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EXPOSURE FACTORS USED IN THE REMEDIAL INVESTIGATION AND BASELINE RISK ASSESSMENT FOR OPERABLE UNIT 4

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LETTER

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MAR 0 5 1993

DOE-1261-93

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - 5HRE-8J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Graham E. Mitchell, Project Manager
Ohio Environmental Protection Agency
40 South Main Street
Dayton, Ohio 45402-2086

Dear Mr. Saric and Mr. Mitchell:

EXPOSURE FACTORS USED IN THE REMEDIAL INVESTIGATION AND BASELINE RISK ASSESSMENT FOR OPERABLE UNIT 4

The purpose of this letter is to transmit, for your review the exposure factors used in the Operable Unit (OU) 4 Remedial Investigation (RI) and Baseline Risk Assessment (BRA). These values were obtained, in part from the final Risk Assessment Work Plan Addendum, recent United States Environmental Protection Agency (U.S. EPA) guidance, and personal communications between the RI contractor and U.S. EPA Region V staff. These informal communications were a direct result of comments on the Site-Wide Characterization Report. The intent was to provide an informal mechanism to resolve potential risk assessment issues prior to submittal of the RI. To this end, the enclosed exposure factors should be reviewed as the latest and best effort to meet the needs of risk assessment in a constantly changing and evolving environment.

Your review comments, prior to submittal of the Draft OU 4 RI, will facilitate report revisions, if required. Therefore, transmittal of your comments, as soon as possible to Randi Allen, will be greatly appreciated.

If you or your staff have any questions, please contact Randi Allen at FTS/Commercial (513) 738-6158.

Sincerely,

Jack R. Craig
Fernald Remedial Action
Project Manager

FN:Allen

Recycled and Recyclable

Enclosure: As Stated

cc w/enc.:

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AR Coordinator, FERMCO

TABLE D.3-10

PARAMETERS USED TO ESTIMATE POTENTIAL EXPOSURES FOR CURRENT LAND USE RECEPTORS[a]

Pathway Parameters	Trespassing Child Age 7-18	Groundskeeper Worker	Off-property Resident Farmer Age 1-70	Off-Property User of Surface Water Age 1-70
Inhalation of VOCs, Fugitive Dust, and Radon				
IR (m^3/hr)	0.83[b]	0.83[b]	0.83[b]	NA[c]
ET (hr/d)	4[d]	8[e]	5.7[f]	NA
EF (d/yr)	52[d]	35[e]	350[g]	NA
ED (yr)	12	25[h]	70	NA
BW (kg)	43	70	70	NA
AT-Noncancer (d)[i]	4380	9125	25550	NA
AT-Cancer (d)[i]	25550	25550	25550	NA
Incidental Ingestion of Soil/Sediment				
IR (g/d)	0.1	0.050[h]	NA	NA
FI	0.25[j]	1[h]	NA	NA
EF (d/yr)	52[d]	35[e]	NA	NA
ED (yr)	12	25[h]	NA	NA
BW (kg)	43	70	NA	NA
AT-Noncancer (d)[i]	4380	9125	NA	NA
AT-Cancer (d)[i]	25550	25550	NA	NA
Dermal Contact with Soil/Sediment				
SA (m^2)	0.38[k]	0.5[k]	NA	NA
AF (mg/cm^2)	1.0[l]	1.0[l]	NA	NA
ABS (unitless)	csv[m]	csv	NA	NA
EF (d/yr)	52[d]	35[e]	NA	NA
ED (yr)	12	25[h]	NA	NA
BW (kg)	43	70	NA	NA
AT-Noncancer (d)[i]	4380	9125	NA	NA
AT-Cancer (d)[i]	25550	25550	NA	NA
External Radiation Exposure				
DR (mrem/hr)	csv	csv	NA	NA
ET indoors (hr/d)	NA	NA	NA	NA
ET outdoors (hr/d)	4[d]	8[e]	NA	NA
EF (d/yr)	52[d]	35[e]	NA	NA
ED (yr)	12	25[h]	NA	NA
SH indoors (unitless)	NA	NA	NA	NA

TABLE D.3-10
(Continued)

Pathway Parameters	Trespassing Child Age 7-18	Groundskeeper Worker	Off-property Resident Farmer Age 1-70	Off-Property User of Surface Water Age 1-70
SH outdoors (unitless)	0	0	NA	NA
Incidental Ingestion of Surface Water				
IR x FI (L/hr)	0.05[n]	NA	NA	NA
ET (hr/d)	0.5[l]	NA	NA	NA
EF (d/yr)	5[l]	NA	NA	NA
ED (yr)	12	NA	NA	NA
BW (kg)	43	NA	NA	NA
AT-Noncancer (d)[i]	4380	NA	NA	NA
AT-Cancer (d)[i]	25550	NA	NA	NA
Dermal Contact with Surface Water				
SA (m^2)	1.5[l]	NA	NA	NA
PC (cm/hr)	csv	NA	NA	NA
ET (hr/d)	0.5[l]	NA	NA	NA
EF (d/yr)	5[l]	NA	NA	NA
ED (yr)	12	NA	NA	NA
BW (kg)	43	NA	NA	NA
AT-Noncancer (d)[i]	4380	NA	NA	NA
AT-Cancer (d)[i]	25550	NA	NA	NA
Drinking Water Ingestion				
IR x FI (L/d)	NA	NA	2	2
EF (d/yr)	NA	NA	350[g]	350[g]
ED (yr)	NA	NA	70	70
BW (kg)	NA	NA	70	70
AT-Noncancer (d)[i]	NA	NA	25550	25550
AT-Cancer (d)[i]	NA	NA	25550	25550
Ingestion of Fruits and Vegetables				
IR x FI (g/d)	NA	NA	122	122
EF (d/yr)	NA	NA	350[g]	350[g]
ED (yr)	NA	NA	70	70
BW (kg)	NA	NA	70	70
AT-Noncancer (d)[i]	NA	NA	25550	25550

TABLE D.3-10
(Continued)

Pathway Parameters	Trespassing Child Age 7-18	Groundskeeper Worker	Off-property Resident Farmer Age 1-70	Off-Property User of Surface Water Age 1-70
AT-Cancer (d)[i]	NA	NA	25550	25550
Ingestion of meat, milk and fish				
IR (meat) x FI (g/d)	NA	NA	75	75
IR (milk) x FI (L/d)	NA	NA	0.3	0.3
IR (fish) x FI (g/d)	NA	NA	NA	54
EF (d/yr)	NA	NA	350[g]	350[g]
ED (yr)	NA	NA	70	70
BW (kg)	NA	NA	70	70
AT-Noncancer (d)[i]	NA	NA	25550	25550
AT-Cancer (d)[i]	NA	NA	25550	25550
Dermal Contact While Bathing				
SA (m^2)	NA	NA	2.00[l]	2.00[l]
PC (cm/hr)	NA	NA	csv	csv
ET (hr/d)	NA	NA	0.25[l]	0.25[l]
EF (d/yr)	NA	NA	350[g]	350[g]
ED (yr)	NA	NA	70	70
BW (kg)	NA	NA	70	70
AT-Noncancer (d)[i]	NA	NA	25550	25550
AT-Cancer (d)[i]	NA	NA	25550	25550
Inhalation of Volatiles Released from Water by Bathing				
IR (m^3/hr)	NA	NA	0.83[b]	0.83[b]
ET (hr/d)	NA	NA	0.25[l]	0.25[l]
EF (d/yr)	NA	NA	350[g]	350[g]
ED (yr)	NA	NA	70	70
BW (kg)	NA	NA	70	70
AT-Noncancer (d)[i]	NA	NA	25550	25550
AT-Cancer (d)[i]	NA	NA	25550	25550

[a] Parameter values obtained from the Risk Assessment Work Plan Addendum (DOE 1992a) unless otherwise noted.
[b] Derived by dividing the default adult human inhalation rate of 20 m^3/day (U.S. EPA, 1989, Risk Assessment Guidance for Superfund) by 24 hours/day, and rounding to two significant figures.
[c] NA = Not applicable.

TABLE D.3-10
(Continued)

[d] Specific guidance from US EPA Region 5: standard tresspass scenario assumes 4 hr/d, 52 d/yr.
[e] Assumes the worker is a groundskeeper, who works 8 hours/day, 1 day/week 35 weeks/year on the grounds of OU4.
[f] Assumes a farmer works outdoors for 2000 hours/year (US EPA, Region V).
[g] U.S. EPA (1991), "Risk Assessment Guidance for Superfund: Vol. I – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)," OSWER Directive 9285.7-01B.
[h] U.S. EPA (1990b), Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Supplemental Guidance, "Standard Exposure Factors", Final Draft, OSWER Directive: 9285.6-03, pg. 10.
[i] Calculated as the product of ED (years) x 365 days/year.
[j] Assumes a small child spends 4 of 16 waking hours/day on-site.
[k] US EPA (1992) "Dermal Exposure Assessment: Principals and Applications, EPA/600/8-91/011B, Section 8.4: 25% of total body surface area, based on 50th percentile body weight, as described in US EPA (1989) Risk Assessment Guidance for Superfund, Sections 6.1 and 6.2.
[l] US EPA (1992) "Dermal Exposure Assessment: Principals and Applications," EPA/600/8-91/011B: AF from pg. 8-17; EF from pg. 8-6; ET and SA adult from pg. 8-7 or Table 10-1; SA child from Section 8-4.
[m] csv = Chemical specific value.
[n] US EPA (1989), "Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A)," pg. 6-36.

TABLE D.3-11

PARAMETERS USED TO ESTIMATE POTENTIAL EXPOSURES FOR FUTURE LAND USE RECEPTORS[a]

Pathway Parameters	Off-property User of Surface Water Age 1-70	Typical On-property Resident Age 1-70	Off-property Resident With Passive Access Controls Age 1-70	RME On-property Farmer Age 1-70	On-property Resident Child Age 1-6
Inhalation of Dusts, Volatiles, and Radon					
IR (m^3/hr)	NA[b]	0.83[c]	0.83[c]	0.83[c]	0.83[c]
ET Indoors (hr/d)	NA	19.8[d]	18.3[d]	18.3[d]	22[e]
ET Outdoors (hr/d)	NA	4.2[d]	5.7[d]	5.7[d]	2[e]
EF (d/yr)	NA	275[d]	350[f]	350[f]	350[f]
ED (yr)	NA	9[g]	70	70	6
BW (kg)	NA	70	70	70	15
AT-Noncancer (d)[h]	NA	3285	25550	25550	2190
AT-Cancer (d)[h]	NA	25550	25550	25550	25550
Ingestion of Drinking Water					
IR x FI (ℓ/d)	2	1.4[d]	2	2	1.4[i]
EF (d/yr)	350[f]	275[d]	350[f]	350[f]	350[f]
ED (yr)	70	9[g]	70	70	6
BW (kg)	70	70	70	70	15
AT-Noncancer (d)[h]	25550	3285	25550	25550	2190
AT-Cancer (d)[h]	25550	25550	25550	25550	25550
Inhalation of Volatiles Released from Water by Showering and Other Household Uses					
IR (m^3/hr)	0.83[c]	0.83[c]	0.83[c]	0.83[c]	0.83[c]
ET (hr/d)	0.25[j]	0.17[j]	0.25[j]	0.25[j]	0.33[j]
EF (d/yr)	350[f]	275[d]	350[f]	350[f]	350[f]
ED (yr)	70	9[g]	70	70	6
BW (kg)	70	70	70	70	15
AT-Noncancer (d)[h]	25550	3285	25550	25550	2190
AT-Cancer (d)[h]	25550	25550	25550	25550	25550
Dermal Contact While Bathing					
SA (m^2)	2.0[j]	2.0[j]	2.0[j]	2.0[j]	0.7[j]
PC (cm/hr)	csv[k]	csv	csv	csv	csv
ET (hr/d)	0.25[j]	0.17[j]	0.25[j]	0.25[j]	0.33[j]
EF (d/yr)	350[f]	275[d]	350[f]	350[f]	350[f]
ED (yr)	70	9[g]	70	70	6
BW (kg)	70	70	70	70	15
AT-Noncancer (d)[h]	25550	3285	25550	25550	2190
AT-Cancer (d)[h]	25550	25550	25550	25550	25550

TABLE D.3-11
(Continued)

Pathway Parameters	Off-property User of Surface Water Age 1-70	Typical On-property Resident Age 1-70	Off-property Resident With Passive Access Controls Age 1-70	RME On-property Farmer Age 1-70	On-property Resident Child Age 1-6
Incidental Ingestion of Soil/Sediment					
IR (g/d)	NA	0.1[d]	NA	0.48[d]	0.2
FI	NA	1[l]	NA	1[l]	1[l]
EF (d/yr)	NA	275[d]	NA	350[f]	350[f]
ED (yr)	NA	9[g]	NA	70	6
BW (kg)	NA	70	NA	70	15
AT-Noncancer (d)[h]	NA	3285	NA	25550	2190
AT-Cancer (d)[h]	NA	25550	NA	25550	25550
Dermal Contact with Soil/Sediment					
SA (m^2)	NA	0.5[m]	NA	0.5[m]	0.18[m]
AF (mg/cm^2)	NA	0.2[j]	NA	1.0[j]	1.0[j]
ABS (unitless)	NA	csv	NA	csv	csv
EF (d/yr)	NA	40[j]	NA	350[f]	350[f]
ED (yr)	NA	9[e]	NA	70	6
BW (kg)	NA	70	NA	70	15
AT-Noncancer (d)[h]	NA	3285	NA	25550	2190
AT-Cancer (d)[h]	NA	25550	NA	25550	25550
External Radiation Exposure					
DR (mrem/hr)	NA	csv	NA	csv	csv
ET Indoors (hr/d)	NA	19.8[d]	NA	18.3[d]	22[e]
ET Outdoors (hr/d)	NA	4.2[d]	NA	5.7[d]	2[e]
EF (d/yr)	NA	275[d]	NA	350[f]	350[f]
ED (yr)	NA	9[g]	NA	70	6
SH Indoors (unitless)	NA	0.5	NA	0.5	0.5
SH Outdoors (unitless)	NA	0	NA	0	0
Ingestion of Vegetables and Fruit					
IR x FI (g/d)	122	122	122	122	101.5[n]
EF (d/yr)	350[f]	275[d]	350[f]	350[f]	350[f]
ED (yr)	70	9[g]	70	70	6
BW (kg)	70	70	70	70	15
AT-Noncancer (d)[h]	25550	3285	25550	25550	2190
AT-Cancer (d)[h]	25550	25550	25550	25550	25550

TABLE D.3-11
(Continued)

Pathway Parameters	Off-property User of Surface Water Age 1-70	Typical On-property Resident Age 1-70	Off-property Resident With Passive Access Controls Age 1-70	RME On-property Farmer Age 1-70	On-property Resident Child Age 1-6
Ingestion of Meat					
IR x FI (g/d)	75	75	75	75	29
EF (d/yr)	350[f]	275[d]	350[f]	350[f]	350[f]
ED (yr)	70	9[g]	70	70	6
BW (kg)	70	70	70	70	15
AT-Noncancer (d)[h]	25550	3285	25550	25550	2190
AT-Cancer (d)[h]	25550	25550	25550	25550	25550
Ingestion of Milk					
IR x FI (L/d)	0.3	0.2[d]	0.3	0.3	0.68
EF (d/yr)	350[f]	275[d]	350[f]	350[f]	350[f]
ED (yr)	70	9[g]	70	70	6
BW (kg)	70	70	70	70	15
AT-Noncancer (d)[h]	25550	3285	25550	25550	2190
AT-Cancer (d)[h]	25550	25550	25550	25550	25550
Ingestion of Fish					
IR x FI (g/d)	54	NA	NA	NA	NA
EF (d/yr)	350[f]	NA	NA	NA	NA
ED (yr)	70	NA	NA	NA	NA
BW (kg)	70	NA	NA	NA	NA
AT-Noncancer (d)[h]	25550	NA	NA	NA	NA
AT-Cancer (d)[h]	25550	NA	NA	NA	NA
Incidental Ingestion of Surface Water During Swim or Play					
IR x FI (L/hr)	NA	NA	NA	NA	0.05[n]
ET (hr/d)	NA	NA	NA	NA	0.5[j]
EF (d/yr)	NA	NA	NA	NA	5[j]
ED (yr)	NA	NA	NA	NA	6
BW (kg)	NA	NA	NA	NA	15
AT-Noncancer (d)[h]	NA	NA	NA	NA	2190
AT-Cancer (d)[h]	NA	NA	NA	NA	25550
Dermal Contact with Surface Water During Swim or Play					
SA (m^2)	NA	NA	NA	NA	0.7[j]
PC (cm/hr)	NA	NA	NA	NA	csv

TABLE D.3-11
(Continued)

Pathway Parameters	Off-property User of Surface Water Age 1-70	Typical On-property Resident Age 1-70	Off-property Resident With Passive Access Controls Age 1-70	RME On-property Farmer Age 1-70	On-property Resident Child Age 1-6
ET (hr/d)	NA	NA	NA	NA	0.5[j]
EF (d/yr)	NA	NA	NA	NA	5[j]
ED (yr)	NA	NA	NA	NA	6
BW (kg)	NA	NA	NA	NA	15
AT-Noncancer (d)[h]	NA	NA	NA	NA	2190
AT-Cancer (d)[h]	NA	NA	NA	NA	25550

[a] Parameter values obtained from the Risk Assessment Work Plan Addendum (DOE 1992a) unless otherwise noted.
[b] NA = Not applicable.
[c] Derived by dividing the default adult human inhalation rate of 20 m^3/day (U.S. EPA, 1989, Risk Assessment Guidance for Superfund) by 24 hours/day, and rounding to two significant figures.
[d] Special guidance from US EPA Region V.
[e] Assumes a resident small child spends 700 hours/year outdoors.
[f] U.S. EPA (1991), "Risk Assessment Guidance for Superfund: Vol. I -- Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)," OSWER Directive 9285.7-01B.
[g] Oswer Standard Default Exposure Parameters (EPA 1991); 50th percentile at one residence.
[h] Calculated as the product of ED (years) x 365 days/year.
[i] Drinking water consumption rate of 1.4 L/day from NRC (Nuclear Regulatory Commission), 1977, U.S. Nuclear Regulatory Commission Regulatory Guide 1.109; NCRP (National Council on Radiation Protection) Report No. 76.
[j] US EPA (1992) "Dermal Exposure Assessment: Principals and Applications," EPA/600/8-91/011B: AF from pg. 8-17; EF from pg. 8-6; ET and SA adult from Table 10-1; SA child from Section 8-4.
[k] csv = Chemical specific value.
[l] Assumed value, based on fraction of day spent on site.
[m] US EPA (1992) "Dermal Exposure Assessment: Principals and Applications, EPA/600/8-91/011B, Section 8.4: 25% of total body surface area, based on 50th percentile body weight, as described in US EPA (1989) Risk Assessment Guidance for Superfund, Sections 6.1 and 6.2.
[n] US EPA (1989) Risk Assessment Guidance for Superfund, pg. 6-36.