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SUBMITTAL OF REQUESTED CHANGE PAGES FOR THE OPERABLE UNIT 1 AND 2 DOCUMENTS (OPERABLE UNIT 1 RI REPORT) REF: 5304, 5305

03/16/94

DOE-1175-94
DOE-FN/EPA
13
LETTER
OU1

Department of Energy
Fernald Environmental Management Project
P.O. Box 398705
Cincinnati, Ohio 45239-8705
(513) 738-6357

- 5303

MAR 16 1994
DOE-1175-94

Mr. James A. Saric, Remedial Project Director
U. S. Environmental Protection Agency
Region V-5HRE-8J
77 West 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:

SUBMITTAL OF REQUESTED CHANGE PAGES FOR THE OPERABLE UNIT 1 AND 2 DOCUMENTS

As requested during the February 24, 1994, meeting between U.S. Environmental Protection Agency (USEPA), Ohio Environmental Protection Agency (OEPA), Department of Energy (DOE), and Fernald Environmental Restoration Management Company (FERMCO), this letter provides a description of the language that will be added to the Operable Unit 1 (OU1) and Operable Unit 2 (OU2) Remedial Investigation and Feasibility Studies (RI/FS) to address the trespassing and recreational exposure scenarios.

The following language will be added to both the OU1 and OU2 RI/FS descriptions of the expanded trespasser scenario.

"For purposes of establishing preliminary remediation goals (PRGs) for the Future Land Use With Continued Federal Ownership, an on-property trespassing receptor was established. Under this exposure scenario, access to the site would be restricted and would be discouraged through the construction and maintenance of signs, fences, and locked gates around the perimeter of the restricted area. Despite these controls, it is assumed that trespassing would occur. The expanded trespassing scenario assumes a youth (ages 6 to 18) trespasses 110 days per year for two hours each day and the same person trespasses as an adult (ages 18 to 50) 40 days per year for one hour each day. This receptor and the associated exposure factors apply only to OUs 1, 2, and 4. The risk assessment for the OU5 FS will include additional trespassing as well as recreational exposure scenarios, which are to be fully developed on a site-wide basis within the OU 5 RI/FS. A full array of trespassing and recreational exposure scenarios from no trespassing through full recreational use of the site will be developed."

01

Recycled and Recyclable

Change pages for the OU1 RI and OU2 RI/FS are included as an enclosure to this letter. Change pages containing the agreed upon language for addressing risks from dermal absorption of PAHs and child inhalation rates are also included. A description of the trespassing and recreational exposure scenarios for OU5 along with the associated exposure factors will be submitted to USEPA and OEPA for approval by March 31, 1994.

If you have any comments concerning these conclusions please contact Randy C. Janke at (513) 648-3123 if there are any additional questions regarding this submittal.

Sincerely,

for Jack R. Craig
Fernald Remediation Action
Project Manager

FN:RC Janke

Enclosures: As Stated

cc w/enc:

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OPERABLE UNIT 1
REMEDIAL INVESTIGATION
CHANGE PAGES

March 15, 1994

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310 • Risks and hazard quotients (HQs) are not quantified for chemicals for which toxicity data are not available in IRIS, HEAST, or from ECAO.}

Justification: It is not possible to perform a quantitative risk assessment for chemicals for which toxicity data are not available. The large number of chemicals that are quantitatively assessed is adequate to provide estimates of risk for this operable unit.

Since publication of the Risk Assessment Work Plan Addendum, EPA has provided additional technical guidance concerning methods, models, and parameters that has been incorporated into this Baseline Risk Assessment to the fullest extent possible. Additional guidance documents are referenced where applicable.

2/24/94 Meeting

E.1.3.3 Recent Agency Guidance

On February 24, 1994 a meeting was held between USEPA Region V and DOE personnel. In this meeting, agreements were reached regarding use of a new receptor (the expanded trespasser), dermal exposure to polycyclic aromatic hydrocarbons (PAHs), child inhalation rates, and skin surface area used for dermal exposure. The approach used in this baseline risk assessment was modified for consistency with these agreements.

Expanded Trespasser

For the purpose of establishing preliminary remediation goals (PRGs) for the Future Land Use With Continued Federal Ownership, an on-property trespassing receptor was established. Under this exposure scenario, access to the site would be restricted and discouraged through the construction and maintenance of signs, fences, and locked gates around the perimeter of the restricted area. Despite these controls, it was assumed that trespassing would occur. The expanded trespassing scenario assumes a youth (ages 6 to 18) trespasses 110 days per year for two hours each day and the same person trespasses as an adult (ages 18 to 50) 40 days per year for one hour each day. This receptor and the associated exposure factors apply only to Operable Units 1, 2, 3, and 4. The risk assessment for the OU5 FS will include additional trespassing as well as recreational exposure scenarios, which are to be fully developed on a site-wide basis within the Operable Unit 5 RI/FS. A full array of trespassing and recreational exposure scenarios from no trespassing through full recreational use of the site will be developed.

Dermal Exposures to PAHs

Reliable cancer slope factors for dermal exposure to (PAHs) are currently unavailable. Current policy indicates it is inappropriate to extrapolate dermal slope factors from oral slope factors for PAHs. Also, extrapolation from other routes of exposure is inappropriate due to varied absorption, metabolic transformations and target organ end point responses. However, PAHs are potent skin carcinogens. Current information on the contribution to cancer risk from dermal exposure to PAHs indicates the toxicity from the dermal pathway may be as toxic as from the oral route of exposure. In order to provide an estimate of the risk contribution from PAHs via dermal exposure for all direct contact pathways, the risk posed for dermal exposure was assumed equal to the risk from oral exposure.

Child Inhalation Rates

DOE calculated a value of 0.5 m^3/hr. for use as the appropriate value for the child's inhalation rate to be used for residential exposure scenarios. This value was developed utilizing currently used physiological parameters by pediatric medical practitioners from the Children's Hospital at the University of Cincinnati Medical Center. The ventilation volumes and rates used approximate the normal active child, in a conservative manner. The value developed for risk assessments is an upward adjustment of the normal child, to the moderately active child whose ventilation rate and volume are on the high side of the normal range. Accordingly, the value of 0.5m^3/hour is used as the inhalation rate for children, 0-6 years of age, and accounts for an increased activity above the normal resting level of activity. This value, developed in consultation with the physicians, is based upon current medical parameters used to treat patients. A value of .83m^3/hour was used for trespassing scenarios to account for even higher ventilation volumes.

Body Surface Area for Dermal Exposure

The 95th percentile body surface area value of 2.3m^2, recommended by EPA was the physiological parameter used for the human body surface area during calculation of dermal exposures for all risk assessments. DOE disagrees with this guidance and has presented a dissenting opinion. The matter will be examined by EPA, but until such time that EPA acts upon this matter, the above value will be used. {Meeting Comment End}

TABLE 7-11
PRELIMINARY REMEDIATION GOALS - SOIL

	Future Land Use Without Continued Federal Ownership (Resident Farmer)			Future Land Use With Continued Federal Ownership (Expanded Trespasser)			Off-property Resident Farmer			
Constituent	HI = 0.2 RfD-Based PRG	10^{-4} Risk Based PRG	10^{-6} Risk Based PRG	HI = 0.2 RfD-Based PRG	10^{-4} Risk Based PRG	10^{-6} Risk Based PRG	HI = 0.2 RfD-Based PRG	10^{-4} Risk Based PRG	10^{-6} Risk Based PRG	Background 95th Percentile
Radionuclides(pCi/g)										
Cs-137 + daughters		1	0.01		100	1		700,000	7,000	0.71
Np-237 + daughters		0.4	0.04		500	5		50,000	500	-
Pu-238		50	0.5		12,000	120		40,000	400	-
Pu-239/240		50	0.5		12,000	120		40,000	400	-
Ra-226 + 5 daughters[f]		0.4	0.004		40	0.4		16,000	160	1.45
Sr-90 + daughters		2	0.02		85,000	850		1,200,000	12,000	-
Tc-99		100	1		2×10^5	23,000		2×10^7	200,000	-
Th-230		100	1		90,000	900		50,000	500	1.97
Th-232 + daughters		0.3	0.003		80	0.8		60,000	600	1.36
U-234		100	1		90,000	900		60,000	0	1.24
U-235 + daughters		9	0.09		900	9		60,000	600	0.15
U-238 + 2 daughters		30	0.3		5,500	55		30,000	300	1.22
Inorganics (mg/kg)										
Antimony	2			30			>10,000			7.7
Arsenic	5	4	0.04	200	1600	16	>10,000	60,000	600	8.5
Beryllium	12	0.3	0.003	26	3	0.03	>10,000	33,000	330	0.6
Cadmium	0.8	1,200	12	26	900,000	900	>10,000	500,000	5,000	0.8
Chromium	30	170	2	1,000	130,000	1,300	>10,000	70,000	700	16
Copper[g]										14
Lead[g]										26
Manganese	260			2,200			>10,000			1,800
Mercury	5×10^{-3}			5			4,000			0.3
Molybdenum	5			900			>10,000			2.6
Nickel	48	8,700	87	8,000	7,000,000	70,000	>10,000	4×10^6	36,000	21
Silver	0.6			130			>10,000			2.6
Thallium	0.4			140			>10,000			0.6
Uranium	25			76						3.7
Vanadium	160			1,600			>10,000			30

TABLE 7-11
(Continued)

Constituent	Future Land Use Without Continued Federal Ownership (Resident Farmer)			Future Land Use With Continued Federal Ownership (Expanded Trespasser)			Off-property Resident Farmer			Background 95th Percentile
	HI = 0.2 RfD-Based PRG	10^{-4} Risk Based PRG	10^{-6} Risk Based PRG	HI = 0.2 RfD-Based PRG	10^{-4} Risk Based PRG	10^{-6} Risk Based PRG	HI = 0.2 RfD-Based PRG	10^{-4} Risk Based PRG	10^{-6} Risk Based PRG	
Organic (mg/kg)										
Aroclor-1248[b]		0.1	0.001		4	0.04		1,500	15	
Aroclor-1254[b]		0.07	0.0007		4	0.04		1,000	10	
Aroclor-1260[b]		0.1	0.001		4	0.04		900	9	
Benzo(a)anthracene		2	0.02		2,400	24		90,000	900	
Benzo(a)pyrene		0.2	0.002		350	3.5		700	7	
Benzo(b)fluoranthene		0.6	0.006		2,900	29		20,000	200	
Benzo(k)fluoranthene[g]		0.9	0.009		6,700	67		20,000	200	
Indeno(1,2,3-cd)pyrene		0.03	3×10^{-4}		1,300	13		>10,000	>10,000	
Pentachlorophenol	76	11	0.1	500	270	3		1×10^{6}	14,000	
Tetrachloroethene	2	2	0.02	26,000	1.2×10^{5}	1,200		760,000	7,600	
Heptachlorodibenzo-p-dioxin		2×10^{-4}	2×10^{-6}		0.1	0.001		6	0.06	
Heptachlorodibenzofuran		1×10^{-3}	1×10^{-5}		0.1	0.001		6	0.06	
Octachlorodibenzo-p-dioxin		2×10^{-3}	2×10^{-5}		1	0.01		60	0.6	
Octachlorodibenzofuran		1×10^{-2}	1×10^{-4}		5	0.05		60	0.6	
Hexachlorodibenzofuran		1×10^{-4}	1×10^{-6}		0.01	0.0001		0.6	0.006	
Hexachlorodibenzo-p-dioxin		2×10^{-5}	2×10^{-7}		0.01	0.0001		0.6	0.006	
2,3,7,8-Tetrachlorodibenzofuran		9×10^{-5}	9×10^{-7}		1×10^{-3}	1×10^{-5}		0.06	0.0006	
Vinyl chloride		4×10^{-3}	4×10^{-5}		7,000	70		20,000	200	

[a] PRG developed using unit Risk Factors from the OU1 baseline risk assessment.
[b] PRG developed using unit Risk Factors from the OU1 baseline risk assessment.
[c] PRG is greater than 10,000 mg/kg
[d] PRGs developed using parameters for recreational exposures and HEAST.
[e] PRGs developed using parameters for recreational exposures and HEAST and IRIS.
[f] 40 CFR 192 is an ARAR - based cleanup level of 5 pCi/g of radium in the first 15 cm of soil.
[g] No toxicity data available to develop a PRG.
[h] Requirements for PCB Spill Cleanup, 40 CFR 761.125, 10 mg/hg.

TABLE E.IV-1
ILCRs FOR ON-PROPERTY GROUNDSKEEPER CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	External Exposure[a]
Radionuclides					
Cs_{137+1d}	1.9E-12	2.0E-09	NA	1.3E-06	
Np_{237+1d}	1.8E-09	9.6E-09	NA	1.7E-07	
Pu_{238}	4.8E-10	1.9E-09	NA	2.2E-12	
$Pu_{239/240}$	9.3E-10	4.0E-09	NA	4.3E-12	
Ra_{226+8d}	NA	NA	NA	NA	
Ra_{228+1d}	NA	NA	NA	NA	
Sr_{90+1d}	1.2E-11	4.7E-09	NA	ND	
Tc_{99}	NA	NA	NA	NA	
Th_{230}	5.1E-07	1.7E-07	NA	6.3E-09	
U_{234}	3.8E-07	1.6E-07	NA	2.8E-09	
U_{235+1D}	4.3E-09	2.6E-08	NA	3.6E-06	
U_{238+2d}	5.0E-06	1.9E-06	NA	2.3E-05	
Rn_{222+4d}	4.0E-12	NA	NA	NA	
Total Radionuclides	5.9E-06	2.3E-06		2.8E-05	4.6E-05
Chemicals					
arsenic	NA	NA	NA	NA	NA
beryllium	4.4E-10	1.6E-07	9.3E-06	NA	NA
cadmium	2.5E-09	ND	ND	NA	NA
lead	NA	NA	NA	NA	NA
nickel	NA	NA	NA	NA	NA
pcbs	ND	5.3E-07	1.2E-06	NA	NA
benzo(a)anthracene	6.0E-12	5.1E-09	5.1E-09	NA	NA
benzo(a)pyrene	1.8E-11	1.5E-08	1.5E-08	NA	NA
benzo(b)fluoranthene	3.1E-12	2.6E-09	2.6E-09	NA	NA
benzo(k)fluoranthene	1.1E-12	8.6E-10	8.6E-10	NA	NA
chrysene	NA	1.4E-10	1.4E-10	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA
Sum Chem. (TEF for PAHs):	3.0E-09	7.1E-07	1.1E-05		
Sum Chem. (BaP for PAHs):	3.1E-09	8.1E-07	1.1E-05		
TOTAL ALL (TEF):	5.9E-06	3.0E-06	1.1E-05	2.8E-05	4.6E-05
TOTAL ALL (BaP):	5.9E-06	3.1E-06	1.1E-05	2.8E-05	4.6E-05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.
[a] Risk from external radiation exposure is calculated from to exposure to gamma radiation sources.
[b] Risk from dermal contact to PAH's is assumed to equal risk from oral ingestion of PAH's.

TABLE E.IV-7
ILCRs FOR TRESPASSING YOUTH
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	External Exposure[a]
Radionuclides					
Cs_{137+1d}	2.2E-13	3.5E-10	NA	4.6E-07	
Np_{237+1d}	2.1E-10	1.7E-09	NA	6.1E-08	
Pu_{238}	5.7E-11	3.4E-10	NA	8.0E-13	
$Pu_{239/240}$	1.1E-10	7.2E-10	NA	1.5E-12	
Ra_{226+8d}	NA	NA	NA	NA	
Ra_{228+1d}	NA	NA	NA	NA	
Sr_{90+1d}	1.4E-12	8.4E-10	NA	ND	
Tc_{99}	NA	NA	NA	NA	
Th_{230}	6.0E-08	3.0E-08	NA	2.2E-09	
U_{234}	4.5E-08	2.9E-08	NA	1.0E-09	
U_{235+1D}	5.0E-10	4.7E-09	NA	1.3E-06	
U_{238+2d}	5.9E-07	3.4E-07	NA	8.1E-06	
Rn_{222+4d}	4.8E-13	NA	NA	NA	
Total Radionuclides	7.0E-07	4.1E-07		9.9E-06	1.7E-05
Chemicals					
arsenic	NA	NA	NA	NA	NA
beryllium	8.6E-11	4.7E-08	7.9E-06	NA	NA
cadmium	4.9E-10	ND	ND	NA	NA
lead	NA	NA	NA	NA	NA
nickel	NA	NA	NA	NA	NA
pcbs	ND	1.5E-07	1.0E-06	NA	NA
benzo(a)anthracene	1.2E-12	1.5E-09	1.5E-09	NA	NA
benzo(a)pyrene	3.5E-12	4.4E-09	4.4E-09	NA	NA
benzo(b)fluoranthene	5.9E-13	7.5E-10	7.5E-10	NA	NA
benzo(k)fluoranthene	2.2E-13	2.5E-10	2.5E-10	NA	NA
chrysene	NA	4.0E-11	4.0E-11	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA
Sum Chem. (TEF for PAHs):	5.8E-10	2.1E-07	8.9E-06		
Sum Chem. (BaP for PAHs):	5.9E-10	2.3E-07	9.0E-06		
TOTAL ALL (TEF):	7.0E-07	6.2E-07	8.9E-06	9.9E-06	1.7E-05
TOTAL ALL (BaP):	7.0E-07	6.5E-07	9.0E-06	9.9E-06	1.7E-05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.
[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.
[b] Risk from dermal contact to PAH's is assumed to equal risk from oral ingestion of PAH's.

TABLE E.IV-11
ILCRs FOR TRESPASSING YOUTH
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment			Buried Pit Material
Exposure Pathways: / Contaminants of Concern[1]	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure	External Exposure[a]
Radionuclides										
Cs_{137+1d}	1.3E-10	2.3E-09	NA	2.9E-06	1.4E-12	NA	1.0E-10	NA	1.4E-07	
Np_{237+1d}	1.5E-07	1.3E-08	NA	4.5E-07	1.8E-10	NA	4.1E-10	NA	1.5E-08	
Pu_{238}	1.1E-08	2.4E-09	NA	5.5E-12	4.8E-12	NA	3.3E-10	NA	8.0E-13	
$Pu_{239/240}$	4.9E-08	5.5E-09	NA	1.2E-11	1.2E-12	NA	8.6E-11	NA	1.9E-13	
Ra_{226+8d}	2.8E-07	2.7E-07	NA	3.8E-05	NA	NA	NA	NA	NA	
Ru_{106}	1.6E-10	3.1E-11	NA	ND	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.2E-10	1.2E-09	NA	ND	5.6E-10	NA	2.3E-10	NA	ND	
Tc_{99}	1.6E-08	3.2E-09	NA	2.7E-11	4.8E-09	NA	2.3E-11	NA	2.0E-13	
Th_{230}	3.0E-05	1.8E-07	NA	1.3E-08	1.6E-11	NA	3.7E-09	NA	2.9E-10	
$Th_{232+10d}$	3.9E-06	6.1E-08	NA	5.5E-05	1.2E-11	NA	2.7E-09	NA	2.6E-06	
U_{234}	5.9E-06	4.5E-08	NA	1.5E-09	7.3E-09	NA	3.6E-09	NA	1.3E-10	
U_{235+1D}	1.6E-06	9.2E-09	NA	2.5E-06	8.3E-10	NA	4.0E-10	NA	1.1E-07	
U_{238+2d}	4.3E-05	3.5E-07	NA	8.1E-06	5.2E-08	NA	2.5E-08	NA	6.2E-07	
Rn_{222+4d}	5.7E-11	NA	NA	NA	NA	NA	NA	NA	NA	
Total Radionuclides	8.5E-05	9.4E-07		1.1E-04	6.6E-08		3.7E-08		3.5E-06	7.2E-06
Chemicals										
arsenic	4.2E-05	3.5E-05	8.2E-06	NA	3.6E-09	5.6E-10	2.9E-08	2.2E-08	NA	NA
beryllium	1.9E-08	1.3E-07	2.9E-05	NA	2.2E-10	3.3E-09	1.2E-08	8.2E-06	NA	NA
cadmium	2.0E-08	ND	ND	NA	ND	ND	ND	ND	NA	NA
chromium vi	7.9E-07	ND	ND	NA	ND	ND	ND	ND	NA	NA
lead	ND	ND	ND	NA	ND	ND	ND	ND	NA	NA
nickel	3.5E-08	ND	ND	NA	ND	ND	ND	ND	NA	NA
pcbs	ND	1.4E-07	1.2E-06	NA	3.5E-11	5.0E-08	4.2E-08	1.2E-06	NA	NA
benzo(a)anthracene	2.5E-11	1.2E-09	1.2E-09	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	1.4E-10	4.0E-09	4.0E-09	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	3.3E-11	7.6E-10	7.6E-10	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	1.6E-13	1.7E-10	1.7E-10	NA	NA	NA	NA	NA	NA	NA
chrysene	ND	3.3E-11	3.3E-11	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	ND	1.3E-10	1.3E-10	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	1.6E-09	1.2E-08	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	7.8E-11	5.8E-09	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	5.7E-11	3.6E-10	4.8E-09	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	2.0E-10	1.3E-09	1.7E-08	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	2.5E-11	1.6E-10	2.1E-09	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	2.3E-10	1.5E-09	1.9E-08	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	1.3E-11	8.3E-11	1.1E-09	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	1.8E-12	1.7E-10	1.7E-08	NA	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	4.3E-05	3.6E-05	3.8E-05		3.9E-09	5.3E-08	8.3E-08	9.4E-06		
Sum Chem (BaP for PAHs):	4.3E-05	3.6E-05	3.8E-05		3.9E-09	5.3E-08	8.3E-08	9.4E-06		
TOTAL ALL (TEF Approach):	1.3E-04	3.7E-05	3.8E-05	1.1E-04	7.0E-08	5.3E-08	1.2E-07	9.4E-06	3.5E-06	7.2E-06
TOTAL ALL (BaP Approach):	1.3E-04	3.7E-05	3.8E-05	1.1E-04	7.0E-08	5.3E-08	1.2E-07	9.4E-06	3.5E-06	7.2E-06

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.
[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.
[b] Risk from dermal contact is [illegible]

TABLE E.IV-15
ILCRs FOR EXPANDED TRESPASSER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment			Buried Pit Material
Exposure Pathways: / Contaminants of Concern[1]	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure	External Exposure[a]
Radionuclides										
Cs_{137+1d}	2.0E-10	3.7E-09	NA	6.7E-06	1.4E-12	NA	1.0E-10	NA	1.4E-07	
Np_{237+1d}	2.4E-07	2.1E-08	NA	1.0E-06	1.8E-10	NA	4.1E-10	NA	1.5E-08	
Pu_{238}	1.8E-08	3.9E-09	NA	1.3E-11	4.8E-12	NA	3.3E-10	NA	8.0E-13	
$Pu_{239/240}$	7.7E-08	9.1E-09	NA	2.7E-11	1.2E-12	NA	8.6E-11	NA	1.9E-13	
Ra_{226+8d}	4.3E-07	4.5E-07	NA	8.7E-05	NA	NA	NA	NA	NA	
Ru_{106}	2.6E-10	5.2E-11	NA	ND	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.9E-10	2.1E-09	NA	ND	5.6E-10	NA	2.3E-10	NA	ND	
Tc_{99}	2.5E-08	5.3E-09	NA	6.2E-11	4.8E-09	NA	2.3E-11	NA	2.0E-13	
Th_{230}	4.7E-05	3.0E-07	NA	3.1E-08	1.6E-11	NA	3.7E-09	NA	2.9E-10	
$Th_{232+10d}$	6.1E-06	1.0E-07	NA	1.3E-04	1.2E-11	NA	2.7E-09	NA	2.6E-06	
U_{234}	9.3E-06	7.4E-08	NA	3.5E-09	7.3E-09	NA	3.6E-09	NA	1.3E-10	
U_{235+1D}	2.4E-06	1.5E-08	NA	5.8E-06	8.3E-10	NA	4.0E-10	NA	1.1E-07	
U_{238+2d}	6.8E-05	5.8E-07	NA	1.9E-05	5.2E-08	NA	2.5E-08	NA	6.2E-07	
Rn_{222+4d}	9.1E-11	NA	NA	NA	NA	NA	NA	NA	NA	
Total Radionuclides	1.3E-04	1.6E-06		2.5E-04	6.6E-08		3.7E-08		3.5E-06	2.6E-05
Chemicals										
arsenic	5.8E-05	5.1E-05	3.2E-05	NA	3.6E-09	5.6E-10	2.9E-08	2.2E-08	NA	NA
beryllium	2.6E-08	1.9E-07	1.1E-04	NA	2.2E-10	3.3E-09	1.2E-08	8.2E-06	NA	NA
cadmium	2.8E-08	ND	ND	NA	ND	ND	ND	ND	NA	NA
chromium vi	1.1E-06	ND	ND	NA	ND	ND	ND	ND	NA	NA
lead	ND	ND	ND	NA	ND	ND	ND	ND	NA	NA
nickel	4.8E-08	ND	ND	NA	ND	ND	ND	ND	NA	NA
pcbs	ND	2.0E-07	4.8E-06	NA	3.5E-11	5.0E-08	4.2E-08	1.2E-06	NA	NA
benzo(a)anthracene	3.5E-11	1.7E-09	1.7E-09	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	1.9E-10	5.7E-09	5.7E-09	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	4.5E-11	1.1E-09	1.1E-09	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	2.2E-13	2.4E-10	2.4E-10	NA	NA	NA	NA	NA	NA	NA
chrysene	ND	4.8E-11	4.8E-11	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	ND	1.9E-10	1.9E-10	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	2.3E-09	4.6E-08	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	1.1E-10	2.2E-08	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	7.8E-11	5.2E-10	1.8E-08	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	2.7E-10	1.8E-09	6.5E-08	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	3.4E-11	2.3E-10	8.0E-09	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	3.1E-10	2.1E-09	7.4E-08	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	1.8E-11	1.2E-10	4.2E-09	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	2.5E-12	2.4E-10	6.4E-08	NA	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	6.0E-05	5.2E-05	1.5E-04		3.9E-09	5.3E-08	8.3E-08	9.4E-06		
Sum Chem (BaP for PAHs):	6.0E-05	5.2E-05	1.5E-04		3.9E-09	5.3E-08	8.3E-08	9.4E-06		
TOTAL ALL (TEF Approach):	1.9E-04	5.3E-05	1.5E-04	2.5E-04	7.0E-08	5.3E-08	1.2E-07	9.4E-06	3.5E-06	2.6E-05
TOTAL ALL (BaP Approach):	1.9E-04	5.3E-05	1.5E-04	2.5E-04	7.0E-08	5.3E-08	1.2E-07	9.4E-06	3.5E-06	2.6E-05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.
[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.
[b] Risk from dermal contact to PAHs [illegible]

TABLE E.IV-17
ILCRs FOR ON-PROPERTY GROUNDSKEEPER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	External Exposure[a]
Radionuclides					
Cs_{137+1d}	1.1E-09	1.7E-08	NA	1.1E-05	
Np_{237+1d}	1.3E-06	9.4E-08	NA	1.7E-06	
Pu_{238}	9.6E-08	1.8E-08	NA	2.0E-11	
$Pu_{239/240}$	4.1E-07	4.1E-08	NA	4.3E-11	
Ra_{226+8d}	2.3E-06	2.0E-06	NA	1.4E-04	
Ru_{106}	1.4E-09	2.3E-10	NA	ND	
Sr_{90+1d}	1.0E-09	9.2E-09	NA	ND	
Tc_{99}	1.3E-07	2.4E-08	NA	1.0E-10	
Th_{230}	2.5E-04	1.3E-06	NA	5.0E-08	
$Th_{232+10d}$	3.3E-05	4.5E-07	NA	2.1E-04	
U_{234}	5.0E-05	3.3E-07	NA	5.7E-09	
U_{235+1D}	1.3E-05	6.8E-08	NA	9.3E-06	
U_{238+2d}	3.6E-04	2.6E-06	NA	3.0E-05	
Rn_{222+4d}	4.9E-10	NA	NA	NA	
Total Radionuclides	7.2E-04	6.9E-06		4.0E-04	4.6E-05
Chemicals					
arsenic	2.2E-04	1.6E-04	9.7E-06	NA	NA
beryllium	9.9E-08	5.9E-07	3.4E-05	NA	NA
cadmium	1.0E-07	ND	ND	NA	NA
chromium vi	4.1E-06	ND	ND	NA	NA
lead	ND	ND	ND	NA	NA
nickel	1.8E-07	ND	ND	NA	NA
pcbs	ND	6.4E-07	1.5E-06	NA	NA
benzo(a)anthracene	1.3E-10	5.4E-09	5.4E-09	NA	NA
benzo(a)pyrene	7.2E-10	1.8E-08	1.8E-08	NA	NA
benzo(b)fluoranthene	1.7E-10	3.4E-09	3.4E-09	NA	NA
benzo(k)fluoranthene	8.1E-13	7.7E-10	7.7E-10	NA	NA
chrysene	ND	1.5E-10	1.5E-10	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	ND	6.0E-10	6.0E-10	NA	NA
n-nitrosodipropylamine	ND	7.3E-09	1.4E-08	NA	NA
pentachlorophenol	ND	3.5E-10	6.8E-09	NA	NA
vinyl chloride	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	2.9E-10	1.6E-09	5.6E-09	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	1.0E-09	5.8E-09	2.0E-08	NA	NA
heptachlorodibenzofuran	1.3E-10	7.2E-10	2.5E-09	NA	NA
octachlorodibenzo-p-dioxin	1.2E-09	6.6E-09	2.3E-08	NA	NA
octachlorodibenzofuran	6.6E-11	3.7E-10	1.3E-09	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	9.4E-12	7.6E-10	2.0E-08	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	2.2E-04	1.6E-04	4.5E-05		
Sum Chem (BaP for PAHs):	2.2E-04	1.6E-04	4.5E-05		
TOTAL ALL (TEF for PAHs):	9.4E-04	1.7E-04	4.5E-05	4.0E-04	4.6E-05
TOTAL ALL (BaP for PAHs):	9.4E-04	1.7E-04	4.5E-05	4.0E-04	4.6E-05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.
[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.
[b] Risk from dermal contact to PAH's is assumed to equal risk from oral ingestion of PAH's.