

**Enclosure (4)**

---

**CA06453 SGTR**

**Radiological Consequences**

**Design Basis Calculation**

**Using AST**

---

ESP No.:	ES200100401	Supp No.	000	Rev. No.	000	Page 1 of 1
----------	-------------	----------	-----	----------	-----	-------------

## FORM 19, CALCULATION COVER SHEET

## A. INITIATION (Control Doc Type - DCALC)

Page 1 of 114

DCALC No.: CA06453

Revision No.: 000

Vendor Calculation (Check one): ☐ Yes ☒ No

Responsible Group: FOSU

Responsible Engineer: Gerard E. Gryczkowski

## B. CALCULATION

ENGINEERING  
DISCIPLINE:☐ Civil☐ Instr & Controls☒ Nuc Engrg☐ Electrical☐ Mechanical☐ Nuc Fuel Mngmt☐ Other:☐ Reliability Engrg

Title: STEAM GENERATOR TUBE RUPTURE ACCIDENT USING ALTERNATE SOURCE TERMS

Unit ☐ 1☐ 2☒ COMMON

Proprietary or Safeguards Calculation

☐ YES☒ NO

Comments: NA

Vendor Calc No.: NA

REVISION No.: NA

Vendor Name: NA

Safety Class (Check one):

☒ SR☐ AQ☐ NSR

There are assumptions that require Verification during walkdown:

AIT #: NA

This calculation SUPERSEDES: NA

## C. REVIEW AND APPROVAL:

Responsible Engineer: Gerard E. Gryczkowski

8/05/2005

Printed Name and Signature

Date

Independent Reviewer: ZM Somerville

Printed Name and Signature

Date

Approval: P. J. Wengowski

Printed Name and Signature

Date

IF the results or conclusions of this calculation or revision might affect a procedure or the basis of a procedure, a Change Notification Form (Form 14) shall be forwarded to the Procedure Development Unit with a summary of the calculation's purpose and results.

## 2. LIST OF EFFECTIVE PAGES

Page	Latest Rev	Page	Latest Rev	Page	Latest Rev	Page	Latest Rev	Page	Latest Rev
001	0	002	0	003	0	004	0	005	0
006	0	007	0	008	0	009	0	010	0
011	0	012	0	013	0	014	0	015	0
016	0	017	0	018	0	019	0	020	0
021	0	022	0	023	0	024	0	025	0
026	0	027	0	028	0	029	0	030	0
031	0	032	0	033	0	034	0	035	0
036	0	037	0	038	0	039	0	040	0
041	0	042	0	043	0	044	0	045	0
046	0	047	0	048	0	049	0	050	0
051	0	052	0	053	0	054	0	055	0
056	0	057	0	058	0	059	0	060	0
061	0	062	0	063	0	064	0	065	0
066	0	067	0	068	0	069	0	070	0
071	0	072	0	073	0	074	0	075	0
076	0	077	0	078	0	079	0	080	0
081	0	082	0	083	0	084	0	085	0
086	0	087	0	088	0	089	0	090	0
091	0	092	0	093	0	094	0	095	0
096	0	097	0	098	0	099	0	100	0
101	0	102	0	103	0	104	0	105	0
106	0	107	0	108	0	109	0	110	0
111	0	112	0	113	0	114	0		

### 3. REVIEWER COMMENTS

(1) P.19 - Last table - LR should be units of lbm/min rather than lbm/sec.  
Response: Fixed

#### 4. TABLE OF CONTENTS

01. COVER SHEET	1
02. LIST OF EFFECTIVE PAGES	2
03. REVIEWER COMMENTS	3
04. TABLE OF CONTENTS	4
05. INTRODUCTION	6
06. INPUT DATA	9
07. TECHNICAL ASSUMPTIONS	15
08. REFERENCES	16
09. METHODS OF ANALYSIS	18
09.A WESTINGHOUSE SGTR CALCULATIONS	18
09.B PRIMARY AND SECONDARY ACTIVITIES	21
09.C RADTRAD COMPUTATIONS	22
09.D TIME TO COOLDOWN VIA ADV OF UNAFFECTED STEAM GENERATOR	22
10. CALCULATIONS	24
11. DOCUMENTATION OF COMPUTER CODES	25
12. RESULTS	26
13. CONCLUSIONS	29
14. ATTACHMENTS	30
ATTACHMENT A: SGTR EVENT RELEASE ACTIVITIES	30
ATTACHMENT B: ADV CHOKE FLOW VS DECAY HEAT CALCULATIONS	32
ATTACHMENT C: NUCLEAR INVENTORY FILE CIS3358.NIF	34
ATTACHMENT D: NUCLEAR INVENTORY FILE PIS.NIF	37
ATTACHMENT E: NUCLEAR INVENTORY FILE SEC05.NIF	40
ATTACHMENT F: RELEASE FRACTION AND TIMING FILE SGTRCI8.RFT	42
ATTACHMENT G: RELEASE FRACTION AND TIMING FILE SGTRCN.RFT	43
ATTACHMENT H: RELEASE FRACTION AND TIMING FILE SGTRSEC.RFT	44
ATTACHMENT I: RELEASE FRACTION AND TIMING FILE SGTRPI.RFT	45

ATTACHMENT J: RELEASE FRACTION AND TIMING FILE SGTRPN.RFT	46
ATTACHMENT K: CONVERSION FACTORS FILE FGR14.INP	47
ATTACHMENT L: CONVERSION FACTORS FILE FGR05.INP	51
ATTACHMENT M: SGTRCAI OUTPUT FILE	53
ATTACHMENT N: SGTRCAN OUTPUT FILE	55
ATTACHMENT O: SGTRCUI OUTPUT FILE	57
ATTACHMENT P: SGTRCUN OUTPUT FILE	59
ATTACHMENT Q: SQTRCAS OUTPUT FILE	61
ATTACHMENT R: SGTRCUS OUTPUT FILE	63
ATTACHMENT S: SGTRCAIM OUTPUT FILE	65
ATTACHMENT T: SGTRCANM OUTPUT FILE	67
ATTACHMENT U: SGTRCUIM OUTPUT FILE	69
ATTACHMENT V: SGTRCUNM OUTPUT FILE	71
ATTACHMENT W: SGTRPAI OUTPUT FILE	73
ATTACHMENT X: SGTRPAN OUTPUT FILE	75
ATTACHMENT Y: SGTRPUI OUTPUT FILE	77
ATTACHMENT Z: SGTRPUN OUTPUT FILE	79
ATTACHMENT AA: SQTRPAS OUTPUT FILE	81
ATTACHMENT AB: SGTRPUS OUTPUT FILE	83
ATTACHMENT AC: SGTRPAIM OUTPUT FILE	85
ATTACHMENT AD: SGTRPANM OUTPUT FILE	87
ATTACHMENT AE: SGTRPUIM OUTPUT FILE	89
ATTACHMENT AF: SGTRPUNM OUTPUT FILE	91
ATTACHMENT AG: ETP 97-064R CONTROL ROOM INLEAKAGE RESULTS	93
ATTACHMENT AH: ETP 01-035R PERFLUOROCARBON TRACER GAS TESTING	109
LAST PAGE OF REPORT	114

## 5. INTRODUCTION

Chapter 14.15 of the Updated Final Safety Analysis Report (UFSAR) presents the licensing basis evaluation of the Steam Generator Tube Rupture (SGTR) Event. A SGTR Event is defined as the penetration of the barrier between the reactor coolant system (RCS) and the main steam system. The integrity of this barrier is of radiological safety significance, in that a leaking steam generator (SG) tube allows the transfer of reactor coolant into the main steam system. Radioactivity contained in the reactor coolant would then mix with the fluid in the secondary side of the affected steam generator. This radioactivity would then be transported by steam to the turbine/condenser/vent stack/atmosphere or directly to the atmosphere via the Atmospheric Dump Valves (ADV) or Main Steam Safety Valves (MSSVs).

The current design basis accident (DBA) assumes that cooldown of the RCS to shutdown cooling (SDC) conditions utilizes the ADVs of both SGs until SDC is attained (Ref.07). However, that analysis did not consider 10 CFR 50 Appendix A GDC 19 control room dose limitations. Thus in this revised analysis, the ADV of the affected SG must be isolated after two hours to limit activity emissions.

The limiting Steam Generator Tube Rupture (SGTR) event as re-analyzed by Westinghouse in CN-TAS-05-13 (Ref.05) is considered to be a complete double-ended tube break and is postulated to occur due to a complete failure of a tube-to-sheet weld or the rapid propagation of a circumferential crack. The SGTR event allows primary coolant to leak into the secondary side via the steam generator (SG). The primary coolant transfer causes the pressurizer level to decrease, provided that the tube leak rate exceeds the charging pump capacities and causes the level in the affected steam generator to increase. In the case of the double ended tube rupture, the leak rate far exceeds the charging pump capacities and, consequently, the pressurizer level will decrease. The decrease in the pressurizer level and the inability of the heaters to maintain pressurizer pressure causes the Reactor Coolant System (RCS) pressure to decrease. The drop in the pressure will cause a reactor trip on Thermal Margin/Low Pressure (TM/LP), ensuring that the Departure from Nucleate Boiling (DNB) Specified Acceptable Fuel Design Limit (SAFDL) is not exceeded. Peak Linear Heat Rate (PLHR) is of no concern because there is no appreciable power increase during the transient. The decrease in pressurizer level continues until the pressurizer empties, dropping the primary pressure to the hot leg saturation pressure. An upper head void begins to appear and a Safety Injection Actuation Signal (SIAS) is actuated. The High Pressure Safety Injection (HPSI) flow first contributes to further reduction of the primary pressure due to its cooling effect but eventually injects enough coolant to refill the pressurizer, restore the primary pressure to provide subcooling, and collapse the upper head void. The reactor trip also generates a turbine trip causing the secondary pressure to rapidly increase due to closure of the turbine valve. In the assumed evolution, the steam bypass valves are not available to mitigate the rise in secondary pressure. The action of the Atmospheric Dump Valves (ADV) and Main Steam Safety Valves (MSSVs) will limit the secondary pressure until the operator is able to assume control. The operator identifies the event from the radiation alarms, the increasing radioactivity in the condenser off-gas monitor, steam generator blowdown monitor, stack gas or main steam line monitors, the reactor trip on low RCS pressure, the decreasing pressurizer level, and the increasing water level in the affected steam generator.

After the operator identifies the event, the operator initiates a cooldown of the RCS according to the SGTR Emergency Operating Procedure-6 (EOP-6 Reference 10). This cooldown is performed to relieve secondary pressure and stop the cycling of the MSSVs by bringing the primary hot leg temperature down to 515°F. In this analysis, the single failure blocks the ADV of the intact steam generator at the beginning of the event. Thus, this initial cooldown is carried out using the ADV of the affected SG only. The operator will be required to identify this additional factor, initiate action to unblock the ADV of the intact steam generator, and isolate the affected SG to mitigate the release of radioactivity to the environment. After the operator isolates the affected steam generator, the operator will continue cooling down the RCS using the intact steam generator. The affected steam generator level will be maintained by using backflow to the RCS.

At this point, the operator has three cooldown modes to attain shutdown cooling (SDC) conditions:

- The operator continues the cooldown via the ADV of the unaffected SG until the SDC entry conditions are reached. It will take approximately 14 days for the decay heat generation to decline to a level that can be removed via a single SG and ADV. Note that a thirty day cooldown via the ADV of the unaffected SG is conservatively modeled in this work.
- The operator continues the cooldown via the ADV of the unaffected SG but also loads SG blowdown to the Waste Processing System (WPS) on to the backup power sources, so that SG blowdown may be used during the event. Note that use of SG blowdown can occur at any point that space in the Miscellaneous Waste Receiver Tank and/or Miscellaneous Waste Monitor Tank allows. Thus the maximum offsite and control room doses are identical to those of the first option.
- The operators can re-open the ADV of the affected SG for up to 8 hours after an initial cooldown of 24 hours post-accident.

Previously, power reactor licensees have typically used the U.S.A.E.C Technical Information Document TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites," (Ref.18) as the basis for DBA analysis source terms. TID-14844 is referenced in 10 CFR 100.11, the power reactor siting regulation, which contains offsite dose limits in terms of whole body and thyroid doses. In December 1999, the NRC issued a new regulation, 10 CFR 50.67, "Accident Source Term," which provided a mechanism for licensed power reactors to replace the traditional accident source term used in their DBA analyses with an alternate source term. Regulatory guidance for the implementation of these ASTs is provided in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" (Ref.08). Section 50.67 of 10 CFR requires a licensee seeking to use AST to apply for a license amendment and requires that the application contain an evaluation of the consequences of affected DBAs. As part of the implementation of the AST, the total effective dose equivalent (TEDE) acceptance criterion of 10 CFR 50.67 replaces the previous whole body and thyroid dose guidelines of 10 CFR 100.11 and 10 CFR 50, Appendix A, GDC-19 for the loss-of-coolant accident (LOCA), the main steam line break (MSLB), the steam generator tube rupture (SGTR), the seized rotor event (SRE), the fuel handling accident (FHA), and the control rod ejection accident (CREA). The NSSS response to the SGTR was simulated using the CESEC and COOL computer codes.

The current work utilizes the alternate source term (AST) methodology of 10 CFR 50.67 and Regulatory Guide 1.183 to calculate offsite and control room doses for a SGTR. Modification of the control room emergency ventilation system to a nominal 10000 cfm flow with a 90% filtration efficiency for elemental and organic iodine and a 99% filtration efficiency for particulate iodine was credited. Also credited was installation of automatic isolation dampers and radiation monitors at Access Controls 11 and 13 on the Auxiliary Building Roof. This modification limits activity ingress into the control room from either the West Road Inlet or the Turbine Building, thus limiting the atmospheric dispersion coefficient value. The Technical Specification limit for RCS activity was reduced from 1.0  $\mu\text{Ci/gm}$  to 0.5  $\mu\text{Ci/gm}$ .

Per RG 1.183 (Ref.08), if no or minimal fuel damage is postulated, the activity should be the maximum coolant activity allowed by the technical specifications, assuming two cases of iodine spiking. Thus, two cases are modeled to determine the maximum offsite and control room doses.

- Preaccident Iodine Spike (PIS) Case: A reactor transient has occurred prior to the postulated SGTR and has raised the primary coolant iodine concentration to the maximum value permitted by the TSs, which is sixty times the TS 3.4.15 limit of 0.5  $\mu\text{Ci/gm}$ .
- Concurrent Iodine Spike (CIS) Case: The primary system transient associated with the SGTR causes an iodine spike in the primary system. The increase in primary coolant iodine concentration is estimated using a spiking model that assumes the iodine release rate from the fuel rods to the primary coolant increases to a value 335 times greater than the release rate corresponding to the iodine concentration at the equilibrium value. Per RG 1.183, the assumed iodine spike duration should be 8 hours.

The exclusion area boundary (EAB), low population zone (LPZ), and control room (CR) doses for the design-basis CIS and PIS SGTR for the three cooldown modes described previously (cooldown via ADV of unaffected SG from 2 hours to 30 days, cooldown via ADV of affected SG from 24-32 hours, and cooldown via blowdown to the WPS) are detailed in the following table.



SGTR Results			
	EAB	LPZ	CR
	Rem	Rem	Rem
CIS Unaffected ADV 0-30 days	0.1964	0.0484	1.7081
CIS Affected ADV 0-2/24-32 hr	0.1964	0.0476	1.6929
CIS Affected ADV 0-2 hr/WPS	0.1964	0.0484	1.7081
CIS Regulatory Limits	2.5000	2.5000	5.0000
PIS Unaffected ADV 0-30 days	0.4910	0.1164	4.1590
PIS Affected ADV 0-2/24-32 hr	0.4910	0.1162	4.1655
PIS Affected ADV 0-2 hr/WPS	0.4910	0.1164	4.1590
PIS Regulatory Limits	25.0000	25.0000	5.0000

Note that all values are below the regulatory limits. Also note that the additional dose generated by opening the ADV of the affected SG for 8 hours 24 hours into the accident is approximately equal to the dose that would have been generated by the ADV of the unaffected SG being open from 32 hours to 30 days. Thus, cooldown of the reactor to SDC conditions can occur via all three cooldown modes (cooldown via ADV of unaffected SG from 0 to 30 days, cooldown via ADV of affected SG from 0-2 and 24-32 hours, and cooldown via blowdown to the WPS) with approximately the same offsite and control room doses being generated by each.

## 6. INPUT DATA

The input data to determine the exclusion area boundary (EAB), low population zone (LPZ), and control room (CR) doses from a Steam Generator Tube Rupture (SGTR) Event are the following:

(01) The initial thermal power utilized in the SGTR thermohydraulic responses of Ref.5 was 2754 MWt (102% of core full power per UFSAR 3.2.1 and Ref.1) plus 17 MWt Reactor Coolant Pump (RCP) power per Ref.12.

(02) The isotopic half-lives ( $t_i$ ) were extracted from Ref.06 and are listed in column A of Attachment A. The decay constants ( $\lambda_i$ ), listed in column B of Attachment A, are readily calculated via the following algorithm:

$$\lambda_i = \ln(2) / t_i$$

(03) The initial drop in pressurizer pressure will cause a reactor trip on Thermal Margin/Low Pressure (TM/LP), ensuring that the Departure from Nucleate Boiling (DNB) Specified Acceptable Fuel Design Limit (SAFDL) is not exceeded. Peak Linear Heat Rate (PLHR) is of no concern because there is no appreciable power increase during the transient. Thus, no fuel failure is caused by a SGTR event.

Per RG 1.183 (Ref.08), if no or minimal fuel damage is postulated, the activity should be the maximum coolant activity allowed by the technical specifications, assuming two cases of iodine spiking. Thus, two cases are modeled to determine the maximum offsite and control room doses.

- Preaccident Iodine Spike (PIS) Case: A reactor transient has occurred prior to the postulated SGTR and has raised the primary coolant iodine concentration to the maximum value permitted by the TSs, which is sixty times the TS 3.4.15 limit of 0.5  $\mu\text{Ci/gm}$ .
- Concurrent Iodine Spike (CIS) Case: The primary system transient associated with the SGTR causes an iodine spike in the primary system. The increase in primary coolant iodine concentration is estimated using a spiking model that assumes the iodine release rate from the fuel rods to the primary coolant increases to a value 335 times greater than the release rate corresponding to the iodine concentration at the equilibrium value. Per RG 1.183, the assumed iodine spike duration should be 8 hours.

(04) Per Ref.8, the primary TS PIS activities are assumed to be homogeneously distributed throughout the primary system at the beginning of the accident. Per Ref.8, the primary TS CIS activities are released homogeneously into the primary system over the 8 hour duration of the CIS spike. Per Ref.8, the secondary TS activities are assumed to be homogeneously distributed throughout the secondary system at the beginning of the accident. These release assumptions are incorporated into the release fraction and timing files.

RFT Files	Release Timing	Noble Gas Release	Iodine Release	Attachment
	Hours	Fraction	Fraction	
sgtrci8.rft	8	0	1	F
sgtrcn.rft	0.0001	1	0	G
sgtrpi.rft	0.0001	0	1	I
sgtrpn.rft	0.0001	1	0	J
sgtrsec.rft	0.0001	0	1	H

(05) The dose conversion factors (DCFs) were extracted from Refs.20-21 and inserted into input files for use by RADTRAD. This data is included in the Conversion Factor Files FGR14.INP in Attachment K for use with primary system isotopics and FGR05.INP in Attachment L for use with secondary system isotopics. Note that the cloudshine data in the Conversion Factor Files corresponds to the FGR-12 data, while the inhaled chronic data in the Conversion Factor Files corresponds to the worst-case effective data in FGR-11. The remaining data in the Conversion Factor Files is extraneous and not used by RADTRAD.

(06) Per Ref.08, iodine releases from the steam generators to the environment should be assumed to be 97% elemental and 3% organic.

(07) The 391900 lbm RCS mass was extracted from Section 9.A and Ref.5. The minimum time-dependent RCS mass was chosen to maximize offsite and control room doses.

(08) The 124644 lbm affected SG mass was extracted from Section 9.A and Ref.5. The minimum time-dependent affected SG mass was chosen to maximize offsite and control room doses.

(09) The 56420 lbm unaffected SG mass was extracted from Section 9.A and Ref.5. The minimum time-dependent unaffected SG mass was chosen to maximize offsite and control room doses.

(10) The control room volume is 289194 ft<sup>3</sup> per Ref.19.

(11) Control room recirculation flow:

- Flowrate: 10000 ± 1000 cfm  
(Note that this value will be the result of a new modification.)
- Initiation delay time: 20 minutes  
(Ref.29 conservatively assumes a 20 minute time delay for a manual start of the Control Room Emergency Ventilation System.)
- Filter efficiencies: 90% for elemental and organic iodine species  
(Ref.28 and Technical Specification 5.5.11 allow a 95% filter efficiency for a 2" activated carbon bed depth; however, NRC Generic Letter 99-02 (Ref.30) requires plants that test their activated charcoal to the ASTM D3803-1989 standards to use a safety factor of two. This results in a maximum credited efficiency of 90% for accident analyses.)
- Filter efficiencies: 99% for particulate iodine (Per Ref.28, an engineered-safety-feature air filtration system satisfying a filter penetration less than 0.05% at rated flow can be considered to warrant a 99% removal efficiency for particulates in accident dose evaluations.)

(12) The breathing rates are extracted from Ref.08:

Time (hours)	Breathing Rate (m3/sec)
0-8	3.5E-04
8-24	1.8E-04
24-720	2.3E-04

(13) The control room occupancy factors are extracted from Ref.08:

Time (hours)	Occupancy Factor
0-24	1.0
24-96	0.6
96-720	0.4

(14) Control room inleakage: The control room inleakages for the two trains Air Conditioning Units (ACU) 11 and 12 were measured by NUCON International Inc. via sulfur hexafluoride (SF<sub>6</sub>) tracer gas tests as documented in Refs.23-26 (Attachment AG). An additional inleakage test was performed by Brookhaven National Laboratory (BNL) via a perfluorocarbon tracer gas (PFT) test as documented in Ref.27 (Attachment AH).

	ACU 11	ACU 12
SF <sub>6</sub> Test 11/11/97	4300±300 cfm	3000±300 cfm
SF <sub>6</sub> Test 11/11/97	3600±600 cfm	2550±450 cfm
SF <sub>6</sub> Test 11/11/97	2900±250 cfm	2750±380 cfm
SF <sub>6</sub> Test 1/18/00	2600±200 cfm	3000±250 cfm
PFT Test 5/1/02	2930±185 cfm	2930±185 cfm

The latest SF<sub>6</sub> and PFT tests show fairly good agreement, as indicated above. A conservative value of 3500 cfm will be utilized in this work.

The control room inleakage points were deduced from the PFT testing carried out by Brookhaven National Laboratory and include the Auxiliary Building West Road inlet (WR), the Turbine Building inlet (TB), Access Control 11 (AC11), Access Control 13 (AC13), the Switchgear Rooms (SWGRs), and the Main Steam Isolation Valve Rooms (MSIVs). AC11 and AC13 will be equipped with dampers and radiation monitors, which will isolate this leakage path in case of an accident. The SWGRs are in continual recirculation mode and thus are also isolated from the environment. The MSIV rooms are also isolated from the environment, except for the Main Steam Line Break Accident which occurs in these rooms, due to the thermal buoyancy of the air in these rooms and due to the J-neck exhaust. For conservatism, all of the measured inleakage will be assumed to enter the control room from the most conservative pathway of either the West Road or Turbine Building inlets.

(15) The atmospheric dump valve (ADV)-to-site boundary, two-hour, atmospheric dispersion coefficient of 1.44E-4 sec/m<sup>3</sup> was calculated via the Gifford wake model extracted from UFSAR 2.3.6, as follows

$$\chi/Q = 1/[\mu * (\pi\sigma_y\sigma_z + cA)] = 1.44E-4 \text{ sec/m}^3$$

where for 1150 m exclusion area boundary distance and 5% frequency

$\mu$  = average wind speed = 1 m/sec

$\sigma_y$  = standard deviation of the distribution in the lateral direction = 92 m (UFSAR Table 2-14)

$\sigma_z$  = standard deviation of the distribution in the vertical direction = 24 m (UFSAR Table 2-14)

c = wake factor

A = cross-sectional area of structure from which material is released = 0 m

(16) Atmospheric dispersion coefficients from the ADV to low population zone (2 miles)  
(UFSAR Fig.2.3-3/UFSAR 14.24.3)

Time (hours)	$\chi/Q$ (sec/m <sup>3</sup> )
0-2	3.39E-05
2-24	2.20E-06
24-720	5.40E-07

Note that the 0-2 hour value was adjusted via the Gifford wake model for a vent stack release rather than a containment release.

(17) Atmospheric dispersion coefficients from the ADV to the Control Room: (Ref.19)

The initial secondary activity together with initial primary activity and failed fuel activity released to the primary that then leaks into the secondary will escape out of the steam generators via the ADVs and condenser. Note that per the requirements of Regulatory Guide (RG) 1.183 (Ref.08), the release of fission products from the secondary system should be evaluated with the assumption of a coincident loss of offsite power (LOOP). Thus, the use of condensers can not be credited in this work. The main control room inleakage points include the west road inlets, the turbine

building, and Access Controls 11 and 13 on the Auxiliary Building roof. Installation of automatic isolation dampers and radiation monitors at Access Controls 11 and 13 on the Auxiliary Building Roof are credited in this work.

Atmospheric Dispersion Coefficients (sec/m <sup>3</sup> )				
	radv1-lb	radv2-lb	radv1-wr	radv2-wr
0-2 hr	3.70E-03	3.83E-03	1.40E-03	1.35E-03
2-8 hr	2.78E-03	3.25E-03	1.08E-03	9.39E-04
8-24hr	1.03E-03	1.32E-03	4.73E-04	3.78E-04
1-4 days	8.24E-04	9.92E-04	3.48E-04	2.52E-04
4-30 days	6.31E-04	7.92E-04	2.44E-04	1.66E-04

The atmospheric dispersion coefficients corresponding to the Unit 2 ADV to the turbine building will be conservatively utilized in this work. Note that neither thermal buoyancy nor vertical effluent velocity are credited in this work.

(18) Per Ref.08, the primary to secondary ruptured tube leakage and TS leakage of 200 gpd (TS 3.4.13) is assumed to continue until shutdown cooling (SDC) conditions defined as 300°F and 270 psia per the EOPs are attained and releases from the steam generators have been terminated. Per Ref.08, "the TS leakage should be apportioned between affected and unaffected steam generators in such a manner that the calculated dose is maximized." Thus, since the primary to secondary flow from the RCS to the affected SG was maximized in Ref.5 for the worst-case thermohydraulic conditions, all of the TS primary to secondary leakage is assumed to flow to the unaffected steam generator.

Three cooldown modes are available to the operators to attain shutdown cooling (SDC) conditions:

- The operator continues the cooldown via the ADV of the unaffected SG until the SDC entry conditions are reached. It will take approximately 14 days for the decay heat generation to decline to a level that can be removed via a single SG and ADV. Note that a thirty day cooldown via the ADV of the unaffected SG is conservatively modeled in this work.
- The operator continues the cooldown via the ADV of the unaffected SG but also loads SG blowdown to the Waste Processing System (WPS) on to the backup power sources, so that SG blowdown may be used during the event. Note that use of SG blowdown can occur at any point that space in the Miscellaneous Waste Receiver Tank and/or Miscellaneous Waste Monitor Tank allows. Thus the maximum offsite and control room doses are identical to those of the first option.
- The operators can re-open the ADV of the affected SG for up to 8 hours after an initial cooldown of 24 hours post-accident.

(19) Transport Pathways:

Pathway: Iodine via ADV of Affected SG - Isolated after 2 Hours							
	Flow(lbm)	Time(sec)	Flow(lbm/min)	FF	PF	Total(lbm/min)	Time(hr)
rsc-env	0	0	5393.2048	0.135	1.00	728.083	0.000
	37303	415	3533.8378	0.135	1.00	477.068	0.115
	48199	600	2783.2941	0.135	1.00	375.745	0.167
	52142	685	3181.2875	0.045	1.00	143.158	0.190
	85747	1318.8	2635.0837	0.045	1.00	118.579	0.366
	312900	6491	0.0000	0.055	1.00	0.000	1.803
							720.000
rsc-asg	0	0	5393.2048	0.865	1.00	4665.122	0.000
	37303	415	3533.8378	0.865	1.00	3056.770	0.115
	48199	600	2783.2941	0.865	1.00	2407.549	0.167
	52142	685	3181.2875	0.955	1.00	3038.130	0.190
	85747	1318.8	2635.0837	0.955	1.00	2516.505	0.366

	312900	6491	0.0000	0.945	1.00	0.000	1.803
							720.000
asg-env	0	0	0.0000	1	0.01	0.000	0.000
	0	415	28394.9189	1	0.01	283.949	0.115
	87551	600	8720.4706	1	0.01	87.205	0.167
	99905	685	5002.0196	1	0.01	50.020	0.190
	152743	1319	1454.2779	1	0.01	14.543	0.366
	240053	4921	0.0107	1	0.01	0.000	1.367
							720.000

Pathway: Noble Gas via ADV of Affected SG - Isolated after 2 Hours							
	Flow(lbm)	Time(sec)	Flow(lbm/min)	FF	PF	Total(lbm/min)	Time(hr)
rsc-env	0	0	5393.2048	1	1.00	5393.205	0.000
	37303	415	3533.8378	1	1.00	3533.838	0.115
	48199	600	2783.2941	1	1.00	2783.294	0.167
	52142	685	3181.2875	1	1.00	3181.287	0.190
	85747	1318.8	2635.0837	1	1.00	2635.084	0.366
	312900	6491	0.0000	1	1.00	0.000	1.803
							720.000
rsc-asg			0.0000	1	1	0.000	720
asg-env			0.0000	1	1	0.000	720

Pathway: Iodine via ADV of Unaffected SG - Isolated after 30 Days							
	Flow(lbm)	Time(sec)	Flow(lbm/min)	FF	PF	Total(lbm/min)	Time(hr)
rsc-env	50050.13	2592000	1.1586	0.070	1.00	0.0811	720.000
rsc-usg	50050.13	2592000	1.1586	0.930	1.00	1.0775	720.000
usg-env	0	0	0.0000	1	0.01	0.0000	0.000
	0	5031	936.0720	1	0.01	9.3607	1.398
							720.000

Pathway: Noble Gas via ADV of Unaffected SG - Isolated after 30 Days							
	Flow(lbm)	Time(sec)	Flow(lbm/min)	FF	PF	Total(lbm/min)	Time(hr)
rsc-env	50050.13	2592000	1.1586	1	1	1.1586	720
rsc-usg	0.00	2592000	0.0000	1	1	0.0000	720
usg-env	0.00	2592000	0.0000	1	1	0.0000	720

Pathway: Iodine via ADV of Affected SG - Isolated after 2 Hours but Reopened from 24-32 Hours							
	Flow(lbm)	Time(sec)	Flow(lbm/min)	FF	PF	Total(lbm/min)	Time(hr)
rsc-env	0	0	5393.2048	0.135	1	728.0827	0.000
	37303	415	3533.8378	0.135	1	477.0681	0.115
	48199	600	2783.2941	0.135	1	375.7447	0.167
	52142	685	3181.2875	0.045	1	143.1579	0.190
	85747	1318.8	2635.0837	0.045	1	118.5788	0.366
	312900	6491	0.0000	0.055	1	0.0000	1.803
	312900	20210	0.0000	0.055	1	0.0000	5.614
		86400	231.7003	0.055	1	12.7435	24.000
		115200	0.0000	0.055	1	0.0000	32.000
							720.000

rsc-asg	0	0	5393.2048	0.865	1	4665.1222	0.000
	37303	415	3533.8378	0.865	1	3056.7697	0.115
	48199	600	2783.2941	0.865	1	2407.5494	0.167
	52142	685	3181.2875	0.955	1	3038.1295	0.190
	85747	1318.8	2635.0837	0.955	1	2516.5049	0.366
	312900	6491	0.0000	0.945	1	0.0000	1.803
	312900	20210	18.4718	1.000	1	18.4718	5.614
		86400	231.7003	0.945	1	218.9568	24.000
		115200	0.0000	0.945	1	0.0000	32.000
							720.000
asg-env	0	0	0.0000	1	0.01	0.0000	0.000
	0	415	28394.9189	1	0.01	283.9492	0.115
	87551	600	8720.4706	1	0.01	87.2047	0.167
	99905	685	5002.0196	1	0.01	50.0202	0.190
	152743	1318.8	1454.2779	1	0.01	14.5428	0.366
	240053	4921	0.0107	1	0.01	0.0001	1.367
		86400	588.4786	1	0.01	5.8848	24.000
		115200	0.0000	1	0.01	0.0000	32.000
							720.000

Pathway: Noble Gas via ADV of Affected SG - Isolated after 2 Hours but ReOpened from 24-32 Hours							
	Flow(lbm)	Time(sec)	Flow(lbm/min)	FF	PF	Total(lbm/min)	Time(hr)
rsc-env	0	0	5393.2048	1	1	5393.2048	0.0000
	37303	415	3533.8378	1	1	3533.8378	0.1153
	48199	600	2783.2941	1	1	2783.2941	0.1667
	52142	685	3181.2875	1	1	3181.2875	0.1903
	85747	1318.8	2635.0837	1	1	2635.0837	0.3663
	312900	6491	0.0000	1	1	0.0000	1.8031
	312900	20210	0.0000	1	1	0.0000	5.6139
		86400	231.7003	1	1	231.7003	24.0000
		115200	0.0000	1	1	0.0000	32.0000
							720.0000
rsc-asg			0	1	1	0	720
asg-env			0	1	1	0	720

Pathway: Iodine via ADV of Unaffected SG - Isolated after 32 Hours							
	Flow(lbm)	Time(sec)	Flow(lbm/min)	FF	PF	Total(lbm/min)	Time(hr)
rsc-env	50050.13	2592000	1.1586	0.07	1.00	0.0811	32.00
rsc-usg	50050.13	2592000	1.1586	0.93	1.00	1.0775	32.00
usg-env	0.00	0	0.0000	1.00	0.01	0.0000	0.00
	0.00	5031	936.0720	1.00	0.01	9.3607	1.40
							32.00

Pathway: Noble Gas via ADV of Unaffected SG - Isolated after 32 Hours							
	Flow(lbm)	Time(sec)	Flow(lbm/min)	FF	PF	Total(lbm/min)	Time(hr)
rsc-env	50050.13	2592000	1.1586	1	1	1.1586	32.00
rsc-usg	0.00	2592000	0.0000	1	1	0.0000	32.00
usg-env	0.00	2592000	0.0000	1	1	0.0000	32.00

## 7. TECHNICAL ASSUMPTIONS

The following technical assumptions were utilized in this work:

(01) The limiting SGTR event is considered to be a complete double-ended tube break and is postulated to occur due to a complete failure of a tube-to-sheet weld or the rapid propagation of a circumferential crack. Tube failures other than the double-ended rupture may not result in leak rates which exceed the charging pump capacity. Such events may not result in an Reactor Protection System (RPS) trip but would require a manual trip upon observation of either an RCS leak rate in excess of the T.S. or excessive secondary side activities.

(02) As the SGTR event is a postulated accident, a single failure is assumed. Consistent with the current licensing basis, the single failure in this analysis include a Loss of Alternating Current (LOAC) upon reactor trip, (the loss of forced circulation of the reactor coolant occurs three seconds after reactor trip) and the isolation of the Unaffected SG ADV at the onset of the event. Loss of the condenser (with LOAC) results in the unavailability of steam bypass and forces all post-trip secondary steaming to the atmosphere via the ADVs and the MSSVs. The loss of forced circulation decreases the cooldown capability of the SGs. It also limits the ability of the operator to maintain desired subcooling and to minimize the leakage rate by maintaining a differential pressure between primary and the affected SG. During natural circulation the subcooling is monitored via the Core Exit Thermocouples (CET5) which have a higher uncertainty than the hot leg Resistance Temperature Detector (RTDs) (which would be used during forced circulation).

(03) The SGTR analyses assume no leakage through the Main Steam Isolation Valve (MSIV) on the affected SG once it has been isolated.

(04) No credit is taken for atmospheric cleanup systems except control room filters.

(05) No credit is taken for deposition of the plume on the ground or decay of isotopes in transit to the site boundary.

(06) Buildup of daughter nuclides is taken into account as source term nuclides decay.



## 8. REFERENCES

- (01) "Power Levels of Nuclear Power Plants", Regulatory Guide 1.49 Rev.1, 12/73.
- (02) CCNPP Core Operating Limits Report for Unit 1 Cycle 17 Rev.1
- (03) CCNPP Core Operating Limits Report for Unit 2 Cycle 16 Rev.0
- (04) "Primary and Secondary Isotopic Calculations", CA06422
- (05) CA06595, Westinghouse Calculation CN-TAS-05-13 Rev.0, Calvert Cliffs Units 1 and 2 SGTR Event
- (06) "Chart of the Nuclides - Nuclides and Isotopes", GE Nuclear Energy, Fifteenth Edition.
- (07) "SGTR Event with EOP Based Operator Actions and Isolated ADVs", A-CC-FE-0067 Rev.07.
- (08) "Alternate Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors", Regulatory Guide 1.183
- (09) Emergency Operating Procedure 0 Rev. 9, Post-Trip Immediate Actions
- (10) Emergency Operating Procedure 6 Rev. 16, Steam Generator Tube Rupture
- (11) NEU-94-151/NS-94-020: "Fluid Velocities through the Main Steam Valve Room Stack and ADVs"
- (12) CA03516 (A-CC-FE-0060), "Calvert Cliffs Units 1 & 2 Seized Rotor Analysis"
- (13) "RADTRAD: A Simplified Model for Radionuclide Transport and Removal and Dose Estimation", NUREG/CR-6604, SAND98-0272
- (14) "RADTRAD: A Simplified Model for Radionuclide Transport and Removal and Dose Estimation", NUREG/CR-6604, SAND98-0272/1, Supplement 1.
- (15) "RADTRAD: A Simplified Model for Radionuclide Transport and Removal and Dose Estimation", NUREG/CR-6604, Supplement 2
- (16) "RADTRAD 3.03 Installation and Verification on PCB386", CA06210
- (17) "RADTRAD 3.03 Validation", CA06207
- (18) "Calculation of Distance Factors for Power and Test Reactor Sites", TID-14844, 3/23/62.
- (19) CA06012: CRHVAC Atmospheric Dispersion Coefficient Calculations
- (20) Federal Guidance Report (FGR) 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors," 1989
- (21) Federal Guidance Report (FGR) 12, "External Exposure to Radionuclides in Air, Water, and Soil," 1993,
- (22) "Fuel Performance Analysis", Westinghouse Calculation CN-WFE-02-45, Rev.0

- (23) "Control Room HVAC Inleakage Test", ETP-97-064R Rev.0, 11/11/1997 (First Run)
- (24) "Control Room HVAC Inleakage Test", ETP-97-064R Rev.0, 11/11/1997 (Third Run)
- (25) "Control Room HVAC Inleakage Test", ETP-97-064R Rev.0, 11/11/1997 (Fourth Run)
- (26) "Control Room HVAC Inleakage Test", ETP-97-064R Rev.0, 1/18/2000.
- (27) "Perfluorocarbon Tracer Gas Testing", ETP-01-035R Rev.0, 5/1/2002
- (28) ) Regulatory Guide 1.52 Rev.2: "Design, Testing, and Maintenance Criteria for Post Accident ESF Atmosphere Cleanup System Air Filtration and Absorption Units of LWRs"
- (29) "Control Room Recirculation Filter Initiation Time Delay", NEU-95-026
- (30) NRC Generic Letter 99-02: Laboratory Testing of Nuclear-Grade Activated Charcoal
- (31) ASME Steam Tables, 5th Edition, United Engineering Center, N.Y., N.Y.
- (32) CA05725, WEC-222-7811-A45: Parameter Listing for RSG Inputs for Calvert Cliffs Units 1 & 2
- (33) Crane Technical Paper #410, "Flow of Fluids through Valves, Fittings, and Pipe"
- (34) SP-0811: RSG Design Specification
- (35) Branch Technical Position ASB 9-2: Residual Decay Energy for LWRs for Long-Term Cooling
- (36) ANS/ANSI-1979, "Decay Heat Power in LWRs"

## 9. METHODS OF ANALYSIS

### (9.A) Westinghouse SGTR Calculations

The behavior of the primary and secondary systems during and after a double-ended tube break SGTR event was modeled by Westinghouse in calculation CN-TAS-05-13 (Ref.05), based on EOP-0 (Ref.9) and EOP-6 (Ref.10) operator responses. The results of the analysis were plots and tables from the initiation of a SGTR event until the plant has been cooled to Shutdown Cooling (SDC) entry conditions for the following parameters: Power Fraction, MSSV Flows, RCS Pressure, Integrated MSSV Flows, RCS Temperatures, ADV Flows, Pressurizer Volume, Integrated ADV Flows, Upper Head Void Fraction, Tube Rupture Rate (Affected), Integrated SI Flow, Integrated Tube Rupture Flow (Affected), Hot Leg Subcooling, Rupture Flashing Fraction (Affected), AFW Flows, Leak Rate (Unaffected), SG Pressures, Integrated Leak Flow (Unaffected), SG Masses, and Leak Flashing Fraction (Unaffected).

The CESEC-III Nuclear Steam Supply System (NSSS) simulation code was used to model the SGTR for primary and secondary response during the initial portion of the event. However, CESEC-III does not have the capability to model the multiple operator actions credited in the SGTR event. Thus, the remainder of the event was simulated using the COOL-II code, which can model explicit operator actions. The COOL-II code is a thermal-hydraulic code that simulates the plant cooldown by operator actions based upon the Calvert Cliffs EOPs. Because the COOL-II code does not have a kinetics model, CESEC-III is run to approximately 15 minutes past reactor trip to ensure all power being generated is from decay heat and a conservative decay heat curve is input to COOL-II. Specifically, the analysis used COOL-II to examine four different scenarios:

- Fully isolating the Affected SG 2 hours into the transient and maintaining the highest subcooling possible while accounting for CET uncertainty,
- 2) Fully isolating the Affected SG 2 hours into the transient and maintaining the lowest subcooling possible while accounting for CET uncertainty,
- 3) Isolating the Affected SG 2 hours into the transient and re-opening the Affected SGs ADV at the end of the transient while maintaining the highest subcooling possible by accounting for CET uncertainty, and
- 4) Isolating the Affected SG 2 hours into the transient and re-opening the Affected SGs ADV at the end of the transient while maintaining the lowest subcooling possible by accounting for CET uncertainty.

Note that integrated leak rates are higher with higher subcooling, while ADV steaming rates are similar. Thus the higher subcooling cases were utilized to maximize control room and offsite doses.

The following timeline was developed by Westinghouse based on the EOPs and their computer executions:

- 0000.0 sec Tube rupture occurs
- 0008.4 sec Proportional pressurizer heaters setpoint reached at 2275 psia
- 0066.4 sec Backup pressurizer heaters setpoint reached at 2200 psia
- 0348.4 sec Pressurizer heaters de-energize due to low pressurizer level at 270 ft<sup>3</sup>
- 0417.8 sec Low pressurizer pressure trip analysis setpoint reached at 1829 psia
- 0418.7 sec Trip breakers open, ADVs open
- 0420.8 sec MSSVs open
- 0421.7 sec Loss of forced circulation, RCPs begin to coastdown
- 0426.2 sec Maximum SG pressure is reached at 986 psia
- 0430.9 sec SIAS setpoint is reached at 1765 psia
- 0438.3 sec Pressurizer empties
- 0478.4 sec Safety injection flow begins to enter the RCS
- 0749.9 sec AFW actuation setpoint is reached for the unaffected SG
- 1018.5 sec AFW is initiated to unaffected SG at 100 gpm
- 1318.7 sec 15 minutes post-trip, Operator takes manual control of the plant, Begins cooldown via ADV of affected SG, Prevention of MSSV cycling
- 1438.7 sec AFW increases to 200 gpm to both SGs
- 1800.0 sec Operator opens pressurizer vent

- 2280.0 sec Adequate pressurizer level, Operator begins to throttle HPSIs
- 5040.0 sec Operator unblocks ADV of intact SG
- 7200.0 sec Affected SG isolated, 35°F/hr cooldown rate via ADV of intact SG

The dose-significant time-dependent results of the Westinghouse analysis are as follows:

RCS Mass (lbm)				
Mass(lbm)	Time(sec)	Code	Reference	Figure
443860	0	CESEC	CN-TAS-05-13	F 6.3.2.1-6
408050	650	CESEC	CN-TAS-05-13	F 6.3.2.1-6
418370	1318.8	CESEC	CN-TAS-05-13	F 6.3.2.1-6
391900	1318.8	COOL	CN-TAS-05-13	F 6.3.2.2-6
440000	2241	COOL	CN-TAS-05-13	F 6.3.2.2-6
493500	207900	COOL	CN-TAS-05-13	F 6.3.2.2-6

Affected SG Mass (lbm)				
Mass(lbm)	Time(sec)	Code	Reference	Figure
128214	0	CESEC	CN-TAS-05-13	F 6.3.2.1-11
167304	415	CESEC	CN-TAS-05-13	F 6.3.2.1-11
124644	750	CESEC	CN-TAS-05-13	F 6.3.2.1-11
129710	1318.8	CESEC	CN-TAS-05-13	F 6.3.2.1-11
139000	1318.8	COOL	CN-TAS-05-13	F 6.3.2.2-12
353700	6521	COOL	CN-TAS-05-13	F 6.3.2.2-12
343900	110000	COOL	CN-TAS-05-13	F 6.3.2.2-12
373200	172700	COOL	CN-TAS-05-13	F 6.3.2.2-12
126700	207900	COOL	CN-TAS-05-13	F 6.3.2.2-12

Unaffected SG Mass (lbm)				
Mass(lbm)	Time(sec)	Code	Reference	Figure
128213	0	CESEC	CN-TAS-05-13	F 6.3.2.1-11
128185	417.113	CESEC	CN-TAS-05-13	F 6.3.2.1-11
56420	1318.8	CESEC	CN-TAS-05-13	F 6.3.2.1-11
68480	1318.8	COOL	CN-TAS-05-13	F 6.3.2.2-12
150000	5331	COOL	CN-TAS-05-13	F 6.3.2.2-12
200000	21610	COOL	CN-TAS-05-13	F 6.3.2.2-12

Integrated Leak Flow form RCS to Affected SG (lbm)					
LR(lbm)	Time(sec)	Code	Reference	Figure	LR(lbm/min)
0	0	CESEC	CN-TAS-05-13	F 6.3.2.1-9	5393.2048
37303	415	CESEC	CN-TAS-05-13	F 6.3.2.1-9	3533.8378
48199	600	CESEC	CN-TAS-05-13	F 6.3.2.1-9	2783.2941
52142	685	CESEC	CN-TAS-05-13	F 6.3.2.1-9	3181.2875
85747	1318.8	CESEC	CN-TAS-05-13	F 6.3.2.1-9	2635.0837
312900	6491	COOL	CN-TAS-05-13	F 6.3.2.2-9	0.0000
312900	20210	COOL	CN-TAS-05-13	F 6.3.2.2-9	18.4718
360000	173200	COOL	CN-TAS-05-13	F 6.3.2.2-9	231.7003
494000	207900	COOL	CN-TAS-05-13	F 6.3.2.2-9	

Integrated MSSV Release from Affected SG (lbm)				
SR(lbm)	Time(sec)	Code	Reference	Figure
0	415	CESEC	CN-TAS-05-13	F 6.3.2.1-15
35960	600	CESEC	CN-TAS-05-13	F 6.3.2.1-15
37373	685	CESEC	CN-TAS-05-13	F 6.3.2.1-15

Integrated MSSV Release from Unaffected SG (lbm)				
SR(lbm)	Time(sec)	Code	Reference	Figure
0	415	CESEC	CN-TAS-05-13	F 6.3.2.1-15
35464	600	CESEC	CN-TAS-05-13	F 6.3.2.1-15
38814	685	CESEC	CN-TAS-05-13	F 6.3.2.1-15

Integrated ADV Release from Affected SG (lbm)				
SR(lbm)	Time(sec)	Code	Reference	Figure
0	415	CESEC	CN-TAS-05-13	F 6.3.2.1-17
16127	600	CESEC	CN-TAS-05-13	F 6.3.2.1-17
23718	685	CESEC	CN-TAS-05-13	F 6.3.2.1-17
76556	1318.8	CESEC	CN-TAS-05-13	F 6.3.2.1-17
163866	4921	COOL	CN-TAS-05-13	F 6.3.2.2-15
163896	172800	COOL	CN-TAS-05-13	F 6.3.2.2-15
508156	207900	COOL	CN-TAS-05-13	F 6.3.2.2-15

Integrated ADV Release from Unaffected SG (lbm)					
SR(lbm)	Time(sec)	Code	Reference	Figure	SR(lbm/s)
0	5031	COOL	CN-TAS-05-13	F 6.3.2.2-15	936.0720
3165000	207900	COOL	CN-TAS-05-13	F 6.3.2.2-15	

Note that for conservatism, the integrated MSSV steam releases from the affected and unaffected SGs are added to the integrated ADV steam release from the affected SG.

Integrated Steam Release from Affected SG (lbm)					
Time(sec)	ADVA(lbm)	MSSVA(lbm)	MSSVU(lbm)	SRA(lbm)	SRA(lbm/min)
0	0	0	0	0	0.0000
415	0	0	0	0	28394.9189
600	16127	35960	35464	87551	8720.4706
685	23718	37373	38814	99905	5002.0196
1318.8	76556	37373	38814	152743	1454.2779
4921	163866	37373	38814	240053	0.0107
172800	163896	37373	38814	240083	588.4786
207900	508156	37373	38814	584343	

Flashing Fraction in Affected SG				
Flash Fraction	Time(sec)	Code	Reference	Figure
0.135	0-600	CESEC	CN-TAS-05-13	F 6.3.2.1-10
0.045	600-1318.6	CESEC	CN-TAS-05-13	F 6.3.2.1-10
0.055	1318.6-207900	CESEC	CN-TAS-05-13	F 6.3.2.1-10

Flashing Fraction in Unaffected SG				
Flash Fraction	Time(sec)	Code	Reference	Figure
0.070	0-207900	COOL	CN-TAS-05-13	F 6.3.2.2-11

### (9.B) Primary and Secondary Specific Activities

An EXCEL spreadsheet (Attachment A) was developed to calculate the activity released to the primary and secondary systems post-SGTR. Four sets of isotopic activities were generated:

- Technical Specification Primary iodine and noble gas activities
- Technical Specification Secondary iodine activities
- Preaccident Iodine Spike (PIS) primary activities
- Concurrent Iodine Spike (CIS) primary activities

#### (9.B.1) Primary Specific Activities

The initial primary specific activities in  $\mu\text{Ci/gm}$  consistent with the TS 3.4.15 1.0  $\mu\text{Ci/gm}$  limit were extracted from Ref.4 and are listed in column E of Attachment A. These were converted to total primary isotopic source terms in Ci in Attachment A column F via the following algorithm:

$$A_{i0} = \text{AST}_i * M_{\text{RCS}} * 0.000001$$

where  $\text{AST}_i$  = Isotopic activity per unit mass ( $\mu\text{Ci/gm}$ ) (Ref.04 and Attachment A Column E)  
 $M_{\text{RCS}}$  = Water mass in RCS (gm)

The primary iodine isotopic source terms were then halved in Attachment A column G to reflect that the TS 3.4.15 limit for primary activity will be reduced from 1.0  $\mu\text{Ci/gm}$  to 0.5  $\mu\text{Ci/gm}$ .

#### (9.B.2) Secondary Specific Activities

The initial secondary specific activities in  $\mu\text{Ci/gm}$  consistent with the TS 3.7.14 0.1  $\mu\text{Ci/gm}$  limit were extracted from Ref.4 and are listed in column C of Attachment A. These were converted to total secondary isotopic source terms in Attachment A column D via the following algorithm:

$$A_{i0} = \text{AST}_i * M_{\text{SG}} * 0.000001$$

where  $\text{AST}_i$  = Isotopic activity per unit mass ( $\mu\text{Ci/gm}$ ) (Ref.04)  
 $M_{\text{SG}}$  = Water mass in SG (gm)

These isotopic activities were inserted into the nuclear inventory file SEC05.NIF for use by RADTRAD. The file is listed in Attachment E and consist of the 5 iodine isotopes. The activities are the total secondary activities and are not per unit power. Thus a power of one should be designated when employing these files.

#### (9.B.3) Preaccident Iodine Spike Primary Specific Activities

The primary specific activities in Ci consistent with a Preaccident Iodine Spike (PIS) of 60 per RG 1.183 and with the TS 3.4.15 1.0  $\mu\text{Ci/gm}$  limit were extracted from Ref.4 and are listed in column H of Attachment A. The primary iodine isotopic source terms were then halved in Attachment A column I to reflect that the TS 3.4.15 limit for primary activity will be reduced from 1.0  $\mu\text{Ci/gm}$  to 0.5  $\mu\text{Ci/gm}$ .

These isotopic activities were inserted into the nuclear inventory file PIS.NIF for use by RADTRAD. The file is listed in Attachment D and consists of the 5 iodine and 9 noble gas isotopes. The activities are the total primary activities and are not per unit power. Thus a power of one should be designated when employing these files.

#### (9.B.4) Concurrent Iodine Spike Primary Specific Activities

The primary specific activities in Ci consistent with a Concurrent Iodine Spike (CIS) of 335 per RG 1.183, with a duration of 8 hours per RG 1.183, and with the TS 3.4.15 1.0  $\mu\text{Ci/gm}$  limit were extracted from Ref.4 and are listed

in column J of Attachment A. The primary iodine isotopic source terms were then halved in Attachment A column K to reflect that the TS 3.4.15 limit for primary activity will be reduced from 1.0  $\mu\text{Ci/gm}$  to 0.5  $\mu\text{Ci/gm}$ .

These isotopic activities were inserted into the nuclear inventory file CIS3358.NIF for use by RADTRAD. The file is listed in Attachment C and consists of the 5 iodine and 9 noble gas isotopes. The activities are the total primary activities and are not per unit power. Thus a power of one should be designated when employing these files.

#### (9.C) RADTRAD Computations

The current work re-analyzes control room habitability for SGTR based on the alternate source term methodology of Ref.08 and control room inleakage of 3500 cfm. This was accomplished by utilizing the RADTRAD computer code (Refs.13-15).

The RADTRAD computer code calculates TEDE and thyroid doses to personnel at the site boundary, low population zone, and control room per 10 CFR 50.67 resulting from any postulated accident which releases radioactivity within the containment, spent fuel pool, or within any primary or secondary system. RADTRAD models the transport of up to 63 radionuclides from the source region, through a secondary region if any, and then to the environment and to the control room. The code includes the capability to model time-dependent activity release; time-dependent spray/filtration/deposition removal processes, piping/filter/inleakage transfer mechanisms, atmospheric dispersion; and natural decay. RADTRAD is documented and benchmarked in Refs.13-17.

Four SGTR scenarios were modeled in this work:

- Cooldown of the RCS via the ADV of the affected SG from 0-2 hours and via the unaffected SG from 0-30 days with PIS primary activity.
- Cooldown of the RCS via the ADV of the affected SG from 0-2 hours and via the unaffected SG from 0-30 days with CIS primary activity.
- Cooldown of the RCS via the ADV of the affected SG from 0-2 hours and from 24-32 hours and via the unaffected SG from 0-32 hours with PIS primary activity.
- Cooldown of the RCS via the ADV of the affected SG from 0-2 hours and from 24-32 hours and via the unaffected SG from 0-32 hours with CIS primary activity.

Each SGTR model is composed of six release components:

- Primary iodine activity release from the affected SG
- Primary noble gas activity release from the affected SG
- TS secondary iodine activity release from the affected SG
- Primary iodine activity release from the unaffected SG
- Primary noble gas activity release from the unaffected SG
- TS secondary iodine activity release from the unaffected SG

The SGTR occurs at time  $t=0$  with the PIS primary activity and the TS secondary activity uniformly distributed throughout their respective systems. The SGTR occurs at time  $t=0$  with the TS secondary activity uniformly distributed throughout the secondary system and with the CIS primary activity released homogeneously into the primary system over an 8 hour duration. The primary noble gases are released at a 200 gpd rate into the unaffected steam generator and at the time-dependent tube rupture leak rate into the affected SG and then directly through the ADVs and MSSVs into the environment, when the ADVs and MSSVs are in the open position. The primary iodines are released at a 200 gpd rate into the unaffected steam generator and at the time-dependent tube rupture leak rate into the affected SG, where a percentage is vented directly through the ADVs and MSSVs into the environment via flashing. The remaining iodines are added to the secondary system, which is released by steaming with a partition factor of 100 out of the ADVs, when the ADVs and MSSVs are in the open position. No cleanup mechanisms (spray, filtration, plateout) are assumed in the primary or secondary systems. The activity released to the environment is transported to the site boundary and to the control room via appropriate atmospheric dispersion coefficients. While time-dependent control room inleakage can be modeled by RADTRAD, it is a constant in this work. Control room filtration is credited in this work. The control room and site boundary doses are calculated based on appropriate breathing rates and occupancy factors and on FGR 11 and 12 dose conversion factors.

#### (9.D) Time to Cooldown Via ADV of Unaffected Steam Generator

Westinghouse calculation CN-TAS-05-13 did not run the COOL executions to SDC conditions without the use of SG blowdown or the affected SG but stopped the execution at 200 hours. Extrapolation of the 200 hour cooldown (Attachment B) indicates that it will take approximately 14 days to reach SDC conditions.

Attachment B also includes an EXCEL spreadsheet, which compares maximum SG cooldown rates from an open ADV with the decay heat generation rates. The spreadsheet employs the CRITCO critical mass flow rate correlation from CN-TAS-05-13 (Ref.5) Section 6.2.13.6 to calculate maximum steam flow through the ADVs as a function of source pressure.

- $W(\text{lbm/sec}) = (0.049 \text{ ft}^2) * (1977.6 \text{ ft/sec}) * p(\text{psia}) / (h-185.0)$

where p is the source pressure and h the steam enthalpy from the steam tables (Ref.31). The cooldown rate can then be readily calculated as

- $C(\text{btu/sec}) = W(\text{lbm/sec}) * (h-80)$

where 80 is the enthalpy of the AFW entering the SG per Ref.12. The decay heat generation rate can then be calculated via the ANS/ANSI-1979 correlation (Ref.36). The cooldown rate at a SG temperature of 290°F (10°F less than SDC conditions) is approximately equal to the decay heat generation rate at 14 days, which agrees with the extrapolation performed above.



## 10. CALCULATIONS

The following computations were performed in this calculational package for the CIS SGTR:

CIS Files	2-hour	2-hour	30-day	30-day	2-hour
Steam Generator	Affected	Affected	Unaffected	Unaffected	Affected
Activity Source	Primary	Primary	Primary	Primary	Secondary
Radionuclide Component	Iodine	Noble Gas	Iodine	Noble Gas	Iodine
Case Input Files	sgtrcai.psf	sgtrcan.psf	sgtrcui.psf	sgtrcun.psf	sgtrcas.psf
Dose Conversion Factor File	fgr14.inp	fgr14.inp	fgr14.inp	fgr14.inp	fgr05.inp
Release Fraction/Timing File	sgtrci8.rft	sgtrcn.rft	sgtrci8.rft	sgtrcn.rft	sgtrsec.rft
Nuclear Inventory File	cis3358.nif	cis3358.nif	cis3358.nif	cis3358.nif	sec05.nif
Case Output Files	sgtrcai.o0	sgtrcan.o0	sgtrcui.o0	sgtrcun.o0	sgtrcas.o0
CIS Files	30-day	32-hour	32-hour	32-hour	32-hour
Steam Generator	Unaffected	Affected	Affected	Unaffected	Unaffected
Activity Source	Secondary	Primary	Primary	Primary	Primary
Radionuclide Component	Iodine	Iodine	Noble Gas	Iodine	Noble Gas
Case Input Files	sgtrcus.psf	sgtrcaim.psf	sgtrcanm.psf	sgtrcuim.psf	sgtrcunm.psf
Dose Conversion Factor File	fgr05.inp	fgr14.inp	fgr14.inp	fgr14.inp	fgr14.inp
Release Fraction/Timing File	sgtrsec.rft	sgtrci8.rft	sgtrcn.rft	sgtrci8.rft	sgtrcn.rft
Nuclear Inventory File	sec05.nif	cis3358.nif	cis3358.nif	cis3358.nif	cis3358.nif
Case Output Files	sgtrcus.o0	sgtrcaim.o0	sgtrcanm.o0	sgtrcuim.o0	sgtrcunm.o0

The following computations were performed in this calculational package for the PIS SGTR:

PIS Files	2-hour	2-hour	30-day	30-day	2-hour
Steam Generator	Affected	Affected	Unaffected	Unaffected	Affected
Activity Source	Primary	Primary	Primary	Primary	Secondary
Radionuclide Component	Iodine	Noble Gas	Iodine	Noble Gas	Iodine
Case Input Files	sgtrpai.psf	sgtrpan.psf	sgtrpui.psf	sgtrpun.psf	sgtrpas.psf
Dose Conversion Factor File	fgr14.inp	fgr14.inp	fgr14.inp	fgr14.inp	fgr05.inp
Release Fraction/Timing File	sgtrpi.rft	sgtrpn.rft	sgtrpi.rft	sgtrpn.rft	sgtrsec.rft
Nuclear Inventory File	pis.nif	pis.nif	pis.nif	pis.nif	sec05.nif
Case Output Files	sgtrpai.o0	sgtrpan.o0	sgtrpui.o0	sgtrpun.o0	sgtrpas.o0
PIS Files	30-day	32-hour	32-hour	32-hour	32-hour
Steam Generator	Unaffected	Affected	Affected	Unaffected	Unaffected
Activity Source	Secondary	Primary	Primary	Primary	Primary
Radionuclide Component	Iodine	Iodine	Noble Gas	Iodine	Noble Gas
Case Input Files	sgtrpus.psf	sgtrpaim.psf	sgtrpanm.psf	sgtrpuim.psf	sgtrpunm.psf
Dose Conversion Factor File	fgr05.inp	fgr14.inp	fgr14.inp	fgr14.inp	fgr14.inp
Release Fraction/Timing File	sgtrsec.rft	sgtrpi.rft	sgtrpn.rft	sgtrpi.rft	sgtrpn.rft
Nuclear Inventory File	sec05.nif	pis.nif	pis.nif	pis.nif	pis.nif
Case Output Files	sgtrpus.o0	sgtrpaim.o0	sgtrpanm.o0	sgtrpuim.o0	sgtrpunm.o0

## 11. DOCUMENTATION OF COMPUTER CODES

This work employed the RADTRAD computer code, which was verified, benchmarked, and documented in Refs.13-17 and which models the transport of halogen and noble gas isotopes from a primary system to a secondary system and thence to the environment and control room. The installation of RADTRAD is detailed in Ref.16 and the validation in Ref.17.

The RADTRAD computer code can calculate TEDE and thyroid doses to personnel at the site boundary, low population zone, and control room per the alternate source term methodology 10 CFR 50.67 and Regulatory Guide 1.183 or can calculate whole body and thyroid doses to personnel at the site boundary, low population zone, and control room per the standard source term methodology of TID-14844 (Ref.18) resulting from any postulated accident which releases radioactivity within the containment, spent fuel pool, or within any primary system. RADTRAD models the transport of radioactivity from up to 63 radioisotopes from the sprayed and unsprayed regions of a primary containment or a SFP area, through the secondary containment if any, and then to the environment and to the control room. The code includes the capability to model time-dependent activity release; containment spray, filtration, and leakage; control room filtration and inleakage; primary and secondary containment purge filters; control room intake filters; atmospheric dispersion; and natural decay. Doses are calculated for individuals residing at the site boundary or low population zone and in the control room.

Some inputs for the RADTRAD computer program were generated via an EXCEL spreadsheet.

## 12. RESULTS

The limiting Steam Generator Tube Rupture (SGTR) event as re-analyzed by Westinghouse in CN-TAS-05-13 (Ref.05) is considered to be a complete double-ended tube break and is postulated to occur due to a complete failure of a tube-to-sheet weld or the rapid propagation of a circumferential crack. The SGTR event allows primary coolant to leak into the secondary side via the steam generator (SG). The primary coolant transfer causes the pressurizer level to decrease, provided that the tube leak rate exceeds the charging pump capacities and causes the level in the affected steam generator to increase. In the case of the double ended tube rupture, the leak rate far exceeds the charging pump capacities and, consequently, the pressurizer level will decrease. The decrease in the pressurizer level and the inability of the heaters to maintain pressurizer pressure causes the Reactor Coolant System (RCS) pressure to decrease. The drop in the pressure will cause a reactor trip on Thermal Margin/Low Pressure (TM/LP), ensuring that the Departure from Nucleate Boiling (DNB) Specified Acceptable Fuel Design Limit (SAFDL) is not exceeded. Peak Linear Heat Rate (PLHR) is of no concern because there is no appreciable power increase during the transient. The decrease in pressurizer level continues until the pressurizer empties, dropping the primary pressure to the hot leg saturation pressure. An upper head void begins to appear and a Safety Injection Actuation Signal (SIAS) is actuated. The High Pressure Safety Injection (HPSI) flow first contributes to further reduction of the primary pressure due to its cooling effect but eventually injects enough coolant to refill the pressurizer, restore the primary pressure to provide subcooling, and collapse the upper head void. The reactor trip also generates a turbine trip causing the secondary pressure to rapidly increase due to closure of the turbine valve. In the assumed evolution, the steam bypass valves are not available to mitigate the rise in secondary pressure. The action of the Atmospheric Dump Valves (ADV) and Main Steam Safety Valves (MSSVs) will limit the secondary pressure until the operator is able to assume control. The operator identifies the event from the radiation alarms, the increasing radioactivity in the condenser off-gas monitor, steam generator blowdown monitor, stack gas or main stream line monitors, the reactor trip on low RCS pressure, the decreasing pressurizer level, and the increasing water level in the affected steam generator.

After the operator identifies the event, the operator initiates a cooldown of the RCS according to the SGTR Emergency Operating Procedure-6 (EOP-6 Reference 10). This cooldown is performed to relieve secondary pressure and stop the cycling of the MSSVs by bringing the primary hot leg temperature down to 515°F. In this analysis, the single failure blocks the ADV of the intact steam generator at the beginning of the event. Thus, this initial cooldown is carried out using the ADV of the affected SG only. The operator will be required to identify this additional factor, initiate action to unblock the ADV of the intact steam generator, and isolate the affected SG to mitigate the release of radioactivity to the environment. After the operator isolates the affected steam generator, the operator will continue cooling down the RCS using the intact steam generator. The affected steam generator level will be maintained by using backflow to the RCS.

At this point, the operator has three cooldown modes to attain shutdown cooling (SDC) conditions:

- The operator continues the cooldown via the ADV of the unaffected SG until the SDC entry conditions are reached. It will take approximately 14 days for the decay heat generation to decline to a level that can be removed via a single SG and ADV. Note that a thirty day cooldown via the ADV of the unaffected SG is conservatively modeled in this work.
- The operator continues the cooldown via the ADV of the unaffected SG but also loads SG blowdown to the Waste Processing System (WPS) on to the backup power sources, so that SG blowdown may be used during the event. Note that use of SG blowdown can occur at any point that space in the Miscellaneous Waste Receiver Tank and/or Miscellaneous Waste Monitor Tank allows. Thus the maximum offsite and control room doses are identical to those of the first option.
- The operators can re-open the ADV of the affected SG for up to 8 hours after an initial cooldown of 24 hours post-accident.

Previously, power reactor licensees have typically used the U.S.A.E.C Technical Information Document TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites," (Ref.18) as the basis for DBA analysis

source terms. TID-14844 is referenced in 10 CFR 100.11, the power reactor siting regulation, which contains offsite dose limits in terms of whole body and thyroid doses. In December 1999, the NRC issued a new regulation, 10 CFR 50.67, "Accident Source Term," which provided a mechanism for licensed power reactors to replace the traditional accident source term used in their DBA analyses with an alternate source term. Regulatory guidance for the implementation of these ASTs is provided in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" (Ref.08). Section 50.67 of 10 CFR requires a licensee seeking to use AST to apply for a license amendment and requires that the application contain an evaluation of the consequences of affected DBAs. As part of the implementation of the AST, the total effective dose equivalent (TEDE) acceptance criterion of 10 CFR 50.67 replaces the previous whole body and thyroid dose guidelines of 10 CFR 100.11 and 10 CFR 50, Appendix A, GDC-19 for the loss-of-coolant accident (LOCA), the main steam line break (MSLB), the steam generator tube rupture (SGTR), the seized rotor event (SRE), the fuel handling accident (FHA), and the control rod ejection accident (CREA). The NSSS response to the SGTR was simulated using the CESEC and COOL computer codes.

The current work utilizes the alternate source term (AST) methodology of 10 CFR 50.67 and Regulatory Guide 1.183 to calculate offsite and control room doses for a SGTR. Modification of the control room emergency ventilation system to a nominal 10000 cfm flow with a 90% filtration efficiency for elemental and organic iodine and a 99% filtration efficiency for particulate iodine was credited. Also credited was installation of automatic isolation dampers and radiation monitors at Access Controls 11 and 13 on the Auxiliary Building Roof. This modification limits activity ingress into the control room from either the West Road Inlet or the Turbine Building, thus limiting the atmospheric dispersion coefficient value. The Technical Specification limit for RCS activity was reduced from 1.0  $\mu\text{Ci/gm}$  to 0.5  $\mu\text{Ci/gm}$ .

Per RG 1.183 (Ref.08), if no or minimal fuel damage is postulated, the activity should be the maximum coolant activity allowed by the technical specifications, assuming two cases of iodine spiking. Thus, two cases are modeled to determine the maximum offsite and control room doses.

- Preaccident Iodine Spike (PIS) Case: A reactor transient has occurred prior to the postulated SGTR and has raised the primary coolant iodine concentration to the maximum value permitted by the TSs, which is sixty times the TS 3.4.15 limit of 0.5  $\mu\text{Ci/gm}$ .
- Concurrent Iodine Spike (CIS) Case: The primary system transient associated with the SGTR causes an iodine spike in the primary system. The increase in primary coolant iodine concentration is estimated using a spiking model that assumes the iodine release rate from the fuel rods to the primary coolant increases to a value 335 times greater than the release rate corresponding to the iodine concentration at the equilibrium value. Per RG 1.183, the assumed iodine spike duration should be 8 hours.

The exclusion area boundary (EAB), low population zone (LPZ), and control room (CR) doses for the design-basis CIS and PIS SGTR for the three cooldown modes described previously (cooldown via ADV of unaffected SG from 2 hours to 30 days, cooldown via ADV of affected SG from 24-32 hours, and cooldown via blowdown to the WPS (same doses as first cooldown mode)) and for the two primary source terms (CIS and PIS) are detailed in the following tables.

CIS SGTR Results for 30 Day ADV Cooldown Via Unaffected SG				
	EAB	LPZ	CR	Att
Affected ADV 0-2 hr	Rem	Rem	Rem	
Iodine Affected SG	1.2717E-01	2.9938E-02	9.3750E-01	M
Noble Gas Affected SG	6.8532E-02	1.6134E-02	9.6455E-02	N
Iodine Unaffected SG	1.2765E-04	2.1304E-03	6.4341E-01	O
Noble Gas Unaffected SG	4.2657E-05	2.1764E-05	6.1242E-04	P
Secondary Affected SG	4.0834E-04	9.6140E-05	3.6907E-03	Q
Secondary Unaffected SG	1.3065E-04	9.4724E-05	2.6449E-02	R
Total	0.1964	0.0484	1.7081	
Regulatory Limits	2.5000	2.5000	5.0000	

PIS SGTR Results for 30 Day ADV Cooldown Via Unaffected SG				
	EAB	LPZ	CR	Att
Affected ADV 0-2 hr	Rem	Rem	Rem	
Iodine Affected SG	4.2164E-01	9.9262E-02	3.8150E+00	W
Noble Gas Affected SG	6.8532E-02	1.6134E-02	9.6455E-02	X
Iodine Unaffected SG	2.8016E-04	7.6090E-04	2.1679E-01	Y
Noble Gas Unaffected SG	4.2657E-05	2.1764E-05	6.1242E-04	Z
Secondary Affected SG	4.0834E-04	9.6140E-05	3.6907E-03	AA
Secondary Unaffected SG	1.3065E-04	9.4724E-05	2.6449E-02	AB
Total	0.4910	0.1164	4.1590	
Regulatory Limits	25.0000	25.0000	5.0000	

CIS SGTR Results for 8 Hour ADV Cooldown Via Affected SG				
SGTR Results CIS	EAB	LPZ	CR	Att
Affected ADV 0-2 & 24-32 hr	Rem	Rem	Rem	
Iodine Affected SG	1.2717E-01	3.1076E-02	1.4981E+00	S
Noble Gas Affected SG	6.8532E-02	1.6160E-02	9.8137E-02	T
Iodine Unaffected SG	1.2765E-04	2.0510E-04	6.6235E-02	U
Noble Gas Unaffected SG	4.2672E-05	1.4890E-05	3.0975E-04	V
Secondary Affected SG	4.0834E-04	9.6140E-05	3.6907E-03	Q
Secondary Unaffected SG	1.3065E-04	9.4724E-05	2.6449E-02	R
Total	0.1964	0.0476	1.6929	
Regulatory Limits	2.5000	2.5000	5.0000	

PIS SGTR Results for 8 Hour ADV Cooldown Via Affected SG				
SGTR Results PIS	EAB	LPZ	CR	Att
Affected ADV 0-2 & 24-32 hr	Rem	Rem	Rem	
Iodine Affected SG	4.2164E-01	9.9652E-02	4.0084E+00	AC
Noble Gas Affected SG	6.8532E-02	1.6160E-02	9.8137E-02	AD
Iodine Unaffected SG	2.8016E-04	1.3454E-04	2.8553E-02	AE
Noble Gas Unaffected SG	4.2672E-05	1.4890E-05	3.0975E-04	AF
Secondary Affected SG	4.0834E-04	9.6140E-05	3.6907E-03	AA
Secondary Unaffected SG	1.3065E-04	9.4724E-05	2.6449E-02	AB
Total	0.4910	0.1162	4.1655	
Regulatory Limits	25.0000	25.0000	5.0000	

### 13. CONCLUSIONS

The exclusion area boundary (EAB), low population zone (LPZ), and control room (CR) doses for the design-basis CIS and PIS SGTR for the three cooldown modes described previously (cooldown via ADV of unaffected SG from 2 hours to 30 days, cooldown via ADV of affected SG from 24-32 hours, and cooldown via blowdown to the WPS) are detailed in the following table.

SGTR Results			
	EAB	LPZ	CR
	Rem	Rem	Rem
CIS Unaffected ADV 0-30 days	0.1964	0.0484	1.7081
CIS Affected ADV 0-2/24-32 hr	0.1964	0.0476	1.6929
CIS Affected ADV 0-2 hr/WPS	0.1964	0.0484	1.7081
CIS Regulatory Limits	2.5000	2.5000	5.0000
PIS Unaffected ADV 0-30 days	0.4910	0.1164	4.1590
PIS Affected ADV 0-2/24-32 hr	0.4910	0.1162	4.1655
PIS Affected ADV 0-2 hr/WPS	0.4910	0.1164	4.1590
PIS Regulatory Limits	25.0000	25.0000	5.0000

Note that all values are below the regulatory limits. Also note that the additional dose generated by opening the ADV of the affected SG for 8 hours 24 hours into the accident is approximately equal to the dose that would have been generated by the ADV of the unaffected SG being open from 32 hours to 30 days. Thus, cooldown of the reactor to SDC conditions can occur via all three cooldown modes (cooldown via ADV of unaffected SG from 0 to 30 days, cooldown via ADV of affected SG from 0-2 and 24-32 hours, and cooldown via blowdown to the WPS) with approximately the same offsite and control room doses being generated by each.

This work relies on the following modifications and new methodologies:

- Modification of the control room emergency ventilation system to a nominal 10000 cfm flow with a 90% filtration efficiency for elemental and organic iodine was credited.
- Installation of automatic isolation dampers and radiation monitors at Access Controls 11 and 13 on the Auxiliary Building Roof was credited.
- Alternate Source Term Methodology was employed.
- The Technical Specification limit for RCS activity was reduced from 1.0  $\mu\text{Ci/gm}$  to 0.5  $\mu\text{Ci/gm}$ .

## 14. ATTACHMENTS

### ATTACHMENT A SGTR EVENT RELEASE ACTIVITIES

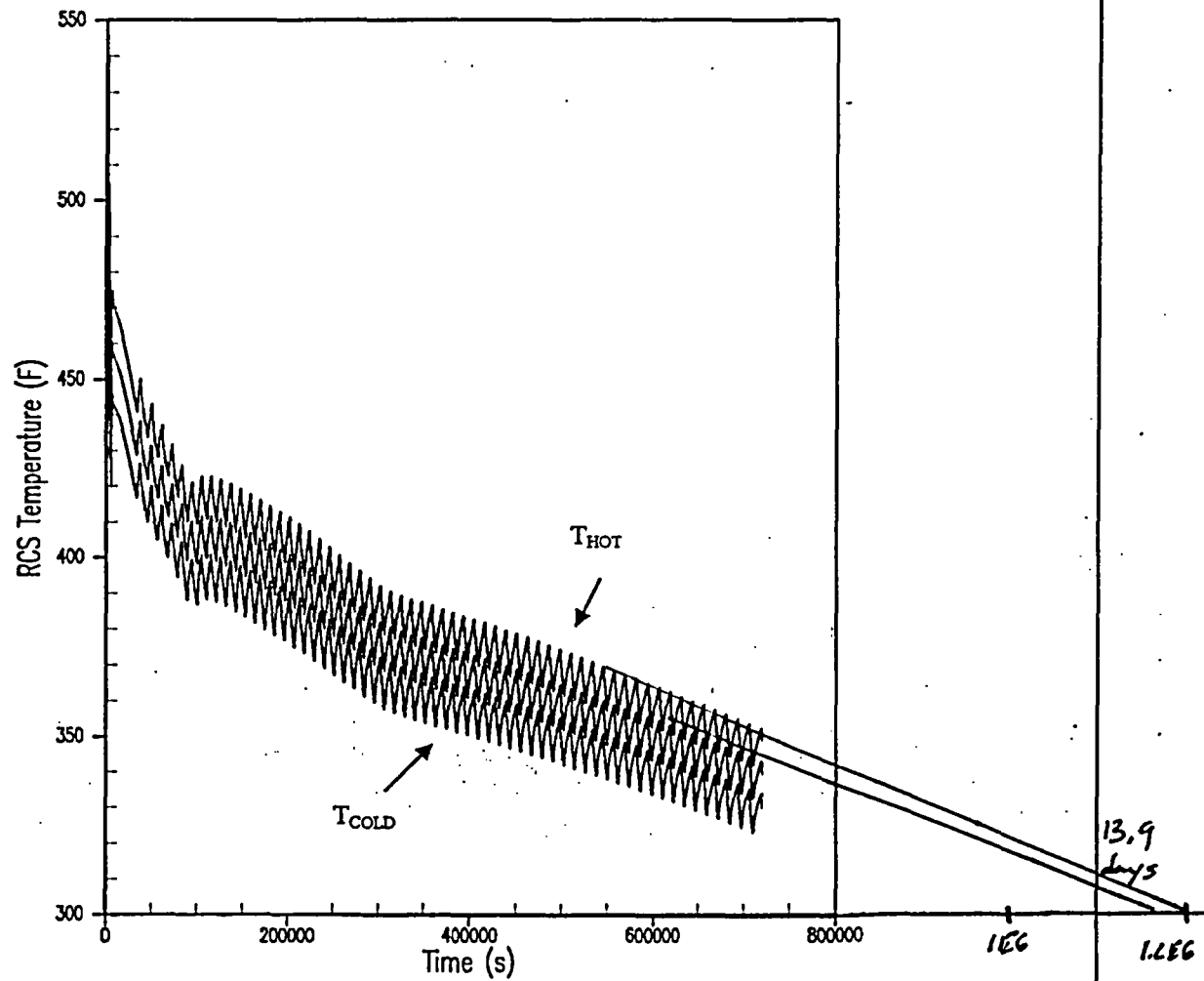
Calculation of SGTR Release Activities							
			0.1 $\mu\text{Ci/g}$	0.1 $\mu\text{Ci/g}$	1 $\mu\text{Ci/g}$	1 $\mu\text{Ci/g}$	0.5 $\mu\text{Ci/g}$
	Half-life	lambda	Secondary	Secondary	Primary	Primary	Primary
			Source	Source	Source	Source	Source
	sec	1/sec	microCi/g	Ci	microCi/g	Ci	Ci
	A	B	C	D	E	F	G
Kr-85	3.3830E+08	2.0489E-09			3.8761E+01	7.9975E+03	7.9975E+03
Kr-85m	1.6128E+04	4.2978E-05			2.0344E+00	4.1975E+02	4.1975E+02
Kr-87	4.5780E+03	1.5141E-04			1.1747E+00	2.4238E+02	2.4238E+02
Kr-88	1.0224E+04	6.7796E-05			3.6579E+00	7.5473E+02	7.5473E+02
I-131	6.9466E+05	9.9783E-07	8.9260E-02	1.1172E+01	7.7893E-01	1.6071E+02	8.0357E+01
I-132	8.2800E+03	8.3713E-05	2.2758E-03	2.8485E-01	2.5868E-01	5.3372E+01	2.6686E+01
I-133	7.4880E+04	9.2568E-06	5.7417E-02	7.1866E+00	1.0972E+00	2.2638E+02	1.1319E+02
I-134	3.1560E+03	2.1963E-04	5.2168E-04	6.5297E-02	1.4798E-01	3.0532E+01	1.5266E+01
I-135	2.3796E+04	2.9129E-05	1.3584E-02	1.7003E+00	6.0207E-01	1.2422E+02	6.2112E+01
Xe-133	4.5317E+05	1.5296E-06			4.0021E+02	8.2574E+04	8.2574E+04
Xe-135	3.2724E+04	2.1182E-05			9.5607E+00	1.9726E+03	1.9726E+03
Xe-133m	1.8922E+05	3.6632E-06			5.7016E+00	1.1764E+03	1.1764E+03
Xe-135m	9.1800E+02	7.5506E-04			1.2511E+00	2.5814E+02	2.5814E+02
Xe138	8.4600E+02	8.1932E-04			6.6019E-01	1.3622E+02	1.3622E+02
	60 $\mu\text{Ci/g}$	30 $\mu\text{Ci/g}$	8 Hour	8 Hour			
	PIS	PIS	335 CIS	335 CIS/2			
	Source	Source	Source	Source			
	Ci	Ci	Ci	Ci			
	H	I	J	K			
Kr-85	7.9975E+03	7.9975E+03	7.9975E+03	7.9975E+03			
Kr-85m	4.1975E+02	4.1975E+02	4.1975E+02	4.1975E+02			
Kr-87	2.4238E+02	2.4238E+02	2.4238E+02	2.4238E+02			
Kr-88	7.5473E+02	7.5473E+02	7.5473E+02	7.5473E+02			
I-131	9.6428E+03	4.8214E+03	2.9841E+04	1.4920E+04			
I-132	3.2023E+03	1.6012E+03	5.2880E+04	2.6440E+04			
I-133	1.3583E+04	6.7914E+03	6.0066E+04	3.0033E+04			
I-134	1.8319E+03	9.1595E+02	7.0070E+04	3.5035E+04			
I-135	7.4534E+03	3.7267E+03	5.6990E+04	2.8495E+04			
Xe-133	8.2574E+04	8.2574E+04	8.2574E+04	8.2574E+04			
Xe-135	1.9726E+03	1.9726E+03	1.9726E+03	1.9726E+03			
Xe-133m	1.1764E+03	1.1764E+03	1.1764E+03	1.1764E+03			
Xe-135m	2.5814E+02	2.5814E+02	2.5814E+02	2.5814E+02			
Xe138	1.3622E+02	1.3622E+02	1.3622E+02	1.3622E+02			

A	Half-lives: Chart of the Nuclides Fifteenth Edition'						
B	Decay constants: $\text{Ln}(2/\lambda(t))$						
C	Secondary Source in $\mu\text{Ci/gm}$ : CA06422						
D	Secondary Source in Ci for 0.1 $\mu\text{Ci/gm}$ total ( $I^*M2sg^*1.e-6$ ): CA06422						
E	Primary Source in $\mu\text{Ci/gm}$ : CA06422						
F	Primary Source in Ci for 1.0 $\mu\text{Ci/gm}$ total ( $F^*Mtot^*1.e-6$ ): CA06422						
G	Primary Source in Ci for 0.5 $\mu\text{Ci/gm}$ total: CA06422						
H	PIS Source for 60 $\mu\text{Ci/gm}$ from CA06422						
I	PIS Source for 30 $\mu\text{Ci/gm}$ from CA06422						
J	335 CIS Source for 8 hour release from CA06422						
K	335 CIS Source for 8 hour release for 0.5 $\mu\text{Ci/gm}$ from CA06422						
Compartment							
1	RCS(cf)	7286.18					
	Vrcs(cf)	9576		UFSAR T4.1			
	Vpzz(cf)	600		UFSAR T4.7			
	vrcs(cf/lbm)	0.022132		Steam Tables @ 574.5 F & 2250 psia - UFSAR T4.1 F4.9			
	vpzz(cf/lbm)	0.02703		Steam Tables @ 653 F & 2250 psia - UFSAR T4.7			
	Mrcs(lbm)	432676.67		Vrcs/vrcs			
	Mpzz(lbm)	22197.56		Vpzz/vpzz			
	Mtot(lbm-g)	454874.23	206327482.1	Mrcs+Mpzz			
	vstp(cf/lbm)	0.016018		Steam Tables @ 1 gm/cc			
	Vtot(cf)	7286.18		Mtot*vstp @ STP			
2	SG(cf)	4420.04					
	M2sg(lbm-g)	275942.00	125165188.2	WEC 222-7811-A45 Sheet 30 - 102%FP			
	V2sg(cf)	4420.04		M2sg*vstp @ STP			
3	AFW(cf)	10000.00					
4	Environment						
5	Control Room	289194 cf	9000 cfm (0.3333-720 hr)		90/99/90-e/p/o		



**ATTACHMENT B  
ADV CHOKE FLOW VS DECAY HEAT CALCULATIONS**

Steam Flow Rate through the ADVs								
Atmospheric pressure (psia)	14.700		Ref. NEU-94-151					
Resistance coefficient (K)	9.820		Ref. NEU-94-151					
Maximum DP/PI		0.771	Ref. NEU-94-151		Crane P.A-22			
Expansion Factor (Y)		0.704	Ref. NEU-94-151		Crane P.A-22			
Limiting Diameter di(in-m)		3.760	0.095504	Ref. NEU-94-151				
Exit Diameter de(in-m)		10.020	0.254508	Ref. NEU-94-151				
Correlation		0.049	1977.6		Ref.CN-TAS-05-13			
S.G.	S.G.	S.G.	Exit	Exit	Limiting	Enthalpy		Cooldown
Temp	Pressure	Specific Vol	Pressure	Specific Vol	Mass Flow	SG	AFW	Rate
TSG	PSG	SVSG	PEX	SVEX	MFEX	h(g)	hfw	CDR
F	psia	ft <sup>3</sup> /lbm	psia	ft <sup>3</sup> /lbm	lbm/sec	btu/lbm	btu/lbm	btu/sec
290.000	57.546	7.461	13.178	29.678	5.622	1176.80	80.000	6002.122
300.000	67.000	6.466	15.343	25.742	6.527	1179.70	80.000	7006.664
344.343	125.000	3.586	28.625	14.360	12.041	1191.00	80.000	13206.457
372.000	177.660	2.563	40.684	10.332	17.017	1196.70	80.000	18866.373
400.000	247.290	1.863	56.629	7.575	23.586	1201.00	80.000	26361.761
500.000	680.610	0.675	155.860	2.906	64.831	1202.30	80.000	72638.947
522.000	826.580	0.549	189.287	2.412	79.015	1198.70	80.000	87934.800
525.250	850.001	0.533	194.650	2.348	81.310	1198.00	80.000	90369.835
545.000	1003.333	0.444	229.763	2.001	96.473	1192.80	80.000	106175.536
557.000	1106.300	0.398	253.343	1.820	106.797	1188.80	80.000	116650.977
PSG=	From Steam Tables @ TSG							
SVSG=	From Steam Tables @ TSG							
PEX=	(1-DP/PI)*PSG							
SVEX=	From Steam Tables @ PEX							
MFEX=	(0.049)*(1977.6)*P/(h-185) from CN-TAS-05-13							
h(g)	Gas enthalpy @ TSG from Steam Tables							
hfw	Enthalpy of AFW entering the SG per CA03516							
CDR	Cooldown rate = MFEX*(h(g)-hfw)							
Time after	Decay	Decay Heat	Nominal + Decay of Heavy Elements + Sigma Uncertainty					
Shutdown	Heat		ANSI/ANS-1979: Decay Heat Power in LWRs					
(days)	(Btu/sec)							
10	6741							
11	6460							
12	6236							
13	6090							
14	5944							
15	5798							
16	5651							



Calvert Cliffs  
Nuclear Power Plant

STEAM GENERATOR TUBE RUPTURE EVENT  
WITH EOP BASED OPERATOR ACTIONS  
CORE COOLANT TEMPERATURE VS TIME  
COOL - II Duration, Low Subcooling  
Total Affected SG Isolation

ATTACHMENT C  
NUCLEAR INVENTORY FILE CIS3358.NIF

Nuclide Inventory Name:

Normalized MACCS Sample 3412 MWth PWR Core Inventory

Power Level:

0.1000E+01

Nuclides:

14

Nuclide 001:

Kr-85

1

0.3382974720E+09

0.8500E+02

7.9975E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 002:

Kr-85m

1

0.1612800000E+05

0.8500E+02

4.1975E+02

Kr-85 0.2100E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 003:

Kr-87

1

0.4578000000E+04

0.8700E+02

2.4238E+02

Rb-87 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 004:

Kr-88

1

0.1022400000E+05

0.8800E+02

7.5473E+02

Rb-88 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 005:

I-131

2

0.6946560000E+06

0.1310E+03

1.4920E+04

Xe-131m 0.1100E-01

none 0.0000E+00

none 0.0000E+00

Nuclide 006:

I-132

2

0.8280000000E+04

0.1320E+03

2.6440E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 007:

I-133

2

0.7488000000E+05

0.1330E+03

3.0033E+04

Xe-133m 0.2900E-01

Xe-133 0.9700E+00

none 0.0000E+00

Nuclide 008:

I-134

2

0.3156000000E+04

0.1340E+03

3.5035E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 009:

I-135

2

0.2379600000E+05

0.1350E+03

2.8495E+04

Xe-135m 0.1500E+00

Xe-135 0.8500E+00

none 0.0000E+00

Nuclide 010:

Xe-133

1

0.4531680000E+06

0.1330E+03

8.2574E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 011:

Xe-135

1

0.3272400000E+05

0.1350E+03

1.9726E+03

Cs-135 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 012:

Xe-133m

1

0.1892200000E+06

0.1330E+03

1.1764E+03

Xe-133 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 013:

Xe-135m

1

0.9180000000E+03

0.1350E+03

2.5814E+02

Xe-135 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 014:

Xe-138

1

0.8460000000E+03

0.1380E+03

1.3622E+02

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

End of Nuclear Inventory File

ATTACHMENT D  
NUCLEAR INVENTORY FILE PIS.NIF

Nuclide Inventory Name:

Normalized MACCS Sample 3412 MWth PWR Core Inventory

Power Level:

0.1000E+01

Nuclides:

14

Nuclide 001:

Kr-85

1

0.3382974720E+09

0.8500E+02

7.9975E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 002:

Kr-85m

1

0.1612800000E+05

0.8500E+02

4.1975E+02

Kr-85 0.2100E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 003:

Kr-87

1

0.4578000000E+04

0.8700E+02

2.4238E+02

Rb-87 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 004:

Kr-88

1

0.1022400000E+05

0.8800E+02

7.5473E+02

Rb-88 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 005:

I-131

2

0.6946560000E+06

0.1310E+03

4.8214E+03

Xe-131m 0.1100E-01

none 0.0000E+00

none 0.0000E+00

Nuclide 006:

I-132

2

0.8280000000E+04

0.1320E+03

1.6012E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 007:

I-133

2

0.7488000000E+05

0.1330E+03

6.7914E+03

Xe-133m 0.2900E-01

Xe-133 0.9700E+00

none 0.0000E+00

Nuclide 008:

I-134

2

0.3156000000E+04

0.1340E+03

9.1595E+02

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 009:

I-135

2

0.2379600000E+05

0.1350E+03

3.7267E+03

Xe-135m 0.1500E+00

Xe-135 0.8500E+00

none 0.0000E+00

Nuclide 010:

Xe-133

1

0.4531680000E+06

0.1330E+03

8.2574E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 011:

Xe-135

1

0.3272400000E+05

0.1350E+03

1.9726E+03

Cs-135 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 012:

Xe-133m

1

0.1892200000E+06

0.1330E+03

1.1764E+03

Xe-133 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 013:

Xe-135m

1

0.9180000000E+03

0.1350E+03

2.5814E+02

Xe-135 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 014:

Xe-138

1

0.8460000000E+03

0.1380E+03

1.3622E+02

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

End of Nuclear Inventory File



ATTACHMENT E  
NUCLEAR INVENTORY FILE SEC05.NIF

Nuclide Inventory Name:

Normalized MACCS Sample 3412 MWth PWR Core Inventory

Power Level:

0.1000E+01

Nuclides:

05

Nuclide 001:

I-131

2

0.6946560000E+06

0.1310E+03

1.1172E+01

Xe-131m 0.1100E-01

none 0.0000E+00

none 0.0000E+00

Nuclide 002:

I-132

2

0.8280000000E+04

0.1320E+03

2.8485E-01

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 003:

I-133

2

0.7488000000E+05

0.1330E+03

7.1866E+00

Xe-133m 0.2900E-01

Xe-133 0.9700E+00

none 0.0000E+00

Nuclide 004:

I-134

2

0.3156000000E+04

0.1340E+03

6.5297E-02

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 005:

I-135

2

0.2379600000E+05

0.1350E+03

1.7003E+00

Xe-135m 0.1500E+00

Xe-135 0.8500E+00

none 0.0000E+00  
End of Nuclear Inventory File

ATTACHMENT F  
NUCLEAR INVENTORY FILE SGTRCI8.RFT

Release Fraction and Timing Name:

PWR, RG 1.183, Table 2 Section 3.2

Duration (h): Design Basis Accident

8.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Noble Gases:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Iodine:

1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Cesium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Tellurium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Strontium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Barium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Ruthenium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Cerium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Lanthanum:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Non-Radioactive Aerosols (kg):

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

End of Release File

ATTACHMENT G  
RELEASE FRACTION AND TIMING FILE SGTRCN.RFT

Release Fraction and Timing Name:

PWR, RG 1.183, Table 2 Section 3.2

Duration (h): Design Basis Accident

0.0001E+00 0.0000E+00 0.0000E+00 0.0000E+00

Noble Gases:

1.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Iodine:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Cesium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Tellurium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Strontium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Barium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Ruthenium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Cerium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Lanthanum:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Non-Radioactive Aerosols (kg):

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

End of Release File

ATTACHMENT H  
RELEASE FRACTION AND TIMING FILE SGTRSEC.RFT

Release Fraction and Timing Name:

PWR, RG 1.183, Table 2 Section 3.2

Duration (h): Design Basis Accident

0.0001E+00 0.0000E+00 0.0000E+00 0.0000E+00

Noble Gases:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Iodine:

1.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Cesium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Tellurium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Strontium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Barium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Ruthenium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Cerium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Lanthanum:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Non-Radioactive Aerosols (kg):

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

End of Release File

ATTACHMENT I  
RELEASE FRACTION AND TIMING FILE SGTRPI.RFT

Release Fraction and Timing Name:

PWR, RG 1.183, Table 2 Section 3.2

Duration (h): Design Basis Accident

0.0001E+00 0.0000E+00 0.0000E+00 0.0000E+00

Noble Gases:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Iodine:

1.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Cesium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Tellurium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Strontium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Barium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Ruthenium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Cerium:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Lanthanum:

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

Non-Radioactive Aerosols (kg):

0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

End of Release File

ATTACHMENT J  
RELEASE FRACTION AND TIMING FILE SGTRPN.RFT

Release Fraction and Timing Name:

PWR, RG 1.183, Table 2 Section 3.2

Duration (h): Design Basis Accident

0.0001E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Noble Gases:

1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Iodine:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Cesium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Tellurium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Strontium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Barium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Ruthenium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Cerium:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Lanthanum:

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

Non-Radioactive Aerosols (kg):

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
------------	------------	------------	------------

End of Release File

# ATTACHMENT K CONVERSION FACTORS FILE FGR14.INP

FGRDCF 10/24/95 03:24:50 beta-test version 1.10, minor FORTRAN fixes 5/4/95

Implicit daughter half-lives (m) less than 90 and less than 0.100 of parent

9 ORGANS DEFINED IN THIS FILE:

GONADS  
BREAST  
LUNGS  
RED MARR  
BONE SUR  
THYROID  
REMAINDER  
EFFECTIVE  
SKIN(FGR)

14 NUCLIDES DEFINED IN THIS FILE:

Kr-85  
Kr-85m  
Kr-87  
Kr-88  
I-131 D  
I-132 D  
I-133 D  
I-134 D  
I-135 D Including: Xe-135m  
Xe-133  
Xe-135  
Xe-133m  
Xe-135m  
Xe-138

	CLOUDSHINE	GROUND	GROUND	GROUND	INHALED	INHALED	INGESTION
	SHINE	8HR	SHINE	7DAY	SHINE	RATE	ACUTE
						CHRONIC	
Kr-85							
GONADS	1.170E-16	8.121E-14	1.704E-12	2.820E-18	-1.000E+00	0.000E+00	0.000E+00
BREAST	1.340E-16	7.891E-14	1.656E-12	2.740E-18	-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.140E-16	7.056E-14	1.481E-12	2.450E-18	-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.090E-16	6.998E-14	1.469E-12	2.430E-18	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	2.200E-16	1.287E-13	2.702E-12	4.470E-18	-1.000E+00	0.000E+00	0.000E+00
THYROID	1.180E-16	7.459E-14	1.565E-12	2.590E-18	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.090E-16	6.941E-14	1.457E-12	2.410E-18	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.190E-16	7.603E-14	1.596E-12	2.640E-18	-1.000E+00	0.000E+00	0.000E+00
SKIN(FGR)	1.320E-14	2.304E-11	4.835E-10	8.000E-16	-1.000E+00	0.000E+00	0.000E+00
Kr-85m							
GONADS	7.310E-15	2.594E-12	3.653E-12	1.570E-16	-1.000E+00	0.000E+00	0.000E+00
BREAST	8.410E-15	2.527E-12	3.560E-12	1.530E-16	-1.000E+00	0.000E+00	0.000E+00
LUNGS	7.040E-15	2.379E-12	3.351E-12	1.440E-16	-1.000E+00	0.000E+00	0.000E+00
RED MARR	6.430E-15	2.346E-12	3.304E-12	1.420E-16	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	1.880E-14	5.286E-12	7.446E-12	3.200E-16	-1.000E+00	0.000E+00	0.000E+00
THYROID	7.330E-15	2.395E-12	3.374E-12	1.450E-16	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	6.640E-15	2.313E-12	3.257E-12	1.400E-16	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	7.480E-15	2.511E-12	3.537E-12	1.520E-16	-1.000E+00	0.000E+00	0.000E+00
SKIN(FGR)	2.240E-14	2.247E-11	3.164E-11	1.360E-15	-1.000E+00	0.000E+00	0.000E+00
Kr-87							



GONADS	4.000E-14	4.962E-12	5.026E-12	7.610E-16	-1.000E+00	0.000E+00	0.000E+00
BREAST	4.500E-14	4.740E-12	4.802E-12	7.270E-16	-1.000E+00	0.000E+00	0.000E+00
LUNGS	4.040E-14	4.603E-12	4.663E-12	7.060E-16	-1.000E+00	0.000E+00	0.000E+00
RED MARR	4.000E-14	4.708E-12	4.769E-12	7.220E-16	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	6.020E-14	6.514E-12	6.598E-12	9.990E-16	-1.000E+00	0.000E+00	0.000E+00
THYROID	4.130E-14	4.473E-12	4.531E-12	6.860E-16	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	3.910E-14	4.590E-12	4.650E-12	7.040E-16	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	4.120E-14	4.773E-12	4.835E-12	7.320E-16	-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	1.370E-13	8.802E-11	8.916E-11	1.350E-14	-1.000E+00	0.000E+00	0.000E+00
Kr-88							
GONADS	9.900E-14	2.278E-11	2.655E-11	1.800E-15	-1.000E+00	0.000E+00	0.000E+00
BREAST	1.110E-13	2.177E-11	2.537E-11	1.720E-15	-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.010E-13	2.139E-11	2.493E-11	1.690E-15	-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.000E-13	2.190E-11	2.552E-11	1.730E-15	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	1.390E-13	2.886E-11	3.363E-11	2.280E-15	-1.000E+00	0.000E+00	0.000E+00
THYROID	1.030E-13	2.012E-11	2.345E-11	1.590E-15	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	9.790E-14	2.139E-11	2.493E-11	1.690E-15	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.020E-13	2.202E-11	2.567E-11	1.740E-15	-1.000E+00	0.000E+00	0.000E+00
SKIN (FGR)	1.350E-13	5.607E-11	6.534E-11	4.430E-15	-1.000E+00	0.000E+00	0.000E+00
I-131							
GONADS	1.780E-14	1.119E-11	1.789E-10	3.940E-16	-1.000E+00	2.530E-11	4.070E-11
BREAST	2.040E-14	1.082E-11	1.730E-10	3.810E-16	-1.000E+00	7.880E-11	1.210E-10
LUNGS	1.760E-14	1.016E-11	1.626E-10	3.580E-16	-1.000E+00	6.570E-10	1.020E-10
RED MARR	1.680E-14	1.022E-11	1.635E-10	3.600E-16	-1.000E+00	6.260E-11	9.440E-11
BONE SUR	3.450E-14	1.675E-11	2.679E-10	5.900E-16	-1.000E+00	5.730E-11	8.720E-11
THYROID	1.810E-14	1.053E-11	1.685E-10	3.710E-16	-1.000E+00	2.920E-07	4.760E-07
REMAINDER	1.670E-14	9.908E-12	1.585E-10	3.490E-16	-1.000E+00	8.030E-11	1.570E-10
EFFECTIVE	1.820E-14	1.067E-11	1.707E-10	3.760E-16	-1.000E+00	8.890E-09	1.440E-08
SKIN (FGR)	2.980E-14	1.825E-11	2.920E-10	6.430E-16	-1.000E+00	0.000E+00	0.000E+00
I-132							
GONADS	1.090E-13	2.523E-11	2.771E-11	2.320E-15	-1.000E+00	9.950E-12	2.330E-11
BREAST	1.240E-13	2.414E-11	2.652E-11	2.220E-15	-1.000E+00	1.410E-11	2.520E-11
LUNGS	1.090E-13	2.305E-11	2.532E-11	2.120E-15	-1.000E+00	2.710E-10	2.640E-11
RED MARR	1.070E-13	2.360E-11	2.592E-11	2.170E-15	-1.000E+00	1.400E-11	2.460E-11
BONE SUR	1.730E-13	3.327E-11	3.655E-11	3.060E-15	-1.000E+00	1.240E-11	2.190E-11
THYROID	1.120E-13	2.381E-11	2.616E-11	2.190E-15	-1.000E+00	1.740E-09	3.870E-09
REMAINDER	1.050E-13	2.283E-11	2.509E-11	2.100E-15	-1.000E+00	3.780E-11	1.650E-10
EFFECTIVE	1.120E-13	2.403E-11	2.640E-11	2.210E-15	-1.000E+00	1.030E-10	1.820E-10
SKIN (FGR)	1.580E-13	8.199E-11	9.007E-11	7.540E-15	-1.000E+00	0.000E+00	0.000E+00
I-133							
GONADS	2.870E-14	1.585E-11	6.748E-11	6.270E-16	-1.000E+00	1.950E-11	3.630E-11
BREAST	3.280E-14	1.519E-11	6.468E-11	6.010E-16	-1.000E+00	2.940E-11	4.680E-11
LUNGS	2.860E-14	1.446E-11	6.156E-11	5.720E-16	-1.000E+00	8.200E-10	4.530E-11
RED MARR	2.770E-14	1.466E-11	6.242E-11	5.800E-16	-1.000E+00	2.720E-11	4.300E-11
BONE SUR	4.870E-14	2.161E-11	9.202E-11	8.550E-16	-1.000E+00	2.520E-11	4.070E-11
THYROID	2.930E-14	1.502E-11	6.393E-11	5.940E-16	-1.000E+00	4.860E-08	9.100E-08
REMAINDER	2.730E-14	1.418E-11	6.038E-11	5.610E-16	-1.000E+00	5.000E-11	1.550E-10
EFFECTIVE	2.940E-14	1.509E-11	6.425E-11	5.970E-16	-1.000E+00	1.580E-09	2.800E-09
SKIN (FGR)	5.830E-14	1.150E-10	4.897E-10	4.550E-15	-1.000E+00	0.000E+00	0.000E+00
I-134							
GONADS	1.270E-13	1.200E-11	1.202E-11	2.640E-15	-1.000E+00	4.250E-12	1.100E-11
BREAST	1.440E-13	1.145E-11	1.147E-11	2.520E-15	-1.000E+00	6.170E-12	1.170E-11
LUNGS	1.270E-13	1.100E-11	1.102E-11	2.420E-15	-1.000E+00	1.430E-10	1.260E-11
RED MARR	1.250E-13	1.127E-11	1.129E-11	2.480E-15	-1.000E+00	6.080E-12	1.090E-11

BONE SUR	1.960E-13	1.568E-11	1.571E-11	3.450E-15	-1.000E+00	5.310E-12	9.320E-12
THYROID	1.300E-13	1.127E-11	1.129E-11	2.480E-15	-1.000E+00	2.880E-10	6.210E-10
REMAINDER	1.220E-13	1.091E-11	1.093E-11	2.400E-15	-1.000E+00	2.270E-11	1.340E-10
EFFECTIVE	1.300E-13	1.150E-11	1.152E-11	2.530E-15	-1.000E+00	3.550E-11	6.660E-11
SKIN(FGR)	1.870E-13	4.477E-11	4.485E-11	9.850E-15	-1.000E+00	0.000E+00	0.000E+00

## I-135

GONADS	8.078E-14	3.113E-11	5.489E-11	1.599E-15	-1.000E+00	1.700E-11	3.610E-11
BREAST	9.143E-14	2.971E-11	5.240E-11	1.526E-15	-1.000E+00	2.340E-11	3.850E-11
LUNGS	8.145E-14	2.886E-11	5.089E-11	1.482E-15	-1.000E+00	4.410E-10	3.750E-11
RED MARR	8.054E-14	2.965E-11	5.228E-11	1.523E-15	-1.000E+00	2.240E-11	3.650E-11
BONE SUR	1.184E-13	3.983E-11	7.024E-11	2.046E-15	-1.000E+00	2.010E-11	3.360E-11
THYROID	8.324E-14	2.852E-11	5.030E-11	1.465E-15	-1.000E+00	8.460E-09	1.790E-08
REMAINDER	7.861E-14	2.883E-11	5.084E-11	1.481E-15	-1.000E+00	4.700E-11	1.540E-10
EFFECTIVE	8.294E-14	2.989E-11	5.271E-11	1.535E-15	-1.000E+00	3.320E-10	6.080E-10
SKIN(FGR)	1.156E-13	9.826E-11	1.733E-10	5.047E-15	-1.000E+00	0.000E+00	0.000E+00

## Xe-133

GONADS	1.610E-15	1.465E-12	2.052E-11	5.200E-17	-1.000E+00	0.000E+00	0.000E+00
BREAST	1.960E-15	1.505E-12	2.107E-11	5.340E-17	-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.320E-15	1.045E-12	1.464E-11	3.710E-17	-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.070E-15	8.791E-13	1.231E-11	3.120E-17	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	5.130E-15	4.254E-12	5.958E-11	1.510E-16	-1.000E+00	0.000E+00	0.000E+00
THYROID	1.510E-15	1.181E-12	1.653E-11	4.190E-17	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.240E-15	1.042E-12	1.460E-11	3.700E-17	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.560E-15	1.299E-12	1.819E-11	4.610E-17	-1.000E+00	0.000E+00	0.000E+00
SKIN(FGR)	4.970E-15	1.953E-12	2.734E-11	6.930E-17	-1.000E+00	0.000E+00	0.000E+00

## Xe-135

GONADS	1.170E-14	5.455E-12	1.194E-11	2.530E-16	-1.000E+00	0.000E+00	0.000E+00
BREAST	1.330E-14	5.325E-12	1.166E-11	2.470E-16	-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.130E-14	4.959E-12	1.086E-11	2.300E-16	-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.070E-14	4.959E-12	1.086E-11	2.300E-16	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	2.570E-14	9.120E-12	1.997E-11	4.230E-16	-1.000E+00	0.000E+00	0.000E+00
THYROID	1.180E-14	5.023E-12	1.100E-11	2.330E-16	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.080E-14	4.829E-12	1.058E-11	2.240E-16	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.190E-14	5.217E-12	1.142E-11	2.420E-16	-1.000E+00	0.000E+00	0.000E+00
SKIN(FGR)	3.120E-14	4.506E-11	9.867E-11	2.090E-15	-1.000E+00	0.000E+00	0.000E+00

## Xe-133m

GONADS	1.420E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
BREAST	1.700E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.190E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.100E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	3.230E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
THYROID	1.360E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.150E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.370E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
SKIN(FGR)	1.040E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00

## Xe-135m

GONADS	2.000E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
BREAST	2.290E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
LUNGS	1.980E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
RED MARR	1.910E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	3.500E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
THYROID	2.040E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.890E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	2.040E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00

SKIN(FGR)	2.970E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
Xe-138							
GONADS	5.590E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
BREAST	6.320E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
LUNGS	5.660E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
RED MARR	5.600E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
BONE SUR	8.460E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
THYROID	5.770E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	5.490E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	5.770E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00
SKIN(FGR)	1.070E-13	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	0.000E+00	0.000E+00

# ATTACHMENT L CONVERSION FACTORS FILE FGR05.INP

FGRDCF 10/24/95 03:24:50 beta-test version 1.10, minor FORTRAN fixes 5/4/95  
Implicit daughter half-lives (m) less than 90 and less than 0.100 of parent

9 ORGANS DEFINED IN THIS FILE:

GONADS  
BREAST  
LUNGS  
RED MARR  
BONE SUR  
THYROID  
REMAINDER  
EFFECTIVE  
SKIN(FGR)

05 NUCLIDES DEFINED IN THIS FILE:

I-131 D  
I-132 D  
I-133 D  
I-134 D  
I-135 D Including: Xe-135m

	CLOUDSHINE	GROUND SHINE 8HR	GROUND SHINE 7DAY	GROUND SHINE RATE	INHALED ACUTE	INHALED CHRONIC	INGESTION
I-131							
GONADS	1.780E-14	1.119E-11	1.789E-10	3.940E-16	-1.000E+00	2.530E-11	4.070E-11
BREAST	2.040E-14	1.082E-11	1.730E-10	3.810E-16	-1.000E+00	7.880E-11	1.210E-10
LUNGS	1.760E-14	1.016E-11	1.626E-10	3.580E-16	-1.000E+00	6.570E-10	1.020E-10
RED MARR	1.680E-14	1.022E-11	1.635E-10	3.600E-16	-1.000E+00	6.260E-11	9.440E-11
BONE SUR	3.450E-14	1.675E-11	2.679E-10	5.900E-16	-1.000E+00	5.730E-11	8.720E-11
THYROID	1.810E-14	1.053E-11	1.685E-10	3.710E-16	-1.000E+00	2.920E-07	4.760E-07
REMAINDER	1.670E-14	9.908E-12	1.585E-10	3.490E-16	-1.000E+00	8.030E-11	1.570E-10
EFFECTIVE	1.820E-14	1.067E-11	1.707E-10	3.760E-16	-1.000E+00	8.890E-09	1.440E-08
SKIN(FGR)	2.980E-14	1.825E-11	2.920E-10	6.430E-16	-1.000E+00	0.000E+00	0.000E+00
I-132							
GONADS	1.090E-13	2.523E-11	2.771E-11	2.320E-15	-1.000E+00	9.950E-12	2.330E-11
BREAST	1.240E-13	2.414E-11	2.652E-11	2.220E-15	-1.000E+00	1.410E-11	2.520E-11
LUNGS	1.090E-13	2.305E-11	2.532E-11	2.120E-15	-1.000E+00	2.710E-10	2.640E-11
RED MARR	1.070E-13	2.360E-11	2.592E-11	2.170E-15	-1.000E+00	1.400E-11	2.460E-11
BONE SUR	1.730E-13	3.327E-11	3.655E-11	3.060E-15	-1.000E+00	1.240E-11	2.190E-11
THYROID	1.120E-13	2.381E-11	2.616E-11	2.190E-15	-1.000E+00	1.740E-09	3.870E-09
REMAINDER	1.050E-13	2.283E-11	2.509E-11	2.100E-15	-1.000E+00	3.780E-11	1.650E-10
EFFECTIVE	1.120E-13	2.403E-11	2.640E-11	2.210E-15	-1.000E+00	1.030E-10	1.820E-10
SKIN(FGR)	1.580E-13	8.199E-11	9.007E-11	7.540E-15	-1.000E+00	0.000E+00	0.000E+00
I-133							
GONADS	2.870E-14	1.585E-11	6.748E-11	6.270E-16	-1.000E+00	1.950E-11	3.630E-11
BREAST	3.280E-14	1.519E-11	6.468E-11	6.010E-16	-1.000E+00	2.940E-11	4.680E-11
LUNGS	2.860E-14	1.446E-11	6.156E-11	5.720E-16	-1.000E+00	8.200E-10	4.530E-11
RED MARR	2.770E-14	1.466E-11	6.242E-11	5.800E-16	-1.000E+00	2.720E-11	4.300E-11
BONE SUR	4.870E-14	2.161E-11	9.202E-11	8.550E-16	-1.000E+00	2.520E-11	4.070E-11
THYROID	2.930E-14	1.502E-11	6.393E-11	5.940E-16	-1.000E+00	4.860E-08	9.100E-08
REMAINDER	2.730E-14	1.418E-11	6.038E-11	5.610E-16	-1.000E+00	5.000E-11	1.550E-10
EFFECTIVE	2.940E-14	1.509E-11	6.425E-11	5.970E-16	-1.000E+00	1.580E-09	2.800E-09
SKIN(FGR)	5.830E-14	1.150E-10	4.897E-10	4.550E-15	-1.000E+00	0.000E+00	0.000E+00

I-134

GONADS	1.270E-13	1.200E-11	1.202E-11	2.640E-15	-1.000E+00	4.250E-12	1.100E-11
BREAST	1.440E-13	1.145E-11	1.147E-11	2.520E-15	-1.000E+00	6.170E-12	1.170E-11
LUNGS	1.270E-13	1.100E-11	1.102E-11	2.420E-15	-1.000E+00	1.430E-10	1.260E-11
RED MARR	1.250E-13	1.127E-11	1.129E-11	2.480E-15	-1.000E+00	6.080E-12	1.090E-11
BONE SUR	1.960E-13	1.568E-11	1.571E-11	3.450E-15	-1.000E+00	5.310E-12	9.320E-12
THYROID	1.300E-13	1.127E-11	1.129E-11	2.480E-15	-1.000E+00	2.880E-10	6.210E-10
REMAINDER	1.220E-13	1.091E-11	1.093E-11	2.400E-15	-1.000E+00	2.270E-11	1.340E-10
EFFECTIVE	1.300E-13	1.150E-11	1.152E-11	2.530E-15	-1.000E+00	3.550E-11	6.660E-11
SKIN(FGR)	1.870E-13	4.477E-11	4.485E-11	9.850E-15	-1.000E+00	0.000E+00	0.000E+00

I-135

GONADS	8.078E-14	3.113E-11	5.489E-11	1.599E-15	-1.000E+00	1.700E-11	3.610E-11
BREAST	9.143E-14	2.971E-11	5.240E-11	1.526E-15	-1.000E+00	2.340E-11	3.850E-11
LUNGS	8.145E-14	2.886E-11	5.089E-11	1.482E-15	-1.000E+00	4.410E-10	3.750E-11
RED MARR	8.054E-14	2.965E-11	5.228E-11	1.523E-15	-1.000E+00	2.240E-11	3.650E-11
BONE SUR	1.184E-13	3.983E-11	7.024E-11	2.046E-15	-1.000E+00	2.010E-11	3.360E-11
THYROID	8.324E-14	2.852E-11	5.030E-11	1.465E-15	-1.000E+00	8.460E-09	1.790E-08
REMAINDER	7.861E-14	2.883E-11	5.084E-11	1.481E-15	-1.000E+00	4.700E-11	1.540E-10
EFFECTIVE	8.294E-14	2.989E-11	5.271E-11	1.535E-15	-1.000E+00	3.320E-10	6.080E-10
SKIN(FGR)	1.156E-13	9.826E-11	1.733E-10	5.047E-15	-1.000E+00	0.000E+00	0.000E+00

ATTACHMENT M  
SGTRCAI OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	1.0187E-01	3.7450E-03	2.3983E-02	8.8163E-04	9.8130E-02	3.1357E-03
0.167	1.8051E-01	6.6200E-03	4.2496E-02	1.5585E-03	2.3442E-01	7.4869E-03
0.190	2.1341E-01	7.8190E-03	5.0240E-02	1.8407E-03	3.1759E-01	1.0141E-02
0.333	3.3073E-01	1.2081E-02	7.7860E-02	2.8442E-03	9.9575E-01	3.1768E-02
0.366	3.6651E-01	1.3374E-02	8.6283E-02	3.1484E-03	1.1849E+00	3.7794E-02
0.766	9.0439E-01	3.2612E-02	2.1291E-01	7.6775E-03	4.1019E+00	1.3058E-01
1.000	1.3781E+00	4.9335E-02	3.2444E-01	1.1614E-02	6.6153E+00	2.1033E-01
1.367	2.3386E+00	8.2866E-02	5.5054E-01	1.9508E-02	1.2092E+01	3.8378E-01
1.667	3.1965E+00	1.1251E-01	7.5250E-01	2.6488E-02	1.7780E+01	5.6358E-01
1.803	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.0640E+01	6.5389E-01
2.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.4054E+01	7.6161E-01
2.300	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.6937E+01	8.5252E-01
2.600	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.8332E+01	8.9643E-01
2.900	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9006E+01	9.1764E-01
3.200	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9332E+01	9.2790E-01
3.500	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9490E+01	9.3285E-01
3.800	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9566E+01	9.3525E-01
4.100	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9603E+01	9.3641E-01
4.400	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9621E+01	9.3697E-01
4.700	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9630E+01	9.3724E-01
5.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9634E+01	9.3737E-01
5.300	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9636E+01	9.3744E-01
5.600	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9637E+01	9.3747E-01
5.614	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9637E+01	9.3747E-01
6.014	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3749E-01
6.314	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3749E-01
6.614	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
6.914	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
7.214	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
7.514	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
7.814	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
8.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
8.300	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
8.600	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
8.900	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
9.200	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
9.500	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
9.800	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
10.100	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
10.400	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
24.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
48.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01

48.111 3.6232E+00 1.2717E-01 8.5296E-01 2.9938E-02 2.9638E+01 9.3750E-01  
96.000 3.6232E+00 1.2717E-01 8.5296E-01 2.9938E-02 2.9638E+01 9.3750E-01  
720.000 3.6232E+00 1.2717E-01 8.5296E-01 2.9938E-02 2.9638E+01 9.3750E-01

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.3109E-02	3.6232E+00	1.2717E-01

ATTACHMENT N  
SGTRCAN OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	1.2417E-02	0.0000E+00	2.9231E-03	0.0000E+00	7.9596E-04
0.167	0.0000E+00	1.5796E-02	0.0000E+00	3.7186E-03	0.0000E+00	1.5807E-03
0.190	0.0000E+00	1.6939E-02	0.0000E+00	3.9877E-03	0.0000E+00	1.9739E-03
0.333	0.0000E+00	2.4686E-02	0.0000E+00	5.8115E-03	0.0000E+00	4.9659E-03
0.366	0.0000E+00	2.6346E-02	0.0000E+00	6.2023E-03	0.0000E+00	5.7638E-03
0.766	0.0000E+00	4.1366E-02	0.0000E+00	9.7383E-03	0.0000E+00	1.7448E-02
1.000	0.0000E+00	4.8786E-02	0.0000E+00	1.1485E-02	0.0000E+00	2.5278E-02
1.367	0.0000E+00	5.8788E-02	0.0000E+00	1.3840E-02	0.0000E+00	3.8135E-02
1.667	0.0000E+00	6.5715E-02	0.0000E+00	1.5470E-02	0.0000E+00	4.8670E-02
1.803	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	5.3356E-02
2.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	5.9588E-02
2.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	6.7366E-02
2.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	7.3481E-02
2.900	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	7.8294E-02
3.200	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.2087E-02
3.500	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.5079E-02
3.800	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.7441E-02
4.100	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.9307E-02
4.400	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.0783E-02
4.700	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.1952E-02
5.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.2877E-02
5.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.3611E-02
5.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4193E-02
5.614	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4217E-02
6.014	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4804E-02
6.314	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5141E-02
6.614	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5408E-02
6.914	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5620E-02
7.214	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5790E-02
7.514	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5924E-02
7.814	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6031E-02
8.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6087E-02
8.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6161E-02
8.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6220E-02
8.900	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6267E-02
9.200	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6305E-02
9.500	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6335E-02
9.800	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6359E-02
10.100	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6378E-02
10.400	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6393E-02
24.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6455E-02
48.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6455E-02



48.111 0.0000E+00 6.8532E-02 0.0000E+00 1.6134E-02 0.0000E+00 9.6455E-02  
96.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6134E-02 0.0000E+00 9.6455E-02  
720.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6134E-02 0.0000E+00 9.6455E-02

#####

Worst Two-Hour Doses

#####

eab

Time	Whole Body	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)
0.0	6.8532E-02	0.0000E+00	6.8532E-02

# ATTACHMENT O SGTRCUI OUTPUT FILE

#####

## Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	1.1695E-05	4.2990E-07	2.7532E-06	1.0121E-07	1.1230E-05	3.5886E-07
0.167	2.4641E-05	9.0321E-07	5.8009E-06	2.1263E-07	2.8812E-05	9.2017E-07
0.190	3.1883E-05	1.1672E-06	7.5058E-06	2.7478E-07	4.0819E-05	1.3033E-06
0.333	9.7955E-05	3.5676E-06	2.3060E-05	8.3988E-07	2.0368E-04	6.4967E-06
0.366	1.1806E-04	4.2940E-06	2.7794E-05	1.0109E-06	2.6464E-04	8.4389E-06
0.766	5.1484E-04	1.8485E-05	1.2120E-04	4.3517E-06	1.8012E-03	5.7304E-05
1.000	8.7507E-04	3.1201E-05	2.0601E-04	7.3452E-06	3.5142E-03	1.1166E-04
1.367	1.6285E-03	5.7506E-05	3.8338E-04	1.3538E-05	7.5786E-03	2.4038E-04
1.667	2.4928E-03	8.7374E-05	5.8684E-04	2.0569E-05	1.2376E-02	3.9204E-04
1.803	2.9450E-03	1.0291E-04	6.9329E-04	2.4226E-05	1.5048E-02	4.7640E-04
2.000	3.6680E-03	1.2765E-04	8.6352E-04	3.0051E-05	1.9463E-02	6.1571E-04
2.300	3.6680E-03	1.2765E-04	8.8274E-04	3.0705E-05	2.7002E-02	8.5334E-04
2.600	3.6680E-03	1.2765E-04	9.0492E-04	3.1455E-05	3.5422E-02	1.1184E-03
2.900	3.6680E-03	1.2765E-04	9.3011E-04	3.2303E-05	4.4953E-02	1.4182E-03
3.200	3.6680E-03	1.2765E-04	9.5840E-04	3.3250E-05	5.5722E-02	1.7565E-03
3.500	3.6680E-03	1.2765E-04	9.8983E-04	3.4299E-05	6.7802E-02	2.1358E-03
3.800	3.6680E-03	1.2765E-04	1.0245E-03	3.5451E-05	8.1247E-02	2.5575E-03
4.100	3.6680E-03	1.2765E-04	1.0624E-03	3.6707E-05	9.6094E-02	3.0229E-03
4.400	3.6680E-03	1.2765E-04	1.1036E-03	3.8069E-05	1.1238E-01	3.5329E-03
4.700	3.6680E-03	1.2765E-04	1.1483E-03	3.9540E-05	1.3012E-01	4.0885E-03
5.000	3.6680E-03	1.2765E-04	1.1964E-03	4.1121E-05	1.4937E-01	4.6905E-03
5.300	3.6680E-03	1.2765E-04	1.2480E-03	4.2813E-05	1.7013E-01	5.3397E-03
5.600	3.6680E-03	1.2765E-04	1.3031E-03	4.4618E-05	1.9244E-01	6.0370E-03
5.614	3.6680E-03	1.2765E-04	1.3058E-03	4.4705E-05	1.9352E-01	6.0707E-03
6.014	3.6680E-03	1.2765E-04	1.3853E-03	4.7299E-05	2.2583E-01	7.0796E-03
6.314	3.6680E-03	1.2765E-04	1.4492E-03	4.9381E-05	2.5193E-01	7.8944E-03
6.614	3.6680E-03	1.2765E-04	1.5169E-03	5.1582E-05	2.7967E-01	8.7598E-03
6.914	3.6680E-03	1.2765E-04	1.5884E-03	5.3904E-05	3.0907E-01	9.6767E-03
7.214	3.6680E-03	1.2765E-04	1.6637E-03	5.6347E-05	3.4015E-01	1.0646E-02
7.514	3.6680E-03	1.2765E-04	1.7430E-03	5.8915E-05	3.7295E-01	1.1668E-02
7.814	3.6680E-03	1.2765E-04	1.8263E-03	6.1607E-05	4.0748E-01	1.2743E-02
8.000	3.6680E-03	1.2765E-04	1.8800E-03	6.3340E-05	4.2977E-01	1.3437E-02
8.300	3.6680E-03	1.2765E-04	1.9256E-03	6.4865E-05	4.6041E-01	1.4391E-02
8.600	3.6680E-03	1.2765E-04	1.9722E-03	6.6420E-05	4.8358E-01	1.5112E-02
8.900	3.6680E-03	1.2765E-04	2.0198E-03	6.8003E-05	5.0332E-01	1.5727E-02
9.200	3.6680E-03	1.2765E-04	2.0683E-03	6.9615E-05	5.2157E-01	1.6294E-02
9.500	3.6680E-03	1.2765E-04	2.1178E-03	7.1256E-05	5.3927E-01	1.6844E-02
9.800	3.6680E-03	1.2765E-04	2.1681E-03	7.2924E-05	5.5687E-01	1.7391E-02
10.100	3.6680E-03	1.2765E-04	2.2194E-03	7.4621E-05	5.7459E-01	1.7942E-02
10.400	3.6680E-03	1.2765E-04	2.2716E-03	7.6345E-05	5.9253E-01	1.8500E-02
24.000	3.6680E-03	1.2765E-04	5.4857E-03	1.8023E-04	1.7030E+00	5.2829E-02
48.000	3.6680E-03	1.2765E-04	8.1680E-03	2.6419E-04	3.0574E+00	9.4412E-02

48.111 3.6680E-03 1.2765E-04 8.1823E-03 2.6463E-04 3.0646E+00 9.4632E-02  
96.000 3.6680E-03 1.2765E-04 1.5264E-02 4.8354E-04 6.6350E+00 2.0369E-01  
720.000 3.6680E-03 1.2765E-04 6.8856E-02 2.1304E-03 2.1070E+01 6.4341E-01

#####

Worst Two-Hour Doses

#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.2296E-05	3.6680E-03	1.2765E-04

# ATTACHMENT P SGTRCUN OUTPUT FILE

#####

## Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	2.7953E-06	0.0000E+00	6.5806E-07	0.0000E+00	1.7835E-07
0.167	0.0000E+00	4.0305E-06	0.0000E+00	9.4886E-07	0.0000E+00	3.6911E-07
0.190	0.0000E+00	4.5711E-06	0.0000E+00	1.0761E-06	0.0000E+00	4.7355E-07
0.333	0.0000E+00	7.9060E-06	0.0000E+00	1.8612E-06	0.0000E+00	1.3866E-06
0.366	0.0000E+00	8.6521E-06	0.0000E+00	2.0368E-06	0.0000E+00	1.6525E-06
0.766	0.0000E+00	1.7541E-05	0.0000E+00	4.1294E-06	0.0000E+00	6.3667E-06
1.000	0.0000E+00	2.2537E-05	0.0000E+00	5.3056E-06	0.0000E+00	1.0119E-05
1.367	0.0000E+00	3.0134E-05	0.0000E+00	7.0940E-06	0.0000E+00	1.7063E-05
1.667	0.0000E+00	3.6155E-05	0.0000E+00	8.5115E-06	0.0000E+00	2.3446E-05
1.803	0.0000E+00	3.8831E-05	0.0000E+00	9.1415E-06	0.0000E+00	2.6494E-05
2.000	0.0000E+00	4.2657E-05	0.0000E+00	1.0042E-05	0.0000E+00	3.1046E-05
2.300	0.0000E+00	4.2657E-05	0.0000E+00	1.0130E-05	0.0000E+00	3.8080E-05
2.600	0.0000E+00	4.2657E-05	0.0000E+00	1.0215E-05	0.0000E+00	4.5085E-05
2.900	0.0000E+00	4.2657E-05	0.0000E+00	1.0298E-05	0.0000E+00	5.2041E-05
3.200	0.0000E+00	4.2657E-05	0.0000E+00	1.0380E-05	0.0000E+00	5.8937E-05
3.500	0.0000E+00	4.2657E-05	0.0000E+00	1.0460E-05	0.0000E+00	6.5763E-05
3.800	0.0000E+00	4.2657E-05	0.0000E+00	1.0539E-05	0.0000E+00	7.2514E-05
4.100	0.0000E+00	4.2657E-05	0.0000E+00	1.0616E-05	0.0000E+00	7.9186E-05
4.400	0.0000E+00	4.2657E-05	0.0000E+00	1.0693E-05	0.0000E+00	8.5778E-05
4.700	0.0000E+00	4.2657E-05	0.0000E+00	1.0767E-05	0.0000E+00	9.2291E-05
5.000	0.0000E+00	4.2657E-05	0.0000E+00	1.0841E-05	0.0000E+00	9.8725E-05
5.300	0.0000E+00	4.2657E-05	0.0000E+00	1.0914E-05	0.0000E+00	1.0508E-04
5.600	0.0000E+00	4.2657E-05	0.0000E+00	1.0986E-05	0.0000E+00	1.1136E-04
5.614	0.0000E+00	4.2657E-05	0.0000E+00	1.0989E-05	0.0000E+00	1.1165E-04
6.014	0.0000E+00	4.2657E-05	0.0000E+00	1.1083E-05	0.0000E+00	1.1991E-04
6.314	0.0000E+00	4.2657E-05	0.0000E+00	1.1152E-05	0.0000E+00	1.2603E-04
6.614	0.0000E+00	4.2657E-05	0.0000E+00	1.1221E-05	0.0000E+00	1.3208E-04
6.914	0.0000E+00	4.2657E-05	0.0000E+00	1.1289E-05	0.0000E+00	1.3806E-04
7.214	0.0000E+00	4.2657E-05	0.0000E+00	1.1356E-05	0.0000E+00	1.4398E-04
7.514	0.0000E+00	4.2657E-05	0.0000E+00	1.1423E-05	0.0000E+00	1.4985E-04
7.814	0.0000E+00	4.2657E-05	0.0000E+00	1.1489E-05	0.0000E+00	1.5566E-04
8.000	0.0000E+00	4.2657E-05	0.0000E+00	1.1529E-05	0.0000E+00	1.5924E-04
8.300	0.0000E+00	4.2657E-05	0.0000E+00	1.1594E-05	0.0000E+00	1.6462E-04
8.600	0.0000E+00	4.2657E-05	0.0000E+00	1.1659E-05	0.0000E+00	1.6937E-04
8.900	0.0000E+00	4.2657E-05	0.0000E+00	1.1722E-05	0.0000E+00	1.7360E-04
9.200	0.0000E+00	4.2657E-05	0.0000E+00	1.1786E-05	0.0000E+00	1.7742E-04
9.500	0.0000E+00	4.2657E-05	0.0000E+00	1.1848E-05	0.0000E+00	1.8091E-04
9.800	0.0000E+00	4.2657E-05	0.0000E+00	1.1911E-05	0.0000E+00	1.8413E-04
10.100	0.0000E+00	4.2657E-05	0.0000E+00	1.1973E-05	0.0000E+00	1.8714E-04
10.400	0.0000E+00	4.2657E-05	0.0000E+00	1.2034E-05	0.0000E+00	1.8997E-04
24.000	0.0000E+00	4.2657E-05	0.0000E+00	1.4557E-05	0.0000E+00	2.8302E-04
48.000	0.0000E+00	4.2657E-05	0.0000E+00	1.5488E-05	0.0000E+00	3.4567E-04

48.111 0.0000E+00 4.2657E-05 0.0000E+00 1.5492E-05 0.0000E+00 3.4593E-04  
96.000 0.0000E+00 4.2657E-05 0.0000E+00 1.6987E-05 0.0000E+00 4.4451E-04  
720.000 0.0000E+00 4.2657E-05 0.0000E+00 2.1764E-05 0.0000E+00 6.1242E-04

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

eab

Time	Whole Body	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)
0.0	4.2657E-05	0.0000E+00	4.2657E-05

ATTACHMENT Q  
SGTRCAS OUTPUT FILE

#####  
Cumulative Dose Summary  
#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.167	4.7882E-03	1.4915E-04	1.1272E-03	3.5112E-05	2.3595E-03	7.2461E-05
0.190	5.4416E-03	1.6950E-04	1.2810E-03	3.9902E-05	4.5726E-03	1.4043E-04
0.333	7.7946E-03	2.4278E-04	1.8350E-03	5.7155E-05	2.1544E-02	6.6160E-04
0.366	8.3299E-03	2.5945E-04	1.9610E-03	6.1080E-05	2.5944E-02	7.9673E-04
0.766	1.0250E-02	3.1924E-04	2.4130E-03	7.5154E-05	6.6073E-02	2.0289E-03
1.000	1.1368E-02	3.5404E-04	2.6763E-03	8.3347E-05	8.1619E-02	2.5062E-03
1.367	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.0074E-01	3.0933E-03
1.667	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1077E-01	3.4012E-03
1.803	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1341E-01	3.4822E-03
2.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1598E-01	3.5611E-03
2.300	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1816E-01	3.6279E-03
2.600	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1922E-01	3.6603E-03
2.900	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1973E-01	3.6760E-03
3.200	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1998E-01	3.6836E-03
3.500	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2010E-01	3.6873E-03
3.800	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2015E-01	3.6891E-03
4.100	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2018E-01	3.6899E-03
4.400	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2020E-01	3.6903E-03
4.700	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2020E-01	3.6905E-03
5.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6906E-03
5.300	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
5.600	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
5.614	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
6.014	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
6.314	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
6.614	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
6.914	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
7.214	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
7.514	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
7.814	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
8.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
8.300	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
8.600	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
8.900	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
9.200	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
9.500	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
9.800	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
10.100	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
10.400	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
24.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
48.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03

48.111 1.3115E-02 4.0838E-04 3.0875E-03 9.6140E-05 1.2021E-01 3.6907E-03  
96.000 1.3115E-02 4.0838E-04 3.0875E-03 9.6140E-05 1.2021E-01 3.6907E-03  
720.000 1.3115E-02 4.0838E-04 3.0875E-03 9.6140E-05 1.2021E-01 3.6907E-03

#####

Worst Two-Hour Doses

#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	6.0267E-06	1.3115E-02	4.0838E-04

# ATTACHMENT R SGTRCUS OUTPUT FILE

#####

## Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.167	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.190	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.333	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.366	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.766	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.367	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.667	1.9966E-03	6.2103E-05	4.7002E-04	1.4620E-05	4.5564E-03	1.3986E-04
1.803	2.8983E-03	9.0147E-05	6.8231E-04	2.1222E-05	8.7899E-03	2.6980E-04
2.000	4.2010E-03	1.3065E-04	9.8899E-04	3.0758E-05	1.6330E-02	5.0123E-04
2.300	4.2010E-03	1.3065E-04	1.0192E-03	3.1696E-05	2.9065E-02	8.9204E-04
2.600	4.2010E-03	1.3065E-04	1.0492E-03	3.2630E-05	4.2132E-02	1.2930E-03
2.900	4.2010E-03	1.3065E-04	1.0791E-03	3.3559E-05	5.5325E-02	1.6978E-03
3.200	4.2010E-03	1.3065E-04	1.1088E-03	3.4482E-05	6.8547E-02	2.1035E-03
3.500	4.2010E-03	1.3065E-04	1.1384E-03	3.5401E-05	8.1748E-02	2.5085E-03
3.800	4.2010E-03	1.3065E-04	1.1679E-03	3.6316E-05	9.4906E-02	2.9121E-03
4.100	4.2010E-03	1.3065E-04	1.1972E-03	3.7225E-05	1.0801E-01	3.3140E-03
4.400	4.2010E-03	1.3065E-04	1.2263E-03	3.8130E-05	1.2105E-01	3.7141E-03
4.700	4.2010E-03	1.3065E-04	1.2553E-03	3.9031E-05	1.3404E-01	4.1123E-03
5.000	4.2010E-03	1.3065E-04	1.2842E-03	3.9926E-05	1.4696E-01	4.5085E-03
5.300	4.2010E-03	1.3065E-04	1.3129E-03	4.0818E-05	1.5982E-01	4.9028E-03
5.600	4.2010E-03	1.3065E-04	1.3415E-03	4.1704E-05	1.7261E-01	5.2952E-03
5.614	4.2010E-03	1.3065E-04	1.3429E-03	4.1746E-05	1.7321E-01	5.3134E-03
6.014	4.2010E-03	1.3065E-04	1.3807E-03	4.2921E-05	1.9017E-01	5.8334E-03
6.314	4.2010E-03	1.3065E-04	1.4090E-03	4.3797E-05	2.0282E-01	6.2212E-03
6.614	4.2010E-03	1.3065E-04	1.4371E-03	4.4669E-05	2.1541E-01	6.6071E-03
6.914	4.2010E-03	1.3065E-04	1.4651E-03	4.5536E-05	2.2793E-01	6.9910E-03
7.214	4.2010E-03	1.3065E-04	1.4930E-03	4.6399E-05	2.4040E-01	7.3731E-03
7.514	4.2010E-03	1.3065E-04	1.5207E-03	4.7258E-05	2.5281E-01	7.7533E-03
7.814	4.2010E-03	1.3065E-04	1.5483E-03	4.8113E-05	2.6515E-01	8.1317E-03
8.000	4.2010E-03	1.3065E-04	1.5653E-03	4.8640E-05	2.7278E-01	8.3653E-03
8.300	4.2010E-03	1.3065E-04	1.5794E-03	4.9081E-05	2.8297E-01	8.6776E-03
8.600	4.2010E-03	1.3065E-04	1.5934E-03	4.9519E-05	2.9045E-01	8.9068E-03
8.900	4.2010E-03	1.3065E-04	1.6073E-03	4.9956E-05	2.9660E-01	9.0953E-03
9.200	4.2010E-03	1.3065E-04	1.6212E-03	5.0390E-05	3.0210E-01	9.2638E-03
9.500	4.2010E-03	1.3065E-04	1.6350E-03	5.0821E-05	3.0727E-01	9.4221E-03
9.800	4.2010E-03	1.3065E-04	1.6488E-03	5.1251E-05	3.1227E-01	9.5752E-03
10.100	4.2010E-03	1.3065E-04	1.6624E-03	5.1679E-05	3.1717E-01	9.7254E-03
10.400	4.2010E-03	1.3065E-04	1.6761E-03	5.2104E-05	3.2201E-01	9.8738E-03
24.000	4.2010E-03	1.3065E-04	2.2320E-03	6.9425E-05	5.1854E-01	1.5887E-02
48.000	4.2010E-03	1.3065E-04	2.4650E-03	7.6624E-05	6.3814E-01	1.9539E-02



48.111 4.2010E-03 1.3065E-04 2.4659E-03 7.6652E-05 6.3860E-01 1.9553E-02  
96.000 4.2010E-03 1.3065E-04 2.7483E-03 8.5345E-05 7.8211E-01 2.3929E-02  
720.000 4.2010E-03 1.3065E-04 3.0536E-03 9.4724E-05 8.6485E-01 2.6449E-02

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.8171E-06	4.2010E-03	1.3065E-04

ATTACHMENT S  
SGTRCAIM OUTPUT FILE

#####

Cumulative Dose Summary

#####

Time (hr)	eab		lpz		cr	
	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	1.0187E-01	3.7450E-03	2.3983E-02	8.8163E-04	9.8130E-02	3.1357E-03
0.167	1.8051E-01	6.6200E-03	4.2496E-02	1.5585E-03	2.3442E-01	7.4869E-03
0.190	2.1341E-01	7.8190E-03	5.0240E-02	1.8407E-03	3.1759E-01	1.0141E-02
0.333	3.3073E-01	1.2081E-02	7.7860E-02	2.8442E-03	9.9575E-01	3.1768E-02
0.366	3.6651E-01	1.3374E-02	8.6283E-02	3.1484E-03	1.1849E+00	3.7794E-02
0.766	9.0439E-01	3.2612E-02	2.1291E-01	7.6775E-03	4.1019E+00	1.3058E-01
1.000	1.3781E+00	4.9335E-02	3.2444E-01	1.1614E-02	6.6153E+00	2.1033E-01
1.367	2.3386E+00	8.2866E-02	5.5054E-01	1.9508E-02	1.2092E+01	3.8378E-01
1.667	3.1965E+00	1.1251E-01	7.5250E-01	2.6488E-02	1.7780E+01	5.6358E-01
1.803	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.0640E+01	6.5389E-01
2.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.4054E+01	7.6161E-01
2.300	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.6937E+01	8.5252E-01
2.600	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.8332E+01	8.9643E-01
2.900	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9006E+01	9.1764E-01
3.200	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9332E+01	9.2790E-01
3.500	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9490E+01	9.3285E-01
3.800	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9566E+01	9.3525E-01
4.100	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9603E+01	9.3641E-01
4.400	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9621E+01	9.3697E-01
4.700	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9630E+01	9.3724E-01
5.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9634E+01	9.3737E-01
5.300	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9636E+01	9.3744E-01
5.600	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9637E+01	9.3747E-01
5.614	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9637E+01	9.3747E-01
6.014	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3749E-01
6.314	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3749E-01
6.614	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
6.914	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
7.214	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
7.514	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
7.814	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
8.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
8.300	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
8.600	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
8.900	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
9.200	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
9.500	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
9.800	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
10.100	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
10.400	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
24.000	3.6232E+00	1.2717E-01	8.5296E-01	2.9938E-02	2.9638E+01	9.3750E-01
32.000	3.6232E+00	1.2717E-01	8.8907E-01	3.1076E-02	4.6497E+01	1.4562E+00

96.000 3.6232E+00 1.2717E-01 8.8907E-01 3.1076E-02 4.7858E+01 1.4981E+00  
720.000 3.6232E+00 1.2717E-01 8.8907E-01 3.1076E-02 4.7858E+01 1.4981E+00

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.3109E-02	3.6232E+00	1.2717E-01

ATTACHMENT T  
SGTRCANM OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	1.2417E-02	0.0000E+00	2.9231E-03	0.0000E+00	7.9596E-04
0.167	0.0000E+00	1.5796E-02	0.0000E+00	3.7186E-03	0.0000E+00	1.5807E-03
0.190	0.0000E+00	1.6939E-02	0.0000E+00	3.9877E-03	0.0000E+00	1.9739E-03
0.333	0.0000E+00	2.4686E-02	0.0000E+00	5.8115E-03	0.0000E+00	4.9659E-03
0.366	0.0000E+00	2.6346E-02	0.0000E+00	6.2023E-03	0.0000E+00	5.7638E-03
0.766	0.0000E+00	4.1366E-02	0.0000E+00	9.7383E-03	0.0000E+00	1.7448E-02
1.000	0.0000E+00	4.8786E-02	0.0000E+00	1.1485E-02	0.0000E+00	2.5278E-02
1.367	0.0000E+00	5.8788E-02	0.0000E+00	1.3840E-02	0.0000E+00	3.8135E-02
1.667	0.0000E+00	6.5715E-02	0.0000E+00	1.5470E-02	0.0000E+00	4.8670E-02
1.803	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	5.3356E-02
2.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	5.9588E-02
2.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	6.7366E-02
2.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	7.3481E-02
2.900	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	7.8294E-02
3.200	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.2087E-02
3.500	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.5079E-02
3.800	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.7441E-02
4.100	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.9307E-02
4.400	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.0783E-02
4.700	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.1952E-02
5.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.2877E-02
5.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.3611E-02
5.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4193E-02
5.614	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4217E-02
6.014	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4804E-02
6.314	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5141E-02
6.614	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5408E-02
6.914	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5620E-02
7.214	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5790E-02
7.514	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5924E-02
7.814	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6031E-02
8.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6087E-02
8.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6161E-02
8.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6220E-02
8.900	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6267E-02
9.200	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6305E-02
9.500	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6335E-02
9.800	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6359E-02
10.100	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6378E-02
10.400	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6393E-02
24.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6455E-02
32.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6160E-02	0.0000E+00	9.7871E-02

48.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6160E-02 0.0000E+00 9.8137E-02  
48.111 0.0000E+00 6.8532E-02 0.0000E+00 1.6160E-02 0.0000E+00 9.8137E-02  
96.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6160E-02 0.0000E+00 9.8137E-02  
720.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6160E-02 0.0000E+00 9.8137E-02

#####

Worst Two-Hour Doses

#####

eab

Time	Whole Body	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)
0.0	6.8532E-02	0.0000E+00	6.8532E-02

# ATTACHMENT U SGTRCUIM OUTPUT FILE

#####

## Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	1.1695E-05	4.2990E-07	2.7532E-06	1.0121E-07	1.1230E-05	3.5886E-07
0.167	2.4641E-05	9.0321E-07	5.8009E-06	2.1263E-07	2.8812E-05	9.2017E-07
0.190	3.1883E-05	1.1672E-06	7.5058E-06	2.7478E-07	4.0819E-05	1.3033E-06
0.333	9.7955E-05	3.5676E-06	2.3060E-05	8.3988E-07	2.0368E-04	6.4967E-06
0.366	1.1806E-04	4.2940E-06	2.7794E-05	1.0109E-06	2.6464E-04	8.4389E-06
0.766	5.1484E-04	1.8485E-05	1.2120E-04	4.3517E-06	1.8012E-03	5.7304E-05
1.000	8.7507E-04	3.1201E-05	2.0601E-04	7.3452E-06	3.5142E-03	1.1166E-04
1.367	1.6285E-03	5.7506E-05	3.8338E-04	1.3538E-05	7.5786E-03	2.4038E-04
1.667	2.4928E-03	8.7374E-05	5.8684E-04	2.0569E-05	1.2376E-02	3.9204E-04
1.803	2.9450E-03	1.0291E-04	6.9329E-04	2.4226E-05	1.5048E-02	4.7640E-04
2.000	3.6680E-03	1.2765E-04	8.6352E-04	3.0051E-05	1.9463E-02	6.1571E-04
2.300	3.6680E-03	1.2765E-04	8.8274E-04	3.0705E-05	2.7002E-02	8.5334E-04
2.600	3.6680E-03	1.2765E-04	9.0492E-04	3.1455E-05	3.5422E-02	1.1184E-03
2.900	3.6680E-03	1.2765E-04	9.3011E-04	3.2303E-05	4.4953E-02	1.4182E-03
3.200	3.6680E-03	1.2765E-04	9.5840E-04	3.3250E-05	5.5722E-02	1.7565E-03
3.500	3.6680E-03	1.2765E-04	9.8983E-04	3.4299E-05	6.7802E-02	2.1358E-03
3.800	3.6680E-03	1.2765E-04	1.0245E-03	3.5451E-05	8.1247E-02	2.5575E-03
4.100	3.6680E-03	1.2765E-04	1.0624E-03	3.6707E-05	9.6094E-02	3.0229E-03
4.400	3.6680E-03	1.2765E-04	1.1036E-03	3.8069E-05	1.1238E-01	3.5329E-03
4.700	3.6680E-03	1.2765E-04	1.1483E-03	3.9540E-05	1.3012E-01	4.0885E-03
5.000	3.6680E-03	1.2765E-04	1.1964E-03	4.1121E-05	1.4937E-01	4.6905E-03
5.300	3.6680E-03	1.2765E-04	1.2480E-03	4.2813E-05	1.7013E-01	5.3397E-03
5.600	3.6680E-03	1.2765E-04	1.3031E-03	4.4618E-05	1.9244E-01	6.0370E-03
5.614	3.6680E-03	1.2765E-04	1.3058E-03	4.4705E-05	1.9352E-01	6.0707E-03
6.014	3.6680E-03	1.2765E-04	1.3853E-03	4.7299E-05	2.2583E-01	7.0796E-03
6.314	3.6680E-03	1.2765E-04	1.4492E-03	4.9381E-05	2.5193E-01	7.8944E-03
6.614	3.6680E-03	1.2765E-04	1.5169E-03	5.1582E-05	2.7967E-01	8.7598E-03
6.914	3.6680E-03	1.2765E-04	1.5884E-03	5.3904E-05	3.0907E-01	9.6767E-03
7.214	3.6680E-03	1.2765E-04	1.6637E-03	5.6347E-05	3.4015E-01	1.0646E-02
7.514	3.6680E-03	1.2765E-04	1.7430E-03	5.8915E-05	3.7295E-01	1.1668E-02
7.814	3.6680E-03	1.2765E-04	1.8263E-03	6.1607E-05	4.0748E-01	1.2743E-02
8.000	3.6680E-03	1.2765E-04	1.8800E-03	6.3340E-05	4.2977E-01	1.3437E-02
8.300	3.6680E-03	1.2765E-04	1.9256E-03	6.4865E-05	4.6041E-01	1.4391E-02
8.600	3.6680E-03	1.2765E-04	1.9722E-03	6.6420E-05	4.8358E-01	1.5112E-02
8.900	3.6680E-03	1.2765E-04	2.0198E-03	6.8003E-05	5.0332E-01	1.5727E-02
9.200	3.6680E-03	1.2765E-04	2.0683E-03	6.9615E-05	5.2157E-01	1.6294E-02
9.500	3.6680E-03	1.2765E-04	2.1178E-03	7.1256E-05	5.3927E-01	1.6844E-02
9.800	3.6680E-03	1.2765E-04	2.1681E-03	7.2924E-05	5.5687E-01	1.7391E-02
10.100	3.6680E-03	1.2765E-04	2.2194E-03	7.4621E-05	5.7459E-01	1.7942E-02
10.400	3.6680E-03	1.2765E-04	2.2716E-03	7.6345E-05	5.9253E-01	1.8500E-02
24.000	3.6680E-03	1.2765E-04	5.4857E-03	1.8023E-04	1.7030E+00	5.2829E-02
32.000	3.6680E-03	1.2765E-04	6.2753E-03	2.0510E-04	2.1069E+00	6.5260E-02

96.000 3.6680E-03 1.2765E-04 6.2753E-03 2.0510E-04 2.1387E+00 6.6235E-02  
720.000 3.6680E-03 1.2765E-04 6.2753E-03 2.0510E-04 2.1387E+00 6.6235E-02

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.2296E-05	3.6680E-03	1.2765E-04

ATTACHMENT V  
SGTRCUNM OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	2.7963E-06	0.0000E+00	6.5829E-07	0.0000E+00	1.7841E-07
0.167	0.0000E+00	4.0319E-06	0.0000E+00	9.4919E-07	0.0000E+00	3.6924E-07
0.190	0.0000E+00	4.5727E-06	0.0000E+00	1.0765E-06	0.0000E+00	4.7372E-07
0.333	0.0000E+00	7.9087E-06	0.0000E+00	1.8618E-06	0.0000E+00	1.3871E-06
0.366	0.0000E+00	8.6550E-06	0.0000E+00	2.0375E-06	0.0000E+00	1.6531E-06
0.766	0.0000E+00	1.7547E-05	0.0000E+00	4.1308E-06	0.0000E+00	6.3689E-06
1.000	0.0000E+00	2.2545E-05	0.0000E+00	5.3074E-06	0.0000E+00	1.0122E-05
1.367	0.0000E+00	3.0144E-05	0.0000E+00	7.0965E-06	0.0000E+00	1.7069E-05
1.667	0.0000E+00	3.6167E-05	0.0000E+00	8.5144E-06	0.0000E+00	2.3454E-05
1.803	0.0000E+00	3.8845E-05	0.0000E+00	9.1447E-06	0.0000E+00	2.6503E-05
2.000	0.0000E+00	4.2672E-05	0.0000E+00	1.0046E-05	0.0000E+00	3.1057E-05
2.300	0.0000E+00	4.2672E-05	0.0000E+00	1.0133E-05	0.0000E+00	3.8093E-05
2.600	0.0000E+00	4.2672E-05	0.0000E+00	1.0218E-05	0.0000E+00	4.5100E-05
2.900	0.0000E+00	4.2672E-05	0.0000E+00	1.0302E-05	0.0000E+00	5.2059E-05
3.200	0.0000E+00	4.2672E-05	0.0000E+00	1.0384E-05	0.0000E+00	5.8958E-05
3.500	0.0000E+00	4.2672E-05	0.0000E+00	1.0464E-05	0.0000E+00	6.5786E-05
3.800	0.0000E+00	4.2672E-05	0.0000E+00	1.0543E-05	0.0000E+00	7.2539E-05
4.100	0.0000E+00	4.2672E-05	0.0000E+00	1.0620E-05	0.0000E+00	7.9213E-05
4.400	0.0000E+00	4.2672E-05	0.0000E+00	1.0696E-05	0.0000E+00	8.5808E-05
4.700	0.0000E+00	4.2672E-05	0.0000E+00	1.0771E-05	0.0000E+00	9.2323E-05
5.000	0.0000E+00	4.2672E-05	0.0000E+00	1.0845E-05	0.0000E+00	9.8759E-05
5.300	0.0000E+00	4.2672E-05	0.0000E+00	1.0918E-05	0.0000E+00	1.0512E-04
5.600	0.0000E+00	4.2672E-05	0.0000E+00	1.0989E-05	0.0000E+00	1.1140E-04
5.614	0.0000E+00	4.2672E-05	0.0000E+00	1.0993E-05	0.0000E+00	1.1169E-04
6.014	0.0000E+00	4.2672E-05	0.0000E+00	1.1087E-05	0.0000E+00	1.1996E-04
6.314	0.0000E+00	4.2672E-05	0.0000E+00	1.1156E-05	0.0000E+00	1.2607E-04
6.614	0.0000E+00	4.2672E-05	0.0000E+00	1.1225E-05	0.0000E+00	1.3212E-04
6.914	0.0000E+00	4.2672E-05	0.0000E+00	1.1293E-05	0.0000E+00	1.3811E-04
7.214	0.0000E+00	4.2672E-05	0.0000E+00	1.1360E-05	0.0000E+00	1.4403E-04
7.514	0.0000E+00	4.2672E-05	0.0000E+00	1.1427E-05	0.0000E+00	1.4990E-04
7.814	0.0000E+00	4.2672E-05	0.0000E+00	1.1493E-05	0.0000E+00	1.5572E-04
8.000	0.0000E+00	4.2672E-05	0.0000E+00	1.1533E-05	0.0000E+00	1.5929E-04
8.300	0.0000E+00	4.2672E-05	0.0000E+00	1.1598E-05	0.0000E+00	1.6468E-04
8.600	0.0000E+00	4.2672E-05	0.0000E+00	1.1663E-05	0.0000E+00	1.6942E-04
8.900	0.0000E+00	4.2672E-05	0.0000E+00	1.1726E-05	0.0000E+00	1.7366E-04
9.200	0.0000E+00	4.2672E-05	0.0000E+00	1.1790E-05	0.0000E+00	1.7748E-04
9.500	0.0000E+00	4.2672E-05	0.0000E+00	1.1853E-05	0.0000E+00	1.8097E-04
9.800	0.0000E+00	4.2672E-05	0.0000E+00	1.1915E-05	0.0000E+00	1.8419E-04
10.100	0.0000E+00	4.2672E-05	0.0000E+00	1.1977E-05	0.0000E+00	1.8720E-04
10.400	0.0000E+00	4.2672E-05	0.0000E+00	1.2038E-05	0.0000E+00	1.9004E-04
24.000	0.0000E+00	4.2672E-05	0.0000E+00	1.4562E-05	0.0000E+00	2.8312E-04
32.000	0.0000E+00	4.2672E-05	0.0000E+00	1.4890E-05	0.0000E+00	3.0602E-04



48.000 0.0000E+00 4.2672E-05 0.0000E+00 1.4890E-05 0.0000E+00 3.0975E-04  
 48.111 0.0000E+00 4.2672E-05 0.0000E+00 1.4890E-05 0.0000E+00 3.0975E-04  
 96.000 0.0000E+00 4.2672E-05 0.0000E+00 1.4890E-05 0.0000E+00 3.0975E-04  
 720.000 0.0000E+00 4.2672E-05 0.0000E+00 1.4890E-05 0.0000E+00 3.0975E-04

#####

Worst Two-Hour Doses

#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	4.2672E-05	0.0000E+00	4.2672E-05

ATTACHMENT W  
SGTRPAI OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	4.0449E+00	1.3140E-01	9.5224E-01	3.0933E-02	4.3481E+00	1.3536E-01
0.167	5.3802E+00	1.7474E-01	1.2666E+00	4.1136E-02	8.8243E+00	2.7468E-01
0.190	5.7977E+00	1.8828E-01	1.3649E+00	4.4325E-02	1.1135E+01	3.4660E-01
0.333	6.8354E+00	2.2193E-01	1.6092E+00	5.2247E-02	2.6620E+01	8.2845E-01
0.366	7.0724E+00	2.2961E-01	1.6650E+00	5.4054E-02	3.0224E+01	9.4058E-01
0.766	9.0710E+00	2.9427E-01	2.1355E+00	6.9277E-02	6.3844E+01	1.9863E+00
1.000	1.0158E+01	3.2936E-01	2.3913E+00	7.7536E-02	7.7668E+01	2.4160E+00
1.367	1.1756E+01	3.8083E-01	2.7675E+00	8.9654E-02	9.5000E+01	2.9546E+00
1.667	1.2654E+01	4.0971E-01	2.9789E+00	9.6451E-02	1.0615E+02	3.3008E+00
1.803	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.1038E+02	3.4324E+00
2.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.1505E+02	3.5774E+00
2.300	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.1901E+02	3.7000E+00
2.600	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2092E+02	3.7593E+00
2.900	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2184E+02	3.7880E+00
3.200	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2229E+02	3.8019E+00
3.500	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2251E+02	3.8087E+00
3.800	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2262E+02	3.8119E+00
4.100	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2267E+02	3.8135E+00
4.400	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2269E+02	3.8143E+00
4.700	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2270E+02	3.8147E+00
5.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8148E+00
5.300	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8149E+00
5.600	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
5.614	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
6.014	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
6.314	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
6.614	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
6.914	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
7.214	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
7.514	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
7.814	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
8.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
8.300	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
8.600	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
8.900	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
9.200	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
9.500	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
9.800	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
10.100	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
10.400	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
24.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
48.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00

48.111 1.3026E+01 4.2164E-01 3.0664E+00 9.9262E-02 1.2271E+02 3.8150E+00  
96.000 1.3026E+01 4.2164E-01 3.0664E+00 9.9262E-02 1.2271E+02 3.8150E+00  
720.000 1.3026E+01 4.2164E-01 3.0664E+00 9.9262E-02 1.2271E+02 3.8150E+00

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.7520E-02	1.3026E+01	4.2164E-01

ATTACHMENT X  
SGTRPAN OUTPUT FILE

#####  
Cumulative Dose Summary  
#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	1.2417E-02	0.0000E+00	2.9231E-03	0.0000E+00	7.9596E-04
0.167	0.0000E+00	1.5796E-02	0.0000E+00	3.7186E-03	0.0000E+00	1.5807E-03
0.190	0.0000E+00	1.6939E-02	0.0000E+00	3.9877E-03	0.0000E+00	1.9739E-03
0.333	0.0000E+00	2.4686E-02	0.0000E+00	5.8115E-03	0.0000E+00	4.9659E-03
0.366	0.0000E+00	2.6346E-02	0.0000E+00	6.2023E-03	0.0000E+00	5.7638E-03
0.766	0.0000E+00	4.1366E-02	0.0000E+00	9.7383E-03	0.0000E+00	1.7448E-02
1.000	0.0000E+00	4.8786E-02	0.0000E+00	1.1485E-02	0.0000E+00	2.5278E-02
1.367	0.0000E+00	5.8788E-02	0.0000E+00	1.3840E-02	0.0000E+00	3.8135E-02
1.667	0.0000E+00	6.5715E-02	0.0000E+00	1.5470E-02	0.0000E+00	4.8670E-02
1.803	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	5.3356E-02
2.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	5.9588E-02
2.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	6.7366E-02
2.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	7.3481E-02
2.900	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	7.8294E-02
3.200	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.2087E-02
3.500	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.5079E-02
3.800	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.7441E-02
4.100	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.9307E-02
4.400	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.0783E-02
4.700	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.1952E-02
5.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.2877E-02
5.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.3611E-02
5.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4193E-02
5.614	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4217E-02
6.014	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4804E-02
6.314	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5141E-02
6.614	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5408E-02
6.914	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5620E-02
7.214	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5790E-02
7.514	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5924E-02
7.814	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6031E-02
8.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6087E-02
8.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6161E-02
8.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6220E-02
8.900	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6267E-02
9.200	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6305E-02
9.500	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6335E-02
9.800	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6359E-02
10.100	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6378E-02
10.400	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6393E-02
24.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6455E-02
48.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6455E-02

48.111 0.0000E+00 6.8532E-02 0.0000E+00 1.6134E-02 0.0000E+00 9.6455E-02  
96.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6134E-02 0.0000E+00 9.6455E-02  
720.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6134E-02 0.0000E+00 9.6455E-02

#####

Worst Two-Hour Doses

#####

eab

Time	Whole Body	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)
0.0	6.8532E-02	0.0000E+00	6.8532E-02

# ATTACHMENT Y SGTRPUI OUTPUT FILE

#####  
Cumulative Dose Summary  
#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	4.7168E-04	1.5322E-05	1.1104E-04	3.6071E-06	5.0462E-04	1.5709E-05
0.167	6.8481E-04	2.2240E-05	1.6122E-04	5.2356E-06	1.0552E-03	3.2845E-05
0.190	7.7902E-04	2.5296E-05	1.8339E-04	5.9551E-06	1.3596E-03	4.2320E-05
0.333	1.3656E-03	4.4319E-05	3.2149E-04	1.0433E-05	4.0486E-03	1.2600E-04
0.366	1.4993E-03	4.8650E-05	3.5296E-04	1.1453E-05	4.8245E-03	1.5014E-04
0.766	3.1311E-03	1.0144E-04	7.3712E-04	2.3882E-05	1.5673E-02	4.8756E-04
1.000	4.0823E-03	1.3215E-04	9.6104E-04	3.1109E-05	2.2711E-02	7.0635E-04
1.367	5.5690E-03	1.8004E-04	1.3110E-03	4.2385E-05	3.4183E-02	1.0628E-03
1.667	7.0226E-03	2.2678E-04	1.6532E-03	5.3387E-05	4.4275E-02	1.3762E-03
1.803	7.6955E-03	2.4839E-04	1.8117E-03	5.8474E-05	4.9162E-02	1.5280E-03
2.000	8.6856E-03	2.8016E-04	2.0447E-03	6.5954E-05	5.6496E-02	1.7556E-03
2.300	8.6856E-03	2.8016E-04	2.0683E-03	6.6709E-05	6.7597E-02	2.1001E-03
2.600	8.6856E-03	2.8016E-04	2.0925E-03	6.7483E-05	7.8447E-02	2.4368E-03
2.900	8.6856E-03	2.8016E-04	2.1173E-03	6.8277E-05	8.9322E-02	2.7740E-03
3.200	8.6856E-03	2.8016E-04	2.1428E-03	6.9090E-05	1.0035E-01	3.1160E-03
3.500	8.6856E-03	2.8016E-04	2.1689E-03	6.9922E-05	1.1160E-01	3.4646E-03
3.800	8.6856E-03	2.8016E-04	2.1956E-03	7.0772E-05	1.2309E-01	3.8207E-03
4.100	8.6856E-03	2.8016E-04	2.2228E-03	7.1641E-05	1.3484E-01	4.1847E-03
4.400	8.6856E-03	2.8016E-04	2.2507E-03	7.2528E-05	1.4686E-01	4.5569E-03
4.700	8.6856E-03	2.8016E-04	2.2792E-03	7.3434E-05	1.5914E-01	4.9371E-03
5.000	8.6856E-03	2.8016E-04	2.3083E-03	7.4358E-05	1.7169E-01	5.3255E-03
5.300	8.6856E-03	2.8016E-04	2.3380E-03	7.5299E-05	1.8450E-01	5.7219E-03
5.600	8.6856E-03	2.8016E-04	2.3682E-03	7.6259E-05	1.9757E-01	6.1263E-03
5.614	8.6856E-03	2.8016E-04	2.3697E-03	7.6304E-05	1.9818E-01	6.1453E-03
6.014	8.6856E-03	2.8016E-04	2.4109E-03	7.7611E-05	2.1603E-01	6.6974E-03
6.314	8.6856E-03	2.8016E-04	2.4425E-03	7.8612E-05	2.2971E-01	7.1205E-03
6.614	8.6856E-03	2.8016E-04	2.4747E-03	7.9631E-05	2.4365E-01	7.5515E-03
6.914	8.6856E-03	2.8016E-04	2.5074E-03	8.0666E-05	2.5784E-01	7.9901E-03
7.214	8.6856E-03	2.8016E-04	2.5407E-03	8.1719E-05	2.7228E-01	8.4364E-03
7.514	8.6856E-03	2.8016E-04	2.5746E-03	8.2788E-05	2.8697E-01	8.8902E-03
7.814	8.6856E-03	2.8016E-04	2.6090E-03	8.3874E-05	3.0190E-01	9.3516E-03
8.000	8.6856E-03	2.8016E-04	2.6306E-03	8.4555E-05	3.1128E-01	9.6414E-03
8.300	8.6856E-03	2.8016E-04	2.6487E-03	8.5140E-05	3.2396E-01	1.0033E-02
8.600	8.6856E-03	2.8016E-04	2.6671E-03	8.5732E-05	3.3341E-01	1.0325E-02
8.900	8.6856E-03	2.8016E-04	2.6858E-03	8.6334E-05	3.4135E-01	1.0570E-02
9.200	8.6856E-03	2.8016E-04	2.7048E-03	8.6943E-05	3.4860E-01	1.0794E-02
9.500	8.6856E-03	2.8016E-04	2.7240E-03	8.7560E-05	3.5556E-01	1.1009E-02
9.800	8.6856E-03	2.8016E-04	2.7435E-03	8.8186E-05	3.6244E-01	1.1221E-02
10.100	8.6856E-03	2.8016E-04	2.7632E-03	8.8820E-05	3.6932E-01	1.1433E-02
10.400	8.6856E-03	2.8016E-04	2.7832E-03	8.9461E-05	3.7625E-01	1.1647E-02
24.000	8.6856E-03	2.8016E-04	3.9372E-03	1.2607E-04	7.7636E-01	2.3957E-02
48.000	8.6856E-03	2.8016E-04	4.8460E-03	1.5434E-04	1.2358E+00	3.8029E-02

48.111 8.6856E-03 2.8016E-04 4.8508E-03 1.5448E-04 1.2382E+00 3.8102E-02  
96.000 8.6856E-03 2.8016E-04 7.1930E-03 2.2675E-04 2.4194E+00 7.4151E-02  
720.000 8.6856E-03 2.8016E-04 2.4577E-02 7.6090E-04 7.1022E+00 2.1679E-01

#####

Worst Two-Hour Doses

#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.0854E-05	8.6856E-03	2.8016E-04

ATTACHMENT Z  
SGTRPUN OUTPUT FILE

#####  
Cumulative Dose Summary  
#####

	eab		lpz		cr	
Time (hr)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	2.7953E-06	0.0000E+00	6.5806E-07	0.0000E+00	1.7835E-07
0.167	0.0000E+00	4.0305E-06	0.0000E+00	9.4886E-07	0.0000E+00	3.6911E-07
0.190	0.0000E+00	4.5711E-06	0.0000E+00	1.0761E-06	0.0000E+00	4.7355E-07
0.333	0.0000E+00	7.9060E-06	0.0000E+00	1.8612E-06	0.0000E+00	1.3866E-06
0.366	0.0000E+00	8.6521E-06	0.0000E+00	2.0368E-06	0.0000E+00	1.6525E-06
0.766	0.0000E+00	1.7541E-05	0.0000E+00	4.1294E-06	0.0000E+00	6.3667E-06
1.000	0.0000E+00	2.2537E-05	0.0000E+00	5.3056E-06	0.0000E+00	1.0119E-05
1.367	0.0000E+00	3.0134E-05	0.0000E+00	7.0940E-06	0.0000E+00	1.7063E-05
1.667	0.0000E+00	3.6155E-05	0.0000E+00	8.5115E-06	0.0000E+00	2.3446E-05
1.803	0.0000E+00	3.8831E-05	0.0000E+00	9.1415E-06	0.0000E+00	2.6494E-05
2.000	0.0000E+00	4.2657E-05	0.0000E+00	1.0042E-05	0.0000E+00	3.1046E-05
2.300	0.0000E+00	4.2657E-05	0.0000E+00	1.0130E-05	0.0000E+00	3.8080E-05
2.600	0.0000E+00	4.2657E-05	0.0000E+00	1.0215E-05	0.0000E+00	4.5085E-05
2.900	0.0000E+00	4.2657E-05	0.0000E+00	1.0298E-05	0.0000E+00	5.2041E-05
3.200	0.0000E+00	4.2657E-05	0.0000E+00	1.0380E-05	0.0000E+00	5.8937E-05
3.500	0.0000E+00	4.2657E-05	0.0000E+00	1.0460E-05	0.0000E+00	6.5763E-05
3.800	0.0000E+00	4.2657E-05	0.0000E+00	1.0539E-05	0.0000E+00	7.2514E-05
4.100	0.0000E+00	4.2657E-05	0.0000E+00	1.0616E-05	0.0000E+00	7.9186E-05
4.400	0.0000E+00	4.2657E-05	0.0000E+00	1.0693E-05	0.0000E+00	8.5778E-05
4.700	0.0000E+00	4.2657E-05	0.0000E+00	1.0767E-05	0.0000E+00	9.2291E-05
5.000	0.0000E+00	4.2657E-05	0.0000E+00	1.0841E-05	0.0000E+00	9.8725E-05
5.300	0.0000E+00	4.2657E-05	0.0000E+00	1.0914E-05	0.0000E+00	1.0508E-04
5.600	0.0000E+00	4.2657E-05	0.0000E+00	1.0986E-05	0.0000E+00	1.1136E-04
5.614	0.0000E+00	4.2657E-05	0.0000E+00	1.0989E-05	0.0000E+00	1.1165E-04
6.014	0.0000E+00	4.2657E-05	0.0000E+00	1.1083E-05	0.0000E+00	1.1991E-04
6.314	0.0000E+00	4.2657E-05	0.0000E+00	1.1152E-05	0.0000E+00	1.2603E-04
6.614	0.0000E+00	4.2657E-05	0.0000E+00	1.1221E-05	0.0000E+00	1.3208E-04
6.914	0.0000E+00	4.2657E-05	0.0000E+00	1.1289E-05	0.0000E+00	1.3806E-04
7.214	0.0000E+00	4.2657E-05	0.0000E+00	1.1356E-05	0.0000E+00	1.4398E-04
7.514	0.0000E+00	4.2657E-05	0.0000E+00	1.1423E-05	0.0000E+00	1.4985E-04
7.814	0.0000E+00	4.2657E-05	0.0000E+00	1.1489E-05	0.0000E+00	1.5566E-04
8.000	0.0000E+00	4.2657E-05	0.0000E+00	1.1529E-05	0.0000E+00	1.5924E-04
8.300	0.0000E+00	4.2657E-05	0.0000E+00	1.1594E-05	0.0000E+00	1.6462E-04
8.600	0.0000E+00	4.2657E-05	0.0000E+00	1.1659E-05	0.0000E+00	1.6937E-04
8.900	0.0000E+00	4.2657E-05	0.0000E+00	1.1722E-05	0.0000E+00	1.7360E-04
9.200	0.0000E+00	4.2657E-05	0.0000E+00	1.1786E-05	0.0000E+00	1.7742E-04
9.500	0.0000E+00	4.2657E-05	0.0000E+00	1.1848E-05	0.0000E+00	1.8091E-04
9.800	0.0000E+00	4.2657E-05	0.0000E+00	1.1911E-05	0.0000E+00	1.8413E-04
10.100	0.0000E+00	4.2657E-05	0.0000E+00	1.1973E-05	0.0000E+00	1.8714E-04
10.400	0.0000E+00	4.2657E-05	0.0000E+00	1.2034E-05	0.0000E+00	1.8997E-04
24.000	0.0000E+00	4.2657E-05	0.0000E+00	1.4557E-05	0.0000E+00	2.8302E-04
48.000	0.0000E+00	4.2657E-05	0.0000E+00	1.5488E-05	0.0000E+00	3.4567E-04



48.111 0.0000E+00 4.2657E-05 0.0000E+00 1.5492E-05 0.0000E+00 3.4593E-04  
96.000 0.0000E+00 4.2657E-05 0.0000E+00 1.6987E-05 0.0000E+00 4.4451E-04  
720.000 0.0000E+00 4.2657E-05 0.0000E+00 2.1764E-05 0.0000E+00 6.1242E-04

#####

Worst Two-Hour Doses

#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	4.2657E-05	0.0000E+00	4.2657E-05

ATTACHMENT AA  
SGTRPAS OUTPUT FILE

#####  
Cumulative Dose Summary  
#####

Time (hr)	eab		lpz		cr	
	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.167	4.7882E-03	1.4915E-04	1.1272E-03	3.5112E-05	2.3595E-03	7.2461E-05
0.190	5.4416E-03	1.6950E-04	1.2810E-03	3.9902E-05	4.5726E-03	1.4043E-04
0.333	7.7946E-03	2.4278E-04	1.8350E-03	5.7155E-05	2.1544E-02	6.6160E-04
0.366	8.3299E-03	2.5945E-04	1.9610E-03	6.1080E-05	2.5944E-02	7.9673E-04
0.766	1.0250E-02	3.1924E-04	2.4130E-03	7.5154E-05	6.6073E-02	2.0289E-03
1.000	1.1368E-02	3.5404E-04	2.6763E-03	8.3347E-05	8.1619E-02	2.5062E-03
1.367	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.0074E-01	3.0933E-03
1.667	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1077E-01	3.4012E-03
1.803	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1341E-01	3.4822E-03
2.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1598E-01	3.5611E-03
2.300	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1816E-01	3.6279E-03
2.600	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1922E-01	3.6603E-03
2.900	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1973E-01	3.6760E-03
3.200	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.1998E-01	3.6836E-03
3.500	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2010E-01	3.6873E-03
3.800	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2015E-01	3.6891E-03
4.100	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2018E-01	3.6899E-03
4.400	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2020E-01	3.6903E-03
4.700	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2020E-01	3.6905E-03
5.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6906E-03
5.300	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
5.600	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
5.614	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
6.014	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
6.314	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
6.614	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
6.914	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
7.214	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
7.514	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
7.814	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
8.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
8.300	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
8.600	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
8.900	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
9.200	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
9.500	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
9.800	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
10.100	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
10.400	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
24.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03
48.000	1.3115E-02	4.0838E-04	3.0875E-03	9.6140E-05	1.2021E-01	3.6907E-03

48.111 1.3115E-02 4.0838E-04 3.0875E-03 9.6140E-05 1.2021E-01 3.6907E-03  
96.000 1.3115E-02 4.0838E-04 3.0875E-03 9.6140E-05 1.2021E-01 3.6907E-03  
720.000 1.3115E-02 4.0838E-04 3.0875E-03 9.6140E-05 1.2021E-01 3.6907E-03

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	6.0267E-06	1.3115E-02	4.0838E-04

ATTACHMENT AB  
SGTRPUS OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.167	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.190	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.333	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.366	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.766	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.367	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.667	1.9966E-03	6.2103E-05	4.7002E-04	1.4620E-05	4.5564E-03	1.3986E-04
1.803	2.8983E-03	9.0147E-05	6.8231E-04	2.1222E-05	8.7899E-03	2.6980E-04
2.000	4.2010E-03	1.3065E-04	9.8899E-04	3.0758E-05	1.6330E-02	5.0123E-04
2.300	4.2010E-03	1.3065E-04	1.0192E-03	3.1696E-05	2.9065E-02	8.9204E-04
2.600	4.2010E-03	1.3065E-04	1.0492E-03	3.2630E-05	4.2132E-02	1.2930E-03
2.900	4.2010E-03	1.3065E-04	1.0791E-03	3.3559E-05	5.5325E-02	1.6978E-03
3.200	4.2010E-03	1.3065E-04	1.1088E-03	3.4482E-05	6.8547E-02	2.1035E-03
3.500	4.2010E-03	1.3065E-04	1.1384E-03	3.5401E-05	8.1748E-02	2.5085E-03
3.800	4.2010E-03	1.3065E-04	1.1679E-03	3.6316E-05	9.4906E-02	2.9121E-03
4.100	4.2010E-03	1.3065E-04	1.1972E-03	3.7225E-05	1.0801E-01	3.3140E-03
4.400	4.2010E-03	1.3065E-04	1.2263E-03	3.8130E-05	1.2105E-01	3.7141E-03
4.700	4.2010E-03	1.3065E-04	1.2553E-03	3.9031E-05	1.3404E-01	4.1123E-03
5.000	4.2010E-03	1.3065E-04	1.2842E-03	3.9926E-05	1.4696E-01	4.5085E-03
5.300	4.2010E-03	1.3065E-04	1.3129E-03	4.0818E-05	1.5982E-01	4.9028E-03
5.600	4.2010E-03	1.3065E-04	1.3415E-03	4.1704E-05	1.7261E-01	5.2952E-03
5.614	4.2010E-03	1.3065E-04	1.3429E-03	4.1746E-05	1.7321E-01	5.3134E-03
6.014	4.2010E-03	1.3065E-04	1.3807E-03	4.2921E-05	1.9017E-01	5.8334E-03
6.314	4.2010E-03	1.3065E-04	1.4090E-03	4.3797E-05	2.0282E-01	6.2212E-03
6.614	4.2010E-03	1.3065E-04	1.4371E-03	4.4669E-05	2.1541E-01	6.6071E-03
6.914	4.2010E-03	1.3065E-04	1.4651E-03	4.5536E-05	2.2793E-01	6.9910E-03
7.214	4.2010E-03	1.3065E-04	1.4930E-03	4.6399E-05	2.4040E-01	7.3731E-03
7.514	4.2010E-03	1.3065E-04	1.5207E-03	4.7258E-05	2.5281E-01	7.7533E-03
7.814	4.2010E-03	1.3065E-04	1.5483E-03	4.8113E-05	2.6515E-01	8.1317E-03
8.000	4.2010E-03	1.3065E-04	1.5653E-03	4.8640E-05	2.7278E-01	8.3653E-03
8.300	4.2010E-03	1.3065E-04	1.5794E-03	4.9081E-05	2.8297E-01	8.6776E-03
8.600	4.2010E-03	1.3065E-04	1.5934E-03	4.9519E-05	2.9045E-01	8.9068E-03
8.900	4.2010E-03	1.3065E-04	1.6073E-03	4.9956E-05	2.9660E-01	9.0953E-03
9.200	4.2010E-03	1.3065E-04	1.6212E-03	5.0390E-05	3.0210E-01	9.2638E-03
9.500	4.2010E-03	1.3065E-04	1.6350E-03	5.0821E-05	3.0727E-01	9.4221E-03
9.800	4.2010E-03	1.3065E-04	1.6488E-03	5.1251E-05	3.1227E-01	9.5752E-03
10.100	4.2010E-03	1.3065E-04	1.6624E-03	5.1679E-05	3.1717E-01	9.7254E-03
10.400	4.2010E-03	1.3065E-04	1.6761E-03	5.2104E-05	3.2201E-01	9.8738E-03
24.000	4.2010E-03	1.3065E-04	2.2320E-03	6.9425E-05	5.1854E-01	1.5887E-02
48.000	4.2010E-03	1.3065E-04	2.4650E-03	7.6624E-05	6.3814E-01	1.9539E-02

48.111 4.2010E-03 1.3065E-04 2.4659E-03 7.6652E-05 6.3860E-01 1.9553E-02  
96.000 4.2010E-03 1.3065E-04 2.7483E-03 8.5345E-05 7.8211E-01 2.3929E-02  
720.000 4.2010E-03 1.3065E-04 3.0536E-03 9.4724E-05 8.6485E-01 2.6449E-02

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.8171E-06	4.2010E-03	1.3065E-04

ATTACHMENT AC  
SGTRPAIM OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	4.0449E+00	1.3140E-01	9.5224E-01	3.0933E-02	4.3481E+00	1.3536E-01
0.167	5.3802E+00	1.7474E-01	1.2666E+00	4.1136E-02	8.8243E+00	2.7468E-01
0.190	5.7977E+00	1.8828E-01	1.3649E+00	4.4325E-02	1.1135E+01	3.4660E-01
0.333	6.8354E+00	2.2193E-01	1.6092E+00	5.2247E-02	2.6620E+01	8.2845E-01
0.366	7.0724E+00	2.2961E-01	1.6650E+00	5.4054E-02	3.0224E+01	9.4058E-01
0.766	9.0710E+00	2.9427E-01	2.1355E+00	6.9277E-02	6.3844E+01	1.9863E+00
1.000	1.0158E+01	3.2936E-01	2.3913E+00	7.7536E-02	7.7668E+01	2.4160E+00
1.367	1.1756E+01	3.8083E-01	2.7675E+00	8.9654E-02	9.5000E+01	2.9546E+00
1.667	1.2654E+01	4.0971E-01	2.9789E+00	9.6451E-02	1.0615E+02	3.3008E+00
1.803	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.1038E+02	3.4324E+00
2.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.1505E+02	3.5774E+00
2.300	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.1901E+02	3.7000E+00
2.600	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2092E+02	3.7593E+00
2.900	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2184E+02	3.7880E+00
3.200	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2229E+02	3.8019E+00
3.500	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2251E+02	3.8087E+00
3.800	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2262E+02	3.8119E+00
4.100	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2267E+02	3.8135E+00
4.400	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2269E+02	3.8143E+00
4.700	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2270E+02	3.8147E+00
5.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8148E+00
5.300	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8149E+00
5.600	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
5.614	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
6.014	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
6.314	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
6.614	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
6.914	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
7.214	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
7.514	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
7.814	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
8.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
8.300	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
8.600	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
8.900	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
9.200	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
9.500	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
9.800	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
10.100	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
10.400	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
24.000	1.3026E+01	4.2164E-01	3.0664E+00	9.9262E-02	1.2271E+02	3.8150E+00
32.000	1.3026E+01	4.2164E-01	3.0789E+00	9.9652E-02	1.2856E+02	3.9942E+00

96.000 1.3026E+01 4.2164E-01 3.0789E+00 9.9652E-02 1.2902E+02 4.0084E+00  
720.000 1.3026E+01 4.2164E-01 3.0789E+00 9.9652E-02 1.2902E+02 4.0084E+00

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.7520E-02	1.3026E+01	4.2164E-01

ATTACHMENT AD  
SGTRPANM OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	1.2417E-02	0.0000E+00	2.9231E-03	0.0000E+00	7.9596E-04
0.167	0.0000E+00	1.5796E-02	0.0000E+00	3.7186E-03	0.0000E+00	1.5807E-03
0.190	0.0000E+00	1.6939E-02	0.0000E+00	3.9877E-03	0.0000E+00	1.9739E-03
0.333	0.0000E+00	2.4686E-02	0.0000E+00	5.8115E-03	0.0000E+00	4.9659E-03
0.366	0.0000E+00	2.6346E-02	0.0000E+00	6.2023E-03	0.0000E+00	5.7638E-03
0.766	0.0000E+00	4.1366E-02	0.0000E+00	9.7383E-03	0.0000E+00	1.7448E-02
1.000	0.0000E+00	4.8786E-02	0.0000E+00	1.1485E-02	0.0000E+00	2.5278E-02
1.367	0.0000E+00	5.8788E-02	0.0000E+00	1.3840E-02	0.0000E+00	3.8135E-02
1.667	0.0000E+00	6.5715E-02	0.0000E+00	1.5470E-02	0.0000E+00	4.8670E-02
1.803	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	5.3356E-02
2.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	5.9588E-02
2.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	6.7366E-02
2.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	7.3481E-02
2.900	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	7.8294E-02
3.200	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.2087E-02
3.500	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.5079E-02
3.800	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.7441E-02
4.100	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	8.9307E-02
4.400	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.0783E-02
4.700	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.1952E-02
5.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.2877E-02
5.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.3611E-02
5.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4193E-02
5.614	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4217E-02
6.014	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.4804E-02
6.314	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5141E-02
6.614	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5408E-02
6.914	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5620E-02
7.214	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5790E-02
7.514	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.5924E-02
7.814	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6031E-02
8.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6087E-02
8.300	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6161E-02
8.600	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6220E-02
8.900	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6267E-02
9.200	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6305E-02
9.500	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6335E-02
9.800	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6359E-02
10.100	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6378E-02
10.400	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6393E-02
24.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6134E-02	0.0000E+00	9.6455E-02
32.000	0.0000E+00	6.8532E-02	0.0000E+00	1.6160E-02	0.0000E+00	9.7871E-02



48.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6160E-02 0.0000E+00 9.8137E-02  
48.111 0.0000E+00 6.8532E-02 0.0000E+00 1.6160E-02 0.0000E+00 9.8137E-02  
96.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6160E-02 0.0000E+00 9.8137E-02  
720.000 0.0000E+00 6.8532E-02 0.0000E+00 1.6160E-02 0.0000E+00 9.8137E-02

#####

Worst Two-Hour Doses

#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	6.8532E-02	0.0000E+00	6.8532E-02

ATTACHMENT AE  
SGTRPUIM OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	4.7168E-04	1.5322E-05	1.1104E-04	3.6071E-06	5.0462E-04	1.5709E-05
0.167	6.8481E-04	2.2240E-05	1.6122E-04	5.2356E-06	1.0552E-03	3.2845E-05
0.190	7.7902E-04	2.5296E-05	1.8339E-04	5.9551E-06	1.3596E-03	4.2320E-05
0.333	1.3656E-03	4.4319E-05	3.2149E-04	1.0433E-05	4.0486E-03	1.2600E-04
0.366	1.4993E-03	4.8650E-05	3.5296E-04	1.1453E-05	4.8245E-03	1.5014E-04
0.766	3.1311E-03	1.0144E-04	7.3712E-04	2.3882E-05	1.5673E-02	4.8756E-04
1.000	4.0823E-03	1.3215E-04	9.6104E-04	3.1109E-05	2.2711E-02	7.0635E-04
1.367	5.5690E-03	1.8004E-04	1.3110E-03	4.2385E-05	3.4183E-02	1.0628E-03
1.667	7.0226E-03	2.2678E-04	1.6532E-03	5.3387E-05	4.4275E-02	1.3762E-03
1.803	7.6955E-03	2.4839E-04	1.8117E-03	5.8474E-05	4.9162E-02	1.5280E-03
2.000	8.6856E-03	2.8016E-04	2.0447E-03	6.5954E-05	5.6496E-02	1.7556E-03
2.300	8.6856E-03	2.8016E-04	2.0683E-03	6.6709E-05	6.7597E-02	2.1001E-03
2.600	8.6856E-03	2.8016E-04	2.0925E-03	6.7483E-05	7.8447E-02	2.4368E-03
2.900	8.6856E-03	2.8016E-04	2.1173E-03	6.8277E-05	8.9322E-02	2.7740E-03
3.200	8.6856E-03	2.8016E-04	2.1428E-03	6.9090E-05	1.0035E-01	3.1160E-03
3.500	8.6856E-03	2.8016E-04	2.1689E-03	6.9922E-05	1.1160E-01	3.4646E-03
3.800	8.6856E-03	2.8016E-04	2.1956E-03	7.0772E-05	1.2309E-01	3.8207E-03
4.100	8.6856E-03	2.8016E-04	2.2228E-03	7.1641E-05	1.3484E-01	4.1847E-03
4.400	8.6856E-03	2.8016E-04	2.2507E-03	7.2528E-05	1.4686E-01	4.5569E-03
4.700	8.6856E-03	2.8016E-04	2.2792E-03	7.3434E-05	1.5914E-01	4.9371E-03
5.000	8.6856E-03	2.8016E-04	2.3083E-03	7.4358E-05	1.7169E-01	5.3255E-03
5.300	8.6856E-03	2.8016E-04	2.3380E-03	7.5299E-05	1.8450E-01	5.7219E-03
5.600	8.6856E-03	2.8016E-04	2.3682E-03	7.6259E-05	1.9757E-01	6.1263E-03
5.614	8.6856E-03	2.8016E-04	2.3697E-03	7.6304E-05	1.9818E-01	6.1453E-03
6.014	8.6856E-03	2.8016E-04	2.4109E-03	7.7611E-05	2.1603E-01	6.6974E-03
6.314	8.6856E-03	2.8016E-04	2.4425E-03	7.8612E-05	2.2971E-01	7.1205E-03
6.614	8.6856E-03	2.8016E-04	2.4747E-03	7.9631E-05	2.4365E-01	7.5515E-03
6.914	8.6856E-03	2.8016E-04	2.5074E-03	8.0666E-05	2.5784E-01	7.9901E-03
7.214	8.6856E-03	2.8016E-04	2.5407E-03	8.1719E-05	2.7228E-01	8.4364E-03
7.514	8.6856E-03	2.8016E-04	2.5746E-03	8.2788E-05	2.8697E-01	8.8902E-03
7.814	8.6856E-03	2.8016E-04	2.6090E-03	8.3874E-05	3.0190E-01	9.3516E-03
8.000	8.6856E-03	2.8016E-04	2.6306E-03	8.4555E-05	3.1128E-01	9.6414E-03
8.300	8.6856E-03	2.8016E-04	2.6487E-03	8.5140E-05	3.2396E-01	1.0033E-02
8.600	8.6856E-03	2.8016E-04	2.6671E-03	8.5732E-05	3.3341E-01	1.0325E-02
8.900	8.6856E-03	2.8016E-04	2.6858E-03	8.6334E-05	3.4135E-01	1.0570E-02
9.200	8.6856E-03	2.8016E-04	2.7048E-03	8.6943E-05	3.4860E-01	1.0794E-02
9.500	8.6856E-03	2.8016E-04	2.7240E-03	8.7560E-05	3.5556E-01	1.1009E-02
9.800	8.6856E-03	2.8016E-04	2.7435E-03	8.8186E-05	3.6244E-01	1.1221E-02
10.100	8.6856E-03	2.8016E-04	2.7632E-03	8.8820E-05	3.6932E-01	1.1433E-02
10.400	8.6856E-03	2.8016E-04	2.7832E-03	8.9461E-05	3.7625E-01	1.1647E-02
24.000	8.6856E-03	2.8016E-04	3.9372E-03	1.2607E-04	7.7636E-01	2.3957E-02
32.000	8.6856E-03	2.8016E-04	4.2085E-03	1.3454E-04	9.1538E-01	2.8221E-02

96.000 8.6856E-03 2.8016E-04 4.2085E-03 1.3454E-04 9.2620E-01 2.8553E-02  
720.000 8.6856E-03 2.8016E-04 4.2085E-03 1.3454E-04 9.2620E-01 2.8553E-02

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

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.0854E-05	8.6856E-03	2.8016E-04

ATTACHMENT AF  
SGTRPUNM OUTPUT FILE

#####

Cumulative Dose Summary

#####

	eab		lpz		cr	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.115	0.0000E+00	2.7963E-06	0.0000E+00	6.5829E-07	0.0000E+00	1.7841E-07
0.167	0.0000E+00	4.0319E-06	0.0000E+00	9.4919E-07	0.0000E+00	3.6924E-07
0.190	0.0000E+00	4.5727E-06	0.0000E+00	1.0765E-06	0.0000E+00	4.7372E-07
0.333	0.0000E+00	7.9087E-06	0.0000E+00	1.8618E-06	0.0000E+00	1.3871E-06
0.366	0.0000E+00	8.6550E-06	0.0000E+00	2.0375E-06	0.0000E+00	1.6531E-06
0.766	0.0000E+00	1.7547E-05	0.0000E+00	4.1308E-06	0.0000E+00	6.3689E-06
1.000	0.0000E+00	2.2545E-05	0.0000E+00	5.3074E-06	0.0000E+00	1.0122E-05
1.367	0.0000E+00	3.0144E-05	0.0000E+00	7.0965E-06	0.0000E+00	1.7069E-05
1.667	0.0000E+00	3.6167E-05	0.0000E+00	8.5144E-06	0.0000E+00	2.3454E-05
1.803	0.0000E+00	3.8845E-05	0.0000E+00	9.1447E-06	0.0000E+00	2.6503E-05
2.000	0.0000E+00	4.2672E-05	0.0000E+00	1.0046E-05	0.0000E+00	3.1057E-05
2.300	0.0000E+00	4.2672E-05	0.0000E+00	1.0133E-05	0.0000E+00	3.8093E-05
2.600	0.0000E+00	4.2672E-05	0.0000E+00	1.0218E-05	0.0000E+00	4.5100E-05
2.900	0.0000E+00	4.2672E-05	0.0000E+00	1.0302E-05	0.0000E+00	5.2059E-05
3.200	0.0000E+00	4.2672E-05	0.0000E+00	1.0384E-05	0.0000E+00	5.8958E-05
3.500	0.0000E+00	4.2672E-05	0.0000E+00	1.0464E-05	0.0000E+00	6.5786E-05
3.800	0.0000E+00	4.2672E-05	0.0000E+00	1.0543E-05	0.0000E+00	7.2539E-05
4.100	0.0000E+00	4.2672E-05	0.0000E+00	1.0620E-05	0.0000E+00	7.9213E-05
4.400	0.0000E+00	4.2672E-05	0.0000E+00	1.0696E-05	0.0000E+00	8.5808E-05
4.700	0.0000E+00	4.2672E-05	0.0000E+00	1.0771E-05	0.0000E+00	9.2323E-05
5.000	0.0000E+00	4.2672E-05	0.0000E+00	1.0845E-05	0.0000E+00	9.8759E-05
5.300	0.0000E+00	4.2672E-05	0.0000E+00	1.0918E-05	0.0000E+00	1.0512E-04
5.600	0.0000E+00	4.2672E-05	0.0000E+00	1.0989E-05	0.0000E+00	1.1140E-04
5.614	0.0000E+00	4.2672E-05	0.0000E+00	1.0993E-05	0.0000E+00	1.1169E-04
6.014	0.0000E+00	4.2672E-05	0.0000E+00	1.1087E-05	0.0000E+00	1.1996E-04
6.314	0.0000E+00	4.2672E-05	0.0000E+00	1.1156E-05	0.0000E+00	1.2607E-04
6.614	0.0000E+00	4.2672E-05	0.0000E+00	1.1225E-05	0.0000E+00	1.3212E-04
6.914	0.0000E+00	4.2672E-05	0.0000E+00	1.1293E-05	0.0000E+00	1.3811E-04
7.214	0.0000E+00	4.2672E-05	0.0000E+00	1.1360E-05	0.0000E+00	1.4403E-04
7.514	0.0000E+00	4.2672E-05	0.0000E+00	1.1427E-05	0.0000E+00	1.4990E-04
7.814	0.0000E+00	4.2672E-05	0.0000E+00	1.1493E-05	0.0000E+00	1.5572E-04
8.000	0.0000E+00	4.2672E-05	0.0000E+00	1.1533E-05	0.0000E+00	1.5929E-04
8.300	0.0000E+00	4.2672E-05	0.0000E+00	1.1598E-05	0.0000E+00	1.6468E-04
8.600	0.0000E+00	4.2672E-05	0.0000E+00	1.1663E-05	0.0000E+00	1.6942E-04
8.900	0.0000E+00	4.2672E-05	0.0000E+00	1.1726E-05	0.0000E+00	1.7366E-04
9.200	0.0000E+00	4.2672E-05	0.0000E+00	1.1790E-05	0.0000E+00	1.7748E-04
9.500	0.0000E+00	4.2672E-05	0.0000E+00	1.1853E-05	0.0000E+00	1.8097E-04
9.800	0.0000E+00	4.2672E-05	0.0000E+00	1.1915E-05	0.0000E+00	1.8419E-04
10.100	0.0000E+00	4.2672E-05	0.0000E+00	1.1977E-05	0.0000E+00	1.8720E-04
10.400	0.0000E+00	4.2672E-05	0.0000E+00	1.2038E-05	0.0000E+00	1.9004E-04
24.000	0.0000E+00	4.2672E-05	0.0000E+00	1.4562E-05	0.0000E+00	2.8312E-04
32.000	0.0000E+00	4.2672E-05	0.0000E+00	1.4890E-05	0.0000E+00	3.0602E-04

48.000 0.0000E+00 4.2672E-05 0.0000E+00 1.4890E-05 0.0000E+00 3.0975E-04  
48.111 0.0000E+00 4.2672E-05 0.0000E+00 1.4890E-05 0.0000E+00 3.0975E-04  
96.000 0.0000E+00 4.2672E-05 0.0000E+00 1.4890E-05 0.0000E+00 3.0975E-04  
720.000 0.0000E+00 4.2672E-05 0.0000E+00 1.4890E-05 0.0000E+00 3.0975E-04

#####

Worst Two-Hour Doses

#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	4.2672E-05	0.0000E+00	4.2672E-05

ATTACHMENT AG  
ETP-97-064R CONTROL ROOM INLEAKAGE RESULTS

CONTROLLED  
COPY

CA06453 Rev0  
Page 94

CALVERT CLIFFS NUCLEAR POWER PLANT

TECHNICAL PROCEDURE

ENGINEERING TEST PROCEDURE

UNIT 0

ETP 97-064R

CONTROL ROOM HVAC SYSTEM INLEAKAGE TEST

REVISION 0

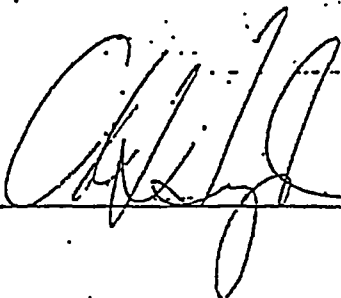
Effective Date 11/11/1997

Safety Related X  
Non-Safety Related       

Writer: D. T. McElheny

Sponsor: V. P. Spunar

Approved



11/11/97  
Date

CONTROLLED  
COPY

NUCON International, Inc.

## Decay Test Data

Estimated duration of test: 2 hours  
 Beginning concentration (C<sub>i</sub>): 19.0 ppb  
 Ending concentration (C<sub>f</sub>): 2.7 ppb  
 Time at start of test: Time "zero" for decay test was at 01:15 hours on 18 Nov 97.  
 Time at end of test: 03:12 hours on 19 Nov 97  
 Sample time intervals: 15 minute, except for last sample

## Time / Sample Concentration

Time/Conc.	Time/Conc.	Time/Conc.	Time/Conc.
01:15 / 19.0	/	/	/
01:30 / 14.8	/	/	/
01:45 / 12.1	/	/	/
02:00 / 8.3	/	/	/
02:15 / 6.7	/	/	/
02:30 / 5.1	/	/	/
03:12 / 2.7	/	/	/

(A) Air Change Rate (1/min)

0.0170

(Q) Inleakage Flow Rate (CFM)

4300

95% Confidence Limit

(A) = 0.0170 ± 0.0012

95% Confidence Interval

4000 < Q < 4600

Comments: Decay samples taken at a sample port on the discharge of #11 return fan. All sample concentrations in the ppb range.

Walter O. Webb W. Peter Friedman

Test personnel signature(s) and date: NUCON International Inc.





## NUCON International, Inc.

## Decay Test Data

Estimated duration of test: 1.4 hours  
Beginning concentration (C<sub>i</sub>): 40.5 ppb  
Ending concentration (C<sub>f</sub>): 14.2 ppb  
Time at start of test: Time "zero" for decay test was at 23:16 hours on 19 Nov 97.  
Time at end of test: 00:46 hours on 20 Nov 97  
Sample time intervals: 15 minute

## Time / Sample Concentration

Time/Conc.	Time/Conc.	Time/Conc.	Time/Conc.
23:16 / 40.5	/	/	/
23:31 / 35.2	/	/	/
23:46 / 21.2	/	/	/
00:01 / 26.7	/	/	/
00:16 / 20.3	/	/	/
00:31 / 16.7	/	/	/
00:46 / 14.2	/	/	/

(A) Air Change Rate (1/min)

0.0118

(Q) Inleakage Flow Rate (CFM)

3000

95% Confidence Limit

(A) = 0.0118 ± 0.0012

95% Confidence Interval

2900 &lt; Q &lt; 3300

Comments: Decay samples taken at a sample port on the discharge of #12 return fan. These samples were taken in conjunction with samples taken in CAS and on both CSR return ducts. The decay sample taken at 23:46 hours was disregarded due to a faulty gas sample bag.

Walt O. Wiloff W. Peter Freeman  
Test personnel signature(s) and date: NUCON International Inc.

CALVERT CLIFFS NUCLEAR POWER PLANT  
TECHNICAL PROCEDURE  
ENGINEERING TEST PROCEDURE  
UNIT 0  
ETP 97-064R  
CONTROL ROOM HVAC SYSTEM INLEAKAGE TEST  
REVISION 0

3rd  
Run of  
ETP

Effective Date 11/11/1997

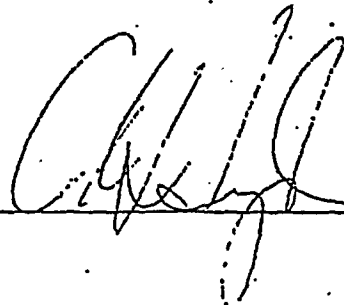
Safety Related X  
Non-Safety Related       

**CONTROLLED  
COPY**

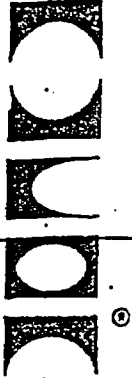
Writer: D. T. McElheny

Sponsor: V. P. Spunar

Approved



11/11/97  
Date



NUCON International, Inc.

P.O. BOX 29151 7000 HUNTLEY ROAD  
COLUMBUS, OHIO 43229 U.S.A.

Att. 1 Chron Log

Page 3 of 7

CA06453 Rev.D

Page 98

TELEPHONE: (614) 846-5710  
OUTSIDE OHIO: 1-800-992-5192  
FAX: (614) 431-0858

## Control Room Inleakage Test Report

performed for:

Baltimore Gas and Electric Company  
Calvert Cliffs Nuclear Power Station  
1850 Calvert Cliffs Pkwy.  
Lusby, Maryland  
20657

P.O. No. 16582

20 April 1998

### Distribution:

BG&E:

Dale McElheny (1)

NUCON:

12BG847 MF (1)

Field Test (1)

QA (1)

Marketing (1)

NUCON 12BG847 /02

## Decay Test Data

Estimated duration of test: 120 minutes  
 Beginning concentration (Cr): 25.0 ppb  
 Ending concentration (C(O)): 4.1 ppb  
 Time at start of test: Time "zero" for decay test was at 22:03 hrs. on 10 Feb 98  
 Time at end of test: 00:03 hrs. on 11 Feb 98  
 Sample time intervals: 20 minutes apart

## Time / Sample Concentration

Time/Conc.	Time/Conc.	Time/Conc.	Time/Conc.
22:03 / 25.0	/	/	/
22:23 / 17.9	/	/	/
22:43 / 11.9	/	/	/
23:03 / 9.7	/	/	/
23:23 / 9.0	/	/	/
23:43 / 5.7	/	/	/
00:03 / 4.1	/	/	/

(A) Air Change Rate (1/min)

0.0143

(Q) Inleakage Flow Rate (CFM)

3,600

95% Confidence Limit

(A) = 0.0143 ± 0.0025

95% Confidence Interval

$$3000 < Q < 4300$$

10.0m  
4200

Comments: Decay samples taken at a sample port on the discharge of #11 return fan. All sample concentrations in the ppb range.

\* Per conversation w/ Pete Freeman 5/27/98. DTM

Test personnel signature(s) and date: NUCON International Inc.

### Decay Test Data

Estimated duration of test: 120 minutes  
 Beginning concentration (Ct): 47 ppb  
 Ending concentration (C(O)): 12.6 ppb  
 Time at start of test: Time "zero" for decay test was at 02:05 hrs. on 11 Feb 98  
 Time at end of test: 04:05 hrs. on 11 Feb 98  
 Sample time intervals: 20 minutes apart

### Time / Sample Concentration

Time/Conc.	Time/Conc.	Time/Conc.	Time/Conc.
<u>02:05 / 47.0</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>02:25 / 33.2</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>02:45 / 27.4</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>03:05 / 24.8</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>03:25 / 21.4</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>03:45 / 16.1</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>04:05 / 12.6</u>	<u>/</u>	<u>/</u>	<u>/</u>

(A) Air Change Rate (1/min)

0.0101

95% Confidence Limit

(A) = 0.0101 ± 0.0018

(Q) Inleakage Flow Rate (CFM)

2550

95% Confidence Interval

2100 < Q < 3000

Comments: Decay samples taken at a sample port on the discharge of #12 return fan. All sample concentrations in the ppb range.

Test personnel signature(s) and date: NUCON International Inc.

CALVERT CLIFFS NUCLEAR POWER PLANT  
TECHNICAL PROCEDURE  
ENGINEERING TEST PROCEDURE

---

UNIT 0

ETP 97-064R

CONTROL ROOM HVAC SYSTEM INLEAKAGE TEST

REVISION 0

HTH  
Rev. of  
ETP

Effective Date: 11/11/1997

Safety Related X  
Non-Safety Related       

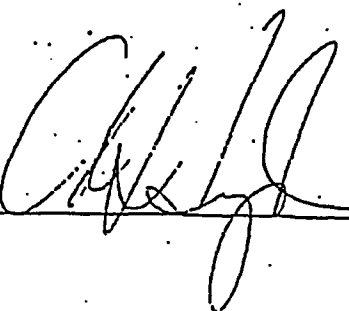
---

**CONTROLLED  
COPY**

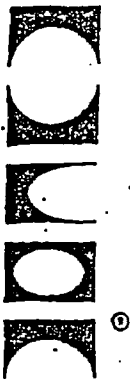
Writer: D. T. McElheny

Sponsor: V. P. Spunar

Approved



11/11/97  
Date



NUCON International, Inc.

P.O. BOX 29151 7000 HUNTLEY ROAD  
COLUMBUS, OHIO 43229 U.S.A.

Att. 1. Chron. Log

Page 3 of 11

CA06453 Rev.0

Page 102

TELEPHONE: (614) 846-5710  
OUTSIDE OHIO: 1-800-992-5192  
FAX: (614) 431-0858

## Control Room Inleakage Test Report

performed for:

Baltimore Gas and Electric Company  
Calvert Cliffs Nuclear Power Station  
1850 Calvert Cliffs Pkwy.  
Lusby, Maryland  
20657

P.O. No. 16582

20 April 1998

---

### Distribution:

BG&E:

Dale McElheny (1)

NUCON:

12BG847 MF (1)

Field Test (1)

QA (1)

Marketing (1)

NUCON 12BG847 /02

## Decay Test Data

Estimated duration of test: 120 minutes  
Beginning concentration (Ct): 37.5 ppb  
Ending concentration (C(O)): 9.2 ppb  
Time at start of test: Time "zero" for decay test was at 01:15 hrs on 12 Feb 98  
Time at end of test: 03:15 hrs on 12 Feb 98  
Sample time intervals: 20 minutes apart

## Time / Sample Concentration

Time/Conc.	Time/Conc.	Time/Conc.	Time/Conc.
1:15 / 37.5	/	/	/
1:35 / 28.1	/	/	/
1:55 / 24.7	/	/	/
2:15 / 19.3	/	/	/
2:35 / 15.7	/	/	/
2:55 / 11.7	/	/	/
3:15 / 9.2	/	/	/

(A) Air Change Rate ( $\text{min}^{-1}$ )

0.0115

95% Confidence Limit

(A) = 0.0115  $\pm$  .0010

(Q) Inleakage Flow Rate (CFM)

2,900

95% Confidence Interval

2650 &lt; Q &lt; 3150

Comments: Decay samples taken at a sample port on the discharge of #11 return fan. All sample concentrations in the ppb range.



FT-86 (Rev. 1 10/97)

ACU #12 Trip 2 Test w/Temporary Modification In-place

Attachment 2  
Page 37 of 40

### Decay Test Data

Estimated duration of test: 120 minutes  
 Beginning concentration (Cr): 37.5 ppb  
 Ending concentration (C/O): 9.2 ppb  
 Time at start of test: Time "zero" for decay test was at 21:25 hrs. on 11 Feb 98  
 Time at end of test: 23:25 hrs. on 11 Feb 98  
 Sample time intervals: 20 minutes apart

#### Time / Sample Concentration

Time/Conc.	Time/Conc.	Time/Conc.	Time/Conc.
<u>21:25 / 37.6</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>21:45 / 30.2</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>22:05 / 25.2</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>22:25 / 22.7</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>22:45 / 15.5</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>23:05 / 13.4</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>23:25 / 10.5</u>	<u>/</u>	<u>/</u>	<u>/</u>

(A) Air Change Rate (1/min)

0.0109

(Q) Inleakage Flow Rate (CFM)

2,750

95% Confidence Limit.

(A) = 0.0109 ± .0015

95% Confidence Interval

2370 < Q < 3130

Comments: Decay samples taken at a sample port on the discharge of #12 return fan. All sample concentrations in the ppb range.

Test personnel signature(s) and date: NUCON International Inc.

CA06453 Rev.0  
Page 105

CALVERT CLIFFS NUCLEAR POWER PLANT

TECHNICAL PROCEDURE

ENGINEERING TEST PROCEDURE

UNIT 0

ETP 97-064R

CONTROL ROOM HVAC SYSTEM INLEAKAGE TEST

REVISION 1

File 86-183  
Kevin 6/17/44

5901 - M.

Effective Date 1/18/00

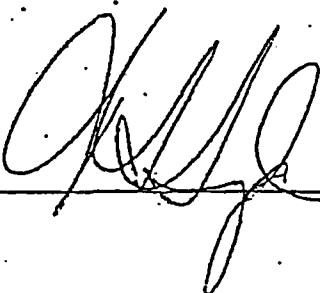
Safety Related X  
Non-Safety Related       

CONTROLLED COPY

Writer: D. T. McElheny

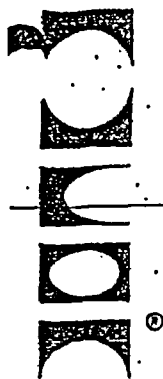
Sponsor: T. R. Lupold

Approved



Date

1/18/00



NUCON International, Inc.

P.O. BOX 29151 7000 HUNTLEY ROAD  
COLUMBUS, OHIO 43229 U.S.A.

CA06453 Rev0  
Page 106  
ETP 97-064R  
Rev 1

TELEPHONE: (614) 846-5710  
TOLL FREE: 1-800-992-5192  
FAX: (614) 431-0858  
WEB SITE: [www.nucon-int.com](http://www.nucon-int.com)

Attachment 1  
Page 2 of 14

## Control Room Inleakage Test Report

performed for:

Baltimore Gas and Electric Company  
Calvert Cliffs Nuclear Power Station  
1850 Calvert Cliffs Pkwy.  
Lusby, Maryland  
20657

P.O. No. 16582

3 March 2000

### Distribution:

BG&E:

Dale McElheny (1)

NUCON:

12BG658 MF (1)

Field Test (1)

QA (1)

Marketing (1)

NUCON 12BG658 /01

### Decay Test Data

Estimated duration of test: 180 minutes  
 Beginning concentration (Cf): 51.4 ppb  
 Ending concentration (C(O)): 13.2 ppb  
 Time at start of test: Time "zero" for decay test was at 01:05 hrs. on 26 Jan 00  
 Time at end of test: 04:05 hrs. on 26 Jan 00  
 Sample time intervals: 15 minutes apart

### Time / Sample Concentration

Time/Conc.	Time/Conc.	Time/Conc.	Time/Conc.
/	120/23.8	/	/
30/ 51.4	135/21.0	/	/
45/ 47.6	150/17.8	/	/
60/ 41.9	165/16.4	/	/
75/ 33.0	180/13.2	/	/
90/ 30.7	/	/	/
105/ 29.3	/	/	/

(A) Air Change Rate ( 1/min)

0.00896

(Q) Inleakage Flow Rate (CFM)

2600

95% Confidence Limit

(A) = 0.00896 ± 0.00065

95 % Confidence Interval

2400 < Q < 2800

Comments: Decay samples taken at a sample port on the discharge of #12 return fan. All sample concentrations in the ppb range.

W. Peter Freeman Eric M Banks 3 March 00  
 Test personnel signature(s) and date: NUCON International Inc.

### Decay Test Data

Estimated duration of test: 180 minutes  
 Beginning concentration (C<sub>t</sub>): 59.2 ppb @ 15 minutes into test  
 Ending concentration (C<sub>0</sub>): 8.8 ppb @ 195 minutes into test  
 Time at start of test: Time "zero" for decay test was at 23:35 hrs. on 26 Jan 00  
 Time at end of test: 03:00 hrs. on 27 Jan 00  
 Sample time intervals: 15 minutes apart to 105 minutes then @ 140, 165, and 195 minutes

#### Time / Sample Concentration

Time/Conc.	Time/Conc.	Time/Conc.	Time/Conc.
<u>15/59.2</u>	<u>165/13.8</u>	<u>/</u>	<u>/</u>
<u>30/52.5</u>	<u>195/8.8</u>	<u>/</u>	<u>/</u>
<u>45/42.8</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>60/40.2</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>75/36.1</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>105/26.2</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>140/17.4</u>	<u>/</u>	<u>/</u>	<u>/</u>

(A) Air Change Rate (1/min)

0.0103

(Q) Inleakage Flow Rate (CFM)

3000

95% Confidence Limit

(A) = 0.0103 ± 0.00085

95 % Confidence Interval

2750 < Q < 3250

Comments: Decay samples taken at a sample port on the discharge of #11 return fan. All sample concentrations in the ppb range.

W. Peter Meiman & Eric M. Banks 37 March 00  
 Test personnel signature(s) and date: NUCON International Inc.

ATTACHMENT AH  
ETP 01-035R PERFLUOROCARBON TRACER GAS TESTING

CA06453 Rev.0  
Page 110

CALVERT CLIFFS NUCLEAR POWER PLANT  
TECHNICAL PROCEDURE  
ENGINEERING TEST PROCEDURE

UNIT 0

ETP 01-035R

PERFLUOROCARBON TRACER GAS TESTING

REVISION 0

**CONTROLLED  
COPY**

Effective Date 5/1/02

Safety Related X  
Non-Safety Related       

Writer: D. T. McElheny

Sponsor: M. A. Junge

Approved

Richard L. Jones

12-1-02

Date

CA06453 RevD  
Page IIITRACER TECHNOLOGY CENTER  
BROOKHAVEN NATIONAL LABORATORY

FACSIMILE

DATE: July 29, 2002

TO: John E. Wynn Jr.  
Aux Systems Engr Unit  
Calvert Cliffs Nuclear Power Plant  
Lusby, MD 20657

FAX NO: (410) 495 - 4727

## MESSAGE:

John,

I'm on vacation this week but wanted to send you the final results but without my final assessment. Remarkably, total inleakage was  $2930 \pm 185$  cfm. Other flows, in cfm, were:

Zone	From/To	CR Inleakage	% of total	CR Outleakage	% of total
0	Outside	$275 \pm 185$	9	$1866 \pm 470$	64
2	AB	$436 \pm 157$	15	$366 \pm 248$	13
3	TB	$466 \pm 172$	16	$599 \pm 415$	20
4	MSIVs	$272 \pm 134$	9	$44 \pm 33$	2
5	AC11	$274 \pm 33$	9	$19 \pm 3$	1
6	AC13	$387 \pm 38$	13	$11 \pm 8$	0
7	SWGRs	$818 \pm 114$	28	$21 \pm 10$	1

More next week. I'll put a copy in the mail also.



Total no. of pages including this cover page: 4

From: Russell N. Dietz - Head  
Tracer Technology Center  
Atmospheric Sciences Division  
Brookhaven National Laboratory  
Bldg 815E  
Upton, NY 11973-5000

Telephone: (631) 344-3059  
Fax: (631) 344-2887  
Confirmation: (631) 344-3275  
Email: dietz@bnl.gov  
Secretary: Barbara J. Roland  
Secretary's email: roland@bnl.gov



JUL 29 '02 03:37PM BNL DAS/ECD 426

P.2/4

## BNL-AIMS

12:36:28 07-26-2002

PROJECT: CALVERT CLIFFS START: 09:00 (06-06-1902)  
HOUSE: CALVERT CLIFFS STOP: 10:00 (06-18-1902)BNL CODE: CAL1A0  
ANALYZED: 06-27-1902\*\*\*\*\* RATES \*\*\*\*\*  
OVERALL INFILTRATION RATE = %515978.1 g 88992.1(m<sup>3</sup>/h)  
TRAIL AIR EXCHANGE RATE = 1.461 g 0.251(1/h)

ZONE LOCATION	SOURCE RATE @25C QTY @T (nL/m)	EXFILTRATION RATE (m <sup>3</sup> /h)	SD	INFILTRATION RATE (m <sup>3</sup> /h)	SD	ACH (/h)	SD
CR	%663.0 1 41812	3170.4	797.8	464.8	379.6	0.055	0.04
AB	%3858.0 4 973218	30896.3	11048.8	32707.5	11645.0	0.680	0.2
TB	%3870.0 12 %3399361	411130.1	88819.1	419373.8	90345.6	1.482	0
MSIVs	%458.0 4 189594	22087.4	10568.3	5694.9	8281.4	4.658	6.77
No.11 AC	%2150.0 1 132691	30819.8	3244.6	32226.2	3348.5	19.042	2.1
No.13 AC	6.4 30 12620	14492.4	1194.7	8912.2	1907.4	2.460	0.541
SWGRs	9.2 10 6435	3381.7	10458.4	16598.8	1527.7	2.346	0.246

ONE-ZONE	RATE g	SD (m <sup>3</sup> /h)	ZONE-ZONE	RATE g	SD (m <sup>3</sup> /h)
1	622.2	421.7	2	741.3	267.9
1	1018.1	704.6	2	792.5	293.2
1	74.3	56.7	2	462.5	227.7
1	32.3	5.2	2	464.5	227.7
1	19.4	13.7	2	1889.7	1990.0
1	38.6	16.9	2	1145.7	460.3
1	2870.5	1460.4	2	378.6	448.8
1	31.1	69.4	2	334.4	224.3
1	12.0	6.0	2	314.4	224.3
1	11.2	21.7	2	611.1	556.6
1	552.2	220.7	2	1154.4	556.6
1	17034.4	%11524.3	2	807.0	235.2
1	163.3	115.6	2	1002.9	424.6
1	8416.3	1985.2	2	12671.2	%11136.9
1	215.4	133.1	2	188.1	86.7
1	60.1	35.6	2	755.3	506.8
1	12.7	6.5	2	541.3	547.4
1	30.9	19.1	2	125.9	120.7
1	60.8	11.3	2	27.6	62.7
1	22.3	7.0	2	7.0	214.7
1	91.1	20.9	2		

NE RATE g	SD (m <sup>3</sup> /h)	ACH g	SD (/h)	ZONE RATE g	SD (m <sup>3</sup> /h)	ACH g	SD (/h)
1 4873.4	310.5	0.586	0.047	2 35114.3	%12483.9	0.730	0.262
3 %437897.5	%93722.6	1.547	0.340	4 23186.9	%11083.4	18.966	9
5 32647.6	3389.9	19.291	2.223	6 17439.5	1095.1	4.814	0.386
7 17547.1	1595.5	2.480	0.257				

\*\*\*\*\* ANALYSIS \*\*\*\*\*  
Total Infiltration = 2930 ± 185 g/h

FOL SOURCE TYPE	AVE. TRACER CONC. (pL/L) g SD							
	ptPDCH	PMCP	PDCB	T-PTCH	PMCH	ocPDCH	ippCH	
480 ptPDCH	3.447 g 0.403	4.466 g 0.173	2.352 g 0.111	0.786 g 0.078	0.386 g 0.014	0.101 g 0.005	0.106 g 0	
110 PMCP	0.151 g 0.088	27.815 g 9.791	0.174 g 0.085	0.103 g 0.090	0.046 g 0.026	0.009 g 0.004	0.008 g 0	
000 PDCB	0.021 g 0.019	0.219 g 0.049	7.784 g 1.632	0.006 g 0.001	0.009 g 0.001	0.002 g 0.001	0.011 g 0	
223 T-PTCH	0.043 g 0.011	0.196 g 0.026	5.846 g 2.452	8.184 g 3.895	0.033 g 0.009	0.025 g 0.011	0.000 g 0	
592 PMCH	0.009 g 0.001	0.017 g 0.003	0.067 g 0.021	0.016 g 0.005	4.065 g 0.389	0.003 g 0.003	0.000 g 0	
322 ocPDCH	0.020 g 0.001	0.129 g 0.010	3.764 g 0.299	0.010 g 0.001	0.019 g 0.002	0.725 g 0.035	0.006 g 0	
75 ippCH	0.023 g 0.007	0.888 g 0.143	0.136 g 0.054	0.019 g 0.005	0.008 g 0.001	0.004 g 0.001	0.387 g 0	

JUL 29 '02 03:38PM BNL DAS/ECD 426

CONCENTRATION (PL/L)

P.3/4

CATS	ptPDCH	PMCP	PDCE	T-PTCH	PMCH	ocPDCH	IPPC	otPDCH	stPDCH	MPDCH	2-PTCH	
4777	7.147	3.899	2.683	0.637	0.375	0.096	0.083	0.000	8.273	7.315	0.191	DELETED
580	7.742	4.630	2.584	1.290	0.335	0.090	0.115	0.000	9.085	8.045	0.400	DELETED
8149	8.107	4.402	2.249	0.733	0.399	0.097	0.096	0.000	9.463	8.384	0.223	DELETED
12400	9.277	4.610	2.428	0.808	0.315	0.109	0.107	0.000	10.964	9.758	0.244	DELETED
12521	8.890	4.691	2.325	0.794	0.391	0.106	0.109	0.000	10.545	9.361	0.238	DELETED
12055	8.689	4.280	2.432	0.804	0.399	0.104	0.122	0.000	10.829	9.185	0.241	DELETED
12631	8.324	4.340	2.500	0.777	0.379	0.101	0.123	0.000	9.886	8.765	0.292	DELETED
10161	8.252	4.382	2.327	0.758	0.425	0.107	0.103	0.000	9.774	8.664	0.232	DELETED
12057	8.446	4.598	2.370	0.978	0.388	0.101	0.105	0.000	10.017	8.883	0.304	DELETED
11079	7.998	4.410	2.484	0.712	0.394	0.096	0.096	0.000	9.357	8.269	0.218	DELETED
1328	8.082	4.327	2.169	0.721	0.383	0.093	0.100	0.000	9.420	8.346	0.221	DELETED
938	8.415	4.405	2.298	0.777	0.382	0.100	0.105	0.000	9.824	8.800	0.237	DELETED
620	7.126	3.865	2.295	0.657	0.804	0.101	0.089	0.000	8.413	7.441	0.198	DELETED
2268	6.923	4.160	2.469	0.644	0.526	0.110	0.087	0.000	8.174	7.227	0.194	DELETED
2188	7.555	4.335	2.589	0.698	0.553	0.118	0.096	0.000	8.920	7.896	0.211	DELETED
3644	8.586	4.498	3.554	0.826	0.184	0.145	0.052	0.000	4.003	3.510	0.094	DELETED
12390	0.204	0.418	15.834	0.020	0.015	0.002	0.007	0.000	0.187	0.184	0.006	DELETED
12036	5.449	3.128	7.235	0.502	0.276	0.067	0.065	0.000	6.274	5.527	0.149	DELETED
12302	5.119	2.808	5.224	0.475	0.475	0.140	0.062	0.000	5.907	5.200	0.139	DELETED
12083	1.033	0.619	3.481	0.090	0.876	0.310	0.018	0.000	1.259	1.098	0.025	DELETED
4779	0.031	0.098	2.728	0.014	1.359	0.490	0.005	0.000	0.459	0.400	0.005	DELETED
4627	3.552	2.287	1.977	0.323	1.448	0.122	0.043	0.000	3.944	3.458	0.082	DELETED
12497	2.791	1.837	1.829	0.249	1.879	0.106	0.034	0.000	3.014	2.637	0.070	DELETED
12189	0.030	11.417	0.020	0.002	0.009	0.001	0.003	0.000	0.000	0.000	0.000	DELETED
12063	0.028	10.242	0.141	0.001	0.014	0.002	0.007	0.000	0.000	0.000	0.000	DELETED
12393	0.028	1.611	1.886	0.088	1.488	0.338	0.005	0.000	0.330	0.289	0.028	DELETED
12009	0.072	16.480	0.089	0.076	0.035	0.011	0.014	0.000	0.000	0.000	0.021	DELETED
12264	0.143	35.832	0.214	0.203	0.057	0.013	0.008	0.000	0.000	0.000	0.056	DELETED
12376	0.167	43.634	0.244	0.257	0.030	0.006	0.008	0.000	0.000	0.000	0.072	DELETED
12297	0.523	14.879	1.321	0.682	0.536	0.119	0.009	0.000	0.641	0.560	0.201	DELETED
12191	0.169	16.484	1.166	0.638	0.538	0.118	0.008	0.000	0.398	0.269	0.188	DELETED
12379	0.335	30.172	0.222	0.061	0.088	0.012	0.005	0.000	0.408	0.357	0.017	DELETED
12012	1.489	20.585	0.519	0.175	0.295	0.030	0.018	0.000	1.561	1.362	0.049	DELETED
12244	0.112	25.193	0.138	0.061	0.069	0.003	0.003	0.000	0.182	0.160	0.017	DELETED
12155	0.107	26.430	0.094	0.044	0.031	0.003	0.003	0.000	0.381	0.159	0.012	DELETED
12354	0.507	0.312	4.404	0.044	0.923	0.253	0.011	0.000	0.688	0.600	0.012	DELETED
11218	4.194	2.583	1.088	0.367	0.203	0.049	0.057	0.000	4.586	4.026	0.107	DELETED
561	0.053	3.165	0.464	0.092	0.219	0.070	0.008	0.000	0.124	0.109	0.025	DELETED
2018	0.122	16.960	0.214	0.018	0.014	0.012	0.016	0.000	0.177	0.155	0.006	DELETED
11151	0.013	0.204	5.908	0.005	0.010	0.002	0.026	0.000	0.020	0.018	0.002	DELETED
9590	0.018	0.397	7.035	0.005	0.009	0.002	0.008	0.000	0.025	0.022	0.002	DELETED
12402	0.020	0.176	7.297	0.006	0.010	0.002	0.009	0.000	0.026	0.023	0.002	DELETED
12337	0.014	0.156	6.492	0.004	0.009	0.002	0.004	0.000	0.020	0.018	0.002	DELETED
12417	0.017	0.235	9.217	0.007	0.009	0.003	0.008	0.000	0.024	0.022	0.002	DELETED
12425	0.030	0.205	8.388	0.008	0.010	0.003	0.005	0.000	0.038	0.034	0.003	DELETED
12488	0.062	0.381	15.438	0.009	0.009	0.004	0.008	0.000	0.064	0.057	0.003	DELETED
12383	0.015	0.185	6.342	0.005	0.007	0.001	0.011	0.000	0.021	0.019	0.002	DELETED
12203	0.055	0.320	10.741	0.008	0.009	0.003	0.004	0.000	0.056	0.050	0.003	DELETED
12176	0.013	0.278	9.691	0.006	0.009	0.001	0.005	0.000	0.019	0.017	0.002	DELETED
12288	0.031	0.382	12.712	0.013	0.008	0.002	0.011	0.000	0.035	0.031	0.004	DELETED
12269	0.018	0.221	6.731	0.006	0.007	0.002	0.029	0.000	0.025	0.022	0.002	DELETED
12022	0.051	0.216	7.580	0.026	0.018	0.000	0.000	0.000	0.000	0.000	1.799	DELETED
12156	0.036	0.177	4.112	0.038	0.033	0.000	0.000	0.000	0.000	0.000	3.610	DELETED
1818	0.009	0.019	0.081	0.020	4.340	0.005	0.001	0.000	0.019	0.017	0.006	DELETED
8706	0.008	0.015	0.052	0.012	3.780	0.001	0.000	0.000	0.014	0.012	0.004	DELETED
1319	0.020	0.189	3.849	0.011	0.018	0.751	0.006	0.000	0.877	0.591	0.004	DELETED
707	0.020	0.128	4.011	0.009	0.021	0.685	0.006	0.000	0.612	0.534	0.004	DELETED
1281	0.019	0.120	3.432	0.009	0.017	0.739	0.005	0.000	0.887	0.582	0.004	DELETED
12340	0.013	0.070	0.178	0.023	0.016	0.004	0.325	0.000	0.027	0.025	0.006	DELETED
12502	0.016	1.129	0.208	0.027	0.009	0.005	0.378	0.000	0.634	0.031	0.008	DELETED
12307	0.024	0.751	0.080	0.015	0.007	0.004	0.399	0.000	0.040	0.035	0.005	DELETED
12300	0.031	0.880	0.095	0.019	0.008	0.004	0.385	0.000	0.046	0.041	0.006	DELETED
2158	0.019	0.963	0.182	0.022	0.007	0.005	0.392	0.000	0.038	0.034	0.007	DELETED
6706	0.017	0.942	0.173	0.022	0.008	0.005	0.389	0.000	0.037	0.033	0.007	DELETED
7750	0.023	0.728	0.084	0.013	0.007	0.003	0.332	0.000	0.044	0.039	0.004	DELETED
10831	0.031	0.732	0.085	0.015	0.006	0.003	0.339	0.000	0.043	0.038	0.005	DELETED

PDCE PMCP PMCH ocPDCH pPDCH MPDCH PTCH  
0.74 0.74 0.82 0.62 0.65 0.88 0.71

COEFFICIENTE FILM  
60177

\*\*\*\*\* NOTES \*\*\*\*\*

gas volumes are reported at 21.5 C. and 1 atm.  
standard deviation in the source strength has been set at 4 %  
standard deviation in the volume measurement has been set at 5 %  
overall normalized condition number  $(K(C)/N^{1.5}) = 0.429$

$C/N = 1.136$

all condition numbers are:

1 2 3 4 5 6

CA06453 Rev.0  
Page 114

## FLOW-RATIOS STD.DEV.

## TRN/FILTERN

1	0.147	0.1142
2	1.059	0.0455
3	1.020	0.0363
4	0.258	0.3540
5	1.046	0.0108
6	0.615	0.1209
7	4.908	15.1200

## ZONAL

2-1	0.839	0.4851
3-1	1.285	0.9277
4-1	0.161	0.0969
5-1	0.069	0.0093
6-1	0.029	0.0209
7-1	0.026	0.0122
3-2	19.743	62.9947
4-2	0.082	0.1957
5-2	0.036	0.0273
6-2	0.036	0.0723
7-2	0.903	0.7688
4-3	110.853	89.6471
5-3	0.203	0.1401
6-3	8.892	3.1448
7-3	0.017	0.0174
-4	0.435	0.2269
5-4	0.017	0.0085
7-4	-0.057	0.0552
6-5	0.483	0.4655
7-5	0.809	1.8474
7-6	12.975	896.7011

RD DEVIATION OF ptpdch IN ZONE 2 IS GREATER THAN 25 %  
 RD DEVIATION OF ptpdch IN ZONE 3 IS GREATER THAN 25 %  
 RD DEVIATION OF ptpdch IN ZONE 4 IS GREATER THAN 25 %  
 RD DEVIATION OF ptpdch IN ZONE 7 IS GREATER THAN 25 %  
 RD DEVIATION OF pncp IN ZONE 2 IS GREATER THAN 25 %  
 RD DEVIATION OF pdcB IN ZONE 2 IS GREATER THAN 25 %  
 RD DEVIATION OF pdcB IN ZONE 4 IS GREATER THAN 25 %  
 RD DEVIATION OF pdcB IN ZONE 5 IS GREATER THAN 25 %  
 RD DEVIATION OF pdcB IN ZONE 7 IS GREATER THAN 25 %  
 RD DEVIATION OF t-ptch IN ZONE 2 IS GREATER THAN 25 %  
 RD DEVIATION OF t-ptch IN ZONE 4 IS GREATER THAN 25 %  
 RD DEVIATION OF t-ptch IN ZONE 5 IS GREATER THAN 25 %  
 RD DEVIATION OF pncB IN ZONE 2 IS GREATER THAN 25 %  
 RD DEVIATION OF pncB IN ZONE 4 IS GREATER THAN 25 %  
 RD DEVIATION OF ocpdch IN ZONE 2 IS GREATER THAN 25 %  
 RD DEVIATION OF ocpdch IN ZONE 3 IS GREATER THAN 25 %  
 RD DEVIATION OF ocpdch IN ZONE 4 IS GREATER THAN 25 %  
 RD DEVIATION OF ocpdch IN ZONE 5 IS GREATER THAN 25 %  
 RD DEVIATION OF lppch IN ZONE 2 IS GREATER THAN 25 %  
 RD DEVIATION OF lppch IN ZONE 3 IS GREATER THAN 25 %  
 RD DEVIATION OF lppch IN ZONE 5 IS GREATER THAN 25 %