INL/EXT-20-61119-Revision-0



# **Evaluation of the MARVEL Reactor Inhalation Dose Consequences**

#### August 2020

Troy P Reiss



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## Evaluation of the MARVEL Reactor Inhalation Dose Consequences

**Troy P Reiss** 

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http://www.inl.gov

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#### Evaluation of the MARVEL Reactor Inhalation Dose Consequences

1.	Effective Date	TBD	Professional Engineer's Stamp
2.	Does this ECAR involve a Safety SSC?	No	
3.	Safety SSC Determination Document ID	N/A	
4.	SSC ID	N/A	
5.	Project No.		
6.	Engineering Job (EJ) No.	N/A	
7.	Building	MFC-720	
8.	Site Area	INL	

#### 9. Objective / Purpose

The following dose consequence analysis is performed to support the preliminary Microreactor Applications Research Validation and Evaluation Project (MARVEL) design effort. The purpose of the MARVEL project is to develop a nuclear microreactor applications test bed at Idaho National Laboratory (INL) to perform research and development on various operational features of microreactors to ultimately improve integration of microreactors to end-user applications. The MARVEL concept is a 100 kilowatt (kW) thermal (kWth) and approximately 20-kW electric (kWe) generating microreactor. The MARVEL system will be located in the INL TREAT facility in the north high-bay equipment pit.

This ECAR considers the bounding release fractions of the MARVEL reactor concept and documents the dose consequences to the public and collocated worker.

10. If revision, please state the reason and list sections and/or page being affected.  $N\!/\!A$ 

11. Conclusion / Recommendations

The bounding release fractions for the MARVEL reactor are documented in this report. The inhalation dose consequences for MARVEL is documented below.

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## **PROJECT ROLES AND RESPONSIBILITIES**

Project Role	Name	Organization	Pages Covered (if applicable)
Performer	Troy P. Reiss	H350	See eCR 679311
Checker <sup>a</sup>	Doug Gerstner	H372	See eCR 679311
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CUI Reviewer <sup>c</sup>	Steven Martinson	F510	See eCR 679311
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Requestor <sup>ef</sup>	Yasir Arafat	C140	See eCR 679311
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Document Owner <sup>f</sup>	Jason P. Andrus	H350	See eCR 679311
Reviewer <sup>f</sup>	James Parry	U020	See eCR 679311
Reviewer <sup>f</sup>	James R. Biggs	U021	See eCR 679311

#### **Responsibilities:**

a. Confirmation of completeness, mathematical accuracy, and correctness of data and appropriateness of assumptions.

b. Concurrence of method or approach. See definition, LWP-10106.

- c. Concurrence with the document's markings in accordance with LWP-11202.
- d. Concurrence of procedure compliance. Concurrence with method/approach and conclusion.
- e. Authorizes the commencement of work of the engineering deliverable. See Appendix A.

f. Concurrence with the document's assumptions and input information. See definition of Acceptance, LWP-10200.

**NOTE:** Delete or mark "N/A" for project roles not engaged. Include ALL personnel and their roles listed above in the eCR system. The list of the roles above is not all inclusive. If needed, the list can be extended or reduced.

## **1** SCOPE AND BRIEF DESCRIPTION

The following dose consequence analysis is performed to support the preliminary Microreactor Applications Research Validation and Evaluation Project (MARVEL) design effort. The purpose of the MARVEL project is to develop a nuclear microreactor applications test bed at Idaho National Laboratory (INL) to perform research and development on various operational features of microreactors to ultimately improve integration of microreactors to end-user applications. The MARVEL concept is a 100 kilowatt (kW) thermal (kWth) and approximately 20-kW electric (kWe) generating microreactor. The MARVEL system will be located in the INL Transient Reactor Test (TREAT) facility in the north high-bay equipment pit.

This ECAR considers the bounding release fractions of the MARVEL reactor concept and documents the dose consequences to the public and collocated worker.

## 2 DESIGN OR TECHNICAL PARAMETER INPUT AND SOURCES

Technical parameter input and sources are identified in the text as appropriate.

## **3** RESULTS OF LITERATURE SEARCHES AND OTHER BACKGROUND DATA

The documents used to develop radionuclide inventories and bounding dose consequences are identified in the text as appropriate.

## **4** ASSUMPTIONS

Assumptions are described in the text as appropriate.

## **5 COMPUTER CODE VALIDATION**

- A. Computer type: Dell Latitude 7400 Property Tag Number: 611704
- B. Operating System and Version: Windows 10 Enterprise
- C. Computer program name and revision: Radiological Safety Analysis Computer Program (RSAC) 7.2. RSAC 7.2 program is a radiological safety analysis program that has been used extensively at INL for calculating the doses to facility workers, collocated workers, and off-site public due to radiological releases. It has been independently verified and validated for these types of calculations. Evidence of, or reference to, computer program validation: RSAC 7.2 configuration management is maintained in Enterprise Architecture under configuration number 223954. RSAC 7.2 was used to calculate final dose consequences for this ECAR. Case study verification for program installation on each computer platform was successfully completed by running each of the 20 example problems under the RSAC QC menu option.

## 6 DISCUSSION/ANALYSIS

#### 6.1 Release Scenarios

The release scenarios for microreactors analyzed in this document consist of fuel failure events coupled with a reactor boundary breach. The intent of this ECAR is to provide bounding fuel release calculation and not consider other confinement barriers. The release scenarios were evaluated for the distances documented in SAR-420, "Transient Reactor Test (TREAT) Facility FSAR."<sup>1</sup>

- Collocated worker: 100 m, 300 m
- TREAT control room: 770 m
- Materials and Fuels Complex (MFC): 1,000 m
- Exclusion area boundary (EAB): 6,000 m
- Low population zone (LPZ): 32 km
- Idaho Falls: 48 km

#### 6.2 Release Parameters

The accident-specific parameters used to evaluate the dose to downwind receptors requires that certain assumptions be made that modify the dispersion release fraction due to the physical aspects of the release. The five components of the following source term equation recommended by DOE-HDBK-3010-94, "Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities,"<sup>2</sup> contain the basis for the material release parameters. To calculate downwind radiological doses for these scenarios, a source term (ST) was determined. The ST is the amount of radioactive material released during the postulated accident scenario. The STs are determined using the following equation:

$$ST = MAR \times DR \times ARF \times RF \times LPF$$

Where:

ST	=	source term
MAR	=	material-at-risk
DR	=	damage ratio
ARF	=	airborne release fraction
RF	=	respirable fraction
LPF	=	leak path factor

#### 6.3 Material-at-Risk

The material-at-risk (MAR) is the total inventory that could be impacted for a given accident scenario and is expressed in terms of total quantity at risk. The radiological inventory used for this accident analysis is from ECAR-XXXX and is a reactor run calculated for seven million megajoules (MJ), which is two years of 24/7 operation at ~111 kW. The MAR is shown in the RSAC output files in Appendix A.

#### 6.4 Damage Ratio

The damage ratio (DR) represents the fraction of MAR that could be affected by the postulated accident and is a function of the accident initiator and the operational scenario being evaluated. DRs are determined based on engineering judgment, best available information, and prior analyses. The DR for all scenarios is evaluated at 1.0. It assumes that the events are significant enough such that 100% of the ST MAR is damaged enough to be released.

#### 6.5 Airborne Release Fraction

The ARF is the coefficient used to estimate the amount of material suspended in the air as an aerosol, thus available for transport. The ARF is related to the physical stresses of a specific accident and the physical characteristics of the material involved in the accident. The ARF values were taken from LA-UR-18-28899, "Kilopower Space Reactor Launch Safety Maximum Credible Dose for a Criticality Accident."<sup>3</sup> The ARF values are listed in Table 1.

#### 6.6 Respirable Fraction

The RF is the fraction of airborne particles that can be transported through air and inhaled into the pulmonary region of the human respiratory system. The RF includes particles having a 10-µm aerodynamic equivalent diameter or less. The RF values are listed in Table 1.

#### 6.7 Leak Path Factor

The LPF is the fraction of material in the aerosol transported through some confinement deposition or filtration mechanism. Typically, this factor accounts for the amount of the airborne MAR that escapes from a building or room. LPFs are assumed to be 1.0 to ensure an unmitigated analysis.

		1				
Group No.	Group Name	Rep. Ele.	Elements in Group	ARF×RF		
1	Noble Gases	Xe	Xe, Kr, He, Ne, Ar, Rn, H	7.5E-1		
2	Alkali Metals	Cs	Cs, Rb, Li, K, Fr, Na	7.0E-1		
3	Alkali Earths	Ва	Ba, Sr, Mg, Ca, Ra, Be	4.0E-2		
4	Halogens	Ι	I, F, Cl, Br, At	7.0E-1		
5	Chalogens	Те	Te, S, Se, O, Po, N	4.5E-1		
6	Platinoids	Ru	Ru, Rh, Pd, Os, Ir, Pt, Au, Ni	4.0E-2		
7	Transition	Мо	Mo, V, Cr, Fe, Co, Mn, Nb, Tc	4.0E-2		
	Metals					
8	Tetravalent	Ce	Ce, Ti, Zr, Hf, Th, Pa, U, Np Pu	4.0E-2		
9	Trivalent	La	La, Al, Sc, Y, Ac, Pr, Nd, Pm, Sm, Eu, Gd,	4.0E-2		
			Tb, Dy, Ho, Er, Tm, Yb, Lu, Am, Bk, Cf			
10	Main Group I	Cd	Cd, Hg, Zn, As, Sb, Pd, Tl, Bi	4.0E-2		
11	Main Group II	Sn	Sn, Ca, In, Ag	4.0E-2		
12	Boron	В	B, Si, P, C	4.0E-2		
The release fractions were determined from two respects distriction events. The first is the CNIADED AND test						

Table 1. Airborne release fractions and respirable fractions.

The release fractions were determined from two reactor destruction events. The first is the SNAPTRAN-2 test using a zirconium hydride and 10 weight percent of highly enriched (93 percent) uranium fuel. A nearly instantaneously reactivity addition of ~5 dollars increased the reactor power to 74,000 MW in approximately 0.75 m/sec which caused reactor disassembly. The second is the KIWI-TNT destructive test using a UC<sub>2</sub> fuel. The KIWI-TNT destructive test was a ~\$8 insertion of reactivity to the KIWI reactor resulting in reactor disassembly. The resulting fission product plumes was tracked and quantified to give the release fractions. Although the fuel compositions are different from MARVEL, the release fractions are judged to provide a bounding radioactive material release for the MARVEL fuel.

#### 6.8 Committed Effective Dose

The committed effective dose (CED) for downwind receptors is estimated from:

CED	=	$ST \times \chi/Q \times BR \times DCF \times DDF$
CED	=	committed effective dose
ST	=	source term (Ci)
χ/Q	=	plume dispersion (s/m <sup>3</sup> )
BR	=	breathing rate (m/s <sup>3</sup> )
DCF	=	dose conversion factor (rem/ci)
DDF	=	fraction of radionuclide remaining in plume after dry deposition (no units)

The  $\chi/Q$  plume dispersion value is a function of the meteorological conditions involved in the accident and relative location of the release point and the receptor and is calculated in RSAC.  $\chi/Q$  is considered to be constant for all radionuclides of respirable size in an event and is independent of particular radionuclide and source types. Breathing rate (BR) is the assumed breathing rate described in DOE O 440.1B, "Worker

Protection Program for DOE,<sup>\*\*4</sup> and is 3.33E-4 m<sup>3</sup>/sec. ICRP-68, "Dose Coefficients for Intakes of Radionuclides by Workers,<sup>\*\*5</sup> dose conversion factor (DCF) values were utilized in the CED calculation for facility and collocated workers, and ICRP-72, "Age-dependent Doses from Intakes of Radionuclides,<sup>\*\*6</sup> DCF values were utilized in the calculation of the CED for the public. In both cases, the RSAC default DCF, the DCF for the lung absorption type that would result in the highest dose, was selected. The dry deposition factor (DDF) accounts for the material that is removed from the plume via deposition on the ground and accounts only for plume depletion that is expected to occur, independent of weather conditions.

#### 6.9 Downwind Exposures

RSAC-7 was used to quantify the doses of the postulated accidents. The program is used to calculate the doses from the release of radionuclides to the atmosphere. The meteorological capabilities of RSAC-7 include Gaussian plume diffusion for the Pasquill-Gifford, Hilsmeier-Gifford, and Markee diffusion models. The Markee model is used in this analysis for all scenarios because it was developed for INL sagebrush terrain for effluent releases from a few minutes to 15 minutes in duration. The RSAC input parameters are summarized in Table 2.

RSAC Input Parameters	Input Values
Release elevation (m)	0
Stability class	F
Wind speed (m/second)	1.04
Diffusion coefficient	Markee
Downwind receptor distance (m)	100, 300, 770, 1,000, 6,000, 32,000, and 48,000
Breathing rate (m <sup>3</sup> /second)	3.33E-04 (default parameter)

Table 2. RSAC parameters downwind scenario.

The RSAC-7 program allows the user to specify meteorological conditions at the time of radiological release and to calculate diffusion, dispersion, and depletion factors. It also allows the user to perform a variety of dose calculations. An internal dose can be calculated for up to 15 human organs in addition to the inhalation pathway.

Doses from the ingestion, ground contamination, and air immersion exposure pathways are negligible and are not calculated for on-site workers or off-site public. Contribution to the doses from long-term ingestion of farm or garden products is very small because implementation of the emergency preparedness program provides adequate warning to the off-site public about harvesting and ingesting foods that could be contaminated as a result of a radiological release.

Univariate distributions of wind conditions were developed by combining wind speed class and stability class into one variable (i.e., wind condition) and deriving the probability distribution of this variable.<sup>7</sup> Cumulative probability distributions were then developed based on rankings of the wind conditions, ranging from good to bad in terms of their effect on dispersion of airborne contaminants. Based on this work and 95% meteorology, a stability class of F and a wind speed class of 1 (i.e., 1.04 m/second) were used for the RSAC-7 runs.<sup>8</sup> A ground release was assumed for this scenario. Buoyant plume rise was not used. Receptor locations were at 100 m and 300 m downwind from the release for the collocated worker,

770 m for the TREAT control room, 1,000 m for MFC, 6,000 m for the off-site public dose (which is the nearest site boundary to TREAT), 32,000 m to the nearest LPZ (Mud Lake), and Idaho Falls at 48,000 m.

## 6.10 Bounding Inhalation Dose Consequences

The bounding inhalation dose consequences are listed below in Table 3. The scenario for the release considers a reactor operating at 111 kWth for two years continuously. An accident occurs where the reactor releases 100% of the radionuclide inventory instantly. All fission products and fuel activation products are in the fuel at the time of release; there is no plate-out in the coolant system, no cleanup system, and no chemical interactions with coolant. There is no decay time for the fuel.

		Collocated	
Release Distance	Source	Worker, rem	Public, rem
	CED	2.93E+02	
100 m	Cloud gamma	2.90E+00	
	Total	2.96E+02	
	CED	8.60E+01	
300 m	Cloud gamma	9.77E-01	
	Total	8.70E+01	
	CED	2.71E+01	
770 m	Cloud gamma	3.78E-01	
	Total	2.75E+01	
	CED	1.96E+01	
1,000 m	Cloud gamma	2.81E-01	
	Total	1.99E+01	
	CED		2.63E+00
6,000 m	Cloud gamma		2.33E-02
	Total		2.65E+00
	CED		4.01E-01
32,000 m	Cloud gamma		1.55E-03
	Total		4.03E-01
	CED		2.60E-01
48,000 m	Cloud gamma		8.55E-04
	Total		2.61E-01

Table 3. Inhalation dose consequences for MARVEL.

## 7 REFERENCES

- 1. SAR-420, "Transient Reactor Test (TREAT) Facility FSAR," current revision.
- 2. DOE-HDBK-3010-94, "Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities," Change 1, U.S. Department of Energy, March 2000.
- 3. LA-UR-18-28899, "Kilopower Space Reactor Launch Safety Maximum Credible Dose for a Criticality Accident," Los Alamos National Laboratory, August 2018.

- 4. DOE O 440.1B, "Worker Protection Program for DOE," Change 2, U.S. Department of Energy, March 2013.
- 5. ICRP-68, "Dose Coefficients for Intakes of Radionuclides by Workers," International Commission on Radiological Protection, 1994.
- 6. ICRP-72, "Age-Dependent Doses from Intakes of Radionuclides," International Commission on Radiological Protection, 1996.
- 7. DOE-STD-3009-2014, "Preparation of Nonreactor Nuclear Facility Documented Safety Analysis," U.S. Department of Energy, November 2014.
- 8. Einerson, J. J., *Air Dispersion Parameters for Use in Idaho National Engineering Laboratory Department of Energy Safety Analyses*, EGG-WM-11243, Rev. 1, Idaho National Engineering and Environmental Laboratory, August 1994.

## Appendix A

## **RSAC Output Files**

Evaluation of Microreactor Inhalation Dose Consequences

#### Figure A-1. MARVEL collocated worker RSAC output files.

Radiological Safety Analysis Computer Program (RSAC 7.2.0 )Name: Windows UserCompany: Idaho National LaboratoryComputer: INL611704Run Date: 06/11/2020File: Marvel SNAPTRAN CW\_2.rsac

#### Input

```
* MARVEL
# Assume 100% release of fuel and fission poducts using MARVEL source term.
# MARVEL Fuel Inventory
2000,-1,0
# Original file copied to temporary external file
2002, TempSrcl.txt
# 2002, C:\Users\REISTP\OneDrive - Idaho National
Laboratory\Microreactor\Marvel
2999
# ARF
1000
1001,1,0.,0.
1004,1,0.04
1101,18,0.75,85,0.7
1102,35,0.7,17,0.7
1103,55,0.7,9,0.7
1104,87,0.7,1,0.75
1105,53,0.7,19,0.7
1106,36,0.75,11,0.7
1107,84,0.45,37,0.7
1108,86,0.75,16,0.45
1109,51,0.04,34,0.45
1110,52,0.45,54,0.75
1999
# Conservative Dispersion
5000,0
5001,1.04,0.,400.,1.099E3,0.,1
5002,0.001,0.01,0.,0.001,0.001
5101,100.,300.,770.,1000.
5201,1.,0.
5400,2,0.,0.
5410,2,6,0,0.
5999
# Dose Consequence
7000,1,-1,1,0,2,7
7001,3.33E-04,0.,0,0,1.
7002,26
7999
# Cloud Gamma
```

Radiological Safety Analysis Computer Program (RSAC 7.2.0 )Name: Windows UserCompany: Idaho National LaboratoryComputer: INL611704Run Date: 06/11/2020File: Marvel SNAPTRAN CW\_2.rsac

Serial: 134684 Run Time: 15:49:09

9000,0,0. 10000

## **Direct Radionuclide Input**

P	REVIOUS :	INVENTORY IN	CREAS	SED BY THE FOLI	LOWING VALU	ES
RADI	ONUCLIDE	INPUT READ	FROM	EXTERNAL FILE	USER FILE	TempSrc1.txt
NUCL	IDE	HALF LI	FE	CURIE		
892250	Ac225	1.000E+01	d	6.430E-11		
892260	Ac226	2.937E+01	h	1.060E-12		
892270	Ac227	2.177E+01	yr	1.190E-08		
892280	Ac228	6.150E+00	h	8.550E-09		
471050	Ag105	4.129E+01	d	7.470E-16		
471060	Ag106	2.396E+01	m	7.320E-11		
471061	Ag106m	8.280E+00	d	1.650E-10		
471080	Ag108	2.382E+00	m	7.190E-06		
471081	Ag108m	4.380E+02	yr	6.840E-09		
471091	Ag109m	3.960E+01	S	6.300E+01		
471100	Ag110	2.460E+01	S	1.090E+00		
471101	Ag110m	2.498E+02	d	2.760E-02		
471110	Ag111	7.450E+00	d	2.360E+01		
471111	Ag111m	6.480E+01	S	2.370E+01		
471120	Ag112	3.130E+00	h	1.630E+01		
471130	Ag113	5.370E+00	h	1.060E+01		
471131	Ag113m	6.870E+01	S	1.550E+01		
471140	Ag114	4.600E+00	S	1.330E+01		
471150	Ag115	2.000E+01	m	1.290E+01		
471180	Ag118	3.760E+00	S	8.480E+00		
471181	Ag118m	2.000E+00	S	3.890E+00		
471190	Aq119	2.100E+00	S	8.470E+00		
471200	Aq120	3.200E-01	S	3.850E+00		
471210	Ag121	7.800E-01	S	3.200E+00		
471230	Ag123	3.000E-01	S	4.710E-01		
471240	Aq124	1.720E-01	S	5.820E-01		
471250	Aq125	1.660E-01	S	2.410E-02		
471260	Ag126	1.070E-01	S	4.790E-03		
471280	Aq128	5.800E-02	S	1.000E-04		
952390	Am239	1.190E+01	h	3.360E-11		
952400	Am240	5.080E+01	h	1.880E-07		
952410	Am241	4.326E+02	vr	1.960E-03		
952420	Am242	1.602E+01	h	3.690E-02		
	P RADI NUCL 892250 892260 892270 892280 471050 471060 471061 471081 471081 471091 47100 47101 471100 471101 471100 471110 471110 471130 471130 471130 471130 471130 471150 471180 471181 471190 471200 471210 471200 471210 471220 471220 471220 471220 471220 471220 471220 471220 471220	PREVIOUS         RADIONUCLIDE           NUCLIDE         892250         Ac225           892260         Ac227           892270         Ac227           892280         Ac228           471050         Ag105           471061         Ag106m           471081         Ag108m           471001         Ag100m           471101         Ag110           471101         Ag110m           471100         Ag111           471111         Ag111m           471120         Ag112           471131         Ag113m           471140         Ag113           471181         Ag118m           471180         Ag118           471180         Ag119           471200         Ag120           471200         Ag121           471200         Ag123           47	PREVIOUS INVENTORY IN           RADIONUCLIDE INPUT READ           NUCLIDE         HALF LI           892250         Ac225         1.000E+01           892260         Ac226         2.937E+01           892270         Ac227         2.177E+01           892280         Ac228         6.150E+00           471050         Ag105         4.129E+01           471061         Ag106         2.396E+01           471081         Ag108         2.382E+00           471091         Ag109m         3.960E+01           471101         Ag110         2.460E+01           471101         Ag110         2.498E+02           471110         Ag111         7.450E+00           471120         Ag112         3.130E+00           471130         Ag113         5.370E+00           471130         Ag113         5.370E+00           471140         Ag114         4.600E+00           471130         Ag113         5.370E+00           471140         Ag118         3.760E+01           471180         Ag118         3.760E+00           471180         Ag118         3.760E+00           471180         Ag123         3.000E-01 </th <th>PREVIOUS INVENTORY INCREAS           RADIONUCLIDE         INPUT READ FROM           NUCLIDE         HALF LIFE           892250         Ac225         1.000E+01         d           892260         Ac226         2.937E+01         h           892270         Ac227         2.177E+01         yr           892280         Ac228         6.150E+00         h           471050         Ag105         4.129E+01         d           471060         Ag106         2.396E+01         m           471080         Ag108         2.382E+00         m           471091         Ag109m         3.960E+01         s           471100         Ag110         2.460E+01         s           471101         Ag110m         2.498E+02         d           471110         Ag111         7.450E+00         h           471120         Ag112         3.130E+00         h           471130         Ag113         5.370E+00         h           471130         Ag113         5.370E+00         s           471140         Ag114         4.600E+01         s           471180         Ag118         3.760E+00         s           471180</th> <th>PREVIOUS INVENTORY INCREASED BY THE FOLD RADIONUCLIDE INPUT READ FROM EXTERNAL FILE NUCLIDE         HALF LIFE         CURIE           892250         Ac225         1.000E+01         d         6.430E-11           892260         Ac226         2.937E+01         h         1.060E-12           892270         Ac227         2.177E+01         yr         1.190E-08           892280         Ac228         6.150E+00         h         8.50E-09           471050         Ag105         4.129E+01         d         7.470E-16           471061         Ag106m         8.280E+00         d         1.650E-10           471080         Ag108         2.382E+00         m         7.190E-06           471091         Ag109m         3.960E+01         s         6.300E+01           471100         Ag110         2.460E+01         s         1.090E+00           471101         Ag110m         2.498E+02         d         2.760E-02           471110         Ag111         7.450E+00         d         2.360E+01           471120         Ag112         3.130E+00         h         1.630E+01           471130         Ag113         5.370E+00         h         1.060E+01           471130         Ag113</th> <th>PREVIOUS INVENTORY INCREASED BY THE FOLLOWING VALU RADIONUCLIDE INPUT READ FROM EXTERNAL FILE USER FILE NUCLIDE HALF LIFE CURE           892250 AC225 1.000E+01 d 6.430E-11           892260 AC226 2.937E+01 h 1.060E-12           892270 AC227 2.177E+01 yr 1.190E-08           892280 AC228 6.150E+00 h 8.550E-09           471050 Ag105 4.129E+01 d 7.470E-16           471060 Ag106 2.396E+01 m 7.320E-11           471080 Ag108 2.382E+00 d 1.650E-10           471081 Ag108m 4.380E+02 yr 6.840E-09           471091 Ag109m 3.960E+01 s 6.300E+01           471100 Ag110m 2.4498E+02 yr 6.840E-09           471110 Ag110m 2.4498E+02 d 2.760E-02           471110 Ag110m 2.4498E+01 s 2.370E+01           471110 Ag111 7.450E+00 h 1.630E+01           471110 Ag111 7.450E+00 h 1.060E+01           471110 Ag113 6.870E+01 s 1.330E+01           471120 Ag113 2.000E+01 s 1.330E+01           471181 Ag118m 2.000E+01 s 3.890E+00           471180 Ag118 3.760E+00 s 8.470E+00           471180 Ag118 3.700E+01 s 3.800E+00           471120 Ag121 7.800E-01 s 3.800E+00           471120 Ag123 3.000E-01 s 3.800E+00           471120 Ag124 1.720E-01 s 5.820E-01           47120 Ag123 3.000E-01 s 4.710E-01           471</th>	PREVIOUS INVENTORY INCREAS           RADIONUCLIDE         INPUT READ FROM           NUCLIDE         HALF LIFE           892250         Ac225         1.000E+01         d           892260         Ac226         2.937E+01         h           892270         Ac227         2.177E+01         yr           892280         Ac228         6.150E+00         h           471050         Ag105         4.129E+01         d           471060         Ag106         2.396E+01         m           471080         Ag108         2.382E+00         m           471091         Ag109m         3.960E+01         s           471100         Ag110         2.460E+01         s           471101         Ag110m         2.498E+02         d           471110         Ag111         7.450E+00         h           471120         Ag112         3.130E+00         h           471130         Ag113         5.370E+00         h           471130         Ag113         5.370E+00         s           471140         Ag114         4.600E+01         s           471180         Ag118         3.760E+00         s           471180	PREVIOUS INVENTORY INCREASED BY THE FOLD RADIONUCLIDE INPUT READ FROM EXTERNAL FILE NUCLIDE         HALF LIFE         CURIE           892250         Ac225         1.000E+01         d         6.430E-11           892260         Ac226         2.937E+01         h         1.060E-12           892270         Ac227         2.177E+01         yr         1.190E-08           892280         Ac228         6.150E+00         h         8.50E-09           471050         Ag105         4.129E+01         d         7.470E-16           471061         Ag106m         8.280E+00         d         1.650E-10           471080         Ag108         2.382E+00         m         7.190E-06           471091         Ag109m         3.960E+01         s         6.300E+01           471100         Ag110         2.460E+01         s         1.090E+00           471101         Ag110m         2.498E+02         d         2.760E-02           471110         Ag111         7.450E+00         d         2.360E+01           471120         Ag112         3.130E+00         h         1.630E+01           471130         Ag113         5.370E+00         h         1.060E+01           471130         Ag113	PREVIOUS INVENTORY INCREASED BY THE FOLLOWING VALU RADIONUCLIDE INPUT READ FROM EXTERNAL FILE USER FILE NUCLIDE HALF LIFE CURE           892250 AC225 1.000E+01 d 6.430E-11           892260 AC226 2.937E+01 h 1.060E-12           892270 AC227 2.177E+01 yr 1.190E-08           892280 AC228 6.150E+00 h 8.550E-09           471050 Ag105 4.129E+01 d 7.470E-16           471060 Ag106 2.396E+01 m 7.320E-11           471080 Ag108 2.382E+00 d 1.650E-10           471081 Ag108m 4.380E+02 yr 6.840E-09           471091 Ag109m 3.960E+01 s 6.300E+01           471100 Ag110m 2.4498E+02 yr 6.840E-09           471110 Ag110m 2.4498E+02 d 2.760E-02           471110 Ag110m 2.4498E+01 s 2.370E+01           471110 Ag111 7.450E+00 h 1.630E+01           471110 Ag111 7.450E+00 h 1.060E+01           471110 Ag113 6.870E+01 s 1.330E+01           471120 Ag113 2.000E+01 s 1.330E+01           471181 Ag118m 2.000E+01 s 3.890E+00           471180 Ag118 3.760E+00 s 8.470E+00           471180 Ag118 3.700E+01 s 3.800E+00           471120 Ag121 7.800E-01 s 3.800E+00           471120 Ag123 3.000E-01 s 3.800E+00           471120 Ag124 1.720E-01 s 5.820E-01           47120 Ag123 3.000E-01 s 4.710E-01           471

Radiological	Safety Analy	sis Computer Providence Providenc	ogram	(RSAC 7.2.0)	
Name: Windo	ows User	Company: Idaho National Laboratory			Serial: 134684
Computer: D	NL611704	Run Date: 06/11/2020			Run Time: 15:49:09
File: Marvel	SNAPTRAN	CW_2.rsac			
952421	Am242m	1.410E+02	yr	7.900E-06	
952430	Am243	7.370E+03	yr	8.450E-08	
952440	Am244	1.010E+01	h	8.130E-07	
952441	Am244m	2.600E+01	m	1.220E-05	
952450	Am245	2.050E+00	h	1.190E-12	
330720	As 72	2.600E+01	h	3.620E-11	
330730	As 73	8.030E+01	d	2.670E-09	
330740	As 74	1.777E+01	d	2.280E-07	
330760	As 76	1.093E+00	d	1.640E-03	
330770	As 77	3.883E+01	h	7.750E+00	
330780	As 78	9.070E+01	m	2.010E+01	
330790	As 79	9.010E+00	m	4.270E+01	
NUCLI	I DE	HALF LI	FE	CURIE	
330800	As 80	1.520E+01	S	1.200E+02	
330810	As 81	3.330E+01	S	1.840E+02	
330830	As 83	1.340E+01	S	2.990E+02	
330840	As 84	4.200E+00	S	2.010E+02	
330850	As 85	2.021E+00	S	1.910E+02	
330860	As 86	9.450E-01	S	5.370E+02	
330870	As 87	5.600E-01	S	4.140E+01	
330880	As 88	1.300E-01	S	1.180E+02	
330890	As 89	1.294E-01	S	1.760E-01	
561310	Ba131	1.150E+01	d	1.090E-12	
561330	Ba133	1.052E+01	yr	1.780E-08	
561351	Ba135m	2.870E+01	h	3.050E-04	
561371	Ba137m	2.552E+00	m	2.500E+02	
561390	Ba139	8.306E+01	m	6.030E+03	
561400	Ba140	1.275E+01	d	5.840E+03	
561410	Ba141	1.827E+01	m	5.480E+03	
561420	Ba142	1.060E+01	m	5.390E+03	
561430	Ba143	1.450E+01	S	5.190E+03	
561440	Ba144	1.150E+01	S	4.100E+03	
561450	Ba145	4.310E+00	S	1.820E+03	
561460	Bal46	2.220E+00	S	8.690E+02	
561470	Ba147	8.940E-01	S	2.340E+02	
561480	Ba148	6.070E-01	S	2.300E+01	
561490	Ba149	3.440E-01	S	1.430E+00	
561520	Bal52	7.548E-01	S	1.610E-04	
832100	B1210	5.012E+00	d	1.800E-11	
832110	B1211	2.140E+00	m	1.050E-08	
832120	B1212	6.055E+01	m	6.170E-07	
832130	B1213	4.559E+01	m	6.430E-11	
832140	B1214	1.990E+01	m	1.310E-13	
350770	Br 77	5.704E+01	h	6.810E-10	
350800	Br 80	1.768E+01	m	2.440E-04	

Radiological	Safety Analy	ysis Computer Pr	ogram	(RSAC 7.2.0)	
Name: Wind	ows User	Company: Idaho National Laboratory			Serial: 134684
Computer: I	NL611704	Run Date	: 06/11	/2020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	VCW_2.rsac			
350801	Br 80m	4.420E+00	h	1.510E-04	
350820	Br 82	3.528E+01	h	2.820E-01	
350821	Br 82m	6.130E+00	m	2.140E-01	
350830	Br 83	2.400E+00	h	5.000E+02	
350840	Br 84	3.176E+01	m	9.170E+02	
350841	Br 84m	6.000E+00	m	1.630E+01	
350850	Br 85	2.900E+00	m	1.210E+03	
350860	Br 86	5.510E+01	S	1.690E+03	
350870	Br 87	5.565E+01	S	1.890E+03	
350880	Br 88	1.629E+01	S	1.630E+03	
350890	Br 89	4.348E+00	S	1.020E+03	
350900	Br 90	1.910E+00	S	5.260E+02	
350910	Br 91	5.410E-01	S	2.120E+02	
350920	Br 92	3.430E-01	S	2.680E+01	
350930	Br 93	1.020E-01	S	4.150E+00	
350940	Br 94	7.000E-02	S	2.850E-01	
350950	Br 95	1.166E-01	S	3.670E-03	
481070	Cd107	6.500E+00	h	2.900E-13	
NUCL	IDE	HALF LI	FE	CURIE	
481090	Cd109	4.614E+02	d	2.680E-08	
481111	Cd111m	4.854E+01	m	3.920E-06	
481130	Cd113	7.700E+15	yr	1.250E-15	
481131	Cd113m	1.410E+01	yr	7.930E-03	
481150	Cd115	5.346E+01	h	1.300E+01	
481151	Cd115m	4.456E+01	d	7.450E-01	
481170	Cd117	2.490E+00	h	1.100E+01	
481171	Cd117m	3.360E+00	h	2.760E+00	
481180	Cd118	5.030E+01	m	1.240E+01	
481190	Cd119	2.690E+00	m	8.470E+00	
481200	Cd120	5.080E+01	S	1.280E+01	
481210	Cd121	1.350E+01	S	7.160E+00	
481230	Cd123	2.100E+00	S	1.060E+01	
481240	Cd124	1.250E+00	S	1.230E+01	
481250	Cd125	6.500E-01	S	5.110E+00	
481260	Cd126	5.060E-01	S	7.490E+00	
481270	Cd127	3.700E-01	S	7.340E+00	
481280	Cd128	3.400E-01	S	3.230E+00	
481290	Cd129	2.700E-01	S	1.210E-02	
481300	Cd130	2.000E-01	S	7.880E+01	
481310	Cd131	1.193E-01	S	1.450E+01	
481320	Cd132	1.448E-01	S	1.780E-03	
581370	Ce137	9.000E+00	h	1.830E-09	
581390	Ce139	1.376E+02	d	1.150E-03	
581410	Ce141	3.251E+01	d	5.490E+03	
581430	Ce143	3.304E+01	h	5.590E+03	

Radiological S	Safety Analy	sis Computer Providence	ogram	(RSAC 7.2.0)	
Name: Windows User Company: Idaho National Laboratory					Serial: 134684
Computer: D	NL611704	Run Date: 06/11/2020			Run Time: 15:49:09
File: Marvel	SNAPTRAN				
581440	Ce144	2.849E+02	d	4.290E+03	
581450	Ce145	3.010E+00	m	3.690E+03	
581460	Ce146	1.352E+01	m	2.820E+03	
581470	Ce147	5.640E+01	S	1.790E+03	
581480	Ce148	5.600E+01	S	1.500E+03	
581490	Ce149	5.300E+00	S	7.410E+02	
581510	Ce151	1.020E+00	S	9.940E+01	
581520	Ce152	1.400E+00	S	2.120E+01	
581530	Ce153	1.725E+00	S	2.160E+00	
581540	Ce154	3.590E-01	S	1.660E-01	
581550	Ce155	7.125E-01	S	1.080E-02	
581560	Ce156	1.162E+00	S	5.990E-04	
581570	Ce157	3.618E-01	S	2.260E-05	
962400	Cm240	2.700E+01	d	3.560E-12	
962410	Cm241	3.280E+01	d	8.840E-10	
962420	Cm242	1.629E+02	d	1.230E-02	
962430	Cm243	2.910E+01	yr	8.060E-08	
962440	Cm244	1.811E+01	yr	1.650E-07	
962450	Cm245	8.500E+03	yr	5.320E-13	
962460	Cm246	4.760E+03	yr	9.930E-16	
270720	Co 72	9.000E-02	S	1.010E-04	
270730	Co 73	1.155E-01	S	3.940E-05	
270740	Co 74	1.075E-01	S	5.730E-06	
270750	Co 75	8.016E-02	S	7.820E-07	
NUCLI	IDE	HALF LI	FE	CURIE	
551310	Cs131	9.689E+00	d	1.440E-06	
551320	Cs132	6.479E+00	d	1.660E-03	
551340	Cs134	2.065E+00	yr	1.210E+01	
551341	Cs134m	2.912E+00	h	4.180E+00	
551350	Cs135	2.300E+06	yr	3.510E-03	
551351	Cs135m	5.300E+01	m	3.540E-01	
551360	Cs136	1.316E+01	d	1.300E+01	
551370	Cs137	3.008E+01	yr	2.630E+02	
551380	Cs138	3.341E+01	m	6.310E+03	
551381	Cs138m	2.910E+00	m	2.150E+02	
551390	Cs139	9.270E+00	m	5.960E+03	
551400	Cs140	6.370E+01	S	5.370E+03	
551410	Cs141	2.484E+01	S	3.930E+03	
551420	Cs142	1.680E+00	S	2.550E+03	
551430	Cs143	1.780E+00	S	1.370E+03	
551440	Cs144	1.010E+00	S	4.090E+02	
551450	Cs145	5.940E-01	S	7.610E+01	
551460	Cs146	3.210E-01	S	8.300E+00	
551470	Cs147	2.250E-01	S	2.200E+00	
551480	Cs148	1.580E-01	S	3.640E-02	

Radiological S	Safety Analys	sis Computer Pro	ogram (R	SAC 7.2.0)	
Name: Windo	ws User	Company	: Idaho N	Serial: 134684	
Computer: IN	NL611704	Run Date	: 06/11/2	020	Run Time: 15:49:09
File: Marvel S	NAPTRAN	CW 2.rsac			
200660	Cha 6.6	E 1000.00		1 0405 04	
290660	Cu 66	5.120E+00	m	1.840E-04	
290670	Cu 67	6.183E+01	n	6.930E-04	
290720	Cu 72	6.630E+00	S	Z.390E-02	
290730	Cu 73	3.900E+00	S	5.900E-02	
290740	Cu 74	1.030E+00	5	1.400E-02	
290750	Cu 75	1.224E+00	5	1.020E-01	
290760	Cu 76	6.410E-01	5	8.400E-02	
290770	Cu 77	4.690E-01	2	4.400E-02	
290780	Cu 70	1 000E-01	2	1.020E-02	
290790	Cu 75	9 110E-02	2	9.540E-05	
661570	Du 157	9.110E-02	р р	1 240E-05	
661590	Dy157	1 444E+00	d	1.240E-15 1.170E-09	
661650	Dy165	2 334E+00	h	6.060E-03	
661660	Dy166	8.160E+01	h	2.880E-03	
681650	Er165	1.036E+01	h	1.850E-09	
681690	Er169	9.390E+00	d	3.350E-04	
681710	Er171	7.516E+00	h	9.040E-05	
681720	Er172	4.930E+01	h	1.230E-04	
631490	Eu149	9.310E+01	d	2.130E-09	
631520	Eu152	1.354E+01	vr	1.800E-02	
631521	Eu152m	9.312E+00	h	2.860E-01	
631540	Eu154	8.601E+00	vr	3.340E-01	
631550	Eu155	4.753E+00	vr	6.950E+00	
631560	Eu156	1.519E+01	d	2.650E+01	
631570	Eu157	1.518E+01	h	7.690E+00	
631580	Eu158	4.590E+01	m	4.100E+00	
631590	Eu159	1.810E+01	m	1.460E+00	
872210	Fr221	4.900E+00	m	6.430E-11	
872230	Fr223	2.180E+01	m	1.640E-10	
NUCLI	DE	HALF LI	FE	CURIE	
310670	Ga 67	3.262E+00	d	7.940E-15	
310680	Ga 68	6.771E+01	m	2.270E-10	
310700	Ga 70	2.114E+01	m	1.100E-06	
310720	Ga 72	1.410E+01	h	3.140E-02	
310730	Ga 73	4.860E+00	h	1.100E-01	
310740	Ga 74	8.120E+00	m	3.340E-01	
310750	Ga 75	1.260E+02	S	1.040E+00	
310760	Ga 76	3.260E+01	S	2.950E+00	
310770	Ga 77	1.320E+01	S	7.030E+00	
310780	Ga 78	5.090E+00	S	1.320E+01	
310790	Ga 79	2.847E+00	S	1.770E+01	
310800	Ga 80	1.676E+00	S	1.130E+01	
310810	Ga 81	1.217E+00	S	7.720E+00	
310830	Ga 83	3.100E-01	S	2.200E-01	

Radiological	Safety Analy	sis Computer Pro	ogram	(RSAC 7.2.0)	
Name: Windows User Company: Idaho National Laboratory					Serial: 134684
Computer: I	NL611704	Run Date	: 06/1	1/2020	Run Time: 15:49:00
File: Marvel	SNAPTRAN	CW 2.rsac			
210040	a	0 5007 00		1 0205 01	
310840	Ga 84	8.500E-02	S	1.030E+01	
641510	Gd151	1.240E+02	a	1.570E-08	
641520	Gd152	1.080E+14	yr	9.420E-16	
641530	Gal53	2.410E+02	a	1.040E-03	
641590	Gal59	1.848E+01	n	1.490E+00	
320690	Ge 69	3.905E+01	n	1.040E-14	
320710	Ge /I	1.1436+01	α	6.I30E-09	
320750	Ge 75	8.278E+01	m	1.050E+00	
320751	Ge /5m	4.//UE+UI	S	4.410E-02	
320770	Ge //	1.130E+01	h	7.670E+00	
320771	Ge //m	5.290E+01	S	9.290E-02	
320780	Ge 78	8.800E+01	m	2.000E+01	
320790	Ge 79	1.898E+01	S	2.850E+01	
320800	Ge 80	2.950E+01	S	1.070E+02	
320810	Ge 81	7.600E+00	S	1.230E+02	
320830	Ge 83	1.850E+00	S	3.020E+01	
320840	Ge 84	9.470E-01	S	2.730E+01	
320850	Ge 85	5.350E-01	S	2.280E+00	
320860	Ge 86	2.590E-01	S	5.460E+02	
320870	Ge 87	1.255E-01	S	1.980E+00	
320880	Ge 88	1.42/E-01	S	4.730E-02	
10030	H 3	1.232E+01	yr	1.020E+00	
721720	HI172	1.870E+00	yr	3.940E-11	
721730	HII/3	2.360E+01	n	4.130E-07	
721750	HI1/5	7.000E+01	a	6.050E-02	
721771	HII//m	5.140E+01	m	1.260E-03	
721781	HI1/8m	3.100E+01	yr	4.020E-04	
721901	HII/9m	2.505E+01	h	1.330E+01	
721001	HIIOUM UE101	4.220E+00	n d	2.910E-02	
721010	HIIOI UE102	4.239E+01	a	0.620E-01	
671610	HLI02	9.000E+06	yr b	1.670E-10	
671610	H0161	2.400E+00	11 m	1 150E 00	
671620	H0162	1.500E+01	111	1.100E-09	
671621	H0162m	0.700E+01	111	1.100E-09	
671640	HO164	2.900E+01	m	1.110E 07	
NUCT.	HOI 64III	5./50E+01	III TT	CUPTE	
671660	10E Ho166	2 692E±01	г <u>ь</u> b	2 940E-03	
671661	Hol66m	1 2005+01	11 WP	2.940E-03	
671670	Ho167	3 100E+03	y L	1 300E-03	
531220	T122	1 3225+01	h	2 1000-00	
531240	T123	4 176F±00	d	3 0508-09	
531250	T125	5 9/0E+00	d	2 590F-08	
531260	T125	1 2935-01	d	3 6908-05	
531280	T129	2 / GGET01	m	A 000F-01	
331200	1120	2 J J D T U I	ALL		

Radiological	Safety Analy	ysis Computer Pro	ogram	(RSAC 7.2.0)	
Name: Wind	ows User	Company	: Idaho	o National Laboratory	Serial: 134684
Computer: I	NL611704	Run Date:	06/11	/2020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	VCW 2.rsac			
		—			
531290	I129	1.570E+07	vr	4.650E-05	
531300	T130	1.236E+01	h	1.000E+00	
531301	T130m	8.840E+00	m	5.550E-01	
531310	I131	8.025E+00	d	2.730E+03	
531320	I132	2.295E+00	h	4.110E+03	
531321	I132m	1.387E+00	h	1.110E+01	
531330	T133	2.080E+01	h	6.330E+03	
531331	T133m	9.000E+00	S	4.480E+02	
531340	I134	5.250E+01	m	7.380E+03	
531341	I134m	3.520E+00	m	3.520E+02	
531350	I135	6.580E+00	h	5.950E+03	
531360	I136	8.340E+01	S	2.530E+03	
531361	I136m	4.690E+01	S	1.200E+03	
531370	I137	2.450E+01	S	2.890E+03	
531380	I138	6.230E+00	S	1.420E+03	
531390	I139	2.290E+00	S	7.360E+02	
531400	I140	8.600E-01	S	1.500E+02	
531410	I141	4.300E-01	S	3.960E+01	
531420	I142	1.960E-01	S	5.780E+00	
531430	I143	3.280E-01	S	8.890E-02	
531440	I144	1.327E-01	S	2.480E-03	
491110	In111	2.805E+00	d	8.640E-14	
491120	In112	1.497E+01	m	8.230E-10	
491131	In113m	1.658E+00	h	7.200E-10	
491140	In114	7.190E+01	S	2.660E-05	
491141	Inll4m	4.951E+01	d	1.540E-05	
491150	In115	4.410E+14	yr	3.890E-14	
491151	In115m	4.486E+00	h	1.300E+01	
491161	In116m	5.429E+01	m	2.360E-01	
491170	In117	4.320E+01	m	8.400E+00	
491171	In117m	1.162E+02	m	1.010E+01	
491180	In118	5.000E+00	S	1.250E+01	
491181	In118m	4.450E+00	m	1.960E-03	
491190	In119	2.400E+00	m	6.350E+00	
491191	In119m	1.800E+01	m	7.670E+00	
491200	In120	3.080E+00	S	1.300E+01	
491201	In120m	4.620E+01	S	4.340E-01	
491210	In121	2.310E+01	S	8.560E+00	
491211	In121m	3.880E+00	m	5.190E+00	
491230	In123	6.170E+00	S	7.670E+00	
491231	In123m	4.780E+01	S	7.740E+00	
491240	In124	3.120E+00	S	1.470E+01	
NUCL	IDE	HALF LI	FE	CURIE	
491250	In125	2.360E+00	S	8.710E+00	
491251	In125m	1.220E+01	S	6.830E+00	

Radiological Safety Analysis Computer Program (RSAC 7.2.0)							
Name: Windows User Company: Idaho National Laboratory					Serial: 134684		
Computer: D	NL611704	Run Date:	06/11/20	020	Run Time: 15:49:0!		
File: Marvel S	SNAPTRAN	CW_2.rsac					
491260	In126	1.640E+00	S	9.990E+00			
491270	In127	1.090E+00	S	4.420E+01			
491271	In127m	3.670E+00	S	7.190E+00			
491280	In128	8.400E-01	S	1.670E+01			
491290	In129	6.100E-01	S	2.690E+01			
491300	In130	2.900E-01	S	8.970E+01			
491301	In130m	1.700E+00	m	7.380E+00			
491310	In131	2.800E-01	S	1.230E+01			
491320	In132	2.070E-01	S	6.290E+00			
491330	In133	1.800E-01	S	2.290E-01			
491340	In134	1.380E-01	S	7.960E-03			
360790	Kr 79	3.504E+01	h	4.070E-10			
360810	Kr 81	2.290E+05	yr	2.180E-11			
360831	Kr 83m	1.830E+00	h	5.000E+02			
360850	Kr 85	1.076E+01	yr	3.210E+01			
360851	Kr 85m	4.480E+00	h	1.210E+03			
360870	Kr 87	7.630E+01	m	2.370E+03			
360880	Kr 88	2.840E+00	h	3.290E+03			
360890	Kr 89	3.150E+00	m	4.180E+03			
360900	Kr 90	3.232E+01	S	4.330E+03			
360910	Kr 91	8.570E+00	S	3.100E+03			
360920	Kr 92	1.840E+00	S	1.560E+03			
360930	Kr 93	1.286E+00	S	4.610E+02			
360940	Kr 94	2.000E-01	S	8.690E+01			
360950	Kr 95	7.800E-01	S	8.040E+00			
360970	Kr 97	1.485E-01	S	6.990E-02			
360980	Kr 98	2.243E-01	S	1.520E+00			
571350	La135	1.950E+01	11	8.020E-09			
571370	Ld13/	0.000E+04	Ϋ́́Υ	0.400E-10 2.950E-12			
571300	La130	1.670E+00	d d	5.950E-15			
571400	La140	2 920E+00	u h	5 500E+02			
571410	La141	9 110F+01	11 m	5 480 - + 03			
571420	La142	1 4205+01	m	5 560 - + 03			
571440	La145	4 080E+01	S	5 110E+03			
571450	La145	2.480E+01	5	3.600E+03			
571460	La146	6.270E+00	S	1.570E+03			
571470	La147	4.060E+00	S	8.560E+02			
571480	La148	1.260E+00	S	3.570E+02			
571490	La149	1.050E+00	S	8.320E+01			
571510	La151	9.536E-01	S	1.410E+00			
571520	La152	3.094E-01	S	1.000E-01			
571530	La153	4.370E-01	S	7.710E-03			
571540	La154	1.753E-01	S	2.930E-04			
711710	Lu171	8.240E+00	d	3.130E-16			

Radiological	Safety Analy	ysis Computer Pro	ogram	(RSAC 7.2.0)	
Name: Wind	lows User	Company	: Idaho	Serial: 134684	
Computer: 1	NL611704	Run Date	: 06/11	/2020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	VCW 2.rsac			
		_			
711720	Lu172	6.700E+00	d	4.760E-11	
711730	Lu173	1.370E+00	vr	2.620E-07	
711740	T11174	3.310E+00	vr	1.080E-08	
NUCL	TDE	HALF LT	-1	CURTE	
711741	Lu174m	1.420E+02	d	1.420E-08	
711760	Lu176	3.760E+10	vr	2.770E-15	
711761	Lu176m	3.635E+00	h h	3.660E-04	
711770	Lu177	6.647E+00	d	1.900E-05	
711771	Lu177m	1.604E+02	d	1.190E-08	
421010	Mo101	1.461E+01	m	4.910E+03	
421020	Mo102	1.130E+01	m	4.100E+03	
421030	Mo103	6.750E+01	S	2.900E+03	
421040	Mo104	6.000E+01	s	1 800E+03	
421050	Mo105	3.560E+01	5	9.630E+02	
421060	Mo106	8.400E+00	S	4.140E+02	
421070	Mo107	3.500E+00	S	1.410E+02	
421080	Mo108	1.090E+00	S	3.860E+01	
421090	Mo109	5.300E-01	5	1 690E+01	
421110	Mo111	3.000E-01	5	4.020E-01	
421120	Mo112	6.890E-01	S	3.580E-02	
421130	Mo113	1.970E-01	5	3.470E-03	
421140	Mo114	3.215E-01	5	1.490E - 04	
420930	Mo 93	4.000E+03	vr	6.510E-11	
420931	Mo 93m	6.850E+00	h h	6.890E-09	
420990	Mo 99	6.594E+01	h	5.770E+03	
411000	Nb100	1.500E+00	5	5.590E+03	
411001	Nb100m	2,990E+00	S	3.020E+02	
411010	Nb101	7.100E+00	S	4.740E+03	
411020	Nb102	4.300E+00	S	2.710E+03	
411030	Nb103	1.500E+00	S	1.880E+03	
411040	Nb104	4.800E+00	S	3.790E+02	
411050	Nb105	2.950E+00	s	2.620E+02	
411060	Nb106	1.020E+00	S	2.180E+01	
411070	Nb107	3.300E-01	S	3.970E+00	
411080	Nb108	1.930E-01	S	3.160E-01	
411090	Nb109	1.900E-01	S	4.770E-01	
411110	Nb111	1.562E-01	S	2.970E-03	
410931	Nb 93m	1.613E+01	vr	2.460E-04	
410940	Nb 94	2.030E+04	vr	3.840E-08	
410941	Nb 94m	6.263E+00	m	3.870E-04	
410950	Nb 95	3.497E+01	d	6.410E+03	
410951	Nb 95m	8.660E+01	h	6.930E+01	
410960	Nb 96	2.335E+01	h	2.070E+00	
410970	Nb 97	7.210E+01	m	6.160E+03	
410971	Nb 97m	5.270E+01	S	5.850E+03	

Radiological Safety Analysis Computer Program (RSAC 7.2.0)								
Name: Wind	ows User	Company	: Idaho N	Vational Laboratory	Serial: 134684			
Computer: I	NL611704	Run Date:	06/11/2	020	Run Time: 15:49:09			
File: Marvel	SNAPTRAN	CW_2.rsac						
410980	Nb 98	5.150E+01	m	5.430E+03				
410981	Nb 98m	5.130E+01	m	3.550E+01				
410990	Nb 99	1.500E+01	S	3.490E+03				
410991	Nb 99m	2.600E+00	m	2.280E+03				
601410	Nd141	2.490E+00	h	1.980E-06				
601440	Nd144	2.290E+15	yr	1.690E-12				
601470	Nd147	1.098E+01	d	2.120E+03				
601490	Nd149	1.728E+00	h	1.030E+03				
601510	Nd151	1.244E+01	m	4.050E+02				
NUCL	IDE	HALF LI	FE	CURIE				
601520	Nd152	1.140E+01	m	2.580E+02				
601530	Nd153	3.160E+01	S	1.470E+02				
601540	Nd154	2.590E+01	S	6.320E+01				
601550	Nd155	8.900E+00	S	1.910E+01				
601560	Nd156	5.470E+00	S	5.260E+00				
601570	Nd157	4.150E+00	S	6.770E-01				
601580	Nd158	7.890E+00	S	8.940E-02				
601590	Nd159	1.410E+00	S	6.660E-03				
280650	Ni 65	2.517E+00	h	4.880E-07				
280660	N1 66	5.460E+01	h	1.840E-04				
280720	Ni 72	1.570E+00	S	8.670E-03				
280730	N1 /3	8.000E-01	S	8.030E-03				
280740	N1 /4	5.000E-01	S	4.860E-03				
280750	NI 75	6.000E-01	5	1.640E-03				
280760	NI 76	4.400E-01	5	5.430E-04				
200770	NI //	1.030E-01	5	6.530E-05				
932340	NI 70	1.376E-01 4 400E+00	а Б	0.750E-00 1 110E-14				
932350	Np235	3 962E+02	d	4 950E-08				
932330	Np237	2 144E+06	vr	6 460E-05				
932380	Np238	2.117E+00	d	1.920E+00				
932390	Np239	2.356E+00	d	3.530E+04				
932400	Np240	6.190E+01	m	5.740E-01				
932401	Np240m	7.220E+00	m	9.760E-01				
912300	Pa230	1.740E+01	d	8.590E-09				
912310	Pa231	3.276E+04	vr	3.830E-07				
912320	Pa232	1.310E+00	d	3.030E-04				
912330	Pa233	2.697E+01	d	8.840E-05				
912340	Pa234	6.700E+00	h	9.460E-06				
912341	Pa234m	1.159E+00	m	5.890E-03				
822090	Pb209	3.253E+00	h	6.430E-11				
822100	Pb210	2.220E+01	yr	1.840E-11				
822110	Pb211	3.610E+01	m	1.050E-08				
822120	Pb212	1.064E+01	h	6.170E-07				
822140	Pb214	2.680E+01	m	1.310E-13				

Radiological	Safety Analy	sis Computer Pro	ogram	(RSAC 7.2.0)	
Name: Wind	ows User	Company	: Idaho	Serial: 134684	
Computer: I	NL611704	Run Date:	06/11	/2020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	VCW 2.rsac			
461010	Pd101	8.470E+00	h	9.150E-13	
461030	Pd103	1.699E+01	d	5.540E-06	
461070	Pd107	6.500E+06	yr	3.980E-05	
461071	Pd107m	2.130E+01	s	1.680E-03	
461090	Pd109	1.370E+01	h	6.300E+01	
461091	Pd109m	4.690E+00	m	5.410E-03	
461110	Pd111	2.340E+01	m	2.390E+01	
461111	Pd111m	5.500E+00	h	6.870E-03	
461120	Pd112	2.103E+01	h	1.630E+01	
461130	Pd113	9.300E+01	S	1.620E+01	
461140	Pd114	2.420E+00	m	1.250E+01	
461150	Pd115	5.000E+01	S	1.240E+01	
461180	Pd118	1.900E+00	S	4.010E+00	
461190	Pd119	9.200E-01	S	9.750E-01	
461200	Pd120	5.000E-01	S	2.720E+00	
NUCL	IDE	HALF LI	FE	CURIE	
461210	Pd121	6.222E-01	S	1.430E-01	
461230	Pd123	3.100E-01	S	6.760E-03	
461240	Pd124	5.600E-01	S	1.300E-03	
611430	Pm143	2.650E+02	d	7.130E-16	
611440	Pm144	3.630E+02	d	1.170E-11	
611450	Pm145	1.770E+01	yr	1.160E-07	
611460	Pm146	5.530E+00	yr	1.660E-04	
611470	Pm147	2.623E+00	yr	8.430E+02	
611480	Pm148	5.368E+00	a	3.020E+01	
611481	Pm148m	4.129E+01	a h	2.210E+01	
611490	Pm150	5.308E+01	n b	1.030E+03	
611510	Dm151	2.000E+00	h	1.420E+00	
611520	Dm152	2.040E+01 4 120E+00	m	4.000E+02	
611521	Dm152m	4.120E+00 7.520E+00	m	1 7505+02	
611530	Dm153	5.250E+00	m	1.5608+00	
611540	Pm154	1 730E+00	m	6 900E+02	
611541	Pm154m	2 680E+00	m	5.900E+00	
611550	Pm155	4 150E+01	S	3 270E+01	
611560	Pm156	2.670E+01	S	1.330E+01	
611570	Pm157	1.056E+01	s	4.200E+00	
611580	Pm158	4.800E+00	S	1.000E+00	
611590	Pm159	4.230E+00	S	1.800E-01	
842100	Po210	1.384E+02	d	1.040E-11	
842160	Po216	1.450E-01	S	6.170E-07	
842180	Po218	3.980E+00	m	1.310E-13	
591390	Pr139	4.410E+00	h	1.690E-07	
591420	Pr142	1.912E+01	h	3.380E+00	
591421	Pr142m	1.460E+01	h	1.180E+00	

Radiological Safety Analysis Computer Program (RSAC 7.2.0)							
Name: Wind	ows User	Company	: Idaho N	ational Laboratory	Serial: 134684		
Computer: I	NL611704	Run Date:	06/11/20	020	Run Time: 15:49:09		
File: Marvel	SNAPTRAN	CW 2.rsac					
		_					
591430	Pr143	1.357E+01	d	5.390E+03			
591440	Pr144	1.728E+01	m	4.290E+03			
591441	Pr144m	7.200E+00	m	4.150E+01			
591450	Pr145	5.984E+00	h	3.690E+03			
591460	Pr146	2.415E+01	m	2.820E+03			
591470	Pr147	1.340E+01	m	2.120E+03			
591480	Pr148	2.290E+00	m	1.540E+03			
591490	Pr149	2.260E+00	m	1.020E+03			
591510	Pr151	1.890E+01	S	3.280E+02			
591520	Pr152	3.630E+00	S	1.220E+02			
591530	Pr153	4.300E+00	S	3.960E+01			
591540	Pr154	2.300E+00	S	5.880E+00			
591550	Pr155	1.890E+00	S	9.630E-01			
591560	Pr156	5.104E-01	S	9.470E-02			
591570	Pr157	6.780E-01	S	8.960E-03			
591580	Pr158	2.630E-01	S	5.220E-04			
591590	Pr159	3.140E-01	S	2.370E-05			
942360	Pu236	2.858E+00	vr	2.730E-06			
942370	Pu237	4.520E+01	d	5.660E-06			
942380	Pu238	8.770E+01	yr	1.220E-02			
942390	Pu239	2.411E+04	yr	1.930E+00			
NUCL	IDE	HALF LI	FE	CURIE			
942400	Pu240	6.561E+03	yr	1.270E-01			
942410	Pu241	1.429E+01	yr	2.440E+00			
942420	Pu242	3.735E+05	yr	4.830E-07			
942430	Pu243	4.956E+00	ĥ	2.190E-03			
942450	Pu245	1.050E+01	h	1.190E-12			
882220	Ra222	3.617E+01	S	6.440E-10			
882230	Ra223	1.143E+01	d	1.050E-08			
882240	Ra224	3.660E+00	d	6.170E-07			
882250	Ra225	1.490E+01	d	6.780E-11			
882260	Ra226	1.600E+03	yr	1.340E-13			
882270	Ra227	4.220E+01	m	9.380E-13			
882280	Ra228	5.750E+00	yr	1.890E-13			
371000	Rb100	5.100E-02	S	3.750E+01			
370810	Rb 81	4.572E+00	h	1.400E-10			
370830	Rb 83	8.620E+01	d	1.070E-06			
370840	Rb 84	3.282E+01	d	4.340E-05			
370860	Rb 86	1.863E+01	d	1.540E-01			
370870	Rb 87	4.810E+10	yr	6.900E-08			
370880	Rb 88	1.777E+01	m	3.310E+03			
370890	Rb 89	1.515E+01	m	4.380E+03			
370900	Rb 90	1.580E+02	S	4.480E+03			
370901	Rb 90m	2.580E+02	S	8.250E+02			
370910	Rb 91	5.840E+01	S	5.170E+03			

Radiological Safety Analysis Computer Program (RSAC 7.2.0)									
Name: Windows User Company: Idaho National Laboratory					Serial: 134684				
Computer: I	NL611704	Run Date:	06/11/20	020	Run Time: 15:49:09				
File: Marvel	SNAPTRAN	CW 2.rsac							
		_							
370920	Ph 92	1 1925+00	e	1 1705+03					
370930	Rb 93	5 840E+00	2	3 310E+03					
370940	Rb 94	2 702E+00	5	1 560E+03					
370950	Rb 95	3.775E-01	s	7.330E+02					
370970	Rb 97	1.699E-01	S	3.610E+01					
370980	Rb 98	9.600E-02	S	4.480E+00					
370990	Rb 99	5.030E-02	S	2.180E-01					
751860	Re186	3.718E+00	d	1.020E-12					
451010	Rh101	3.300E+00	yr	4.070E-08					
451011	Rh101m	4.340E+00	d	9.040E-08					
451020	Rh102	2.073E+02	d	1.680E-04					
451021	Rh102m	3.742E+00	yr	2.560E-05					
451031	Rh103m	5.611E+01	m	2.940E+03					
451050	Rh105	3.536E+01	h	1.040E+03					
451051	Rh105m	4.000E+01	S	2.950E+02					
451060	Rh106	3.007E+01	S	3.380E+02					
451061	Rh106m	1.310E+02	m	1.250E-01					
451070	Rh107	2.170E+01	m	2.190E+02					
451080	Rh108	1.680E+01	S	1.010E+02					
451081	Rh108m	6.000E+00	m	4.090E-01					
451090	Rh109	8.000E+01	S	6.280E+01					
451110	Rh111	1.100E+01	S	2.390E+01					
451120	RNIIZ	2.100E+00	S	1.6208+01					
451130	RHII3 Ph114	2.800E+00	5	2.200E+01					
451140	Dh119	2 953E-01	0 0	1 9205-01					
451100	Rh119	1 178E-01	2	1.0205-01					
NUCL	TDE	HALF LT		CURIE					
451200	Rh120	1.624E-01	S	1.100E-02					
451210	Rh121	2.210E-01	S	1.490E-03					
862180	Rn218	3.500E-02	S	6.440E-10					
862190	Rn219	3.960E+00	S	1.050E-08					
862200	Rn220	5.560E+01	S	6.170E-07					
862220	Rn222	3.823E+00	d	1.310E-13					
441030	Ru103	3.925E+01	d	2.970E+03					
441050	Ru105	4.440E+00	h	1.040E+03					
441060	Ru106	3.718E+02	d	3.370E+02					
441070	Ru107	3.750E+00	m	2.180E+02					
441080	Ru108	4.550E+00	m	1.010E+02					
441090	Ru109	3.450E+01	S	6.130E+01					
441110	Ru111	2.120E+00	m	2.210E+01					
441120	Ru112	1.750E+00	S	1.310E+01					
441130	Ru113	8.000E-01	S	7.390E+00					
441140	Ru114	5.300E-01	S	2.390E+00					
441180	Ru118	6.160E-01	S	2.840E-03					

Radiological Safety Analysis Computer Program (RSAC 7.2.0)								
Name: Windows User Company: Idaho National Laboratory					Serial: 134684			
Computer: I	NL611704	Run Date:	06/11/20	020	Run Time: 15:49:09			
File: Marvel	SNAPTRAN	CW_2.rsac						
441200	Ru120	2.932E-01	S	2.840E-05				
440970	Ru 97	2.830E+00	d	6.200E-12				
511181	Sb118m	5.000E+00	h	6.350E-11				
511190	Sb119	3.819E+01	h	2.430E-08				
511200	Sb120	1.589E+01	m	2.820E-06				
511220	Sb122	2.724E+00	d	4.090E-02				
511240	Sb124	6.020E+01	d	4.090E-02				
511241	Sb124m	9.300E+01	S	6.240E-03				
511250	Sb125	2.759E+00	yr	1.350E+01				
511260	Sb126	1.235E+01	d	8.490E-01				
511261	Sb126m	1.915E+01	m	1.600E+00				
511270	Sb127	3.850E+00	d	1.570E+02				
511280	Sb128	9.010E+00	h	2.290E+01				
511281	Sb128m	1.040E+01	m	3.290E+02				
511290	Sb129	4.400E+00	h	5.320E+02				
511300	Sb130	3.950E+01	m	6.960E+02				
511301	SDI30m	6.300E+00	m	9.710E+02				
511310	SDI31 ch122	2.303E+01	m	2.420E+03				
511320	SD132 Sb132m	2.790E+00	m	9 7205+02				
511330	Sb132m	2 500E+00	m	1 990E+03				
511340	sb134	7.800E-01	S	3.500E+02				
511341	Sb134m	1.007E+01	S	3.600E+02				
511350	Sb135	1.710E+00	S	1.460E+02				
511360	Sb136	8.200E-01	S	1.290E+01				
511370	Sb137	2.837E-01	S	6.580E+01				
511380	Sb138	1.304E-01	S	7.870E-02				
511390	Sb139	1.720E-01	S	4.370E-03				
340750	Se 75	1.190E+02	d	1.820E-09				
340790	Se 79	2.950E+05	yr	2.010E-04				
340791	Se 79m	3.920E+00	m	4.170E+01				
340810	Se 81	1.845E+01	m	1.910E+02				
340811	Se 81m	5.728E+01	m	1.330E+01				
NUCL	IDE	HALF LI	FE	CURIE				
340830	Se 83	2.230E+01	m	4.280E+02				
340831	Se 83m	7.010E+01	S	3.930E+01				
340840	Se 84	3.260E+00	m	9.000E+02				
340850	Se 05	1 520E+01	5	1 2705+02				
340000	Se 00	5.500E+01	2	7 2505+02				
340870	Se 07	1.530E+00	2 e	3 2905+02				
340890	Se 89	4.100E-01	5	4.880E+01				
340900	Se 90	5.545E-01	S	1.250E+01				
340910	Se 91	2.700E-01	S	7.980E-01				
340920	Se 92	2.478E-01	S	5.800E-02				

Radiological	Safety Analy	sis Computer Pro	ogram (I	RSAC 7.2.0)	
Name: Windows User Company: Idaho National Laboratory					Serial: 134684
Computer: I	NL611704	Run Date	: 06/11/2	2020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	CW_2.rsac			
621450	Sm145	3.400E+02	d	1.480E-07	
621460	Sm146	1.030E+08	yr	2.700E-12	
621470	Sm147	1.060E+11	yr	5.860E-09	
621480	Sm148	7.000E+15	yr	5.650E-15	
621510	Sm151	9.000E+01	yr	5.410E+00	
621530	Sm153	4.650E+01	ĥ	1.710E+02	
621550	Sm155	2.230E+01	m	3.440E+01	
621560	Sm156	9.400E+00	h	1.700E+01	
621570	Sm157	4.820E+02	S	7.530E+00	
621580	Sm158	5.300E+00	m	3.870E+00	
621590	Sm159	1.137E+01	S	1.170E+00	
501130	Sn113	1.151E+02	d	2.170E-11	
501171	Sn117m	1.360E+01	d	2.930E-02	
501191	Sn119m	2.930E+02	d	3.840E-01	
501210	Sn121	2.703E+01	h	1.310E+01	
501211	Sn121m	5.500E+01	yr	3.060E-02	
501230	Sn123	1.292E+02	d	1.170E+00	
501231	Sn123m	4.006E+01	m	1.550E+01	
501250	Sn125	9.640E+00	d	1.380E+01	
501251	Sn125m	9.520E+00	m	2.140E+01	
501260	Sn126	2.300E+05	yr	3.380E-04	
501270	Sn127	2.100E+00	h	9.550E+01	
501271	Sn127m	4.130E+00	m	5.500E+01	
501280	Sn128	5.907E+01	m	3.220E+02	
501290	Sn129	2.230E+00	m	2.840E+02	
501291	Sn129m	6.900E+00	m	1.880E+02	
501300	Sn130	3.720E+00	m	5.840E+02	
501310	Sn131	5.600E+01	S	4.480E+02	
501320	Sn132	3.970E+01	S	5.660E+02	
501330	Sn133	1.450E+00	S	1.030E+02	
501340	Sn134	1.120E+00	S	1.790E+01	
501350	Sn135	2.910E-01	S	7.710E-01	
501360	Sn136	4.131E-01	S	2.830E-02	
381000	Sr100	2.020E-01	S	3.760E+01	
381010	Sr101	1.180E-01	S	4.560E+00	
381020	Sr102	6.900E-02	S	2.200E-01	
381030	Sr103	1.386E-01	S	3.540E-03	
381040	Sr104	1.925E-01	S	3.240E-04	
380830	Sr 83	3.241E+01	h	2.370E-11	
NUCLI	IDE	HALF LI	FE	CURIE	
380850	Sr 85	6.484E+01	d	2.590E-07	
380851	Sr 85m	6.763E+01	m	1.530E-07	
380871	Sr 87m	2.815E+00	h	8.580E-02	
380890	Sr 89	5.053E+01	d	4.400E+03	
380900	Sr 90	2.879E+01	yr	2.530E+02	

Radiological	Safety Analy	sis Computer Pro	gram (R	SAC 7.2.0)	
Name: Wind	ows User	Company:	Idaho N	ational Laboratory	Serial: 134684
Computer: I	NL611704	Run Date:	06/11/20	020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	CW_2.rsac			
		_			
380910	Sr 91	9 630E+00	h	5 410E+03	
380920	Sr 92	2 710E+00	h	5.530F+03	
380930	Sr 93	7.423E+00	m	5.820E+03	
380940	Sr 94	7.530E+01	S	5.650E+03	
380950	Sr 95	2.390E+01	S	4.930E+03	
380970	Sr 97	4.260E-01	S	1.650E+03	
380980	Sr 98	6.530E-01	S	7.750E+02	
380990	Sr 99	2.690E-01	S	1.390E+02	
731780	Ta178	9.310E+00	m	5.700E-14	
731790	Ta179	1.820E+00	vr	3.620E-10	
731800	Ta180	8.154E+00	h	4.820E-07	
731820	Ta182	1.150E+02	d	6.130E-03	
731821	Ta182m	2.640E-01	h	8.500E-07	
731830	Ta183	5.100E+00	d	1.300E-03	
651550	Tb155	5.320E+00	d	9.630E-11	
651560	Tb156	5.350E+00	d	5.990E-09	
651561	Tb156m	2.440E+01	h	6.060E-10	
651570	Tb157	7.100E+01	yr	1.720E-09	
651580	Tb158	1.800E+02	yr	1.230E-08	
651600	Tb160	7.230E+01	d	8.130E-03	
651610	Tb161	6.910E+00	d	1.990E-01	
431010	Tc101	1.420E+01	m	4.910E+03	
431020	Tc102	5.280E+00	S	4.110E+03	
431021	Tc102m	4.350E+00	m	9.310E+00	
431030	Tc103	5.420E+01	S	2.980E+03	
431040	Tc104	1.830E+01	m	1.900E+03	
431050	Tc105	7.600E+00	m	1.040E+03	
431060	Tc106	3.560E+01	S	4.770E+02	
431070	Tc107	2.120E+01	S	2.000E+02	
431080	TC108	5.170E+00	S	7.440E+01	
431090	TC109	8.700E-01	S	3.910E+01	
431110	TCIII TcIII	2.900E-01	S	5.4/0E+00	
431120	TCI12	2.800E-01	5	1.090E+00	
431130	TCI15	1.300E-01	5	2.630E-01	
431140		1.754E-01	2	3.700E-02	
430980	TC 90	4.280E+00 2.600E+06	u	1 530F-13	
430971	TC 97m	9 010E+01	d	2 840E-07	
430980	TC 98	4 200E+06	vr	4 720E-10	
430990	TC 99	2.111E+05	vr	3.760E-02	
430991	TC 99m	6.020E+00	h h	5.070E+03	
521210	Te121	1.916E+01	d	7.990E-09	
521211	Te121m	1.540E+02	d	3.510E-09	
521231	Te123m	1.192E+02	d	2.350E-05	
521251	Te125m	5.740E+01	d	2.830E+00	

Radiological	Safety Analy	ysis Computer Pr	ogram	(RSAC 7.2.0)	
Name: Wind	lows User	Company	: Idaho	Serial: 134684	
Computer: ]	Computer: INL611704 Run Date: 06/11/2020			/2020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	NCW 2.rsac			
NUCT	TDF		TT	CURTE	
521270	To127	9 350E+00	ь h	1 560F+02	
521270	Te127	1 090E+02	d	2 490E+01	
521290	Te129	6.960E+01	m	5.080E+02	
521291	Te129m	3.360E+01	d	8,940E+01	
521310	Te131	2.500E+01	m	2.450E+03	
521311	Te131m	3.325E+01	h	4.020E+02	
521320	Te132	3.204E+00	d	4.080E+03	
521330	Te133	1.250E+01	m	3.180E+03	
521331	Te133m	5.540E+01	m	3.530E+03	
521340	Te134	4.180E+01	m	6.540E+03	
521350	Te135	1.900E+01	S	3.150E+03	
521360	Te136	1.750E+01	S	1.290E+03	
521370	Te137	2.490E+00	S	3.920E+02	
521380	Te138	1.400E+00	S	6.730E+01	
521390	Te139	4.237E-01	S	7.320E+00	
521400	Te140	7.520E-01	S	1.550E+01	
521410	Te141	2.358E-01	S	8.250E-02	
521420	Te142	4.912E-01	S	2.800E-03	
902260	Th226	3.057E+01	m	6.440E-10	
902270	Th227	1.868E+01	d	1.090E-08	
902280	Th228	1.912E+00	yr	6.300E-07	
902290	Th229	7.340E+03	yr	7.260E-12	
902300	Th230	7.538E+04	yr	4.610E-10	
902310	Th231	2.552E+01	h	9.120E-03	
902320	Th232	1.405E+10	yr	1.710E-12	
902340	Th234	2.410E+01	d	5.890E-03	
812070	T1207	4.770E+00	m	1.050E-08	
812080	T1208	3.053E+00	m	2.220E-07	
812090	T1209	2.200E+00	m	1.410E-12	
691670	1m167	9.250E+00	a	1.520E-12	
691700	1m170	1.286E+02	a	6.430E-06	
691710	IIII1/1	1.920E+00	YL.	4.540E-05	
691720	IIII172	0.360E+01	h	1.240E-04	
091730	111220	0.240E+00	d	2.290E-13	
922310	U230 U231	4 200E+01	d	2 110F-10	
922320	11232	6.890E+01	vr	3 0705-06	
922330	11233	1.592E+05	vr	6.780E-08	
922340	11234	2.455E+05	vr	5.010E-05	
922350	11235	7.038E+08	vr	9.120E-03	
922360	U236	2.342E+07	vr	1.300E-03	
922370	U237	6.750E+00	d	1.580E+02	
922380	U238	4.468E+09	vr	5.890E-03	
922390	U239	2.345E+01	m	3.530E+04	

Radiological	Safety Analy	sis Computer Pro	ograi	m (RSAC 7.2.0)	
Name: Windows User Company: Idaho National Laboratory					Serial: 134684
<b>Computer:</b> INL611704 <b>Run Date:</b> 06/11/2020				11/2020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	VCW 2.rsac			
		_			
741810	W181	1.212E+02	d	1.000E-09	
741850	W185	7.510E+01	d	2.020E-10	
741870	W187	2.400E+01	h	2.270E-16	
541250	Xe125	1.690E+01	h	1.510E-12	
541270	Xe127	3.640E+01	d	5.120E-08	
541291	Xe129m	8.880E+00	d	8.200E-06	
NUCL	IDE	HALF LI	FE	CURIE	
541311	Xe131m	1.184E+01	d	2.980E+01	
541330	Xe133	5.243E+00	d	6.070E+03	
541331	Xe133m	2.190E+00	d	1.830E+02	
541341	Xe134m	2.900E-01	S	3.360E+01	
541350	Xe135	9.140E+00	h	5.840E+03	
541351	Xe135m	1.529E+01	m	1.130E+03	
541370	Xe137	3.818E+00	m	5.780E+03	
541380	Xe138	1.408E+01	m	5.910E+03	
541390	Xe139	3.968E+01	S	4.710E+03	
541400	Xe140	1.360E+01	S	3.410E+03	
541410	Xe141	1.730E+00	S	1.180E+03	
541420	Xe142	1.220E+00	S	4.200E+02	
541430	Xe143	3.000E-01	S	4.060E+01	
541440	Xe144	1.150E+00	S	6.690E+00	
541450	Xe145	9.000E-01	S	2.030E-01	
541460	Xe146	9.372E-01	S	1.920E-02	
541470	Xel47	2.638E-01	S	1.820E-03	
391000	Y100	9.400E-01	S	6.430E+02	
391010	Y101	4.480E-01	S	2.750E+02	
391020	¥102	3.600E-01	S	2.640E+02	
391030	Y103	2.300E-01	S	3.740E+00	
391040	Y104	1.442E-01	S	6.790E-01	
391050	¥105	1.736E-01	S	3.490E-02	
391070	Y OO	1.046E-01	2	1.580E-05	
390880	1 00 V 00	1.066E+02	h	3.340E-04	
390900	1 90 V 90m	3 190E+01	h	2.010E+02	
390901	Y 91	5.951E+00	d	5 4005+03	
390910	1 91 V 91m	J.0J1E+01	m	3 1905+03	
390911	V 92	3.540E+00	h	5.590E+03	
390930	Y 93	1.018E+01	h	5.920E+03	
390940	Y 94	1 870E+01	m	6.030E+03	
390950	Y 95	1.030E+01	m	5.970E+03	
390970	Y 97	3.750E+00	S	2 880E+03	
390980	Y 98	2.000E+00	S	1.870E+0.3	
390990	Y 99	1.470E+00	S	1.990E+03	
701690	Yb169	3.202E+01	d	1.210E-12	
701750	Yb175	4.185E+00	d	2.210E-07	

#### **Evaluation of Microreactor Inhalation Dose Consequences**

Radiological	Safety Analy	ysis Computer Pr	ogram	(RSAC 7.2.0)	
Name: Wind	lows User	Company	: Idah	o National Laboratory	Serial: 134684
Computer: INL611704 Run Date: 06/11/20			: 06/1	1/2020	Run Time: 15:49:09
File: Marvel	SNAPTRAN	NCW_2.rsac			
701770	Yb177	1.911E+00	h	2.770E-07	
300690	Zn 69	5.640E+01	m	2.440E-03	
300691	Zn 69m	1.376E+01	h	3.460E-06	
300711	Zn 71m	3.960E+00	h	5.150E-04	
300720	Zn 72	4.650E+01	h	3.130E-02	
300730	Zn 73	2.350E+01	S	1.090E-01	
300740	Zn 74	9.540E+01	S	3.200E-01	
300750	Zn 75	1.020E+01	S	8.480E-01	
300760	Zn 76	5.700E+00	S	1.910E+00	
300770	Zn 77	2.080E+00	S	3.050E+00	
300780	Zn 78	1.470E+00	S	3.370E+00	
300790	Zn 79	9.950E-01	S	1.550E+00	
NUCL	IDE	HALF LI	FE	CURIE	
300800	Zn 80	5.400E-01	S	2.390E-01	
300810	Zn 81	2.900E-01	S	4.650E-03	
300830	Zn 83	8.386E-02	S	1.560E-04	
401000	Zr100	7.100E+00	S	5.310E+03	
401010	Zr101	2.300E+00	S	2.920E+03	
401020	Zr102	2.900E+00	S	1.950E+03	
401030	Zr103	1.300E+00	S	5.160E+02	
401040	Zr104	1.200E+00	S	8.810E+01	
401050	Zr105	6.000E-01	S	1.060E+02	
401060	Zr106	9.800E-01	s	3.820E-02	
401070	Zr107	2.485E-01	S	6.410E-03	
401080	Zr108	4.075E-01	S	3.310E-04	
401090	Zr109	1.387E-01	S	3.890E-04	
400880	Zr 88	8.340E+01	d	6.100E-10	
400890	Zr 89	7.841E+01	h	1.730E+00	
400930	Zr 93	1.530E+06	yr	6.040E-03	
400950	Zr 95	6.402E+01	d	6.410E+03	
400970	Zr 97	1.691E+01	h	6.150E+03	
400980	Zr 98	3.070E+01	S	5.330E+03	
400990	Zr 99	2.100E+00	S	5.340E+03	

#### **Fission Product Calculation**

FRACTIONATION (ELEMENT, VALUE) Ar 7.500E-01 At 7.000E-01 Br 7.000E-01 Cl 7.000E-01 Cs 7.000E-01 F 7.000E-01 Fr 7.000E-01 H 7.500E-01 I 7.000E-01 K 7.000E-01 Kr 7.500E-01 Na 7.000E-01 Po 4.500E-01 Rb 7.000E-01 Rn 7.500E-01 S 4.500E-01 Sb 4.000E-02 Se 4.500E-01 Te 4.500E-01 Xe 7.500E-01 FRACTIONATION FOR THE REST OF THE RADIONUCLIDE INVENTORY = 4.000E-02 TOTAL RADIONUCLIDE REMAINING = 5.293E+15 D/S OR 1.430E+05 CI

Evaluation of Microreactor Inhalation Dose Consequences

Radiological Safety Analysis Computer Program (RSAC 7.2.0 )Name: Windows UserCompany: Idaho National LaboratorySerial:Computer: INL611704Run Date: 06/11/2020Run TiFile: Marvel SNAPTRAN CW\_2.rsac2.rsac

Serial: 134684 Run Time: 15:49:09

#### Meteorological Data

	MEAN WIND SPEED = MIXING LAYER HEIGHT =	1.040E+00 (: 4.000E+02 (:	m/s) STACK m) AIR	HEIGHT = 0 DENSITY = 1	.000E+00 .099E+03	(m) (g/cu
m)						
	WET DEPOSITION SCAVENO	GING COEFFIC	IENT = 0.000	E+00 (1/s)		
	DRY DEPOSITION VELOCIT	FIES (m/s)				
	SOLIDS = 1.000E-0	)3 HALOGE	NS = 1.000E -	02 NOBLE (	GASES =	
0.00	00E+00					
	CESIUM = 1.000E-0	3 RUTHENI	UM = 1.000E -	03		
	THERE IS 1 SET OF LEAP	KAGE CONSTAN	TS (K1,K2)			
	1.000E+00	0.000E+00				
	PLUME MEANDER FACTOR =	= 1.00E+00				
	PASQUILL CLASS F METEO	DROLOGY, MAR	KEE SIGMA VA	LUES		
	NO BUILDING WAKE CORRE	ECTION MADE				
	DOWNWIND DISTANCE	STACK	SIGY	SIGZ	CHI/	Q
		HEIGHT (m)	(m)	(m)	(s/m^	3)
	1.000E+02	0.000E+00	2.069E+01	3.625E+00	4.081E	-03
	3.000E+02	0.000E+00	5.364E+01	4.728E+00	1.207E	2-03
	7.700E+02	0.000E+00	1.279E+02	6.190E+00	3.866E	-04
	1.000E+03	0.000E+00	1.629E+02	6.695E+00	2.807E	-04
	PLUME DEPLETION BY FAI	LLOUT IS INC	LUDED			
	FRACTION OF PLUME RE	EMAINING AIR	BORNE FOLLOW	ING DEPLETIC	ON BY	
DEPO	DSITION					
	DOWNWIND DISTANCE	SOLIDS	HALOGENS	CESIUM	RUTHENIU	ЛМ
	1.000E+02	9.780E-01	8.008E-01	9.780E-01	9.780E-0	1
	3.000E+02	9.713E-01	7.476E-01	9.713E-01	9.713E-0	1
	7.700E+02	9.594E-01	6.606E-01	9.594E-01	9.594E-0	1
	1.000E+03	9.548E-01	6.294E-01	9.548E-01	9.548E-0	1

#### Inhalation Dose Calculation

USING DOSE CONVERSION FACTORS FROM ICRP-68 FOR ADULT WORKER RESPIRABLE FRACTION = 1.000E+00 BREATHING RATE = 3.330E-04 (m^3/s) RELEASE TIME FOR EXPONENTIAL DECAY FUNCTION = 1.000E+00 (s) INTERNAL EXPOSURE TIME PERIOD = 5.000E+01 (yr) LUNG ABSORPTION TYPES SELECTED TO GIVE MAXIMUM DOSE ICRP-68 INHALATION DOSE FOR ADULT WORKER ICRP-68 INHALATION DOSE (rem) CHI/Q = 4.081E-03 (s/m^3) DOWNWIND DISTANCE = 1.00E+02 (m) PLUME TRAVEL TIME = 9.62E+01 (s) COMMITTED EQUIVALENT

#### Evaluation of Microreactor Inhalation Dose Consequences

Radiological Safety Analysis Computer Program (RSAC 7.2.0)							
Name: Windows User	Company: Idaho Nationa	al Laboratory Serial: 134684					
Computer: INL611704	Run Date: 06/11/2020	Run Time: 15:49:09					
File: Marvel SNAPTRAN CW	2.rsac						
TOTAL	E 50 DOSE =	2.93E+02					
ICRP-68 INHALATION	N DOSE (rem)	$CHI/Q = 1.207E-03 (s/m^3)$					
DOWNWIND DISTANC	CE = 3.00E + 02 (m)	PLUME TRAVEL TIME = 2.88E+02 (s)					
		COMMITTED EQUIVALENT					
TOTAL	$E_{50} DOSE =$	8.60E+01					
ICRP-68 INHALATION	N DOSE (rem)	$CHI/Q = 3.866E - 04 (s/m^3)$					
DOWNWIND DISTANC	CE = 7.70E + 02 (m)	PLUME TRAVEL TIME = $7.40E+02$ (s)					
		COMMITTED EQUIVALENT					
TOTAL	E 50 DOSE =	2.71E+01					
ICRP-68 INHALATION	N DOSE (rem)	$CHI/Q = 2.807E - 04 (s/m^3)$					
DOWNWIND DISTANC	CE = 1.00E + 03 (m)	PLUME TRAVEL TIME = 9.62E+02 (s)					
		COMMITTED EQUIVALENT					
TOTAL	$E_{50} DOSE =$	1.95E+01					

#### Gamma Dose Calculation

EXPOSURE TIME = 1.0000E+00 (S) CALCULATIONS MADE USING THE FINITE MODEL DOWNWIND DISTANCE = 1.000E+02 (M) DOWNWIND DISTANCE = 3.000E+02 (M) DOWNWIND DISTANCE = 7.700E+02 (M) DOWNWIND DISTANCE = 1.000E+03 (M) DOSE = 2.90E+00 (REM) DOSE = 3.78E-01 (REM) DOSE = 2.81E-01 (REM)

#### **Execution Time**

1.70E-01 SECONDS

Evaluation of Microreactor Inhalation Dose Consequences

#### Figure A-2. MARVEL public RSAC output files.

Radiological Safety Analysis Computer Program (RSAC 7.2.0)						
Name: Windows User Company: Idaho National Laboratory Serial: 134684						
Computer: INL611704	Run Date: 06/11/2020	Run Time: 15:48:09				
File: Marvel SNAPTRAN_2.rsac						

#### Input

```
* MARVEL
# Assume 100% release of fuel and fission poducts using MARVEL source term.
#
# MARVEL Fuel Inventory
2000,-1,0
# Original file copied to temporary external file
2002, TempSrcl.txt
# 2002, C:\Users\REISTP\OneDrive - Idaho National
Laboratory\Microreactor\Marvel
2999
# ARF
1000
1001,1,0.,0.
1004,1,0.04
1101,18,0.75,85,0.7
1102,35,0.7,17,0.7
1103,55,0.7,9,0.7
1104,87,0.7,1,0.75
1105,53,0.7,19,0.7
1106,36,0.75,11,0.7
1107,84,0.45,37,0.7
1108,86,0.75,16,0.45
1109,51,0.04,34,0.45
1110,52,0.45,54,0.75
1999
# Conservative Dispersion
5000,0
5001,1.04,0.,400.,1.099E3,0.,1
5002,0.001,0.01,0.,0.001,0.001
5101,6000.,32000.,48000.
5201,1.,0.
5400,2,0.,0.
5410,2,6,0,0.
5999
# Dose Consequence
7000,1,-1,1,0,2,6
7001,3.33E-04,0.,0,0,1.
7002,26
7999
# Cloud Gamma
```

Evaluation of Microreactor Inhalation Dose Consequences

Radiological Safety Analysis Computer Program (RSAC 7.2.0 )Name: Windows UserCompany: Idaho National LaboratoryComputer: INL611704Run Date: 06/11/2020File: Marvel SNAPTRAN\_2.rsac

Serial: 134684 Run Time: 15:48:09

9000,0,0. 10000

#### Direct Radionuclide Input

F	REVIOUS	INVENTORY IN	CREAS	SED BY THE FOLLOWING VAL	UES
RADI	ONUCLIDE	INPUT READ	FROM	EXTERNAL FILE USER FILE	TempSrc1.txt
NUCL	IDE	HALF LI	FE	CURIE	
892250	Ac225	1.000E+01	d	6.430E-11	
892260	Ac226	2.937E+01	h	1.060E-12	
892270	Ac227	2.177E+01	yr	1.190E-08	
892280	Ac228	6.150E+00	h	8.550E-09	
471050	Ag105	4.129E+01	d	7.470E-16	
471060	Ag106	2.396E+01	m	7.320E-11	
471061	Ag106m	8.280E+00	d	1.650E-10	
471080	Ag108	2.382E+00	m	7.190E-06	
471081	Ag108m	4.380E+02	yr	6.840E-09	
471091	Ag109m	3.960E+01	S	6.300E+01	
471100	Ag110	2.460E+01	S	1.090E+00	
471101	Ag110m	2.498E+02	d	2.760E-02	
471110	Ag111	7.450E+00	d	2.360E+01	
471111	Ag111m	6.480E+01	S	2.370E+01	
471120	Ag112	3.130E+00	h	1.630E+01	
471130	Ag113	5.370E+00	h	1.060E+01	
471131	Ag113m	6.870E+01	S	1.550E+01	
471140	Ag114	4.600E+00	S	1.330E+01	
471150	Ag115	2.000E+01	m	1.290E+01	
471180	Ag118	3.760E+00	S	8.480E+00	
471181	Ag118m	2.000E+00	S	3.890E+00	
471190	Ag119	2.100E+00	S	8.470E+00	
471200	Ag120	3.200E-01	S	3.850E+00	
471210	Ag121	7.800E-01	S	3.200E+00	
471230	Ag123	3.000E-01	S	4.710E-01	
471240	Ag124	1.720E-01	S	5.820E-01	
471250	Ag125	1.660E-01	S	2.410E-02	
471260	Ag126	1.070E-01	S	4.790E-03	
471280	Ag128	5.800E-02	S	1.000E-04	
952390	Am239	1.190E+01	h	3.360E-11	
952400	Am240	5.080E+01	h	1.880E-07	
952410	Am241	4.326E+02	yr	1.960E-03	
952420	Am242	1.602E+01	ĥ	3.690E-02	

Radiological	Safety Analy	ysis Computer Pro	ogram	(RSAC 7.2.0)	
Name: Wind	ows User	Company	: Idah	o National Laboratory	Serial: 134684
Computer: INL611704 Run Date: 06/11/2020				/2020	Run Time: 15:48:09
File: Marvel	SNAPTRAN	J_2.rsac			
952421	Am242m	1.410E+02	yr	7.900E-06	
952430	Am243	7.370E+03	yr	8.450E-08	
952440	Am244	1.010E+01	h	8.130E-07	
952441	Am244m	2.600E+01	m	1.220E-05	
952450	Am245	2.050E+00	h	1.190E-12	
330720	As 72	2.600E+01	h	3.620E-11	
330730	As 73	8.030E+01	d	2.670E-09	
330740	As 74	1.777E+01	d	2.280E-07	
330760	As 76	1.093E+00	d	1.640E-03	
330770	As 77	3.883E+01	h	7.750E+00	
330780	As 78	9.070E+01	m	2.010E+01	
330790	As 79	9.010E+00	m	4.270E+01	
NUCL	IDE	HALF LI	FE	CURIE	
330800	As 80	1.520E+01	S	1.200E+02	
330810	As 81	3.330E+01	S	1.840E+02	
330830	As 83	1.340E+01	S	2.990E+02	
330840	As 84	4.200E+00	S	2.010E+02	
330850	As 85	2.021E+00	S	1.910E+02	
330860	As 86	9.450E-01	S	5.370E+02	
330870	As 87	5.600E-01	S	4.140E+01	
330880	As 88	1.300E-01	S	1.180E+02	
330890	As 89	1.294E-01	S	1.760E-01	
561310	Bal31	1.150E+01	d	1.090E-12	
561330	Bal33	1.052E+01	yr	1.780E-08	
561351	Bal35m	2.870E+01	h	3.050E-04	
561371	Bal3/m	2.552E+00	m	2.500E+02	
561390	Ba139	8.306E+01	m	6.030E+03	
561400	Bal40	1.275E+01	a	5.840E+03	
561410	Ba141	1.827E+01	m	5.480E+03	
561420	Ba142	1.060E+01	m	5.390E+03	
561430	Ba143	1.450E+01	S	5.190E+03	
561440	Bal44	1.150E+01	S	4.100E+03	
561450	Bal45	4.310E+00	S	1.820E+03	
561460	Ba146	2.220E+00	S	8.690E+02	
561470	Ba147	8.940E-01	S	2.340E+02	
561480	Ba148	6.070E-01	S	2.300E+01	
561490	Ba149 Do152	3.440E-01	5	1.430E+00	
022100	Dalj2	7.546E-01	2	1 9005 11	
032100	B1210	5.012E+00	a	1.0505.00	
032110	B1211	2.140E+00	m	1.050E-08	
032120	B1212	0.000E+01	m	6.130E-11	
032130	D1213	1 000E+01	111	0.430E-11 1 210E.12	
350770	D1414 Dr 77	5 704E+01	h	6 910E-10	
350770	DI //	1 7600.01	11	0.010E-10	
220000	BL OU	T.100E+01	111	2.4406-04	

Radiological Safety Analysis Computer Program (RSAC 7.2.0)							
Name: Wind	lows User	Company	: Idaho N	Vational Laboratory	Serial: 134684		
Computer: I	NL611704	Run Date	06/11/2	020	Run Time: 15:48:09		
File: Marvel	SNAPTRAN	2 rsac					
	Sinn non						
250001	Dr 00m	4 4205+00	h	1 5105 04			
350801	Br 80m	4.420E+00	h	1.510E-04			
350820	Br 82	3.528E+01	n	2.820E-01			
350821	Br 82m	6.130E+00	III b	2.140E-01			
350830	Br 83	2.400E+00	n	5.000E+02			
350840	Br 84	3.1/6E+UI	m	9.170E+02			
350841	Br 84m	6.000E+00	m	1.6308+01			
350850	Br 85	2.900E+00	m	1.210E+03			
350860	Br 86	5.510E+01	S	1.690E+03			
350870	Br 87	5.565E+01	S	1.890E+03			
350880	Br 88	1.629E+01	S	1.630E+03			
350890	Br 89	4.348E+00	S	1.020E+03			
350900	Br 90	1.910E+00	S	5.260E+02			
350910	Br 91	5.410E-01	S	2.120E+02			
350920	Br 92	3.430E-01	S	2.680E+01			
350930	Br 93	1.020E-01	S	4.150E+00			
350940	Br 94	7.000E-02	S	2.850E-01			
350950	Br 95	1.166E-01	S	3.670E-03			
481070	Cd107	6.500E+00	h	2.900E-13			
NUCL	IDE	HALF LI	FE	CURIE			
481090	Cd109	4.614E+02	d	2.680E-08			
481111	Cd111m	4.854E+01	m	3.920E-06			
481130	Cd113	7.700E+15	yr	1.250E-15			
481131	Cd113m	1.410E+01	yr	7.930E-03			
481150	Cd115	5.346E+01	h	1.300E+01			
481151	Cd115m	4.456E+01	d	7.450E-01			
481170	Cd117	2.490E+00	h	1.100E+01			
481171	Cd117m	3.360E+00	h	2.760E+00			
481180	Cd118	5.030E+01	m	1.240E+01			
481190	Cd119	2.690E+00	m	8.470E+00			
481200	Cd120	5.080E+01	S	1.280E+01			
481210	Cd121	1.350E+01	S	7.160E+00			
481230	Cd123	2.100E+00	S	1.060E+01			
481240	Cd124	1.250E+00	S	1.230E+01			
481250	Cd125	6.500E-01	S	5.110E+00			
481260	Cd126	5.060E-01	S	7.490E+00			
481270	Cd127	3.700E-01	S	7.340E+00			
481280	Cd128	3.400E-01	S	3.230E+00			
481290	Cd129	2.700E-01	S	1.210E-02			
481300	Cd130	2.000E-01	S	7.880E+01			
481310	Cd131	1.193E-01	S	1.450E+01			
481320	Cd132	1.448E-01	S	1.780E-03			
581370	Ce137	9.000E+00	h	1.830E-09			
581390	Ce139	1.376E+02	d	1.150E-03			
581410	Ce141	3.251E+01	d	5.490E+03			
581430	Ce143	3.304E+01	h	5.590E+03			

Radiological	Safety Analys	sis Computer Pro	ogram (R	SAC 7.2.0)	
Name: Wind	ows User	Company	Idaho N	ational Laboratory	Serial: 134684
Computer: I	NL611704	Run Date:	06/11/20	020	Run Time: 15:48:09
File: Marvel	SNAPTRAN	2.rsac			
591440	Co144	2 9/95102	d	1 2905+03	
501440	Ce144 Co145	2.0496+02	m	4.2905+03	
581460	Ce145	1 352E+01	m	2 820E+03	
581470	Ce147	5.640E+01	S	1.790E+03	
581480	Ce148	5.600E+01	S	1.500E+03	
581490	Ce149	5.300E+00	S	7.410E+02	
581510	Ce151	1.020E+00	S	9.940E+01	
581520	Ce152	1.400E+00	S	2.120E+01	
581530	Ce153	1.725E+00	S	2.160E+00	
581540	Ce154	3.590E-01	S	1.660E-01	
581550	Ce155	7.125E-01	S	1.080E-02	
581560	Ce156	1.162E+00	S	5.990E-04	
581570	Ce157	3.618E-01	S	2.260E-05	
962400	Cm240	2.700E+01	d	3.560E-12	
962410	Cm241	3.280E+01	d	8.840E-10	
962420	Cm242	1.629E+02	d	1.230E-02	
962430	Cm243	2.910E+01	yr	8.060E-08	
962440	Cm244	1.811E+01	yr	1.650E-07	
962450	Cm245	8.500E+03	yr	5.320E-13	
962460	Cm246	4.760E+03	yr	9.930E-16	
270720	Co 72	9.000E-02	S	1.010E-04	
270730	Co 73	1.155E-01	S	3.940E-05	
270740	Co 74	1.075E-01	S	5.730E-06	
270750	Co 75	8.016E-02	S	7.820E-07	
NUCL	IDE	HALF LI	FE	CURIE	
551310	Cs131	9.689E+00	d	1.440E-06	
551320	Cs132	6.479E+00	d	1.660E-03	
551340	CS134	2.065E+00	yr	1.210E+01	
551341	CS134m	2.912E+00	n	4.180E+00	
551350	CS135	2.300E+06	yr	3.510E-03	
551351	Cs135m	5.300E+01	m	3.540E-01	
551360	CS136	1.316E+01	a	1.300E+01 2.620E+02	
551320	Cs137	3.341E+01	уг	6 310E+02	
551381	Cs138m	2 910E±00	m	2 1505+03	
551300	Cs130m	9.270E+00	m	5 9605+02	
551400	Cs140	6.370E+01	S	5.370E+03	
551410	Cs141	2.484E+01	S	3.930E+03	
551420	Cs142	1.680E+00	S	2.550E+03	
551430	Cs143	1.780E+00	S	1.370E+03	
551440	Cs144	1.010E+00	S	4.090E+02	
551450	Cs145	5.940E-01	S	7.610E+01	
551460	Cs146	3.210E-01	S	8.300E+00	
551470	Cs147	2.250E-01	S	2.200E+00	
551480	Cs148	1.580E-01	S	3.640E-02	

Radiological	Safety Analy	sis Computer Pro	ogram (I	RSAC 7.2.0)	
Name: Windows User Company: Idaho National Laboratory				National Laboratory	Serial: 134684
Computer: I	NL611704	Run Date	: 06/11/	2020	Run Time: 15:48:09
File: Marvel	SNAPTRAN	2 rsac			
I net ivial ver	SIVII IIVIII				
200660	Gu. 66	E 100E.00		1 0405 04	
290660	Cu 66	5.120E+00	m	1.840E-04	
290670	Cu 67	6.183E+01	n	6.930E-04	
290720	Cu 72	6.630E+00	S	Z.390E-02	
290730	Cu 73	3.900E+00	5	5.900E-02	
290740	Cu 74	1.630E+00	S	7.480E-02	
290750	Cu 75	1.224E+00	S	1.020E-01	
290760	Cu 76	6.410E-01	S	8.400E-02	
290770	Cu 77	4.690E-01	S	4.460E-02	
290780	Cu 78	3.420E-01	S	1.120E-02	
290790	Cu 79	1.880E-01	S	4.020E-04	
290800	Cu 80	9.110E-02	S	8.540E-05	
661570	Dy157	8.140E+00	n	1.240E-15	
661590	DY159	1.444E+02	a	4.1/0E-09	
661650	Dy165	2.334E+00	n h	6.060E-03	
661660	Dyloo Eml(E	8.160E+01	n b	2.880E-03	
681650	Er165	1.036E+01		1.850E-09	
681690	Er169	9.390E+00	a	3.350E-04	
601710	Ef1/1 En172	1.020E+00	n b	9.040E-05	
601720	EI172	4.950E+01	11	1.230E-04	
621520	Eu149	9.310E+01	u	1 900E-02	
631520	Eu152	9 312E+01	y r	2.860E-01	
631540	Eu152m	9.512E+00 8.601E+00	11 VE	3 340E-01	
631550	Eu154	4 753E+00	Y L	5.940E-01	
631560	Eu155	1 519F±01	d d	2 650F+01	
631570	Eu150	1 5185+01	h	7 6905+00	
631580	Eu159	1 590F+01	m	1 100E+00	
631590	Eu150	1.810E+01	m	1.460E+00	
872210	Eu100 Fr221	4.900E+00	m	6.430E-11	
872230	Fr223	2.180E+01	m	1.640E-10	
NUCL	TDE	HALF LT	373	CURIE	
310670	Ga 67	3.262E+00	d	7.940E-15	
310680	Ga 68	6.771E+01	m	2.270E-10	
310700	Ga 70	2.114E+01	m	1.100E-06	
310720	Ga 72	1.410E+01	h	3.140E-02	
310730	Ga 73	4.860E+00	h	1.100E-01	
310740	Ga 74	8.120E+00	m	3.340E-01	
310750	Ga 75	1.260E+02	S	1.040E+00	
310760	Ga 76	3.260E+01	S	2.950E+00	
310770	Ga 77	1.320E+01	S	7.030E+00	
310780	Ga 78	5.090E+00	S	1.320E+01	
310790	Ga 79	2.847E+00	S	1.770E+01	
310800	Ga 80	1.676E+00	S	1.130E+01	
310810	Ga 81	1.217E+00	S	7.720E+00	
310830	Ga 83	3.100E-01	S	2.200E-01	

Radiological S	Safety Analy	vsis Computer Province Provinc	ogram	(RSAC 7.2.0)	
Name: Windo	Serial: 134684				
Computer: D	NL611704	Run Date	: 06/11	1/2020	Run Time: 15:48:09
File: Marvel S	SNAPTRAN	2.rsac			
310840	Ga 84	8 500E-02	S	1 030E+01	
641510	Gd151	1 240E+02	d	1.570-08	
641520	Gd152	1 080F+14	ur	9 4205-16	
641530	Gd153	2.410E+02	d	1.040E-03	
641590	Gd159	1.848E+01	h	1.490E+00	
320690	Ge 69	3.905E+01	h	1.040E - 14	
320710	Ge 71	1.143E+01	d	6.130E-09	
320750	Ge 75	8.278E+01	m	1.050E+00	
320751	Ge 75m	4.770E+01	S	4.410E-02	
320770	Ge 77	1.130E+01	h	7.670E+00	
320771	Ge 77m	5.290E+01	s	9.290E-02	
320780	Ge 78	8.800E+01	m	2.000E+01	
320790	Ge 79	1.898E+01	S	2.850E+01	
320800	Ge 80	2.950E+01	S	1.070E+02	
320810	Ge 81	7.600E+00	S	1.230E+02	
320830	Ge 83	1.850E+00	s	3.020E+01	
320840	Ge 84	9.470E-01	s	2.730E+01	
320850	Ge 85	5.350E-01	S	2,280E+00	
320860	Ge 86	2.590E-01	S	5.460E+02	
320870	Ge 87	1.255E-01	S	1,980E+00	
320880	Ge 88	1.427E-01	S	4.730E-02	
10030	н 3	1.232E+01	vr	1.020E+00	
721720	Hf172	1.870E+00	vr	3.940E-11	
721730	Hf173	2.360E+01	h	4.130E - 07	
721750	Hf175	7.000E+01	d	6.050E-02	
721771	Hf177m	5.140E+01	m	1.260E-03	
721781	Hf178m	3.100E+01	vr	4.020E - 04	
721791	Hf179m	2.505E+01	d	1.330E+01	
721801	Hf180m	5.500E+00	h	2,910E-02	
721810	Hf181	4.239E+01	d	8.620E-01	
721820	Hf182	9.000E+06	vr	1.670E-10	
671610	Ho161	2.480E+00	h	6.560E-11	
671620	Ho162	1.500E+01	m	1.150E-09	
671621	Ho162m	6.700E+01	m	1.100E-09	
671640	Ho164	2.900E+01	m	1.590E-07	
671641	Ho164m	3.750E+01	m	1.110E - 07	
NUCLI	DE	HALF LI	FE	CURIE	
671660	H0166	2.682E+01	h	2.940E-03	
671661	Ho166m	1.200E+03	vr	3.000E-09	
671670	Ho167	3.100E+00	h	1.300E-03	
531230	I123	1.322E+01	h	2.400E-09	
531240	I124	4.176E+00	d	3.050E-14	
531250	I125	5.940E+01	d	2.590E-08	
531260	T126	1.293E+01	d	3.690E-05	
531280	T128	2.499E+01	m	4.000E-01	

Radiological	Safety Analy	sis Computer Pro	ogram (	(RSAC 7.2.0)	
Name: Windows User Company: Idaho National Laboratory					Serial: 134684
Computer: I	NL611704	Run Date:	06/11/	/2020	Run Time: 15:48:09
File: Marvel	SNAPTRAN	2.rsac			
		-			
531290	I129	1.570E+07	vr	4.650E-05	
531300	I130	1.236E+01	h	1.000E+00	
531301	I130m	8.840E+00	m	5.550E-01	
531310	I131	8.025E+00	d	2.730E+03	
531320	I132	2.295E+00	h	4.110E+03	
531321	I132m	1.387E+00	h	1.110E+01	
531330	I133	2.080E+01	h	6.330E+03	
531331	I133m	9.000E+00	S	4.480E+02	
531340	I134	5.250E+01	m	7.380E+03	
531341	I134m	3.520E+00	m	3.520E+02	
531350	I135	6.580E+00	h	5.950E+03	
531360	I136	8.340E+01	S	2.530E+03	
531361	I136m	4.690E+01	S	1.200E+03	
531370	I137	2.450E+01	S	2.890E+03	
531380	I138	6.230E+00	S	1.420E+03	
531390	I139	2.290E+00	S	7.360E+02	
531400	I140	8.600E-01	S	1.500E+02	
531410	I141	4.300E-01	S	3.960E+01	
531420	I142	1.960E-01	S	5.780E+00	
531430	I143	3.280E-01	S	8.890E-02	
531440	I144	1.327E-01	S	2.480E-03	
491110	In111	2.805E+00	d	8.640E-14	
491120	In112	1.49/E+01	m	8.230E-10	
491131	Inll3m	1.658E+00	n	7.200E-10	
491140	Inll4	7.190E+01	S	2.660E-05	
491141	INII4m	4.951E+01	a	1.540E-05	
491150	Iniio Iniio	4.410E+14	yr	3.890E-14	
491101	Inii5m Tp116m	4.400E+00 5.420E+01	11 m	2 260E-01	
491101	In110m	J.429E+01	m	2.300E-01 8 400E+00	
491170	In117 Tp117m	1 162E+01	m	1 0105+00	
491180	In11/m Tp118	5 000F+00	s s	1 250E+01	
491181	Tn118m	4.450E+00	m	1.960E-03	
491190	Tn119	2.400E+00	m	6.350E+00	
491191	Tn119m	1.800E+01	m	7.670E+00	
491200	Tn120	3.080E+00	S	1.300E+01	
491201	In120m	4.620E+01	S	4.340E-01	
491210	In121	2.310E+01	S	8.560E+00	
491211	In121m	3.880E+00	m	5.190E+00	
491230	In123	6.170E+00	S	7.670E+00	
491231	In123m	4.780E+01	S	7.740E+00	
491240	In124	3.120E+00	S	1.470E+01	
NUCLI	IDE	HALF LI	FE	CURIE	
491250	In125	2.360E+00	S	8.710E+00	
491251	In125m	1.220E+01	S	6.830E+00	

Radiological Safety Analysis Computer Program (RSAC 7.2.0)							
Name: Windows User Company: Idaho National Laboratory					Serial: 134684		
Computer: I	NL611704	Run Date:	06/11/20	020	Run Time: 15:48:09		
File: Marvel	SNAPTRAN	2.rsac					
	-						
191260	Tp126	1 6408+00	~	9 9905+00			
491200	IN120 Tp127	1.0405+00	2	4.420E+00			
491270	In127 Tn127m	3 670E+00	2	7 1905+00			
491280	In127m Tn128	8.400E-01	5	1.670E+01			
491290	Tn129	6.100E-01	s	2.690E+01			
491300	In130	2.900E-01	S	8.970E+01			
491301	In130m	1.700E+00	m	7.380E+00			
491310	In131	2.800E-01	S	1.230E+01			
491320	In132	2.070E-01	S	6.290E+00			
491330	In133	1.800E-01	S	2.290E-01			
491340	In134	1.380E-01	S	7.960E-03			
360790	Kr 79	3.504E+01	h	4.070E-10			
360810	Kr 81	2.290E+05	yr	2.180E-11			
360831	Kr 83m	1.830E+00	h	5.000E+02			
360850	Kr 85	1.076E+01	yr	3.210E+01			
360851	Kr 85m	4.480E+00	h	1.210E+03			
360870	Kr 87	7.630E+01	m	2.370E+03			
360880	Kr 88	2.840E+00	h	3.290E+03			
360890	Kr 89	3.150E+00	m	4.180E+03			
360900	Kr 90	3.232E+01	S	4.330E+03			
360910	Kr 91	8.570E+00	S	3.100E+03			
360920	Kr 92	1.840E+00	S	1.560E+03			
360930	Kr 93	1.286E+00	S	4.610E+02			
360940	Kr 94	2.000E-01	S	8.690E+01			
360950	Kr 95	7.800E-01	S	8.040E+00			
360970	Kr 97	1.485E-01	S	6.990E-02			
360980	Kr 98	2.243E-01	S	1.520E+00			
5/1350	La135	1.950E+01	n	8.020E-09			
571370	Lal3/	6.000E+04	Уr	8.480E-10			
571380	La138	1.020E+11	Ϋ́́Υ	3.950E-13			
571400	La140	1.079E+00	h	6.020E+03			
571410	La141	3.920E+00 9 110E±01	m	5.00E+03			
571420	La142	1 420E+01	m	5.560E+03			
571440	La144	4 080E+01	S	5.110E+03			
571450	La145	2.480E+01	S	3.600E+03			
571460	La146	6.270E+00	S	1.570E+03			
571470	La147	4.060E+00	S	8.560E+02			
571480	La148	1.260E+00	S	3.570E+02			
571490	La149	1.050E+00	S	8.320E+01			
571510	La151	9.536E-01	S	1.410E+00			
571520	La152	3.094E-01	S	1.000E-01			
571530	La153	4.370E-01	S	7.710E-03			
571540	La154	1.753E-01	S	2.930E-04			
711710	Lu171	8.240E+00	d	3.130E-16			

## Evaluation of Microreactor Inhalation Dose Consequences

Name: Windows User		Company	: Idaho	National Laboratory	Serial: 134684
Computer: I	Run Date	: 06/11	/2020	Run Time: 15:48:09	
ile: Marvel	SNAPTRAN	1_2.rsac			
211200	- 170	6 2002.00		4 7 60 7 11	
711720	Lu172	6.700E+00	a	4.760E-11	
/11/30	Lu173	1.370E+00	yr	2.6208-07	
/11/40	LUI/4	3.310E+00	yr	1.080E-08	
NUCL	IDE IN174m	HALF LI	. F.E.	LURIE	
711741	Lul/4m	1.420E+02	a	1.420E-08	
711760	Lu176	3.760E+10	yr	2.770E-15	
/11/61	Lu1/6m	3.635E+00	n	3.660E-04	
711770	Lu177	6.64/E+00	d	1.900E-05	
/11//1	Lul/m	1.604E+02	d	1.190E-08	
421010	Mo101	1.461E+01	m	4.910E+03	
421020	Mo102	1.130E+01	m	4.100E+03	
421030	Mo103	6.750E+01	S	2.900E+03	
421040	Mo104	6.000E+01	S	1.800E+03	
421050	Mo105	3.560E+01	S	9.630E+02	
421060	Mo106	8.400E+00	S	4.140E+02	
421070	Mo107	3.500E+00	S	1.410E+02	
421080	Mo108	1.090E+00	S	3.860E+01	
421090	Mo109	5.300E-01	S	1.690E+01	
421110	Mo111	3.000E-01	S	4.020E-01	
421120	Mo112	6.890E-01	S	3.580E-02	
421130	Mo113	1.970E-01	S	3.470E-03	
421140	Mo114	3.215E-01	S	1.490E-04	
420930	Mo 93	4.000E+03	yr	6.510E-11	
420931	Mo 93m	6.850E+00	h	6.890E-09	
420990	Mo 99	6.594E+01	h	5.770E+03	
411000	Nb100	1.500E+00	S	5.590E+03	
411001	Nb100m	2.990E+00	S	3.020E+02	
411010	Nb101	7.100E+00	S	4.740E+03	
411020	Nb102	4.300E+00	S	2.710E+03	
411030	Nb103	1.500E+00	S	1.880E+03	
411040	Nb104	4.800E+00	S	3.790E+02	
411050	Nb105	2 950E+00	S	2 620E+02	
411060	Nb106	1 020E+00	S	2.180E+01	
411070	Nb107	3 300E-01	S	3 970E+00	
411070	Nb107	1 930E-01	2	3 160E-01	
411000	Nb100	1.930E-01	2	4 770E-01	
411090	ND109	1.900E-01	S C	4.770E-01	
411110	Nb 93m	1.502E-01	D UT	2.970E-03	
410931	Nb 04	2 0205-04	Ϋ́Υ	2.4000-04	
410041	ND 94	2.030E+04	ΥΥ Υ	3.040E-00	
410941	ND 94m	0.203E+UU	111	5.070E-04	
410950	ND 95	3.49/E+UI	a	6.410E+03	
410951	MC 95M	8.00UE+UI	11	0.930E+01	
410960	ND 96	2.335E+01	n	2.070E+00	
410970	ND 97	7.210E+01	m	6.160E+03	
410971	Nb 97m	5.270E+01	S	5.850E+03	

Radiological Safety Analysis Computer Program (RSAC 7.2.0)							
Name: Wind	ows User	Company	: Idaho	National Laboratory	Serial: 134684		
Computer: I	NL611704	Run Date:	06/11/	/2020	Run Time: 15:48:09		
File: Marvel	SNAPTRAN	2.rsac					
410000	Mb 00	5 150E+01		5 4200-02			
410960	ND 90	5.130E+01	m	3.430E+03			
410981	ND 98m	5.130E+01	m	3.550E+01			
410990	ND 99	1.500E+01	5	3.490E+03			
410991	ND 99m	2.600E+00	111	2.280E+03			
601410	NdI4I	2.490E+00	n	1.980E-06			
601440	Nal44	2.290E+15	yr	1.690E-12			
601470	Nal4/	1.098E+01	α	2.120E+03			
601490	Nd149	1.728E+00	h	1.030E+03			
601510	Nalsi	1.244E+01	m	4.050E+02			
NUCL.	IDE	HALF LI	F.F.	CURIE			
601520	Nd152	1.140E+01	m	2.580E+02			
601530	Nd153	3.160E+01	S	1.470E+02			
601540	Nd154	2.590E+01	S	6.320E+01			
601550	Nd155	8.900E+00	S	1.910E+01			
601560	Nd156	5.470E+00	S	5.260E+00			
601570	Nd157	4.150E+00	S	6.770E-01			
601580	Nd158	7.890E+00	S	8.940E-02			
601590	Nd159	1.410E+00	S	6.660E-03			
280650	Ni 65	2.517E+00	h	4.880E-07			
280660	Ni 66	5.460E+01	h	1.840E-04			
280720	Ni 72	1.570E+00	S	8.670E-03			
280730	Ni 73	8.000E-01	S	8.030E-03			
280740	Ni 74	5.000E-01	S	4.860E-03			
280750	Ni 75	6.000E-01	S	1.640E-03			
280760	Ni 76	4.400E-01	S	5.430E-04			
280770	Ni 77	1.030E-01	S	6.530E-05			
280780	Ni 78	1.376E-01	S	6.750E-06			
932340	Np234	4.400E+00	d	1.110E-14			
932350	Np235	3.962E+02	d	4.950E-08			
932370	Np237	2.144E+06	yr	6.460E-05			
932380	Np238	2.117E+00	d	1.920E+00			
932390	Np239	2.356E+00	d	3.530E+04			
932400	Np240	6.190E+01	m	5.740E-01			
932401	Np240m	7.220E+00	m	9.760E-01			
912300	Pa230	1.740E+01	d	8.590E-09			
912310	Pa231	3.276E+04	yr	3.830E-07			
912320	Pa232	1.310E+00	d	3.030E-04			
912330	Pa233	2.697E+01	d	8.840E-05			
912340	Pa234	6.700E+00	h	9.460E-06			
912341	Pa234m	1.159E+00	m	5.890E-03			
822090	Pb209	3.253E+00	h	6.430E-11			
822100	Pb210	2.220E+01	yr	1.840E-11			
822110	Pb211	3.610E+01	m	1.050E-08			
822120	Pb212	1.064E+01	h	6.170E-07			
822140	Pb214	2.680E+01	m	1.310E-13			

Radiological	Safety Analy	vsis Computer Pro	ogram	(RSAC 7.2.0)	
Name: Wind	ows User	Company	: Idaho	Serial: 134684	
Computer: I	NL611704	Run Date:	: 06/11	/2020	Run Time: 15:48:09
File: Marvel	SNAPTRAN	_2.rsac			
461010	Pd101	8.470E+00	h	9.150E-13	
461030	Pd103	1.699E+01	d	5.540E-06	
461070	Pd107	6.500E+06	yr	3.980E-05	
461071	Pd107m	2.130E+01	S	1.680E-03	
461090	Pd109	1.370E+01	h	6.300E+01	
461091	Pd109m	4.690E+00	m	5.410E-03	
461110	Pd111	2.340E+01	m	2.390E+01	
461111	Pd111m	5.500E+00	h	6.870E-03	
461120	Pd112	2.103E+01	h	1.630E+01	
461130	Pd113	9.300E+01	S	1.620E+01	
461140	Pd114	2.420E+00	m	1.250E+01	
461150	Pd115	5.000E+01	S	1.240E+01	
461180	Pd118	1.900E+00	S	4.010E+00	
461190	Pd119	9.200E-01	S	9.750E-01	
461200	Pd120	5.000E-01	S	2.720E+00	
NUCL	IDE	HALF LI	FE	CURIE	
461210	Pd121	6.222E-01	S	1.430E-01	
461230	Pd123	3.100E-01	S	6.760E-03	
461240	Pd124	5.600E-01	S	1.300E-03	
611430	Pm143	2.650E+02	d	7.130E-16	
611440	Pm144	3.630E+02	d	1.170E-11	
611450	Pm145	1.770E+01	yr	1.160E-07	
611460	Pm146	5.530E+00	yr	1.660E-04	
611470	Pm147	2.623E+00	yr	8.430E+02	
611480	Pm148	5.368E+00	d	3.020E+01	
611481	Pm148m	4.129E+01	d	2.210E+01	
611490	Pm149	5.308E+01	h	1.030E+03	
611500	Pm150	2.680E+00	h	1.420E+00	
611510	Pm151	2.840E+01	h	4.060E+02	
611520	Pm152	4.120E+00	m	2.590E+02	
611521	Pm152m	7.520E+00	m	1.750E+00	
611530	Pm153	5.250E+00	m	1.560E+02	
611540	Pm154	1.730E+00	m	6.900E+01	
611541	Pm154m	2.680E+00	m	5.900E+00	
611550	Pm155	4.150E+01	S	3.270E+01	
611560	Pm156	2.670E+01	S	1.330E+01	
611570	Pm157	1.056E+01	S	4.200E+00	
611580	Pm158	4.800E+00	S	1.000E+00	
611590	Pm159	4.230E+00	S	1.800E-01	
842100	Po210	1.384E+02	d	1.040E-11	
842160	P0216	1.450E-01	S	6.170E-07	
842180	P0218	3.980E+00	m	1.310E-13	
591390	Pr139	4.410E+00	h	1.690E-07	
591420	Pr142	1.912E+01	h	3.380E+00	
591421	Pr142m	1.460E+01	h	1.180E+00	

Radiological Safety Analysis Computer Program (RSAC 7.2.0)							
Name: Winde	ows User	Company:	Idah	o National Laboratory	Serial: 134684		
Computer: I	NL611704	Run Date:	06/11	1/2020	Run Time: 15:48:09		
File: Marvel	SNAPTRA	N 2.rsac					
		_					
591430	Pr143	1.357E+01	d	5.390E+03			
591440	Pr144	1.728E+01	m	4.290E+03			
591441	Pr144m	7.200E+00	m	4.150E+01			
591450	Pr145	5.984E+00	h	3.690E+03			
591460	Pr146	2.415E+01	m	2.820E+03			
591470	Pr147	1.340E+01	m	2.120E+03			
591480	Pr148	2.290E+00	m	1.540E+03			
591490	Pr149	2.260E+00	m	1.020E+03			
591510	Pr151	1.890E+01	S	3.280E+02			
591520	Pr152	3.630E+00	S	1.220E+02			
591530	Pr153	4.300E+00	S	3.960E+01			
591540	Pr154	2.300E+00	S	5.880E+00			
591550	Pr155	1.890E+00	S	9.630E-01			
591560	Pr156	5.104E-01	S	9.470E-02			
591570	Pr157	6.780E-01	S	8.960E-03			
591580	Pr158	2.630E-01	S	5.220E-04			
591590	Pr159	3.140E-01	S	2.370E-05			
942360	Pu236	2.858E+00	yr	2.730E-06			
942370	Pu237	4.520E+01	d	5.660E-06			
942380	Pu238	8.770E+01	yr	1.220E-02			
942390	Pu239	2.411E+04	yr	1.930E+00			
NUCLI	IDE	HALF LI	FE	CURIE			
942400	Pu240	6.561E+03	yr	1.270E-01			
942410	Pu241	1.429E+01	yr	2.440E+00			
942420	Pu242	3.735E+05	yr	4.830E-07			
942430	Pu243	4.956E+00	h	2.190E-03			
942450	Pu245	1.050E+01	h	1.190E-12			
882220	Ra222	3.61/E+UI	S	6.440E-10			
882230	Ra223	1.143E+01	a	1.050E-08			
882240	RaZZ4	3.660E+00	a	6.170E-07			
002250	Rd225	1.490E+01	a	0.780E-II			
882260	Ra226	1.600E+03	мт	1.340E-13 9.390E-13			
882280	Ra227	5 750E+01	III WP	1 890E-13			
371000	Ra220	5 100E-02	Ϋ́	3 750E+01			
370810	Rb 81	1.572E+00	h	1 400E-10			
370830	Rb 83	8.620E+01	d	1.070E-06			
370840	Rb 84	3.282E+01	d	4.340E - 05			
370860	Rb 86	1.863E+01	d	1.540E - 01			
370870	Rb 87	4.810E+10	vr	6.900E-08			
370880	Rb 88	1.777E+01	m	3.310E+03			
370890	Rb 89	1.515E+01	m	4.380E+03			
370900	Rb 90	1.580E+02	S	4.480E+03			
370901	Rb 90m	2.580E+02	S	8.250E+02			
370910	Rb 91	5.840E+01	S	5.170E+03			

Radiological Safety Analysis Computer Program (RSAC 7.2.0)							
Name: Windows User Company: Idaho National Laboratory					Serial: 134684		
Computer: I	NL611704	Run Date	: 06/11/2	020	Run Time: 15:48:09		
File: Marvel	SNAPTRAN	2.rsac					
		_					
370920	Rb 92	4.492E+00	S	4.470E+03			
370930	Rb 93	5.840E+00	S	3.310E+03			
370940	Rb 94	2.702E+00	S	1.560E+03			
370950	Rb 95	3.775E-01	S	7.330E+02			
370970	Rb 97	1.699E-01	S	3.610E+01			
370980	Rb 98	9.600E-02	S	4.480E+00			
370990	Rb 99	5.030E-02	S	2.180E-01			
751860	Re186	3.718E+00	d	1.020E-12			
451010	Rh101	3.300E+00	yr	4.070E-08			
451011	Rh101m	4.340E+00	d	9.040E-08			
451020	Rh102	2.073E+02	d	1.680E-04			
451021	Rh102m	3.742E+00	yr	2.560E-05			
451031	Rh103m	5.611E+01	m	2.940E+03			
451050	Rh105	3.536E+01	h	1.040E+03			
451051	Rh105m	4.000E+01	S	2.950E+02			
451060	Rh106	3.007E+01	S	3.380E+02			
451061	Rh106m	1.310E+02	m	1.250E-01			
451070	Rh107	2.170E+01	m	2.190E+02			
451080	Rh108	1.680E+01	S	1.010E+02			
451081	Rh108m	6.000E+00	m	4.090E-01			
451090	Rh109	8.000E+01	S	6.280E+01			
451110	RhIII Dh112	1.100E+01	S	2.390E+01			
451120	Rh112	2.100E+00	S	1.6206+01			
451130	RHII3	2.800E+00	5	1.510E+01			
451140	RHII4 Db110	1.850E+00	5	8.290E+00			
451100	RHIIO Ph110	2.955E-01	2	1.820E-01			
4JIIJU NUCL	TDE	4.470E-01 HALF LT	ट मन	4.050E-02 CURTE			
451200	Bh120	1.624E-01	5	1.100E-02			
451210	Rh121	2.210E-01	S	1,490E-03			
862180	Rn218	3.500E-02	S	6.440E-10			
862190	Rn219	3.960E+00	S	1.050E-08			
862200	Rn220	5.560E+01	S	6.170E-07			
862220	Rn222	3.823E+00	d	1.310E-13			
441030	Ru103	3.925E+01	d	2.970E+03			
441050	Ru105	4.440E+00	h	1.040E+03			
441060	Ru106	3.718E+02	d	3.370E+02			
441070	Ru107	3.750E+00	m	2.180E+02			
441080	Ru108	4.550E+00	m	1.010E+02			
441090	Ru109	3.450E+01	S	6.130E+01			
441110	Ru111	2.120E+00	m	2.210E+01			
441120	Ru112	1.750E+00	S	1.310E+01			
441130	Ru113	8.000E-01	S	7.390E+00			
441140	Ru114	5.300E-01	S	2.390E+00			
441180	Ru118	6.160E-01	S	2.840E-03			

Radiological Safety Analysis Computer Program (RSAC 7.2.0)								
Name: Wind	ows User	Company	: Idaho N	Vational Laboratory	Serial: 134684			
Computer: I	NL611704	Run Date	06/11/2	020	Run Time: 15:48:09			
File: Marvel	SNAPTRAN	2.rsac						
441200	Bu120	2 932E-01	c.	2 840E-05				
440970	R11 97	2.830E+00	d	6.200E-12				
511181	Sb118m	5.000E+00	h	6.350E-11				
511190	Sb119	3.819E+01	h	2.430E-08				
511200	Sb120	1.589E+01	m	2.820E-06				
511220	Sb122	2.724E+00	d	4.090E-02				
511240	Sb124	6.020E+01	d	4.090E-02				
511241	Sb124m	9.300E+01	S	6.240E-03				
511250	Sb125	2.759E+00	vr	1.350E+01				
511260	Sb126	1.235E+01	d	8.490E-01				
511261	Sb126m	1.915E+01	m	1.600E+00				
511270	Sb127	3.850E+00	d	1.570E+02				
511280	Sb128	9.010E+00	h	2.290E+01				
511281	Sb128m	1.040E+01	m	3.290E+02				
511290	Sb129	4.400E+00	h	5.320E+02				
511300	Sb130	3.950E+01	m	6.960E+02				
511301	Sb130m	6.300E+00	m	9.710E+02				
511310	Sb131	2.303E+01	m	2.420E+03				
511320	Sb132	2.790E+00	m	1.690E+03				
511321	Sb132m	4.100E+00	m	9.720E+02				
511330	Sb133	2.500E+00	m	1.990E+03				
511340	Sb134	7.800E-01	S	3.500E+02				
511341	Sb134m	1.007E+01	S	3.600E+02				
511350	Sb135	1.710E+00	S	1.460E+02				
511360	Sb136	8.200E-01	S	1.290E+01				
511370	Sb137	2.83/E-01	S	6.580E+01				
511380	SD138	1.304E-01	S	7.870E-02				
311390	SDI39	1.720E-01	5	4.370E-03				
340750	Se 75	1.190E+02	a	1.820E-09				
240790	Se 79	2.950E+05	ΥΥ	4 170E+01				
340791	Se 79m	3.920E+00	m	1 910E+01				
340810	Se 01 Se 81m	5 728E+01	m	1 330E+01				
NUCL	TDE	HALF LT	373	CURTE				
340830	SP 83	2.230E+01	m	4.280E+02				
340831	Se 83m	7.010E+01	S	3.930E+01				
340840	Se 84	3.260E+00	m	9.000E+02				
340850	Se 85	3.170E+01	S	9.890E+02				
340860	Se 86	1.530E+01	S	1.270E+03				
340870	Se 87	5.500E+00	S	7.250E+02				
340880	Se 88	1.530E+00	S	3.290E+02				
340890	Se 89	4.100E-01	S	4.880E+01				
340900	Se 90	5.545E-01	S	1.250E+01				
340910	Se 91	2.700E-01	S	7.980E-01				
340920	Se 92	2.478E-01	S	5.800E-02				

Radiological	Safety Analy	sis Computer Pro	ogram	(RSAC 7.2.0)	
Name: Wind	ows User	Serial: 134684			
Computer: I	NL611704	Run Date	: 06/11	/2020	Run Time: 15:48:09
File: Marvel	SNAPTRAN	2.rsac			
621450	Sm145	3.400E+02	d	1.480E-07	
621460	Sm146	1.030E+08	vr	2.700E-12	
621470	Sm147	1.060E+11	vr	5.860E-09	
621480	Sm148	7.000E+15	vr	5.650E-15	
621510	Sm151	9.000E+01	vr	5.410E+00	
621530	Sm153	4.650E+01	h	1.710E+02	
621550	Sm155	2.230E+01	m	3.440E+01	
621560	Sm156	9.400E+00	h	1.700E+01	
621570	Sm157	4.820E+02	S	7.530E+00	
621580	Sm158	5.300E+00	m	3.870E+00	
621590	Sm159	1.137E+01	S	1.170E+00	
501130	Sn113	1.151E+02	d	2.170E-11	
501171	Sn117m	1.360E+01	d	2.930E-02	
501191	Sn119m	2.930E+02	d	3.840E-01	
501210	Sn121	2.703E+01	h	1.310E+01	
501211	Sn121m	5.500E+01	vr	3.060E-02	
501230	Sn123	1.292E+02	d	1.170E+00	
501231	Sn123m	4.006E+01	m	1.550E+01	
501250	Sn125	9.640E+00	d	1.380E+01	
501251	Sn125m	9.520E+00	m	2.140E+01	
501260	Sn126	2.300E+05	yr	3.380E-04	
501270	Sn127	2.100E+00	ĥ	9.550E+01	
501271	Sn127m	4.130E+00	m	5.500E+01	
501280	Sn128	5.907E+01	m	3.220E+02	
501290	Sn129	2.230E+00	m	2.840E+02	
501291	Sn129m	6.900E+00	m	1.880E+02	
501300	Sn130	3.720E+00	m	5.840E+02	
501310	Sn131	5.600E+01	S	4.480E+02	
501320	Sn132	3.970E+01	S	5.660E+02	
501330	Sn133	1.450E+00	S	1.030E+02	
501340	Sn134	1.120E+00	S	1.790E+01	
501350	Sn135	2.910E-01	S	7.710E-01	
501360	Sn136	4.131E-01	S	2.830E-02	
381000	Sr100	2.020E-01	S	3.760E+01	
381010	Sr101	1.180E-01	S	4.560E+00	
381020	Sr102	6.900E-02	S	2.200E-01	
381030	Sr103	1.386E-01	S	3.540E-03	
381040	Sr104	1.925E-01	S	3.240E-04	
380830	Sr 83	3.241E+01	h	2.370E-11	
NUCL	IDE	HALF LI	FE	CURIE	
380850	Sr 85	6.484E+01	d	2.590E-07	
380851	Sr 85m	6.763E+01	m	1.530E-07	
380871	Sr 87m	2.815E+00	h	8.580E-02	
380890	Sr 89	5.053E+01	d	4.400E+03	
380900	Sr 90	2.879E+01	yr	2.530E+02	

Radiological Safety Analysis Computer Program (RSAC 7.2.0)								
Name: Wind	ows User	Company	Idaho N	ational Laboratory	Serial: 134684			
Computer: I	NL611704	Run Date:	06/11/20	020	Run Time: 15:48:09			
File: Marvel	SNAPTRAN	2 rsac						
The way	SINAI IRAN	2.1540						
200010	Gm 01	0 (207.00	1-	F 4100-00				
380910	Sr 91	9.630E+00	n Þ	5.410E+03				
380920	Sr 92	2.710E+00	n	5.530E+03				
380930	SE 93	7.423E+00	m	5.8208+03				
380940	SE 94	7.530E+01	S	5.650E+03				
380950	SE 95	2.390E+01	5	4.930E+03				
380970	SE 97	4.200E-01	5	1.650E+03				
380980	SE 98	6.530E-01	S	1.200E+02				
380990	SE 99	2.690E-01	5	I.390E+02				
721700	Ia170	9.310E+00	111	3.620E 10				
731790	Tal /9	9 154E+00	YL P	3.620E-10				
721020	Ta100	0.104E+00	11	4.820E-07				
721020	Ta102	1.150E+02	u h	0.130E-03				
731830	Ta102m	5 100E+00	d	1 300E-07				
651550	Ta105	5 3205+00	d	9 630 - 11				
651560	TD155 Tb156	5.350E+00	d	5.030E-11				
651561	Tb156m	2 110E+01	h	6.060F-10				
651570	TD150m	7 1005+01	11 Wr	1 7205-09				
651580	Tb158	1 800E+01	yr yr	1 230E-08				
651600	Tb160	7.230E+01	d d	8.130E-03				
651610	Tb161	6.910E+00	d	1,990E-01				
431010	Tc101	1.420E+01	m	4.910E+03				
431020	Tc102	5.280E+00	S	4.110E+03				
431021	Tc102m	4.350E+00	m	9.310E+00				
431030	Tc103	5.420E+01	S	2.980E+03				
431040	Tc104	1.830E+01	m	1.900E+03				
431050	Tc105	7.600E+00	m	1.040E+03				
431060	Tc106	3.560E+01	S	4.770E+02				
431070	Tc107	2.120E+01	S	2.000E+02				
431080	Tc108	5.170E+00	S	7.440E+01				
431090	Tc109	8.700E-01	S	3.910E+01				
431110	Tc111	2.900E-01	S	5.470E+00				
431120	Tc112	2.800E-01	S	1.090E+00				
431130	Tc113	1.300E-01	S	2.630E-01				
431140	Tc114	1.734E-01	S	3.700E-02				
430960	TC 96	4.280E+00	d	3.650E-13				
430970	TC 97	2.600E+06	yr	1.530E-13				
430971	TC 97m	9.010E+01	d	2.840E-07				
430980	TC 98	4.200E+06	yr	4.720E-10				
430990	TC 99	2.111E+05	yr	3.760E-02				
430991	TC 99m	6.020E+00	h	5.070E+03				
521210	Te121	1.916E+01	d	7.990E-09				
521211	Tel21m	1.540E+02	d	3.510E-09				
521231	Te123m	1.192E+02	d	2.350E-05				
521251	Te125m	5.740E+01	d	2.830E+00				

Radiological	Safety Analy	ysis Computer Pr	ogram	(RSAC 7.2.0)	
Name: Wind	lows User	Company	: Idaho	o National Laboratory	Serial: 134684
Computer: ]	NL611704	Run Date	: 06/11	/2020	Run Time: 15:48:09
File: Marvel	SNAPTRAN	J 2.rsac			
NUCL	TDE	HALF LT	ਸ਼ਾਜ	CURTE	
521270	Te127	9.350E+00	h	1.560E+02	
521271	Te127m	1.090E+02	d	2.490E+01	
521290	Te129	6.960E+01	m	5.080E+02	
521291	Tel29m	3.360E+01	d	8.940E+01	
521310	Te131	2.500E+01	m	2.450E+03	
521311	Tel31m	3.325E+01	h	4.020E+02	
521320	Te132	3.204E+00	d	4.080E+03	
521330	Te133	1.250E+01	m	3.180E+03	
521331	Te133m	5.540E+01	m	3.530E+03	
521340	Te134	4.180E+01	m	6.540E+03	
521350	Te135	1.900E+01	S	3.150E+03	
521360	Te136	1.750E+01	S	1.290E+03	
521370	Te137	2.490E+00	S	3.920E+02	
521380	Te138	1.400E+00	S	6.730E+01	
521390	Te139	4.237E-01	S	7.320E+00	
521400	Te140	7.520E-01	S	1.550E+01	
521410	Te141	2.358E-01	S	8.250E-02	
521420	Te142	4.912E-01	S	2.800E-03	
902260	Th226	3.057E+01	m	6.440E-10	
902270	Th227	1.868E+01	d	1.090E-08	
902280	Th228	1.912E+00	yr	6.300E-07	
902290	Th229	7.340E+03	yr	7.260E-12	
902300	Th230	7.538E+04	yr	4.610E-10	
902310	Th231	2.552E+UI	n	9.120E-03	
902320	Th232	1.405E+10	Уr	I./IUE-12	
902340	TH234	2.410E+01	a	1 050E-09	
812070	T1207	4.770E+00	m	2 2205-07	
812090	T1200	2 200E+00	m	1 4105-12	
691670	Tm167	9 250E+00	d	1 520E-12	
691700	Tm170	1 286E+02	d	6 430E-06	
691710	Tm171	1.920E+00	vr	4.540E-05	
691720	Tm172	6.360E+01	h	1.240E-04	
691730	Tm173	8.240E+00	h	2.290E-13	
922300	U230	2.080E+01	d	6.430E-10	
922310	U231	4.200E+00	d	2.110E-10	
922320	U232	6.890E+01	yr	3.070E-06	
922330	U233	1.592E+05	yr	6.780E-08	
922340	U234	2.455E+05	yr	5.010E-05	
922350	U235	7.038E+08	yr	9.120E-03	
922360	U236	2.342E+07	yr	1.300E-03	
922370	U237	6.750E+00	d	1.580E+02	
922380	U238	4.468E+09	yr	5.890E-03	
922390	U239	2.345E+01	m	3.530E+04	

Radiological	Safety Analy	ysis Computer Pro	ograr	n (RSAC 7.2.0 )		
Name: Wind	Company	Company: Idaho National Laboratory				
Computer: INL611704 Run Da			06/	11/2020	Run Time: 15:48:09	
File: Marvel	SNAPTRAN	J 2.rsac				
741810	W181	1.212E+02	d	1.000E-09		
741850	W185	7.510E+01	d	2.020E-10		
741870	W187	2.400E+01	h	2.270E-16		
541250	Xe125	1.690E+01	h	1.510E-12		
541270	Xe127	3.640E+01	d	5.120E-08		
541291	Xe129m	8.880E+00	d	8.200E-06		
NUCL	IDE	HALF LI	FE	CURIE		
541311	Xe131m	1.184E+01	d	2.980E+01		
541330	Xe133	5.243E+00	d	6.070E+03		
541331	Xe133m	2.190E+00	d	1.830E+02		
541341	Xe134m	2.900E-01	S	3.360E+01		
541350	Xe135	9.140E+00	h	5.840E+03		
541351	Xe135m	1.529E+01	m	1.130E+03		
541370	Xe137	3.818E+00	m	5.780E+03		
541380	Xe138	1.408E+01	m	5.910E+03		
541390	Xe139	3.968E+01	S	4.710E+03		
541400	Xe140	1.360E+01	S	3.410E+03		
541410	Xe141	1.730E+00	S	1.180E+03		
541420	Xe142	1.220E+00	S	4.200E+02		
541430	Xe143	3.000E-01	S	4.060E+01		
541440	Xe144	1.150E+00	S	6.690E+00		
541450	Xe145	9.000E-01	S	2.030E-01		
541460	Xe146	9.372E-01	S	1.920E-02		
541470	Xe147	2.638E-01	s	1.820E-03		
391000	Y100	9.400E-01	S	6.430E+02		
391010	Y101	4.480E-01	S	2.750E+02		
391020	Y102	3.600E-01	S	2.640E+02		
391030	Y103	2.300E-01	S	3.740E+00		
391040	Y104	1.442E-01	S	6.790E-01		
391050	Y105	1.736E-01	S	3.490E-02		
391070	Y107	1.046E-01	S	1.580E-05		
390880	Y 88	1.066E+02	d	3.340E-04		
390900	Y 90	6.400E+01	h	2.610E+02		
390901	Y 90m	3.190E+00	h	6.740E-01		
390910	Y 91	5.851E+01	d	5.400E+03		
390911	Y 91m	4.971E+01	m	3.180E+03		
390920	Y 92	3.540E+00	h	5.590E+03		
390930	Y 93	1.018E+01	h	5.920E+03		
390940	Y 94	1.870E+01	m	6.030E+03		
390950	Y 95	1.030E+01	m	5.970E+03		
390970	Y 97	3.750E+00	S	2.880E+03		
390980	Y 98	2.000E+00	S	1.0007.02		
390990	1 99 Vb1 00	1.4/0E+00	S	1.9908+03		
701690	1D169	3.202E+01	a	1.210E-12		
101/50	C/ Lar	4.185E+00	a	Z.ZIUE-0/		

Radiological	Safety Analy	sis Computer Pr	ogram	(RSAC 7.2.0)			
Name: Windows User		Company: Idaho National Laboratory			Serial: 134684		
Computer: INL611704		Run Date: 06/11/2020			Run Time: 15:48:09		
File: Marvel	SNAPTRAN	_2.rsac					
701770	Yb177	1.911E+00	h	2.770E-07			
300690	Zn 69	5.640E+01	m	2.440E-03			
300691	Zn 69m	1.376E+01	h	3.460E-06			
300711	Zn 71m	3.960E+00	h	5.150E-04			
300720	Zn 72	4.650E+01	h	3.130E-02			
300730	Zn 73	2.350E+01	S	1.090E-01			
300740	Zn 74	9.540E+01	S	3.200E-01			
300750	Zn 75	1.020E+01	S	8.480E-01			
300760	Zn 76	5.700E+00	S	1.910E+00			
300770	Zn 77	2.080E+00	S	3.050E+00			
300780	Zn 78	1.470E+00	S	3.370E+00			
300790	Zn 79	9.950E-01	S	1.550E+00			
NUCL	IDE	HALF LI	FE	CURIE			
300800	Zn 80	5.400E-01	S	2.390E-01			
300810	Zn 81	2.900E-01	S	4.650E-03			
300830	Zn 83	8.386E-02	S	1.560E-04			
401000	Zr100	7.100E+00	S	5.310E+03			
401010	Zr101	2.300E+00	S	2.920E+03			
401020	Zr102	2.900E+00	S	1.950E+03			
401030	Zr103	1.300E+00	S	5.160E+02			
401040	Zr104	1.200E+00	S	8.810E+01			
401050	Zr105	6.000E-01	S	1.060E+02			
401060	Zr106	9.800E-01	S	3.820E-02			
401070	Zr107	2.485E-01	S	6.410E-03			
401080	Zr108	4.075E-01	S	3.310E-04			
401090	Zr109	1.387E-01	S	3.890E-04			
400880	Zr 88	8.340E+01	d	6.100E-10			
400890	Zr 89	7.841E+01	h	1.730E+00			
400930	Zr 93	1.530E+06	yr	6.040E-03			
400950	Zr 95	6.402E+01	d	6.410E+03			
400970	Zr 97	1.691E+01	h	6.150E+03			
400980	Zr 98	3.070E+01	S	5.330E+03			
400990	Zr 99	2.100E+00	S	5.340E+03			

#### **Fission Product Calculation**

FRACTIONATION (ELEMENT, VALUE) Ar 7.500E-01 At 7.000E-01 Br 7.000E-01 Cl 7.000E-01 Cs 7.000E-01 F 7.000E-01 Fr 7.000E-01 H 7.500E-01 I 7.000E-01 K 7.000E-01 Kr 7.500E-01 Na 7.000E-01 Po 4.500E-01 Rb 7.000E-01 Rn 7.500E-01 Na 7.000E-01 Sb 4.000E-02 Se 4.500E-01 Te 4.500E-01 Xe 7.500E-01 FRACTIONATION FOR THE REST OF THE RADIONUCLIDE INVENTORY = 4.000E-02 TOTAL RADIONUCLIDE REMAINING = 5.293E+15 D/S OR 1.430E+05 CI

**Evaluation of Microreactor Inhalation Dose Consequences** 

Radiological Safety Analysis Computer Program (RSAC 7.2.0)					
Name: Windows User	Company: Idaho National Laboratory	Serial: 134684			
Computer: INL611704	Run Date: 06/11/2020	Run Time: 15:48:09			
File: Marvel SNAPTRAN_2.rsac					

#### Meteorological Data

m)	MEAN WIND SPEED = MIXING LAYER HEIGHT =	1.040E+00 (m 4.000E+02 (m	n/s) STACK n) AIR	HEIGHT = 0 DENSITY = 1	.000E+00 .099E+03	(m) (g/cu
,	WET DEPOSITION SCAVEN	SING CORFFICT	ENT = 0.000	E+00 (1/s)		
	DRY DEPOSITION VELOCI	TTES (m/s)		2.00 (2/5/		
	SOLIDS = 1.000E-0	03 HALOGEN	IS = 1.000E -	02 NOBLE	GASES =	
0.00	0E+00					
	CESIUM = 1.000E-0	03 RUTHENIU	M = 1.000E-	03		
	THERE IS 1 SET OF LEAD	KAGE CONSTANT	S (K1,K2)			
	1.000E+00	0.000E+00				
	PLUME MEANDER FACTOR =	= 1.00E+00				
	PASQUILL CLASS F METE	DROLOGY, MARK	EE SIGMA VA	LUES		
	NO BUILDING WAKE CORR	ECTION MADE				
	DOWNWIND DISTANCE	STACK	SIGY	SIGZ	CHI/	Q
		HEIGHT (m)	(m)	(m)	(s/m^	3)
	6.000E+03	0.000E+00	7.842E+02	1.163E+01	3.355E	-05
	3.200E+04	0.000E+00	2.588E+03	1.939E+01	6.098E	-06
	4.800E+04	0.000E+00	3.273E+03	2.194E+01	4.263E	-06
	PLUME DEPLETION BY FAI	LLOUT IS INCL	UDED			
	FRACTION OF PLUME R	EMAINING AIRE	ORNE FOLLOW	ING DEPLETI	ON BY	
DEPO	SITION					
	DOWNWIND DISTANCE	SOLIDS	HALOGENS	CESIUM	RUTHENIU	М
	6.000E+03	9.026E-01	3.588E-01	9.026E-01	9.026E-0	1
	3.200E+04	7.971E-01	1.035E-01	7.971E-01	7.971E-0	1
	4.800E+04	7.572E-01	6.193E-02	7.572E-01	7.572E-0	1

#### Inhalation Dose Calculation

USING DOSE CONVERSION FACTORS FROM ICRP-72 FOR MEMBERS OF THE PUBLIC RESPIRABLE FRACTION = 1.000E+00 BREATHING RATE = 3.330E-04 (m^3/s) RELEASE TIME FOR EXPONENTIAL DECAY FUNCTION = 1.000E+00 (s) INTERNAL EXPOSURE TIME PERIOD = 5.000E+01 (yr) LUNG ABSORPTION TYPES SELECTED TO GIVE MAXIMUM DOSE INHALATION DOSE CALCULATIONS FOR ADULT AGE ICRP-72 INHALATION DOSE (rem) DOWNWIND DISTANCE = 6.00E+03 (m) COMMITTED COMMITTED COMMITTED COMMITTED COMMITTED COMMITTED COMMITTED C03E+00

Evaluation of Microreactor Inhalation Dose Consequences

Radiological Safety Analysis C	omputer Program (RSAC	7.2.0)
Name: Windows User	Company: Idaho Nationa	al Laboratory Serial: 134684
Computer: INL611704	Run Date: 06/11/2020	Run Time: 15:48:09
File: Marvel SNAPTRAN_2.rs	ac	
ICRP-72 INHALATION	N DOSE (rem)	$CHI/Q = 6.098E - 06 (s/m^3)$
DOWNWIND DISTAN	CE = 3.20E + 04 (m)	PLUME TRAVEL TIME = 3.08E+04 (s)
		COMMITTED EQUIVALENT
TOTAL	E 50 DOSE =	4.01E-01
ICRP-72 INHALATION	N DOSE (rem)	$CHI/Q = 4.263E - 06 (s/m^3)$
DOWNWIND DISTAN	CE = 4.80E + 04 (m)	PLUME TRAVEL TIME = $4.62E+04$ (s)
		COMMITTED EQUIVALENT
TOTAL	E 50 DOSE =	2.60E-01

#### **Gamma Dose Calculation**

EXPOSURE TIME = $1.0000E+00$ (S)								
CALCULATIC	ONS MADE US	SING THE FI	NITE MODEL					
				EXTERNAL	EDE			
DOWNWIND DI	STANCE =	6.000E+03	(M)	DOSE =	2.33E-02	(REM)		
DOWNWIND DI	STANCE =	3.200E+04	(M)	DOSE =	1.55E-03	(REM)		
DOWNWIND DI	ISTANCE =	4.800E+04	(M)	DOSE =	8.55E-04	(REM)		

#### **Execution Time**

1.30E-01 SECONDS