cm^3)) x 1.0E-1 x 1 = 6.50E-9 (Ci/s)

This value compares to the value calculated for Co-60 shown in the tenth column of Table 2b.

The eleventh column of Table 2b shows the total release in Ci over the 30 day accident duration. This value is found as follows:

Release (Ci) = Release Rate (Ci/s) x Accident Duration (s)

A check of this calculation for Co-60 produces:

Release (Ci) = 6.50E-9 (Ci/s) x 2.59E+6 (s) = 1.68E-2 Ci

This value compares to the calculated value for Co-60 in the eleventh column of Table 2b.

The twelfth column of Table 2b contains the X/Q at a distance of 500 m downwind. This value is 1.94E-3 s/m^3.

The thirteenth column of Table 2a contains the dose conversion factor for skin from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No. 12 (Reference 7). The fourteenth column of Table 2b contains the dose conversion factor for skin from submersion in the plume, in units of (mrem m^3/μCi s), and is obtained as the product of the entry in Column 13 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for skin using Co-60 produces:

1.45-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 5.37E-4 (mrem m^3/μCi s)

This value compares to the value calculated for Co-60 in the fourteenth column of Table 2b.

The sixteenth column of Table 2b contains the effective dose conversion factor from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal

Guidance Report No. 12 (Reference 7). The seventeenth column of Table 2b contains the effective dose conversion factor for submersion in the plume, in units of (mrem m^3/μCi s), and is obtained as the product of the entry in Column 16 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for skin using Co-60 produces:

1.26E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 4.66E-4 (mrem m^3/μCi s)

This value compares to the value calculated for Co-60 in the seventeenth column of Table 2b.

The doses of interest from submersion in the plume are found in columns 15 and 18 of Table 2b and are calculated using the formula:

EDE (mrem/y) = DCF (mrem m^3/μCi s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 μCi/Ci

Substituting the value for skin using Co-60:

Skin Dose (mrem) = 5.37E-4 (mrem m^3/μCi s) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 1E6 μCi/Ci = 1.75E-2 mrem

This value compares to the value calculated for Co-60 in the fifteenth column of Table 2b.

The effective dose equivalent from submersion in the plume is found in the eighteenth column of Table 2b as:

EDE (mrem/y) = 4.66E-4 (mrem m^3/μCi s) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 1.94E-3 (s/m^3) x 1E6 μCi/Ci = 1.50E-2 mrem/y

This value compares to the value calculated for Co-60 in the eighteenth column of Table 2b, completing the verification of the spreadsheet calculations used to produce Table 2b.

Table 3b- SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Total Effective Dose Equivalent at 500 m Downwind

Table 3b contains the total effective dose equivalent for the accident involving the SNC TranStor Storage Canister at a distance of 500 m downwind, and is calculated using the following equation:

Total Effective Dose Equivalent (mrem/y) = Effective Dose Equivalent from Submersion in the Plume Totaled over all Radionuclides in the Plume (mrem/y) + Inhalation Committed Effective Dose Equivalent Totaled over all Radionuclides in the Plume (mrem/y)

The dose results are obtained from Tables 1b and 2b and inserted in Columns 1 and 3 of Table 3b. Substituting the values for Inhalation Committed Effective Dose Equivalent and the Effective Dose Equivalent from Submersion for this accident at 500 m in the equation above:

1.64E-2 (mrem/y) + 2.69E+0 (mrem/y) = 2.70E+0 (mrem/y)

This value compares to the value calculated for this accident at 500 m shown in the last column of Table 3b, completing the verification of the spreadsheet calculations used to produce Table 3b.

Table 4b– SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Summary of Inhalation Doses at 500 m Downwind

Table 4b summarizes the information in Tables 1b, 2b and 3b. Each of the radionuclides of interest are listed with the internal doses to organs and committed effective inhalation dose from Table 1b and the external dose to skin and effective dose from Table 2b. The information on internal dose was transferred from Table 1b columns 16, 19, 22, 25, 28, 31, 34 and 37 to columns 2, 3, 4, 5, 6, 7, 8, and 9 of Table 2b. The external dose was transferred from Table 2a columns 15 and 18 to columns 10 and 11 of this table.

The information on deposition in the soil, was transferred from Table 1b columns 38 and 39 into columns 12 and 13 of Table 4b. The total effective dose equivalent (TEDE) is the total found in Table 3b.

Table 5b - SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Committed Effective Dose Equivalent and Dose to Organs From Inhalation Plus Deposition Estimates (Ci/m^2) at 3,219 m Downwind

The first eight columns are entered from data supporting the SNC TranStor Storage Canister that can be found in Section 4.0, Input and Section 5.0, Assumptions. Column 7, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The fuel release fractions are consistent with ISG-5 guidance (Reference 1).The exposure duration for this accident is entered into the ninth column of Table 5b as 30 days, converted to seconds: 2.59E+6s.

The tenth column of Table 5b contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Canister Release Fraction x Fuel Release Fraction = Release Rate

An independent calculation for Co-60 produces:

6.00E+1 (Ci/Assembly) x 61 (Assemblies) x
(1.00E-4 (cm^3/s)/ 5.63E+6 (cm^3)) x 1.00E-1 x 1 = 6.50E-9 (Ci/s)

This value compares to the value calculated for Co-60 shown in the tenth column of Table 5b.

The eleventh column of Table 5b contains the X/Q at a distance of 3,219 m downwind. This value is 9.42E-5 s/m^3. The twelfth column of Table 5b contains the breathing rate of 3.30E-4 m^3/s, consistent with guidance provided in Federal Guidance Report No. 11 (Reference 6). The thirteenth column is the respirable fraction.

Columns 14, 17, 20, 23, 26, 29 and 32 all contain committed organ dose conversion factors for inhalation in units of Sv/Bq inhaled. The thirty-fifth column of Table 5b contains the committed effective dose conversion factor from inhalation, in units of Sv/Bq inhaled. These dose factors were obtained from Federal Guidance Report No. 11 (Reference 6). Columns 15, 18, 21, 24, 27, 30, 33, and 36 of Table 5b contain the dose conversion factors for inhalation, in units of mrem/μCi, obtained as the product of the entry in Columns 14, 17, 20, 23, 26, 29 , 32 and 35 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 11 (Reference 6). A check of this conversion calculation for Co-60 produces:

Gonad DCF (mrem/μCi) = 4.76E-9 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq =
1.76E+1 mrem/μCi (Column 15)
Breast DCF (mrem/μCi) = 1.84E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq =
6.81E+1 mrem/μCi (Column 18)
Lung DCF (mrem/μCi) = 3.45E-7 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq =
1.28E+3 mrem/μCi (Column 21)
R. Marrow DCF (mrem/μCi) = 1.72E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq =
6.36E+1 mrem/μCi Column 24)
B Surface DCF (mrem/μCi) = 1.35E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq =
5.00E+1 mrem/μCi (Column 27)
Thyroid DCF (mrem/μCi) = 1.62E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq =
5.99E+1 mrem/μCi (Column 30)
Remainder DCF (mrem/μCi) = 3.60E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq =
1.33E+2 mrem/μCi (Column 33)

Effective DCF (mrem/μCi) = 5.91E-8 Sv/Bq x 3.7E9 mrem/μCi per Sv/Bq =
2.19E2 mrem/μCi (Column 36)

These calculations confirm the operation of the spreadsheet to obtain DCFs.

The committed dose equivalent and the CEDE are found using the following equation:

CDE and CEDE (mrem) = DCF (mrem/μCi) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x Breathing Rate (m^3/s) x 1E6 μCi/Ci

This equation is used to calculate the dose to each of the organs identified in Federal Guidance Report No. 11 and the CEDE. The calculated values of the respective doses to organs are found in columns 16, 19, 22, 25, 28, 31 and 34. The CEDE is found in column 37.

Substituting the values for Co-60:

Gonad CDE (mrem) = 1.76E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 9.23E-3 mrem (Column 16)
Breast CDE (mrem) = 6.81E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 3.57E-2 mrem (Column 19)
Lung CDE (mrem) = 1.28E+3 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 6.69E-1 mrem (Column 22)
Red Marrow CDE (mrem) = 6.36E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 3.34E-2 mrem (Column 25)
Bone Surface CDE (mrem) = 5.00E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 2.62E-2 mrem (Column 28)
Thyroid CDE (mrem) = 5.99E+1 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 3.14E-2 mrem (Column 31)
Remainder CDE (mrem) = 1.33E+2 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 6.98E-2 mrem (Column 34)
Effective CEDE (mrem/y) = 2.19E+2 (mrem/μCi) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 3.30E-4 (m^3/s) x 1E6 μCi/Ci = 1.15E-1 mrem/y (Column 37)

These calculations confirm the operation of the spreadsheet to obtain CDEs and the CEDE.

The final two columns of Table 5b contain deposition estimates. This estimate was made assuming that the effluent concentration in a given sector is uniform across the sector at a given distance, as described in Regulatory Guide 1.111 (Reference 8). The relative deposition (m^{-1}) was obtained from Figure 6 of Regulatory Guide 1.111 as 2.3E-5 m^{-1} at 3,219 m, downwind. The calculation performed in the next to last column of Table 5b is as follows:

Deposition at 3,219 m (Ci/m^2) = Relative Deposition (m^{-1}) x Release Rate (Ci/s) x Accident Duration (s) / (π x 2 x 3,219 (m)/16)

Substituting values for Co-60:

Deposition at 3,219 m (Ci/m^2) = 2.3E-5 m^{-1} x 6.50E-9 (Ci/s) x 2.59E+6 (s) / (1264) = 3.07E-10 (Ci/m^2)

This value compares to the value calculated for Co-60 in column 38 of Table 5b.

Finally, the deposition in units of pCi/g is calculated to produce input to the RESRAD computer program. It is assumed that the deposited radioactive material is mixed in the top 1 cm of soil, and that the soil has a density of 1.5E+6 g/m^3. This calculation is in column 39 of Table 5b and is as follows:

Deposition at 3,219 m (pCi/g) = Deposition at 3,219 m (Ci/m^2) x Unit Conversion (pCi/Ci) / (Effective Soil Depth (m) x soil density (g/m^3))

Substituting values for Co-60:

Deposition at 3,219 m (pCi/g) = 3.07E-10 (Ci/m2) x 1E12 pCi/Ci / (0.01 (m) x 1.5E6 (g/m^3)) = 2.04E-2 pCi/g

This value compares to the value calculated for Co-60 in column 39 of Table 5b, completing the verification of the spreadsheet calculations used to produce Table 5b.

Table 6b - SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Effective Dose - External Exposure from Submersion at 3,219 m Downwind

The first eight columns are entered from data supporting the SNC TranStor Storage Canister that can be found in Section 4.0, Input and Section 5.0, Assumptions. Column 7, the Fraction Released per second is obtained by dividing the Leak Rate by the Canister Volume. The fuel release fractions are consistent with ISG-5 guidance (Reference 1).

The ninth column of Table 6b contains the exposure duration for this accident, 30 days, as expressed in seconds: 2.59E+6 s.

The tenth column of Table 6b contains the release rate, by radionuclide in Ci/s, and is found by the following formula:

Inventory (Ci/Assembly) x Number of Assemblies x (Leak rate (cm^3/s) / Volume (cm^3)) x Canister Release Fraction x Fuel Release Fraction =Release Rate

An independent calculation for Co-60 produces:

6.00E+1 (Ci/Assembly) x 61 (Assemblies) x
(1.00E-4 (cm^3/s)/ 5.63E+6 (cm^3)) x 0.1 x 1 = 6.50E-9 (Ci/s)

This value compares to the value calculated for Co-60 shown in the tenth column of Table 6b. The eleventh column of Table 6b shows the total release in Ci over the 30 day accident duration. This value is found as follows:

Release (Ci) = Release Rate (Ci/s) x Accident Duration (s)

A check of this calculation for Co-60 produces:

Release (Ci) = 6.50E-9 (Ci/s) x 2.59E+6 (s) = 1.68E-2 Ci

This value compares to the calculated value for Co-60 in the eleventh column of Table 6b.

The twelfth column of Table 6b contains the X/Q at a distance of 3,219 m downwind. This value is 9.42E-5 s/m^3.

The thirteenth column of Table 6b contains the dose conversion factor for skin from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No. 12 (Reference 7). The fourteenth column of Table 6b contains the dose conversion factor for skin from submersion in the plume, in units of (mrem m^3/μCi s), and is obtained as the product of the entry in Column 13 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for skin using Co-60 produces:

1.45-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 5.37E-4 (mrem m^3/μCi s)

This value compares to the value calculated for Co-60 in the fourteenth column of Table 6b.

The dose to skin from submersion in the plume is found in column 15 of Table 6b and is calculated using the formula:

EDE (mrem/y) = DCF (mrem m^3/μCi s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 μCi/Ci

Substituting the values for Co-60:

Skin Dose (mrem/y) = 5.37E-4 (mrem $m^3/\mu Ci$ s) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 1E6 μCi/Ci = 8.51E-4 mrem

This value compares to the value calculated for Co-60 in the fifteenth column of Table 6b.

The sixteenth column of Table 6b contains the effective dose conversion factor from submersion in the plume, expressed in units of (Sv m^3/Bq s). This information was obtained from Federal Guidance Report No. 12 (Reference 7). The seventeenth column of Table 6b contains the effective dose conversion factor for submersion in the plume, in units of (mrem $m^3/\mu Ci$ s), and is obtained as the product of the entry in Column 16 times a conversion factor of 3.7E+9 mrem/μCi per Sv/Bq found in Federal Guidance Report No. 12 (Reference 7). A check of this calculation for Co-60 produces:

1.26E-13 (Sv m^3/Bq s) x 3.7E9 mrem/μCi per Sv/Bq = 4.66E-4 (mrem $m^3/\mu Ci$ s)

This value compares to the value calculated for Co-60 in the seventeenth column of Table 6b.

The effective dose equivalent from submersion in the plume is found as:

EDE (mrem/y) = DCF (mrem $m^3/\mu Ci$ s) x Release Rate (Ci/s) x Duration (s) x X/Q (s/m^3) x 1E6 μCi/Ci

Substituting the values for Co-60:

EDE (mrem/y) = 4.66E-4 (mrem $m^3/\mu Ci$ s) x 6.50E-9 (Ci/s) x 2.59E6 (s) x 9.42E-5 (s/m^3) x 1E6 μCi/Ci = 7.40E-4 mrem/y

This value compares to the value calculated for Co-60 in the eighteenth column of Table 6b, completing the verification of the spreadsheet calculations used to produce Table 6b.

Table 7b - SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Total Effective Dose Equivalent at 3,219 m Downwind

Table 7b contains the total effective dose equivalent for the accident involving the SNC TranStor Storage Canister at a distance of 3,219 m downwind, and is calculated using the following equation:

Total Effective Dose Equivalent (mrem/y) = Effective Dose Equivalent from Submersion in the Plume Totaled over all Radionuclides in the Plume (mrem/y) + Inhalation Committed Effective Dose Equivalent Totaled over all Radionuclides in the Plume (mrem/y)

The dose results are obtained from Tables 5b and 6b and inserted in Columns 1 and 3 of Table 7b. Substituting the values for Inhalation Committed Effective Dose Equivalent and the Effective Dose Equivalent from Submersion for this accident at 3219 m in the equation above:

7.94E-4 (mrem/y) + 1.30E-1 (mrem/y) = 1.31E-1 (mrem/y)

This value compares to the value calculated for this accident at 3,219 m shown in the last column of Table 7b, completing the verification of the spreadsheet calculations used to produce Table 7b.

Table 8b– SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Summary of Inhalation Doses at 3219 m Downwind

Table 8b, summarizes the information in Tables 5b, 6b and 7b. Each of the radionuclides of interest are listed with the internal doses to organs and committed effective inhalation dose from Table 5b and the external dose to skin and effective dose from Table 6b. The information on internal dose was transferred from Table 5b columns 16, 19, 22, 25, 28, 31, 34, and 37 to columns 2, 3, 4, 5, 6, 7, 8, and 9 of this table. The external dose was transferred from Table 6b columns 15 and 18 to columns 10 and 11 of this table.

The information on deposition in the soil, was transferred from Table 5b columns 36 and 37 into columns 12 and 13 of Table 8b. The total effective dose equivalent (TEDE) is the total found in Table 7b.

9.0 CONCLUSION

Estimates of the public doses and the radioactive material deposited from a plume released during a 30-day canister leak accident were developed for the HI-STAR and TranStor canisters using a spreadsheet analysis. The results of this analysis are shown in Tables 1 through 8 (Attachment A) for the HI-STAR canister, in Tables 1a through 8a for the TranStor canister (Attachment B), and in Tables 1b through 8b for the revised TranStor canister (Attachment C).. The dose results are:

HI-STAR MPC-68 Cask: 13.4 mrem/y Total Effective Dose Equivalent at 500 m downwind
0.653 mrem/y Total Effective Dose Equivalent at 3,219 m downwind

TranStor Cask:

Original parameters 75.9 mrem/y Total Effective Dose Equivalent at 500 m downwind
3.69 mrem/y Total Effective Dose Equivalent at 3,219 m downwind

Expanded parameters with credit for canister release and respirable fraction
2.70 mrem/y Total Effective Dose Equivalent at 500 m downwind
0.131 mrem/y Total Effective Dose Equivalent at 3,219 m downwind

10.0 REFERENCES

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Table 1 MPC-68 Accident Conditions: Committed Effective Dose Equivalent and Dose to Organs From Inhalation, Plus Deposition Estimates (Ci/m2) at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	X/Q (s/m3)	Breathing Rate (m3/s)	Gonad DCF (Sv/Bq)	Gonad DCF (mrem/uCi)	Gonad CDE (mrem)
										Gases			
H-3	8.72E+01	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	4.69E-09	1.94E-03	3.30E-04	1.73E-11	6.40E-02	4.98E-04
I-129	7.72E-03	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	4.15E-13	1.94E-03	3.30E-04	8.69E-11	3.22E-01	2.22E-07
Kr-85	1.43E+03	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	7.69E-08	1.94E-03	3.30E-04	0.00E+00	0.00E+00	0.00E+00
										Crud			
Co-60	6.50E+01	68	5.99E+06	1.58E-05	2.63E-12	1	2.59E+06	1.17E-08	1.94E-03	3.30E-04	4.76E-09	1.76E+01	3.41E-01
										Volatiles			
Sr-90	1.52E+04	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	5.45E-10	1.94E-03	3.30E-04	2.64E-09	9.77E+00	8.84E-03
Ru-106	4.16E+03	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	1.49E-10	1.94E-03	3.30E-04	1.38E-08	5.11E+01	1.26E-02
Cs-134	7.20E+03	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	2.58E-10	1.94E-03	3.30E-04	1.30E-08	4.81E+01	2.06E-02
Cs-137	2.29E+04	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	8.21E-10	1.94E-03	3.30E-04	8.76E-09	3.24E+01	4.42E-02
										Fines			
Pu-241	2.10E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.13E-10	1.94E-03	3.30E-04	6.82E-07	2.52E+03	4.73E-01
Y-90	1.52E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	8.18E-11	1.94E-03	3.30E-04	9.52E-12	3.52E-02	4.78E-06
Pm-147	8.88E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	4.78E-11	1.94E-03	3.30E-04	1.88E-14	6.96E-05	5.52E-09
Ce-144	2.46E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.32E-11	1.94E-03	3.30E-04	1.93E-09	7.14E+00	1.57E-04
Pr-144	2.46E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.32E-11	1.94E-03	3.30E-04	2.41E-15	8.92E-06	1.96E-10
Eu-154	1.07E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	5.76E-12	1.94E-03	3.30E-04	1.17E-08	4.33E+01	4.14E-04
Cm-244	9.30E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	5.00E-12	1.94E-03	3.30E-04	1.59E-05	5.88E+04	4.89E-01
Pu-238	7.49E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	4.03E-12	1.94E-03	3.30E-04	2.80E-05	1.04E+05	6.93E-01
Sb-125	6.40E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	3.44E-12	1.94E-03	3.30E-04	3.60E-10	1.33E+00	7.61E-06
Eu-155	3.51E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.89E-12	1.94E-03	3.30E-04	3.56E-10	1.32E+00	4.13E-06
Am-241	2.20E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.18E-12	1.94E-03	3.30E-04	3.25E-05	1.20E+05	2.36E-01
Te-125m	1.56E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	8.39E-13	1.94E-03	3.30E-04	1.24E-10	4.59E-01	6.39E-07
Pu-240	1.26E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	6.78E-13	1.94E-03	3.30E-04	3.18E-05	1.18E+05	1.32E-01
Pu-239	6.16E+01	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	3.31E-13	1.94E-03	3.30E-04	3.18E-05	1.18E+05	6.47E-02
							Total:					**Total:**	2.52E+00

Table 1 MPC-68 Accident Conditions: Committed Effective Dose Equivalent and Dose to Organs From Inhalation, Plus Deposition Estimates (Ci/m2) at 500 m Downwind (Continued)

Column 1	Column 15	Column 16	Column 17	Column 18	Column 19	Column 20	Column 21	Column 22	Column 23	Column 24	Column 25	Column 26
Nuclide	Breast DCF (Sv/Bq)	Breast DCF (mrem/uCi)	Breast CDE (mrem)	Lung DCF (Sv/Bq)	Lung DCF (mrem/uCi)	Lung CDE (mrem)	R Marrow DCF (Sv/Bq)	R Marrow DCF (mrem/uCi)	R Marrow CDE (mrem)	B Surface DCF (Sv/Bq)	B Surface DCF (mrem/uCi)	B Surface CDE (mrem)
H-3	1.73E-11	6.40E-02	4.98E-04	1.73E-11	6.40E-02	4.98E-04	1.73E-11	6.40E-02	4.98E-04	1.73E-11	6.40E-02	4.98E-04
I-129	2.09E-10	7.73E-01	5.33E-07	3.14E-10	1.16E+00	8.01E-07	1.40E-10	5.18E-01	3.57E-07	1.38E-10	5.11E-01	3.52E-07
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	1.84E-08	6.81E+01	1.32E+00	3.45E-07	1.28E+03	2.47E+01	1.72E-08	6.36E+01	1.23E+00	1.35E-08	5.00E+01	9.66E-01
Sr-90	2.64E-09	9.77E+00	8.84E-03	2.86E-06	1.06E+04	9.57E+00	3.36E-07	1.24E+03	1.12E+00	7.27E-07	2.69E+03	2.43E+00
Ru-106	1.37E-08	5.07E+01	1.26E-02	1.04E-06	3.85E+03	9.53E-01	1.37E-08	5.07E+01	1.26E-02	1.37E-08	5.07E+01	1.26E-02
Cs-134	1.08E-08	4.00E+01	1.71E-02	1.18E-08	4.37E+01	1.87E-02	1.18E-08	4.37E+01	1.87E-02	1.10E-08	4.07E+01	1.74E-02
Cs-137	7.84E-09	2.90E+01	3.95E-02	8.82E-09	3.26E+01	4.45E-02	8.30E-09	3.07E+01	4.19E-02	7.94E-09	2.94E+01	4.00E-02
Pu-241	3.06E-11	1.13E-01	2.12E-05	3.18E-06	1.18E+04	2.21E+00	3.36E-06	1.24E+04	2.33E+00	4.20E-05	1.55E+05	2.91E+01
Y-90	9.52E-12	3.52E-02	4.78E-06	9.31E-09	3.44E+01	4.68E-03	2.79E-10	1.03E+00	1.40E-04	2.78E-10	1.03E+00	1.40E-04
Pm-147	3.60E-14	1.33E-04	1.06E-08	7.74E-08	2.86E+02	2.27E-02	8.16E-09	3.02E+01	2.39E-03	1.02E-07	3.77E+02	2.99E-02
Ce-144	1.97E-09	7.29E+00	1.60E-04	7.91E-07	2.93E+03	6.43E-02	2.67E-08	9.88E+01	2.17E-03	4.54E-08	1.68E+02	3.69E-03
Pr-144	1.05E-14	3.89E-05	8.53E-10	9.40E-11	3.48E-01	7.64E-06	8.08E-14	2.99E-04	6.57E-09	1.35E-13	5.00E-04	1.10E-08
Eu-154	1.55E-08	5.74E+01	5.48E-04	7.92E-08	2.93E+02	2.80E-03	1.06E-07	3.92E+02	3.75E-03	5.23E-07	1.94E+03	1.85E-02
Cm-244	1.04E-09	3.85E+00	3.20E-05	1.93E-05	7.14E+04	5.93E-01	9.38E-05	3.47E+05	2.88E+00	1.17E-03	4.33E+06	3.59E+01
Pu-238	1.00E-09	3.70E+00	2.47E-05	3.20E-04	1.18E+06	7.92E+00	1.52E-04	5.62E+05	3.76E+00	1.90E-03	7.03E+06	4.70E+01
Sb-125	4.16E-10	1.54E+00	8.80E-06	2.17E-08	8.03E+01	4.59E-04	6.49E-10	2.40E+00	1.37E-05	2.73E-09	1.01E+01	5.77E-05
Eu-155	6.14E-10	2.27E+00	7.12E-06	1.19E-08	4.40E+01	1.38E-04	1.43E-08	5.29E+01	1.66E-04	1.52E-07	5.62E+02	1.76E-03
Am-241	2.67E-09	9.88E+00	1.94E-05	1.84E-05	6.81E+04	1.34E-01	1.74E-04	6.44E+05	1.26E+00	2.17E-03	8.03E+06	1.58E+01
Te-125m	1.07E-10	3.96E-01	5.51E-07	1.04E-08	3.85E+01	5.36E-05	3.01E-09	1.11E+01	1.55E-05	3.21E-08	1.19E+02	1.65E-04
Pu-240	9.51E-10	3.52E+00	3.96E-06	3.23E-04	1.20E+06	1.34E+00	1.69E-04	6.25E+05	7.04E-01	2.11E-03	7.81E+06	8.78E+00
Pu-239	9.22E-10	3.41E+00	1.88E-06	3.23E-04	1.20E+06	6.57E-01	1.69E-04	6.25E+05	3.44E-01	2.11E-03	7.81E+06	4.29E+00
		Total:	1.40E+00		Total:	4.82E+01		Total:	1.37E+01		Total:	1.44E+02

Table 1 MPC-68 Accident Conditions: Committed Effective Dose Equivalent and Dose to Organs From Inhalation, Plus Deposition Estimates (Ci/m2) at 500 m Downwind (Continued)

Column 1	Column 27	Column 28	Column 29	Column 30	Column 31	Column 32	Column 33	Column 34	Column 35	Column 36	Column 37
Nuclide	Thyroid DCF (Sv/Bq)	Thyroid DCF (mrem/uCi)	Thyroid CDE (mrem)	Remainder DCF (Sv/Bq)	Remainder DCF (mrem/uCi)	Remainder CDE (mrem)	Effective DCF (Sv/Bq)	Effective DCF (mrem/uCi)	Inhalation CEDE (mrem/y)	Deposition at 500 m (Ci/m2)	Deposition at 500 m Depth = 0.01m (pCi/g)
H-3	1.73E-11	6.40E-02	4.98E-04	1.73E-11	6.40E-02	4.98E-04	1.73E-11	6.40E-02	4.98E-04	4.96E-09	3.31E-01
I-129	1.56E-06	5.77E+03	3.98E-03	1.18E-10	4.37E-01	3.01E-07	4.69E-08	1.74E+02	1.20E-04	4.39E-13	2.93E-05
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.14E-08	5.43E+00
Co-60	1.62E-08	5.99E+01	1.16E+00	3.60E-08	1.33E+02	2.58E+00	5.91E-08	2.19E+02	4.23E+00	1.23E-08	8.22E-01
Sr-90	2.64E-09	9.77E+00	8.84E-03	5.73E-09	2.12E+01	1.92E-02	3.51E-07	1.30E+03	1.18E+00	5.77E-10	3.85E-02
Ru-106	1.37E-08	5.07E+01	1.26E-02	1.69E-08	6.25E+01	1.55E-02	1.29E-07	4.77E+02	1.18E-01	1.58E-10	1.05E-02
Cs-134	1.11E-08	4.11E+01	1.76E-02	1.39E-08	5.14E+01	2.20E-02	1.25E-08	4.63E+01	1.98E-02	2.73E-10	1.82E-02
Cs-137	7.93E-09	2.93E+01	4.00E-02	9.12E-09	3.37E+01	4.60E-02	8.63E-09	3.19E+01	4.35E-02	8.69E-10	5.79E-02
Pu-241	1.24E-11	4.59E-02	8.60E-06	1.31E-06	4.85E+03	9.09E-01	2.23E-06	8.25E+03	1.55E+00	1.20E-10	7.97E-03
Y-90	9.52E-12	3.52E-02	4.78E-06	3.87E-09	1.43E+01	1.94E-03	2.28E-09	8.44E+00	1.14E-03	8.65E-11	5.77E-03
Pm-147	1.98E-14	7.33E-05	5.81E-09	5.89E-09	2.18E+01	1.73E-03	1.06E-08	3.92E+01	3.11E-03	5.06E-11	3.37E-03
Ce-144	1.88E-09	6.96E+00	1.53E-04	1.03E-07	3.81E+02	8.37E-03	1.01E-07	3.74E+02	8.21E-03	1.40E-11	9.34E-04
Pr-144	8.47E-15	3.13E-05	6.88E-10	1.40E-12	5.18E-03	1.14E-07	1.17E-11	4.33E-02	9.51E-07	1.40E-11	9.34E-04
Eu-154	7.14E-09	2.64E+01	2.52E-04	1.13E-07	4.18E+02	3.99E-03	7.73E-08	2.86E+02	2.73E-03	6.09E-12	4.06E-04
Cm-244	1.01E-09	3.74E+00	3.10E-05	4.78E-05	1.77E+05	1.47E+00	6.70E-05	2.48E+05	2.06E+00	5.29E-12	3.53E-04
Pu-238	9.62E-10	3.56E+00	2.38E-05	7.02E-05	2.60E+05	1.74E+00	1.06E-04	3.92E+05	2.62E+00	4.26E-12	2.84E-04
Sb-125	3.24E-10	1.20E+00	6.85E-06	1.45E-09	5.37E+00	3.07E-05	3.30E-09	1.22E+01	6.98E-05	3.64E-12	2.43E-04
Eu-155	2.40E-10	8.88E-01	2.78E-06	1.11E-08	4.11E+01	1.29E-04	1.12E-08	4.14E+01	1.30E-04	2.00E-12	1.33E-04
Am-241	1.60E-09	5.92E+00	1.16E-05	7.82E-05	2.89E+05	5.68E-01	1.20E-04	4.44E+05	8.72E-01	1.25E-12	8.35E-05
Te-125m	9.93E-11	3.67E-01	5.12E-07	6.75E-10	2.50E+00	3.48E-06	1.97E-09	7.29E+00	1.02E-05	8.88E-13	5.92E-05
Pu-240	9.05E-10	3.35E+00	3.77E-06	7.56E-05	2.80E+05	3.15E-01	1.16E-04	4.29E+05	4.83E-01	7.17E-13	4.78E-05
Pu-239	9.03E-10	3.34E+00	1.84E-06	7.56E-05	2.80E+05	1.54E-01	1.16E-04	4.29E+05	2.36E-01	3.51E-13	2.34E-05
		Total:	1.24E+00		**Total:**	7.85E+00			**1.34E+01**		

Input Prepared By: W.E. Kennedy, Jr. Date: 5/12/99

Input Reviewed By: Cheryl Y. Smith Date: 5/12/99

Table 2 MPC-68 Accident Conditions: Effective Dose - External Exposure from Submersion at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Skin DCF (Sv m3/Bq s)	Skin DCF (mrem m3/uCi s)	Skin Dose (mrem)	Effective DCF (Sv m3/Bq s)	Effective DCF (mrem m3/uCi s)	Effective Dose (mrem)
H-3	8.72E+01	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	4.69E-09	1.22E-02	1.94E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-19	1.22E-09	2.89E-08
I-129	7.72E-03	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	4.15E-13	1.08E-06	1.94E-03	1.10E-15	4.07E-06	8.50E-09	3.80E-16	1.41E-06	2.93E-09
Kr-85	1.43E+03	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	7.69E-08	1.99E-01	1.94E-03	1.32E-14	4.88E-05	1.89E-02	1.19E-16	4.40E-07	1.70E-04
Co-60	6.50E+01	68	5.99E+06	1.58E-05	2.63E-12	1	2.59E+06	1.17E-08	3.02E-02	1.94E-03	1.45E-13	5.37E-04	3.14E-02	1.26E-13	4.66E-04	2.73E-02
Sr-90	1.52E+04	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	5.45E-10	1.41E-03	1.94E-03	9.20E-15	3.40E-05	9.33E-05	7.53E-18	2.79E-08	7.63E-08
Ru-106	4.16E+03	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	1.49E-10	3.87E-04	1.94E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	7.20E+03	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	2.58E-10	6.69E-04	1.94E-03	9.45E-14	3.50E-04	4.54E-04	7.57E-14	2.80E-04	3.63E-04
Cs-137	2.29E+04	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	8.21E-10	2.13E-03	1.94E-03	8.63E-15	3.19E-05	1.32E-04	7.74E-18	2.86E-08	1.18E-07
Ba-137m	2.16E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.16E-10	3.00E-04	1.94E-03	3.73E-14	1.38E-04	8.04E-05	2.88E-14	1.07E-04	6.21E-05
Pu-241	2.10E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.13E-10	2.93E-04	1.94E-03	1.17E-19	4.33E-10	2.46E-10	7.25E-20	2.68E-10	1.52E-10
Y-90	1.52E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	8.18E-11	2.12E-04	1.94E-03	6.24E-14	2.31E-04	9.49E-05	1.90E-16	7.03E-07	2.89E-07
Pm-147	8.88E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	4.78E-11	1.24E-04	1.94E-03	8.11E-16	3.00E-06	7.20E-07	6.93E-19	2.56E-09	6.16E-10
Rh-106	4.16E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	2.23E-11	5.78E-05	1.94E-03	1.09E-13	4.03E-04	4.52E-05	1.04E-14	3.85E-05	4.31E-06
Ce-144	2.46E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.32E-11	3.43E-05	1.94E-03	2.93E-15	1.08E-05	7.21E-07	8.53E-16	3.16E-06	2.10E-07
Pr-144	2.46E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.32E-11	3.43E-05	1.94E-03	8.43E-14	3.12E-04	2.07E-05	1.95E-15	7.22E-06	4.80E-07
Eu-154	1.07E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	5.76E-12	1.49E-05	1.94E-03	8.29E-14	3.07E-04	8.87E-06	6.14E-14	2.27E-04	6.57E-06
Cm-244	9.30E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	5.00E-12	1.30E-05	1.94E-03	3.91E-17	1.45E-07	3.64E-09	4.91E-18	1.82E-08	4.57E-10
Pu-238	7.49E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	4.03E-12	1.04E-05	1.94E-03	4.09E-17	1.51E-07	3.06E-09	4.88E-18	1.81E-08	3.66E-10
Sb-125	6.40E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	3.44E-12	8.92E-06	1.94E-03	2.65E-14	9.81E-05	1.70E-06	2.02E-14	7.47E-05	1.29E-06
Eu-155	3.51E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.89E-12	4.89E-06	1.94E-03	3.39E-15	1.25E-05	1.19E-07	2.49E-15	9.21E-06	8.74E-08
Am-241	2.20E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.18E-12	3.07E-06	1.94E-03	1.28E-15	4.74E-06	2.82E-08	8.18E-16	3.03E-06	1.80E-08
Te-125m	1.56E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	8.39E-13	2.17E-06	1.94E-03	1.94E-15	7.18E-06	3.03E-08	4.53E-16	1.68E-06	7.09E-09
Pu-240	1.26E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	6.78E-13	1.76E-06	1.94E-03	3.92E-17	1.45E-07	4.94E-10	4.75E-18	1.76E-08	6.00E-11
Pu-239	6.16E+01	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	3.31E-13	8.59E-07	1.94E-03	1.86E-17	6.88E-08	1.15E-10	4.24E-18	1.57E-08	2.61E-11
												Total:	**5.12E-02**		**Total:**	**2.79E-02**

Table 3 MPC-68 Accident Total Effective Dose Equivalent at 500 m Downwind

External Dose (mrem/y)	Plus	Inhalation CEDE (mrem/y)	Equals	TEDE (mrem/y)
2.79E-02	Plus	1.34E+01	Equals	**1.35E+01**

W. E. Kennedy, J. 5/12/99
Input Prepared By Date

Cheryl G Smith 5/12/99
Input Reviewed By Date

Calc 05996.02-UR-009, Rev 1 Pg A4

Table 4 MPC-68 Accident Conditions: Summary of Inhalation Doses at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13
	INTERNAL DOSE								EXTERNAL DOSE		DEPOSITION	
Nuclide	Gonad CDE (mrem)	Breast CDE (mrem)	Lung CDE (mrem)	R Marrow CDE (mrem)	B Surface CDE (mrem)	Thyroid CDE (mrem)	Remainder CDE (mrem/uCi)	Inhalation CEDE (mrem/y)	Skin Dose (mrem)	Effective Dose (mrem)	Deposition at 500 m (Ci/m2)	Deposition at 500 m Depth = 0.01m (pCi/g)
H-3	4.98E-04	4.98E-04	4.98E-04	4.98E-04	4.98E-04	4.98E-04	4.98E-04	4.98E-04	0.00E+00	2.89E-08	4.96E-09	3.31E-01
I-129	2.22E-07	5.33E-07	8.01E-07	3.57E-07	3.52E-07	3.98E-03	3.01E-07	1.20E-04	8.50E-09	2.93E-09	4.39E-13	2.93E-05
Kr-85									1.89E-02	1.70E-04	8.14E-08	5.43E+00
Co-60	3.41E-01	1.32E+00	2.47E+01	1.23E+00	9.66E-01	1.16E+00	2.58E+00	4.23E+00	3.14E-02	2.73E-02	1.23E-08	8.22E-01
Sr-90	8.84E-03	8.84E-03	9.57E+00	1.12E+00	2.43E+00	8.84E-03	1.92E-02	1.18E+00	9.33E-05	7.63E-08	5.77E-10	3.85E-02
Ru-106	1.26E-02	1.26E-02	9.53E-01	1.26E-02	1.26E-02	1.26E-02	1.55E-02	1.18E-01	0.00E+00	0.00E+00	1.58E-10	1.05E-02
Cs-134	2.06E-02	1.71E-02	1.87E-02	1.87E-02	1.74E-02	1.76E-02	2.20E-02	1.98E-02	4.54E-04	3.63E-04	2.73E-10	1.82E-02
Cs-137	4.42E-02	3.95E-02	4.45E-02	4.19E-02	4.00E-02	4.00E-02	4.60E-02	4.35E-02	1.32E-04	1.18E-07	8.69E-10	5.79E-02
Ba-137m									8.04E-05	6.21E-05		
Pu-241	4.73E-01	2.12E-05	2.21E+00	2.33E+00	2.91E+01	8.60E-06	9.09E-01	1.55E+00	2.46E-10	1.52E-10	1.20E-10	7.97E-03
Y-90	4.78E-06	4.78E-06	4.68E-03	1.40E-04	1.40E-04	4.78E-06	1.94E-03	1.14E-03	9.49E-05	2.89E-07	8.65E-11	5.77E-03
Pm-147	5.52E-09	1.06E-08	2.27E-02	2.39E-03	2.99E-02	5.81E-09	1.73E-03	3.11E-03	7.20E-07	6.16E-10	5.06E-11	3.37E-03
Rh-106									4.52E-05	4.31E-06		
Ce-144	1.57E-04	1.60E-04	6.43E-02	2.17E-03	3.69E-03	1.53E-04	8.37E-03	8.21E-03	7.21E-07	2.10E-07	1.40E-11	9.34E-04
Pr-144	1.96E-10	8.53E-10	7.64E-06	6.57E-09	1.10E-08	6.88E-10	1.14E-07	9.51E-07	2.07E-05	4.80E-07	1.40E-11	9.34E-04
Eu-154	4.14E-04	5.48E-04	2.80E-03	3.75E-03	1.85E-02	2.52E-04	3.99E-03	2.73E-03	8.87E-06	6.57E-06	6.09E-12	4.06E-04
Cm-244	4.89E-01	3.20E-05	5.93E-01	2.88E+00	3.59E+01	3.10E-05	1.47E+00	2.06E+00	3.64E-09	4.57E-10	5.29E-12	3.53E-04
Pu-238	6.93E-01	2.47E-05	7.92E+00	3.76E+00	4.70E+01	2.38E-05	1.74E+00	2.62E+00	3.06E-09	3.66E-10	4.26E-12	2.84E-04
Sb-125	7.61E-06	8.80E-06	4.59E-04	1.37E-05	5.77E-05	6.85E-06	3.07E-05	6.98E-05	1.70E-06	1.29E-06	3.64E-12	2.43E-04
Eu-155	4.13E-06	7.12E-06	1.38E-04	1.66E-04	1.76E-03	2.78E-06	1.29E-04	1.30E-04	1.19E-07	8.74E-08	2.00E-12	1.33E-04
Am-241	2.36E-01	1.94E-05	1.34E-01	1.26E+00	1.58E+01	1.16E-05	5.68E-01	8.72E-01	2.82E-08	1.80E-08	1.25E-12	8.35E-05
Te-125m	6.39E-07	5.51E-07	5.36E-05	1.55E-05	1.65E-04	5.12E-07	3.48E-06	1.02E-05	3.03E-08	7.09E-09	8.88E-13	5.92E-05
Pu-240	1.32E-01	3.96E-06	1.34E+00	7.04E-01	8.78E+00	3.77E-06	3.15E-01	4.83E-01	4.94E-10	6.00E-11	7.17E-13	4.78E-05
Pu-239	6.47E-02	1.88E-06	6.57E-01	3.44E-01	4.29E+00	1.84E-06	1.54E-01	2.36E-01	1.15E-10	2.61E-11	3.51E-13	2.34E-05
Totals	**2.52E+00**	**1.40E+00**	**4.82E+01**	**1.37E+01**	**1.44E+02**	**1.24E+00**	**7.85E+00**	**1.34E+01**	**5.12E-02**	**2.79E-02**		
TEDE	**1.35E+01**											

Input Prepared By: W. E. Kennedy, J. Date: 5/12/99

Input Reviewed By: Cheryl Y. Smith Date: 5/12/99

Calc 05996.02-KR-009, Rev. 1 Pg A5.

Table 5 MPC-68 Accident Conditions: Committed Effective Dose Equivalent and Dose to Organs From Inhalation, Plus Deposition Estimates (Ci/m2) at 3,219 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	X/Q (s/m3)	Breathing Rate (m3/s)	Gonad DCF (Sv/Bq)	Gonad DCF (mrem/uCi)	Gonad CDE (mrem)
										Gases			
H-3	8.72E+01	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	4.69E-09	9.42E-05	3.30E-04	1.73E-11	6.40E-02	2.42E-05
I-129	7.72E-03	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	4.15E-13	9.42E-05	3.30E-04	8.69E-11	3.22E-01	1.08E-08
Kr-85	1.43E+03	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	7.69E-08	9.42E-05	3.30E-04	0.00E+00	0.00E+00	0.00E+00
										Crud			
Co-60	6.50E+01	68	5.99E+06	1.58E-05	2.63E-12	1	2.59E+06	1.17E-08	9.42E-05	3.30E-04	4.76E-09	1.76E+01	1.65E-02
										Volatiles			
Sr-90	1.52E+04	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	5.45E-10	9.42E-05	3.30E-04	2.64E-09	9.77E+00	4.29E-04
Ru-106	4.16E+03	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	1.49E-10	9.42E-05	3.30E-04	1.38E-08	5.11E+01	6.14E-04
Cs-134	7.20E+03	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	2.58E-10	9.42E-05	3.30E-04	1.30E-08	4.81E+01	1.00E-03
Cs-137	2.29E+04	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	8.21E-10	9.42E-05	3.30E-04	8.76E-09	3.24E+01	2.15E-03
										Fines			
Pu-241	2.10E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.13E-10	9.42E-05	3.30E-04	6.82E-07	2.52E+03	2.30E-02
Y-90	1.52E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	8.18E-11	9.42E-05	3.30E-04	9.52E-12	3.52E-02	2.32E-07
Pm-147	8.88E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	4.78E-11	9.42E-05	3.30E-04	1.88E-14	6.96E-05	2.68E-10
Ce-144	2.46E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.32E-11	9.42E-05	3.30E-04	1.93E-09	7.14E+00	7.62E-06
Pr-144	2.46E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.32E-11	9.42E-05	3.30E-04	2.41E-15	8.92E-06	9.51E-12
Eu-154	1.07E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	5.76E-12	9.42E-05	3.30E-04	1.17E-08	4.33E+01	2.01E-05
Cm-244	9.30E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	5.00E-12	9.42E-05	3.30E-04	1.59E-05	5.88E+04	2.37E-02
Pu-238	7.49E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	4.03E-12	9.42E-05	3.30E-04	2.80E-05	1.04E+05	3.36E-02
Sb-125	6.40E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	3.44E-12	9.42E-05	3.30E-04	3.60E-10	1.33E+00	3.70E-07
Eu-155	3.51E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.89E-12	9.42E-05	3.30E-04	3.56E-10	1.32E+00	2.00E-07
Am-241	2.20E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.18E-12	9.42E-05	3.30E-04	3.25E-05	1.20E+05	1.15E-02
Te-125m	1.56E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	8.39E-13	9.42E-05	3.30E-04	1.24E-10	4.59E-01	3.10E-08
Pu-240	1.26E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	6.78E-13	9.42E-05	3.30E-04	3.18E-05	1.18E+05	6.43E-03
Pu-239	6.16E+01	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	3.31E-13	9.42E-05	3.30E-04	3.18E-05	1.18E+05	3.14E-03
Total:													**1.22E-01**

Table 5 MPC-68 Accident Conditions: Committed Effective Dose Equivalent and Dose to Organs From Inhalation, Plus Deposition Estimates (Ci/m2) at 3,219 m Downwind (Continued)

Column 1	Column 15	Column 16	Column 17	Column 18	Column 19	Column 20	Column 21	Column 22	Column 23	Column 24	Column 25	Column 26
Nuclide	Breast DCF (Sv/Bq)	Breast DCF (mrem/uCi)	Breast CDE (mrem)	Lung DCF (Sv/Bq)	Lung DCF (mrem/uCi)	Lung CDE (mrem)	R Marrow DCF (Sv/Bq)	R Marrow DCF (mrem/uCi)	R Marrow CDE (mrem)	B Surface DCF (Sv/Bq)	B Surface DCF (mrem/uCi)	B Surface CDE (mrem)
H-3	1.73E-11	6.40E-02	2.42E-05	1.73E-11	6.40E-02	2.42E-05	1.73E-11	6.40E-02	2.42E-05	1.73E-11	6.40E-02	2.42E-05
I-129	2.09E-10	7.73E-01	2.59E-08	3.14E-10	1.16E+00	3.89E-08	1.40E-10	5.18E-01	1.73E-08	1.38E-10	5.11E-01	1.71E-08
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	1.84E-08	6.81E+01	6.40E-02	3.45E-07	1.28E+03	1.20E+00	1.72E-08	6.36E+01	5.98E-02	1.35E-08	5.00E+01	4.69E-02
Sr-90	2.64E-09	9.77E+00	4.29E-04	2.86E-06	1.06E+04	4.65E-01	3.36E-07	1.24E+03	5.46E-02	7.27E-07	2.69E+03	1.18E-01
Ru-106	1.37E-08	5.07E+01	6.10E-04	1.04E-06	3.85E+03	4.63E-02	1.37E-08	5.07E+01	6.10E-04	1.37E-08	5.07E+01	6.10E-04
Cs-134	1.08E-08	4.00E+01	8.32E-04	1.18E-08	4.37E+01	9.09E-04	1.18E-08	4.37E+01	9.09E-04	1.10E-08	4.07E+01	8.47E-04
Cs-137	7.84E-09	2.90E+01	1.92E-03	8.82E-09	3.26E+01	2.16E-03	8.30E-09	3.07E+01	2.03E-03	7.94E-09	2.94E+01	1.94E-03
Pu-241	3.06E-11	1.13E-01	1.03E-06	3.18E-06	1.18E+04	1.07E-01	3.36E-06	1.24E+04	1.13E-01	4.20E-05	1.55E+05	1.41E+00
Y-90	9.52E-12	3.52E-02	2.32E-07	9.31E-09	3.44E+01	2.27E-04	2.79E-10	1.03E+00	6.80E-06	2.78E-10	1.03E+00	6.78E-06
Pm-147	3.60E-14	1.33E-04	5.13E-10	7.74E-08	2.86E+02	1.10E-03	8.16E-09	3.02E+01	1.16E-04	1.02E-07	3.77E+02	1.45E-03
Ce-144	1.97E-09	7.29E+00	7.77E-06	7.91E-07	2.93E+03	3.12E-03	2.67E-08	9.88E+01	1.05E-04	4.54E-08	1.68E+02	1.79E-04
Pr-144	1.05E-14	3.89E-05	4.14E-11	9.40E-11	3.48E-01	3.71E-07	8.08E-14	2.99E-04	3.19E-10	1.35E-13	5.00E-04	5.33E-10
Eu-154	1.55E-08	5.74E+01	2.66E-05	7.92E-08	2.93E+02	1.36E-04	1.06E-07	3.92E+02	1.82E-04	5.23E-07	1.94E+03	8.98E-04
Cm-244	1.04E-09	3.85E+00	1.55E-06	1.93E-05	7.14E+04	2.88E-02	9.38E-05	3.47E+05	1.40E-01	1.17E-03	4.33E+06	1.75E+00
Pu-238	1.00E-09	3.70E+00	1.20E-06	3.20E-04	1.18E+06	3.84E-01	1.52E-04	5.62E+05	1.83E-01	1.90E-03	7.03E+06	2.28E+00
Sb-125	4.16E-10	1.54E+00	4.27E-07	2.17E-08	8.03E+01	2.23E-05	6.49E-10	2.40E+00	6.66E-07	2.73E-09	1.01E+01	2.80E-06
Eu-155	6.14E-10	2.27E+00	3.46E-07	1.19E-08	4.40E+01	6.70E-06	1.43E-08	5.29E+01	8.05E-06	1.52E-07	5.62E+02	8.56E-05
Am-241	2.67E-09	9.88E+00	9.42E-07	1.84E-05	6.81E+04	6.49E-03	1.74E-04	6.44E+05	6.14E-02	2.17E-03	8.03E+06	7.66E-01
Te-125m	1.07E-10	3.96E-01	2.68E-08	1.04E-08	3.85E+01	2.60E-06	3.01E-09	1.11E+01	7.53E-07	3.21E-08	1.19E+02	8.03E-06
Pu-240	9.51E-10	3.52E+00	1.92E-07	3.23E-04	1.20E+06	6.53E-02	1.69E-04	6.25E+05	3.42E-02	2.11E-03	7.81E+06	4.26E-01
Pu-239	9.22E-10	3.41E+00	9.11E-08	3.23E-04	1.20E+06	3.19E-02	1.69E-04	6.25E+05	1.67E-02	2.11E-03	7.81E+06	2.09E-01
			6.78E-02			**2.34E+00**			**6.66E-01**			**7.02E+00**

Table 5 MPC-68 Accident Conditions: Committed Effective Dose Equivalent and Dose to Organs From Inhalation, Plus Deposition Estimates (Ci/m2) at 3,219 m Downwind (Continued)

Column 1	Column 27	Column 28	Column 29	Column 30	Column 31	Column 32	Column 33	Column 34	Column 35	Column 36	Column 37
Nuclide	Thyroid DCF (Sv/Bq)	Thyroid DCF (mrem/uCi)	Thyroid CDE (mrem)	Remainder DCF (Sv/Bq)	Remainder DCF (mrem/uCi)	Remainder CDE (mrem)	Effective DCF (Sv/Bq)	Effective DCF (mrem/uCi)	Inhalation CEDE (mrem/y)	Deposition at 3219 m (Ci/m2)	Deposition at 3219 m Depth = 0.01m (pCi/g)
H-3	1.73E-11	6.40E-02	2.42E-05	1.73E-11	6.40E-02	2.42E-05	1.73E-11	6.40E-02	2.42E-05	2.21E-10	1.48E-02
I-129	1.56E-06	5.77E+03	1.93E-04	1.18E-10	4.37E-01	1.46E-08	4.69E-08	1.74E+02	5.81E-06	1.96E-14	1.31E-06
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.63E-09	2.42E-01
Co-60	1.62E-08	5.99E+01	5.63E-02	3.60E-08	1.33E+02	1.25E-01	5.91E-08	2.19E+02	2.05E-01	5.50E-10	3.67E-02
Sr-90	2.64E-09	9.77E+00	4.29E-04	5.73E-09	2.12E+01	9.31E-04	3.51E-07	1.30E+03	5.71E-02	2.57E-11	1.71E-03
Ru-106	1.37E-08	5.07E+01	6.10E-04	1.69E-08	6.25E+01	7.52E-04	1.29E-07	4.77E+02	5.74E-03	7.04E-12	4.69E-04
Cs-134	1.11E-08	4.11E+01	8.55E-04	1.39E-08	5.14E+01	1.07E-03	1.25E-08	4.63E+01	9.63E-04	1.22E-11	8.12E-04
Cs-137	7.93E-09	2.93E+01	1.94E-03	9.12E-09	3.37E+01	2.23E-03	8.63E-09	3.19E+01	2.11E-03	3.87E-11	2.58E-03
Pu-241	1.24E-11	4.59E-02	4.18E-07	1.31E-06	4.85E+03	4.41E-02	2.23E-06	8.25E+03	7.51E-02	5.33E-12	3.55E-04
Y-90	9.52E-12	3.52E-02	2.32E-07	3.87E-09	1.43E+01	9.44E-05	2.28E-09	8.44E+00	5.56E-05	3.86E-12	2.57E-04
Pm-147	1.98E-14	7.33E-05	2.82E-10	5.89E-09	2.18E+01	8.39E-05	1.06E-08	3.92E+01	1.51E-04	2.25E-12	1.50E-04
Ce-144	1.88E-09	6.96E+00	7.42E-06	1.03E-07	3.81E+02	4.06E-04	1.01E-07	3.74E+02	3.99E-04	6.24E-13	4.16E-05
Pr-144	8.47E-15	3.13E-05	3.34E-11	1.40E-12	5.18E-03	5.52E-09	1.17E-11	4.33E-02	4.62E-08	6.24E-13	4.16E-05
Eu-154	7.14E-09	2.64E+01	1.23E-05	1.13E-07	4.18E+02	1.94E-04	7.73E-08	2.86E+02	1.33E-04	2.72E-13	1.81E-05
Cm-244	1.01E-09	3.74E+00	1.51E-06	4.78E-05	1.77E+05	7.13E-02	6.70E-05	2.48E+05	1.00E-01	2.36E-13	1.57E-05
Pu-238	9.62E-10	3.56E+00	1.16E-06	7.02E-05	2.60E+05	8.43E-02	1.06E-04	3.92E+05	1.27E-01	1.90E-13	1.27E-05
Sb-125	3.24E-10	1.20E+00	3.33E-07	1.45E-09	5.37E+00	1.49E-06	3.30E-09	1.22E+01	3.39E-06	1.62E-13	1.08E-05
Eu-155	2.40E-10	8.88E-01	1.35E-07	1.11E-08	4.11E+01	6.25E-06	1.12E-08	4.14E+01	6.31E-06	8.91E-14	5.94E-06
Am-241	1.60E-09	5.92E+00	5.65E-07	7.82E-05	2.89E+05	2.76E-02	1.20E-04	4.44E+05	4.24E-02	5.58E-14	3.72E-06
Te-125m	9.93E-11	3.67E-01	2.49E-08	6.75E-10	2.50E+00	1.69E-07	1.97E-09	7.29E+00	4.93E-07	3.96E-14	2.64E-06
Pu-240	9.05E-10	3.35E+00	1.83E-07	7.56E-05	2.80E+05	1.53E-02	1.16E-04	4.29E+05	2.34E-02	3.20E-14	2.13E-06
Pu-239	9.03E-10	3.34E+00	8.92E-08	7.56E-05	2.80E+05	7.47E-03	1.16E-04	4.29E+05	1.15E-02	1.56E-14	1.04E-06
			6.04E-02			**3.81E-01**			**6.52E-01**		

Input Prepared By: W. E. Kennedy, Jr. Date: 5/12/99

Input Reviewed By: Cherry Cy Smith Date: 5/12/99

Calc 05996.02-CR-009, Rev. 1 Pg A8

Table 6 MPC-68 Accident Conditions: Effective Dose - External Exposure from Submersion at 3219 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Skin DCF (Sv m3/Bq s)	Skin DCF (mrem m3/uCi s)	Skin Dose (mrem)	Effective DCF (Sv m3/Bq s)	Effective DCF (mrem m3/uCi s)	Effective Dose (mrem)
H-3	8.72E+01	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	4.69E-09	1.22E-02	9.42E-05	0.00E+00	0.00E+00	0.00E+00	3.31E-19	1.22E-09	1.40E-09
I-129	7.72E-03	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	4.15E-13	1.08E-06	9.42E-05	1.10E-15	4.07E-06	4.12E-10	3.80E-16	1.41E-06	1.42E-10
Kr-85	1.43E+03	68	5.99E+06	1.58E-05	2.63E-12	0.3	2.59E+06	7.69E-08	1.99E-01	9.42E-05	1.32E-14	4.88E-05	9.17E-04	1.19E-16	4.40E-07	8.27E-06
Co-60	6.50E+01	68	5.99E+06	1.58E-05	2.63E-12	1	2.59E+06	1.17E-08	3.02E-02	9.42E-05	1.45E-13	5.37E-04	1.53E-03	1.26E-13	4.66E-04	1.33E-03
Sr-90	1.52E+04	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	5.45E-10	1.41E-03	9.42E-05	9.20E-15	3.40E-05	4.53E-06	7.53E-18	2.79E-08	3.71E-09
Ru-106	4.16E+03	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	1.49E-10	3.87E-04	9.42E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	7.20E+03	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	2.58E-10	6.69E-04	9.42E-05	9.45E-14	3.50E-04	2.20E-05	7.57E-14	2.80E-04	1.77E-05
Cs-137	2.29E+04	68	5.99E+06	1.58E-05	2.63E-12	2.00E-04	2.59E+06	8.21E-10	2.13E-03	9.42E-05	8.63E-15	3.19E-05	6.40E-06	7.74E-18	2.86E-08	5.74E-09
Ba-137m	2.16E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.16E-10	3.00E-04	9.42E-05	3.73E-14	1.38E-04	3.91E-06	2.88E-14	1.07E-04	3.02E-06
Pu-241	2.10E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.13E-10	2.93E-04	9.42E-05	1.17E-19	4.33E-10	1.19E-11	7.25E-20	2.68E-10	7.40E-12
Y-90	1.52E+04	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	8.18E-11	2.12E-04	9.42E-05	6.24E-14	2.31E-04	4.61E-06	1.90E-16	7.03E-07	1.40E-08
Pm-147	8.88E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	4.78E-11	1.24E-04	9.42E-05	8.11E-16	3.00E-06	3.50E-08	6.93E-19	2.56E-09	2.99E-11
Rh-106	4.16E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	2.23E-11	5.78E-05	9.42E-05	1.09E-13	4.03E-04	2.19E-06	1.04E-14	3.85E-05	2.09E-07
Ce-144	2.46E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.32E-11	3.43E-05	9.42E-05	2.93E-15	1.08E-05	3.50E-08	8.53E-16	3.16E-06	1.02E-08
Pr-144	2.46E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.32E-11	3.43E-05	9.42E-05	8.43E-14	3.12E-04	1.01E-06	1.95E-15	7.22E-06	2.33E-08
Eu-154	1.07E+03	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	5.76E-12	1.49E-05	9.42E-05	8.29E-14	3.07E-04	4.31E-07	6.14E-14	2.27E-04	3.19E-07
Cm-244	9.30E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	5.00E-12	1.30E-05	9.42E-05	3.91E-17	1.45E-07	1.77E-10	4.91E-18	1.82E-08	2.22E-11
Pu-238	7.49E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	4.03E-12	1.04E-05	9.42E-05	4.09E-17	1.51E-07	1.49E-10	4.88E-18	1.81E-08	1.78E-11
Sb-125	6.40E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	3.44E-12	8.92E-06	9.42E-05	2.65E-14	9.81E-05	8.24E-08	2.02E-14	7.47E-05	6.28E-08
Eu-155	3.51E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.89E-12	4.89E-06	9.42E-05	3.39E-15	1.25E-05	5.78E-09	2.49E-15	9.21E-06	4.25E-09
Am-241	2.20E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	1.18E-12	3.07E-06	9.42E-05	1.28E-15	4.74E-06	1.37E-09	8.18E-16	3.03E-06	8.75E-10
Te-125m	1.56E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	8.39E-13	2.17E-06	9.42E-05	1.94E-15	7.18E-06	1.47E-09	4.53E-16	1.68E-06	3.44E-10
Pu-240	1.26E+02	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	6.78E-13	1.76E-06	9.42E-05	3.92E-17	1.45E-07	2.40E-11	4.75E-18	1.76E-08	2.91E-12
Pu-239	6.16E+01	68	5.99E+06	1.58E-05	2.63E-12	3.00E-05	2.59E+06	3.31E-13	8.59E-07	9.42E-05	1.86E-17	6.88E-08	5.57E-12	4.24E-18	1.57E-08	1.27E-12
												Total:	2.49E-03		Total:	1.36E-03

Table 7 MPC-68 Accident Total Effective Dose Equivalent at 3219 m Downwind

External Dose (mrem/y)	Plus	Inhalation CEDE (mrem/y)	Equals	TEDE (mrem/y)
1.36E-03	Plus	6.52E-01	Equals	6.53E-01

W. E. Kennedy, J. 5/12/99
Input Prepared By Date

Cheryl C. Y. Smith 5/12/99
Input Reviewed By Date

Calc 05996.02-CR-009, Rev. 1

Pg A9

Table 8 MPC-68 Accident Conditions: Summary of Inhalation Doses at 3219 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 36	Column 37
	INTERNAL DOSE								EXTERNAL DOSE		DEPOSITION	
Nuclide	Gonad CDE (mrem/uCi)	Breast CDE (mrem/uCi)	Lung CDE (mrem/uCi)	R Marrow CDE (mrem/uCi)	B Surface CDE (mrem/uCi)	Thyroid CDE (mrem/uCi)	Remainder CDE (mrem/uCi)	Inhalation CEDE (mrem/y)	Skin Dose (mrem)	Effective Dose (mrem)	Deposition at 3219 m (Ci/m2)	Deposition at 3219 m Depth =
H-3	2.42E-05	2.42E-05	2.42E-05	2.42E-05	2.42E-05	2.42E-05	2.42E-05	2.42E-05	0.00E+00	1.40E-09	2.21E-10	1.48E-02
I-129	1.08E-08	2.59E-08	3.89E-08	1.73E-08	1.71E-08	1.93E-04	1.46E-08	5.81E-06	4.12E-10	1.42E-10	1.96E-14	1.31E-06
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.17E-04	8.27E-06	3.63E-09	2.42E-01
Co-60	1.65E-02	6.40E-02	1.20E+00	5.98E-02	4.69E-02	5.63E-02	1.25E-01	2.05E-01	1.53E-03	1.33E-03	5.50E-10	3.67E-02
Sr-90	4.29E-04	4.29E-04	4.65E-01	5.46E-02	1.18E-01	4.29E-04	9.31E-04	5.71E-02	4.53E-06	3.71E-09	2.57E-11	1.71E-03
Ru-106	6.14E-04	6.10E-04	4.63E-02	6.10E-04	6.10E-04	6.10E-04	7.52E-04	5.74E-03	0.00E+00	0.00E+00	7.04E-12	4.69E-04
Cs-134	1.00E-03	8.32E-04	9.09E-04	9.09E-04	8.47E-04	8.55E-04	1.07E-03	9.63E-04	2.20E-05	1.77E-05	1.22E-11	8.12E-04
Cs-137	2.15E-03	1.92E-03	2.16E-03	2.03E-03	1.94E-03	1.94E-03	2.23E-03	2.11E-03	6.40E-06	5.74E-09	3.87E-11	2.58E-03
Ba-137m									3.91E-06	3.02E-06		
Pu-241	2.30E-02	1.03E-06	1.07E-01	1.13E-01	1.41E+00	4.18E-07	4.41E-02	7.51E-02	1.19E-11	7.40E-12	5.33E-12	3.55E-04
Y-90	2.32E-07	2.32E-07	2.27E-04	6.80E-06	6.78E-06	2.32E-07	9.44E-05	5.56E-05	4.61E-06	1.40E-08	3.86E-12	2.57E-04
Pm-147	2.68E-10	5.13E-10	1.10E-03	1.16E-04	1.45E-03	2.82E-10	8.39E-05	1.51E-04	3.50E-08	2.99E-11	2.25E-12	1.50E-04
Rh-106									2.19E-06	2.09E-07		
Ce-144	7.62E-06	7.77E-06	3.12E-03	1.05E-04	1.79E-04	7.42E-06	4.06E-04	3.99E-04	3.50E-08	1.02E-08	6.24E-13	4.16E-05
Pr-144	9.51E-12	4.14E-11	3.71E-07	3.19E-10	5.33E-10	3.34E-11	5.52E-09	4.62E-08	1.01E-06	2.33E-08	6.24E-13	4.16E-05
Eu-154	2.01E-05	2.66E-05	1.36E-04	1.82E-04	8.98E-04	1.23E-05	1.94E-04	1.33E-04	4.31E-07	3.19E-07	2.72E-13	1.81E-05
Cm-244	2.37E-02	1.55E-06	2.88E-02	1.40E-01	1.75E+00	1.51E-06	7.13E-02	1.00E-01	1.77E-10	2.22E-11	2.36E-13	1.57E-05
Pu-238	3.36E-02	1.20E-06	3.84E-01	1.83E-01	2.28E+00	1.16E-06	8.43E-02	1.27E-01	1.49E-10	1.78E-11	1.90E-13	1.27E-05
Sb-125	3.70E-07	4.27E-07	2.23E-05	6.66E-07	2.80E-06	3.33E-07	1.49E-06	3.39E-06	8.24E-08	6.28E-08	1.62E-13	1.08E-05
Eu-155	2.00E-07	3.46E-07	6.70E-06	8.05E-06	8.56E-05	1.35E-07	6.25E-06	6.31E-06	5.78E-09	4.25E-09	8.91E-14	5.94E-06
Am-241	1.15E-02	9.42E-07	6.49E-03	6.14E-02	7.66E-01	5.65E-07	2.76E-02	4.24E-02	1.37E-09	8.75E-10	5.58E-14	3.72E-06
Te-125m	3.10E-08	2.68E-08	2.60E-06	7.53E-07	8.03E-06	2.49E-08	1.69E-07	4.93E-07	1.47E-09	3.44E-10	3.96E-14	2.64E-06
Pu-240	6.43E-03	1.92E-07	6.53E-02	3.42E-02	4.26E-01	1.83E-07	1.53E-02	2.34E-02	2.40E-11	2.91E-12	3.20E-14	2.13E-06
Pu-239	3.14E-03	9.11E-08	3.19E-02	1.67E-02	2.09E-01	8.92E-08	7.47E-03	1.15E-02	5.57E-12	1.27E-12	1.56E-14	1.04E-06
Totals:	**1.22E-01**	**6.78E-02**	**2.34E+00**	**6.66E-01**	**7.02E+00**	**6.04E-02**	**3.81E-01**	**6.52E-01**	**2.49E-03**	**1.36E-03**		
TEDE	**6.53E-01**											

Input Prepared By: W. E. Kennedy, Jr. Date: 5/12/99

Input Reviewed By: Cheryl Y. Smith Date: 5/12/99

Calc 05996.02-CR-009, Rev. 1 Pg A10.

Table 1a SNC TranStor Cask with BWR Fuel - Accident Analysis: Committed Effective Dose Equivalent and Doses to Organs From Inhalation, Plus Deposition Estimates (uCi/m2) at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	X/Q (s/m3)	Breathing Rate (m3/s)	Gonad DCF (Sv/Bq)	Gonad DCF (mrem/uCi)	Gonad CDE (mrem)
										Gases			
H-3	7.96E+01	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	2.59E-08	1.94E-03	3.30E-04	1.73E-11	6.40E-02	2.75E-03
I-129	7.64E-03	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	2.48E-12	1.94E-03	3.30E-04	8.69E-11	3.22E-01	1.32E-06
Kr-85	1.30E+03	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	4.23E-07	1.94E-03	3.30E-04	0.00E+00	0.00E+00	0.00E+00
										Crud			
Co-60	6.00E+01	61	5.63E+06	1.00E-04	1.78E-11	1	2.59E+06	6.50E-08	1.94E-03	3.30E-04	4.76E-09	1.76E+01	1.90E+00
										Volatiles			
Sr-90	1.46E+04	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	3.16E-09	1.94E-03	3.30E-04	2.64E-09	9.77E+00	5.13E-02
Ru-106	1.85E+03	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	4.01E-10	1.94E-03	3.30E-04	1.38E-08	5.11E+01	3.40E-02
Cs-134	4.77E+03	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	1.03E-09	1.94E-03	3.30E-04	1.30E-08	4.81E+01	8.25E-02
Cs-137	2.20E+04	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	4.77E-09	1.94E-03	3.30E-04	8.76E-09	3.24E+01	2.56E-01
										Fines			
Pu-241	1.85E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	6.01E-10	1.94E-03	3.30E-04	6.82E-07	2.52E+03	2.52E+00
Y-90	1.46E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	4.75E-10	1.94E-03	3.30E-04	9.52E-12	3.52E-02	2.77E-05
Pm-147	6.37E+03	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.07E-10	1.94E-03	3.30E-04	1.88E-14	6.96E-05	2.39E-08
Ce-144	8.39E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.73E-11	1.94E-03	3.30E-04	1.93E-09	7.14E+00	3.23E-04
Pr-144	8.39E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.73E-11	1.94E-03	3.30E-04	2.41E-15	8.92E-06	4.04E-10
Eu-154	8.98E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.92E-11	1.94E-03	3.30E-04	1.17E-08	4.33E+01	2.10E-03
Cm-244	8.66E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.81E-11	1.94E-03	3.30E-04	1.59E-05	5.88E+04	2.75E+00
Pu-238	7.12E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.31E-11	1.94E-03	3.30E-04	2.80E-05	1.04E+05	3.98E+00
Sb-125	5.04E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	1.64E-11	1.94E-03	3.30E-04	3.60E-10	1.33E+00	3.62E-05
Eu-155	2.93E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	9.52E-12	1.94E-03	3.30E-04	3.56E-10	1.32E+00	2.08E-05
Am-241	2.37E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	7.70E-12	1.94E-03	3.30E-04	3.25E-05	1.20E+05	1.54E+00
Pu-240	1.21E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	3.93E-12	1.94E-03	3.30E-04	3.18E-05	1.18E+05	7.68E-01
Pu-239	5.53E+01	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	1.80E-12	1.94E-03	3.30E-04	3.18E-05	1.18E+05	3.51E-01
												Total:	1.42E+01

SNC TranStor Accident Analysis Spreadsheets
Calc 05996.02-4R-009, Rev. 1 Pg B1

Table 1a SNC TranStor Cask with BWR Fuel - Accident Analysis: Committed Effective Dose Equivalent and Doses to Organs From Inhalation, Plus Deposition Estimates (uCi/m2) at 500 m Downwind (Continued)

Column 1	Column 15	Column 16	Column 17	Column 18	Column 19	Column 20	Column 21	Column 22	Column 23	Column 24	Column 25	Column 26
Nuclide	Breast DCF (Sv/Bq)	Breast DCF (mrem/uCi)	Breast CDE (mrem)	Lung DCF (Sv/Bq)	Lung DCF (mrem/uCi)	Lung CDE (mrem)	R Marrow DCF (Sv/Bq)	R Marrow DCF (mrem/uCi)	R Marrow CDE (mrem)	B Surface DCF (Sv/Bq)	B Surface DCF (mrem/uCi)	B Surface CDE (mrem)
H-3	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03
I-129	2.09E-10	7.73E-01	3.19E-06	3.14E-10	1.16E+00	4.79E-06	1.40E-10	5.18E-01	2.13E-06	1.38E-10	5.11E-01	2.10E-06
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	1.84E-08	6.81E+01	7.34E+00	3.45E-07	1.28E+03	1.38E+02	1.72E-08	6.36E+01	6.87E+00	1.35E-08	5.00E+01	5.39E+00
Sr-90	2.64E-09	9.77E+00	5.13E-02	2.86E-06	1.06E+04	5.56E+01	3.36E-07	1.24E+03	6.53E+00	7.27E-07	2.69E+03	1.41E+01
Ru-106	1.37E-08	5.07E+01	3.37E-02	1.04E-06	3.85E+03	2.56E+00	1.37E-08	5.07E+01	3.37E-02	1.37E-08	5.07E+01	3.37E-02
Cs-134	1.08E-08	4.00E+01	6.85E-02	1.18E-08	4.37E+01	7.49E-02	1.18E-08	4.37E+01	7.49E-02	1.10E-08	4.07E+01	6.98E-02
Cs-137	7.84E-09	2.90E+01	2.29E-01	8.82E-09	3.26E+01	2.58E-01	8.30E-09	3.07E+01	2.43E-01	7.94E-09	2.94E+01	2.32E-01
Pu-241	3.06E-11	1.13E-01	1.13E-04	3.18E-06	1.18E+04	1.17E+01	3.36E-06	1.24E+04	1.24E+01	4.20E-05	1.55E+05	1.55E+02
Y-90	9.52E-12	3.52E-02	2.77E-05	9.31E-09	3.44E+01	2.71E-02	2.79E-10	1.03E+00	8.13E-04	2.78E-10	1.03E+00	8.10E-04
Pm-147	3.60E-14	1.33E-04	4.58E-08	7.74E-08	2.86E+02	9.84E-02	8.16E-09	3.02E+01	1.04E-02	1.02E-07	3.77E+02	1.30E-01
Ce-144	1.97E-09	7.29E+00	3.30E-04	7.91E-07	2.93E+03	1.32E-01	2.67E-08	9.88E+01	4.47E-03	4.54E-08	1.68E+02	7.60E-03
Pr-144	1.05E-14	3.89E-05	1.76E-09	9.40E-11	3.48E-01	1.57E-05	8.08E-14	2.99E-04	1.35E-08	1.35E-13	5.00E-04	2.26E-08
Eu-154	1.55E-08	5.74E+01	2.78E-03	7.92E-08	2.93E+02	1.42E-02	1.06E-07	3.92E+02	1.90E-02	5.23E-07	1.94E+03	9.37E-02
Cm-244	1.04E-09	3.85E+00	1.80E-04	1.93E-05	7.14E+04	3.34E+00	9.38E-05	3.47E+05	1.62E+01	1.17E-03	4.33E+06	2.02E+02
Pu-238	1.00E-09	3.70E+00	1.42E-04	3.20E-04	1.18E+06	4.55E+01	1.52E-04	5.62E+05	2.16E+01	1.90E-03	7.03E+06	2.70E+02
Sb-125	4.16E-10	1.54E+00	4.18E-05	2.17E-08	8.03E+01	2.18E-03	6.49E-10	2.40E+00	6.53E-05	2.73E-09	1.01E+01	2.75E-04
Eu-155	6.14E-10	2.27E+00	3.59E-05	1.19E-08	4.40E+01	6.96E-04	1.43E-08	5.29E+01	8.36E-04	1.52E-07	5.62E+02	8.89E-03
Am-241	2.67E-09	9.88E+00	1.26E-04	1.84E-05	6.81E+04	8.70E-01	1.74E-04	6.44E+05	8.23E+00	2.17E-03	8.03E+06	1.03E+02
Pu-240	9.51E-10	3.52E+00	2.30E-05	3.23E-04	1.20E+06	7.80E+00	1.69E-04	6.25E+05	4.08E+00	2.11E-03	7.81E+06	5.10E+01
Pu-239	9.22E-10	3.41E+00	1.02E-05	3.23E-04	1.20E+06	3.56E+00	1.69E-04	6.25E+05	1.87E+00	2.11E-03	7.81E+06	2.33E+01
		Total:	7.73E+00		Total:	2.69E+02		Total:	7.82E+01		Total:	8.24E+02

Calc 05996.02-UR-009, Rev 1 pg B2.

Table 1a SNC TranStor Cask with BWR Fuel -Accident Analysis: Committed Effective Dose Equivalent and Doses to Organs From Inhalation, Plus Deposition Estimates (uCi/m2) at 500 m Downwind (Continued)

Column 1	Column 27	Column 28	Column 29	Column 30	Column 31	Column 32	Column 33	Column 34	Column 35	Column 36	Column 37
Nuclide	Thyroid DCF (Sv/Bq)	Thyroid DCF (mrem/uCi)	Thyroid CDE (mrem)	Remainder DCF (Sv/Bq)	Remainder DCF (mrem/uCi)	Remainder CDE (mrem)	Effective DCF (Sv/Bq)	Effective DCF (mrem/uCi)	Inhalation CEDE (mrem/y)	Deposition at 500 m (Ci/m2)	Deposition at 500 m Depth = 0.01 m (pCi/g)
H-3	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03	2.74E-08	1.82E+00
I-129	1.56E-06	5.77E+03	2.38E-02	1.18E-10	4.37E-01	1.80E-06	4.69E-08	1.74E+02	7.15E-04	2.63E-12	1.75E-04
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.47E-07	2.98E+01
Co-60	1.62E-08	5.99E+01	6.47E+00	3.60E-08	1.33E+02	1.44E+01	5.91E-08	2.19E+02	2.36E+01	6.87E-08	4.58E+00
Sr-90	2.64E-09	9.77E+00	5.13E-02	5.73E-09	2.12E+01	1.11E-01	3.51E-07	1.30E+03	6.82E+00	3.35E-09	2.23E-01
Ru-106	1.37E-08	5.07E+01	3.37E-02	1.69E-08	6.25E+01	4.16E-02	1.29E-07	4.77E+02	3.18E-01	4.24E-10	2.83E-02
Cs-134	1.11E-08	4.11E+01	7.04E-02	1.39E-08	5.14E+01	8.82E-02	1.25E-08	4.63E+01	7.93E-02	1.09E-09	7.29E-02
Cs-137	7.93E-09	2.93E+01	2.32E-01	9.12E-09	3.37E+01	2.67E-01	8.63E-09	3.19E+01	2.53E-01	5.04E-09	3.36E-01
Pu-241	1.24E-11	4.59E-02	4.58E-05	1.31E-06	4.85E+03	4.84E+00	2.23E-06	8.25E+03	8.23E+00	6.36E-10	4.24E-02
Y-90	9.52E-12	3.52E-02	2.77E-05	3.87E-09	1.43E+01	1.13E-02	2.28E-09	8.44E+00	6.64E-03	5.02E-10	3.35E-02
Pm-147	1.98E-14	7.33E-05	2.52E-08	5.89E-09	2.18E+01	7.49E-03	1.06E-08	3.92E+01	1.35E-02	2.19E-10	1.46E-02
Ce-144	1.88E-09	6.96E+00	3.15E-04	1.03E-07	3.81E+02	1.72E-02	1.01E-07	3.74E+02	1.69E-02	2.88E-11	1.92E-03
Pr-144	8.47E-15	3.13E-05	1.42E-09	1.40E-12	5.18E-03	2.34E-07	1.17E-11	4.33E-02	1.96E-06	2.88E-11	1.92E-03
Eu-154	7.14E-09	2.64E+01	1.28E-03	1.13E-07	4.18E+02	2.03E-02	7.73E-08	2.86E+02	1.39E-02	3.09E-11	2.06E-03
Cm-244	1.01E-09	3.74E+00	1.75E-04	4.78E-05	1.77E+05	8.26E+00	6.70E-05	2.48E+05	1.16E+01	2.98E-11	1.98E-03
Pu-238	9.62E-10	3.56E+00	1.37E-04	7.02E-05	2.60E+05	9.97E+00	1.06E-04	3.92E+05	1.51E+01	2.45E-11	1.63E-03
Sb-125	3.24E-10	1.20E+00	3.26E-05	1.45E-09	5.37E+00	1.46E-04	3.30E-09	1.22E+01	3.32E-04	1.73E-11	1.15E-03
Eu-155	2.40E-10	8.88E-01	1.40E-05	1.11E-08	4.11E+01	6.49E-04	1.12E-08	4.14E+01	6.55E-04	1.01E-11	6.71E-04
Am-241	1.60E-09	5.92E+00	7.57E-05	7.82E-05	2.89E+05	3.70E+00	1.20E-04	4.44E+05	5.68E+00	8.15E-12	5.43E-04
Pu-240	9.05E-10	3.35E+00	2.19E-05	7.56E-05	2.80E+05	1.83E+00	1.16E-04	4.29E+05	2.80E+00	4.16E-12	2.77E-04
Pu-239	9.03E-10	3.34E+00	9.97E-06	7.56E-05	2.80E+05	8.34E-01	1.16E-04	4.29E+05	1.28E+00	1.90E-12	1.27E-04
		Total:	6.88E+00		Total:	4.44E+01			7.57E+01		

Input Prepared By: W. E. Kennedy, Jr. Date: 5/12/99

Input Reviewed By: Cheryl Y. Smith Date: 5/12/99

Calc 05996.02-HR-009, Rev. 1

Pg B3

Table 2a SNC TranStor Cask with BWR Fuel - Accident Analysis: Effective Dose - External Exposure from Submersion at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Skin DCF Sv m3/Bq s	Skin DCF (mrem m3/uCi s)	Skin Dose (mrem)	Effective DCF (Sv m3/Bq s)	Effective DCF (mrem m3/uCi s)	Effective Dose (mrem)
H-3	7.96E+01	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	2.59E-08	6.70E-02	1.94E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-19	1.22E-09	1.59E-07
I-129	7.64E-03	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	2.48E-12	6.43E-06	1.94E-03	1.10E-15	4.07E-06	5.08E-08	3.80E-16	1.41E-06	1.75E-08
Kr-85	1.30E+03	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	4.23E-07	1.09E+00	1.94E-03	1.32E-14	4.88E-05	1.04E-01	1.19E-16	4.40E-07	9.35E-04
Co-60	6.00E+01	61	5.63E+06	1.00E-04	1.78E-11	1	2.59E+06	6.50E-08	1.68E-01	1.94E-03	1.45E-13	5.37E-04	1.75E-01	1.26E-13	4.66E-04	1.52E-01
Sr-90	1.46E+04	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	3.16E-09	8.19E-03	1.94E-03	9.20E-15	3.40E-05	5.41E-04	7.53E-18	2.79E-08	4.43E-07
Ru-106	1.85E+03	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	4.01E-10	1.04E-03	1.94E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	4.77E+03	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	1.03E-09	2.68E-03	1.94E-03	9.45E-14	3.50E-04	1.82E-03	7.57E-14	2.80E-04	1.45E-03
Cs-137	2.20E+04	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	4.77E-09	1.23E-02	1.94E-03	8.63E-15	3.19E-05	7.65E-04	7.74E-18	2.86E-08	6.86E-07
Ba-137m	2.20E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	7.15E-10	1.85E-03	1.94E-03	3.73E-14	1.38E-04	4.96E-04	2.88E-14	1.07E-04	3.83E-04
Pu-241	1.85E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	6.01E-10	1.56E-03	1.94E-03	1.17E-19	4.33E-10	1.31E-09	7.25E-20	2.68E-10	8.11E-10
Y-90	1.46E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	4.75E-10	1.23E-03	1.94E-03	6.24E-14	2.31E-04	5.51E-04	1.90E-16	7.03E-07	1.68E-06
Pm-147	6.37E+03	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.07E-10	5.36E-04	1.94E-03	8.11E-16	3.00E-06	3.12E-06	6.93E-19	2.56E-09	2.67E-09
Rh-106	1.85E+03	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	6.01E-11	1.56E-04	1.94E-03	1.09E-13	4.03E-04	1.22E-04	1.04E-14	3.85E-05	1.16E-05
Ce-144	8.39E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.73E-11	7.06E-05	1.94E-03	2.93E-15	1.08E-05	1.49E-06	8.53E-16	3.16E-06	4.32E-07
Pr-144	8.39E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.73E-11	7.06E-05	1.94E-03	8.43E-14	3.12E-04	4.27E-05	1.95E-15	7.22E-06	9.89E-07
Eu-154	8.98E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.92E-11	7.56E-05	1.94E-03	8.29E-14	3.07E-04	4.50E-05	6.14E-14	2.27E-04	3.33E-05
Cm-244	8.66E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.81E-11	7.29E-05	1.94E-03	3.91E-17	1.45E-07	2.05E-08	4.91E-18	1.82E-08	2.57E-09
Pu-238	7.12E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.31E-11	5.99E-05	1.94E-03	4.09E-17	1.51E-07	1.76E-08	4.88E-18	1.81E-08	2.10E-09
Sb-125	5.04E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	1.64E-11	4.24E-05	1.94E-03	2.65E-14	9.81E-05	8.07E-06	2.02E-14	7.47E-05	6.15E-06
Eu-155	2.93E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	9.52E-12	2.47E-05	1.94E-03	3.39E-15	1.25E-05	6.00E-07	2.49E-15	9.21E-06	4.41E-07
Am-241	2.37E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	7.70E-12	2.00E-05	1.94E-03	1.28E-15	4.74E-06	1.83E-07	8.18E-16	3.03E-06	1.17E-07
Pu-240	1.21E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	3.93E-12	1.02E-05	1.94E-03	3.92E-17	1.45E-07	2.87E-09	4.75E-18	1.76E-08	3.48E-10
Pu-239	5.53E+01	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	1.80E-12	4.66E-06	1.94E-03	1.86E-17	6.88E-08	6.22E-10	4.24E-18	1.57E-08	1.42E-10
												Total:	2.83E-01		Total:	1.55E-01

Table 3a SNC TranStor Cask with BWR Fuel - Accident Analysis

Total Effective Dose Equivalent at 500 m Downwind

External Dose (mrem/y)	Plus	Inhalation CEDE (mrem/y)	Equals	TEDE (mrem/y)
1.55E-01	Plus	7.57E+01	Equals	7.59E+01

W. E. Kennedy, J. 5/12/99
Input Prepared By Date

Cheryl Y Smith 5/12/99
Input Reviewed By Date

Calc 05996.02-NR-009, Rev. 1
Pg B4

Table 4a SNC TranStor Cask with BWR Fuel - Accident Analysis:
Summary of Inhalation Doses at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13
	INTERNAL DOSE								EXTERNAL DOSE		DEPOSITION	
Nuclide	Gonad CDE (mrem)	Breast CDE (mrem)	Lung CDE (mrem)	R Marrow CDE (mrem)	B Surface CDE (mrem)	Thyroid CDE (mrem)	Remainder CDE (mrem)	Inhalation CEDE (mrem/y)	Skin Dose (mrem)	Effective Dose (mrem)	Deposition at 500 m (Ci/m2)	Deposition at 500 m Depth = 0.01 m
H-3	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	0.00E+00	1.59E-07	2.74E-08	1.82E+00
I-129	1.32E-06	3.19E-06	4.79E-06	2.13E-06	2.10E-06	2.38E-02	1.80E-06	7.15E-04	5.08E-08	1.75E-08	2.63E-12	1.75E-04
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-01	9.35E-04	4.47E-07	2.98E+01
Co-60	1.90E+00	7.34E+00	1.38E+02	6.87E+00	5.39E+00	6.47E+00	1.44E+01	2.36E+01	1.75E-01	1.52E-01	6.87E-08	4.58E+00
Sr-90	5.13E-02	5.13E-02	5.56E+01	6.53E+00	1.41E+01	5.13E-02	1.11E-01	6.82E+00	5.41E-04	4.43E-07	3.35E-09	2.23E-01
Ru-106	3.40E-02	3.37E-02	2.56E+00	3.37E-02	3.37E-02	3.37E-02	4.16E-02	3.18E-01	0.00E+00	0.00E+00	4.24E-10	2.83E-02
Cs-134	8.25E-02	6.85E-02	7.49E-02	7.49E-02	6.98E-02	7.04E-02	8.82E-02	7.93E-02	1.82E-03	1.45E-03	1.09E-09	7.29E-02
Cs-137	2.56E-01	2.29E-01	2.58E-01	2.43E-01	2.32E-01	2.32E-01	2.67E-01	2.53E-01	7.65E-04	6.86E-07	5.04E-09	3.36E-01
Ba-137m									4.96E-04	3.83E-04		
Pu-241	2.52E+00	1.13E-04	1.17E+01	1.24E+01	1.55E+02	4.58E-05	4.84E+00	8.23E+00	1.31E-09	8.11E-10	6.36E-10	4.24E-02
Y-90	2.77E-05	2.77E-05	2.71E-02	8.13E-04	8.10E-04	2.77E-05	1.13E-02	6.64E-03	5.51E-04	1.68E-06	5.02E-10	3.35E-02
Pm-147	2.39E-08	4.58E-08	9.84E-02	1.04E-02	1.30E-01	2.52E-08	7.49E-03	1.35E-02	3.12E-06	2.67E-09	2.19E-10	1.46E-02
Rh-106									1.22E-04	1.16E-05		
Ce-144	3.23E-04	3.30E-04	1.32E-01	4.47E-03	7.60E-03	3.15E-04	1.72E-02	1.69E-02	1.49E-06	4.32E-07	2.88E-11	1.92E-03
Pr-144	4.04E-10	1.76E-09	1.57E-05	1.35E-08	2.26E-08	1.42E-09	2.34E-07	1.96E-06	4.27E-05	9.89E-07	2.88E-11	1.92E-03
Eu-154	2.10E-03	2.78E-03	1.42E-02	1.90E-02	9.37E-02	1.28E-03	2.03E-02	1.39E-02	4.50E-05	3.33E-05	3.09E-11	2.06E-03
Cm-244	2.75E+00	1.80E-04	3.34E+00	1.62E+01	2.02E+02	1.75E-04	8.26E+00	1.16E+01	2.05E-08	2.57E-09	2.98E-11	1.98E-03
Pu-238	3.98E+00	1.42E-04	4.55E+01	2.16E+01	2.70E+02	1.37E-04	9.97E+00	1.51E+01	1.76E-08	2.10E-09	2.45E-11	1.63E-03
Sb-125	3.62E-05	4.18E-05	2.18E-03	6.53E-05	2.75E-04	3.26E-05	1.46E-04	3.32E-04	8.07E-06	6.15E-06	1.73E-11	1.15E-03
Eu-155	2.08E-05	3.59E-05	6.96E-04	8.36E-04	8.89E-03	1.40E-05	6.49E-04	6.55E-04	6.00E-07	4.41E-07	1.01E-11	6.71E-04
Am-241	1.54E+00	1.26E-04	8.70E-01	8.23E+00	1.03E+02	7.57E-05	3.70E+00	5.68E+00	1.83E-07	1.17E-07	8.15E-12	5.43E-04
Pu-240	7.68E-01	2.30E-05	7.80E+00	4.08E+00	5.10E+01	2.19E-05	1.83E+00	2.80E+00	2.87E-09	3.48E-10	4.16E-12	2.77E-04
Pu-239	3.51E-01	1.02E-05	3.56E+00	1.87E+00	2.33E+01	9.97E-06	8.34E-01	1.28E+00	6.22E-10	1.42E-10	1.90E-12	1.27E-04
Totals:	1.42E+01	7.73E+00	2.69E+02	7.82E+01	8.24E+02	6.88E+00	4.44E+01	7.57E+01	2.83E-01	1.55E-01		
TEDE	7.59E+01											

Input Prepared By: W. E. Kennedy, J. Date: 5/12/99

Input Reviewed By: Cheryl Y. Smith Date: 5/12/99

Calc 05996.02-UR-009, Rev. 1 pg B5.

Table 5a SNC TranStor Cask with BWR Fuel - Accident Analysis: Committed Effective Dose Equivalent and Doses to Organs From Inhalation Plus Deposition Estimates (Ci/m2) at 3,219 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	X/Q (s/m3)	Breathing Rate (m3/s)	Gonad DCF (Sv/Bq)	Gonad DCF (mrem/uCi)	Gonad CDE (mrem)
										Gases			
H-3	7.96E+01	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	2.59E-08	9.42E-05	3.30E-04	1.73E-11	6.40E-02	1.33E-04
I-129	7.64E-03	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	2.48E-12	9.42E-05	3.30E-04	8.69E-11	3.22E-01	6.43E-08
Kr-85	1.30E+03	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	4.23E-07	9.42E-05	3.30E-04	0.00E+00	0.00E+00	0.00E+00
										Crud			
Co-60	6.00E+01	61	5.63E+06	1.00E-04	1.78E-11	1	2.59E+06	6.50E-08	9.42E-05	3.30E-04	4.76E-09	1.76E+01	9.23E-02
										Volatiles			
Sr-90	1.46E+04	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	3.16E-09	9.42E-05	3.30E-04	2.64E-09	9.77E+00	2.49E-03
Ru-106	1.85E+03	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	4.01E-10	9.42E-05	3.30E-04	1.38E-08	5.11E+01	1.65E-03
Cs-134	4.77E+03	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	1.03E-09	9.42E-05	3.30E-04	1.30E-08	4.81E+01	4.01E-03
Cs-137	2.20E+04	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	4.77E-09	9.42E-05	3.30E-04	8.76E-09	3.24E+01	1.25E-02
										Fines			
Pu-241	1.85E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	6.01E-10	9.42E-05	3.30E-04	6.82E-07	2.52E+03	1.22E-01
Y-90	1.46E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	4.75E-10	9.42E-05	3.30E-04	9.52E-12	3.52E-02	1.35E-06
Pm-147	6.37E+03	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.07E-10	9.42E-05	3.30E-04	1.88E-14	6.96E-05	1.16E-09
Ce-144	8.39E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.73E-11	9.42E-05	3.30E-04	1.93E-09	7.14E+00	1.57E-05
Pr-144	8.39E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.73E-11	9.42E-05	3.30E-04	2.41E-15	8.92E-06	1.96E-11
Eu-154	8.98E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.92E-11	9.42E-05	3.30E-04	1.17E-08	4.33E+01	1.02E-04
Cm-244	8.66E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.81E-11	9.42E-05	3.30E-04	1.59E-05	5.88E+04	1.33E-01
Pu-238	7.12E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.31E-11	9.42E-05	3.30E-04	2.80E-05	1.04E+05	1.93E-01
Sb-125	5.04E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	1.64E-11	9.42E-05	3.30E-04	3.60E-10	1.33E+00	1.76E-06
Eu-155	2.93E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	9.52E-12	9.42E-05	3.30E-04	3.56E-10	1.32E+00	1.01E-06
Am-241	2.37E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	7.70E-12	9.42E-05	3.30E-04	3.25E-05	1.20E+05	7.46E-02
Pu-240	1.21E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	3.93E-12	9.42E-05	3.30E-04	3.18E-05	1.18E+05	3.73E-02
Pu-239	5.53E+01	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	1.80E-12	9.42E-05	3.30E-04	3.18E-05	1.18E+05	1.70E-02
												Total:	6.91E-01

Table 5a SNC TranStor Cask with BWR Fuel - Accident Analysis: Committed Effective Dose Equivalent and Doses to Organs From Inhalation Plus Deposition Estimates (Ci/m2) at 3,219 m Downwind (Continued)

Column 1	Column 15	Column 16	Column 17	Column 18	Column 19	Column 20	Column 21	Column 22	Column 23	Column 24	Column 25	Column 26
Nuclide	Breast DCF (Sv/Bq)	Breast DCF (mrem/uCi)	Breast CDE (mrem)	Lung DCF (Sv/Bq)	Lung DCF (mrem/uCi)	Lung CDE (mrem)	R Marrow DCF (Sv/Bq)	R Marrow DCF (mrem/uCi)	R Marrow CDE (mrem)	B Surface DCF (Sv/Bq)	B Surface DCF (mrem/uCi)	B Surface CDE (mrem)
H-3	1.73E-11	6.40E-02	1.33E-04	1.73E-11	6.40E-02	1.33E-04	1.73E-11	6.40E-02	1.33E-04	1.73E-11	6.40E-02	1.33E-04
I-129	2.09E-10	7.73E-01	1.55E-07	3.14E-10	1.16E+00	2.32E-07	1.40E-10	5.18E-01	1.04E-07	1.38E-10	5.11E-01	1.02E-07
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	1.84E-08	6.81E+01	3.57E-01	3.45E-07	1.28E+03	6.69E+00	1.72E-08	6.36E+01	3.33E-01	1.35E-08	5.00E+01	2.62E-01
Sr-90	2.64E-09	9.77E+00	2.49E-03	2.86E-06	1.06E+04	2.70E+00	3.36E-07	1.24E+03	3.17E-01	7.27E-07	2.69E+03	6.86E-01
Ru-106	1.37E-08	5.07E+01	1.64E-03	1.04E-06	3.85E+03	1.24E-01	1.37E-08	5.07E+01	1.64E-03	1.37E-08	5.07E+01	1.64E-03
Cs-134	1.08E-08	4.00E+01	3.33E-03	1.18E-08	4.37E+01	3.64E-03	1.18E-08	4.37E+01	3.64E-03	1.10E-08	4.07E+01	3.39E-03
Cs-137	7.84E-09	2.90E+01	1.11E-02	8.82E-09	3.26E+01	1.25E-02	8.30E-09	3.07E+01	1.18E-02	7.94E-09	2.94E+01	1.13E-02
Pu-241	3.06E-11	1.13E-01	5.49E-06	3.18E-06	1.18E+04	5.70E-01	3.36E-06	1.24E+04	6.02E-01	4.20E-05	1.55E+05	7.53E+00
Y-90	9.52E-12	3.52E-02	1.35E-06	9.31E-09	3.44E+01	1.32E-03	2.79E-10	1.03E+00	3.95E-05	2.78E-10	1.03E+00	3.93E-05
Pm-147	3.60E-14	1.33E-04	2.22E-09	7.74E-08	2.86E+02	4.78E-03	8.16E-09	3.02E+01	5.04E-04	1.02E-07	3.77E+02	6.30E-03
Ce-144	1.97E-09	7.29E+00	1.60E-05	7.91E-07	2.93E+03	6.43E-03	2.67E-08	9.88E+01	2.17E-04	4.54E-08	1.68E+02	3.69E-04
Pr-144	1.05E-14	3.89E-05	8.54E-11	9.40E-11	3.48E-01	7.64E-07	8.08E-14	2.99E-04	6.57E-10	1.35E-13	5.00E-04	1.10E-09
Eu-154	1.55E-08	5.74E+01	1.35E-04	7.92E-08	2.93E+02	6.89E-04	1.06E-07	3.92E+02	9.22E-04	5.23E-07	1.94E+03	4.55E-03
Cm-244	1.04E-09	3.85E+00	8.73E-06	1.93E-05	7.14E+04	1.62E-01	9.38E-05	3.47E+05	7.87E-01	1.17E-03	4.33E+06	9.82E+00
Pu-238	1.00E-09	3.70E+00	6.90E-06	3.20E-04	1.18E+06	2.21E+00	1.52E-04	5.62E+05	1.05E+00	1.90E-03	7.03E+06	1.31E+01
Sb-125	4.16E-10	1.54E+00	2.03E-06	2.17E-08	8.03E+01	1.06E-04	6.49E-10	2.40E+00	3.17E-06	2.73E-09	1.01E+01	1.33E-05
Eu-155	6.14E-10	2.27E+00	1.74E-06	1.19E-08	4.40E+01	3.38E-05	1.43E-08	5.29E+01	4.06E-05	1.52E-07	5.62E+02	4.32E-04
Am-241	2.67E-09	9.88E+00	6.13E-06	1.84E-05	6.81E+04	4.23E-02	1.74E-04	6.44E+05	4.00E-01	2.17E-03	8.03E+06	4.98E+00
Pu-240	9.51E-10	3.52E+00	1.12E-06	3.23E-04	1.20E+06	3.79E-01	1.69E-04	6.25E+05	1.98E-01	2.11E-03	7.81E+06	2.47E+00
Pu-239	9.22E-10	3.41E+00	4.94E-07	3.23E-04	1.20E+06	1.73E-01	1.69E-04	6.25E+05	9.06E-02	2.11E-03	7.81E+06	1.13E+00
		Total:	3.76E-01		Total:	1.31E+01		Total:	3.80E+00		Total:	4.00E+01

Calc 05996.02-UR-009, Rev. 1 Pg B7.

Table 5a SNC TranStor Cask with BWR Fuel - Accident Analysis: Committed Effective Dose Equivalent and Doses to Organs From Inhalation Plus Deposition Estimates (Ci/m2) at 3,219 m Downwind (Continued)

Column 1	Column 27	Column 28	Column 29	Column 30	Column 31	Column 32	Column 33	Column 34	Column 35	Column 36	Column 37
Nuclide	Thyroid DCF (Sv/Bq)	Thyroid DCF (mrem/uCi)	Thyroid CDE (mrem)	Remainder DCF (Sv/Bq)	Remainder DCF (mrem/uCi)	Remainder CDE (mrem)	Effective DCF (Sv/Bq)	Effective DCF (mrem/uCi)	Inhalation CEDE (mrem/y)	Deposition at 3,219 m (Ci/m2)	Deposition at 3,219 m Depth = 0.01 m (pCi/g)
H-3	1.73E-11	6.40E-02	1.33E-04	1.73E-11	6.40E-02	1.33E-04	1.73E-11	6.40E-02	1.33E-04	1.22E-09	8.13E-02
I-129	1.56E-06	5.77E+03	1.15E-03	1.18E-10	4.37E-01	8.74E-08	4.69E-08	1.74E+02	3.47E-05	1.17E-13	7.81E-06
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-08	1.33E+00
Co-60	1.62E-08	5.99E+01	3.14E-01	3.60E-08	1.33E+02	6.98E-01	5.91E-08	2.19E+02	1.15E+00	3.07E-09	2.04E-01
Sr-90	2.64E-09	9.77E+00	2.49E-03	5.73E-09	2.12E+01	5.40E-03	3.51E-07	1.30E+03	3.31E-01	1.49E-10	9.95E-03
Ru-106	1.37E-08	5.07E+01	1.64E-03	1.69E-08	6.25E+01	2.02E-03	1.29E-07	4.77E+02	1.54E-02	1.89E-11	1.26E-03
Cs-134	1.11E-08	4.11E+01	3.42E-03	1.39E-08	5.14E+01	4.28E-03	1.25E-08	4.63E+01	3.85E-03	4.87E-11	3.25E-03
Cs-137	7.93E-09	2.93E+01	1.13E-02	9.12E-09	3.37E+01	1.30E-02	8.63E-09	3.19E+01	1.23E-02	2.25E-10	1.50E-02
Pu-241	1.24E-11	4.59E-02	2.22E-06	1.31E-06	4.85E+03	2.35E-01	2.23E-06	8.25E+03	4.00E-01	2.84E-11	1.89E-03
Y-90	9.52E-12	3.52E-02	1.35E-06	3.87E-09	1.43E+01	5.48E-04	2.28E-09	8.44E+00	3.23E-04	2.24E-11	1.49E-03
Pm-147	1.98E-14	7.33E-05	1.22E-09	5.89E-09	2.18E+01	3.64E-04	1.06E-08	3.92E+01	6.54E-04	9.76E-12	6.51E-04
Ce-144	1.88E-09	6.96E+00	1.53E-05	1.03E-07	3.81E+02	8.37E-04	1.01E-07	3.74E+02	8.21E-04	1.29E-12	8.57E-05
Pr-144	8.47E-15	3.13E-05	6.89E-11	1.40E-12	5.18E-03	1.14E-08	1.17E-11	4.33E-02	9.51E-08	1.29E-12	8.57E-05
Eu-154	7.14E-09	2.64E+01	6.21E-05	1.13E-07	4.18E+02	9.83E-04	7.73E-08	2.86E+02	6.73E-04	1.38E-12	9.18E-05
Cm-244	1.01E-09	3.74E+00	8.48E-06	4.78E-05	1.77E+05	4.01E-01	6.70E-05	2.48E+05	5.62E-01	1.33E-12	8.85E-05
Pu-238	9.62E-10	3.56E+00	6.64E-06	7.02E-05	2.60E+05	4.84E-01	1.06E-04	3.92E+05	7.31E-01	1.09E-12	7.28E-05
Sb-125	3.24E-10	1.20E+00	1.58E-06	1.45E-09	5.37E+00	7.08E-06	3.30E-09	1.22E+01	1.61E-05	7.73E-13	5.15E-05
Eu-155	2.40E-10	8.88E-01	6.81E-07	1.11E-08	4.11E+01	3.15E-05	1.12E-08	4.14E+01	3.18E-05	4.49E-13	2.99E-05
Am-241	1.60E-09	5.92E+00	3.67E-06	7.82E-05	2.89E+05	1.80E-01	1.20E-04	4.44E+05	2.76E-01	3.63E-13	2.42E-05
Pu-240	9.05E-10	3.35E+00	1.06E-06	7.56E-05	2.80E+05	8.86E-02	1.16E-04	4.29E+05	1.36E-01	1.85E-13	1.24E-05
Pu-239	9.03E-10	3.34E+00	4.84E-07	7.56E-05	2.80E+05	4.05E-02	1.16E-04	4.29E+05	6.22E-02	8.48E-14	5.65E-06
		Total:	3.34E-01		Total:	2.15E+00			3.68E+00		

Input Prepared By: W. E. Kennedy, J. Date: 5/12/99

Input Reviewed By: Cheryl Y. Smith Date: 5/12/99

Calc 05996.02-CR-009, Rev. 1

Pg 88

Table 6a SNC TranStor Cask with BWR Fuel - Accident Analysis: Effective Dose - External Exposure from Submersion at 3,219 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Skin DCF Sv m3/Bq s	Skin DCF (mrem m3/uCi s)	Skin Dose (mrem)	Effective DCF (Sv m3/Bq s)	Effective DCF (mrem m3/uCi s)	Effective Dose (mrem)
H-3	7.96E+01	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	2.59E-08	6.70E-02	9.42E-05	0.00E+00	0.00E+00	0.00E+00	3.31E-19	1.22E-09	7.73E-09
I-129	7.64E-03	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	2.48E-12	6.43E-06	9.42E-05	1.10E-15	4.07E-06	2.47E-09	3.80E-16	1.41E-06	8.52E-10
Kr-85	1.30E+03	61	5.63E+06	1.00E-04	1.78E-11	0.3	2.59E+06	4.23E-07	1.09E+00	9.42E-05	1.32E-14	4.88E-05	5.04E-03	1.19E-16	4.40E-07	4.54E-05
Co-60	6.00E+01	61	5.63E+06	1.00E-04	1.78E-11	1	2.59E+06	6.50E-08	1.68E-01	9.42E-05	1.45E-13	5.37E-04	8.51E-03	1.26E-13	4.66E-04	7.39E-03
Sr-90	1.46E+04	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	3.16E-09	8.19E-03	9.42E-05	9.20E-15	3.40E-05	2.63E-05	7.53E-18	2.79E-08	2.15E-08
Ru-106	1.85E+03	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	4.01E-10	1.04E-03	9.42E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	4.77E+03	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	1.03E-09	2.68E-03	9.42E-05	9.45E-14	3.50E-04	8.82E-05	7.57E-14	2.80E-04	7.06E-05
Cs-137	2.20E+04	61	5.63E+06	1.00E-04	1.78E-11	2.00E-04	2.59E+06	4.77E-09	1.23E-02	9.42E-05	8.63E-15	3.19E-05	3.71E-05	7.74E-18	2.86E-08	3.33E-08
Ba-137m	2.20E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	7.15E-10	1.85E-03	9.42E-05	3.73E-14	1.38E-04	2.41E-05	2.88E-14	1.07E-04	1.86E-05
Pu-241	1.85E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	6.01E-10	1.56E-03	9.42E-05	1.17E-19	4.33E-10	6.35E-11	7.25E-20	2.68E-10	3.94E-11
Y-90	1.46E+04	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	4.75E-10	1.23E-03	9.42E-05	6.24E-14	2.31E-04	2.67E-05	1.90E-16	7.03E-07	8.14E-08
Pm-147	6.37E+03	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.07E-10	5.36E-04	9.42E-05	8.11E-16	3.00E-06	1.52E-07	6.93E-19	2.56E-09	1.30E-10
Rh-106	1.85E+03	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	6.01E-11	1.56E-04	9.42E-05	1.09E-13	4.03E-04	5.92E-06	1.04E-14	3.85E-05	5.65E-07
Ce-144	8.39E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.73E-11	7.06E-05	9.42E-05	2.93E-15	1.08E-05	7.21E-08	8.53E-16	3.16E-06	2.10E-08
Pr-144	8.39E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.73E-11	7.06E-05	9.42E-05	8.43E-14	3.12E-04	2.08E-06	1.95E-15	7.22E-06	4.80E-08
Eu-154	8.98E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.92E-11	7.56E-05	9.42E-05	8.29E-14	3.07E-04	2.18E-06	6.14E-14	2.27E-04	1.62E-06
Cm-244	8.66E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.81E-11	7.29E-05	9.42E-05	3.91E-17	1.45E-07	9.94E-10	4.91E-18	1.82E-08	1.25E-10
Pu-238	7.12E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	2.31E-11	5.99E-05	9.42E-05	4.09E-17	1.51E-07	8.54E-10	4.88E-18	1.81E-08	1.02E-10
Sb-125	5.04E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	1.64E-11	4.24E-05	9.42E-05	2.65E-14	9.81E-05	3.92E-07	2.02E-14	7.47E-05	2.99E-07
Eu-155	2.93E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	9.52E-12	2.47E-05	9.42E-05	3.39E-15	1.25E-05	2.91E-08	2.49E-15	9.21E-06	2.14E-08
Am-241	2.37E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	7.70E-12	2.00E-05	9.42E-05	1.28E-15	4.74E-06	8.90E-09	8.18E-16	3.03E-06	5.69E-09
Pu-240	1.21E+02	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	3.93E-12	1.02E-05	9.42E-05	3.92E-17	1.45E-07	1.39E-10	4.75E-18	1.76E-08	1.69E-11
Pu-239	5.53E+01	61	5.63E+06	1.00E-04	1.78E-11	3.00E-05	2.59E+06	1.80E-12	4.66E-06	9.42E-05	1.86E-17	6.88E-08	3.02E-11	4.24E-18	1.57E-08	6.88E-12
													1.38E-02		**Total:**	**7.53E-03**

Table 7a SNC TranStor Cask with BWR Fuel - Accident Analysis

Total Effective Dose Equivalent at 3,219 m Downwind

External Dose (mrem/y)	Plus	Inhalation CEDE (mrem/y)	Equals	TEDE (mrem/y)
7.53E-03	Plus	3.68E+00	Equals	3.69E+00

W. E. Kennedy, J. 5/12/99
Input Prepared By Date

Cheryl Y. Smith 5/12/99
Input Reviewed By Date

Calc 05996.02-CR-009, Rev. 1

pg B9

Table 8a SNC TranStor Cask with BWR Fuel - Accident Analysis:												
	Summary of Inhalation Doses at 3,219 m Downwind											
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13
	INTERNAL DOSE								EXTERNAL DOSE		DEPOSITION	
Nuclide	Gonad CDE (mrem)	Breast CDE (mrem)	Lung CDE (mrem)	R Marrow CDE (mrem)	B Surface CDE (mrem)	Thyroid CDE (mrem)	Remainder CDE (mrem)	Inhalation CEDE (mrem/y)	Skin Dose (mrem)	Effective Dose (mrem)	Deposition at 3,219 m (Ci/m2)	Deposition at 3,219 m Depth = 0.01 m (pCi/g)
H-3	1.33E-04	1.33E-04	1.33E-04	1.33E-04	1.33E-04	1.33E-04	1.33E-04	1.33E-04	0.00E+00	7.73E-09	1.22E-09	8.13E-02
I-129	6.43E-08	1.55E-07	2.32E-07	1.04E-07	1.02E-07	1.15E-03	8.74E-08	3.47E-05	2.47E-09	8.52E-10	1.17E-13	7.81E-06
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.04E-03	4.54E-05	1.99E-08	1.33E+00
Co-60	9.23E-02	3.57E-01	6.69E+00	3.33E-01	2.62E-01	3.14E-01	6.98E-01	1.15E+00	8.51E-03	7.39E-03	3.07E-09	2.04E-01
Sr-90	2.49E-03	2.49E-03	2.70E+00	3.17E-01	6.86E-01	2.49E-03	5.40E-03	3.31E-01	2.63E-05	2.15E-08	1.49E-10	9.95E-03
Ru-106	1.65E-03	1.64E-03	1.24E-01	1.64E-03	1.64E-03	1.64E-03	2.02E-03	1.54E-02	0.00E+00	0.00E+00	1.89E-11	1.26E-03
Cs-134	4.01E-03	3.33E-03	3.64E-03	3.64E-03	3.39E-03	3.42E-03	4.28E-03	3.85E-03	8.82E-05	7.06E-05	4.87E-11	3.25E-03
Cs-137	1.25E-02	1.11E-02	1.25E-02	1.18E-02	1.13E-02	1.13E-02	1.30E-02	1.23E-02	3.71E-05	3.33E-08	2.25E-10	1.50E-02
Ba-137m									2.41E-05	1.86E-05		
Pu-241	1.22E-01	5.49E-06	5.70E-01	6.02E-01	7.53E+00	2.22E-06	2.35E-01	4.00E-01	6.35E-11	3.94E-11	2.84E-11	1.89E-03
Y-90	1.35E-06	1.35E-06	1.32E-03	3.95E-05	3.93E-05	1.35E-06	5.48E-04	3.23E-04	2.67E-05	8.14E-08	2.24E-11	1.49E-03
Pm-147	1.16E-09	2.22E-09	4.78E-03	5.04E-04	6.30E-03	1.22E-09	3.64E-04	6.54E-04	1.52E-07	1.30E-10	9.76E-12	6.51E-04
Rh-106									5.92E-06	5.65E-07		
Ce-144	1.57E-05	1.60E-05	6.43E-03	2.17E-04	3.69E-04	1.53E-05	8.37E-04	8.21E-04	7.21E-08	2.10E-08	1.29E-12	8.57E-05
Pr-144	1.96E-11	8.54E-11	7.64E-07	6.57E-10	1.10E-09	6.89E-11	1.14E-08	9.51E-08	2.08E-06	4.80E-08	1.29E-12	8.57E-05
Eu-154	1.02E-04	1.35E-04	6.89E-04	9.22E-04	4.55E-03	6.21E-05	9.83E-04	6.73E-04	2.18E-06	1.62E-06	1.38E-12	9.18E-05
Cm-244	1.33E-01	8.73E-06	1.62E-01	7.87E-01	9.82E+00	8.48E-06	4.01E-01	5.62E-01	9.94E-10	1.25E-10	1.33E-12	8.85E-05
Pu-238	1.93E-01	6.90E-06	2.21E+00	1.05E+00	1.31E+01	6.64E-06	4.84E-01	7.31E-01	8.54E-10	1.02E-10	1.09E-12	7.28E-05
Sb-125	1.76E-06	2.03E-06	1.06E-04	3.17E-06	1.33E-05	1.58E-06	7.08E-06	1.61E-05	3.92E-07	2.99E-07	7.73E-13	5.15E-05
Eu-155	1.01E-06	1.74E-06	3.38E-05	4.06E-05	4.32E-04	6.81E-07	3.15E-05	3.18E-05	2.91E-08	2.14E-08	4.49E-13	2.99E-05
Am-241	7.46E-02	6.13E-06	4.23E-02	4.00E-01	4.98E+00	3.67E-06	1.80E-01	2.76E-01	8.90E-09	5.69E-09	3.63E-13	2.42E-05
Pu-240	3.73E-02	1.12E-06	3.79E-01	1.98E-01	2.47E+00	1.06E-06	8.86E-02	1.36E-01	1.39E-10	1.69E-11	1.85E-13	1.24E-05
Pu-239	1.70E-02	4.94E-07	1.73E-01	9.06E-02	1.13E+00	4.84E-07	4.05E-02	6.22E-02	3.02E-11	6.88E-12	8.48E-14	5.65E-06
Total:	6.91E-01	3.76E-01	1.31E+01	3.80E+00	4.00E+01	3.34E-01	2.15E+00	3.68E+00	1.38E-02	7.53E-03		
TEDE	3.69E+00											

Input Prepared By: W. E. Kennedy, J. Date: 5/12/99

Input Reviewed By: Cheryl L. Smith Date: 5/12/99

Calc 05996.02-CR-009, Rev 1 Pg B10.

Table 1b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction:
Committed Effective Dose Equivalent and Dose to Selected Organs From Inhalation,
Plus Deposition Estimates (Ci/m2) at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column7	Column 8	Column 9	Column 10	Column 11	Column 12	Column13	Column 14	Column 15	Column 16
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Canister Release Fraction	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	X/Q (s/m3)	Breathing Rate (m3/s)	Respirable Fraction	Gonad DCF (Sv/Bq)	Gonad DCF (mrem/uCi)	Gonad CDE (mrem)
											Gases				
H-3	7.96E+01	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	2.59E-08	1.94E-03	3.30E-04	1.00E+00	1.73E-11	6.40E-02	2.75E-03
I-129	7.64E-03	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	2.48E-12	1.94E-03	3.30E-04	1.00E+00	8.69E-11	3.22E-01	1.33E-06
Kr-85	1.30E+03	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	4.23E-07	1.94E-03	3.30E-04	1.00E+00	0.00E+00	0.00E+00	0.00E+00
											Crud				
Co-60	6.00E+01	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	1	2.59E+06	6.50E-09	1.94E-03	3.30E-04	1.00E+00	4.76E-09	1.76E+01	1.90E-01
											Volatiles				
Sr-90	1.46E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	3.17E-10	1.94E-03	3.30E-04	5.00E-02	2.64E-09	9.77E+00	2.57E-04
Ru-106	1.85E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	4.01E-11	1.94E-03	3.30E-04	1.00E+00	1.38E-08	5.11E+01	3.40E-03
Cs-134	4.77E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	1.03E-10	1.94E-03	3.30E-04	1.00E+00	1.30E-08	4.81E+01	8.25E-03
Cs-137	2.20E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	4.77E-10	1.94E-03	3.30E-04	1.00E+00	8.76E-09	3.24E+01	2.57E-02
											Fines				
Pu-241	1.85E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	6.02E-11	1.94E-03	3.30E-04	5.00E-02	6.82E-07	2.52E+03	1.26E-02
Y-90	1.46E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	4.75E-11	1.94E-03	3.30E-04	5.00E-02	9.52E-12	3.52E-02	1.39E-07
Pm-147	6.37E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.07E-11	1.94E-03	3.30E-04	5.00E-02	1.88E-14	6.96E-05	1.20E-10
Ce-144	8.39E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.73E-12	1.94E-03	3.30E-04	5.00E-02	1.93E-09	7.14E+00	1.62E-06
Pr-144	8.39E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.73E-12	1.94E-03	3.30E-04	5.00E-02	2.41E-15	8.92E-06	2.02E-12
Eu-154	8.98E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.92E-12	1.94E-03	3.30E-04	5.00E-02	1.17E-08	4.33E+01	1.05E-05
Cm-244	8.66E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.82E-12	1.94E-03	3.30E-04	5.00E-02	1.59E-05	5.88E+04	1.37E-02
Pu-238	7.12E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.32E-12	1.94E-03	3.30E-04	5.00E-02	2.80E-05	1.04E+05	1.99E-02
Sb-125	5.04E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	1.64E-12	1.94E-03	3.30E-04	5.00E-02	3.60E-10	1.33E+00	1.81E-07
Eu-155	2.93E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	9.53E-13	1.94E-03	3.30E-04	5.00E-02	3.56E-10	1.32E+00	1.04E-07
Am-241	2.37E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	7.71E-13	1.94E-03	3.30E-04	5.00E-02	3.25E-05	1.20E+05	7.69E-03
Pu-240	1.21E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	3.93E-13	1.94E-03	3.30E-04	5.00E-02	3.18E-05	1.18E+05	3.84E-03
Pu-239	5.53E+01	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	1.80E-13	1.94E-03	3.30E-04	5.00E-02	3.18E-05	1.18E+05	1.76E-03
														Total:	**2.90E-01**

SNC TranStor Accident Analysis Spreadsheets (With Credit for Canister Holdup and Respirable Fraction)
Calc 05996.02-HR-009, Rev 1
Pg C1

Table 1b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction:

Committed Effective Dose Equivalent and Dose to Selected Organs From Inhalation,

Plus Deposition Estimates (Ci/m2) at 500 m Downwind (Continued)

Column 1	Column 17	Column 18	Column 19	Column 20	Column 21	Column 22	Column 23	Column 24	Column 25	Column 26	Column 27	Column 28
Nuclide	Breast DCF (Sv/Bq)	Breast DCF (mrem/uCi)	Breast CDE (mrem)	Lung DCF (Sv/Bq)	Lung DCF (mrem/uCi)	Lung CDE (mrem)	R Marrow DCF (Sv/Bq)	R Marrow DCF (mrem/uCi)	R Marrow CDE (mrem)	B Surface DCF (Sv/Bq)	B Surface DCF (mrem/uCi)	B Surface CDE (mrem)
H-3	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03
I-129	2.09E-10	7.73E-01	3.19E-06	3.14E-10	1.16E+00	4.79E-06	1.40E-10	5.18E-01	2.14E-06	1.38E-10	5.11E-01	2.11E-06
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	1.84E-08	6.81E+01	7.35E-01	3.45E-07	1.28E+03	1.38E+01	1.72E-08	6.36E+01	6.87E-01	1.35E-08	5.00E+01	5.39E-01
Sr-90	2.64E-09	9.77E+00	2.57E-04	2.86E-06	1.06E+04	2.78E-01	3.36E-07	1.24E+03	3.26E-02	7.27E-07	2.69E+03	7.06E-02
Ru-106	1.37E-08	5.07E+01	3.37E-03	1.04E-06	3.85E+03	2.56E-01	1.37E-08	5.07E+01	3.37E-03	1.37E-08	5.07E+01	3.37E-03
Cs-134	1.08E-08	4.00E+01	6.86E-03	1.18E-08	4.37E+01	7.49E-03	1.18E-08	4.37E+01	7.49E-03	1.10E-08	4.07E+01	6.98E-03
Cs-137	7.84E-09	2.90E+01	2.30E-02	8.82E-09	3.26E+01	2.58E-02	8.30E-09	3.07E+01	2.43E-02	7.94E-09	2.94E+01	2.33E-02
Pu-241	3.06E-11	1.13E-01	5.65E-07	3.18E-06	1.18E+04	5.87E-02	3.36E-06	1.24E+04	6.21E-02	4.20E-05	1.55E+05	7.76E-01
Y-90	9.52E-12	3.52E-02	1.39E-07	9.31E-09	3.44E+01	1.36E-04	2.79E-10	1.03E+00	4.07E-06	2.78E-10	1.03E+00	4.05E-06
Pm-147	3.60E-14	1.33E-04	2.29E-10	7.74E-08	2.86E+02	4.92E-04	8.16E-09	3.02E+01	5.19E-05	1.02E-07	3.77E+02	6.49E-04
Ce-144	1.97E-09	7.29E+00	1.65E-06	7.91E-07	2.93E+03	6.63E-04	2.67E-08	9.88E+01	2.24E-05	4.54E-08	1.68E+02	3.80E-05
Pr-144	1.05E-14	3.89E-05	8.79E-12	9.40E-11	3.48E-01	7.87E-08	8.08E-14	2.99E-04	6.77E-11	1.35E-13	5.00E-04	1.13E-10
Eu-154	1.55E-08	5.74E+01	1.39E-05	7.92E-08	2.93E+02	7.10E-05	1.06E-07	3.92E+02	9.50E-05	5.23E-07	1.94E+03	4.69E-04
Cm-244	1.04E-09	3.85E+00	8.99E-07	1.93E-05	7.14E+04	1.67E-02	9.38E-05	3.47E+05	8.11E-02	1.17E-03	4.33E+06	1.01E+00
Pu-238	1.00E-09	3.70E+00	7.11E-07	3.20E-04	1.18E+06	2.27E-01	1.52E-04	5.62E+05	1.08E-01	1.90E-03	7.03E+06	1.35E+00
Sb-125	4.16E-10	1.54E+00	2.09E-07	2.17E-08	8.03E+01	1.09E-05	6.49E-10	2.40E+00	3.27E-07	2.73E-09	1.01E+01	1.37E-06
Eu-155	6.14E-10	2.27E+00	1.80E-07	1.19E-08	4.40E+01	3.48E-06	1.43E-08	5.29E+01	4.18E-06	1.52E-07	5.62E+02	4.45E-05
Am-241	2.67E-09	9.88E+00	6.32E-07	1.84E-05	6.81E+04	4.35E-03	1.74E-04	6.44E+05	4.12E-02	2.17E-03	8.03E+06	5.13E-01
Pu-240	9.51E-10	3.52E+00	1.15E-07	3.23E-04	1.20E+06	3.90E-02	1.69E-04	6.25E+05	2.04E-02	2.11E-03	7.81E+06	2.55E-01
Pu-239	9.22E-10	3.41E+00	5.09E-08	3.23E-04	1.20E+06	1.78E-02	1.69E-04	6.25E+05	9.33E-03	2.11E-03	7.81E+06	1.16E-01
		Total:	**7.71E-01**		**Total:**	**1.47E+01**		**Total:**	**1.08E+00**		**Total:**	**4.67E+00**

Calc 05996.02-4R-009, Rev 1

Pg C2

Table 1b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Committed Effective Dose Equivalent and Dose to Selected Organs From Inhalation, Plus Deposition Estimates (Ci/m2) at 500 m Downwind (Continued)

Column 1	Column 29	Column 30	Column 31	Column 32	Column 33	Column 34	Column 35	Column 36	Column 37	Column 38	Column 39
Nuclide	Thyroid DCF (Sv/Bq)	Thyroid DCF (mrem/uCi)	Thyroid CDE (mrem)	Remainder DCF (Sv/Bq)	Remainder DCF (mrem/uCi)	Remainder CDE (mrem)	Effective DCF (Sv/Bq)	Effective DCF (mrem/uCi)	Inhalation CEDE (mrem/y)	Deposition at 500 m (Ci/m2)	Deposition at 500 m Depth = 0.01 m (pCi/g)
H-3	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03	1.73E-11	6.40E-02	2.75E-03	2.73E-08	1.82E+00
I-129	1.56E-06	5.77E+03	2.38E-02	1.18E-10	4.37E-01	1.80E-06	4.69E-08	1.74E+02	7.15E-04	2.62E-12	1.75E-04
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.46E-07	2.98E+01
Co-60	1.62E-08	5.99E+01	6.47E-01	3.60E-08	1.33E+02	1.44E+00	5.91E-08	2.19E+02	2.36E+00	6.87E-09	4.58E-01
Sr-90	2.64E-09	9.77E+00	2.57E-04	5.73E-09	2.12E+01	5.57E-04	3.51E-07	1.30E+03	3.41E-02	3.34E-10	2.23E-02
Ru-106	1.37E-08	5.07E+01	3.37E-03	1.69E-08	6.25E+01	4.16E-03	1.29E-07	4.77E+02	3.18E-02	4.24E-11	2.82E-03
Cs-134	1.11E-08	4.11E+01	7.05E-03	1.39E-08	5.14E+01	8.83E-03	1.25E-08	4.63E+01	7.94E-03	1.09E-10	7.28E-03
Cs-137	7.93E-09	2.93E+01	2.32E-02	9.12E-09	3.37E+01	2.67E-02	8.63E-09	3.19E+01	2.53E-02	5.04E-10	3.36E-02
Pu-241	1.24E-11	4.59E-02	2.29E-07	1.31E-06	4.85E+03	2.42E-02	2.23E-06	8.25E+03	4.12E-02	6.35E-11	4.24E-03
Y-90	9.52E-12	3.52E-02	1.39E-07	3.87E-09	1.43E+01	5.64E-05	2.28E-09	8.44E+00	3.32E-05	5.01E-11	3.34E-03
Pm-147	1.98E-14	7.33E-05	1.26E-10	5.89E-09	2.18E+01	3.75E-05	1.06E-08	3.92E+01	6.74E-05	2.19E-11	1.46E-03
Ce-144	1.88E-09	6.96E+00	1.57E-06	1.03E-07	3.81E+02	8.63E-05	1.01E-07	3.74E+02	8.46E-05	2.88E-12	1.92E-04
Pr-144	8.47E-15	3.13E-05	7.09E-12	1.40E-12	5.18E-03	1.17E-09	1.17E-11	4.33E-02	9.80E-09	2.88E-12	1.92E-04
Eu-154	7.14E-09	2.64E+01	6.40E-06	1.13E-07	4.18E+02	1.01E-04	7.73E-08	2.86E+02	6.93E-05	3.08E-12	2.06E-04
Cm-244	1.01E-09	3.74E+00	8.73E-07	4.78E-05	1.77E+05	4.13E-02	6.70E-05	2.48E+05	5.79E-02	2.97E-12	1.98E-04
Pu-238	9.62E-10	3.56E+00	6.84E-07	7.02E-05	2.60E+05	4.99E-02	1.06E-04	3.92E+05	7.53E-02	2.45E-12	1.63E-04
Sb-125	3.24E-10	1.20E+00	1.63E-07	1.45E-09	5.37E+00	7.30E-07	3.30E-09	1.22E+01	1.66E-06	1.73E-12	1.15E-04
Eu-155	2.40E-10	8.88E-01	7.02E-08	1.11E-08	4.11E+01	3.25E-06	1.12E-08	4.14E+01	3.28E-06	1.01E-12	6.71E-05
Am-241	1.60E-09	5.92E+00	3.79E-07	7.82E-05	2.89E+05	1.85E-02	1.20E-04	4.44E+05	2.84E-02	8.14E-13	5.43E-05
Pu-240	9.05E-10	3.35E+00	1.09E-07	7.56E-05	2.80E+05	9.13E-03	1.16E-04	4.29E+05	1.40E-02	4.16E-13	2.77E-05
Pu-239	9.03E-10	3.34E+00	4.99E-08	7.56E-05	2.80E+05	4.17E-03	1.16E-04	4.29E+05	6.40E-03	1.90E-13	1.27E-05
		Total:	**7.07E-01**		**Total:**	**1.63E+00**			**2.69E+00**		

Input Prepared By: W. E. Kennedy, J. Date: 5/14/99

Input Reviewed By: Cheryl G. Smith Date: 5.14.99

Calc 05996.02-NR-009 Rev. 1 Pg C3.

Table 2b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction:

Effective Dose - External Exposure from Submersion at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17	Column 18
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Canister Release Fraction	Fraction Released per second	Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Skin DCF Sv m3/Bq s	Skin DCF (mrem m3/uCi s)	Skin Dose (mrem)	Effective DCF (Sv m3/Bq s)	Effective DCF (mrem m3/uCi s)	Effective Dose (mrem/y)
H-3	7.96E+01	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	2.59E-08	6.70E-02	1.94E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-19	1.22E-09	1.59E-07
I-129	7.64E-03	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	2.48E-12	6.44E-06	1.94E-03	1.10E-15	4.07E-06	5.08E-08	3.80E-16	1.41E-06	1.76E-08
Kr-85	1.30E+03	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	4.23E-07	1.09E+00	1.94E-03	1.32E-14	4.88E-05	1.04E-01	1.19E-16	4.40E-07	9.35E-04
Co-60	6.00E+01	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	1	2.59E+06	6.50E-09	1.68E-02	1.94E-03	1.45E-13	5.37E-04	1.75E-02	1.26E-13	4.66E-04	1.52E-02
Sr-90	1.46E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	3.17E-10	8.20E-04	1.94E-03	9.20E-15	3.40E-05	5.41E-05	7.53E-18	2.79E-08	4.43E-08
Ru-106	1.85E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	4.01E-11	1.04E-04	1.94E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	4.77E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	1.03E-10	2.68E-04	1.94E-03	9.45E-14	3.50E-04	1.82E-04	7.57E-14	2.80E-04	1.46E-04
Cs-137	2.20E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	4.77E-10	1.24E-03	1.94E-03	8.63E-15	3.19E-05	7.65E-05	7.74E-18	2.86E-08	6.86E-08
Ba-137m	2.20E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	7.15E-11	1.85E-04	1.94E-03	3.73E-14	1.38E-04	4.96E-05	2.88E-14	1.07E-04	3.83E-05
Pu-241	1.85E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	6.02E-11	1.56E-04	1.94E-03	1.17E-19	4.33E-10	1.31E-10	7.25E-20	2.68E-10	8.11E-11
Y-90	1.46E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	4.75E-11	1.23E-04	1.94E-03	6.24E-14	2.31E-04	5.51E-05	1.90E-16	7.03E-07	1.68E-07
Pm-147	6.37E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.07E-11	5.37E-05	1.94E-03	8.11E-16	3.00E-06	3.12E-07	6.93E-19	2.56E-09	2.67E-10
Ce-144	8.39E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.73E-12	7.07E-06	1.94E-03	1.09E-13	4.03E-04	5.53E-06	8.53E-16	3.16E-06	4.33E-08
Rh-106	1.85E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	6.02E-12	1.56E-05	1.94E-03	2.93E-15	1.08E-05	3.28E-07	1.04E-14	3.85E-05	1.16E-06
Pr-144	8.39E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.73E-12	7.07E-06	1.94E-03	8.43E-14	3.12E-04	4.28E-06	1.95E-15	7.22E-06	9.89E-08
Eu-154	8.98E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.92E-12	7.56E-06	1.94E-03	8.29E-14	3.07E-04	4.50E-06	6.14E-14	2.27E-04	3.33E-06
Cm-244	8.66E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.82E-12	7.29E-06	1.94E-03	3.91E-17	1.45E-07	2.05E-09	4.91E-18	1.82E-08	2.57E-10
Pu-238	7.12E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.32E-12	6.00E-06	1.94E-03	4.09E-17	1.51E-07	1.76E-09	4.88E-18	1.81E-08	2.10E-10
Sb-125	5.04E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	1.64E-12	4.25E-06	1.94E-03	2.65E-14	9.81E-05	8.07E-07	2.02E-14	7.47E-05	6.16E-07
Eu-155	2.93E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	9.53E-13	2.47E-06	1.94E-03	3.39E-15	1.25E-05	6.01E-08	2.49E-15	9.21E-06	4.41E-08
Am-241	2.37E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	7.71E-13	2.00E-06	1.94E-03	1.28E-15	4.74E-06	1.83E-08	8.18E-16	3.03E-06	1.17E-08
Pu-240	1.21E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	3.93E-13	1.02E-06	1.94E-03	3.92E-17	1.45E-07	2.87E-10	4.75E-18	1.76E-08	3.48E-11
Pu-239	5.53E+01	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	1.80E-13	4.66E-07	1.94E-03	1.86E-17	6.88E-08	6.22E-11	4.24E-18	1.57E-08	1.42E-11
													Total:	1.22E-01		**Total:**	**1.64E-02**

Table 3b SNC TranStor Cask with BWR Fuel - Accident Analysis

Considering Canister Release Rate and Respirable Fraction:

Total Effective Dose Equivalent at 500 m Downwind

External Dose (mrem/y)	Plus	Inhalation CEDE (mrem/y)	Equals	TEDE (mrem/y)
1.64E-02	Plus	2.69E+00	Equals	**2.70E+00**

W. E. Kennedy, J. 5/14/99
Input Prepared By Date

Cheryl G Smith 5.14.99
Input Reviewed By Date

Calc 05996.02-CR-009, Rev. 1 pg C4

Table 4b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction:

Summary of Inhalation Doses at 500 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column12	Column 13
	INTERNAL DOSE								EXTERNAL DOSE		DEPOSITION	
Nuclide	Gonad CDE (mrem)	Breast CDE (mrem)	Lung CDE (mrem)	R Marrow CDE (mrem)	B Surface CDE (mrem)	Thyroid CDE (mrem)	Remainder CDE (mrem)	Inhalation CEDE (mrem/y)	Skin Dose (mrem)	Effective Dose (mrem/y)	Deposition at 500 m (Ci/m2)	Deposition at 500 m Depth = 0.01 m (pCi/g)
H-3	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	2.75E-03	0.00E+00	1.59E-07	2.73E-08	1.82E+00
I-129	1.33E-06	3.19E-06	4.79E-06	2.14E-06	2.11E-06	2.38E-02	1.80E-06	7.15E-04	5.08E-08	1.76E-08	2.62E-12	1.75E-04
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-01	9.35E-04	4.46E-07	2.98E+01
Co-60	1.90E-01	7.35E-01	1.38E+01	6.87E-01	5.39E-01	6.47E-01	1.44E+00	2.36E+00	1.75E-02	1.52E-02	6.87E-09	4.58E-01
Sr-90	2.57E-04	2.57E-04	2.78E-01	3.26E-02	7.06E-02	2.57E-04	5.57E-04	3.41E-02	5.41E-05	4.43E-08	3.34E-10	2.23E-02
Ru-106	3.40E-03	3.37E-03	2.56E-01	3.37E-03	3.37E-03	3.37E-03	4.16E-03	3.18E-02	0.00E+00	0.00E+00	4.24E-11	2.82E-03
Cs-134	8.25E-03	6.86E-03	7.49E-03	7.49E-03	6.98E-03	7.05E-03	8.83E-03	7.94E-03	1.82E-04	1.46E-04	1.09E-10	7.28E-03
Cs-137	2.57E-02	2.30E-02	2.58E-02	2.43E-02	2.33E-02	2.32E-02	2.67E-02	2.53E-02	7.65E-05	6.86E-08	5.04E-10	3.36E-02
Ba-137m									4.96E-05	3.83E-05		
Pu-241	1.26E-02	5.65E-07	5.87E-02	6.21E-02	7.76E-01	2.29E-07	2.42E-02	4.12E-02	1.31E-10	8.11E-11	6.35E-11	4.24E-03
Y-90	1.39E-07	1.39E-07	1.36E-04	4.07E-06	4.05E-06	1.39E-07	5.64E-05	3.32E-05	5.51E-05	1.68E-07	5.01E-11	3.34E-03
Pm-147	1.20E-10	2.29E-10	4.92E-04	5.19E-05	6.49E-04	1.26E-10	3.75E-05	6.74E-05	3.12E-07	2.67E-10	2.19E-11	1.46E-03
Rh-106									5.53E-06	4.33E-08		
Ce-144	1.62E-06	1.65E-06	6.63E-04	2.24E-05	3.80E-05	1.57E-06	8.63E-05	8.46E-05	3.28E-07	1.16E-06	2.88E-12	1.92E-04
Pr-144	2.02E-12	8.79E-12	7.87E-08	6.77E-11	1.13E-10	7.09E-12	1.17E-09	9.80E-09	4.28E-06	9.89E-08	2.88E-12	1.92E-04
Eu-154	1.05E-05	1.39E-05	7.10E-05	9.50E-05	4.69E-04	6.40E-06	1.01E-04	6.93E-05	4.50E-06	3.33E-06	3.08E-12	2.06E-04
Cm-244	1.37E-02	8.99E-07	1.67E-02	8.11E-02	1.01E+00	8.73E-07	4.13E-02	5.79E-02	2.05E-09	2.57E-10	2.97E-12	1.98E-04
Pu-238	1.99E-02	7.11E-07	2.27E-01	1.08E-01	1.35E+00	6.84E-07	4.99E-02	7.53E-02	1.76E-09	2.10E-10	2.45E-12	1.63E-04
Sb-125	1.81E-07	2.09E-07	1.09E-05	3.27E-07	1.37E-06	1.63E-07	7.30E-07	1.66E-06	8.07E-07	6.16E-07	1.73E-12	1.15E-04
Eu-155	1.04E-07	1.80E-07	3.48E-06	4.18E-06	4.45E-05	7.02E-08	3.25E-06	3.28E-06	6.01E-08	4.41E-08	1.01E-12	6.71E-05
Am-241	7.69E-03	6.32E-07	4.35E-03	4.12E-02	5.13E-01	3.79E-07	1.85E-02	2.84E-02	1.83E-08	1.17E-08	8.14E-13	5.43E-05
Pu-240	3.84E-03	1.15E-07	3.90E-02	2.04E-02	2.55E-01	1.09E-07	9.13E-03	1.40E-02	2.87E-10	3.48E-11	4.16E-13	2.77E-05
Pu-239	1.76E-03	5.09E-08	1.78E-02	9.33E-03	1.16E-01	4.99E-08	4.17E-03	6.40E-03	6.22E-11	1.42E-11	1.90E-13	1.27E-05
Total	2.90E-01	7.71E-01	1.47E+01	1.08E+00	4.67E+00	7.07E-01	1.63E+00	2.69E+00	1.22E-01	1.64E-02		
TEDE	2.70E+00											

Input Prepared By: W. E. Kennedy, Jr. Date: 5/14/99

Input Reviewed By: Cheryl G. Smith Date: 5.14.99

Calc 05996.02-AR-009, Rev. 1 pg C5

Table 5b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction:
Committed Effective Dose Equivalent and Dose to Organs From Inhalation Plus Deposition Estimates
(Ci/m2) at 3,219 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Canister Release Fraction	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	X/Q (s/m3)	Breathing Rate (m3/s)	Respirable Fraction
											Gases	
H-3	7.96E+01	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	2.59E-08	9.42E-05	3.30E-04	1.00E+00
I-129	7.64E-03	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	2.48E-12	9.42E-05	3.30E-04	1.00E+00
Kr-85	1.30E+03	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	4.23E-07	9.42E-05	3.30E-04	1.00E+00
											Crud	
Co-60	6.00E+01	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	1	2.59E+06	6.50E-09	9.42E-05	3.30E-04	1.00E+00
											Volatiles	
Sr-90	1.46E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	3.17E-10	9.42E-05	3.30E-04	5.00E-02
Ru-106	1.85E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	4.01E-11	9.42E-05	3.30E-04	1.00E+00
Cs-134	4.77E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	1.03E-10	9.42E-05	3.30E-04	1.00E+00
Cs-137	2.20E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	4.77E-10	9.42E-05	3.30E-04	1.00E+00
											Fines	
Pu-241	1.85E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	6.02E-11	9.42E-05	3.30E-04	5.00E-02
Y-90	1.46E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	4.75E-11	9.42E-05	3.30E-04	5.00E-02
Pm-147	6.37E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.07E-11	9.42E-05	3.30E-04	5.00E-02
Ce-144	8.39E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.73E-12	9.42E-05	3.30E-04	5.00E-02
Pr-144	8.39E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.73E-12	9.42E-05	3.30E-04	5.00E-02
Eu-154	8.98E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.92E-12	9.42E-05	3.30E-04	5.00E-02
Cm-244	8.66E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.82E-12	9.42E-05	3.30E-04	5.00E-02
Pu-238	7.12E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.32E-12	9.42E-05	3.30E-04	5.00E-02
Sb-125	5.04E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	1.64E-12	9.42E-05	3.30E-04	5.00E-02
Eu-155	2.93E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	9.53E-13	9.42E-05	3.30E-04	5.00E-02
Am-241	2.37E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	7.71E-13	9.42E-05	3.30E-04	5.00E-02
Pu-240	1.21E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	3.93E-13	9.42E-05	3.30E-04	5.00E-02
Pu-239	5.53E+01	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	1.80E-13	9.42E-05	3.30E-04	5.00E-02
								Total:				

Table 5b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Committed Effective Dose Equivalent and Dose to Organs From Inhalation Plus Deposition Estimates (Ci/m2) at 3,219 m Downwind (Continued)

Column 1	Column 14	Column 15	Column 16	Column 17	Column 18	Column 19	Column 20	Column 21	Column 22	Column 23	Column 24	Column 25	Column 26	Column 27	Column 28
Nuclide	Gonad DCF (Sv/Bq)	Gonad DCF (mrem/uCi)	Gonad CDE (mrem)	Breast DCF (Sv/Bq)	Breast DCF (mrem/uCi)	Breast CDE (mrem)	Lung DCF (Sv/Bq)	Lung DCF (mrem/uCi)	Lung CDE (mrem)	R Marrow DCF (Sv/Bq)	R Marrow DCF (mrem/uCi)	R Marrow CDE (mrem)	B Surface DCF (Sv/Bq)	B Surface DCF (mrem/uCi)	B Surface CDE (mrem)
H-3	1.73E-11	6.40E-02	1.34E-04	1.73E-11	6.40E-02	1.34E-04	1.73E-11	6.40E-02	1.34E-04	1.73E-11	6.40E-02	1.34E-04	1.73E-11	6.40E-02	1.34E-04
I-129	8.69E-11	3.22E-01	6.44E-08	2.09E-10	7.73E-01	1.55E-07	3.14E-10	1.16E+00	2.33E-07	1.40E-10	5.18E-01	1.04E-07	1.38E-10	5.11E-01	1.02E-07
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	4.76E-09	1.76E+01	9.23E-03	1.84E-08	6.81E+01	3.57E-02	3.45E-07	1.28E+03	6.69E-01	1.72E-08	6.36E+01	3.34E-02	1.35E-08	5.00E+01	2.62E-02
Sr-90	2.64E-09	9.77E+00	1.25E-05	2.64E-09	9.77E+00	1.25E-05	2.86E-06	1.06E+04	1.35E-02	3.36E-07	1.24E+03	1.59E-03	7.27E-07	2.69E+03	3.43E-03
Ru-106	1.38E-08	5.11E+01	1.65E-04	1.37E-08	5.07E+01	1.64E-04	1.04E-06	3.85E+03	1.24E-02	1.37E-08	5.07E+01	1.64E-04	1.37E-08	5.07E+01	1.64E-04
Cs-134	1.30E-08	4.81E+01	4.01E-04	1.08E-08	4.00E+01	3.33E-04	1.18E-08	4.37E+01	3.64E-04	1.18E-08	4.37E+01	3.64E-04	1.10E-08	4.07E+01	3.39E-04
Cs-137	8.76E-09	3.24E+01	1.25E-03	7.84E-09	2.90E+01	1.11E-03	8.82E-09	3.26E+01	1.25E-03	8.30E-09	3.07E+01	1.18E-03	7.94E-09	2.94E+01	1.13E-03
Pu-241	6.82E-07	2.52E+03	6.12E-04	3.06E-11	1.13E-01	2.74E-08	3.18E-06	1.18E+04	2.85E-03	3.36E-06	1.24E+04	3.01E-03	4.20E-05	1.55E+05	3.77E-02
Y-90	9.52E-12	3.52E-02	6.74E-09	9.52E-12	3.52E-02	6.74E-09	9.31E-09	3.44E+01	6.59E-06	2.79E-10	1.03E+00	1.97E-07	2.78E-10	1.03E+00	1.97E-07
Pm-147	1.88E-14	6.96E-05	5.81E-12	3.60E-14	1.33E-04	1.11E-11	7.74E-08	2.86E+02	2.39E-05	8.16E-09	3.02E+01	2.52E-06	1.02E-07	3.77E+02	3.15E-05
Ce-144	1.93E-09	7.14E+00	7.85E-08	1.97E-09	7.29E+00	8.01E-08	7.91E-07	2.93E+03	3.22E-05	2.67E-08	9.88E+01	1.09E-06	4.54E-08	1.68E+02	1.85E-06
Pr-144	2.41E-15	8.92E-06	9.80E-14	1.05E-14	3.89E-05	4.27E-13	9.40E-11	3.48E-01	3.82E-09	8.08E-14	2.99E-04	3.29E-12	1.35E-13	5.00E-04	5.49E-12
Eu-154	1.17E-08	4.33E+01	5.09E-07	1.55E-08	5.74E+01	6.75E-07	7.92E-08	2.93E+02	3.45E-06	1.06E-07	3.92E+02	4.61E-06	5.23E-07	1.94E+03	2.28E-05
Cm-244	1.59E-05	5.88E+04	6.67E-04	1.04E-09	3.85E+00	4.37E-08	1.93E-05	7.14E+04	8.10E-04	9.38E-05	3.47E+05	3.94E-03	1.17E-03	4.33E+06	4.91E-02
Pu-238	2.80E-05	1.04E+05	9.66E-04	1.00E-09	3.70E+00	3.45E-08	3.20E-04	1.18E+06	1.10E-02	1.52E-04	5.62E+05	5.25E-03	1.90E-03	7.03E+06	6.56E-02
Sb-125	3.60E-10	1.33E+00	8.80E-09	4.16E-10	1.54E+00	1.02E-08	2.17E-08	8.03E+01	5.30E-07	6.49E-10	2.40E+00	1.59E-08	2.73E-09	1.01E+01	6.67E-08
Eu-155	3.56E-10	1.32E+00	5.06E-09	6.14E-10	2.27E+00	8.72E-09	1.19E-08	4.40E+01	1.69E-07	1.43E-08	5.29E+01	2.03E-07	1.52E-07	5.62E+02	2.16E-06
Am-241	3.25E-05	1.20E+05	3.73E-04	2.67E-09	9.88E+00	3.07E-08	1.84E-05	6.81E+04	2.11E-04	1.74E-04	6.44E+05	2.00E-03	2.17E-03	8.03E+06	2.49E-02
Pu-240	1.24E-10	4.59E-01	7.27E-10	1.07E-10	3.96E-01	6.28E-10	1.04E-08	3.85E+01	6.10E-08	3.01E-09	1.11E+01	1.77E-08	3.21E-08	1.19E+02	1.88E-07
Pu-239	3.18E-05	1.18E+05	8.52E-05	9.22E-10	3.41E+00	2.47E-09	3.23E-04	1.20E+06	8.66E-04	1.69E-04	6.25E+05	4.53E-04	2.11E-03	7.81E+06	5.66E-03
		Total:	1.39E-02		Total:	3.74E-02		Total:	7.13E-01		Total:	5.14E-02		Total:	2.14E-01

Table 5b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction: Committed Effective Dose Equivalent and Dose to Organs From Inhalation Plus Deposition Estimates (Ci/m2) at 3,219 m Downwind (Continued)

Column 1	Column 29	Column 30	Column 31	Column 32	Column 33	Column 34	Column 35	Column 36	Column 37	Column 38	Column 39
Nuclide	Thyroid DCF (Sv/Bq)	Thyroid DCF (mrem/uCi)	Thyroid CDE (mrem)	Remainder DCF (Sv/Bq)	Remainder DCF (mrem/uCi)	Remainder CDE (mrem)	Effective DCF (Sv/Bq)	Effective DCF (mrem/uCi)	Inhalation CEDE (mrem/y)	Deposition at 3219 m (Ci/m2)	Deposition at 3219 m Depth = 0.01 m (pCi/g)
H-3	1.73E-11	6.40E-02	1.34E-04	1.73E-11	6.40E-02	1.34E-04	1.73E-11	6.40E-02	1.34E-04	1.22E-09	8.14E-02
I-129	1.56E-06	5.77E+03	1.16E-03	1.18E-10	4.37E-01	8.74E-08	4.69E-08	1.74E+02	3.47E-05	1.17E-13	7.81E-06
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-08	1.33E+00
Co-60	1.62E-08	5.99E+01	3.14E-02	3.60E-08	1.33E+02	6.98E-02	5.91E-08	2.19E+02	1.15E-01	3.07E-10	2.04E-02
Sr-90	2.64E-09	9.77E+00	2.49E-04	5.73E-09	2.12E+01	2.70E-05	3.51E-07	1.30E+03	1.66E-03	1.49E-11	9.95E-04
Ru-106	1.37E-08	5.07E+01	1.64E-04	1.69E-08	6.25E+01	2.02E-04	1.29E-07	4.77E+02	1.54E-03	1.89E-12	1.26E-04
Cs-134	1.11E-08	4.11E+01	3.42E-04	1.39E-08	5.14E+01	4.29E-04	1.25E-08	4.63E+01	3.85E-04	4.88E-12	3.25E-04
Cs-137	7.93E-09	2.93E+01	1.13E-03	9.12E-09	3.37E+01	1.30E-03	8.63E-09	3.19E+01	1.23E-03	2.25E-11	1.50E-03
Pu-241	1.24E-11	4.59E-02	2.22E-07	1.31E-06	4.85E+03	1.17E-03	2.23E-06	8.25E+03	2.00E-03	2.84E-12	1.89E-04
Y-90	9.52E-12	3.52E-02	1.35E-07	3.87E-09	1.43E+01	2.74E-06	2.28E-09	8.44E+00	1.61E-06	2.24E-12	1.49E-04
Pm-147	1.98E-14	7.33E-05	1.22E-10	5.89E-09	2.18E+01	1.82E-06	1.06E-08	3.92E+01	3.27E-06	9.77E-13	6.51E-05
Ce-144	1.88E-09	6.96E+00	1.53E-06	1.03E-07	3.81E+02	4.19E-06	1.01E-07	3.74E+02	4.11E-06	1.29E-13	8.58E-06
Pr-144	8.47E-15	3.13E-05	6.89E-12	1.40E-12	5.18E-03	5.69E-11	1.17E-11	4.33E-02	4.76E-10	1.29E-13	8.58E-06
Eu-154	7.14E-09	2.64E+01	6.22E-06	1.13E-07	4.18E+02	4.92E-06	7.73E-08	2.86E+02	3.36E-06	1.38E-13	9.18E-06
Cm-244	1.01E-09	3.74E+00	8.48E-07	4.78E-05	1.77E+05	2.01E-03	6.70E-05	2.48E+05	2.81E-03	1.33E-13	8.85E-06
Pu-238	9.62E-10	3.56E+00	6.64E-07	7.02E-05	2.60E+05	2.42E-03	1.06E-04	3.92E+05	3.66E-03	1.09E-13	7.28E-06
Sb-125	3.24E-10	1.20E+00	1.58E-07	1.45E-09	5.37E+00	3.54E-08	3.30E-09	1.22E+01	8.06E-08	7.73E-14	5.15E-06
Eu-155	2.40E-10	8.88E-01	6.82E-08	1.11E-08	4.11E+01	1.58E-07	1.12E-08	4.14E+01	1.59E-07	4.49E-14	3.00E-06
Am-241	1.60E-09	5.92E+00	3.68E-07	7.82E-05	2.89E+05	8.98E-04	1.20E-04	4.44E+05	1.38E-03	3.63E-14	2.42E-06
Pu-240	9.93E-11	3.67E-01	1.16E-08	6.75E-10	2.50E+00	3.96E-09	1.16E-04	4.29E+05	6.80E-04	1.86E-14	1.24E-06
Pu-239	9.03E-10	3.34E+00	4.84E-08	7.56E-05	2.80E+05	2.03E-04	1.16E-04	4.29E+05	3.11E-04	8.48E-15	5.65E-07
		Total:	3.46E-02		Total:	7.86E-02			1.30E-01		

Input Prepared By: W. E. Kennedy, J. Date: 5/14/99

Input Reviewed By: Cheryl Y. Smith Date: 5.14.99

Calc 05996.02-MR-009, Rev. 1 Pg 68

Table 6b SNC TranStor Cask with BWR Fuel - Accident Analysis Considering Canister Release Rate and Respirable Fraction:

Effective Dose - External Exposure from Submersion at 3,219 m Downwind

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17	Column 18
Nuclide	Inventory (Ci/Assembly)	Number of Assemblies	Canister Volume (cm3)	Leak Rate (cm3/s)	Canister Release Fraction	Fraction Released per second	Fuel Release Fraction	Exposure Duration (s)	Release Rate (Ci/s)	Release (Ci)	X/Q (s/m3)	Skin DCF Sv m3/Bq s	Skin DCF (mrem m3/uCi s)	Skin Dose (mrem)	Effective DCF (Sv m3/Bq s)	Effective DCF (mrem m3/uCi s)	Effective Dose (mrem/y)
H-3	7.96E+01	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	2.59E-08	6.70E-02	9.42E-05	0.00E+00	0.00E+00	0.00E+00	3.31E-19	1.22E-09	7.73E-09
I-129	7.64E-03	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	2.48E-12	6.44E-06	9.42E-05	1.10E-15	4.07E-06	2.47E-09	3.80E-16	1.41E-06	8.52E-10
Kr-85	1.30E+03	61	5.63E+06	1.00E-04	1.00E+00	1.78E-11	0.3	2.59E+06	4.23E-07	1.09E+00	9.42E-05	1.32E-14	4.88E-05	5.04E-03	1.19E-16	4.40E-07	4.54E-05
Co-60	6.00E+01	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	1	2.59E+06	6.50E-09	1.68E-02	9.42E-05	1.45E-13	5.37E-04	8.51E-04	1.26E-13	4.66E-04	7.40E-04
Sr-90	1.46E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	3.17E-10	8.20E-04	9.42E-05	9.20E-15	3.40E-05	2.63E-06	7.53E-18	2.79E-08	2.15E-09
Ru-106	1.85E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	4.01E-11	1.04E-04	9.42E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	4.77E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	1.03E-10	2.68E-04	9.42E-05	9.45E-14	3.50E-04	8.82E-06	7.57E-14	2.80E-04	7.07E-06
Cs-137	2.20E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	2.00E-04	2.59E+06	4.77E-10	1.24E-03	9.42E-05	8.63E-15	3.19E-05	3.72E-06	7.74E-18	2.86E-08	3.33E-09
Ba-137m	2.20E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	7.15E-11	1.85E-04	9.42E-05	3.73E-14	1.38E-04	2.41E-06	2.88E-14	1.07E-04	1.86E-06
Pu-241	1.85E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	6.02E-11	1.56E-04	9.42E-05	1.17E-19	4.33E-10	6.35E-12	7.25E-20	2.68E-10	3.94E-12
Y-90	1.46E+04	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	4.75E-11	1.23E-04	9.42E-05	6.24E-14	2.31E-04	2.67E-06	1.90E-16	7.03E-07	8.14E-09
Pm-147	6.37E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.07E-11	5.37E-05	9.42E-05	8.11E-16	3.00E-06	1.52E-08	6.93E-19	2.56E-09	1.30E-11
Ce-144	8.39E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.73E-12	7.07E-06	9.42E-05	1.09E-13	4.03E-04	2.68E-07	8.53E-16	3.16E-06	2.10E-09
Rh-106	1.85E+03	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	6.02E-12	1.56E-05	9.42E-05	2.93E-15	1.08E-05	1.59E-08	1.04E-14	3.85E-05	5.65E-08
Pr-144	8.39E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.73E-12	7.07E-06	9.42E-05	8.43E-14	3.12E-04	2.08E-07	1.95E-15	7.22E-06	4.80E-09
Eu-154	8.98E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.92E-12	7.56E-06	9.42E-05	8.29E-14	3.07E-04	2.19E-07	6.14E-14	2.27E-04	1.62E-07
Cm-244	8.66E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.82E-12	7.29E-06	9.42E-05	3.91E-17	1.45E-07	9.94E-11	4.91E-18	1.82E-08	1.25E-11
Pu-238	7.12E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	2.32E-12	6.00E-06	9.42E-05	4.09E-17	1.51E-07	8.55E-11	4.88E-18	1.81E-08	1.02E-11
Sb-125	5.04E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	1.64E-12	4.25E-06	9.42E-05	2.65E-14	9.81E-05	3.92E-08	2.02E-14	7.47E-05	2.99E-08
Eu-155	2.93E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	9.53E-13	2.47E-06	9.42E-05	3.39E-15	1.25E-05	2.92E-09	2.49E-15	9.21E-06	2.14E-09
Am-241	2.37E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	7.71E-13	2.00E-06	9.42E-05	1.28E-15	4.74E-06	8.91E-10	8.18E-16	3.03E-06	5.69E-10
Pu-240	1.21E+02	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	3.93E-13	1.02E-06	9.42E-05	3.92E-17	1.45E-07	1.39E-11	4.75E-18	1.76E-08	1.69E-12
Pu-239	5.53E+01	61	5.63E+06	1.00E-04	1.00E-01	1.78E-11	3.00E-05	2.59E+06	1.80E-13	4.66E-07	9.42E-05	1.86E-17	6.88E-08	3.02E-12	4.24E-18	1.57E-08	6.88E-13
													Total:	5.91E-03		Total:	7.94E-04

Table 7b SNC TranStor Cask with BWR Fuel - Accident Analysis

Considering Canister Release Rate and Respirable Fraction:

Total Effective Dose Equivalent at 3,219 m Downwind

External Dose (mrem/y)	Plus	Inhalation CEDE (mrem/y)	Equals	TEDE (mrem/y)
7.94E-04	Plus	1.30E-01	Equals	1.31E-01

W. E. Kennedy, J 5/14/99
Input Prepared By Date

Cheryl G Smith 5.14.99
Input Reviewed By Date

Calc 05996.02-CR-009, Rev 1 Pg C9