129090
M-474

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for Maywood, New Jersey

U.S. Department of Energy

0489-0613.1

Department of Energy

Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831—8723

April 26, 1995

Ms. Angela Carpenter
Federal Facilities Section
U.S. Environmental Protection Agency
Region II
290 Broadway
New York, New York 10007-1866

Dear Ms. carpenter:

MAYWOOD SITE - TRANSMITTAL OF CALCULATION RESULTS FOR NATIONAL EMISSION STANDARD FOR HAZARDOUS AIR POLLUTANTS

Enclosed for your information are the results of radionuclide emission calculations performed by the U.S. Department of Energy in preparation for the scheduled removal of soil from the pile at the Maywood Interim Storage Site.

The contaminated soil to be removed is presently contained within the fully encapsulated storage pile on site. The soil will be transported by rail from the site and shipped to Envirocare in Clive, Utah. Preparatory activities have commenced, and shipment is scheduled to begin the week of May 1, 1995.

The enclosed calculations were preformed in compliance with NESHAPs Subpart H requirements. The results demonstrate that anticipated emissions of non-radon radionuclides from site activities associated with removal of soil would produce a dose of 0.43 mrem/yr to maximally exposed individual located 50 meters north-northeast of the pile. However, this calculation represents the maximum volume of material that may be removed. The actual volume of soil to be removed may be less. Continuous air samplers will be employed at perimeter locations throughout pile removal activities.

If you have questions or need further information, please contact me at (615) 241-6344.

Sincerely,

John Michael Japp, Site Manager
Former Sites Restoration Division

Enclosure

cc w/enclosure:
Paul Giardina, EPA II
Nick Marton, NJDEP

128711

ATTACHMENT

Dose Modeling of Airborne Radioactivity Emission
from Opening the Maywood Interim Storage Site Pile
for 12,300 Cubic Yards of Waste for Disposal

128711

CALCULATION COVER SHEET

Bechtel National, Inc.

Project: FUSRAP - MISS

Job No.: 14501

Discipline: Environmental Technology | Calc. No.: 138-CV-071

Subject: Airborne Radioactivity Emission Rates from Opening the MISS Pile for 12300 yd^3 Disposal

Computer Program: none | Program No.: n/a

Committed Calculation ☒ Preliminary ☐ Superseded ☐

Rev	Sheets	Originator	Checker	Reviewer	Approval	Date
0	5	Carl Eric von Buelow 3/27/95	M. Daniel 3/28/95	3/28/95	3/30/95	

Summary of Revision

Microfilmed:	Rev	Date	Spool Number	Rev	Date	Spool Number

ORG:Carl von Buelow 3/27/95 · CALC:14501-138-CV-071rev0 CHK: 128711

PURPOSE

This calculation estimates the airborne radioactivity emission rates generated by (1) wind erosion of soil from the pile opening at the Maywood Interim Storage Site (MISS) and (2) mechanical disturbances resulting from batch material transfer for loading 12300 cubic yards of radioactively contaminated soil into gondola rail cars for disposal.

SCOPE

This calculation uses the U.S. Environmental Protection Agency's (EPA) rapid assessment methodology for estimating the emission rates of radioactive particles to the atmosphere based on storage pile and aggregate handling predictive emission factor equations (Cowherd 1985 Appendix E).

REFERENCES

Bechtel National, Inc. (BNI), 1991. Characterization Report for the Interim Storage Pile at the Maywood Interim Storage Site. DOE/OR/21949-298. Oak Ridge, TN.

Callahan, Dr.J.P., 1994. Soil Analysis Report for MISS. Contract No. 14501-191-TSC-3906. Controls for Environmental Pollution, Inc (CEP). Santa Fe, NM.

Cowherd, C.Jr., et.al., 1985. Rapid Assessment of Exposure to Particulate Releases from Surface Contamination. EPA/600/8-85/002. Midwest Research Institute. Kansas City, MO.

National Oceanic and Atmospheric Administration (NOAA), 1994. Local Climatological Data for Newark, NJ. National Climatic Data Center. Asheville, NC.

Shleien, B., 1992. The Health Physics and Radiological Health Handbook. Revised Edition. Scinta, Inc. Silver Spring, MD.

ASSUMPTIONS

The planned waste shipment requires the transfer of approximately 12300 cubic yards of soil from openings in the storage pile not to exceed 5000 square feet using a front end loader with a three cubic yard bucket and an average drop height of one meter. Only one opening will be uncovered at a time and only during working hours. The construction season is approximately 30 weeks per year, working 7 days per week, and 12 hours per day.

Daughters in the decay chains of radionuclides are considered to be in secular equilibrium until a radionuclide in the chain is encountered with a measured concentration. Radium daughters are not included since the immediate daughter of Radium is Radon, a gas, which is not applicable to the analysis of particulate behavior.

CALCULATIONS

Wind Erosion

The silt content (s) given as the percent of the soil in the pile that would pass through a 200 mesh (0.075 mm) screen (Callahan 1994) is:

$$s := 22.1 \cdot \%$$ ✓

The number of days (p) with over 0.01 inches of precipitation per year based on the last annualized weather data (1994) for Newark, NJ (NOAA 1994) is:

$$p := 110$$ ✓

The percentage of time (f) that the unobstructed wind speed exceeded 5.4 meters per second (13.8 knots) is derived from the wind speed observations at 3-hour intervals for Newark, NJ (NOAA 1994). Dividing the number of intervals with wind speed exceeding 13.8 knots by the total number of 3-hour intervals is:

$$f := \frac{402}{2920} \qquad f = 13.767 \cdot \%$$ ✓

The wind erosion emission factor (Fw) for emissions from wind erosion of active storage piles (Cowherd 1985 Equation 3 on Page E-9) is:

$$F_w := 1.9 \cdot \frac{s}{1.5 \cdot \%} \cdot \frac{365 - p}{235} \cdot \frac{f}{15 \cdot \%} \cdot \frac{kg}{day \cdot hectare} \qquad F_w = 27.879 \cdot \frac{kg}{day \cdot hectare}$$ ✓

The area (A) of the pile openings (assumption) is:

conversion factor: $1 \cdot m^2 = 10.763910 \cdot ft^2$

conversion factor: $1 \cdot hectare = 10000 \cdot m^2$

$$A := 5000 \cdot ft^2 \qquad A = 464.51520 \cdot m^2$$ ✓ $$A = 0.04645152 \cdot hectare$$ ✓

The maximum actual time (Tmax) that the pile will be opened based on the construction season andworking hours (assumption) is:

$$T_{max} := 30 \cdot \frac{wk}{yr} \cdot 7 \cdot \frac{day}{wk} \cdot 12 \cdot \frac{hr}{day} \qquad T_{max} = 2520 \cdot \frac{hr}{yr}$$ ✓

The total time (Ttot) that the pile could be opened based on the total number of hours in 28 weeks is:

$$T_{tot} := 28 \cdot \frac{wk}{yr} \cdot 7 \cdot \frac{day}{wk} \cdot 24 \cdot \frac{hr}{day} \qquad T_{tot} = 4704 \cdot \frac{hr}{yr}$$ ✓

Dividing the maximum time by the total time, the maximum percentage (P) of time that the pile is opened is:

$$P := \frac{T_{max}}{T_{tot}} \qquad P = 53.571 \cdot \%$$ ✓

Multiplying the wind erosion emission factor by the area of the openings in the storage pile and the percentage of time that the pile is open per year, the annual emission from wind erosion (Ew) is:

conversion factor: $1 \cdot yr = 365 \cdot day$

$$E_w := F_w \cdot A \cdot P \qquad E_w = 253.392 \cdot \frac{kg}{yr}$$ ✓

Material Handling

The batch drop particle size multiplier (k) corresponding to aerodynamic particle sizes less than 10 microns (Cowherd 1985 Table 11.2.3-2 on Page E-7), which is the particle size of concern for inhalation, is:

$$k := 0.36$$ ✓

The mean annual wind speed (U) based on the last annualized weather data (1994) for Newark, NJ (NOAA 1994) is:

conversion factor: $1 \cdot \frac{m}{sec} = 2.236936 \cdot mph$

$U := 10.26 \cdot mph$ ✓ $\quad U = 4.587 \cdot \frac{m}{sec}$ ✓

The average drop height (H) during material handling (assumption) is:

$H := 1 \cdot m$

The moisture content (M) of the soil (Callahan 1994) is:

$M := 14.4 \cdot \%$

The capacity (Y) of the dumping device (assumption) is:

conversion factor: $1 \cdot m^3 = 1.307951 \cdot yd^3$

$Y := 3 \cdot yd^3$ ✓ $\quad Y = 2.294 \cdot m^3$ ✓

The emission factor (Fd) for dropping material into shipping containers as it is removed from a pile (Cowherd 1985 Equation 1 on Page E-7) is:

$$F_d := k \cdot \left(0.00090 \cdot \frac{\% \cdot sec}{m}\right) \cdot \left[\frac{\left(\frac{s}{5}\right) \cdot \left(\frac{U}{2.2}\right) \cdot \left(\frac{H}{1.5}\right)}{\left(\frac{M}{2}\right)^2 \cdot \left(\frac{Y}{4.6}\right)^{\frac{1}{3}}}\right] \cdot \frac{kg}{Mg} \qquad F_d = 4.842 \cdot 10^{-5} \cdot \frac{kg}{Mg}$$ ✓

The maximum volume of soil (V) to be moved in any one year (assumption) is:

conversion factor: $1 \cdot yd^3 = 764555 \cdot cm^3$

$V := 12300 \cdot \frac{yd^3}{yr} \qquad V = 9.404 \cdot 10^9 \cdot \frac{cm^3}{yr}$ ✓

The maximum bulk dry density (ρ) of the soil (Callahan 1994) is:

conversion factor: $1 \cdot \frac{gm}{cm^3} = 62.427961 \cdot \frac{lb}{ft^3}$

$\rho := 120.5 \cdot \frac{lb}{ft^3}$ ✓ $\quad \rho = 1.930 \cdot \frac{gm}{cm^3}$ ✓

Multiplying the volume by the density, the mass of soil (M) to be moved is:

conversion factor: $1 \cdot Mg = 1 \cdot 10^6 \cdot gm$

$M := \rho \cdot V \qquad M = 18151.882 \cdot \frac{Mg}{yr}$ ✓

Multiplying the batch drop emission factor by the mass of soil to be moved, the annual emission from material handling (Ed) is:

$$E_d := F_d M \qquad E_d = 0.878914 \cdot \frac{kg}{yr}$$ ✓

Adding the annual wind emission to the annual material handling emission, the total annual emission (E) is:

$$E := E_w + E_d \qquad E = 254.271 \cdot \frac{kg}{yr}$$ ✓

Radionuclide Source Concentrations

The average radionuclide source concentrations in the MISS storage pile (BNI 1991) are

$$S_{U238} := 17 \cdot \frac{pCi}{gm} \qquad S_{Ra226} := 2.4 \cdot \frac{pCi}{gm} \qquad S_{Th232} := 18.1 \cdot \frac{pCi}{gm}$$

Ratios of uranium isotopes can be calculated from the percentage of specific activity of U-238, U-234, and U-235 in natural uranium since these components make up total uranium. The specific activities (SA) and percent abundance (PA) of each isotope in natural uranium are (Shleien 1992 Table 8.4.1 on Page 165 and Table 8.12 on Page 286):

$$SA_{U238} := 1.24 \cdot 10^{-8} \cdot \frac{TBq}{gm} \qquad PA_{U238} := 99.2739 \cdot \%$$

$$SA_{U234} := 2.31 \cdot 10^{-4} \cdot \frac{TBq}{gm} \qquad PA_{U234} := 0.0057 \cdot \%$$

$$SA_{U235} := 8.00 \cdot 10^{-8} \cdot \frac{TBq}{gm} \qquad PA_{U235} := 0.7204 \cdot \%$$

note:

$1 \cdot TBq = 1 \cdot 10^{12} \cdot Bq$

$1 \cdot Bq = 27.030 \cdot pCi$

The specific activity of total uranium is:

$$SA_{Utot} := PA_{U238} \cdot SA_{U238} + PA_{U234} \cdot SA_{U234} + PA_{U235} \cdot SA_{U235} \qquad SA_{Utot} = 2.605 \cdot 10^{-8} \cdot \frac{TBq}{gm}$$ ✓

The percent (P) contributed by each isotope to the total specific activity of natural uranium is:

$$P_{U238} := \frac{PA_{U238} \cdot SA_{U238}}{SA_{Utot}} \qquad P_{U238} = 47.249 \cdot \%$$ ✓

$$P_{U234} := \frac{PA_{U234} \cdot SA_{U234}}{SA_{Utot}} \qquad P_{U234} = 50.539 \cdot \%$$ ✓

$$P_{U235} := \frac{PA_{U235} \cdot SA_{U235}}{SA_{Utot}} \qquad P_{U235} = 2.212 \cdot \%$$ ✓

The source concentrations of total uranium, U-234, and U-235 are:

$$S_{Utot} := \frac{S_{U238}}{P_{U238}} \qquad S_{Utot} = 36.0 \cdot \frac{pCi}{gm}$$

$$S_{U234} := P_{U234} \cdot S_{Utot} \qquad S_{U234} = 18.2 \cdot \frac{pCi}{gm}$$

$$S_{U235} := P_{U235} \cdot S_{Utot} \qquad S_{U235} = 0.80 \cdot \frac{pCi}{gm}$$

Emission Rates

Multiplying the annual emission by each radionuclide source concentration, the annual radionuclide emission rates (R) are:

conversion factor: $1 \cdot kg = 1 \cdot 10^{3} \cdot gm$

conversion factor: $1 \cdot pCi = 1 \cdot 10^{-12} \cdot Ci$

$$R_{U238} := E \cdot S_{U238} \qquad R_{U238} = 4.323 \cdot 10^{-6} \cdot \frac{Ci}{yr}$$

$$R_{U234} := E \cdot S_{U234} \qquad R_{U234} = 4.624 \cdot 10^{-6} \cdot \frac{Ci}{yr}$$

$$R_{Ra226} := E \cdot S_{Ra226} \qquad R_{Ra226} = 6.103 \cdot 10^{-7} \cdot \frac{Ci}{yr}$$

$$R_{U235} := E \cdot S_{U235} \qquad R_{U235} = 2.024 \cdot 10^{-7} \cdot \frac{Ci}{yr}$$

$$R_{Th232} := E \cdot S_{Th232} \qquad R_{Th232} = 4.602 \cdot 10^{-6} \cdot \frac{Ci}{yr}$$

SUMMARY OF RESULTS

The estimated airborne radioactivity emission rates, including daughters (assumption), generated by wind erosion and material handling during the MISS storage pile opening for removal of 12300 cubic yards of soil, are:

$R_{U238} = 4.323 \cdot 10^{-6} \cdot \frac{Ci}{yr}$ $R_{U235} = 2.024 \cdot 10^{-7} \cdot \frac{Ci}{yr}$ $R_{Th232} = 4.602 \cdot 10^{-6} \cdot \frac{Ci}{yr}$

$R_{Th234} = 4.323 \cdot 10^{-6} \cdot \frac{Ci}{yr}$ $R_{Th231} = 2.024 \cdot 10^{-7} \cdot \frac{Ci}{yr}$ $R_{Ra228} = 4.602 \cdot 10^{-6} \cdot \frac{Ci}{yr}$

$R_{Pa234} = 4.323 \cdot 10^{-6} \cdot \frac{Ci}{yr}$ $R_{Pa231} = 2.024 \cdot 10^{-7} \cdot \frac{Ci}{yr}$ $R_{Ac228} = 4.602 \cdot 10^{-6} \cdot \frac{Ci}{yr}$

$R_{U234} = 4.624 \cdot 10^{-6} \cdot \frac{Ci}{yr}$ $R_{Ac227} = 2.024 \cdot 10^{-7} \cdot \frac{Ci}{yr}$ $R_{Th228} = 4.602 \cdot 10^{-6} \cdot \frac{Ci}{yr}$

$R_{Th230} = 4.624 \cdot 10^{-6} \cdot \frac{Ci}{yr}$ $R_{Th227} = 2.024 \cdot 10^{-7} \cdot \frac{Ci}{yr}$ $R_{Ra224} = 4.602 \cdot 10^{-6} \cdot \frac{Ci}{yr}$

$R_{Ra226} = 6.103 \cdot 10^{-7} \cdot \frac{Ci}{yr}$ $R_{Ra223} = 2.024 \cdot 10^{-7} \cdot \frac{Ci}{yr}$

128711

Bechtel National, Inc.

CALCULATION COVER SHEET

Project: FUSRAP - MISS

Job No.: 14501

Discipline: Environmental Technology

Calc. No.: 138-CV-072

Subject: Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal

Computer Program: CAP88-PC

Program No.: Version 1.0

Committed Calculation ☒ Preliminary ☐ Superseded ☐

Rev	Sheets	Originator	Checker	Reviewer	Approval	Date
0	25	Carl Eric von Buelow 3/27/95	M. Daniel 3/28/95	M.A. Kuhn 3/29/95	Mark Key	3/30/95

~~Summary of Revision~~

Microfilmed:	Rev	Date	Spool Number	Rev	Date	Spool Number

CALCULATION SHEET

128711

ORIGINATOR Carl Eric von Buelow DATE 3/27/95 CALC. NO. 138-CV-072 REV. NO. 0
PROJECT FUSRAP - MISS CHECKED DATE 3/28/95
SUBJECT Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal JOB NO. 14501 SHT. NO. 1 of 25

I. PURPOSE

This calculation estimates the dose received by the maximally exposed individual and the total population within 80 km of the Maywood Interim Storage Site (MISS) from airborne radioactivity emission from (1) wind erosion of soil from the pile opening at MISS and (2) mechanical disturbances resulting from batch material transfer for loading 12300 cubic yards of radioactively contaminated soil into gondola rail cars for disposal.

II. SCOPE

This calculation uses the U.S. Environmental Protection Agency's (EPA) Clean Air Act Assessment Package - 1988 - Personal Computer (CAP88-PC) model for estimating doses resulting from airborne emission of radioactive particles from the MISS pile opening.

III. REFERENCES

1. Parks, B. S., 1992. User's Guide for CAP88-PC, Version 1.0. 402-B-92-001. EPA. Las Vegas, NV.

2. Darby, J. W., 1993. Bechtel National, Inc. (BNI). Letter to J. G. Hart, Jr., U.S. Department of Energy (DOE). CCN 099655. January 22, 1993. Oak Ridge, TN.

3. von Buelow, C. E., 1995. CAP88-PC Population File for MISS. Calculation No. 14501-138-CV-058 Rev. 1. BNI. Oak Ridge, TN.

4. National Oceanic and Atmospheric Administration (NOAA), 1994. Local Climatological Data for Newark, NJ. National Climatic Data Center. Asheville, NC.

5. von Buelow, C. E., 1995. Airborne Radioactivity Emission Rates from Opening the MISS Pile for 12300 yd³ Disposal. Calculation No. 14501-138-CV-071 Rev. 0. BNI. Oak Ridge, TN.

IV. CALCULATIONS

Assumptions

1. Daughters in the decay chains of radionuclides are considered to be in secular equilibrium until a radionuclide in the chain is encountered with a measured concentration. Radium daughters are not included since the immediate daughter of radium is radon, a gas, which is not applicable to the analysis of particulate behavior.

2. The maximally exposed individual is based on site knowledge of the nearest resident and off-site worker. The occupancy factor for the resident is 100%. The occupancy factor for the off-

site worker is 24%. The nearest resident to MISS is 50 m North-Northeast (NNE). The nearest off-site worker to MISS is 45 m Northeast (NE).

3. The effective dose equivalent is calculated for a 50 year exposure. Risk is estimated as total lifetime risk for a lifetime exposure of 70.7565 years.

4. The assumptions used in the CAP88-PC computer model are documented in Reference 1.

CAP88-PC Computer Program

The CAP88-PC model is a set of computer programs, databases, and associated utility programs that estimate the dose and risk from airborne radioactivity emissions. The EPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) compliance procedures for airborne radioactivity emissions at DOE facilities (40 CFR 61.93a) require the use of CAP88-PC model, or other approved procedures, to calculate effective dose equivalents to members of the public. The Former Sites Restoration Division (FSRD) at the DOE Oak Ridge Field Office has concurred on the use of CAP88-PC for use on the Formerly Utilized Sites Remedial Action Program (FUSRAP) in Reference 2. A detailed description of CAP88-PC is provided in Reference 1.

Computer Hardware Configuration

This calculation was run on a COMPAQ ProLinea 3/25zs (serial number A239HCU30119), which is a 386 microcomputer running at 25 mhz using MS-DOS Version 6.22, equipped with a 387 math coprocessor, and networked through a Digital Equipment Corporation (DEC) VAX using PCSA/Pathworks for print and file services.

Inputs

The input parameters are listed in the attached "Synopsis Report". The calculation was performed using both population and individual run types, the MISS population file (Reference 3), nearest resident and off-site worker (Assumption 2), wind file LEA0189 for the LaGuardia International Airport (Reference 1), total annual precipitation of 120.2 cm/yr (Reference 4), average annual temperature of 13.57°C (Reference 4), one area source type with a height of zero meters and area of 464.51520 m^2 (Reference 5), a fixed plume rise with zero meters for each Pasquill category, the default urban agricultural data for the Maywood, NJ area (Reference 1), and calculated radioactivity emission rates (Reference 5).

Outputs

The CAP88-PC output is attached to this calculation. The "Synopsis Report" gives an overview of the input and selected output. The "Dose and Risk Equivalent Summaries" give a more detailed output of the dose assessment. The maximally exposed individual listed in the

"Synopsis Report" is a computer selection based on the population file and is not used in this calculation. The actual maximally exposed individual is taken from the individual "Dose and Risk Estimate Summaries" for the distance and direction to the nearest resident and off-site worker (Assumption 2) with the occupancy factors applied as follows:

Dose (resident at 50 m NNE) = 0.43 x 100% = 0.43 mrem/yr
Dose (worker at 45 m NE) = 0.58 x 24% = 0.14 mrem/yr

Sample Calculation

A sample calculation using the Reactive Metals data set provided with CAP88-PC was successfully completed and verified against the results listed in Section 6.2 of Reference 1 (Reactive Metals data set using wind file ERI0610.WND and population file RMICOMPY.POP).

V. SUMMARY OF RESULTS

The effective individual dose from airborne radioactivity emission from opening the MISS storage pile and handling the soil for the 12300 cubic yard disposal for the maximally exposed individual (a resident 50 m NNE of MISS) is 0.43 mrem/yr. The total collective population dose from airborne radioactivity emission from opening the MISS storage pile and handling the soil for the 12300 cubic yard disposal for the population within 80 km of MISS is 0.224 person-rem/yr. This calculation reflects the doses received over the year from the storage pile opening and soil handling operations alone, and does not reflect airborne emissions from other sources at MISS.

128711

CALCULATION SHEET

ORIGINATOR	Carl Eric von Buelow	DATE 3/27/95	CALC. NO. 138-CV-072	REV. NO. 0	
			CHECKED MDT	DATE 3/28/95	
PROJECT	FUSRAP - MISS		JOB NO. 14501	SHT. NO. 4 of 25	
SUBJECT	Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal				

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Mar 27, 1995 4:06 pm

Facility: Maywood Interim Storage Site
Address: 100 West Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Effective Dose Equivalent
(mrem/year)

3.66E-02

At This Location: 250 Meters North
Source Category: Airborne Radiological Particulates
Source Type: Area
Emission Year: 1994

Comments: Bechtel National, Inc.
Calculation No. 14501-138-CV-072

Dataset Name: MISS-12K
Dataset Date: Mar 27, 1995 4:05 pm
Wind File: WNDFILES\LEA0189.WND
Population File: POPFILES\MISS.POP

128711

CALCULATION SHEET

ORIGINATOR	Carl Eric von Buelow	DATE 3/27/95	CALC. NO. 138-CV-072	REV. NO. 0	
			CHECKED MDD	DATE 3/28/95	
PROJECT	FUSRAP - MISS		JOB NO. 14501	SHT. NO. 5 of 25	
SUBJECT	Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal				

Mar 27, 1995 4:06 pm

SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 250 Meters North
Lifetime Fatal Cancer Risk: 4.08E-07

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	1.76E-04	1.17E-03
BREAST	1.17E-04	8.40E-04
R MAR	1.75E-02	1.08E-01
LUNGS	2.31E-01	1.41E+00
THYROID	1.10E-04	7.59E-04
ENDOST	2.17E-01	1.34E+00
RMNDR	5.20E-04	3.62E-03
EFFEC	3.66E-02	2.24E-01

FREQUENCY DISTRIBUTION OF LIFETIME FATAL CANCER RISKS

Risk Range	Number of People	Number of People In This Risk Range Or Higher	Deaths/Year In This Risk Range	Deaths/Year In This Risk Range Or Higher
1.0E+00 TO 1.0E-01	0	0	0.00E+00	0.00E+00
1.0E-01 TO 1.0E-02	0	0	0.00E+00	0.00E+00
1.0E-02 TO 1.0E-03	0	0	0.00E+00	0.00E+00
1.0E-03 TO 1.0E-04	0	0	0.00E+00	0.00E+00
1.0E-04 TO 1.0E-05	0	0	0.00E+00	0.00E+00
1.0E-05 TO 1.0E-06	0	0	0.00E+00	0.00E+00
LESS THAN 1.0E-06	17362944	17362944	3.53E-05	3.53E-05

Mar 27, 1995 4:06 pm

SYNOPSIS
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 1994

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
U-238	Y	1.00	4.3E-06	4.3E-06
TH-234	Y	1.00	4.3E-06	4.3E-06
PA-234	Y	1.00	4.3E-06	4.3E-06
U-234	Y	1.00	4.6E-06	4.6E-06
TH-230	Y	1.00	4.6E-06	4.6E-06
RA-226	W	1.00	6.1E-07	6.1E-07
U-235	Y	1.00	2.0E-07	2.0E-07
TH-231	Y	1.00	2.0E-07	2.0E-07
PA-231	Y	1.00	2.0E-07	2.0E-07
AC-227	Y	1.00	2.0E-07	2.0E-07
TH-227	Y	1.00	2.0E-07	2.0E-07
RA-223	W	1.00	2.0E-07	2.0E-07
TH-232	Y	1.00	4.6E-06	4.6E-06
RA-228	W	1.00	4.6E-06	4.6E-06
AC-228	Y	1.00	4.6E-06	4.6E-06
TH-228	Y	1.00	4.6E-06	4.6E-06
RA-224	W	1.00	4.6E-06	4.6E-06

SITE INFORMATION

Temperature: 14 degrees C
Precipitation: 120 cm/y
Mixing Height: 1000 m

Mar 27, 1995 4:06 pm

SYNOPSIS
Page 3

SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 4.65E+02

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Fixed (m): (Fixed Rise)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.076	0.000	0.008
Fraction From Assessment Area:	0.924	1.000	0.992
Fraction Imported:	0.000	0.000	0.000

Beef Cattle Density: 4.25E-02
Milk Cattle Density: 3.29E-02
Land Fraction Cultivated for Vegetable Crops: 1.82E-02

Mar 27, 1995 4:06 pm

SYNOPSIS
Page 4

POPULATION DATA

Direction	Distance (m) 250	750	1500	2500	3500	4500	7500
N	67	201	802	1337	1872	2407	20057
NNW	67	201	802	1337	1872	2407	20057
NW	67	201	802	1337	1872	2407	20057
WNW	67	201	802	1337	1872	2407	18015
W	67	201	802	1337	1872	2407	15973
WSW	67	201	802	1337	1872	2407	15973
SW	67	201	802	1337	1872	2407	16228
SSW	67	201	802	1337	1872	2407	20057
S	67	201	802	1337	1872	2407	20057
SSE	67	201	802	1337	1872	2407	25914
SE	67	201	802	1337	1872	2407	20057
ESE	67	201	802	1337	1872	2407	20057
E	67	201	802	1337	1872	2407	20057
ENE	67	201	802	1337	1872	2407	20057
NE	67	201	802	1337	1872	2407	20057
NNE	67	201	802	1337	1872	2407	20057

Direction	Distance (m) 15000	25000	35000	45000	55000	65000	75000
N	74537	60196	70814	29909	28375	32864	31652
NNW	80228	100151	38356	25800	31534	37267	40828
NW	78697	106487	126587	47978	25581	31795	32885
WNW	56704	65308	91431	43632	20950	24760	25044
W	64114	84087	47693	59939	47949	40968	30281
WSW	112233	167453	56447	59420	70303	59251	29756
SW	120063	227594	237745	147380	112163	79165	127971
SSW	142152	249194	283497	211897	153403	180380	385790
S	236424	356896	290094	27391	48812	100953	91523
SSE	537391	974408	1119592	38176	0	0	0
SE	813384	678682	772130	363126	35070	0	0
ESE	837313	483781	278841	306070	279511	103569	51542
E	566935	290745	57469	146563	75595	89339	103084
ENE	84525	76576	79890	60083	55076	65090	75104
NE	65381	57432	102568	129885	161178	126989	143397
NNE	65457	30109	80543	125688	76315	38109	40796

128711

CALCULATION SHEET

ORIGINATOR	Carl Eric von Buelow	DATE 3/27/95	CALC. NO. 138-CV-072	REV. NO. 0	
PROJECT	FUSRAP - MISS		CHECKED	DATE 3/28/95	
SUBJECT	Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal		JOB NO. 14501	SHT. NO. 9 of 25	

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Population Assessment
Mar 27, 1995 4:06 pm

Facility: Maywood Interim Storage Site
Address: 100 West Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Airborne Radiological Particulates
Source Type: Area
Emission Year: 1994

Comments: Bechtel National, Inc.
Calculation No. 14501-138-CV-072

Dataset Name: MISS-12K
Dataset Date: Mar 27, 1995 4:05 pm
Wind File: WNDFILES\LEA0189.WND
Population File: POPFILES\MISS.POP

128711

CALCULATION SHEET

ORIGINATOR	Carl Eric von Buelow	DATE 3/27/95	CALC. NO. 138-CV-072	REV. NO. 0	
PROJECT	FUSRAP - MISS		CHECKED	DATE 3/28/95	
SUBJECT	Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal		JOB NO. 14501	SHT. NO. 10 of 25	

Mar 27, 1995 4:06 pm

SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	1.76E-04	1.17E-03
BREAST	1.17E-04	8.40E-04
R MAR	1.75E-02	1.08E-01
LUNGS	2.31E-01	1.41E+00
THYROID	1.10E-04	7.59E-04
ENDOST	2.17E-01	1.34E+00
RMNDR	5.20E-04	3.62E-03
EFFEC	3.66E-02	2.24E-01

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)	Collective Population (person-rem/y)
INGESTION	6.78E-06	5.58E-04
INHALATION	3.66E-02	2.23E-01
AIR IMMERSION	5.59E-08	2.96E-07
GROUND SURFACE	6.67E-06	7.62E-05
INTERNAL	3.66E-02	2.24E-01
EXTERNAL	6.73E-06	7.65E-05
TOTAL	3.66E-02	2.24E-01

Mar 27, 1995 4:06 pm

SUMMARY
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem/y)	Collective Population (person-rem/y)
U-238	3.43E-03	2.11E-02
TH-234	1.07E-06	7.21E-06
PA-234	9.25E-08	5.99E-07
U-234	4.13E-03	2.54E-02
TH-230	7.86E-03	4.81E-02
RA-226	3.75E-05	2.52E-04
U-235	1.71E-04	1.07E-03
TH-231	1.39E-09	8.37E-09
PA-231	6.63E-04	4.08E-03
AC-227	8.76E-04	5.37E-03
TH-227	1.62E-05	9.85E-05
RA-223	1.14E-05	7.03E-05
TH-232	1.13E-02	6.89E-02
RA-228	7.74E-05	5.52E-04
AC-228	2.72E-06	1.43E-05
TH-228	7.92E-03	4.84E-02
RA-224	1.10E-04	6.65E-04
TOTAL	3.66E-02	2.24E-01

Mar 27, 1995 4:06 pm

SUMMARY
Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
LEUKEMIA	1.50E-08	1.31E-06
BONE	9.86E-09	8.58E-07
THYROID	1.95E-11	2.03E-09
BREAST	1.87E-10	2.11E-08
LUNG	3.81E-07	3.29E-05
STOMACH	1.36E-10	1.37E-08
BOWEL	1.26E-10	1.27E-08
LIVER	1.55E-09	1.37E-07
PANCREAS	9.49E-11	9.54E-09
URINARY	1.08E-10	2.02E-08
OTHER	1.16E-10	1.17E-08
TOTAL	4.08E-07	3.53E-05

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
INGESTION	3.36E-11	3.94E-08
INHALATION	4.08E-07	3.52E-05
AIR IMMERSION	1.34E-12	1.01E-10
GROUND SURFACE	1.53E-10	2.46E-08
INTERNAL	4.08E-07	3.53E-05
EXTERNAL	1.54E-10	2.47E-08
TOTAL	4.08E-07	3.53E-05

128711

CALCULATION SHEET

CALC. NO. 138-CV-072 REV. NO. 0

ORIGINATOR Carl Eric von Buelow DATE 3/27/95 CHECKED MBD DATE 3/28/95

PROJECT FUSRAP - MISS JOB NO. 14501 SHT. NO. 13 of 25

SUBJECT Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal

Mar 27, 1995 4:06 pm

SUMMARY
Page 4

PATHWAY GENETIC RISK SUMMARY
(Collective Population)

Pathway	Genetic Risk (person-rem/y)
INGESTION	7.90E-06
INHALATION	8.63E-05
AIR IMMERSION	2.91F-07
GROUND SURFACE	6.32E-05
INTERNAL	9.42E-05
EXTERNAL	6.35E-05
TOTAL	1.58E-04

CALCULATION SHEET

128711

CALC. NO. 138-CV-072 REV. NO. 0

ORIGINATOR Carl Eric von Buelow DATE 3/27/95 CHECKED DATE 3/28/95

PROJECT FUSRAP - MISS JOB NO. 14501 SHT. NO. 14 of 25

SUBJECT Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal

Mar 27, 1995 4:06 pm

SUMMARY
Page 5

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
U-238	4.61E-08	3.99E-06
TH-234	6.12E-11	5.39E-09
PA-234	2.38E-12	2.15E-10
U-234	5.50E-08	4.76E-06
TH-230	6.50E-08	5.61E-06
RA-226	8.31E-10	7.41E-08
U-235	2.32E-09	2.08E-07
TH-231	4.06E-14	3.43E-12
PA-231	3.74E-09	3.25E-07
AC-227	7.63E-09	6.60E-07
TH-227	4.45E-10	3.83E-08
RA-223	2.84E-10	2.45E-08
TH-232	6.38E-08	5.51E-06
RA-228	1.28E-09	1.19E-07
AC-228	5.49E-11	4.09E-09
TH-228	1.59E-07	1.38E-05
RA-224	2.50E-09	2.13E-07
TOTAL	4.08E-07	3.53E-05

CALCULATION SHEET

CALC. NO. 138-CV-072 REV. NO. 0

ORIGINATOR Carl Eric von Buelow DATE 3/27/95 CHECKED DATE 3/28/95

PROJECT FUSRAP - MISS JOB NO. 14501 SHT. NO. 15 of 25

SUBJECT Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd^3 Disposal

Mar 27, 1995 4:06 pm

SUMMARY
Page 6

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	3.7E-02	4.7E-03	1.4E-03	5.7E-04	3.3E-04	2.3E-04	1.0E-04
NNW	8.5E-03	1.1E-03	3.2E-04	1.3E-04	7.7E-05	5.3E-05	2.4E-05
NW	7.8E-03	9.9E-04	2.9E-04	1.2E-04	7.0E-05	4.7E-05	2.1E-05
WNW	6.3E-03	7.9E-04	2.3E-04	9.5E-05	5.5E-05	3.7E-05	1.6E-05
W	1.8E-02	2.2E-03	6.4E-04	2.7E-04	1.5E-04	1.0E-04	4.7E-05
WSW	2.4E-02	3.0E-03	8.7E-04	3.7E-04	2.1E-04	1.4E-04	6.4E-05
SW	2.5E-02	3.1E-03	8.9E-04	3.7E-04	2.2E-04	1.5E-04	6.6E-05
SSW	1.9E-02	2.4E-03	6.9E-04	2.9E-04	1.7E-04	1.1E-04	5.2E-05
S	2.2E-02	2.8E-03	8.1E-04	3.4E-04	2.0E-04	1.3E-04	6.1E-05
SSE	1.9E-02	2.3E-03	6.6E-04	2.7E-04	1.6E-04	1.1E-04	4.9E-05
SE	2.1E-02	2.7E-03	7.9E-04	3.3E-04	1.9E-04	1.3E-04	5.9E-05
ESE	2.4E-02	3.0E-03	8.9E-04	3.7E-04	2.2E-04	1.5E-04	6.7E-05
E	2.0E-02	2.6E-03	7.5E-04	3.1E-04	1.8E-04	1.2E-04	5.6E-05
ENE	2.0E-02	2.6E-03	7.4E-04	3.1E-04	1.8E-04	1.2E-04	5.5E-05
NE	2.3E-02	2.9E-03	8.5E-04	3.6E-04	2.1E-04	1.4E-04	6.5E-05
NNE	1.9E-02	2.4E-03	6.9E-04	2.9E-04	1.7E-04	1.2E-04	5.2E-05

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	3.7E-05	1.6E-05	9.9E-06	6.7E-06	4.8E-06	3.3E-06	2.6E-06
NNW	8.6E-06	3.8E-06	2.3E-06	1.6E-06	1.1E-06	7.7E-07	6.1E-07
NW	7.5E-06	3.3E-06	2.0E-06	1.3E-06	9.4E-07	6.3E-07	5.0E-07
WNW	5.7E-06	2.4E-06	1.5E-06	9.8E-07	6.8E-07	4.6E-07	3.6E-07
W	1.7E-05	7.2E-06	4.4E-06	2.9E-06	2.0E-06	1.3E-06	1.0E-06
WSW	2.3E-05	1.0E-05	6.2E-06	4.2E-06	3.0E-06	2.0E-06	1.6E-06
SW	2.3E-05	1.0E-05	6.3E-06	4.3E-06	3.0E-06	2.0E-06	1.6E-06
SSW	1.9E-05	8.4E-06	5.2E-06	3.5E-06	2.5E-06	1.7E-06	1.3E-06
S	2.2E-05	1.0E-05	6.3E-06	4.3E-06	3.1E-06	2.1E-06	1.7E-06
SSE	1.8E-05	8.0E-06	5.0E-06	3.4E-06	0.0E+00	0.0E+00	0.0E+00
SE	2.1E-05	9.6E-06	5.9E-06	4.1E-06	2.9E-06	0.0E+00	0.0E+00
ESE	2.5E-05	1.1E-05	6.9E-06	4.8E-06	3.4E-06	2.4E-06	1.9E-06
E	2.0E-05	9.1E-06	5.6E-06	3.8E-06	2.7E-06	1.9E-06	1.5E-06
ENE	2.0E-05	8.8E-06	5.4E-06	3.7E-06	2.6E-06	1.8E-06	1.4E-06
NE	2.4E-05	1.1E-05	6.7E-06	4.6E-06	3.3E-06	2.3E-06	1.8E-06
NNE	1.9E-05	8.4E-06	5.2E-06	3.5E-06	2.5E-06	1.6E-06	1.3E-06

CALCULATION SHEET

ORIGINATOR Carl Eric von Buelow DATE 3/27/95 CALC. NO. 138-CV-072 REV. NO. 0
CHECKED DATE 3/28/95
PROJECT FUSRAP - MISS JOB NO. 14501 SHT. NO. 16 of 25
SUBJECT Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal

Mar 27, 1995 4:06 pm

SUMMARY
Page 7

COLLECTIVE EFFECTIVE DOSE EQUIVALENT (person rem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	2.5E-03	9.4E-04	1.1E-03	7.6E-04	6.2E-04	5.4E-04	2.1E-03
NNW	5.7E-04	2.2E-04	2.5E-04	1.8E-04	1.5E-04	1.3E-04	4.8E-04
NW	5.3E-04	2.0E-04	2.3E-04	1.6E-04	1.3E-04	1.1E-04	4.3E-04
WNW	4.2E-04	1.6E-04	1.8E-04	1.3E-04	1.0E-04	8.9E-05	3.0E-04
W	1.2E-03	4.4E-04	5.1E-04	3.6E-04	2.9E-04	2.5E-04	7.5E-04
WSW	1.6E-03	6.0E-04	7.0E-04	4.9E-04	4.0E-04	3.4E-04	1.0E-03
SW	1.6E-03	6.2E-04	7.2E-04	5.0E-04	4.0E-04	3.5E-04	1.1E-03
SSW	1.3E-03	4.8E-04	5.5E-04	3.9E-04	3.1E-04	2.8E-04	1.0E-03
S	1.5E-03	5.6E-04	6.5E-04	4.6E-04	3.7E-04	3.2E-04	1.2E-03
SSE	1.2E-03	4.5E-04	5.3E-04	3.7E-04	3.0E-04	2.6E-04	1.3E-03
SE	1.4E-03	5.4E-04	6.3E-04	4.4E-04	3.6E-04	3.1E-04	1.2E-03
ESE	1.6E-03	6.1E-04	7.1E-04	5.0E-04	4.1E-04	3.6E-04	1.4E-03
E	1.3E-03	5.2E-04	6.0E-04	4.2E-04	3.4E-04	3.0E-04	1.1E-03
ENE	1.4E-03	5.1E-04	6.0E-04	4.2E-04	3.4E-04	2.9E-04	1.1E-03
NE	1.5E-03	5.9E-04	6.9E-04	4.8E-04	3.9E-04	3.4E-04	1.3E-03
NNE	1.3E-03	4.8E-04	5.6E-04	3.9E-04	3.2E-04	2.8E-04	1.0E-03

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	2.7E-03	9.8E-04	7.0E-04	2.0E-04	1.4E-04	1.1E-04	8.1E-05
NNW	6.9E-04	3.8E-04	8.9E-05	4.1E-05	3.5E-05	2.9E-05	2.5E-05
NW	5.9E-04	3.5E-04	2.5E-04	6.4E-05	2.4E-05	2.0E-05	1.6E-05
WNW	3.3E-04	1.6E-04	1.3E-04	4.3E-05	1.4E-05	1.1E-05	9.1E-06
W	1.1E-03	6.1E-04	2.1E-04	1.8E-04	9.8E-05	5.5E-05	3.2E-05
WSW	2.6E-03	1.7E-03	3.5E-04	2.5E-04	2.1E-04	1.2E-04	4.8E-05
SW	2.8E-03	2.3E-03	1.5E-03	6.3E-04	3.4E-04	1.6E-04	2.0E-04
SSW	2.7E-03	2.1E-03	1.5E-03	7.5E-04	3.8E-04	3.0E-04	5.1E-04
S	5.3E-03	3.6E-03	1.8E-03	1.2E-04	1.5E-04	2.1E-04	1.5E-04
SSE	9.5E-03	7.8E-03	5.5E-03	1.3E-04	0.0E+00	0.0E+00	0.0E+00
SE	1.7E-02	6.5E-03	4.6E-03	1.5E-03	1.0E-04	0.0E+00	0.0E+00
ESE	2.1E-02	5.4E-03	1.9E-03	1.5E-03	9.6E-04	2.5E-04	9.9E-05
E	1.1E-02	2.7E-03	3.2E-04	5.6E-04	2.1E-04	1.7E-04	1.6E-04
ENE	1.7E-03	6.7E-04	4.3E-04	2.2E-04	1.4E-04	1.1E-04	1.0E-04
NE	1.6E-03	6.2E-04	6.9E-04	6.0E-04	5.3E-04	2.9E-04	2.6E-04
NNE	1.2E-03	2.5E-04	4.2E-04	4.4E-04	1.9E-04	6.2E-05	5.3E-05

CALCULATION SHEET

CALC. NO. 138-CV-072 REV. NO. 0

ORIGINATOR Carl Eric von Buelow DATE 3/27/95 CHECKED DATE 3/28/95

PROJECT FUSRAP - MISS JOB NO. 14501 SHT. NO. 17 of 25

SUBJECT Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal

Mar 27, 1995 4:06 pm

SUMMARY
Page 8

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	4.1E-07	5.2E-08	1.5E-08	6.4E-09	3.7E-09	2.5E-09	1.1E-09
NNW	9.5E-08	1.2E-08	3.5E-09	1.5E-09	8.6E-10	5.9E-10	2.7E-10
NW	8.7E-08	1.1E-08	3.2E-09	1.3E-09	7.8E-10	5.3E-10	2.4E-10
WNW	7.1E-08	8.8E-09	2.5E-09	1.1E-09	6.1E-10	4.1E-10	1.8E-10
W	2.0E-07	2.5E-08	7.1E-09	3.0E-09	1.7E-09	1.2E-09	5.2E-10
WSW	2.6E-07	3.3E-08	9.8E-09	4.1E-09	2.4E-09	1.6E-09	7.2E-10
SW	2.7E-07	3.4E-08	1.0E-08	4.2E-09	2.4E-09	1.6E-09	7.3E-10
SSW	2.1E-07	2.7E-08	7.7E-09	3.2E-09	1.9E-09	1.3E-09	5.8E-10
S	2.5E-07	3.1E-08	9.1E-09	3.8E-09	2.2E-09	1.5E-09	6.8E-10
SSE	2.0E-07	2.5E-08	7.3E-09	3.1E-09	1.8E-09	1.2E-09	5.5E-10
SE	2.4E-07	3.0E-08	8.8E-09	3.7E-09	2.1E-09	1.5E-09	6.6E-10
ESE	2.7E-07	3.4E-08	9.9E-09	4.2E-09	2.4E-09	1.7E-09	7.5E-10
E	2.2E-07	2.9E-08	8.4E-09	3.5E-09	2.0E-09	1.4E-09	6.3E-10
ENE	2.3E-07	2.9E-08	8.3E-09	3.5E-09	2.0E-09	1.4E-09	6.2E-10
NE	2.6E-07	3.3E-08	9.5E-09	4.0E-09	2.3E-09	1.6E-09	7.3E-10
NNE	2.1E-07	2.7E-08	7.7E-09	3.2E-09	1.9E-09	1.3E-09	5.8E-10

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	4.1E-10	1.8E-10	1.1E-10	7.5E-11	5.3E-11	3.6E-11	2.9E-11
NNW	9.6E-11	4.2E-11	2.6E-11	1.8E-11	1.2E-11	8.4E-12	6.6E-12
NW	8.4E-11	3.6E-11	2.2E-11	1.5E-11	1.0E-11	6.9E-12	5.4E-12
WNW	6.4E-11	2.7E-11	1.6E-11	1.1E-11	7.4E-12	5.0E-12	3.9E-12
W	1.9E-10	8.0E-11	4.9E-11	3.3E-11	2.3E-11	1.5E-11	1.2E-11
WSW	2.6E-10	1.1E-10	6.9E-11	4.7E-11	3.3E-11	2.3E-11	1.8E-11
SW	2.6E-10	1.1E-10	7.0E-11	4.8E-11	3.4E-11	2.2E-11	1.8E-11
SSW	2.1E-10	9.3E-11	5.8E-11	3.9E-11	2.8E-11	1.8E-11	1.5E-11
S	2.5E-10	1.1E-10	7.0E-11	4.8E-11	3.4E-11	2.3E-11	1.8E-11
SSE	2.0E-10	8.9E-11	5.5E-11	3.8E-11	0.0E+00	0.0E+00	0.0E+00
SE	2.4E-10	1.1E-10	6.6E-11	4.5E-11	3.2E-11	0.0E+00	0.0E+00
ESE	2.7E-10	1.2E-10	7.7E-11	5.3E-11	3.8E-11	2.7E-11	2.1E-11
E	2.3E-10	1.0E-10	6.2E-11	4.3E-11	3.0E-11	2.1E-11	1.7E-11
ENE	2.2E-10	9.8E-11	6.0E-11	4.1E-11	2.9E-11	2.0E-11	1.5E-11
NE	2.6E-10	1.2E-10	7.5E-11	5.2E-11	3.7E-11	2.6E-11	2.0E-11
NNE	2.1E-10	9.4E-11	5.8E-11	3.9E-11	2.8E-11	1.8E-11	1.4E-11

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SUMMARY
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COLLECTIVE FATAL CANCER RATE (deaths/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	3.9E-07	1.5E-07	1.7E-07	1.2E-07	9.8E-08	8.6E-08	3.2E-07
NNW	9.0E-08	3.4E-08	4.0E-08	2.8E-08	2.3E-08	2.0E-08	7.6E-08
NW	8.3E-08	3.1E-08	3.6E-08	2.5E-08	2.1E-08	1.8E-08	6.7E-08
WNW	6.7E-08	2.5E-08	2.9E-08	2.0E-08	1.6E-08	1.4E-08	4.7E-08
W	1.9E-07	7.0E-08	8.1E-08	5.6E-08	4.5E-08	4.0E-08	1.2E-07
WSW	2.5E-07	9.5E-08	1.1E-07	7.7E-08	6.2E-08	5.4E-08	1.6E-07
SW	2.6E-07	9.8E-08	1.1E-07	7.9E-08	6.4E-08	5.6E-08	1.7E-07
SSW	2.0E-07	7.5E-08	8.7E-08	6.1E-08	5.0E-08	4.3E-08	1.6E-07
S	2.4E-07	8.9E-08	1.0E-07	7.2E-08	5.8E-08	5.1E-08	1.9E-07
SSE	1.9E-07	7.1E-08	8.3E-08	5.8E-08	4.7E-08	4.1E-08	2.0E-07
SE	2.3E-07	8.6E-08	1.0E-07	7.0E-08	5.7E-08	4.9E-08	1.9E-07
ESE	2.5E-07	9.6E-08	1.1E-07	7.9E-08	6.4E-08	5.6E-08	2.1E-07
E	2.1E-07	8.1E-08	9.5E-08	6.6E-08	5.4E-08	4.7E-08	1.8E-07
ENE	2.2E-07	8.1E-08	9.4E-08	6.6E-08	5.3E-08	4.7E-08	1.7E-07
NE	2.4E-07	9.2E-08	1.1E-07	7.6E-08	6.2E-08	5.4E-08	2.1E-07
NNE	2.0E-07	7.6E-08	8.8E-08	6.1E-08	5.0E-08	4.4E-08	1.7E-07

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	4.3E-07	1.5E-07	1.1E-07	3.2E-08	2.1E-08	1.7E-08	1.3E-08
NNW	1.1E-07	6.0E-08	1.4E-08	6.4E-09	5.5E-09	4.4E-09	3.8E-09
NW	9.3E-08	5.5E-08	3.9E-08	1.0E-08	3.7E-09	3.1E-09	2.5E-09
WNW	5.1E-08	2.5E-08	2.1E-08	6.6E-09	2.2E-09	1.7E-09	1.4E-09
W	1.7E-07	9.5E-08	3.3E-08	2.8E-08	1.5E-08	8.6E-09	4.9E-09
WSW	4.1E-07	2.7E-07	5.5E-08	3.9E-08	3.3E-08	1.9E-08	7.5E-09
SW	4.4E-07	3.7E-07	2.4E-07	9.9E-08	5.3E-08	2.5E-08	3.2E-08
SSW	4.2E-07	3.3E-07	2.3E-07	1.2E-07	6.0E-08	4.7E-08	7.9E-08
S	8.3E-07	5.7E-07	2.9E-07	1.8E-08	2.3E-08	3.3E-08	2.4E-08
SSE	1.5E-06	1.2E-06	8.7E-07	2.0E-08	0.0E+00	0.0E+00	0.0E+00
SE	2.7E-06	1.0E-06	7.2E-07	2.3E-07	1.6E-08	0.0E+00	0.0E+00
ESE	3.2E-06	8.5E-07	3.0E-07	2.3E-07	1.5E-07	3.9E-08	1.5E-08
E	1.8E-06	4.2E-07	5.1E-08	8.8E-08	3.3E-08	2.7E-08	2.5E-08
ENE	2.6E-07	1.1E-07	6.8E-08	3.5E-08	2.2E-08	1.8E-08	1.6E-08
NE	2.4E-07	9.8E-08	1.1E-07	9.5E-08	8.4E-08	4.6E-08	4.1E-08
NNE	2.0E-07	4.0E-08	6.6E-08	7.0E-08	3.0E-08	9.7E-09	8.2E-09

CALCULATION SHEET

ORIGINATOR	Carl Eric von Buelow	DATE 3/27/95	CALC. NO. 138-CV-072	REV. NO. 0	
			CHECKED [illegible]	DATE 3/28/95	
PROJECT	FUSRAP - MISS		JOB NO. 14501	SHT. NO. 19 of 25	
SUBJECT	Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal				

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Mar 27, 1995 4:10 pm

Facility: Maywood Interim Storage Site
Address: 100 West Hunter Avenue
City: Maywood
State: NJ Zip: 07607

Source Category: Airborne Radiological Particulates
Source Type: Area
Emission Year: 1994

Comments: Bechtel National, Inc.
Calculation No. 14501-138-CV-072

Dataset Name: MISS-12KI
Dataset Date: Mar 27, 1995 4:06 pm
Wind File: WNDFILES\LEA0189.WND

Mar 27, 1995 4:10 pm

SUMMARY
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ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	5.55E-03
BREAST	4.10E-03
R MAR	4.09E-01
LUNGS	5.14E+00
THYROID	3.95E-03
ENDOST	5.09E+00
RMNDR	2.33E-02
EFFEC	8.27E-01

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.48E-02
INHALATION	8.12E-01
AIR IMMERSION	1.25E-06
GROUND SURFACE	1.40E-04
INTERNAL	8.27E-01
EXTERNAL	1.42E-04
TOTAL	8.27E-01

CALCULATION SHEET

ORIGINATOR	Carl Eric von Buelow		DATE 3/27/95	CALC. NO. 138-CV-072	REV. NO. 0		
PROJECT	FUSRAP - MISS			CHECKED [illegible]	DATE 3/28/95		
SUBJECT	Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal			JOB NO. 14501	SHT. NO. 21 of 25		

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SUMMARY
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NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-238	7.93E-02
TH-234	4.23E-05
PA-234	2.03E-06
U-234	9.54E-02
TH-230	1.76E-01
RA-226	1.41E-03
U-235	3.95E-03
TH-231	3.09E-08
PA-231	1.54E-02
AC-227	2.00E-02
TH-227	3.61E-04
RA-223	2.76E-04
TH-232	2.52E-01
RA-228	3.96E-03
AC-228	6.06E-05
TH-228	1.76E-01
RA-224	2.47E-03
TOTAL	8.27E-01

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SUMMARY
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CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.55E-07
BONE	2.33E-07
THYROID	6.94E-10
BREAST	6.30E-09
LUNG	8.47E-06
STOMACH	4.92E-09
BOWEL	5.42E-09
LIVER	3.89E-08
PANCREAS	3.48E-09
URINARY	2.30E-08
OTHER	4.25E-09
TOTAL	9.14E-06

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	7.36E-08
INHALATION	9.07E-06
AIR IMMERSION	2.99E-11
GROUND SURFACE	3.21E-09
INTERNAL	9.14E-06
EXTERNAL	3.24E-09
TOTAL	9.14E-06

128711

CALCULATION SHEET

ORIGINATOR	Carl Eric von Buelow β	DATE 3/27/95	CALC. NO. 138-CV-072	REV. NO. 0	
			CHECKED [illegible]	DATE 3/28/95	
PROJECT	FUSRAP - MISS		JOB NO. 14501	SHT. NO. 23 of 25	
SUBJECT	Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal				

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SUMMARY
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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-238	1.04E-06
TH-234	1.57E-09
PA-234	5.23E-11
U-234	1.24E-06
TH-230	1.45E-06
RA-226	2.14E-08
U-235	5.23E-08
TH-231	9.02E-13
PA-231	8.49E-08
AC-227	1.73E-07
TH-227	9.90E-09
RA-223	6.45E-09
TH-232	1.42E-06
RA-228	4.44E-08
AC-228	1.22E-09
TH-228	3.54E-06
RA-224	5.57E-08
TOTAL	9.14E-06

CALCULATION SHEET

CALC. NO. 138-CV-072 REV. NO. 0

ORIGINATOR Carl Eric von Buelow DATE 3/27/95 CHECKED [illegible] DATE 3/28/95

PROJECT FUSRAP - MISS JOB NO. 14501 SHT. NO. 24 of 25

SUBJECT Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal

Mar 27, 1995 4:10 pm

SUMMARY
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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)	
Direction	45	50
N	8.3E-01	7.2E-01
NNW	2.9E-01	2.1E-01
NW	2.1E-01	1.7E-01
WNW	2.0E-01	1.6E-01
W	4.5E-01	3.7E-01
WSW	6.0E-01	4.9E-01
SW	6.2E-01	5.2E-01
SSW	5.2E-01	4.2E-01
S	5.6E-01	4.7E-01
SSE	4.8E-01	3.9E-01
SE	5.5E-01	4.5E-01
ESE	5.9E-01	5.0E-01
E	5.3E-01	4.3E-01
ENE	5.4E-01	4.4E-01
NE	5.8E-01	4.8E-01
NNE	5.5E-01	4.3E-01

128711

CALCULATION SHEET

ORIGINATOR	Carl Eric von Buelow	DATE 3/27/95	CALC. NO. 138-CV-072	REV. NO. 0	
PROJECT	FUSRAP - MISS		CHECKED MPP	DATE 3/28/95	
SUBJECT	Dose Modeling of Airborne Radioactivity Emission from Opening the MISS Pile for 12300 yd³ Disposal		JOB NO. 14501	SHT. NO. 25 of 25	

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SUMMARY
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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 45	50
N	9.1E-06	8.0E-06
NNW	3.1E-06	2.3E-06
NW	2.3E-06	1.9E-06
WNW	2.2E-06	1.7E-06
W	4.9E-06	4.1E-06
WSW	6.6E-06	5.4E-06
SW	6.9E-06	5.7E-06
SSW	5.7E-06	4.6E-06
S	6.2E-06	5.2E-06
SSE	5.2E-06	4.2E-06
SE	6.0E-06	5.0E-06
ESE	6.6E-06	5.4E-06
E	5.8E-06	4.7E-06
ENE	5.9E-06	4.8E-06
NE	6.3E-06	5.3E-06
NNE	6.0E-06	4.7E-06