

Enclosure (3)

CA06452 MSLB

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 110

DCALC No.: CA06452

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:

MAIN STEAM LINE BREAK EVENT 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

05/09/2005

Printed Name and Signature

Date

Independent Reviewer:

Ian Sommerville

7-5-05

Printed Name and Signature

Date

Approval:

Philip E. Wenger

Printed Name and Signature

7/7/05

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

3. REVIEWER COMMENTS

(1) Why don't the lambda's not compare; with CA06421 ?

Response: The values in CA06421 were from the LOCADOSE User's Manual, CCNPP's previous design basis dose calculation code for many accidents. The new data is extracted from the latest Chart of the Nuclides and is consistent with that employed by the new design basis code RADTRAD. The values are close.

(2) Please state the page # with the reference

Response: Noted for future references.

(3) Xe-138? Where is it from?; not from CA06358?

Response: The Xe-138 core source term 4.9330E+04 Ci/MWt is from CA06358.

(4) p. 11. Where does the AFW = 10,000 cf come from?

Response: It is an arbitrary feedwater source used for SG makeup. It is not used in the MSLB accident analysis.

(5) Why is the power level 1? The sources are in units of Ci/MWt. Also, Why do I see power level some places of 3412?

Response: The primary and secondary isotopic inventories are in total Curies. Thus a power input of 1 is required. No power level of 3412 was found.

(6) Are the results rounded way up?

Response: They are not rounded in this work at all.

(7) What are the cases mslbfff1, 2, 2a ?

Response: Additional cases modeling the main steam piping room volume and the turbine building volume which were not utilized in the results. Note that regulatory guidance does not allow activity holdup before release into the environment.

(8) What does a transfer path do if it is 0 gpd?

Response: Nothing. Note that the model is a base model used in several accidents.

(9) Where does the 4000 cfm come from (p. 12)

Response: It is the SG leakrate comparable in size to the SG volume. It signifies rapid release of the SG contents with little holdup.

(10) Why not use the X/Q from UFSAR table 2-14

Response: The UFSAR Table 2-14 values are for release from the surface area of the containment. The MSG is more like a point release, which results in a larger X/Q.

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	8
07. TECHNICAL ASSUMPTIONS	13
08. REFERENCES	14
09. METHODS OF ANALYSIS	16
09.1 RADTRAD Computations	16
09.2 Gas Gap, Primary, and Secondary Release Activities	16
09.3 Flashing Fraction Calculations	18
10. CALCULATIONS	19
11. DOCUMENTATION OF COMPUTER CODES	20
12. RESULTS	21
13. CONCLUSIONS	23
14. ATTACHMENTS	24
ATTACHMENT A: MAIN STEAM LINE BREAK RELEASE ACTIVITIES	24
ATTACHMENT B: NUCLEAR INVENTORY FILE GAP14.NIF	26
ATTACHMENT C: NUCLEAR INVENTORY FILE PRI14.NIF	29
ATTACHMENT D: NUCLEAR INVENTORY FILE SEC05.NIF	32
ATTACHMENT E: NUCLEAR INVENTORY FILE PIS.NIF	34
ATTACHMENT F: NUCLEAR INVENTORY FILE CIS500.NIF	37
ATTACHMENT G: NUCLEAR INVENTORY FILE CRCB63.NIF	40
ATTACHMENT H: RELEASE FRACTION AND TIMING FILE MSLBGAP.RFT	51
ATTACHMENT I: RELEASE FRACTION AND TIMING FILE MSLBPRI.RFT	52

ATTACHMENT J: RELEASE FRACTION AND TIMING FILE MSLBSEC.RFT	53
ATTACHMENT K: RELEASE FRACTION AND TIMING FILE PIS.RFT	54
ATTACHMENT L: RELEASE FRACTION AND TIMING FILE CIS500.RFT	55
ATTACHMENT M: RELEASE FRACTION AND TIMING FILE MSLBGCS.RFT	56
ATTACHMENT N: CONVERSION FACTORS FILE FGR14.INP	57
ATTACHMENT O: CONVERSION FACTORS FILE FGR05.INP	61
ATTACHMENT P: CONVERSION FACTORS FILE FGR63.INP	63
ATTACHMENT Q: MSLBFF OUTPUT FILE	77
ATTACHMENT R: MSLBPRI OUTPUT FILE	79
ATTACHMENT S: MSLBSEC OUTPUT FILE	81
ATTACHMENT T: MSLBPIS OUTPUT FILE	83
ATTACHMENT U: MSLBCIS OUTPUT FILE	85
ATTACHMENT V: MSLBFFCS OUTPUT FILE	86
ATTACHMENT W: ETP 97-064R CONTROL ROOM INLEAKAGE RESULTS	89
ATTACHMENT X: ETP 01-035R PERFLUOROCARBON TRACER GAS TESTING	105
LAST PAGE OF REPORT	110

5. INTRODUCTION

The Main Steam System carries steam from the Steam Generators (SGs) to the turbine-generators and to other auxiliary equipment. A Main Steam Line Break (MSLB) may occur as a result of thermal stress or cracking in the main steam line. The guillotine-type break assumed in Chapter 14.14 of the Updated Final Safety Analysis Report (UFSAR) is the most adverse transient scenario but its probability of occurrence is extremely low.

A rupture in the Main Steam System increases the rate of heat extraction by the SGs, which causes cooldown of the reactor coolant system (RCS) and causes the affected SG pressure and temperature to rapidly decrease. The steam released through the break in the affected SG extracts heat from the primary side which causes the primary coolant temperature and pressure to rapidly decrease. The decrease in the primary coolant temperature, in combination with a negative Moderator Temperature Coefficient (MTC), results in positive reactivity addition which causes the core power level and core heat flux to increase. The uncontrolled blowdown of the affected SG will initiate one of the following reactor trips: high containment pressure, high power, delta-T power, low SG pressure, or TM/LP. The power increase will be terminated after the Control Element Assemblies (CEAs) are inserted, even assuming most reactive rod stuck out. Following appropriate delays, the Main Steam Isolation Valves (MSIVs) in the main steam lines on both the affected and on the unaffected SGs will close and terminate the blowdown from the unaffected SG. The MSIV is a gas hydraulic, bi-directional, balanced disk, Y-pattern, globe valve designed to hold pressure from either direction. The blowdown from the affected SG will continue since the MSIV is downstream from the break area. The continued blowdown causes the RCS pressure to decrease until the Safety Injection Actuation Signal (SIAS) is initiated, which automatically starts the High Pressure Safety Injection (HPSI) pumps. Since the shutoff head of the HPSI pumps is approximately 1200 psia, no safety injection (SI) flow is delivered immediately. Therefore, the pressure continues to decrease and the pressurizer empties. A Loss of Offsite Power (LOOP) is conservatively assumed after a turbine trip resulting in a coast down of the reactor coolant pumps (RCPs). The negative reactivity addition from the inserted CEAs with most reactive rod stuck out will be sufficient to offset the positive reactivity inserted by the moderator and fuel temperature feedbacks. The HPSI and Charging Pump borated flows will also insert negative reactivity, which ensures that the core remains subcritical during the event. Consequently, the core will remain sufficiently subcritical to prevent any power increase over decay power levels.

UFSAR 14.14 presents the licensing basis evaluation of the MSLB Event. A MSLB Event is defined as the pre-trip guillotine-type rupture of a main steam line outside containment in the Main Steam Piping Room (MSPR). It is assumed that the steam line rupture occurs between the steam generator and the MSIV, allowing blowdown of the affected steam generator to continue. A LOOP with the turbine trip results in the maximum site boundary doses, since the LOOP causes the RCPs to coast down, minimizing core flow, lowering the transient Departure from Nucleate Boiling Ratio (DNBR), and maximizing the number of failed fuel pins.

To maximize control room and offsite doses, the maximum secondary Technical Specification (TS) activity and that fraction of the primary Technical Specification and failed fuel activity which leaks to the secondary from the affected and unaffected steam generators are discharged into the MSPR and out the Main Steam Gooseneck (MSG) on the roof of the auxiliary building. Since the steam generators are designed to withstand RCS operating pressure on the tube side with atmospheric pressure on the shell side, the continued integrity of the RCS barrier is assured. Thus only the maximum Technical Specification primary-to-secondary leakage is assumed. A partition factor of unity is assumed for all discharged activities.

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 Design Basis Analysis (DBA) 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 Nuclear Regulatory Commission (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 (AST) methodology. Regulatory guidance for the implementation of these ASTs is provided in Regulatory Guide (RG) 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 Nuclear Steam Supply System (NSSS) response to the MSLB was simulated using the CESEC computer code.

The current work utilizes the alternate source term methodology of 10 CFR 50.67 and Regulatory Guide 1.183 to calculate offsite and control room doses for a MSLB. A bounding control room inleakage value of 3500 cfm was assumed. 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 99% 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, three cases are modeled to determine the maximum offsite and control room doses.

- **Failed Fuel Case:** The dose analysis of UFSAR 14.14 assumes a conservative 1.35% fuel failure rate and 200 gpd primary-to-secondary leakage. The MSLB analyses of record were generated by Combustion Engineering (CE) in Refs. 11-12, resulting in no failed fuel. To preserve some margin and still meet the 10 CFR 50 App. A GDC 19 limit of 5 rem TEDE in the control room, 0.80% of the fuel pins in the core are assumed to fail.
- **Preaccident Iodine Spike (PIS) Case:** A reactor transient has occurred prior to the postulated MSLB 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 MSLB 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 500 times greater than the release rate corresponding to the iodine concentration at the equilibrium value.

The exclusion area boundary (EAB), low population zone (LPZ), and control room (CR) doses for the design-basis MSLB accidents are detailed in the following table.

MSLB Results			
	EAB	LPZ	CR
	Rem TEDE	Rem TEDE	Rem TEDE
0.8% Failed Fuel	0.2180	0.0577	4.6301
PIS Case	3.2635E-03	9.2117E-04	8.2508E-02
Regulatory Limits	25 (RG 1.183)	25 (RG 1.183)	5 (10CFR50.67)
CIS Case	2.2499E-03	1.0446E-03	2.0757E-01
Regulatory Limits	2.5 (RG 1.183)	2.5 (RG 1.183)	5 (10CFR50.67)

Note that all values are below the regulatory limits.

6. INPUT DATA

The input data to determine the exclusion area boundary (EAB), low population zone (LPZ), and control room (CR) doses from a Main Steam Line Break Accident are the following:

(01) Initial thermal power is 2754 MWt (UFSAR 3.2.1/Ref.1).

(02) The pin power peaking factor is 1.70. Per the Core Operating Limits Reports for Units 1 and 2, (Refs.2-3), the total integrated radial peaking factors (F_r^T) are less than or equal to 1.65. For conservatism, a pin power peaking factor of 1.70 will be used in this work.

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

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

(04) 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, three cases are modeled to determine the maximum offsite and control room doses. See Section 9.2 for more details.

- Failed Fuel Case: The dose analysis of UFSAR 14.14 assumes a conservative 1.35% fuel failure rate and 200 gpd primary-to-secondary leakage. The MSLB analyses of record were generated by Combustion Engineering (CE) in Refs. 11-12, resulting in no failed fuel. To preserve some margin and still meet the 10 CFR 50 App. A GDC 19 limit of 5 rem TEDE in the control room, 0.80% of the fuel pins in the core are assumed to fail.
- Preaccident Iodine Spike (PIS) Case: A reactor transient has occurred prior to the postulated MSLB 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 MSLB 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 500 times greater than the release rate corresponding to the iodine concentration at the equilibrium value.

(05) Per Ref.07, damaged fuel rods are assumed to release their gas gap activities consisting of the following isotopes (Attachment A Column D).

- 16% I-131
- 10% other iodines
- 20% Kr-85
- 10% other noble gases
- 24% alkali metals

(06) Per Refs.8 and 37, the failed fuel gas gap activities are assumed to be released instantaneously and homogeneously throughout the primary system at the initiation of the accident. Per Ref.8, the primary TS and PIS activities are assumed to be homogeneously distributed throughout the primary system at the beginning of the accident. Per Ref.8, the secondary TS activities are assumed to be homogeneously distributed throughout the secondary system at the beginning of the accident. Per Ref.8, the primary CIS iodine activities are linearly and homogeneously released over a 9 hour period into the primary system, while the primary CIS noble gas activities are assumed to be homogeneously distributed throughout the primary system at the beginning of the accident. These release assumptions are incorporated into the release fraction and timing files.

(07) Based on Inputs 5, 6, and 7, the release fraction and timing input files can be generated.

Files	Release Timing	Iodine	Noble Gas	Alkali Metal	Attachment
	Hours	Release Fraction	Release Fraction	Release Fraction	
MSLBGAP.RFT	0.0001	0.0080	0.0080	0.0000	H
MSLBPRI.RFT	0.0001	1.0000	1.0000	0.0000	I
MSLBSEC.RFT	0.0001	0.0000	1.0000	0.0000	J
PIS.RFT	0.0001	1.0000	1.0000	0.0000	K
CIS500.RFT	0.0001	0.0000	1.0000	0.0000	L
	9.0000	1.0000	0.0000	0.0000	
MSLBGCS.RFT	0.0001	0.0000	0.0000	0.00192	M

(08) 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 FGR63.INP in Attachment P for use with failed fuel isotopics, FGR14.INP in Attachment N for use with gas gap and primary system isotopics, and FGR05.INP in Attachment O 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.

(09) Per Ref.08, iodine releases from the steam generators to the environment should be assumed to be 97% elemental and 3% organic. Iodine released from the failed fuel is assumed to be 95% particulate, 4.85% elemental, and 0.15% organic.

(10) Per Ref.08, the primary to secondary leakage of 200 gpd (TS 3.4.13) is assumed to continue until the primary system pressure is less than the secondary system pressure or until the temperature of the leakage is less than 100°C (212°F). In this work, the release of radioactivity from the affected steam generator is assumed to continue until the RCS reaches 212°F. Per Ref.33, assuming a concurrent LOOP, failure of a diesel generator, and failure of the ADVs, operators would require a maximum of 9 hours to cool the RCS to below 212°F.

Also per Ref.08, "the leakage should be apportioned between affected and unaffected steam generators in such a manner that the calculated dose is maximized." Thus, since the flashing fraction for the affected steam generator is 100% while that for the unaffected is less than 10% and since the most-limiting atmospheric dispersion coefficients for the Atmospheric Dump Valve (ADV) to Turbine Building (TB) are within 10% of the most-limiting atmospheric dispersion coefficients of the MSG to TB, all of the primary to secondary leakage is assumed to flow to the affected steam generator.

(11) 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

(12) 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

(13) Control room leakage: The control room leakages for the two trains Air Conditioning Units (ACU) 11 and 12 were measured by NUCON International Inc. via sulfur hexafluoride (SF₆) tracer gas tests as documented in Refs.23-26 (Attachment W). An additional leakage test was performed by Brookhaven National Laboratory (BNL) via a perfluorocarbon tracer gas (PFT) test as documented in Ref.27 (Attachment X).

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

The latest SF₆ 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 leakage 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 leakage will be assumed to enter the control room from the most conservative pathway of either the West Road or Turbine Building inlets.

(14) 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.)

(15) The main steam gooseneck (MSG) - to - site boundary, two-hour, atmospheric dispersion coefficient of 1.44E-4 sec/m³ 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

μ = average wind speed = 1 m/sec

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

σ_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 MSG to low population zone (2 miles)

(UFSAR Fig.2.3-3/UFSAR 14.24.3)

Time (hours)	χ/Q (sec/m ³)
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 point release rather than a containment release.

(17) Atmospheric dispersion coefficients from the Main Steam Gooseneck (MSG) 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 MSG. 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 ³)				
	msg1-wr	msg2-wr	msg1-tb	msg2-tb
0-2 hr	1.54E-03	1.48E-03	3.38E-03	3.48E-03
2-8 hr	1.19E-03	1.02E-03	2.56E-03	2.97E-03
8-24hr	5.15E-04	4.11E-04	9.45E-04	1.21E-03
1-4 days	3.81E-04	2.73E-04	7.73E-04	9.22E-04
4-30 days	2.67E-04	1.81E-04	5.91E-04	7.41E-04

The atmospheric dispersion coefficients corresponding to the Unit 2 MSG 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) Masses and Volumes

1	RCS(cf)	7286.18		Total RCS and PZR volumes normalized to STP
	Vrcs(cf)	9576		RCS volume per UFSAR T4.1
	Vpzs(cf)	600		PZR volume per UFSAR T4.7
	vrcs(cf/lbm)	0.022132		Ref.31 Specific Vol @ 574.5 F and 2250 psia - UFSAR T4.1 F4.9
	vpzs(cf/lbm)	0.02703		Ref.31 Specific Vol @ 653 F and 2250 psia - UFSAR T4.7
	Mrcs(lbm)	432676.67		RCS mass; Vrcs/vrcs
	Mpzs(lbm)	22197.56		PZR mass: Vpzs/vpzs
	Mtot(lbm-g)	454874.23	206327482	RCS + PZR mass: Mrcs+Mpzs
	vstp(cf/lbm)	0.016018		Ref.31 Specific Vol @ 1 gm/cc
	Vtot(cf)	7286.18		Mtot*vstp @ STP
2	SG(cf)	4420.04		Total SG volume normalized to STP
	M2sg(lbm-g)	275942.00	125165188	SG mass per Ref.32 Sheet 30 - 102% Full Power
	V2sg(cf)	4420.04		M2sg*vstp @ STP
3	AFW(cf)	10000.00		Auxiliary Feedwater Volume
4	Environment			
5	Control Room	289194 cf		Control Room Volume (Ref.19)

(19) The volume of the Main Steam Piping Rooms (309/315) can be estimated from Ref.34. Using the net flood area of 1294.75 ft², a floor elevation of 27 ft, and a ceiling elevation of 45'-2'=43', a volume of 20716 ft³ can be calculated.

(20) The volume of the turbine building can be determined from Refs.35-37. Per Ref.35, the floor area is approximately $130' \times 560' = 72800 \text{ ft}^2$. Per Ref.36, the roof elevation is $134' 1.5''$, while per Ref.37 the floor elevation is $11' 7''$. Thus the internal height of the turbine building is $134.125' - 11.5833' = 122.54'$. The resulting gross volume is 8921033 ft^3 . This value will be reduced by 10% to 8000000 ft^3 to account for internal equipment and structures.

(21) Additional RADTRAD Inputs for the failed fuel, primary, and secondary release pathways:

Pathways		Failed Fuel/Primary		Secondary	
			cfm		cfm
1	rsc-env	200 gpd	0.01857	0 gpd	0
2	env-cr	3500 cfm	3500	3500 cfm	3500
3	cr-env	3500 cfm	3500	3500 cfm	3500
4	rsc-sg	0	0	0	0
5	sg-env	0	0	4000 cfm	4000
6	afw-sg	0	0	0	0

7. TECHNICAL ASSUMPTIONS

The following technical assumptions were utilized in this work:

- (01) The 0.8% rod fuel failure is assumed to occur in the highest powered fuel rods.
- (02) No credit is taken for atmospheric cleanup systems except control room filters.
- (03) No credit is taken for deposition of the plume on the ground or decay of isotopes in transit to the site boundary.
- (04) Buildup of daughter nuclides is taken into account as source term nuclides decay.
- (05) All of the secondary Technical Specification activity from the affected and unaffected steam generators is assumed to be released at the start of the MSLB through the MSPR and thus the MSG.
- (06) All of the Technical Specification primary-to-secondary leakage occurs in the affected steam generator and thus is totally and immediately released through the MSG into the environment.
- (07) 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.
- (08) No holdup of the released activity in the SG or MSPR is assumed. Note that this conservatism increases the failed fuel component of the control room dose by a factor of four.

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) "Control Room Habitability Source Term Calculations", CA06358.
- (06) "Chart of the Nuclides - Nuclides and Isotopes", GE Nuclear Energy, Fifteenth Edition.
- (07) "Gas Gap Isotopic Fraction Calculations", CA06421.
- (08) "Alternate Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors", Regulatory Guide 1.183
- (09) CA05738, Calvert Cliffs Unit 1 Cycle 16 Post-Trip Steam Line Break
- (10) CA05739, Calvert Cliffs Units 1 and 2 Pre-Trip Steam Line Break Event
- (11) CA06383, Calvert Cliffs Units 1 and 2 Pre-Trip Steam Line Break Event
- (12) CA06382, Calvert Cliffs Unit 1 Cycle 17 Post-Trip Steam Line Break Event
- (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) NEU-98-027, ES199800165-000, Engineering Evaluation to Determine the Time Required to Cool the RCS to 212°F During a Main Steam Line Break Scenario
- (34) Calculation M-90-175: Internal Plant Flooding for the Main Steam Piping Areas
- (35) BGE Drawing 62012SH0001 Rev.5: Turbine Building Partial Roof Plan
- (36) BGE Drawing 62013SH0001 Rev.3: Turbine Building and Heater Bay - Exterior Elevations East
- (37) BGE Drawing 61638SH0001 Rev.3: Turbine Building Elevation - Col Line 101

9. METHODS OF ANALYSIS

(9.1) RADTRAD Computations

The current work re-analyzes control room habitability for a MSLB 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.

The failed fuel MSLB model is constructed in four parts: gas gap iodine and noble gas releases, gas gap alkali metal releases, TS primary iodine and noble gas activity releases, and TS secondary iodine activity releases. The MSLB occurs at time $t=0$ releasing the failed fuel gas gap iodine, noble gas, and alkali metal activities immediately and homogeneously into the primary system. The gas gap and TS primary activities are released at a 200 gpd rate into the affected steam generator and then via flashing directly through the MSGs into the environment with no holdup in the SG or MSPR. Note that no auxiliary feedwater is added to the affected steam generator, which is assumed to immediately blow dry. The TS activity from both SGs is assumed to be immediately released to the environment via the affected MSG. 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.

The MSLB model with no failed fuel is identical to the above TS primary release model except that it assumes TS primary activity adjusted by the appropriate PIS or CIS factor.

(9.2) Gas Gap, Primary, and Secondary Release Activities

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

- Gas gap iodine, noble gas, and alkali metal activities released via fuel failure
- Technical Specification Primary iodine and noble gas activities
- Technical Specification Secondary iodine activities
- Technical Specification Primary iodine and noble gas activities increased by the PIS factor
- Technical Specification Primary iodine and noble gas activities increased by the CIS factor

(9.2.a) Gas Gap Release Activities

The initial failed fuel isotopic activity in Ci/MWt contained in the gas gaps of all of the assemblies in the core for isotope 'i' is listed in Attachment A Column E and is based on the following algorithm:

$$A_{p,i} = AST_i * RF_i$$

where AST_i = Isotopic activity per unit power (Ci/MWT) (Ref.05 and Attachment A Column C)
 RF_i = Isotopic gas gap release fraction (Ref.07 and Attachment A Column D)

The iodine and noble gas isotopic activities were inserted into the nuclear inventory file GAP14.NIF for use by RADTRAD. The file is listed in Attachment B and consist of the 14 gas-gap noble gas and iodine isotopes. The corresponding iodine and noble gas release fractions in MSLBGAP.RFT are 0.008. The alkali metal isotopic activities are contained in the base deck CRCB63.NIF ilisted in Attachment G. The corresponding alkalai metal release fraction in MSLBGCS.RFT is $0.008 \times 0.24 = 0.00192$, where 0.008 is the failed fuel fraction and 0.24 is twice the non-LOCA alkali metal release fraction of Table 3 of RG 1.183. The factor of two is per the results of Ref.7, where all gas gap release fractions were conservatively doubled.

(9.2.b) 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 F of Attachment A. These were converted to total primary isotopic source terms in Ci in Attachment A column G via the following algorithm:

$$A_{i0} = AST_i * M_{RCS} * 0.000001$$

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

The primary iodine isotopic source terms were then halved in Attachment A column H 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 PRI14.NIF for use by RADTRAD. The file is listed in Attachment C and consist of the 14 primary noble gas and iodine 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.

(9.2.c) 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 I of Attachment A. These were converted to total secondary isotopic source terms in Attachment A column J via the following algorithm:

$$A_{i0} = AST_i * M_{SG} * 0.000001$$

where AST_i = Isotopic activity per unit mass ($\mu\text{Ci/gm}$) (Ref.04)
 M_{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 D 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.

(9.2.d) Primary Specific Activities with a PIS Factor

The initial primary specific activities in $\mu\text{Ci/gm}$ consistent with the TS 3.4.15 $1.0 \mu\text{Ci/gm}$ limit and a PIS factor of 60 were extracted from Ref.4 and are listed in column K of Attachment A. These were converted to total primary isotopic source terms in Attachment A column L via the following algorithm:

$$A_{i0} = AST_i * M_{RCS} * 0.000001$$

where AST_i = PIS isotopic activity per unit mass ($\mu\text{Ci/gm}$) (Ref.04 and Attachment A Column K)
 M_{RCS} = Water mass in RCS (gm)

Note that the PIS iodine isotopic source terms were then halved in Attachment A column L 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 E and consist of the 14 primary noble gas and iodine isotopes. The activities are the total PIS activities and are not per unit power. Thus a power of one should be designated when employing these files.

(9.2.e) Primary Specific Activities with a CIS Factor

The initial primary specific activities in $\mu\text{Ci/gm}$ consistent with the TS 3.4.15 1.0 $\mu\text{Ci/gm}$ limit and a CIS factor of 500 were extracted from Ref.4 and are listed in column M of Attachment A. These were converted to total primary isotopic source terms in Attachment A column N via the following algorithm:

$$A_{i0} = AST_i * M_{RCS} * 0.000001$$

where AST_i = CIS isotopic activity per unit mass ($\mu\text{Ci/gm}$) (Ref.04 and Attachment A Column M)
 M_{RCS} = Water mass in RCS (gm)

Note that the PIS iodine isotopic source terms were then halved in Attachment A column N 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 $\mu\text{Ci/gm}$. The iodine activities were then increased by a factor of 9/8 to account for a 9 hour accident, rather than 8.

These isotopic activities were inserted into the nuclear inventory file CIS.NIF for use by RADTRAD. The file is listed in Attachment F and consist of the 14 primary noble gas and iodine isotopes. The activities are the total CIS activities and are not per unit power. Thus a power of one should be designated when employing these files.

(9.3) Flashing Fraction Calculations

Per Regulatory Guide 1.183 (Ref.8), upon periods of steam generator dryout, all of the primary-to-secondary leakage is assumed to flash to vapor and be released to the environment with no mitigation.

10. CALCULATIONS

The following computational calculations were performed in this calculational package:

Activity Source	Failed Fuel	Failed Fuel	Primary	Secondary	PIS	CIS
Radionuclide Component	Iodine/ Noble Gas	Alkali Metals	Iodine/ Noble Gas	Iodine	Iodine/ Noble Gas	Iodine/ Noble Gas
Case Input Files	mslbff.psf	mslbffcs.psf	mslbpri.psf	mslbsec.psf	mslbpis.psf	mslbcis.psf
Dose Conversion Factor File	fgr14.inp	fgr63.inp	fgr14.inp	fgr05.inp	fgr14.inp	fgr14.inp
Release Fraction/Timing File	mslbgap.rft	mslbgs.rft	mslbpri.rft	mslbsec.rft	pis.rft	cis500.rft
Nuclear Inventory File	gap14.nif	crcb63.nif	pri14.nif	sec05.nif	pis.nif	cis500.nif
Case Output Files	mslbff.o0	mslbffcs.o0	mslbpri.o0	mslbsec.o0	mslbpis.o0	mslbcis.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 containment to a secondary containment 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

UFSAR 14.14 presents the licensing basis evaluation of the MSLB Event. A MSLB Event is defined as the pre-trip guillotine-type rupture of a main steam line outside containment in the Main Steam Piping Room (MSPR). It is assumed that the steam line rupture occurs between the steam generator and the MSIV, allowing blowdown of the affected steam generator to continue. A LOOP with the turbine trip results in the maximum site boundary doses, since the LOOP causes the RCPs to coast down, minimizing core flow, lowering the transient Departure from Nucleate Boiling Ratio (DNBR), and maximizing the number of failed fuel pins.

To maximize control room and offsite doses, the maximum secondary Technical Specification (TS) activity and that fraction of the primary Technical Specification and failed fuel activity which leaks to the secondary from the affected and unaffected steam generators are discharged into the MSPR and out the Main Steam Gooseneck (MSG) on the roof of the auxiliary building. Since the steam generators are designed to withstand RCS operating pressure on the tube side with atmospheric pressure on the shell side, the continued integrity of the RCS barrier is assured. Thus only the maximum Technical Specification primary-to-secondary leakage is assumed. A partition factor of unity is assumed for all discharged activities.

Previously, power reactor licensees have typically used TID-14844 (Ref.18) as the basis for DBA 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 (AST) methodology. Regulatory guidance for the implementation of these ASTs is provided in RG 1.183 (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 DBA accidents.

The current work utilizes the alternate source term methodology of 10 CFR 50.67 and Regulatory Guide 1.183 to calculate offsite and control room doses for a MSLB. A bounding control room inleakage value of 3500 cfm was assumed. 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 99% 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, three cases are modeled to determine the maximum offsite and control room doses.

- **Failed Fuel Case:** The dose analysis of UFSAR 14.14 assumes a conservative 1.35% fuel failure rate and 200 gpd primary-to-secondary leakage. The MSLB analyses of record were generated by Combustion Engineering (CE) in Refs. 11-12, resulting in no failed fuel. To preserve some margin and still meet the 10 CFR 50 App. A GDC 19 limit of 5 rem TEDE in the control room, 0.80% of the fuel pins in the core are assumed to fail.
- **Preaccident Iodine Spike (PIS) Case:** A reactor transient has occurred prior to the postulated MSLB 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 MSLB 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 500 times greater than the release rate corresponding to the iodine concentration at the equilibrium value.

The exclusion area boundary (EAB), low population zone (LPZ), and control room (CR) doses for the design-basis MSLB assuming 0.8% failed fuel are detailed in the following table.

MSLB 0.8% Failed Fuel Results			
	EAB	LPZ	CR
	Rem TEDE	Rem TEDE	Rem TEDE
Failed Fuel Iodine/Noble Gas	1.1659E-01	3.2681E-02	2.6375E+00
Failed Fuel Alkali Metals	7.0290E-02	2.0046E-02	1.7803E+00
Primary	9.0575E-05	2.5313E-05	1.5238E-03
Secondary	3.1067E-02	4.9595E-03	2.1082E-01
Total	0.2180	0.0577	4.6301
Regulatory Limit	25 (RG 1.183)	25 (RG 1.183)	5 (10CFR50.67)

The EAB, LPZ, and CR doses for the MSLB assuming no failed fuel but assuming maximum TS activity with a PIS and CIS are detailed in the following table.

MSLB No Failed Fuel Results			
	EAB	LPZ	CR
	Rem TEDE	Rem TEDE	Rem TEDE
PIS Case	3.2635E-03	9.2117E-04	8.2508E-02
Regulatory Limits	25 (RG 1.183)	25 (RG 1.183)	5 (10CFR50.67)
CIS Case	2.2499E-03	1.0446E-03	2.0757E-01
Regulatory Limits	2.5 (RG 1.183)	2.5 (RG 1.183)	5 (10CFR50.67)

Note that all values are below the regulatory limits.

13. CONCLUSIONS

The exclusion area boundary (EAB), low population zone (LPZ), and control room (CR) doses for the design-basis MSLB accidents are detailed in the following table.

MSLB Results			
	EAB	LPZ	CR
	Rem TEDE	Rem TEDE	Rem TEDE
0.8% Failed Fuel	0.2180	0.0577	4.6301
PIS Case	3.2635E-03	9.2117E-04	8.2508E-02
Regulatory Limits	25 (RG 1.183)	25 (RG 1.183)	5 (10CFR50.67)
CIS Case	2.2499E-03	1.0446E-03	2.0757E-01
Regulatory Limits	2.5 (RG 1.183)	2.5 (RG 1.183)	5 (10CFR50.67)

All MSLB offsite and control room doses are below the regulatory limits.

This work supports the following changes in plant operation:

- This analysis supports a pin power peaking factor of 1.70
- A time to shutdown cooling of 9 hours was assumed..
- This analysis supports an upper limit of 0.8% failed fuel.

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 and a 99% efficiency for particulate 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 MAIN STEAM LINE BREAK RELEASE ACTIVITIES

Calculation of Main Steam Line Break Release Activities					
	Half-life	lambda	Core	Gas Gap	Gas Gap
			Source	Fractions	Source
	sec	1/sec	CI/MWT		CI/MWT
	A	B	C	D	E
Kr-85	3.3830E+08	2.0489E-09	3.7180E+02	0.20	7.4360E+01
Kr-85m	1.6128E+04	4.2978E-05	7.9679E+03	0.10	7.9679E+02
Kr-87	4.5780E+03	1.5141E-04	1.6208E+04	0.10	1.6208E+03
Kr-88	1.0224E+04	6.7796E-05	2.2658E+04	0.10	2.2658E+03
I-131	6.9466E+05	9.9783E-07	2.7562E+04	0.16	4.4099E+03
I-132	8.2800E+03	8.3713E-05	3.9464E+04	0.10	3.9464E+03
I-133	7.4880E+04	9.2568E-06	5.5715E+04	0.10	5.5715E+03
I-134	3.1560E+03	2.1963E-04	6.2858E+04	0.10	6.2858E+03
I-135	2.3796E+04	2.9129E-05	5.2964E+04	0.10	5.2964E+03
Xe-133	4.5317E+05	1.5296E-06	5.5707E+04	0.10	5.5707E+03
Xe-135	3.2724E+04	2.1182E-05	1.7708E+04	0.10	1.7708E+03
Xe133m	1.8922E+05	3.6632E-06	1.7354E+03	0.10	1.7354E+02
Xe135m	9.1800E+02	7.5506E-04	1.1635E+04	0.10	1.1635E+03
Xe138	8.4600E+02	8.1932E-04	4.9330E+04	0.10	4.9330E+03
Rb-86	1.6122E+06	4.2994E-07	5.9034E+01	0.24	1.4168E+01
Cs-134	6.5072E+07	1.0652E-08	7.1917E+03	0.24	1.7260E+03
Cs-136	1.1318E+06	6.1241E-07	1.7111E+03	0.24	4.1066E+02
Cs-137	9.4673E+08	7.3215E-10	4.7857E+03	0.24	1.1486E+03
	1 μ CI/g	1 μ Ci/g	0.5 μ CI/g	0.1 μ CI/g	0.1 μ CI/g
	Primary	Primary	Primary	Secondary	Secondary
	Source	Source	Source	Source	Source
	microCi/g	CI	CI	microCi/g	CI
	F	G	H	I	J
Kr-85	3.8761E+01	7.9975E+03	7.9975E+03		
Kr-85m	2.0344E+00	4.1975E+02	4.1975E+02		
Kr-87	1.1747E+00	2.4238E+02	2.4238E+02		
Kr-88	3.6579E+00	7.5473E+02	7.5473E+02		
I-131	7.7893E-01	1.6071E+02	8.0357E+01	8.9260E-02	1.1172E+01
I-132	2.5868E-01	5.3372E+01	2.6686E+01	2.2758E-03	2.8485E-01
I-133	1.0972E+00	2.2638E+02	1.1319E+02	5.7417E-02	7.1866E+00
I-134	1.4798E-01	3.0532E+01	1.5266E+01	5.2168E-04	6.5297E-02
I-135	6.0207E-01	1.2422E+02	6.2112E+01	1.3584E-02	1.7003E+00
Xe-133	4.0021E+02	8.2574E+04	8.2574E+04		
Xe-135	9.5607E+00	1.9726E+03	1.9726E+03		

Xe133m	5.7016E+00	1.1764E+03	1.1764E+03		
Xe135m	1.2511E+00	2.5814E+02	2.5814E+02		
Xe138	6.6019E-01	1.3622E+02	1.3622E+02		
			1 μ Ci/g	0.5 μ Ci/g	0.5 μ Ci/g
	60 μ Ci/g	30 μ Ci/g	500 SF	500 SF	500 SF
	PIS	PIS	8 Hr CIS	8 Hr CIS	9 Hr CIS
	Primary	Primary	Primary	Primary	Primary
	Source	Source	Source	Source	Source
	microCi/g	Ci	Ci	Ci	Ci
	K	L	M	N	O
Kr-85	3.8761E+01	7.9975E+03	7.9975E+03	7.9975E+03	7.9975E+03
Kr-85m	2.0344E+00	4.1975E+02	4.1975E+02	4.1975E+02	4.1975E+02
Kr-87	1.1747E+00	2.4238E+02	2.4238E+02	2.4238E+02	2.4238E+02
Kr-88	3.6579E+00	7.5473E+02	7.5473E+02	7.5473E+02	7.5473E+02
I-131	4.6736E+01	4.8214E+03	4.4459E+04	2.2229E+04	2.5008E+04
I-132	1.5521E+01	1.6012E+03	7.8899E+04	3.9449E+04	4.4381E+04
I-133	6.5831E+01	6.7914E+03	8.9540E+04	4.4770E+04	5.0366E+04
I-134	8.8786E+00	9.1595E+02	1.0457E+05	5.2284E+04	5.8819E+04
I-135	3.6124E+01	3.7267E+03	8.4998E+04	4.2499E+04	4.7811E+04
Xe-133	4.0021E+02	8.2574E+04	8.2574E+04	8.2574E+04	8.2574E+04
Xe-135	9.5607E+00	1.9726E+03	1.9726E+03	1.9726E+03	1.9726E+03
Xe133m	5.7016E+00	1.1764E+03	1.1764E+03	1.1764E+03	1.1764E+03
Xe135m	1.2511E+00	2.5814E+02	2.5814E+02	2.5814E+02	2.5814E+02
Xe138	6.6019E-01	1.3622E+02	1.3622E+02	1.3622E+02	1.3622E+02
A	Half-lives: Chart of the Nuclides Fifteenth Edition'				
B	Decay constants: $\ln(2)/A(i)$				
C	Core source In Ci/MWt: CA06358				
D	Gas Gap Fractions: CA06421				
E	Gas Gap Source In Ci/MWt: $G(i)=E(i)*F(i)$				
F	Primary Source In microCi/gm: CA06422				
G	Primary Source In Ci for 1.0 microCi/gm total: CA06422				
H	Primary Source In Ci for 0.5 microCi/gm total: CA06422				
I	Secondary Source In microCi/gm: CA06422				
J	Secondary Source In Ci for 0.1 microCi/gm total: CA06422				
K	PIS Source In microCi/gm for 60.0 microCi/gm total: CA06422				
L	PIS Source In Ci for 30.0 microCi/gm total				
M	CIS Source In Ci for 1.0 microCi/gm total&500 Spiking Factor: CA06422				
N	8 Hr CIS Source In Ci for 0.5 microCi/gm total&500 Spiking Factor				
O	9 Hr CIS Source In Ci for 0.5 microCi/gm total&500 Spiking Factor				

ATTACHMENT B
NUCLEAR INVENTORY FILE GAP14.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

7.4360E+01

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 002:

Kr-85m

1

0.1612800000E+05

0.8500E+02

7.9679E+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

1.6208E+03

Rb-87 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 004:

Kr-88

1

0.1022400000E+05

0.8800E+02

2.2658E+03

Rb-88 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 005:

I-131

2

0.6946560000E+06

0.1310E+03

4.4099E+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

3.9464E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 007:

I-133

2

0.7488000000E+05

0.1330E+03

5.5715E+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

6.2858E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 009:

I-135

2

0.2379600000E+05

0.1350E+03

5.2964E+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

5.5707E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 011:

Xe-135

1

0.3272400000E+05

0.1350E+03

1.7708E+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

1.7354E+02

Xe-133 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 013:

Xe-135m

1

0.9180000000E+03

0.1350E+03

1.1635E+03

Xe-135 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 014:

Xe-138

1

0.8460000000E+03

0.1380E+03

4.9330E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

End of Nuclear Inventory File

ATTACHMENT C
NUCLEAR INVENTORY FILE PRI14.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

8.0357E+01

Xe-131m 0.1100E-01

none 0.0000E+00

none 0.0000E+00

Nuclide 006:

I-132

2

0.8280000000E+04

0.1320E+03

2.6686E+01

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 007:

I-133

2

0.7488000000E+05

0.1330E+03

1.1319E+02

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

1.5266E+01

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 009:

I-135

2

0.2379600000E+05

0.1350E+03

6.2112E+01

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 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 E
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 F
NUCLEAR INVENTORY FILE CIS500.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

2.5008E+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

4.4381E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 007:

I-133

2

0.7488000000E+05

0.1330E+03

5.0366E+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

5.8819E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 009:

I-135

2

0.2379600000E+05

0.1350E+03

4.7811E+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 G
NUCLEAR INVENTORY FILE CRCB63.NIF

Nuclide Inventory Name:

Normalized MACCS Sample 3412 MWth PWR Core Inventory

Power Level:

0.1000E+01

Nuclides:

63

Nuclide 001:

Co-58

7

0.6117120000E+07

0.5800E+02

8.0012E+02

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 002:

Co-60

7

0.1663401096E+09

0.6000E+02

9.8625E+02

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 003:

Kr-85

1

0.3382974720E+09

0.8500E+02

3.7180E+02

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 004:

Kr-85m

1

0.1612800000E+05

0.8500E+02

7.9679E+03

Kr-85 0.2100E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 005:

Kr-87

1

0.4578000000E+04

0.8700E+02

1.6208E+04

Rb-87 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 006:

Kr-88

1

0.1022400000E+05

0.8800E+02

2.2658E+04

Rb-88 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 007:

Rb-86

3

0.1612224000E+07

0.8600E+02

5.9034E+01

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 008:

Sr-89

5

0.4363200000E+07

0.8900E+02

3.3293E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 009:

Sr-90

5

0.9189573120E+09

0.9000E+02

3.1769E+03

Y-90 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 010:

Sr-91

5

0.3420000000E+05

0.9100E+02

3.8931E+04

Y-91m 0.5800E+00

Y-91 0.4200E+00

none 0.0000E+00

Nuclide 011:

Sr-92

5

0.9756000000E+04

0.9200E+02

4.0190E+04

Y-92 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 012:

Y-90

9

0.2304000000E+06

0.9000E+02

3.4567E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 013:

Y-91

9

0.5055264000E+07

0.9100E+02

4.2527E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 014:

Y-92

9

0.1274400000E+05

0.9200E+02

4.0519E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 015:

Y-93

9

0.3636000000E+05

0.9300E+02

2.9622E+04

Zr-93 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 016:

Zr-95

9

0.5527872000E+07

0.9500E+02

5.8246E+04

Nb-95m 0.7000E-02

Nb-95 0.9900E+00

none 0.0000E+00

Nuclide 017:

Zr-97

9

0.6084000000E+05

0.9700E+02

4.9425E+04

Nb-97m 0.9500E+00

Nb-97 0.5300E-01

none 0.0000E+00

Nuclide 018:

Nb-95

9

0.3036960000E+07

0.9500E+02

6.0839E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 019:

Mo-99

7

0.2376000000E+06

0.9900E+02

5.0834E+04

Tc-99m 0.8800E+00

Tc-99 0.1200E+00

none 0.0000E+00

Nuclide 020:

Tc-99m

7

0.2167200000E+05

0.9900E+02

4.5424E+04

Tc-99 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 021:

Ru-103

7

0.3393792000E+07

0.1030E+03

4.8774E+04

Rh-103m 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 022:

Ru-105

7

0.1598400000E+05

0.1050E+03

3.1455E+04

Rh-105 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 023:

Ru-106

7

0.3181248000E+08

0.1060E+03

1.9695E+04

Rh-106 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 024:

Rh-105

7

0.1272960000E+06

0.1050E+03

2.8507E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 025:

Sb-127

4

0.3326400000E+06

0.1270E+03

2.4299E+03

Te-127m 0.1800E+00

Te-127 0.8200E+00

none 0.0000E+00

Nuclide 026:

Sb-129

4

0.1555200000E+05

0.1290E+03

8.7888E+03

Te-129m 0.2200E+00

Te-129 0.7700E+00

none 0.0000E+00

Nuclide 027:

Te-127

4

0.3366000000E+05

0.1270E+03

2.4664E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 028:

Te-127m

4

0.9417600000E+07

0.1270E+03

4.6272E+02

Te-127 0.9800E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 029:

Te-129

4

0.4176000000E+04

0.1290E+03

8.4012E+03

I-129 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 030:

Te-129m

4

0.2903040000E+07

0.1290E+03

1.8872E+03

Te-129 0.6500E+00

I-129 0.3500E+00

none 0.0000E+00

Nuclide 031:

Te-131m

4

0.1080000000E+06

0.1310E+03

5.0686E+03

Te-131 0.2200E+00

I-131 0.7800E+00

none 0.0000E+00

Nuclide 032:

Te-132

4

0.2815200000E+06

0.1320E+03

3.8391E+04

I-132 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 033:

I-131

2

0.6946560000E+06

0.1310E+03

2.7562E+04

Xe-131m 0.1100E-01

none 0.0000E+00

none 0.0000E+00

Nuclide 034:

I-132

2

0.8280000000E+04

0.1320E+03

3.9464E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 035:

I-133

2

0.7488000000E+05

0.1330E+03

5.5715E+04

Xe-133m 0.2900E-01

Xe-133 0.9700E+00

none 0.0000E+00

Nuclide 036:

I-134

2

0.3156000000E+04

0.1340E+03

6.2858E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 037:

I-135

2

0.2379600000E+05

0.1350E+03

5.2964E+04

Xe-135m 0.1500E+00

Xe-135 0.8500E+00

none 0.0000E+00

Nuclide 038:

Xe-133

1

0.4531680000E+06

0.1330E+03

5.5707E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 039:

Xe-135

1

0.3272400000E+05

0.1350E+03

1.7708E+04

Cs-135 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 040:

Cs-134

3

0.6507177120E+08

0.1340E+03

7.1917E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 041:

Cs-136

3

0.1131840000E+07

0.1360E+03

1.7111E+03

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 042:

Cs-137

3

0.9467280000E+09

0.1370E+03

4.7857E+03

Ba-137m 0.9500E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 043:

Ba-139

6

0.4962000000E+04

0.1390E+03

5.1001E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 044:

Ba-140

6

0.1100736000E+07

0.1400E+03

5.2928E+04

La-140 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 045:

La-140

9

0.1449792000E+06

0.1400E+03

5.4255E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 046:

La-141

9

0.1414800000E+05

0.1410E+03

4.6433E+04

Ce-141 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 047:

La-142

9

0.5550000000E+04

0.1420E+03

4.4898E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 048:

Ce-141

8

0.2808086400E+07

0.1410E+03

5.1883E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 049:

Ce-143

8

0.1188000000E+06

0.1430E+03

4.4327E+04

Pr-143 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 050:

Ce-144

8

0.2456352000E+08

0.1440E+03

4.2317E+04

Pr-144m 0.1800E-01

Pr-144 0.9800E+00

none 0.0000E+00

Nuclide 051:

Pr-143

9

0.1171584000E+07

0.1430E+03

4.6904E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

Nuclide 052:

Nd-147

9

0.9486720000E+06

0.1470E+03

1.9151E+04

Pm-147 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 053:

Np-239

8

0.2034720000E+06

0.2390E+03

5.5833E+05

Pu-239 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 054:

Pu-238

8

0.2768863824E+10

0.2380E+03

1.7259E+02

U-234 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 055:

Pu-239

8

0.7594336440E+12

0.2390E+03

1.1469E+01

U-235 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 056:

Pu-240

8

0.2062920312E+12

0.2400E+03

2.0026E+01

U-236 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 057:

Pu-241

8

0.4544294400E+09

0.2410E+03

4.9593E+03

U-237 0.2400E-04

Am-241 0.1000E+01

none 0.0000E+00

Nuclide 058:

Am-241

9

0.1363919472E+11

0.2410E+03

7.3183E+00

Np-237 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 059:

Cm-242

9

0.1406592000E+08

0.2420E+03

2.0078E+03

Pu-238 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 060:

Cm-244

9

0.571508136E+9

0.2440E+03

3.1650E+02

Pu-240 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 061:

Xe-133m

1

1.8922000000E+05

0.1330E+03

1.7354E+03

Xe-133 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 062:

Xe-135m

1

9.1800000000E+02

0.1350E+03

1.1635E+04

Xe-135 0.1000E+01

none 0.0000E+00

none 0.0000E+00

Nuclide 063:

Xe-138

1

8.4600000000E+02

0.1380E+03

4.9330E+04

none 0.0000E+00

none 0.0000E+00

none 0.0000E+00

End of Nuclear Inventory File

ATTACHMENT H
RELEASE FRACTION AND TIMING FILE MSLBGAP.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:

0.0080E+00 0.0000E+00 0.0000E+00 0.0000E+00

Iodine:

0.0080E+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 MSLBPRI.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:

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 MSLBSEC.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 K
RELEASE FRACTION AND TIMING FILE PIS.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:

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 L
RELEASE FRACTION AND TIMING FILE CIS500.RFT

Release Fraction and Timing Name:

PWR, RG 1.183, Table 2 Section 3.2

Duration (h): Design Basis Accident

0.0001E+00 9.0000E+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 1.0000E+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 M
RELEASE FRACTION AND TIMING FILE MSLBGCS.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:

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

Cesium:

1.920E-03 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 N 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 halflives (m) less than 90 and less than 0.100 of parent
9 ORGANS DEFINED IN THIS FILE:

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

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 SHINE 8HR	GROUND SHINE 7DAY	GROUND SHINE RATE	INHALED ACUTE	INHALED CHRONIC	INGESTION
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 O 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 halflives (m) less than 90 and less than 0.100 of parent

9 ORGANS DEFINED IN THIS FILE:

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

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	GROUND	GROUND	INHALED	INHALED	INGESTION
	SHINE 8HR	SHINE 7DAY	SHINE RATE	ACUTE	CHRONIC		

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 P
CONVERSION FACTORS FILE FGR63.INP

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

Implicit daughter halflives (m) less than 90 and less than 0.100 of parent

9 ORGANS DEFINED IN THIS FILE:

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

63 NUCLIDES DEFINED IN THIS FILE:

Co-58	Y	
Co-60	Y	
Kr-85		
Kr-85m		
Kr-87		
Kr-88		
Rb-86	D	
Sr-89	Y	
Sr-90	Y	
Sr-91	Y	Including:Y-91m
Sr-92	Y	
Y-90	Y	
Y-91	Y	
Y-92	Y	
Y-93	Y	
Zr-95	D	
Zr-97	Y	Including:Nb-97m , Including:Nb-97
Nb-95	Y	
Mo-99	Y	
Tc-99m	D	
Ru-103	Y	Including:Rh-103m
Ru-105	Y	
Ru-106	Y	Including:Rh-106
Rh-105	Y	
Sb-127	W	
Sb-129	W	
Te-127	W	
Te-127m	W	
Te-129	W	
Te-129m	W	Including:Te-129
Te-131m	W	Including:Te-131
Te-132	W	
I-131	D	
I-132	D	
I-133	D	
I-134	D	
I-135	D	Including:Xe-135m

Xe-133
Xe-135
Cs-134 D
Cs-136 D
Cs-137 D Including:Ba-137m
Ba-139 D
Ba-140 D
La-140 W
La-141 D
La-142 D
Ce-141 Y
Ce-143 Y
Ce-144 Y Including:Pr-144m, Including:Pr-144
Pr-143 Y
Nd-147 Y
Np-239 W
Pu-238 Y
Pu-239 Y
Pu-240 Y
Pu-241 Y
Am-241 W
Cm-242 W
Cm-244 W
Xe-133m
Xe-135m
Xe-138

	CLOUDSHINE	GROUND	GROUND	GROUND	INHALED	INHALED	INGESTION
	SHINE 8HR	SHINE 7DAY	SHINE RATE	ACUTE	CHRONIC		
Co-58							
GONADS	4.660E-14	2.867E-11	5.828E-10	9.970E-16-1.000E+00	6.170E-10	1.040E-09	
BREAST	5.300E-14	2.737E-11	5.565E-10	9.520E-16-1.000E+00	9.370E-10	1.790E-10	
LUNGS	4.640E-14	2.617E-11	5.319E-10	9.100E-16-1.000E+00	1.600E-08	8.530E-11	
RED MARR	4.530E-14	2.671E-11	5.430E-10	9.290E-16-1.000E+00	9.230E-10	2.600E-10	
BONE SUR	7.410E-14	3.795E-11	7.716E-10	1.320E-15-1.000E+00	6.930E-10	1.250E-10	
THYROID	4.770E-14	2.720E-11	5.530E-10	9.460E-16-1.000E+00	8.720E-10	6.310E-11	
REMAINDER	4.440E-14	2.585E-11	5.255E-10	8.990E-16-1.000E+00	1.890E-09	1.580E-09	
EFFECTIVE	4.760E-14	2.732E-11	5.553E-10	9.500E-16-1.000E+00	2.940E-09	8.090E-10	
SKIN(FGR)	5.580E-14	3.278E-11	6.664E-10	1.140E-15-1.000E+00	0.000E+00	0.000E+00	
Co-60							
GONADS	1.230E-13	7.056E-11	1.480E-09	2.450E-15-1.000E+00	4.760E-09	3.190E-09	
BREAST	1.390E-13	6.739E-11	1.413E-09	2.340E-15-1.000E+00	1.840E-08	1.100E-09	
LUNGS	1.240E-13	6.537E-11	1.371E-09	2.270E-15-1.000E+00	3.450E-07	8.770E-10	
RED MARR	1.230E-13	6.710E-11	1.407E-09	2.330E-15-1.000E+00	1.720E-08	1.320E-09	
BONE SUR	1.780E-13	8.956E-11	1.879E-09	3.110E-15-1.000E+00	1.350E-08	9.390E-10	
THYROID	1.270E-13	6.480E-11	1.359E-09	2.250E-15-1.000E+00	1.620E-08	7.880E-10	
REMAINDER	1.200E-13	6.508E-11	1.365E-09	2.260E-15-1.000E+00	3.600E-08	4.970E-09	
EFFECTIVE	1.260E-13	6.768E-11	1.419E-09	2.350E-15-1.000E+00	5.910E-08	2.770E-09	
SKIN(FGR)	1.450E-13	7.948E-11	1.667E-09	2.760E-15-1.000E+00	0.000E+00	0.000E+00	
Kr-85							
GONADS	1.170E-16	8.121E-14	1.704E-12	2.820E-18-1.000E+00	0.000E+00	0.000E+00	
BREAST	1.340E-16	7.891E-14	1.656E-12	2.740E-18-1.000E+00	0.000E+00	0.000E+00	
LUNGS	1.140E-16	7.056E-14	1.481E-12	2.450E-18-1.000E+00	0.000E+00	0.000E+00	
RED MARR	1.090E-16	6.998E-14	1.469E-12	2.430E-18-1.000E+00	0.000E+00	0.000E+00	
BONE SUR	2.200E-16	1.287E-13	2.702E-12	4.470E-18-1.000E+00	0.000E+00	0.000E+00	

THYROID	1.180E-16	7.459E-14	1.565E-12	2.590E-18	-1.000E+00	0.000E+00	0.000E+00
REMAINDER	1.090E-16	6.941E-14	1.457E-12	2.410E-18	-1.000E+00	0.000E+00	0.000E+00
EFFECTIVE	1.190E-16	7.603E-14	1.596E-12	2.640E-18	-1.000E+00	0.000E+00	0.000E+00
SKIN(FGR)	1.320E-14	2.304E-11	4.835E-10	8.000E-16	-1.000E+00	0.000E+00	0.000E+00
Kr-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
Rb-86							
GONADS	4.710E-15	2.788E-12	5.187E-11	9.740E-17	-1.000E+00	1.340E-09	2.150E-09
BREAST	5.340E-15	2.662E-12	4.953E-11	9.300E-17	-1.000E+00	1.330E-09	2.140E-09
LUNGS	4.710E-15	2.553E-12	4.750E-11	8.920E-17	-1.000E+00	3.300E-09	2.140E-09
RED MARR	4.640E-15	2.619E-12	4.873E-11	9.150E-17	-1.000E+00	2.320E-09	3.720E-09
BONE SUR	7.050E-15	3.635E-12	6.764E-11	1.270E-16	-1.000E+00	4.270E-09	6.860E-09
THYROID	4.840E-15	2.599E-12	4.836E-11	9.080E-17	-1.000E+00	1.330E-09	2.140E-09
REMAINDER	4.520E-15	2.542E-12	4.729E-11	8.880E-17	-1.000E+00	1.380E-09	2.330E-09
EFFECTIVE	4.810E-15	2.665E-12	4.958E-11	9.310E-17	-1.000E+00	1.790E-09	2.530E-09
SKIN(FGR)	4.850E-14	2.210E-10	4.111E-09	7.720E-15	-1.000E+00	0.000E+00	0.000E+00
Sr-89							
GONADS	7.730E-17	7.155E-14	1.436E-12	2.490E-18	-1.000E+00	7.950E-12	8.050E-12
BREAST	9.080E-17	7.212E-14	1.447E-12	2.510E-18	-1.000E+00	7.960E-12	7.980E-12
LUNGS	7.080E-17	5.689E-14	1.142E-12	1.980E-18	-1.000E+00	8.350E-08	7.970E-12
RED MARR	6.390E-17	5.345E-14	1.073E-12	1.860E-18	-1.000E+00	1.070E-10	1.080E-10
BONE SUR	1.940E-16	1.560E-13	3.131E-12	5.430E-18	-1.000E+00	1.590E-10	1.610E-10
THYROID	7.600E-17	6.063E-14	1.217E-12	2.110E-18	-1.000E+00	7.960E-12	7.970E-12
REMAINDER	6.710E-17	5.603E-14	1.124E-12	1.950E-18	-1.000E+00	3.970E-09	8.250E-09
EFFECTIVE	7.730E-17	6.523E-14	1.309E-12	2.270E-18	-1.000E+00	1.120E-08	2.500E-09
SKIN(FGR)	3.690E-14	1.914E-10	3.841E-09	6.660E-15	-1.000E+00	0.000E+00	0.000E+00

Sr-90

GONADS	7.780E-18	9.590E-15	2.014E-13	3.330E-19	-1.000E+00	2.690E-10	5.040E-11
BREAST	9.490E-18	1.008E-14	2.116E-13	3.500E-19	-1.000E+00	2.690E-10	5.040E-11
LUNGS	6.440E-18	6.307E-15	1.324E-13	2.190E-19	-1.000E+00	2.860E-06	5.040E-11
RED MARR	5.440E-18	5.558E-15	1.167E-13	1.930E-19	-1.000E+00	3.280E-08	6.450E-09
BONE SUR	2.280E-17	2.393E-14	5.025E-13	8.310E-19	-1.000E+00	7.090E-08	1.390E-08
THYROID	7.330E-18	7.171E-15	1.506E-13	2.490E-19	-1.000E+00	2.690E-10	5.040E-11
REMAINDER	6.110E-18	6.422E-15	1.348E-13	2.230E-19	-1.000E+00	5.730E-09	6.700E-09
EFFECTIVE	7.530E-18	8.179E-15	1.717E-13	2.840E-19	-1.000E+00	3.510E-07	3.230E-09
SKIN(FGR)	9.200E-15	4.032E-12	8.465E-11	1.400E-16	-1.000E+00	0.000E+00	0.000E+00

Sr-91

GONADS	4.819E-14	2.155E-11	5.062E-11	1.026E-15	-1.000E+00	5.669E-11	2.520E-10
BREAST	5.477E-14	2.059E-11	4.838E-11	9.806E-16	-1.000E+00	1.775E-11	3.676E-11
LUNGS	4.803E-14	1.970E-11	4.626E-11	9.376E-16	-1.000E+00	2.170E-09	1.055E-11
RED MARR	4.691E-14	2.011E-11	4.722E-11	9.570E-16	-1.000E+00	2.275E-11	5.659E-11
BONE SUR	7.674E-14	2.852E-11	6.709E-11	1.360E-15	-1.000E+00	1.306E-11	2.070E-11
THYROID	4.938E-14	2.035E-11	4.782E-11	9.693E-16	-1.000E+00	9.930E-12	1.968E-12
REMAINDER	4.610E-14	1.948E-11	4.573E-11	9.268E-16	-1.000E+00	5.802E-10	2.557E-09
EFFECTIVE	4.924E-14	2.057E-11	4.832E-11	9.793E-16	-1.000E+00	4.547E-10	8.455E-10
SKIN(FGR)	9.938E-14	1.748E-10	3.987E-10	8.080E-15	-1.000E+00	0.000E+00	0.000E+00

Sr-92

GONADS	6.610E-14	1.593E-11	1.830E-11	1.300E-15	-1.000E+00	1.020E-11	8.180E-11
BREAST	7.480E-14	1.520E-11	1.745E-11	1.240E-15	-1.000E+00	6.490E-12	1.700E-11
LUNGS	6.670E-14	1.483E-11	1.703E-11	1.210E-15	-1.000E+00	1.050E-09	7.220E-12
RED MARR	6.620E-14	1.520E-11	1.745E-11	1.240E-15	-1.000E+00	6.980E-12	2.290E-11
BONE SUR	9.490E-14	2.010E-11	2.308E-11	1.640E-15	-1.000E+00	4.360E-12	8.490E-12
THYROID	6.820E-14	1.446E-11	1.661E-11	1.180E-15	-1.000E+00	3.920E-12	1.300E-12
REMAINDER	6.450E-14	1.471E-11	1.689E-11	1.200E-15	-1.000E+00	2.900E-10	1.720E-09
EFFECTIVE	6.790E-14	1.532E-11	1.759E-11	1.250E-15	-1.000E+00	2.180E-10	5.430E-10
SKIN(FGR)	8.560E-14	2.280E-11	2.618E-11	1.860E-15	-1.000E+00	0.000E+00	0.000E+00

Y-90

GONADS	1.890E-16	1.586E-13	1.601E-12	5.750E-18	-1.000E+00	5.170E-13	1.430E-14
BREAST	2.200E-16	1.578E-13	1.593E-12	5.720E-18	-1.000E+00	5.170E-13	1.270E-14
LUNGS	1.770E-16	1.313E-13	1.326E-12	4.760E-18	-1.000E+00	9.310E-09	1.260E-14
RED MARR	1.620E-16	1.261E-13	1.273E-12	4.570E-18	-1.000E+00	1.520E-11	3.700E-13
BONE SUR	4.440E-16	3.228E-13	3.259E-12	1.170E-17	-1.000E+00	1.510E-11	3.670E-13
THYROID	1.870E-16	1.385E-13	1.398E-12	5.020E-18	-1.000E+00	5.170E-13	1.260E-14
REMAINDER	1.680E-16	1.291E-13	1.303E-12	4.680E-18	-1.000E+00	3.870E-09	9.680E-09
EFFECTIVE	1.900E-16	1.468E-13	1.482E-12	5.320E-18	-1.000E+00	2.280E-09	2.910E-09
SKIN(FGR)	6.240E-14	2.897E-10	2.924E-09	1.050E-14	-1.000E+00	0.000E+00	0.000E+00

Y-91

GONADS	2.560E-16	1.756E-13	3.546E-12	6.110E-18	-1.000E+00	8.200E-12	3.540E-12
BREAST	2.930E-16	1.713E-13	3.459E-12	5.960E-18	-1.000E+00	8.920E-12	5.540E-13
LUNGS	2.500E-16	1.526E-13	3.082E-12	5.310E-18	-1.000E+00	9.870E-08	2.020E-13
RED MARR	2.410E-16	1.521E-13	3.070E-12	5.290E-18	-1.000E+00	3.190E-10	6.590E-12
BONE SUR	4.560E-16	2.903E-13	5.862E-12	1.010E-17	-1.000E+00	3.180E-10	6.130E-12
THYROID	2.600E-16	1.564E-13	3.157E-12	5.440E-18	-1.000E+00	8.500E-12	1.290E-13
REMAINDER	2.390E-16	1.509E-13	3.047E-12	5.250E-18	-1.000E+00	4.200E-09	8.570E-09
EFFECTIVE	2.600E-16	1.650E-13	3.332E-12	5.740E-18	-1.000E+00	1.320E-08	2.570E-09
SKIN(FGR)	3.850E-14	1.989E-10	4.016E-09	6.920E-15	-1.000E+00	0.000E+00	0.000E+00

Y-92

GONADS	1.270E-14	3.855E-12	4.872E-12	2.650E-16	-1.000E+00	2.610E-12	1.960E-11
BREAST	1.440E-14	3.680E-12	4.652E-12	2.530E-16	-1.000E+00	1.500E-12	3.550E-12
LUNGS	1.270E-14	3.535E-12	4.468E-12	2.430E-16	-1.000E+00	1.240E-09	1.390E-12

RED MARR	1.250E-14	3.608E-12	4.560E-12	2.480E-16	-1.000E+00	2.070E-12	4.910E-12
BONE SUR	1.950E-14	5.091E-12	6.435E-12	3.500E-16	-1.000E+00	1.510E-12	1.750E-12
THYROID	1.300E-14	3.579E-12	4.523E-12	2.460E-16	-1.000E+00	1.050E-12	1.770E-13
REMAINDER	1.220E-14	3.506E-12	4.431E-12	2.410E-16	-1.000E+00	2.030E-10	1.700E-09
EFFECTIVE	1.300E-14	3.680E-12	4.652E-12	2.530E-16	-1.000E+00	2.110E-10	5.150E-10
SKIN(FGR)	1.140E-13	2.022E-10	2.556E-10	1.390E-14	-1.000E+00	0.000E+00	0.000E+00
Y-93							
GONADS	4.670E-15	2.108E-12	4.989E-12	9.510E-17	-1.000E+00	5.310E-12	2.200E-11
BREAST	5.300E-15	2.026E-12	4.794E-12	9.140E-17	-1.000E+00	1.740E-12	3.130E-12
LUNGS	4.680E-15	1.937E-12	4.585E-12	8.740E-17	-1.000E+00	2.520E-09	8.670E-13
RED MARR	4.580E-15	1.972E-12	4.669E-12	8.900E-17	-1.000E+00	4.040E-12	4.930E-12
BONE SUR	7.580E-15	2.948E-12	6.977E-12	1.330E-16	-1.000E+00	3.140E-12	1.730E-12
THYROID	4.790E-15	1.908E-12	4.516E-12	8.610E-17	-1.000E+00	9.260E-13	1.260E-13
REMAINDER	4.510E-15	1.919E-12	4.543E-12	8.660E-17	-1.000E+00	9.250E-10	4.090E-09
EFFECTIVE	4.800E-15	2.021E-12	4.784E-12	9.120E-17	-1.000E+00	5.820E-10	1.230E-09
SKIN(FGR)	8.500E-14	2.726E-10	6.452E-10	1.230E-14	-1.000E+00	0.000E+00	0.000E+00
Zr-95							
GONADS	3.530E-14	2.182E-11	4.421E-10	7.590E-16	-1.000E+00	1.880E-09	8.160E-10
BREAST	4.010E-14	2.084E-11	4.223E-10	7.250E-16	-1.000E+00	1.910E-09	1.050E-10
LUNGS	3.510E-14	1.989E-11	4.030E-10	6.920E-16	-1.000E+00	2.170E-09	2.340E-11
RED MARR	3.430E-14	2.030E-11	4.112E-10	7.060E-16	-1.000E+00	1.300E-08	2.140E-10
BONE SUR	5.620E-14	2.875E-11	5.824E-10	1.000E-15	-1.000E+00	1.030E-07	4.860E-10
THYROID	3.610E-14	2.076E-11	4.205E-10	7.220E-16	-1.000E+00	1.440E-09	8.270E-12
REMAINDER	3.360E-14	1.963E-11	3.978E-10	6.830E-16	-1.000E+00	2.280E-09	2.530E-09
EFFECTIVE	3.600E-14	2.078E-11	4.211E-10	7.230E-16	-1.000E+00	6.390E-09	1.020E-09
SKIN(FGR)	4.500E-14	2.561E-11	5.190E-10	8.910E-16	-1.000E+00	0.000E+00	0.000E+00
Zr-97							
GONADS	4.331E-14	2.179E-11	7.799E-11	9.253E-16	-1.000E+00	1.840E-10	6.228E-10
BREAST	4.928E-14	2.083E-11	7.455E-11	8.846E-16	-1.000E+00	4.706E-11	8.137E-11
LUNGS	4.322E-14	1.992E-11	7.127E-11	8.456E-16	-1.000E+00	4.108E-09	1.770E-11
RED MARR	4.224E-14	2.034E-11	7.279E-11	8.634E-16	-1.000E+00	6.376E-11	1.302E-10
BONE SUR	6.897E-14	2.881E-11	1.031E-10	1.224E-15	-1.000E+00	3.504E-11	4.558E-11
THYROID	4.443E-14	2.061E-11	7.377E-11	8.755E-16	-1.000E+00	2.315E-11	2.671E-12
REMAINDER	4.139E-14	1.966E-11	7.035E-11	8.345E-16	-1.000E+00	2.041E-09	6.990E-09
EFFECTIVE	4.432E-14	2.078E-11	7.438E-11	8.824E-16	-1.000E+00	1.171E-09	2.283E-09
SKIN(FGR)	9.835E-14	2.281E-10	8.148E-10	9.587E-15	-1.000E+00	0.000E+00	0.000E+00
Nb-95							
GONADS	3.660E-14	2.253E-11	4.435E-10	7.850E-16	-1.000E+00	4.320E-10	8.050E-10
BREAST	4.160E-14	2.150E-11	4.231E-10	7.490E-16	-1.000E+00	4.070E-10	1.070E-10
LUNGS	3.650E-14	2.055E-11	4.045E-10	7.160E-16	-1.000E+00	8.320E-09	2.740E-11
RED MARR	3.560E-14	2.101E-11	4.135E-10	7.320E-16	-1.000E+00	4.420E-10	1.990E-10
BONE SUR	5.790E-14	2.957E-11	5.819E-10	1.030E-15	-1.000E+00	5.130E-10	2.940E-10
THYROID	3.750E-14	2.144E-11	4.220E-10	7.470E-16	-1.000E+00	3.580E-10	1.180E-11
REMAINDER	3.490E-14	2.032E-11	4.000E-10	7.080E-16	-1.000E+00	1.070E-09	1.470E-09
EFFECTIVE	3.740E-14	2.147E-11	4.226E-10	7.480E-16	-1.000E+00	1.570E-09	6.950E-10
SKIN(FGR)	4.300E-14	2.598E-11	5.112E-10	9.050E-16	-1.000E+00	0.000E+00	0.000E+00
Mo-99							
GONADS	7.130E-15	4.282E-12	4.403E-11	1.550E-16	-1.000E+00	9.510E-11	2.180E-10
BREAST	8.130E-15	4.116E-12	4.233E-11	1.490E-16	-1.000E+00	2.750E-11	3.430E-11
LUNGS	7.060E-15	3.867E-12	3.977E-11	1.400E-16	-1.000E+00	4.290E-09	1.510E-11
RED MARR	6.820E-15	3.923E-12	4.034E-11	1.420E-16	-1.000E+00	5.240E-11	8.320E-11
BONE SUR	1.240E-14	6.105E-12	6.278E-11	2.210E-16	-1.000E+00	4.130E-11	6.320E-11
THYROID	7.270E-15	4.033E-12	4.147E-11	1.460E-16	-1.000E+00	1.520E-11	1.030E-11
REMAINDER	6.740E-15	3.812E-12	3.920E-11	1.380E-16	-1.000E+00	1.740E-09	4.280E-09

EFFECTIVE	7.280E-15	4.061E-12	4.176E-11	1.470E-16-1.000E+00	1.070E-09	1.360E-09
SKIN(FGR)	3.140E-14	1.039E-10	1.068E-09	3.760E-15-1.000E+00	0.000E+00	0.000E+00
Tc-99m						
GONADS	5.750E-15	2.334E-12	3.877E-12	1.240E-16-1.000E+00	2.770E-12	9.750E-12
BREAST	6.650E-15	2.258E-12	3.752E-12	1.200E-16-1.000E+00	2.150E-12	3.570E-12
LUNGS	5.490E-15	2.127E-12	3.533E-12	1.130E-16-1.000E+00	2.280E-11	3.140E-12
RED MARR	4.910E-15	2.070E-12	3.439E-12	1.100E-16-1.000E+00	3.360E-12	6.290E-12
BONE SUR	1.630E-14	5.383E-12	8.942E-12	2.860E-16-1.000E+00	2.620E-12	4.060E-12
THYROID	5.750E-15	2.145E-12	3.564E-12	1.140E-16-1.000E+00	5.010E-11	8.460E-11
REMAINDER	5.150E-15	2.070E-12	3.439E-12	1.100E-16-1.000E+00	1.020E-11	3.340E-11
EFFECTIVE	5.890E-15	2.277E-12	3.783E-12	1.210E-16-1.000E+00	8.800E-12	1.680E-11
SKIN(FGR)	7.140E-15	2.710E-12	4.502E-12	1.440E-16-1.000E+00	0.000E+00	0.000E+00
Ru-103						
GONADS	2.191E-14	1.404E-11	2.783E-10	4.892E-16-1.000E+00	3.070E-10	5.720E-10
BREAST	2.512E-14	1.350E-11	2.677E-10	4.705E-16-1.000E+00	3.110E-10	1.200E-10
LUNGS	2.180E-14	1.273E-11	2.522E-10	4.432E-16-1.000E+00	1.561E-08	7.310E-11
RED MARR	2.100E-14	1.287E-11	2.551E-10	4.483E-16-1.000E+00	3.190E-10	1.660E-10
BONE SUR	3.892E-14	1.958E-11	3.882E-10	6.823E-16-1.000E+00	2.370E-10	9.631E-11
THYROID	2.241E-14	1.331E-11	2.639E-10	4.638E-16-1.000E+00	2.570E-10	6.250E-11
REMAINDER	2.080E-14	1.248E-11	2.472E-10	4.346E-16-1.000E+00	1.250E-09	2.110E-09
EFFECTIVE	2.251E-14	1.332E-11	2.641E-10	4.642E-16-1.000E+00	2.421E-09	8.271E-10
SKIN(FGR)	2.774E-14	1.785E-11	3.543E-10	6.229E-16-1.000E+00	0.000E+00	0.000E+00
Ru-105						
GONADS	3.720E-14	1.327E-11	1.861E-11	8.070E-16-1.000E+00	1.590E-11	9.670E-11
BREAST	4.240E-14	1.271E-11	1.783E-11	7.730E-16-1.000E+00	6.610E-12	1.590E-11
LUNGS	3.700E-14	1.210E-11	1.697E-11	7.360E-16-1.000E+00	5.730E-10	6.210E-12
RED MARR	3.590E-14	1.230E-11	1.725E-11	7.480E-16-1.000E+00	7.700E-12	2.350E-11
BONE SUR	6.280E-14	1.809E-11	2.537E-11	1.100E-15-1.000E+00	4.620E-12	8.890E-12
THYROID	3.800E-14	1.260E-11	1.766E-11	7.660E-16-1.000E+00	4.150E-12	1.820E-12
REMAINDER	3.540E-14	1.189E-11	1.667E-11	7.230E-16-1.000E+00	1.610E-10	8.540E-10
EFFECTIVE	3.810E-14	1.265E-11	1.773E-11	7.690E-16-1.000E+00	1.230E-10	2.870E-10
SKIN(FGR)	6.730E-14	7.368E-11	1.033E-10	4.480E-15-1.000E+00	0.000E+00	0.000E+00
Ru-106						
GONADS	1.010E-14	6.411E-12	1.340E-10	2.230E-16-1.000E+00	1.300E-09	1.640E-09
BREAST	1.160E-14	6.152E-12	1.286E-10	2.140E-16-1.000E+00	1.780E-09	1.440E-09
LUNGS	1.010E-14	5.836E-12	1.220E-10	2.030E-16-1.000E+00	1.040E-06	1.420E-09
RED MARR	9.750E-15	5.893E-12	1.232E-10	2.050E-16-1.000E+00	1.760E-09	1.460E-09
BONE SUR	1.720E-14	8.883E-12	1.856E-10	3.090E-16-1.000E+00	1.610E-09	1.430E-09
THYROID	1.030E-14	6.066E-12	1.268E-10	2.110E-16-1.000E+00	1.720E-09	1.410E-09
REMAINDER	9.630E-15	5.721E-12	1.196E-10	1.990E-16-1.000E+00	1.200E-08	2.110E-08
EFFECTIVE	1.040E-14	6.095E-12	1.274E-10	2.120E-16-1.000E+00	1.290E-07	7.400E-09
SKIN(FGR)	1.090E-13	4.082E-10	8.531E-09	1.420E-14-1.000E+00	0.000E+00	0.000E+00
Rh-105						
GONADS	3.640E-15	2.127E-12	1.411E-11	7.980E-17-1.000E+00	2.110E-11	5.800E-11
BREAST	4.160E-15	2.063E-12	1.369E-11	7.740E-17-1.000E+00	5.610E-12	8.970E-12
LUNGS	3.570E-15	1.935E-12	1.284E-11	7.260E-17-1.000E+00	9.580E-10	3.860E-12
RED MARR	3.380E-15	1.946E-12	1.291E-11	7.300E-17-1.000E+00	7.770E-12	1.470E-11
BONE SUR	7.530E-15	3.332E-12	2.210E-11	1.250E-16-1.000E+00	4.460E-12	6.750E-12
THYROID	3.680E-15	1.983E-12	1.316E-11	7.440E-17-1.000E+00	2.880E-12	2.910E-12
REMAINDER	3.390E-15	1.885E-12	1.250E-11	7.070E-17-1.000E+00	4.530E-10	1.270E-09
EFFECTIVE	3.720E-15	2.031E-12	1.347E-11	7.620E-17-1.000E+00	2.580E-10	3.990E-10
SKIN(FGR)	1.070E-14	4.691E-12	3.112E-11	1.760E-16-1.000E+00	0.000E+00	0.000E+00
Sb-127						
GONADS	3.260E-14	1.985E-11	2.441E-10	7.100E-16-1.000E+00	2.520E-10	6.140E-10

BREAST	3.720E-14	1.904E-11	2.341E-10	6.810E-16	-1.000E+00	9.120E-11	7.600E-11
LUNGS	3.240E-14	1.809E-11	2.224E-10	6.470E-16	-1.000E+00	6.940E-09	1.570E-11
RED MARR	3.140E-14	1.834E-11	2.255E-10	6.560E-16	-1.000E+00	1.610E-10	1.330E-10
BONE SUR	5.520E-14	2.720E-11	3.345E-10	9.730E-16	-1.000E+00	1.340E-10	5.240E-11
THYROID	3.330E-14	1.884E-11	2.317E-10	6.740E-16	-1.000E+00	6.150E-11	4.640E-12
REMAINDER	3.090E-14	1.775E-11	2.183E-10	6.350E-16	-1.000E+00	2.330E-09	5.870E-09
EFFECTIVE	3.330E-14	1.890E-11	2.324E-10	6.760E-16	-1.000E+00	1.630E-09	1.950E-09
SKIN(FGR)	5.580E-14	7.967E-11	9.799E-10	2.850E-15	-1.000E+00	0.000E+00	0.000E+00
Sb-129							
GONADS	6.970E-14	2.336E-11	3.231E-11	1.440E-15	-1.000E+00	2.150E-11	1.510E-10
BREAST	7.910E-14	2.222E-11	3.074E-11	1.370E-15	-1.000E+00	1.280E-11	2.560E-11
LUNGS	6.980E-14	2.141E-11	2.962E-11	1.320E-15	-1.000E+00	8.980E-10	9.390E-12
RED MARR	6.860E-14	2.190E-11	3.029E-11	1.350E-15	-1.000E+00	1.700E-11	3.670E-11
BONE SUR	1.070E-13	3.033E-11	4.196E-11	1.870E-15	-1.000E+00	1.460E-11	1.340E-11
THYROID	7.160E-14	2.174E-11	3.007E-11	1.340E-15	-1.000E+00	9.720E-12	1.470E-12
REMAINDER	6.710E-14	2.125E-11	2.939E-11	1.310E-15	-1.000E+00	1.870E-10	1.450E-09
EFFECTIVE	7.140E-14	2.238E-11	3.096E-11	1.380E-15	-1.000E+00	1.740E-10	4.840E-10
SKIN(FGR)	1.050E-13	8.273E-11	1.144E-10	5.100E-15	-1.000E+00	0.000E+00	0.000E+00
Te-127							
GONADS	2.370E-16	1.191E-13	2.661E-13	5.480E-18	-1.000E+00	2.020E-12	4.020E-12
BREAST	2.730E-16	1.158E-13	2.588E-13	5.330E-18	-1.000E+00	1.880E-12	3.000E-12
LUNGS	2.320E-16	1.060E-13	2.370E-13	4.880E-18	-1.000E+00	4.270E-10	2.890E-12
RED MARR	2.210E-16	1.058E-13	2.365E-13	4.870E-18	-1.000E+00	4.090E-12	6.570E-12
BONE SUR	4.650E-16	1.862E-13	4.162E-13	8.570E-18	-1.000E+00	4.090E-12	6.460E-12
THYROID	2.400E-16	1.106E-13	2.472E-13	5.090E-18	-1.000E+00	1.840E-12	2.860E-12
REMAINDER	2.210E-16	1.036E-13	2.316E-13	4.770E-18	-1.000E+00	1.110E-10	6.130E-10
EFFECTIVE	2.420E-16	1.125E-13	2.515E-13	5.180E-18	-1.000E+00	8.600E-11	1.870E-10
SKIN(FGR)	1.140E-14	1.173E-11	2.622E-11	5.400E-16	-1.000E+00	0.000E+00	0.000E+00
Te-127m							
GONADS	1.900E-16	4.689E-13	9.642E-12	1.630E-17	-1.000E+00	1.100E-10	1.250E-10
BREAST	2.690E-16	5.150E-13	1.059E-11	1.790E-17	-1.000E+00	1.100E-10	9.740E-11
LUNGS	7.620E-17	1.602E-13	3.295E-12	5.570E-18	-1.000E+00	3.340E-08	9.620E-11
RED MARR	6.430E-17	1.249E-13	2.567E-12	4.340E-18	-1.000E+00	5.360E-09	5.430E-09
BONE SUR	3.940E-16	9.005E-13	1.852E-11	3.130E-17	-1.000E+00	2.040E-08	2.070E-08
THYROID	1.500E-16	2.779E-13	5.714E-12	9.660E-18	-1.000E+00	9.660E-11	9.430E-11
REMAINDER	8.640E-17	1.999E-13	4.111E-12	6.950E-18	-1.000E+00	1.660E-09	2.980E-09
EFFECTIVE	1.470E-16	3.251E-13	6.684E-12	1.130E-17	-1.000E+00	5.810E-09	2.230E-09
SKIN(FGR)	8.490E-16	1.496E-12	3.076E-11	5.200E-17	-1.000E+00	0.000E+00	0.000E+00
Te-129							
GONADS	2.710E-15	3.889E-13	3.922E-13	6.510E-17	-1.000E+00	5.050E-13	1.590E-12
BREAST	3.120E-15	3.800E-13	3.832E-13	6.360E-17	-1.000E+00	5.390E-13	6.050E-13
LUNGS	2.640E-15	3.298E-13	3.326E-13	5.520E-17	-1.000E+00	1.530E-10	4.910E-13
RED MARR	2.540E-15	3.298E-13	3.326E-13	5.520E-17	-1.000E+00	6.190E-13	7.640E-13
BONE SUR	4.880E-15	5.753E-13	5.802E-13	9.630E-17	-1.000E+00	6.220E-13	5.400E-13
THYROID	2.740E-15	3.525E-13	3.555E-13	5.900E-17	-1.000E+00	5.090E-13	3.360E-13
REMAINDER	2.520E-15	3.262E-13	3.289E-13	5.460E-17	-1.000E+00	7.280E-12	1.790E-10
EFFECTIVE	2.750E-15	3.590E-13	3.621E-13	6.010E-17	-1.000E+00	2.090E-11	5.450E-11
SKIN(FGR)	3.570E-14	3.429E-11	3.458E-11	5.740E-15	-1.000E+00	0.000E+00	0.000E+00
Te-129m							
GONADS	3.321E-15	2.206E-12	4.799E-11	8.561E-17	-1.000E+00	1.783E-10	2.420E-10
BREAST	3.838E-15	2.181E-12	4.739E-11	8.454E-17	-1.000E+00	1.694E-10	1.664E-10
LUNGS	3.176E-15	1.741E-12	3.815E-11	6.808E-17	-1.000E+00	4.040E-08	1.593E-10
RED MARR	3.071E-15	1.729E-12	3.793E-11	6.768E-17	-1.000E+00	3.100E-09	3.500E-09
BONE SUR	5.772E-15	3.287E-12	7.147E-11	1.275E-16	-1.000E+00	7.050E-09	7.990E-09

THYROID	3.341E-15	1.923E-12	4.201E-11	7.495E-17	-1.000E+00	1.563E-10	1.572E-10
REMAINDER	3.048E-15	1.746E-12	3.822E-11	6.819E-17	-1.000E+00	3.275E-09	7.196E-09
EFFECTIVE	3.337E-15	1.974E-12	4.308E-11	7.686E-17	-1.000E+00	6.484E-09	2.925E-09
SKIN(FGR)	3.811E-14	1.501E-10	3.360E-09	6.001E-15	-1.000E+00	0.000E+00	0.000E+00
Te-131m							
GONADS	7.292E-14	4.020E-11	2.343E-10	1.535E-15	-1.000E+00	2.345E-10	7.415E-10
BREAST	8.286E-14	3.853E-11	2.246E-10	1.472E-15	-1.000E+00	9.309E-11	1.361E-10
LUNGS	7.265E-14	3.657E-11	2.131E-10	1.397E-15	-1.000E+00	2.296E-09	6.335E-11
RED MARR	7.097E-14	3.736E-11	2.178E-10	1.427E-15	-1.000E+00	1.417E-10	2.435E-10
BONE SUR	1.174E-13	5.467E-11	3.189E-10	2.090E-15	-1.000E+00	2.276E-10	3.248E-10
THYROID	7.471E-14	3.741E-11	2.181E-10	1.429E-15	-1.000E+00	3.669E-08	4.383E-08
REMAINDER	6.965E-14	3.626E-11	2.113E-10	1.385E-15	-1.000E+00	9.509E-10	3.153E-09
EFFECTIVE	7.463E-14	3.825E-11	2.229E-10	1.461E-15	-1.000E+00	1.758E-09	2.514E-09
SKIN(FGR)	1.038E-13	1.033E-10	6.188E-10	4.056E-15	-1.000E+00	0.000E+00	0.000E+00
Te-132							
GONADS	1.020E-14	6.812E-12	7.706E-11	2.450E-16	-1.000E+00	4.150E-10	5.410E-10
BREAST	1.180E-14	6.756E-12	7.643E-11	2.430E-16	-1.000E+00	3.630E-10	3.500E-10
LUNGS	9.650E-15	5.727E-12	6.479E-11	2.060E-16	-1.000E+00	1.670E-09	3.300E-10
RED MARR	8.950E-15	5.588E-12	6.322E-11	2.010E-16	-1.000E+00	4.270E-10	4.440E-10
BONE SUR	2.420E-14	1.273E-11	1.441E-10	4.580E-16	-1.000E+00	7.120E-10	8.300E-10
THYROID	1.020E-14	5.978E-12	6.762E-11	2.150E-16	-1.000E+00	6.280E-08	5.950E-08
REMAINDER	9.160E-15	5.644E-12	6.385E-11	2.030E-16	-1.000E+00	7.890E-10	1.490E-09
EFFECTIVE	1.030E-14	6.339E-12	7.171E-11	2.280E-16	-1.000E+00	2.550E-09	2.540E-09
SKIN(FGR)	1.390E-14	8.313E-12	9.405E-11	2.990E-16	-1.000E+00	0.000E+00	0.000E+00
I-131							
GONADS	1.780E-14	1.119E-11	1.789E-10	3.940E-16	-1.000E+00	2.530E-11	4.070E-11
BREAST	2.040E-14	1.082E-11	1.730E-10	3.810E-16	-1.000E+00	7.880E-11	1.210E-10
LUNGS	1.760E-14	1.016E-11	1.626E-10	3.580E-16	-1.000E+00	6.570E-10	1.020E-10
RED MARR	1.680E-14	1.022E-11	1.635E-10	3.600E-16	-1.000E+00	6.260E-11	9.440E-11
BONE SUR	3.450E-14	1.675E-11	2.679E-10	5.900E-16	-1.000E+00	5.730E-11	8.720E-11
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

Cs-134

GONADS	7.400E-14	4.607E-11	9.646E-10	1.600E-15-1.000E+00	1.300E-08	2.060E-08
BREAST	8.430E-14	4.406E-11	9.224E-10	1.530E-15-1.000E+00	1.080E-08	1.720E-08
LUNGS	7.370E-14	4.204E-11	8.802E-10	1.460E-15-1.000E+00	1.180E-08	1.760E-08
RED MARR	7.190E-14	4.262E-11	8.922E-10	1.480E-15-1.000E+00	1.180E-08	1.870E-08
BONE SUR	1.200E-13	6.105E-11	1.278E-09	2.120E-15-1.000E+00	1.100E-08	1.740E-08
THYROID	7.570E-14	4.377E-11	9.163E-10	1.520E-15-1.000E+00	1.110E-08	1.760E-08
REMAINDER	7.060E-14	4.147E-11	8.681E-10	1.440E-15-1.000E+00	1.390E-08	2.210E-08
EFFECTIVE	7.570E-14	4.377E-11	9.163E-10	1.520E-15-1.000E+00	1.250E-08	1.980E-08
SKIN(FGR)	9.450E-14	6.249E-11	1.308E-09	2.170E-15-1.000E+00	0.000E+00	0.000E+00

Cs-136

GONADS	1.040E-13	6.223E-11	1.102E-09	2.180E-15-1.000E+00	1.880E-09	3.040E-09
BREAST	1.180E-13	5.966E-11	1.056E-09	2.090E-15-1.000E+00	1.670E-09	2.650E-09
LUNGS	1.040E-13	5.710E-11	1.011E-09	2.000E-15-1.000E+00	2.320E-09	2.620E-09

RED MARR	1.010E-13	5.824E-11	1.031E-09	2.040E-15	-1.000E+00	1.860E-09	2.950E-09
BONE SUR	1.660E-13	8.422E-11	1.491E-09	2.950E-15	-1.000E+00	1.700E-09	2.710E-09
THYROID	1.070E-13	5.852E-11	1.036E-09	2.050E-15	-1.000E+00	1.730E-09	2.740E-09
REMAINDER	9.950E-14	5.652E-11	1.001E-09	1.980E-15	-1.000E+00	2.190E-09	3.520E-09
EFFECTIVE	1.060E-13	5.966E-11	1.056E-09	2.090E-15	-1.000E+00	1.980E-09	3.040E-09
SKIN(FGR)	1.250E-13	7.251E-11	1.284E-09	2.540E-15	-1.000E+00	0.000E+00	0.000E+00
Cs-137							
GONADS	2.669E-14	1.669E-11	3.530E-10	5.840E-16	-1.000E+00	8.760E-09	1.390E-08
BREAST	3.047E-14	1.596E-11	3.376E-10	5.585E-16	-1.000E+00	7.840E-09	1.240E-08
LUNGS	2.649E-14	1.517E-11	3.209E-10	5.309E-16	-1.000E+00	8.820E-09	1.270E-08
RED MARR	2.583E-14	1.542E-11	3.260E-10	5.394E-16	-1.000E+00	8.300E-09	1.320E-08
BONE SUR	4.382E-14	2.238E-11	4.734E-10	7.832E-16	-1.000E+00	7.940E-09	1.260E-08
THYROID	2.725E-14	1.588E-11	3.358E-10	5.556E-16	-1.000E+00	7.930E-09	1.260E-08
REMAINDER	2.536E-14	1.490E-11	3.152E-10	5.215E-16	-1.000E+00	9.120E-09	1.450E-08
EFFECTIVE	2.725E-14	1.585E-11	3.353E-10	5.546E-16	-1.000E+00	8.630E-09	1.350E-08
SKIN(FGR)	4.392E-14	5.253E-11	1.110E-09	1.836E-15	-1.000E+00	0.000E+00	0.000E+00
Ba-139							
GONADS	2.130E-15	3.368E-13	3.429E-13	4.790E-17	-1.000E+00	2.560E-12	1.560E-12
BREAST	2.450E-15	3.297E-13	3.357E-13	4.690E-17	-1.000E+00	2.460E-12	5.170E-13
LUNGS	2.030E-15	3.002E-13	3.057E-13	4.270E-17	-1.000E+00	2.530E-10	3.890E-13
RED MARR	1.870E-15	2.932E-13	2.985E-13	4.170E-17	-1.000E+00	3.410E-12	8.590E-13
BONE SUR	5.290E-15	6.841E-13	6.965E-13	9.730E-17	-1.000E+00	2.490E-12	4.380E-13
THYROID	2.130E-15	3.044E-13	3.100E-13	4.330E-17	-1.000E+00	2.400E-12	2.660E-13
REMAINDER	1.920E-15	2.932E-13	2.985E-13	4.170E-17	-1.000E+00	4.820E-11	3.570E-10
EFFECTIVE	2.170E-15	3.227E-13	3.286E-13	4.590E-17	-1.000E+00	4.640E-11	1.080E-10
SKIN(FGR)	6.160E-14	7.241E-11	7.373E-11	1.030E-14	-1.000E+00	0.000E+00	0.000E+00
Ba-140							
GONADS	8.410E-15	5.451E-12	9.607E-11	1.910E-16	-1.000E+00	4.300E-10	9.960E-10
BREAST	9.640E-15	5.280E-12	9.305E-11	1.850E-16	-1.000E+00	2.870E-10	1.590E-10
LUNGS	8.270E-15	4.852E-12	8.550E-11	1.700E-16	-1.000E+00	1.660E-09	6.630E-11
RED MARR	7.930E-15	4.880E-12	8.601E-11	1.710E-16	-1.000E+00	1.290E-09	4.390E-10
BONE SUR	1.550E-14	8.020E-12	1.413E-10	2.810E-16	-1.000E+00	2.410E-09	5.530E-10
THYROID	8.530E-15	5.109E-12	9.003E-11	1.790E-16	-1.000E+00	2.560E-10	5.250E-11
REMAINDER	7.890E-15	4.766E-12	8.399E-11	1.670E-16	-1.000E+00	1.410E-09	7.370E-09
EFFECTIVE	8.580E-15	5.137E-12	9.053E-11	1.800E-16	-1.000E+00	1.010E-09	2.560E-09
SKIN(FGR)	2.520E-14	5.565E-11	9.808E-10	1.950E-15	-1.000E+00	0.000E+00	0.000E+00
La-140							
GONADS	1.140E-13	6.027E-11	4.425E-10	2.240E-15	-1.000E+00	4.540E-10	1.340E-09
BREAST	1.290E-13	5.758E-11	4.228E-10	2.140E-15	-1.000E+00	1.450E-10	1.800E-10
LUNGS	1.150E-13	5.596E-11	4.109E-10	2.080E-15	-1.000E+00	4.210E-09	4.010E-11
RED MARR	1.140E-13	5.731E-11	4.208E-10	2.130E-15	-1.000E+00	2.140E-10	2.810E-10
BONE SUR	1.690E-13	7.776E-11	5.709E-10	2.890E-15	-1.000E+00	1.410E-10	9.770E-11
THYROID	1.180E-13	5.462E-11	4.010E-10	2.030E-15	-1.000E+00	6.870E-11	6.400E-12
REMAINDER	1.110E-13	5.569E-11	4.089E-10	2.070E-15	-1.000E+00	2.120E-09	6.260E-09
EFFECTIVE	1.170E-13	5.812E-11	4.267E-10	2.160E-15	-1.000E+00	1.310E-09	2.280E-09
SKIN(FGR)	1.660E-13	2.217E-10	1.628E-09	8.240E-15	-1.000E+00	0.000E+00	0.000E+00
La-141							
GONADS	2.330E-15	7.315E-13	9.675E-13	4.740E-17	-1.000E+00	1.010E-11	3.770E-12
BREAST	2.640E-15	7.007E-13	9.267E-13	4.540E-17	-1.000E+00	9.840E-12	7.070E-13
LUNGS	2.340E-15	6.713E-13	8.879E-13	4.350E-17	-1.000E+00	6.460E-10	2.720E-13
RED MARR	2.310E-15	6.852E-13	9.063E-13	4.440E-17	-1.000E+00	2.930E-11	1.070E-12
BONE SUR	3.490E-15	9.923E-13	1.312E-12	6.430E-17	-1.000E+00	1.200E-10	6.060E-13
THYROID	2.390E-15	6.590E-13	8.716E-13	4.270E-17	-1.000E+00	9.400E-12	5.290E-14
REMAINDER	2.260E-15	6.682E-13	8.838E-13	4.330E-17	-1.000E+00	2.280E-10	1.240E-09

EFFECTIVE	2.390E-15	7.007E-13	9.267E-13	4.540E-17	-1.000E+00	1.570E-10	3.740E-10
SKIN(FGR)	6.580E-14	1.667E-10	2.204E-10	1.080E-14	-1.000E+00	0.000E+00	0.000E+00
La-142							
GONADS	1.400E-13	1.978E-11	2.034E-11	2.540E-15	-1.000E+00	1.660E-11	6.990E-11
BREAST	1.570E-13	1.885E-11	1.938E-11	2.420E-15	-1.000E+00	1.130E-11	1.540E-11
LUNGS	1.420E-13	1.846E-11	1.898E-11	2.370E-15	-1.000E+00	3.010E-10	8.400E-12
RED MARR	1.420E-13	1.900E-11	1.954E-11	2.440E-15	-1.000E+00	1.360E-11	1.930E-11
BONE SUR	1.950E-13	2.484E-11	2.554E-11	3.190E-15	-1.000E+00	1.110E-11	7.400E-12
THYROID	1.450E-13	1.768E-11	1.818E-11	2.270E-15	-1.000E+00	8.740E-12	1.160E-12
REMAINDER	1.380E-13	1.853E-11	1.906E-11	2.380E-15	-1.000E+00	8.070E-11	5.200E-10
EFFECTIVE	1.440E-13	1.916E-11	1.970E-11	2.460E-15	-1.000E+00	6.840E-11	1.790E-10
SKIN(FGR)	2.160E-13	9.111E-11	9.368E-11	1.170E-14	-1.000E+00	0.000E+00	0.000E+00
Ce-141							
GONADS	3.380E-15	2.213E-12	4.332E-11	7.710E-17	-1.000E+00	5.540E-11	1.080E-10
BREAST	3.930E-15	2.170E-12	4.247E-11	7.560E-17	-1.000E+00	4.460E-11	1.110E-11
LUNGS	3.170E-15	1.951E-12	3.820E-11	6.800E-17	-1.000E+00	1.670E-08	1.430E-12
RED MARR	2.830E-15	1.860E-12	3.641E-11	6.480E-17	-1.000E+00	8.960E-11	3.390E-11
BONE SUR	9.410E-15	5.166E-12	1.011E-10	1.800E-16	-1.000E+00	2.540E-10	2.300E-11
THYROID	3.350E-15	2.003E-12	3.922E-11	6.980E-17	-1.000E+00	2.550E-11	1.800E-13
REMAINDER	2.980E-15	1.894E-12	3.708E-11	6.600E-17	-1.000E+00	1.260E-09	2.500E-09
EFFECTIVE	3.430E-15	2.118E-12	4.146E-11	7.380E-17	-1.000E+00	2.420E-09	7.830E-10
SKIN(FGR)	1.020E-14	3.788E-12	7.416E-11	1.320E-16	-1.000E+00	0.000E+00	0.000E+00
Ce-143							
GONADS	1.280E-14	7.900E-12	4.958E-11	2.980E-16	-1.000E+00	7.530E-11	2.120E-10
BREAST	1.470E-14	7.688E-12	4.825E-11	2.900E-16	-1.000E+00	1.660E-11	2.320E-11
LUNGS	1.230E-14	6.893E-12	4.325E-11	2.600E-16	-1.000E+00	3.880E-09	3.820E-12
RED MARR	1.170E-14	6.787E-12	4.259E-11	2.560E-16	-1.000E+00	2.960E-11	5.070E-11
BONE SUR	2.520E-14	1.323E-11	8.302E-11	4.990E-16	-1.000E+00	1.640E-11	1.610E-11
THYROID	1.280E-14	7.211E-12	4.525E-11	2.720E-16	-1.000E+00	6.230E-12	4.350E-13
REMAINDER	1.170E-14	6.734E-12	4.226E-11	2.540E-16	-1.000E+00	1.420E-09	3.890E-09
EFFECTIVE	1.290E-14	7.396E-12	4.642E-11	2.790E-16	-1.000E+00	9.160E-10	1.230E-09
SKIN(FGR)	3.960E-14	1.058E-10	6.638E-10	3.990E-15	-1.000E+00	0.000E+00	0.000E+00
Ce-144							
GONADS	2.725E-15	6.328E-13	1.319E-11	6.088E-17	-1.000E+00	2.390E-10	6.987E-11
BREAST	3.129E-15	6.274E-13	1.307E-11	5.922E-17	-1.000E+00	3.480E-10	1.223E-11
LUNGS	2.639E-15	5.228E-13	1.089E-11	5.362E-17	-1.000E+00	7.911E-07	6.551E-12
RED MARR	2.507E-15	4.755E-13	9.907E-12	5.247E-17	-1.000E+00	2.880E-09	8.923E-11
BONE SUR	5.441E-15	1.646E-12	3.429E-11	1.127E-16	-1.000E+00	4.720E-09	1.280E-10
THYROID	2.753E-15	5.529E-13	1.152E-11	5.418E-17	-1.000E+00	2.920E-10	5.154E-12
REMAINDER	2.534E-15	5.086E-13	1.060E-11	5.283E-17	-1.000E+00	1.910E-08	1.890E-08
EFFECTIVE	2.773E-15	5.909E-13	1.231E-11	5.766E-17	-1.000E+00	1.010E-07	5.711E-09
SKIN(FGR)	8.574E-14	7.648E-13	1.594E-11	1.250E-14	-1.000E+00	0.000E+00	0.000E+00
Pr-143							
GONADS	2.130E-17	2.264E-14	4.032E-13	7.930E-19	-1.000E+00	4.370E-18	8.990E-18
BREAST	2.550E-17	2.330E-14	4.149E-13	8.160E-19	-1.000E+00	2.220E-18	1.090E-18
LUNGS	1.860E-17	1.642E-14	2.923E-13	5.750E-19	-1.000E+00	1.330E-08	1.910E-19
RED MARR	1.620E-17	1.493E-14	2.659E-13	5.230E-19	-1.000E+00	1.480E-11	1.030E-12
BONE SUR	5.930E-17	5.454E-14	9.711E-13	1.910E-18	-1.000E+00	1.490E-11	1.030E-12
THYROID	2.050E-17	1.802E-14	3.208E-13	6.310E-19	-1.000E+00	1.680E-18	2.660E-20
REMAINDER	1.760E-17	1.642E-14	2.923E-13	5.750E-19	-1.000E+00	1.970E-09	4.220E-09
EFFECTIVE	2.100E-17	2.002E-14	3.564E-13	7.010E-19	-1.000E+00	2.190E-09	1.270E-09
SKIN(FGR)	1.760E-14	5.711E-11	1.017E-09	2.000E-15	-1.000E+00	0.000E+00	0.000E+00
Nd-147							
GONADS	6.130E-15	4.218E-12	7.235E-11	1.480E-16	-1.000E+00	8.410E-11	1.790E-10

BREAST	7.120E-15	4.132E-12	7.088E-11	1.450E-16	-1.000E+00	3.450E-11	1.870E-11
LUNGS	5.820E-15	3.648E-12	6.257E-11	1.280E-16	-1.000E+00	1.060E-08	2.440E-12
RED MARR	5.400E-15	3.505E-12	6.013E-11	1.230E-16	-1.000E+00	9.190E-11	5.050E-11
BONE SUR	1.320E-14	8.265E-12	1.418E-10	2.900E-16	-1.000E+00	3.260E-10	2.220E-11
THYROID	6.120E-15	3.876E-12	6.648E-11	1.360E-16	-1.000E+00	1.820E-11	2.640E-13
REMAINDER	5.530E-15	3.562E-12	6.111E-11	1.250E-16	-1.000E+00	1.760E-09	3.760E-09
EFFECTIVE	6.190E-15	3.961E-12	6.795E-11	1.390E-16	-1.000E+00	1.850E-09	1.180E-09
SKIN(FGR)	1.950E-14	3.135E-11	5.377E-10	1.100E-15	-1.000E+00	0.000E+00	0.000E+00
Np-239							
GONADS	7.530E-15	4.691E-12	4.380E-11	1.710E-16	-1.000E+00	7.450E-11	1.620E-10
BREAST	8.730E-15	4.636E-12	4.329E-11	1.690E-16	-1.000E+00	1.630E-11	1.720E-11
LUNGS	7.180E-15	4.115E-12	3.842E-11	1.500E-16	-1.000E+00	2.360E-09	2.400E-12
RED MARR	6.500E-15	4.005E-12	3.740E-11	1.460E-16	-1.000E+00	2.080E-10	4.660E-11
BONE SUR	2.000E-14	1.001E-11	9.349E-11	3.650E-16	-1.000E+00	2.030E-09	3.590E-11
THYROID	7.520E-15	4.197E-12	3.919E-11	1.530E-16	-1.000E+00	7.620E-12	2.070E-13
REMAINDER	6.760E-15	4.005E-12	3.740E-11	1.460E-16	-1.000E+00	9.590E-10	2.770E-09
EFFECTIVE	7.690E-15	4.471E-12	4.175E-11	1.630E-16	-1.000E+00	6.780E-10	8.820E-10
SKIN(FGR)	1.600E-14	7.215E-12	6.737E-11	2.630E-16	-1.000E+00	0.000E+00	0.000E+00
Pu-238							
GONADS	6.560E-18	4.291E-14	9.011E-13	1.490E-18	-1.000E+00	1.040E-05	2.330E-09
BREAST	1.270E-17	5.558E-14	1.167E-12	1.930E-18	-1.000E+00	4.400E-10	1.800E-13
LUNGS	1.060E-18	2.267E-15	4.759E-14	7.870E-20	-1.000E+00	3.200E-04	8.640E-14
RED MARR	1.680E-18	5.587E-15	1.173E-13	1.940E-19	-1.000E+00	5.800E-05	1.270E-08
BONE SUR	9.300E-18	3.514E-14	7.378E-13	1.220E-18	-1.000E+00	7.250E-04	1.580E-07
THYROID	4.010E-18	9.792E-15	2.056E-13	3.400E-19	-1.000E+00	3.860E-10	7.990E-14
REMAINDER	1.990E-18	9.216E-15	1.935E-13	3.200E-19	-1.000E+00	2.740E-05	2.180E-08
EFFECTIVE	4.880E-18	2.413E-14	5.068E-13	8.380E-19	-1.000E+00	7.790E-05	1.340E-08
SKIN(FGR)	4.090E-17	2.776E-13	5.830E-12	9.640E-18	-1.000E+00	0.000E+00	0.000E+00
Pu-239							
GONADS	4.840E-18	1.768E-14	3.713E-13	6.140E-19	-1.000E+00	1.200E-05	2.640E-09
BREAST	7.550E-18	2.238E-14	4.699E-13	7.770E-19	-1.000E+00	3.990E-10	1.210E-13
LUNGS	2.650E-18	2.267E-15	4.760E-14	7.870E-20	-1.000E+00	3.230E-04	7.890E-14
RED MARR	2.670E-18	3.456E-15	7.258E-14	1.200E-19	-1.000E+00	6.570E-05	1.410E-08
BONE SUR	9.470E-18	1.673E-14	3.514E-13	5.810E-19	-1.000E+00	8.210E-04	1.760E-07
THYROID	3.880E-18	5.126E-15	1.077E-13	1.780E-19	-1.000E+00	3.750E-10	7.500E-14
REMAINDER	2.860E-18	4.838E-15	1.016E-13	1.680E-19	-1.000E+00	3.020E-05	2.120E-08
EFFECTIVE	4.240E-18	1.057E-14	2.220E-13	3.670E-19	-1.000E+00	8.330E-05	1.400E-08
SKIN(FGR)	1.860E-17	1.057E-13	2.220E-12	3.670E-18	-1.000E+00	0.000E+00	0.000E+00
Pu-240							
GONADS	6.360E-18	4.118E-14	8.649E-13	1.430E-18	-1.000E+00	1.200E-05	2.640E-09
BREAST	1.230E-17	5.328E-14	1.119E-12	1.850E-18	-1.000E+00	4.330E-10	1.730E-13
LUNGS	1.090E-18	2.249E-15	4.723E-14	7.810E-20	-1.000E+00	3.230E-04	8.220E-14
RED MARR	1.650E-18	5.386E-15	1.131E-13	1.870E-19	-1.000E+00	6.570E-05	1.410E-08
BONE SUR	9.260E-18	3.398E-14	7.137E-13	1.180E-18	-1.000E+00	8.210E-04	1.760E-07
THYROID	3.920E-18	9.446E-15	1.984E-13	3.280E-19	-1.000E+00	3.760E-10	7.510E-14
REMAINDER	1.960E-18	8.870E-15	1.863E-13	3.080E-19	-1.000E+00	3.020E-05	2.130E-08
EFFECTIVE	4.750E-18	2.313E-14	4.857E-13	8.030E-19	-1.000E+00	8.330E-05	1.400E-08
SKIN(FGR)	3.920E-17	2.644E-13	5.552E-12	9.180E-18	-1.000E+00	0.000E+00	0.000E+00
Pu-241							
GONADS	7.190E-20	6.653E-17	1.396E-15	2.310E-21	-1.000E+00	2.760E-07	5.660E-11
BREAST	8.670E-20	7.229E-17	1.517E-15	2.510E-21	-1.000E+00	2.140E-11	2.790E-15
LUNGS	6.480E-20	4.090E-17	8.584E-16	1.420E-21	-1.000E+00	3.180E-06	4.480E-15
RED MARR	5.630E-20	4.003E-17	8.403E-16	1.390E-21	-1.000E+00	1.430E-06	2.780E-10
BONE SUR	2.190E-19	1.385E-16	2.908E-15	4.810E-21	-1.000E+00	1.780E-05	3.480E-09

THYROID	6.980E-20	4.522E-17	9.491E-16	1.570E-21	-1.000E+00	9.150E-12	1.010E-15
REMAINDER	6.090E-20	4.291E-17	9.007E-16	1.490E-21	-1.000E+00	6.020E-07	1.850E-10
EFFECTIVE	7.250E-20	5.558E-17	1.167E-15	1.930E-21	-1.000E+00	1.340E-06	2.070E-10
SKIN(FGR)	1.170E-19	2.033E-16	4.268E-15	7.060E-21	-1.000E+00	0.000E+00	0.000E+00
Am-241							
GONADS	8.580E-16	9.360E-13	1.966E-11	3.250E-17	-1.000E+00	3.250E-05	2.700E-07
BREAST	1.070E-15	1.014E-12	2.129E-11	3.520E-17	-1.000E+00	2.670E-09	2.620E-11
LUNGS	6.740E-16	5.789E-13	1.216E-11	2.010E-17	-1.000E+00	1.840E-05	3.360E-11
RED MARR	5.210E-16	4.838E-13	1.016E-11	1.680E-17	-1.000E+00	1.740E-04	1.450E-06
BONE SUR	2.870E-15	2.678E-12	5.625E-11	9.300E-17	-1.000E+00	2.170E-03	1.810E-05
THYROID	7.830E-16	6.365E-13	1.337E-11	2.210E-17	-1.000E+00	1.600E-09	1.320E-11
REMAINDER	6.340E-16	5.933E-13	1.246E-11	2.060E-17	-1.000E+00	7.820E-05	6.660E-07
EFFECTIVE	8.180E-16	7.920E-13	1.663E-11	2.750E-17	-1.000E+00	1.200E-04	9.840E-07
SKIN(FGR)	1.280E-15	2.396E-12	5.032E-11	8.320E-17	-1.000E+00	0.000E+00	0.000E+00
Cm-242							
GONADS	7.830E-18	4.893E-14	1.013E-12	1.700E-18	-1.000E+00	5.700E-07	5.200E-09
BREAST	1.480E-17	6.159E-14	1.275E-12	2.140E-18	-1.000E+00	9.440E-10	8.950E-12
LUNGS	1.130E-18	3.022E-15	6.257E-14	1.050E-19	-1.000E+00	1.550E-05	8.840E-12
RED MARR	1.890E-18	6.562E-15	1.359E-13	2.280E-19	-1.000E+00	3.900E-06	3.570E-08
BONE SUR	1.060E-17	4.231E-14	8.759E-13	1.470E-18	-1.000E+00	4.870E-05	4.460E-07
THYROID	4.910E-18	1.261E-14	2.610E-13	4.380E-19	-1.000E+00	9.410E-10	8.820E-12
REMAINDER	2.270E-18	1.079E-14	2.235E-13	3.750E-19	-1.000E+00	2.450E-06	4.020E-08
EFFECTIVE	5.690E-18	2.751E-14	5.697E-13	9.560E-19	-1.000E+00	4.670E-06	3.100E-08
SKIN(FGR)	4.290E-17	2.700E-13	5.589E-12	9.380E-18	-1.000E+00	0.000E+00	0.000E+00
Cm-244							
GONADS	6.900E-18	4.522E-14	9.492E-13	1.570E-18	-1.000E+00	1.590E-05	1.330E-07
BREAST	1.330E-17	5.702E-14	1.197E-12	1.980E-18	-1.000E+00	1.040E-09	8.820E-12
LUNGS	7.080E-19	2.592E-15	5.441E-14	9.000E-20	-1.000E+00	1.930E-05	8.810E-12
RED MARR	1.460E-18	5.875E-15	1.233E-13	2.040E-19	-1.000E+00	9.380E-05	7.820E-07
BONE SUR	8.820E-18	3.859E-14	8.101E-13	1.340E-18	-1.000E+00	1.170E-03	9.770E-06
THYROID	4.190E-18	1.146E-14	2.406E-13	3.980E-19	-1.000E+00	1.010E-09	8.440E-12
REMAINDER	1.810E-18	9.821E-15	2.062E-13	3.410E-19	-1.000E+00	4.780E-05	4.150E-07
EFFECTIVE	4.910E-18	2.529E-14	5.308E-13	8.780E-19	-1.000E+00	6.700E-05	5.450E-07
SKIN(FGR)	3.910E-17	2.506E-13	5.260E-12	8.700E-18	-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 Q
MSLBFF 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
0.333	5.7282E-01	2.0342E-02	1.3485E-01	4.7889E-03	1.5416E+00	4.8540E-02
0.500	8.5839E-01	3.0317E-02	2.0208E-01	7.1372E-03	3.1108E+00	9.7878E-02
0.800	1.3708E+00	4.8024E-02	3.2271E-01	1.1306E-02	6.2297E+00	1.9583E-01
1.100	1.8812E+00	6.5466E-02	4.4287E-01	1.5412E-02	9.5428E+00	2.9975E-01
1.400	2.3898E+00	8.2689E-02	5.6259E-01	1.9466E-02	1.2939E+01	4.0613E-01
1.700	2.8964E+00	9.9723E-02	6.8186E-01	2.3476E-02	1.6366E+01	5.1339E-01
2.000	3.4012E+00	1.1659E-01	8.0071E-01	2.7447E-02	1.9802E+01	6.2079E-01
2.300	3.4012E+00	1.1659E-01	8.0839E-01	2.7702E-02	2.3084E+01	7.2331E-01
2.600	3.4012E+00	1.1659E-01	8.1605E-01	2.7956E-02	2.6170E+01	8.1963E-01
2.900	3.4012E+00	1.1659E-01	8.2368E-01	2.8207E-02	2.9160E+01	9.1288E-01
3.200	3.4012E+00	1.1659E-01	8.3129E-01	2.8457E-02	3.2100E+01	1.0045E+00
3.500	3.4012E+00	1.1659E-01	8.3887E-01	2.8705E-02	3.5013E+01	1.0952E+00
3.800	3.4012E+00	1.1659E-01	8.4643E-01	2.8951E-02	3.7907E+01	1.1853E+00
4.100	3.4012E+00	1.1659E-01	8.5396E-01	2.9197E-02	4.0789E+01	1.2750E+00
4.400	3.4012E+00	1.1659E-01	8.6147E-01	2.9440E-02	4.3659E+01	1.3642E+00
4.700	3.4012E+00	1.1659E-01	8.6895E-01	2.9683E-02	4.6519E+01	1.4531E+00
5.000	3.4012E+00	1.1659E-01	8.7641E-01	2.9924E-02	4.9370E+01	1.5417E+00
5.300	3.4012E+00	1.1659E-01	8.8385E-01	3.0164E-02	5.2212E+01	1.6299E+00
5.600	3.4012E+00	1.1659E-01	8.9127E-01	3.0403E-02	5.5046E+01	1.7178E+00
5.900	3.4012E+00	1.1659E-01	8.9866E-01	3.0640E-02	5.7870E+01	1.8055E+00
6.200	3.4012E+00	1.1659E-01	9.0603E-01	3.0877E-02	6.0687E+01	1.8928E+00
6.500	3.4012E+00	1.1659E-01	9.1338E-01	3.1113E-02	6.3494E+01	1.9798E+00
6.800	3.4012E+00	1.1659E-01	9.2071E-01	3.1347E-02	6.6294E+01	2.0666E+00
7.100	3.4012E+00	1.1659E-01	9.2801E-01	3.1581E-02	6.9085E+01	2.1531E+00
7.400	3.4012E+00	1.1659E-01	9.3530E-01	3.1814E-02	7.1869E+01	2.2393E+00
7.700	3.4012E+00	1.1659E-01	9.4256E-01	3.2046E-02	7.4644E+01	2.3252E+00
8.000	3.4012E+00	1.1659E-01	9.4980E-01	3.2277E-02	7.7412E+01	2.4108E+00
8.300	3.4012E+00	1.1659E-01	9.5352E-01	3.2398E-02	7.9683E+01	2.4811E+00
8.600	3.4012E+00	1.1659E-01	9.5722E-01	3.2520E-02	8.1334E+01	2.5322E+00
8.900	3.4012E+00	1.1659E-01	9.6091E-01	3.2640E-02	8.2697E+01	2.5744E+00
9.000	3.4012E+00	1.1659E-01	9.6214E-01	3.2681E-02	8.3117E+01	2.5874E+00
9.300	3.4012E+00	1.1659E-01	9.6214E-01	3.2681E-02	8.3986E+01	2.6143E+00
9.600	3.4012E+00	1.1659E-01	9.6214E-01	3.2681E-02	8.4387E+01	2.6267E+00
9.900	3.4012E+00	1.1659E-01	9.6214E-01	3.2681E-02	8.4573E+01	2.6324E+00
10.200	3.4012E+00	1.1659E-01	9.6214E-01	3.2681E-02	8.4658E+01	2.6351E+00
24.000	3.4012E+00	1.1659E-01	9.6214E-01	3.2681E-02	8.4732E+01	2.6375E+00
96.000	3.4012E+00	1.1659E-01	9.6214E-01	3.2681E-02	8.4732E+01	2.6375E+00
720.000	3.4012E+00	1.1659E-01	9.6214E-01	3.2681E-02	8.4732E+01	2.6375E+00

Worst Two-Hour Doses
#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.0609E-02	3.4012E+00	1.1659E-01

ATTACHMENT R MSLBPRI 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
0.333	2.8035E-04	1.5927E-05	6.5999E-05	3.7495E-06	7.5456E-04	2.4570E-05
0.733	6.1545E-04	3.4470E-05	1.4489E-04	8.1148E-06	2.7444E-03	8.9995E-05
1.033	8.6578E-04	4.8075E-05	2.0382E-04	1.1318E-05	4.4263E-03	1.4605E-04
1.333	1.1153E-03	6.1468E-05	2.6255E-04	1.4471E-05	6.1761E-03	2.0487E-04
1.633	1.3639E-03	7.4671E-05	3.2109E-04	1.7579E-05	7.9557E-03	2.6509E-04
1.933	1.6118E-03	8.7702E-05	3.7944E-04	2.0646E-05	9.7467E-03	3.2602E-04
2.000	1.6667E-03	9.0575E-05	3.9238E-04	2.1323E-05	1.0145E-02	3.3961E-04
2.300	1.6667E-03	9.0575E-05	3.9615E-04	2.1519E-05	1.1864E-02	3.9845E-04
2.600	1.6667E-03	9.0575E-05	3.9991E-04	2.1713E-05	1.3483E-02	4.5419E-04
2.900	1.6667E-03	9.0575E-05	4.0366E-04	2.1905E-05	1.5053E-02	5.0832E-04
3.200	1.6667E-03	9.0575E-05	4.0739E-04	2.2094E-05	1.6595E-02	5.6156E-04
3.500	1.6667E-03	9.0575E-05	4.1112E-04	2.2282E-05	1.8122E-02	6.1426E-04
3.800	1.6667E-03	9.0575E-05	4.1483E-04	2.2469E-05	1.9639E-02	6.6657E-04
4.100	1.6667E-03	9.0575E-05	4.1853E-04	2.2653E-05	2.1149E-02	7.1860E-04
4.400	1.6667E-03	9.0575E-05	4.2222E-04	2.2836E-05	2.2653E-02	7.7037E-04
4.700	1.6667E-03	9.0575E-05	4.2590E-04	2.3018E-05	2.4152E-02	8.2191E-04
5.000	1.6667E-03	9.0575E-05	4.2957E-04	2.3198E-05	2.5646E-02	8.7322E-04
5.300	1.6667E-03	9.0575E-05	4.3322E-04	2.3376E-05	2.7136E-02	9.2433E-04
5.600	1.6667E-03	9.0575E-05	4.3687E-04	2.3554E-05	2.8621E-02	9.7523E-04
5.900	1.6667E-03	9.0575E-05	4.4050E-04	2.3730E-05	3.0102E-02	1.0259E-03
6.200	1.6667E-03	9.0575E-05	4.4413E-04	2.3905E-05	3.1578E-02	1.0764E-03
6.500	1.6667E-03	9.0575E-05	4.4774E-04	2.4079E-05	3.3050E-02	1.1267E-03
6.800	1.6667E-03	9.0575E-05	4.5135E-04	2.4252E-05	3.4518E-02	1.1768E-03
7.100	1.6667E-03	9.0575E-05	4.5494E-04	2.4424E-05	3.5982E-02	1.2268E-03
7.400	1.6667E-03	9.0575E-05	4.5852E-04	2.4594E-05	3.7442E-02	1.2765E-03
7.700	1.6667E-03	9.0575E-05	4.6210E-04	2.4764E-05	3.8897E-02	1.3261E-03
8.000	1.6667E-03	9.0575E-05	4.6566E-04	2.4933E-05	4.0349E-02	1.3755E-03
8.300	1.6667E-03	9.0575E-05	4.6749E-04	2.5048E-05	4.1552E-02	1.4169E-03
8.600	1.6667E-03	9.0575E-05	4.6931E-04	2.5162E-05	4.2438E-02	1.4480E-03
8.900	1.6667E-03	9.0575E-05	4.7113E-04	2.5276E-05	4.3168E-02	1.4739E-03
9.000	1.6667E-03	9.0575E-05	4.7173E-04	2.5313E-05	4.3392E-02	1.4818E-03
9.300	1.6667E-03	9.0575E-05	4.7173E-04	2.5313E-05	4.3866E-02	1.4992E-03
9.600	1.6667E-03	9.0575E-05	4.7173E-04	2.5313E-05	4.4095E-02	1.5084E-03
9.900	1.6667E-03	9.0575E-05	4.7173E-04	2.5313E-05	4.4206E-02	1.5136E-03
10.200	1.6667E-03	9.0575E-05	4.7173E-04	2.5313E-05	4.4260E-02	1.5167E-03
24.000	1.6667E-03	9.0575E-05	4.7173E-04	2.5313E-05	4.4310E-02	1.5238E-03
96.000	1.6667E-03	9.0575E-05	4.7173E-04	2.5313E-05	4.4310E-02	1.5238E-03
720.000	1.6667E-03	9.0575E-05	4.7173E-04	2.5313E-05	4.4310E-02	1.5238E-03

Worst Two-Hour Doses
#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	3.8893E-05	1.6667E-03	9.0575E-05

ATTACHMENT S
MSLBSEC 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
0.333	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	2.9685E+00	9.1164E-02
0.733	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	5.3816E+00	1.6526E-01
1.033	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.1463E+00	1.8874E-01
1.333	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.5170E+00	2.0012E-01
1.633	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.6967E+00	2.0563E-01
1.933	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.7838E+00	2.0831E-01
2.000	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.7960E+00	2.0868E-01
2.300	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8320E+00	2.0978E-01
2.600	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8494E+00	2.1032E-01
2.900	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8578E+00	2.1058E-01
3.200	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8619E+00	2.1071E-01
3.500	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8639E+00	2.1077E-01
3.800	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8649E+00	2.1080E-01
4.100	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8654E+00	2.1081E-01
4.400	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8656E+00	2.1082E-01
4.700	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8657E+00	2.1082E-01
5.000	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8657E+00	2.1082E-01
5.300	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
5.600	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
5.900	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
6.200	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
6.500	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
6.800	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
7.100	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
7.400	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
7.700	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
8.000	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
8.300	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
8.600	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
8.900	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
9.000	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
9.300	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
9.600	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
9.900	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
10.200	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
24.000	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
96.000	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01
720.000	6.7625E-01	2.1067E-02	1.5920E-01	4.9595E-03	6.8658E+00	2.1082E-01

Worst Two-Hour Doses
#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	3.1755E-04	6.7625E-01	2.1067E-02

ATTACHMENT T MSLBPIS 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
0.333	1.6821E-02	5.5276E-04	3.9599E-03	1.3013E-04	4.5274E-02	1.4101E-03
0.733	3.6927E-02	1.2111E-03	8.6932E-03	2.8512E-04	1.6467E-01	5.1272E-03
1.033	5.1947E-02	1.7015E-03	1.2229E-02	4.0055E-04	2.6558E-01	8.2679E-03
1.333	6.6916E-02	2.1891E-03	1.5753E-02	5.1534E-04	3.7056E-01	1.1535E-02
1.633	8.1835E-02	2.6741E-03	1.9265E-02	6.2952E-04	4.7734E-01	1.4856E-02
1.933	9.6706E-02	3.1566E-03	2.2766E-02	7.4311E-04	5.8480E-01	1.8198E-02
2.000	1.0000E-01	3.2635E-03	2.3543E-02	7.6828E-04	6.0872E-01	1.8941E-02
2.300	1.0000E-01	3.2635E-03	2.3769E-02	7.7561E-04	7.1182E-01	2.2147E-02
2.600	1.0000E-01	3.2635E-03	2.3995E-02	7.8290E-04	8.0900E-01	2.5167E-02
2.900	1.0000E-01	3.2635E-03	2.4219E-02	7.9016E-04	9.0315E-01	2.8092E-02
3.200	1.0000E-01	3.2635E-03	2.4444E-02	7.9739E-04	9.9569E-01	3.0967E-02
3.500	1.0000E-01	3.2635E-03	2.4667E-02	8.0459E-04	1.0873E+00	3.3812E-02
3.800	1.0000E-01	3.2635E-03	2.4890E-02	8.1175E-04	1.1783E+00	3.6637E-02
4.100	1.0000E-01	3.2635E-03	2.5112E-02	8.1889E-04	1.2689E+00	3.9449E-02
4.400	1.0000E-01	3.2635E-03	2.5333E-02	8.2600E-04	1.3592E+00	4.2249E-02
4.700	1.0000E-01	3.2635E-03	2.5554E-02	8.3308E-04	1.4491E+00	4.5039E-02
5.000	1.0000E-01	3.2635E-03	2.5774E-02	8.4013E-04	1.5388E+00	4.7819E-02
5.300	1.0000E-01	3.2635E-03	2.5993E-02	8.4715E-04	1.6281E+00	5.0590E-02
5.600	1.0000E-01	3.2635E-03	2.6212E-02	8.5415E-04	1.7172E+00	5.3352E-02
5.900	1.0000E-01	3.2635E-03	2.6430E-02	8.6113E-04	1.8061E+00	5.6105E-02
6.200	1.0000E-01	3.2635E-03	2.6648E-02	8.6807E-04	1.8947E+00	5.8850E-02
6.500	1.0000E-01	3.2635E-03	2.6864E-02	8.7500E-04	1.9830E+00	6.1586E-02
6.800	1.0000E-01	3.2635E-03	2.7081E-02	8.8190E-04	2.0711E+00	6.4314E-02
7.100	1.0000E-01	3.2635E-03	2.7296E-02	8.8877E-04	2.1589E+00	6.7033E-02
7.400	1.0000E-01	3.2635E-03	2.7511E-02	8.9562E-04	2.2465E+00	6.9744E-02
7.700	1.0000E-01	3.2635E-03	2.7726E-02	9.0245E-04	2.3338E+00	7.2447E-02
8.000	1.0000E-01	3.2635E-03	2.7939E-02	9.0925E-04	2.4209E+00	7.5142E-02
8.300	1.0000E-01	3.2635E-03	2.8049E-02	9.1284E-04	2.4931E+00	7.7377E-02
8.600	1.0000E-01	3.2635E-03	2.8158E-02	9.1642E-04	2.5463E+00	7.9021E-02
8.900	1.0000E-01	3.2635E-03	2.8267E-02	9.1998E-04	2.5901E+00	8.0378E-02
9.000	1.0000E-01	3.2635E-03	2.8304E-02	9.2117E-04	2.6035E+00	8.0794E-02
9.300	1.0000E-01	3.2635E-03	2.8304E-02	9.2117E-04	2.6319E+00	8.1673E-02
9.600	1.0000E-01	3.2635E-03	2.8304E-02	9.2117E-04	2.6457E+00	8.2100E-02
9.900	1.0000E-01	3.2635E-03	2.8304E-02	9.2117E-04	2.6523E+00	8.2308E-02
10.200	1.0000E-01	3.2635E-03	2.8304E-02	9.2117E-04	2.6556E+00	8.2409E-02
24.000	1.0000E-01	3.2635E-03	2.8304E-02	9.2117E-04	2.6586E+00	8.2508E-02
96.000	1.0000E-01	3.2635E-03	2.8304E-02	9.2117E-04	2.6586E+00	8.2508E-02
720.000	1.0000E-01	3.2635E-03	2.8304E-02	9.2117E-04	2.6586E+00	8.2508E-02

Worst Two-Hour Doses
#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.6262E-04	1.0000E-01	3.2635E-03

ATTACHMENT U
MSLBCIS 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
0.333	1.7970E-03	7.2324E-05	4.2304E-04	1.7026E-05	3.4278E-03	1.1044E-04
0.733	8.6608E-03	3.2592E-04	2.0389E-03	7.6727E-05	2.6931E-02	8.6165E-04
1.033	1.7139E-02	6.3079E-04	4.0349E-03	1.4850E-04	6.3602E-02	2.0291E-03
1.333	2.8441E-02	1.0309E-03	6.6956E-03	2.4268E-04	1.1897E-01	3.7873E-03
1.633	4.2541E-02	1.5239E-03	1.0015E-02	3.5874E-04	1.9390E-01	6.1612E-03
1.933	5.9411E-02	2.1079E-03	1.3986E-02	4.9624E-04	2.8870E-01	9.1594E-03
2.000	6.3535E-02	2.2499E-03	1.4957E-02	5.2966E-04	3.1248E-01	9.9106E-03
2.300	6.3535E-02	2.2499E-03	1.5266E-02	5.4025E-04	4.2560E-01	1.3482E-02
2.600	6.3535E-02	2.2499E-03	1.5617E-02	5.5218E-04	5.4976E-01	1.7396E-02
2.900	6.3535E-02	2.2499E-03	1.6008E-02	5.6543E-04	6.8790E-01	2.1747E-02
3.200	6.3535E-02	2.2499E-03	1.6441E-02	5.7999E-04	8.4138E-01	2.6575E-02
3.500	6.3535E-02	2.2499E-03	1.6914E-02	5.9584E-04	1.0108E+00	3.1898E-02
3.800	6.3535E-02	2.2499E-03	1.7427E-02	6.1297E-04	1.1963E+00	3.7724E-02
4.100	6.3535E-02	2.2499E-03	1.7980E-02	6.3136E-04	1.3980E+00	4.4052E-02
4.400	6.3535E-02	2.2499E-03	1.8573E-02	6.5100E-04	1.6159E+00	5.0880E-02
4.700	6.3535E-02	2.2499E-03	1.9204E-02	6.7188E-04	1.8498E+00	5.8207E-02
5.000	6.3535E-02	2.2499E-03	1.9875E-02	6.9399E-04	2.0996E+00	6.6028E-02
5.300	6.3535E-02	2.2499E-03	2.0585E-02	7.1731E-04	2.3652E+00	7.4339E-02
5.600	6.3535E-02	2.2499E-03	2.1332E-02	7.4184E-04	2.6466E+00	8.3137E-02
5.900	6.3535E-02	2.2499E-03	2.2118E-02	7.6756E-04	2.9436E+00	9.2418E-02
6.200	6.3535E-02	2.2499E-03	2.2942E-02	7.9447E-04	3.2560E+00	1.0218E-01
6.500	6.3535E-02	2.2499E-03	2.3803E-02	8.2255E-04	3.5839E+00	1.1241E-01
6.800	6.3535E-02	2.2499E-03	2.4702E-02	8.5180E-04	3.9270E+00	1.2312E-01
7.100	6.3535E-02	2.2499E-03	2.5637E-02	8.8221E-04	4.2853E+00	1.3430E-01
7.400	6.3535E-02	2.2499E-03	2.6609E-02	9.1376E-04	4.6587E+00	1.4594E-01
7.700	6.3535E-02	2.2499E-03	2.7618E-02	9.4645E-04	5.0471E+00	1.5804E-01
8.000	6.3535E-02	2.2499E-03	2.8664E-02	9.8027E-04	5.4503E+00	1.7060E-01
8.300	6.3535E-02	2.2499E-03	2.9220E-02	9.9891E-04	5.7945E+00	1.8132E-01
8.600	6.3535E-02	2.2499E-03	2.9794E-02	1.0181E-03	6.0549E+00	1.8943E-01
8.900	6.3535E-02	2.2499E-03	3.0387E-02	1.0379E-03	6.2778E+00	1.9637E-01
9.000	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.3481E+00	1.9856E-01
9.000	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.3482E+00	1.9856E-01
9.400	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.5274E+00	2.0414E-01
9.700	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.5841E+00	2.0590E-01
10.000	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.6116E+00	2.0676E-01
10.300	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.6249E+00	2.0717E-01
24.000	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.6373E+00	2.0757E-01
96.000	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.6373E+00	2.0757E-01
720.000	6.3535E-02	2.2499E-03	3.0589E-02	1.0446E-03	6.6373E+00	2.0757E-01

Worst Two-Hour Doses

#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	2.5157E-04	6.3535E-02	2.2499E-03

ATTACHMENT V MSLBFFCS 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
0.333	1.0321E-02	1.1715E-02	2.4296E-03	2.7578E-03	2.7794E-02	3.1019E-02
0.500	1.5483E-02	1.7574E-02	3.6449E-03	4.1373E-03	5.6144E-02	6.2659E-02
0.800	2.4773E-02	2.8119E-02	5.8319E-03	6.6197E-03	1.1259E-01	1.2566E-01
1.100	3.4062E-02	3.8663E-02	8.0187E-03	9.1019E-03	1.7274E-01	1.9278E-01
1.400	4.3350E-02	4.9206E-02	1.0205E-02	1.1584E-02	2.3458E-01	2.6180E-01
1.700	5.2638E-02	5.9748E-02	1.2392E-02	1.4066E-02	2.9721E-01	3.3170E-01
2.000	6.1925E-02	7.0290E-02	1.4578E-02	1.6547E-02	3.6020E-01	4.0200E-01
2.300	6.1925E-02	7.0290E-02	1.4720E-02	1.6708E-02	4.2058E-01	4.6938E-01
2.600	6.1925E-02	7.0290E-02	1.4862E-02	1.6869E-02	4.7753E-01	5.3294E-01
2.900	6.1925E-02	7.0290E-02	1.5004E-02	1.7030E-02	5.3290E-01	5.9474E-01
3.200	6.1925E-02	7.0290E-02	1.5146E-02	1.7191E-02	5.8754E-01	6.5571E-01
3.500	6.1925E-02	7.0290E-02	1.5288E-02	1.7352E-02	6.4183E-01	7.1631E-01
3.800	6.1925E-02	7.0290E-02	1.5429E-02	1.7513E-02	6.9597E-01	7.7673E-01
4.100	6.1925E-02	7.0290E-02	1.5571E-02	1.7674E-02	7.5003E-01	8.3706E-01
4.400	6.1925E-02	7.0290E-02	1.5713E-02	1.7835E-02	8.0405E-01	8.9735E-01
4.700	6.1925E-02	7.0290E-02	1.5855E-02	1.7996E-02	8.5806E-01	9.5762E-01
5.000	6.1925E-02	7.0290E-02	1.5997E-02	1.8157E-02	9.1205E-01	1.0179E+00
5.300	6.1925E-02	7.0290E-02	1.6138E-02	1.8318E-02	9.6604E-01	1.0781E+00
5.600	6.1925E-02	7.0290E-02	1.6280E-02	1.8479E-02	1.0200E+00	1.1384E+00
5.900	6.1925E-02	7.0290E-02	1.6422E-02	1.8640E-02	1.0740E+00	1.1986E+00
6.200	6.1925E-02	7.0290E-02	1.6564E-02	1.8801E-02	1.1280E+00	1.2589E+00
6.500	6.1925E-02	7.0290E-02	1.6705E-02	1.8962E-02	1.1819E+00	1.3191E+00
6.800	6.1925E-02	7.0290E-02	1.6847E-02	1.9123E-02	1.2359E+00	1.3793E+00
7.100	6.1925E-02	7.0290E-02	1.6989E-02	1.9283E-02	1.2899E+00	1.4395E+00
7.400	6.1925E-02	7.0290E-02	1.7131E-02	1.9444E-02	1.3438E+00	1.4997E+00
7.700	6.1925E-02	7.0290E-02	1.7272E-02	1.9605E-02	1.3978E+00	1.5600E+00
8.000	6.1925E-02	7.0290E-02	1.7414E-02	1.9766E-02	1.4517E+00	1.6202E+00
8.300	6.1925E-02	7.0290E-02	1.7487E-02	1.9850E-02	1.4961E+00	1.6697E+00
8.600	6.1925E-02	7.0290E-02	1.7560E-02	1.9934E-02	1.5284E+00	1.7058E+00
8.900	6.1925E-02	7.0290E-02	1.7632E-02	2.0018E-02	1.5552E+00	1.7356E+00
9.000	6.1925E-02	7.0290E-02	1.7657E-02	2.0046E-02	1.5634E+00	1.7448E+00
9.300	6.1925E-02	7.0290E-02	1.7657E-02	2.0046E-02	1.5805E+00	1.7639E+00
9.600	6.1925E-02	7.0290E-02	1.7657E-02	2.0046E-02	1.5884E+00	1.7727E+00
9.900	6.1925E-02	7.0290E-02	1.7657E-02	2.0046E-02	1.5921E+00	1.7768E+00
10.200	6.1925E-02	7.0290E-02	1.7657E-02	2.0046E-02	1.5938E+00	1.7787E+00
24.000	6.1925E-02	7.0290E-02	1.7657E-02	2.0046E-02	1.5952E+00	1.7803E+00
96.000	6.1925E-02	7.0290E-02	1.7657E-02	2.0046E-02	1.5952E+00	1.7803E+00
720.000	6.1925E-02	7.0290E-02	1.7657E-02	2.0046E-02	1.5952E+00	1.7803E+00

Worst Two-Hour Doses
#####

eab

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.2538E-03	6.1925E-02	7.0290E-02

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

CONTROLLED
COPY

CA06452 Rev D
Page 90

CALVERT CLIFFS NUCLEAR POWER PLANT

TECHNICAL PROCEDURE

ENGINEERING TEST PROCEDURE

UNIT 0

ETP 97-064R

CONTROL ROOM HVAC SYSTEM INLEAKAGE TEST

REVISION 0

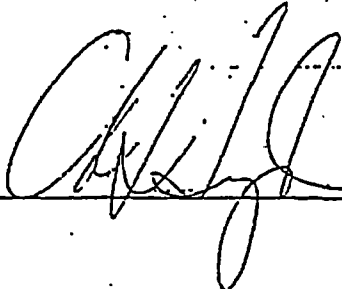
Effective Date 11/11/1997

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_i): 19.0 ppb
 Ending concentration (C_f): 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

95% Confidence Interval

(A) = 0.0170 ± 0.00124000 < Q < 4600

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

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

FT-86 (Rev. 1 10/97)

ACU #12

NUCON International, Inc.

Decay Test Data

Estimated duration of test: 1.4 hours
 Beginning concentration (C_i): 40.5 ppb
 Ending concentration (C₀): 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 < Q < 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 M. 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

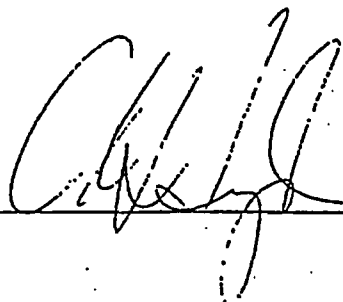
Safety Related X
Non-Safety Related

**CONTROLLED
COPY**

Writer: D. T. McElheny

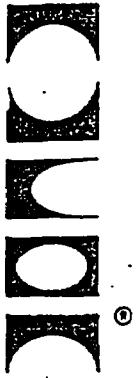
Sponsor: V. P. Spunar

Approved



Date

11/11/97



Att. 1 Chron Log
Page 3 of 7
NUCON International, Inc.

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

CA06452 Rev D

Page 94

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 (C_t): 25.0 ppb
 Ending concentration (C₀): 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.
<u>22:03 / 25.0</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>22:23 / 17.9</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>22:43 / 11.9</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>23:03 / 9.7</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>23:23 / 9.0</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>23:43 / 5.7</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>00:03 / 4.1</u>	<u>/</u>	<u>/</u>	<u>/</u>

(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

$$3000 < Q < \frac{4300}{* 4200}$$

10.2m

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. DMM*

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

Decay Test Data

Estimated duration of test: 120 minutes
 Beginning concentration (C_i): 47 ppb
 Ending concentration (C₀): 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.
02:05 / 47.0	/	/	/
02:25 / 33.2	/	/	/
02:45 / 27.4	/	/	/
03:05 / 24.8	/	/	/
03:25 / 21.4	/	/	/
03:45 / 16.1	/	/	/
04:05 / 12.6	/	/	/

(A) Air Change Rate (1/min)

0.0101

(Q) Inleakage Flow Rate (CFM)

2550

95% Confidence Limit

95% Confidence Interval

(A) = 0.0101 ± 0.00182100 < 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

4th
Run of
ETP

Effective Date 11/11/1997

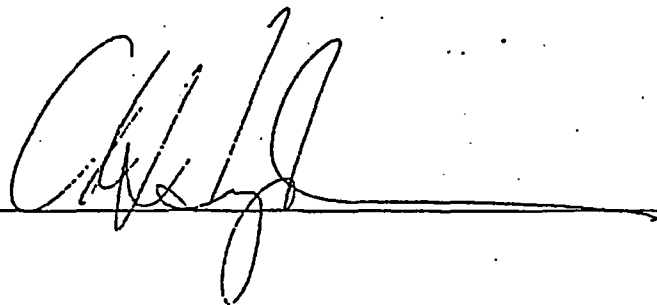
Safety Related X
Non-Safety Related

**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 11

CA06452 Rev.0

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 (C_i): 37.5 ppb
 Ending concentration (C₀): 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 (min⁻¹)0.0115

(Q) Inleakage Flow Rate (CFM)

2,900

95% Confidence Limit

95% Confidence Interval

(A) = 0.0115 ± .00102650 < Q < 3150

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

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

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**95% Confidence Limit****(A) =** 0.0109 \pm .0015**(Q) Inleakage Flow Rate (CFM)**2.750**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.

CALVERT CLIFFS NUCLEAR POWER PLANT
TECHNICAL PROCEDURE
ENGINEERING TEST PROCEDURE
UNIT 0
ETP 97-064R
CONTROL ROOM HVAC SYSTEM INLEAKAGE TEST
REVISION 1

CA06452 Rev. 0
Page 101

File 88-185
Rev'd by 1744

5901 - AL.

Effective Date 1/18/00

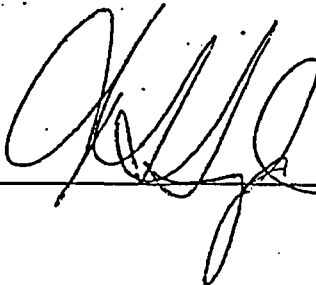
Safety Related X
Non-Safety Related

CONTROLLED COPY

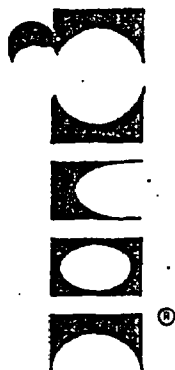
Writer: D. T. McElheny

Sponsor: T. R. Lupold

Approved



1 1/18/00
Date



NUCON International, Inc.

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

Attachment 1
Page 2 of 14

CA06452 Rev D Page 102
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

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 (Ct): 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.
<u>/</u>	<u>120/23.8</u>	<u>/</u>	<u>/</u>
<u>30/ 51.4</u>	<u>135/21.0</u>	<u>/</u>	<u>/</u>
<u>45/ 47.6</u>	<u>150/17.8</u>	<u>/</u>	<u>/</u>
<u>60/ 41.9</u>	<u>165/16.4</u>	<u>/</u>	<u>/</u>
<u>75/ 33.0</u>	<u>180/13.2</u>	<u>/</u>	<u>/</u>
<u>90/ 30.7</u>	<u>/</u>	<u>/</u>	<u>/</u>
<u>105/ 29.3</u>	<u>/</u>	<u>/</u>	<u>/</u>

(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 (Ct): 59.2 ppb @ 15 minutes into test
Ending concentration (C(O)): 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 \pm 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 Freeman Eric M. Banks 3 March 00
Test personnel signature(s) and date: NUCON International Inc.

ATTACHMENT X
ETP 01-035R PERFLUOROCARBON TRACER GAS TESTING

CALVERT CLIFFS NUCLEAR POWER PLANT

TECHNICAL PROCEDURE

ENGINEERING TEST PROCEDURE

UNIT 0

ETP 01-035R

PERFLUOROCARBON TRACER GAS TESTING

REVISION 0

CA06452 Rev.0

Page 106

**CONTROLLED
COPY**

Effective Date 5/1/02

Safety Related X
Non-Safety Related

Writer: D. T. McElheny

Sponsor: M. A. Junge

Approved

Richard L. Speller

1 5-1-02
Date

CA06452 Alex O
Page 107TRACER 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 ± 185 cfm. Other flows, in cfm, were:

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

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 = %515878.1 q 85892.1(m³/h)
 OVERALL AIR EXCHANGE RATE = 1.461 q 0.251(1/h)

ZONE LOCATION	SOURCE RATE @25C QTY	EXFILTRATION RATE	INFILTRATION RATE	ACH	SD
(nL/m)	(nL/h)	(m ³ /h)	(m ³ /h)	(/h)	
CR	%663.0 1	41812	3170.4 797.9	464.8 379.6	0.055 0.04
AB	%3858.0 4	973219	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	2.348 0.246

ZONE-ZONE	RATE	q	SD (m ³ /h)	ZONE-ZONE	RATE	q	SD (m ³ /h)
1-2	622.2	421.7		2-1	741.3	267.9	
1-3	1018.1	704.6		3-1	792.5	292.2	
1-4	74.5	56.7		4-1	462.9	227.7	
1-5	32.3	5.2		5-1	464.8	56.1	
1-6	19.5	13.7		6-1	657.3	64.0	
1-7	36.5	16.9		7-1	1389.7	1933.9	
2-3	2870.3	1460.4		3-2	145.4	465.7	
2-4	31.1	69.4		4-2	378.6	448.3	
2-5	12.0	6.0		5-2	334.0	256.8	
2-6	11.1	21.7		6-2	314.4	249.1	
2-7	552.1	220.7		7-2	611.4	556.4	
3-4	17034.4	%111524.3		4-3	154.4	133.2	
3-5	163.4	115.6		5-3	807.0	235.6	
3-6	8416.2	1965.2		6-3	1002.9	424.6	
3-7	215.4	133.1		7-3	12671.2	%111136.9	
4-5	60.1	35.6		5-4	138.1	86.7	
4-6	12.7	6.5		6-4	755.3	506.8	
4-7	30.9	19.1		7-4	-541.5	547.4	
5-6	60.8	11.3		6-5	125.9	120.7	
5-7	22.3	7.0		7-5	27.6	62.7	
6-7	91.1	20.9		7-6	7.0	214.7	

ZONE	RATE	q	SD (m ³ /h)	ACH	q	SD(/h)	ZONE	RATE	q	SD (m ³ /h)	ACH	q	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 ± 18 S cm

VOL SOURCE TYPE	AVG TRACER CONC.	PTPCH	PMCP	PDCB	T-PTCH	PMCH	ocPDCB	IPPCH
m ³	(pL/L) q SD							
8480 pTPCH	3.447 q 0.403	4.466 q 0.173	2.352 q 0.111	0.786 q 0.078	0.386 q 0.014	0.101 q 0.005	0.106 q 0	
48110 PMCP	0.151 q 0.088	27.815 q 9.791	0.174 q 0.085	0.103 q 0.090	0.046 q 0.026	0.009 q 0.004	0.008 q 0	
283000 PDCB	0.021 q 0.013	0.219 q 0.049	7.784 q 1.632	0.006 q 0.001	0.009 q 0.001	0.002 q 0.001	0.011 q 0	
1223 T-PTCH	0.043 q 0.011	0.196 q 0.026	5.846 q 2.452	8.164 q 3.895	0.033 q 0.009	0.025 q 0.011	0.000 q 0	
1692 PMCH	0.009 q 0.001	0.017 q 0.003	0.067 q 0.021	0.016 q 0.005	4.065 q 0.389	0.008 q 0.003	0.000 q 0	
3622 ocPDCB	0.020 q 0.001	0.129 q 0.010	3.764 q 0.299	0.010 q 0.001	0.019 q 0.002	0.725 q 0.035	0.006 q 0	
75 IPPCH	0.023 q 0.007	0.888 q 0.143	0.136 q 0.054	0.019 q 0.005	0.008 q 0.001	0.004 q 0.001	0.387 q 0	

CATS	ptPDCH	PMCP	PMCH	Y-PTCH	PMCH	ocPDCH	IPPCCH	otPDCH	mtPDCH	MPDCH	2-PTCH	
4777	7.147	3.699	2.656	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	9.453	8.384	0.223	
12400	9.277	4.610	2.428	0.808	0.415	0.109	0.107	0.000	10.964	9.738	0.244	
12321	8.890	4.691	2.325	0.794	0.391	0.106	0.109	0.000	10.545	9.361	0.238	
12055	8.689	4.280	2.432	0.804	0.393	0.104	0.122	0.000	10.329	9.185	0.241	
12631	8.324	4.340	2.500	0.777	0.379	0.101	0.123	0.000	9.886	8.765	0.232	
10181	8.262	4.382	2.327	0.758	0.425	0.107	0.103	0.000	9.774	8.664	0.232	
12057	8.446	4.598	2.370	0.978	0.388	0.101	0.105	0.000	10.017	8.883	0.304	
11079	7.998	4.410	2.484	0.712	0.394	0.096	0.096	0.000	9.357	8.289	0.218	
1328	8.062	4.327	2.169	0.721	0.383	0.093	0.100	0.000	9.420	8.346	0.221	
938	8.415	4.409	2.298	0.777	0.392	0.100	0.105	0.000	9.924	8.800	0.237	
520	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	0.528	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
5644	8.586	2.498	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	1.035	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	3.844	3.458	0.082	DELETED
12497	2.791	1.637	1.829	0.249	1.879	0.106	0.034	0.000	3.014	2.637	0.070	DELETED
12188	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	
12264	0.143	35.832	0.214	0.202	0.057	0.013	0.008	0.000	0.000	0.000	0.056	
12376	0.167	43.634	0.244	0.257	0.030	0.006	0.008	0.000	0.000	0.000	0.072	
12297	0.522	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	0.308	0.269	0.188	DELETED
12379	0.835	30.172	0.222	0.061	0.088	0.012	0.005	0.000	0.408	0.357	0.017	
12012	1.489	20.586	0.519	0.175	0.285	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	
12155	0.107	26.430	0.094	0.044	0.031	0.003	0.003	0.000	0.181	0.159	0.012	
12384	0.507	0.312	4.404	0.044	0.923	0.253	0.011	0.000	0.688	0.600	0.012	DELETED
12118	4.131	2.583	1.088	0.367	0.203	0.049	0.067	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
2016	0.122	16.960	0.214	0.018	0.014	0.012	0.016	0.000	0.177	0.155	0.006	
11151	0.018	0.204	5.908	0.005	0.010	0.002	0.026	0.000	0.020	0.018	0.002	
9590	0.019	0.397	7.035	0.005	0.009	0.002	0.006	0.000	0.025	0.022	0.002	
12402	0.020	0.176	7.297	0.006	0.010	0.002	0.009	0.000	0.026	0.023	0.002	
12337	0.014	0.156	6.492	0.004	0.009	0.002	0.004	0.000	0.020	0.018	0.002	
12417	0.017	0.235	9.217	0.007	0.009	0.003	0.006	0.000	0.024	0.022	0.002	
12425	0.030	0.205	8.388	0.008	0.010	0.003	0.005	0.000	0.038	0.034	0.003	
12468	0.052	0.381	15.438	0.009	0.009	0.004	0.008	0.000	0.064	0.057	0.003	DELETED
12383	0.015	0.195	6.342	0.005	0.007	0.001	0.011	0.000	0.021	0.019	0.002	
12203	0.055	0.320	10.741	0.008	0.009	0.003	0.004	0.000	0.056	0.050	0.003	
12178	0.013	0.279	9.691	0.006	0.009	0.001	0.005	0.000	0.019	0.017	0.002	
12288	0.091	0.882	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	
12022	0.051	0.215	7.580	0.026	0.018	0.000	0.000	0.000	0.000	0.000	1.799	
12156	0.036	0.177	4.112	10.938	0.039	0.033	0.000	0.000	0.000	0.000	3.610	
1818	0.009	0.019	0.081	0.020	4.340	0.005	0.001	0.000	0.019	0.017	0.006	
8706	0.008	0.015	0.052	0.017	3.780	0.001	0.000	0.000	0.014	0.012	0.004	
1319	0.020	0.139	3.849	0.011	0.018	0.751	0.006	0.000	0.877	0.591	0.004	
707	0.020	0.128	4.011	0.009	0.021	0.685	0.006	0.000	0.612	0.534	0.004	
1281	0.019	0.120	3.432	0.009	0.017	0.739	0.005	0.000	0.667	0.582	0.004	
12340	0.013	0.970	0.178	0.023	0.010	0.004	0.325	0.000	0.027	0.025	0.006	
12502	0.016	1.129	0.208	0.027	0.009	0.005	0.378	0.000	0.034	0.031	0.008	
12307	0.024	0.751	0.080	0.015	0.007	0.004	0.399	0.000	0.040	0.035	0.005	
12300	0.031	0.880	0.095	0.019	0.008	0.004	0.385	0.000	0.046	0.041	0.006	
2158	0.019	0.963	0.182	0.022	0.007	0.005	0.392	0.000	0.038	0.034	0.007	
6706	0.017	0.942	0.173	0.022	0.008	0.005	0.389	0.000	0.037	0.033	0.007	
7750	0.029	0.728	0.084	0.013	0.007	0.003	0.332	0.000	0.044	0.039	0.004	
10831	0.031	0.732	0.085	0.015	0.006	0.003	0.339	0.000	0.043	0.036	0.005	

F.: PDCH PMCP PMCH ocPDCH ptPDCH MPDCH PTCH COEFFICIENTS FILE
 0.74 0.74 0.82 0.62 0.65 0.88 0.71 6C177

***** NOTES *****

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

(DC)/N = 1.136

onal condition numbers are:

ONE	2	3	4	5	6	
Condition Number	1.083	1.017	1.379	1.248	1.005	1.124
1.044						

CA06452 Rev.0 Page 110

FLOW-RATIOS STD.DEV.

FILTREN/EXFILTREN

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

PERZONAL

2/ 2- 1	0.639	0.4851
3/ 3- 1	1.285	0.9277
4/ 4- 1	0.181	0.0969
5/ 5- 1	0.069	0.0093
6/ 6- 1	0.029	0.0209
7/ 7- 1	0.026	0.0122
3/ 3- 2	19.743	62.9947
4/ 4- 2	0.082	0.1957
5/ 5- 2	0.036	0.0273
6/ 6- 2	0.036	0.0723
7/ 7- 2	0.903	0.7688
4/ 4- 3	110.353	89.6471
5/ 5- 3	0.203	0.1401
6/ 6- 3	8.392	3.1448
7/ 7- 3	0.017	0.0174
- 4	0.435	0.2269
6/ 6- 4	0.017	0.0085
7/ 7- 4	-0.057	0.0552
6/ 6- 5	0.483	0.4655
7/ 7- 5	0.809	1.8474
7/ 7- 6	12.975	396.7011

STANDARD DEVIATION OF ptPDCH IN ZONE 2 IS GREATER THAN 25 %
 STANDARD DEVIATION OF ptPDCH IN ZONE 3 IS GREATER THAN 25 %
 STANDARD DEVIATION OF ptPDCH IN ZONE 4 IS GREATER THAN 25 %
 STANDARD DEVIATION OF ptPDCH IN ZONE 7 IS GREATER THAN 25 %
 STANDARD DEVIATION OF PMCP IN ZONE 2 IS GREATER THAN 25 %
 STANDARD DEVIATION OF PDCB IN ZONE 2 IS GREATER THAN 25 %
 STANDARD DEVIATION OF PDCB IN ZONE 4 IS GREATER THAN 25 %
 STANDARD DEVIATION OF PDCB IN ZONE 5 IS GREATER THAN 25 %
 STANDARD DEVIATION OF PDCB IN ZONE 7 IS GREATER THAN 25 %
 STANDARD DEVIATION OF T-PTCH IN ZONE 2 IS GREATER THAN 25 %
 STANDARD DEVIATION OF T-PTCH IN ZONE 4 IS GREATER THAN 25 %
 STANDARD DEVIATION OF T-PTCH IN ZONE 5 IS GREATER THAN 25 %
 STANDARD DEVIATION OF PMCH IN ZONE 2 IS GREATER THAN 25 %
 STANDARD DEVIATION OF PMCH IN ZONE 4 IS GREATER THAN 25 %
 STANDARD DEVIATION OF ocPDCH IN ZONE 2 IS GREATER THAN 25 %
 STANDARD DEVIATION OF ocPDCH IN ZONE 3 IS GREATER THAN 25 %
 STANDARD DEVIATION OF ocPDCH IN ZONE 4 IS GREATER THAN 25 %
 STANDARD DEVIATION OF ocPDCH IN ZONE 5 IS GREATER THAN 25 %
 STANDARD DEVIATION OF IPPCH IN ZONE 2 IS GREATER THAN 25 %
 STANDARD DEVIATION OF IPPCH IN ZONE 3 IS GREATER THAN 25 %
 STANDARD DEVIATION OF IPPCH IN ZONE 5 IS GREATER THAN 25 %