Appendix A

Results of the OU 2-10 Air Modeling

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These air modeling calculations are from Attachment 3 of the Draft Final Remedial Design (RD)/Implementing Remedial Action (RA) Work Plan Test Reactor Area (TRA) Warm Waste Pond Interim Action Operable Unit (OU) 2-10, Document Number 02.010.1.1.114.01, Revision 1, August 6, 1993.

MORRISON KNUDSEN CORPORATION

ENVIRONMENTAL SERVICES DIVISION

Calculation Cover Sheet

Calc. Number:	
Contract Number: C527	Discipline: AIR QUALITY
Number of Sheets: 5	

Project: INEL WWP

Feature: AIR MODELING

Item: EMISSION CALCULATIONS & AMBIENT CONCENTRATIONS.

Sources of Data:

- AP-42 - COMPILATION OF EMISSION FACTORS
- ISC2 USERS GUIDE.

Sources of Formulae and References:

☐ Preliminary Calculation ☑ Final Calculation Supersedes Calculation Number _____

Rev. No.	Revision	Calculation By	Date	Checked By	Date	Approved By	Date
0		S. PICKETT	6/9/93				

FOR Picking up & Droping Emissions USE FEL BATCH DROP EQUATION: 11.2.3-3

$$E = K(.0032)\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \frac{lbs}{TON}$$

E = Emission Factor
K = Constant for Particle Size = .74 for TSP
U = Mean Wind Speed 2.23 m/hr = 1 m/s
M = Material Moisture Content 3.1 x 3 = 9.3 Assume watering has increased baseline soil moist.

$$E_o = (.74)(.0032)\frac{\left(\frac{2.23}{5}\right)^{1.3}}{\left(\frac{9.3}{2}\right)^{1.4}} \frac{lbs}{TON}$$

$$E_o = .00010 \frac{lbs}{TON}$$

Find variation of the emission factor over the 6 wind speed categories in ISCST

U_{upper} (m/s)	U_{upper} (m/hr)	U_{mid} m/hr	E_i	E_i/E_o
1.54	3.43	.223	.00010	1
3.09	6.89	5.16	.00029	3
5.14	11.46	9.18	.00062	6.2
8.23	18.35	14.91	.00116	11.6
10.80	24.08	21.22	.00183	18.3
>10.80				0 No work

→ Also use these emissions for moving earth from where the material is dropped by the FEL into the 1952 cell

NOW THAT WE FOUND EMISSION FACTOR DETERMINE EMISSION RATE:

$E_o = .00010 \frac{lbs}{TON}$

$$.00010 \frac{lbs}{Ton} \times 58 \frac{TONS}{HR} \times \frac{1\ HR}{3600s} \times \frac{453g}{1lb} = \boxed{.00073 \frac{g}{s}}$$

FIND σ_{yo} OF PICKUP & UNLOADING:

$$58 \frac{TONS}{HR} \times \frac{2000lbs}{1\ TON} \times \frac{FT^3}{90lbs} \times \frac{1\ YARD^3}{27\ FT^3} \times \frac{LIFT}{1\ YARD} = 46 \frac{YARD^2}{HR}$$

EXCAVATION WILL REMOVE AN AREA = 46 $YARD^2$ EACH HOUR

$\sqrt{46\ YARD^2} = 6.9$ YARDS ON A SIDE $= 20.7FT = 6.31m$

DIVIDE 6.31 BY 4.3 TO OBTAIN $\sigma_{yo} = \boxed{1.47m}$

FIND σ_{yo} OF SPREADING; LIFTS ARE 6 INCHES INSTEAD OF 3FT

$$2863 \frac{YARD^2}{HR} = 17 \text{ YARDS ON A SIDE} \times 50.9FT = 15m$$

15m DIVIDED BY 4.3 = $\boxed{\sigma_{yo} = 3.60m}$

EMISSION FACTOR FOR ROADS @ INEL

$$EF = K(5.9)\left(\frac{S}{12}\right)\left(\frac{W}{4}\right)^{.5}\left(\frac{W}{3}\right)^{.7}\left(\frac{365-P}{365}\right)\left(\frac{S'}{30}\right)$$

S = SILT % = 7% CONSERVATIVE ESTIMATE
S' = SPEED = 5 MPH
W = VEHICLE WEIGHT = 966 LOADER = 22 TONS.
W = # OF WHEELS = 4
K = PARTICULATE SIZE FACTOR = 0.8 FOR TSP
P = # DAYS PRECIP > .01 = 0 FOR SHORT TERM MAX.

$$EF = .8(5.9)\left(\frac{7}{12}\right)\left(\frac{4}{4}\right)^{.5}\left(\frac{22}{3}\right)^{.7}\left(\frac{365}{365}\right)\left(\frac{5}{30}\right)$$

$$EF = 1.65 \frac{lbs}{VMT}$$

ASSUME 95% CONTROL BY INCREASING SOIL MOISTURE BY FACTOR OF 5

$$EF = 1.65 \frac{lbs}{VMT} (1-.95) = \boxed{.093 \frac{lbs}{VMT}}$$

Project INEL-WWSP Contract No. 0527 File No.
Feature AIR MODELING Designed JCP Date 5/27/93
Item TSP EMISSION CALCULATIONS Checked Date

CYCLE ITIME EVERY 5 MINUTES USING TWO LOADERS,
12 CYLES/HR.

MAXIMUM HAUL ROAD DISTANCE IS FROM SOUTH END OF F64 CELL. 1500FT TOTAL CYCLE

- TRAVEL PER HOUR $1500 \times 12 = 18000 \text{ FT} = 3.4 \frac{\text{VMT}}{\text{HR}}$

$3.4 \frac{\text{VMT}}{\text{HR}} \circ 0.093 \frac{\text{lbs}}{\text{VMT}} = 0.3162 \frac{\text{lbs}}{\text{HR}}$

DIVIDE OVER 41 SOURCES

$0.3162 \frac{\text{lbs}}{\text{HR}} \times \frac{1}{41 \text{ SOURCES}} \times \frac{453 \text{g}}{1 \text{lbs}} \frac{1 \text{HR}}{3600 \text{SEC}} = .00097 \frac{\text{g}}{\text{s}}$

Project INEL-WMP — Contract No. 0527 — File No.

Feature AIR MODELING — Designed SLP — Date 6/09/93

Item DETERMINE MAX EXPOSURE — Checked — Date

MAXIMUM WORKER IN-CELL CONCENTRATION FROM ISC MODEL
230 ug/m3 1-HR AVG.

ELEMENT	SOIL CONC (PCi/g)	MAXIMUM AIR CONC (uCi/ml)
CESIUM 137	6833	1.57E-12
COBALT 60	914	2.10E-13
CESIUM 134	0.064	2.16E-15
STONTIUM 90	1883.2	4.32E-14
AMERICIUM 241	7.0	1.61E-15
CURIUM 244	3.8	8.74E-16
PLUTONIUM 238	5.8	1.33E-15
PLUTONIUM 239/240	7.2	1.66E-15
URANIUM 234	2.5	5.75E-16
URANIUM 238	1.5	3.45E-16

$$\frac{pCi}{g} \times \frac{230\ ug}{m^3} \times \frac{1\ g}{1E6\ ug} \times \frac{1\ m^3}{1000\ l} \times \frac{1\ l}{1000\ ml} \times \frac{1\ uCi}{1E6\ pCi}$$

SOIL CONC. OBTAINED FROM ROGER JONES

MAXIMUM AMBIENT CONC 2.1 ug/m3 - HR AVERAGE

ELEMENT	SOIL CONC IN 1964 CELL ug/g	MAX IN-CELL CONC (mg/m3)	MAX AMBIENT CONC (ug/m3)
ARSENIC	5	1.15E-6	1.05E-5
BERYLLIUM	1.8	4.14E-7	3.78E-6
CADMIUM	3	6.9E-7	6.3E-6
TRIVALENT CHROME	333	7.71E-5	7.10E-4
LEAD	18	4.14E-6	3.78E-5
MERCURY	3	—	6.3E-6
ZINC	143	—	3.00E-4

$$\frac{ug}{g} \times \frac{230\ ug}{m^3} \times \frac{1\ g}{1E6\ ug} \times \frac{1\ mg}{1000\ ug}$$

$$\frac{ug}{g} \times 2.1\ \frac{ug}{m^3} \times \frac{1\ g}{1E6\ ug}$$