Record of Decision for
Groundwater, Soil and Associated Media

Pantex Plant
Carson County, Texas
U.S. EPA ID No. TX4890110527

Prepared for:

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Appendix A

Burning Ground Release Units Requiring Remedial Action

SWMUs 14-26 (13 Units): Explosive Burn Pads
(including wash rack and ash disposal trench)
SWMU 27: Explosive Burn Pad 13
SWMU 37: Burning Ground Landfill 1
SWMU 38: Burning Ground Landfill 2
SWMU 39: Burning Ground Landfill 3
SWMU 40: Burning Ground Landfill 4
SWMU 41: Burning Ground Landfill 5
SWMU 42: Burning Ground Landfill 6
SWMU 43: Burning Ground Landfill 7
SWMU 44: Burning Ground Landfill 8
SWMU 47: Chemical Burn/Evaporation Pits

Contains modified excerpts from the
Burning Ground HHRA Report for (BWXT Pantex, May 2006, Revised September 2006)

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A.0 BURNING GROUND RELEASE UNITS REQUIRING REMEDIAL ACTION

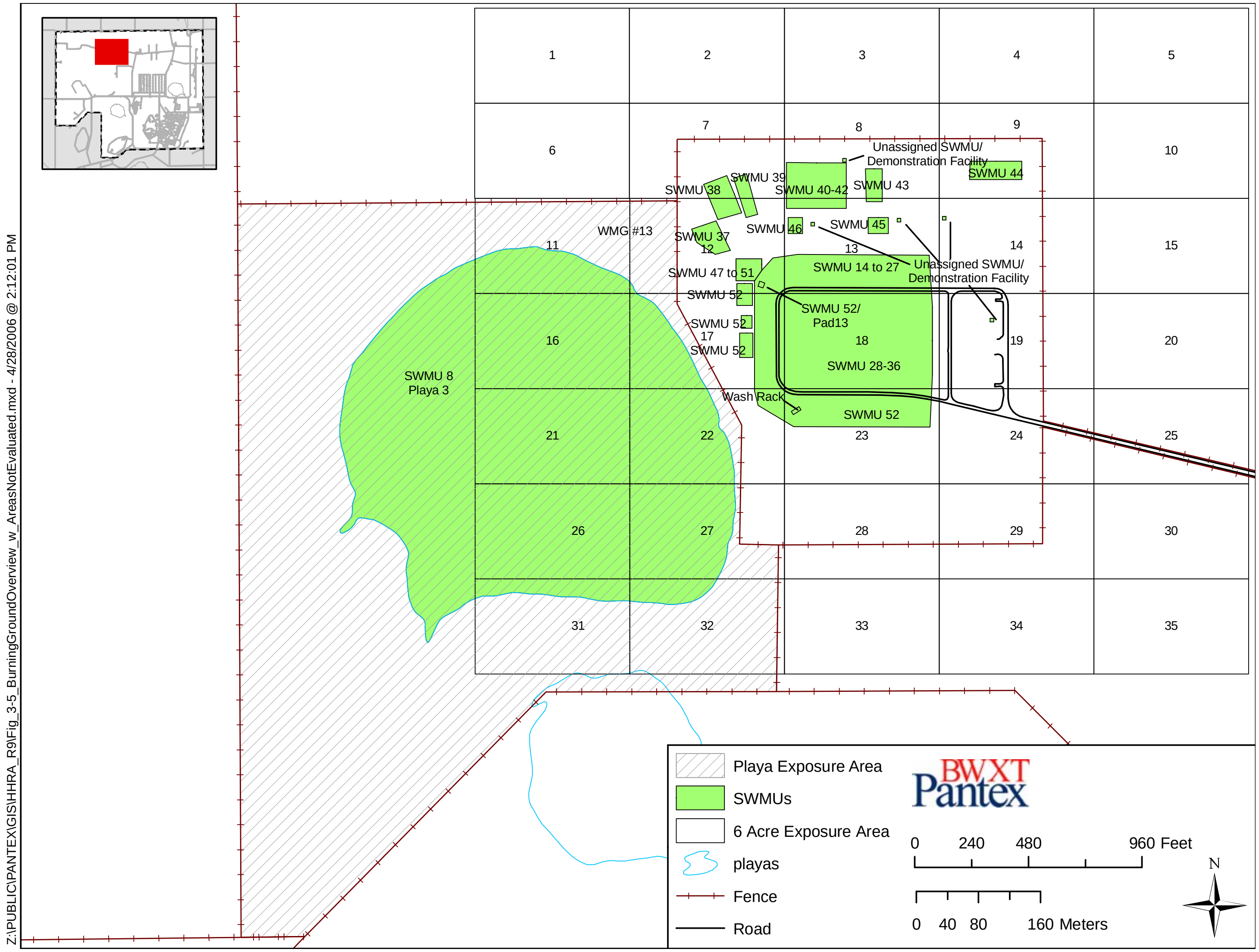

Figure A-1. Burning Ground Release Units and Exposure Area Grid

Table A-1. Crosswalk of Grid Cells to Release Units Requiring Remedial Action

Release Unit	Grid Cells
SWMUs 14-26: Explosive Burn Pads (Ash disposal trench)	18
SWMU 27: Explosive Burn Pad 13	12
SWMU 37: Burning Ground Landfill 1	12
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Table A-2. Complete List of Soil, Groundwater, and Surface Water COPCs at the Burning Ground and Playa 3[a]

COPCs		
	Volatile Organic Compounds	
Acetone	Dichlorodifluoromethane	1,1,1-Trichloroethane[b]
Toluene	2-Hexanone	Trichloroethene
Carbon Tetrachloride[b]	Methylene Chloride	Chloroform
Dibromomethane	Nonanal	1,2,3-Trichloropropane
1,2-Dichloroethane	1,1,2,2-Tetrachloroethane	Tetrahydrofuran
Freon-113[b]	Tetrachloroethylene	Xylenes, total
	Semi-Volatile Organic Compounds	
Anthracene	Carbazole	Di-n-Octyl Phthalate
Bis (2-ethylhexyl) Phthalate	Chrysene	Fluorene
Benzo(a)Anthracene	4-Chlorophenyl Phenyl Ether	Fluoranthene
Benzo(a)Pyrene	Cyclohexanone	Isophorone
Benzo(b)Fluoranthene	Cyclohexene	Indeno(1,2,3-cd)pyrene
Benzo(g,h,i)Perylene	Dibenz(a,h)Anthracene	n-Nitrosodiphenylamine
Benzo(k)Fluoranthene	4,6-Dinitro-2-Methylphenol	Phenanthrene
Benzyl Alcohol	Di-n-Butyl Phthalate	Phenol, total
		Pyrene
	Metals[c]	
Silver	Chromium, Hexavalent	Antimony[b,d]
Aluminum[b,d]	Copper	Selenium[b,d]
Arsenic	Iron	Tin[d]
Boron	Mercury	Strontium
Barium	Manganese	Thallium
Beryllium[d]	Molybdenum[b,d]	Uranium, total[e]
Cadmium	Nickel	Vanadium[b,d]
Cobalt	Lead	Zinc
Chromium		
	High Explosives	
1,3-Dinitrobenzene	Nitrobenzene	RDX
2,4-Dinitrotoluene	2-Nitrotoluene	Tetryl
2,6-Dinitrotoluene	3-Nitrotoluene	1,3,5-Trinitrobenzene
2-Amino-4,6-Dinitrotoluene	4-Nitrotoluene	Trinitrotoluene
4-Amino-2,6-Dinitrotoluene	PETN[b]	TATB
HMX		
	Pesticides	
Aldrin	Alpha-Chlordane	Endosulfan Sulfate[f]
Alpha BHC (Alpha Hexachlorocyclohexane)	4,4'-DDE	Endrin
Beta BHC	Dieldrin	Endrin Aldehyde
Delta BHC	Alpha Endosulfan[f]	Heptachlor
Gamma BHC (Lindane)	Beta Endosulfan[f]	Heptachlor Epoxide
Chlordane		

Table A-2. Complete List of Soil, Groundwater, and Surface Water COPCs at the Burning Ground and Playa 3[a] (continued)

COPCs		
	Dioxin/Furans	
Heptachlorinated Dibenzo-p-Dioxins, total	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-Dioxin	Tetrachlorinated Dibenzo-p-Dioxins, total
Heptachlorinated Dibenzofurans, total	Octachlorodibenzofuran	2,3,7,8-Tetrachlorinated Dibenzo-p-Dioxins
Hexachlorinated Dibenzo-p-Dioxins, total	Pentachlorinated Dibenzo-p-Dioxins, total	Tetrachlorinated Dibenzofurans, total
Hexachlorinated Dibenzofurans, total Octachlorodibenzo-p-Dioxin	Pentachlorinated Dibenzofurans, total	2,3,7,8-Tetrachlorinated Dibenzofuran
	Radionuclides[g]	
^{234}U ^{235}U	^{238}U	^{3}H
	Miscellaneous	
Cyanide[b]	Fluoride	Perchlorate

COPC - contaminant of potential concern

[a] Unless otherwise noted, all chemicals identified as COPCs are from the COPC list included as Enclosure 2 to the Texas Commission on Environmental Quality (TCEQ) Burning Ground Resource Conservation and Recovery Act (RCRA) Facility Investigation Report (RFIR) Approval Letter (TCEQ, 2003a).

[b] Chemical was added to the COPC list because it was detected in groundwater.

[c] Essential nutrients, other than iron, were removed from consideration because they are not toxic at site exposure levels, see Section 4.2.1.10 for discussion of essential nutrients.

[d] Metals were added to COPC list to because all metals are re-evaluated based on availability of new background data.

[e] Total uranium was included as a COPC to evaluate chemical risks from uranium (uranium isotopes were identified as COPCs in the *Radiological Investigation Report (BWXT Pantex, 2004)*). Concentrations were calculated based on natural abundance.

[f] The isomers of endosulfan (alpha and beta endosulfan) and the degradation product (endosulfan sulfate) of technical grade endosulfan were addressed in the Burning Ground HHRA individually and cumulatively. Evaluation of the isomers and degradation product is consistent with the TCEQ approval letter and evaluates the impact of total endosulfan.

[g] Radionuclide COPCs are the COPCs identified in the Radiological Investigation Report for soils. ^{232}Th, which was included on the list of COPCs from the TCEQ *Burning Ground RFIR* Approval Letter (TCEQ, 2003a), was not identified as a COPC in the *Radiological Investigation Report (BWXT Pantex, 2004)*; therefore, it is not included as a COPC. Because no soil background was developed for ^{3}H and ^{235}U, they have been included as COPCs. All other radiological SRCs determined to be within background in the *RI Report (BWXT Pantex, 2004)* are evaluated in Appendix L. The *RI Report (BWXT Pantex, 2004)* did not identified COPCs in surface water or groundwater; therefore, all radiological SRCs for these media are addressed in Appendix L.

Table A-3. Complete List of Soil Gas COPCs at the Burning Grounda

COPCs		
	Volatile Organic Compounds	
Acetone	1,2-Dichloroethene	Methylene Chloride
1,3-Butadiene	cis-1,2-Dichloroethene	1,1,2,2-Tetrachloroethane
Benzene	trans-1,2-Dichloroethene	Tetrachloroethylene
Toluene	Ethylbenzene	Styrene
Carbon Disulfide	1,2-Dibromoethane (Ethylene Dibromide)	1,1,1-Trichloroethane
Chloroethane	Trichlorofluoromethane	Trichloroethene
Chloromethane	Freon-113	Chloroform
Carbon Tetrachloride	Dichlorodifluoromethane	1,2,4-Trimethylbenzene
1,1-Dichloroethane	2-Hexanone	1,3,5-Trimethylbenzene
1,2-Dichloroethane	Methyl Ethyl Ketone (2-Butanone)	m,p-Xylene
1,4-Dichlorobenzene	Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	o-Xylene
1,1-Dichloroethene		

COPC- contaminant of potential concern

[a]Soil gas COPCs consist of all chemicals detected in soil gas.

Table A-4. . COPCs Retained for Further Evaluation in Surface Soils (0-2 ft)

Retained COPCs	**COPCs Retained by Exposure Area**												
	7	**8**	**9**	**12**	**13**	**14**	**17**	**18**	**19**	**22**	**23**	**28**	**Playa 3**
High Explosives													
2,4-Dinitrotoluene				√				√					
2-Amino-4,6-Dinitrotoluene								√					
4-Amino-2,6-Dinitrotoluene								√					
HMX					√			√			√		
Nitrobenzene								√					
RDX		√		√	√	√	√	√		√	√		
TATB			√					√			√		
TNT				√	√			√					
Metals													
Barium				√	√		√	√		√			√
Cadmium					√		√						
Mercury	√	√			√		√						
Thallium													√
Pesticides													
Aldrin								√					
alpha-BHC								√					
beta-BHC								√					
Heptachlor Epoxide								√					
Radionuclides													
^{3}H		√					√		√			√	√
^{234}U							√						
^{238}U	√	√		√	√		√		√	√	√	√	√
Semi-Volatile Organic Compounds													
Benzo(a)Pyrene											√		
Dioxins/Furans													
All Dioxin/Furan Congeners	√	√	√	√	√		√	√					

COPC - contaminant of potential concern

Table A-5. COPCs Retained for Further Evaluation in Soils (0-15 ft)

Retained COPCs	COPCs Retained by Exposure Area											
	7	8	9	12	13	14	17	18	19	22	23	28
High Explosives												
1,3-Dinitrobenzene				√								
2,4-Dinitrotoluene				√				√				
2,6-Dinitrotoluene		√		√								
2-Amino-4,6-Dinitrotoluene								√				
4-Amino-2,6-Dinitrotoluene		√						√				
HMX		√			√			√			√	
Nitrobenzene								√				
RDX		√	√	√	√	√	√	√		√	√	
TATB		√	√					√			√	
TNT		√		√	√			√				
Metals												
Barium	√	√		√	√		√	√		√		√
Cadmium	√	√		√	√		√					
Copper	√	√										
Lead		√										
Manganese		√										
Mercury	√	√			√		√				√	
Nickel				√								
Silver	√	√										
Zinc		√										
Miscellaneous												
Perchlorate		√										
Pesticides												
Aldrin								√				
alpha-BHC								√				
beta-BHC								√				
Dieldrin				√								
Heptachlor Epoxide								√				
Radionuclides												
^{3}H		√					√		√			√
^{234}U							√					
^{235}U		√		√								
^{238}U	√	√		√	√		√	√	√	√	√	√

Table A-5. COPCs Retained for Further Evaluation in Soils (0-15 ft) (continued)

Retained COPCs	**COPCs Retained by Exposure Area**											
	7	**8**	**9**	**12**	**13**	**14**	**17**	**18**	**19**	**22**	**23**	**28**
Semi-Volatile Organic Compounds												
4-Chlorophenyl Phenyl Ether		√										
Benzo(a)Anthracene	√											
Benzo(a)Pyrene	√	√									√	
Benzo(b)Fluoranthene	√											
Benzo(k)Fluoranthene	√											
bis(2-Ethylhexyl) Phthalate								√				
Dibenz(a,h)Anthracene	√											
Indeno(1,2,3-c,d)Pyrene	√											
Volatile Organic Compounds												
Acetone				√								
Dioxins/Furans												
All Dioxin/Furan Congeners	√	√	√	√	√		√	√				

COPC - contaminant of potential concern

Table A-6. COPCs Retained for Further Evaluation in Soil-to-Groundwater Pathway

Retained COPCs	
Metals	
Barium	Iron
Cadmium	Lead
Pesticides	
Dieldrin	
Semi-Volatile Organic Compounds	
bis(2-Ethylhexyl) Phthalate	
Radionuclides	
Total Uranium	

COPC - contaminant of potential concern

A.1 SOIL GAS-TO-AIR PATHWAY

No COPCs were retained for the soil gas-to-air pathway based on measured values. However, this pathway was further evaluated with the fate and transport modeling because of the potential for residual NAPL to be present in the source area. Please see the soil gas-to-groundwater section below for discussion regarding the presence of residual NAPL at the Burning Ground.

A.2 SOIL GAS-TO-GROUNDWATER PATHWAY

A reduced list of COPCs for the soil gas-to-groundwater pathway was developed using approved methodology with the additional considerations described below. A summary of the COPCs retained for the soil gas-to-groundwater pathway for each sample depth category is presented in the table below.

Table A-7. COPCs Retained for Further Evaluation in Soil Gas-to-Groundwater Pathway

Retained COPCs	COPCs Retained by Depth Category		
	Shallow	Intermediate	Deep
Volatile Organic Compounds			
Acetone		√	
Methylene Chloride		√	
Toluene	√[a]	√	
Trichloroethene	√[a]	√	√
1,1,1-Trichloroethane	√[a]		

COPC- contaminant of potential concern
[a]Added for further consideration based upon recent operation data from the SVE system at the Burning Ground.

Three VOCs were added to the list of COPCs retained for further evaluation based upon recent operation data from the soil vapor extraction (SVE) system at the Burning Ground. Soil gas sampling results reported in the August 2005 monthly operation and maintenance report for the SVE system (Shaw, 2005) indicate much of the soil gas plume characterized for the *Burning Ground RFIR* (Stoller, 2002) has been removed by the SVE system in the shallow and intermediate depth zones. Although data indicate SVE has been very effective at remediating soil gas impacts, the SVE operation data described below also indicate a residual, immobile NAPL, composed primarily of toluene, likely remains in the shallow subsurface soils above the Caliche Caprock in the area directly underlying the former SEP. Although it is anticipated that continued operation of the SVE system will remove the remaining residual NAPL, the risk assessment must evaluate current and future risk in the absence of corrective measures. Therefore, COPCs identified as residual NAPL were added to the list of retained COPCs for this pathway.

The NAPL was identified based on field measurements of total VOC concentration in the effluent from each SVE well collected twice weekly. Review of these time-series data indicates high concentrations of total VOCs extracted from the upper and lower screened intervals of well SVE-S-20 since the SVE system began operating. This well is located within the area of the former SEP and is completed in the Blackwater Draw Formation above the Caliche Caprock. Total VOC concentrations in well SVE-I-21, located immediately adjacent to SVE-S-20 but completed in the upper Ogallala Formation below the caliche, were initially high, but have since decreased to low levels. Total VOC concentrations in all other SVE wells have been at initially lower levels than in SVE-S-20 and have exhibited decreasing trends over time. Because the VOC concentrations in the effluent from SVE-S-20 have not decreased, it is probable a residual NAPL is present in the vicinity of well SVE-S-20 within the Blackwater Draw Formation.

For fate and transport analysis, analytical data collected on a monthly basis (as provided in the May 2004 status report) from the influent air stream of the SVE off-gas treatment unit were used to estimate that the residual NAPL remaining at the Burning Ground is composed of approximately 97.9 percent toluene, 1.8 percent trichloroethene, and 0.3 percent 1,1,1-trichloroethane (1,1,1-TCA).

The following paragraphs describe why two VOCs detected or exceeding $ASGL_{GW}$ in certain depth zones were not retained as COPCs for the soil gas-to-groundwater pathway from those zones.

- 1,2-Dibromoethane was detected 3 times in the intermediate zone and once in the deep zone at the detection limit of 16 ppbv, exceeding the $ASGL_{GW}$. All of these detections occurred in August 2000, followed by subsequent data at other locations collected from 2001 to 2004 showing no detections. This VOC was not detected in the shallow soil zone or near the source areas. Based on the few detections at the detection limit and lack of evidence of this VOC near the source area, 1,2-dibromoethane was not retained as a COPC for further evaluation for the soil gas-to-groundwater pathway.

- Although detected, 1,3-butadiene was not retained as a COPC for the soil gas-to-groundwater pathway. An $ASGL_{GW}$ was not calculated for 1,3-butadiene because an $RBSV_{GW}$ was not provided by TCEQ. A single detection of 1,3-butadiene at a concentration of 10 ppbv was reported in the shallow zone above the Caliche Caprock (approximately 80 ft bgs), but 1,3-butadiene was not detected in a second sample taken from the same location and depth on the same day. A single detection of 1,3-butadiene at a concentration of 1.2 ppbv was reported in the deep zone beneath the FGZ. Because the equilibrium concentration of 10 ppbv of 1,3-butadiene in soil gas is approximately 0.01 μg/L in groundwater and the number of detections was limited, 1,3-butadiene is assessed in the uncertainty section.

Trichloroethene observed in deep zone soil gas is the result of short-circuiting along and within the well casing of PTX01-1003 that penetrated the FGZ. This well has been plugged and abandoned to eliminate this pathway, and PTX01-1018 was installed to monitor soil gas at several different depths in the deep zone following the abandonment of PTX01-1003. The highest measured concentration in PTX01-1018 of 1,500 ppbv was collected on 9/23/03; three subsequent measurements at that depth show sequential decline to 400 ppbv in 2004. Results from all other depths at PTX01-1018 have dropped below $ASGL_{GW}$ by 2004. Trichloroethene in deep zone soil gas is retained for further evaluation.

A.3 PERCHED GROUNDWATER COPCS RETAINED FOR FURTHER EVALUATION

HEs, metals, SVOCs, VOCs, cyanide, fluoride, perchlorate, and radionuclides were detected in groundwater samples collected from the perched groundwater. A reduced list of COPCs for the groundwater exposure pathway was developed using approved methodology with the additional considerations described below. Only perchlorate and trichloroethene were retained as COPCs for the groundwater exposure pathway. No groundwater radiological COPCs were identified in the *RI Report*.

Iron was not retained as a COPC for this pathway. Iron is an essential nutrient, and must only be addressed if they have established criteria. Iron has a secondary MCL of 0.30 mg/L. The maximum detected concentration of iron in a non-filtered sample was 1.26 mg/L. Iron was not detected in any filtered samples. Because the iron concentration in filtered samples did not exceed the EPA secondary MCL of 0.30 mg/L, iron was not retained as a COPC for this exposure pathway.

Total chromium was not retained as a COPC for this exposure pathway. The maximum detected concentration of total chromium in a non-filtered sample was 0.161 mg/L. The maximum detected concentration of total chromium in a filtered sample was 0.0019 mg/L. The RRS 1 background value for total chromium is 0.0318 mg/L. Hexavalent chromium, the contaminant of interest at Pantex, was not detected in any groundwater samples. Because the maximum detected concentration of total chromium in a filtered sample was less than the RRS 1 background value and no release of hexavalent chromium has occurred at the Burning Ground, total chromium was not retained as a COPC for this exposure pathway.

No COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified during final investigation.

A.4 COPCs for Surface Water-to-Groundwater Pathway

Metals, pesticides, and SVOCs were detected in surface water samples collected from Playa 3. Both filtered and non-filtered samples were collected. Only metals in non-filtered samples were detected above the GW-Res values. As described below, no COPCs were retained for the surface water-to-groundwater pathway.

Surface water sampling in playas has historically produced suspended sediment or turbid water samples. The total or non-filtered results contain contaminants in both the dissolved phase and in the solid phase sorbed to sediment suspended in the water sample. The migration of contaminants through the silts and clays of the Blackwater Draw Formation and the fine-grained eolian sands of the upper Ogallala sediments is governed by the dissolved phase. Contaminants sorbed to sediment are not expected to migrate through the vadose zone to the underlying groundwater. Review of filtered results for metals COPCs identified in Playa 3 surface water indicate all filtered results are below their respective GW-Res values. Therefore, no further evaluation of the fate and transport of these contaminants from Playa 3 surface water was completed.

Radiological constituents were detected in surface water compliance data collected at Playa 3. The *RI Report* did not identify radiological COPCs in surface water, based on evaluation of the data. Therefore, no surface water radiological COPCs were retained.

Table A-8. Exposure Point Concentration Summary Soil (0-2 ft)

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
Metals									
7	Mercury	7439-97-6	5	4	2.50E-02	1.20E+00	NA	--	1.20E+00
Radionuclides									
7	^{238}U	7440-61-1	1	1	9.00E-01	9.00E-01	NA	--	9.00E-01
High Explosives									
8	RDX	121-82-4	15	4	2.90E-01	4.80E+00	D	1.13E+00	1.13E+00
Metals									
8	Mercury	7439-97-6	15	10	4.80E-02	8.90E+00	X	2.76E+00	2.76E+00
Radionuclides									
8	^{238}U	7440-61-1	4	4	1.83E-01	1.20E+00	NA	--	1.20E+00
8	Tritium	10028-17-8	3	1	6.19E+00	6.19E+00	NA	--	6.19E+00
High Explosives									
9	TATB	3058-38-6	5	1	8.99E+01	8.99E+01	NA	--	8.99E+01
12	2,4-Dinitrotoluene	121-14-2	23	1	7.70E-01	7.70E-01	D	2.57E-01	2.57E-01
12	RDX	121-82-4	23	8	1.50E-01	9.70E+02	D	1.27E+02	1.27E+02
12	TNT	118-96-7	23	6	5.70E-01	3.20E+03	D	3.92E+02	3.92E+02
Metals									
12	Barium	7440-39-3	18	18	2.10E+02	2.74E+05	X	4.41E+04	4.41E+04
Radionuclides									
12	^{238}U	7440-61-1	22	22	1.56E-01	1.20E+01	L	7.53E+00	7.53E+00
High Explosives									
13	HMX	2691-41-0	33	27	8.80E-02	2.10E+04	X	2.35E+03	2.35E+03
13	RDX	121-82-4	33	16	5.70E-02	3.40E+04	D	3.92E+03	3.92E+03
13	TNT	118-96-7	33	6	6.30E-02	8.20E+04	D	1.00E+04	1.00E+04
Metals									
13	Barium	7440-39-3	28	28	1.12E+02	1.50E+05	X	2.12E+04	2.12E+04
13	Cadmium	7440-43-9	29	10	7.00E-02	6.60E+00	D	9.20E-01	9.20E-01
13	Mercury	7439-97-6	25	14	2.80E-02	1.50E+00	X	3.87E-01	3.87E-01

Table A-8. Exposure Point Concentration Summary Soil (0-2 ft) (continued)

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
					Radionuclides				
13	^{238}U	7440-61-1	9	9	1.36E-01	9.00E-01	NA	--	9.00E-01
					High Explosives				
14	RDX	121-82-4	5	5	9.60E-02	4.20E+00	NA	--	4.20E+00
17	RDX	121-82-4	17	7	1.30E-01	1.40E+01	D	3.01E+00	3.01E+00
					Metals				
17	Barium	7440-39-3	15	15	1.44E+02	1.83E+03	L	7.58E+02	7.58E+02
17	Cadmium	7440-43-9	15	4	3.00E-01	3.00E+01	D	5.78E+00	5.78E+00
17	Mercury	7439-97-6	15	7	5.20E-02	2.29E+01	D	6.00E+00	6.00E+00
					Radionuclides				
17	^{238}U	7440-61-1	9	9	4.36E-01	4.89E+00	NA	--	4.89E+00
17	^{234}U	13966-29-5	9	9	1.85E-01	2.28E+01	NA	--	2.28E+01
17	Tritium	10028-17-8	4	2	7.16E-02	3.94E+00	NA	--	3.94E+00
					High Explosives				
18	TATB	3058-38-6	11	6	1.69E-02	4.51E+01	X	1.17E+01	1.17E+01
18	2,4-Dinitrotoluene	121-14-2	20	2	9.40E-01	1.10E+00	D	1.53E+01	1.10E+00
18	2-Amino-4,6-Dinitrotoluene	35572-78-2	7	4	3.80E-01	2.70E+01	NA	--	2.70E+01
18	4-Amino-2,6-Dinitrotoluene	19406-51-0	20	6	7.20E-01	3.30E+01	D	9.57E+00	9.57E+00
18	HMX	2691-41-0	20	20	2.90E+00	2.00E+03	L	2.73E+03	2.00E+03
18	Nitrobenzene	98-95-3	20	1	6.60E+00	6.60E+00	D	1.56E+01	6.60E+00
18	RDX	121-82-4	20	17	9.10E-01	9.40E+04	L	2.92E+07	9.40E+04
18	TNT	118-96-7	20	9	3.00E+00	2.40E+05	D	3.41E+04	3.41E+04
					Metals				
18	Barium	7440-39-3	14	14	1.67E+02	1.40E+05	X	2.93E+04	2.93E+04
					Pesticides				
18	Aldrin	309-00-2	17	1	1.20E-01	1.20E-01	D	2.06E-02	2.06E-02
18	Alpha BHC	319-84-6	17	1	6.90E-01	6.90E-01	D	1.13E-01	1.13E-01
18	Beta BHC	319-85-7	17	3	1.60E-02	7.70E-01	D	1.30E-01	1.30E-01
18	Heptachlor Epoxide	1024-57-3	17	1	1.80E-01	1.80E-01	D	3.03E-02	3.03E-02
					Radionuclides				
19	^{238}U	7440-61-1	1	1	1.10E+00	1.10E+00	NA	--	1.10E+00
19	Tritium	10028-17-8	1	1	4.86E+00	4.86E+00	NA	--	4.86E+00

Table A-8. Exposure Point Concentration Summary Soil (0-2 ft) (continued)

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
High Explosives									
22	RDX	121-82-4	5	3	1.50E-01	3.80E+00	NA	--	3.80E+00
Metals									
22	Barium	7440-39-3	2	2	3.66E+02	1.50E+03	NA	--	1.50E+03
Radionuclides									
22	^{238}U	7440-61-1	6	6	6.00E-01	5.29E+00	NA	--	5.29E+00
High Explosives									
23	TATB	3058-38-6	8	2	8.64E-02	3.43E+03	NA	--	3.43E+03
23	HMX	2691-41-0	8	7	5.00E-01	1.20E+03	NA	--	1.20E+03
23	RDX	121-82-4	8	4	1.20E+00	1.30E+02	NA	--	1.30E+02
Semi-Volatile Compounds									
23	Benzo(a)Pyrene	50-32-8	5	1	8.80E-02	8.80E-02	NA	--	8.80E-02
Radionuclides									
23	^{238}U	7440-61-1	6	6	1.06E-01	1.00E+00	NA	--	1.00E+00
Radionuclides									
28	^{238}U	7440-61-1	2	2	1.30E+00	1.40E+00	NA	--	1.40E+00
28	Tritium	10028-17-8	1	1	3.60E+00	3.6E+00	NA	--	3.6E+00
Metals									
Playa 3	Barium	7440-39-3	56	56	1.20E+02	1.70E+03	X	2.94E+02	2.94E+02
Playa 3	Thallium	7440-28-0	52	8	2.70E-01	7.10E+01	D	7.23E+00	7.23E+00
Radionuclides									
Playa 3	^{3}H	10028-17-8	7	2	3.17E+00	5.07E+00	NA	--	5.07E+00
Playa 3	^{238}U	7440-61-1	7	7	5.07E-01	2.20E+00	NA	--	2.20E+00
Metals									
18a[1]	Barium	7440-39-3	29	29	1.47E+02	2.74E+05	X	4.61E+04	4.61E+04
18a[1]	Mercury	7439-97-6	24	12	2.44E-02	9.60E-01	X	1.85E-01	1.85E-01
High Explosives									
18a[1]	2,4-Dinitrotoluene	121-14-2	35	2	9.40E-01	1.10E+00	D	4.48E+01	1.10E+00
18a[1]	2-Amino-4,6-Dinitrotoluene	35572-78-2	19	6	3.00E-01	2.70E+01	D	9.17E+00	9.17E+00
18a[1]	4-Amino-2,6-Dinitrotoluene	19406-51-0	34	7	2.50E-01	3.30E+01	D	4.46E+01	3.30E+01
18a[1]	HMX	2691-41-0	35	25	6.00E-01	2.10E+04	X	2.13E+03	2.13E+03
18a[1]	Nitrobenzene	98-95-3	35	1	6.60E+00	6.60E+00	D	4.49E+01	6.60E+00
18a[1]	RDX	121-82-4	35	19	8.90E-01	9.40E+04	X	1.00E+04	1.00E+04

Table A-8. Exposure Point Concentration Summary Soil (0-2 ft) (continued)

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
18a[1]	TNT	118-96-7	35	14	3.00E+00	2.40E+05	D	2.45E+04	2.45E+04
Pesticides									
18a[1]	Aldrin	309-00-2	27	3	2.90E-03	1.20E-01	D	2.75E-02	2.75E-02
18a[1]	Alpha BHC	319-84-6	27	1	6.90E-01	6.90E-01	D	8.37E-02	8.37E-02
18a[1]	Beta BHC	319-85-7	27	3	1.60E-02	7.70E-01	D	9.43E-02	9.43E-02
18a[1]	Heptachlor Epoxide	1024-57-3	27	3	2.20E-03	1.80E-01	D	3.43E-02	3.43E-02
Radionuclides									
18a[1]	^{238}U	7440-61-1	29	29	1.06E-01	1.20E+01	L	6.40E+00	6.40E+00

CAS - Chemical Abstract Service
EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.
D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's *t*-statistic.
L - Distribution is lognormal. 95% UCL calculated using Land method.
N - Distribution is normal. 95% UCL calculated using Student's *t*-statistic.
NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.
X - Distribution is nonparametric. 95% UCL calculated using Student's *t*-statistic.
-- 95% UCL not determined due to less than 10 total samples.
[1]Grid Cell 18a represents Grid Cell 18 shifted North and West to include SWMU 52, SWMU 47 to 51, and hotspot areas in the northern portion of Grid Cell 18

Table A-9. Exposure Point Concentration Summary Soil (0-15 ft)

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
Metals									
7	Barium	7440-39-3	15	15	9.50E+01	1.56E+04	X	4.48E+03	4.48E+03
7	Cadmium	7440-43-9	15	6	7.10E-02	8.10E+00	D	2.33E+00	2.33E+00
7	Copper	7440-50-8	11	11	3.20E+00	1.90E+03	X	5.19E+02	5.19E+02
7	Mercury	7439-97-6	16	10	2.40E-02	1.70E+00	X	4.30E-01	4.30E-01
7	Silver	7440-22-4	15	8	7.10E-01	2.60E+02	X	7.72E+01	7.72E+01
Radionuclides									
7	^{238}U	7440-61-1	3	3	2.54E-01	9.00E-01	NA	--	9.00E-01
Semi-Volatile Organic Compounds									
7	Benzo(a)Anthracene	56-55-3	13	3	2.20E-02	1.30E+01	D	3.18E+00	3.18E+00
7	Benzo(a)Pyrene	50-32-8	13	2	3.80E+00	1.30E+01	D	3.24E+00	3.24E+00
7	Benzo(b)Fluoranthene	205-99-2	13	2	4.30E+00	1.10E+01	D	2.88E+00	2.88E+00
7	Benzo(k)Fluoranthene	207-08-9	13	2	4.30E+00	1.00E+01	D	2.67E+00	2.67E+00
7	Dibenz(a,h)Anthracene	53-70-3	13	2	7.60E-01	2.50E+00	D	7.31E-01	7.31E-01
7	Indeno(1,2,3-c,d)Pyrene	193-39-5	13	2	1.40E+00	9.10E+00	D	2.19E+00	2.19E+00
High Explosives									
8	TATB	3058-38-6	14	4	6.68E-02	5.78E+01	D	1.20E+01	1.20E+01
8	2,6-Dinitrotoluene	606-20-2	67	2	2.90E-01	1.90E+00	D	2.05E-01	2.05E-01
8	4-Amino-2,6-Dinitrotoluene	19406-51-0	67	5	3.20E-01	1.90E+01	D	9.06E-01	9.06E-01
8	HMX	2691-41-0	67	35	8.00E-02	3.70E+03	X	1.76E+02	1.76E+02
8	RDX	121-82-4	67	21	2.50E-01	4.60E+02	D	2.54E+01	2.54E+01
8	TNT	118-96-7	67	14	1.70E-01	2.20E+03	D	1.25E+02	1.25E+02
Metals									
8	Barium	7440-39-3	70	70	4.30E+01	5.10E+04	X	2.78E+03	2.78E+03
8	Cadmium	7440-43-9	69	18	3.00E-01	6.00E+01	D	4.08E+00	4.08E+00
8	Copper	7440-50-8	38	38	5.50E+00	2.70E+03	X	2.80E+02	2.80E+02
8	Lead	7439-92-1	70	56	2.40E+00	8.20E+02	X	4.70E+01	4.70E+01
8	Manganese	7439-96-5	36	36	6.00E+01	4.40E+03	X	5.59E+02	5.59E+02
8	Mercury	7439-97-6	68	35	2.40E-02	9.80E+00	X	1.30E+00	1.30E+00
8	Silver	7440-22-4	71	29	2.80E-01	3.00E+02	D	1.50E+01	1.50E+01
8	Zinc	7440-66-6	37	37	1.20E+01	1.20E+04	X	9.29E+02	9.29E+02

Table A-9. Exposure Point Concentration Summary Soil (0-15 ft), Continued

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
Miscellaneous									
8	Perchlorate	14797-73-0	14	6	1.40E-01	5.30E+00	D	1.48E+00	1.48E+00
Radionuclides									
8	^{238}U	7440-61-1	20	20	1.40E-01	1.95E+01	X	3.45E+00	3.45E+00
8	^{235}U	15117-96-1	20	4	1.00E-02	3.15E-01	D	5.27E-02	5.27E-02
8	Tritium	10028-17-8	19	5	3.52E-02	6.19E+00	D	9.65E-01	9.65E-01
Semi-Volatile Organic Compounds									
8	4-Chlorophenyl Phenyl Ether	7005-72-3	1	1	4.50E-01	4.50E-01	NA	--	4.50E-01
8	Benzo(a)Pyrene	50-32-8	39	1	8.80E-02	8.80E-02	D	1.95E-01	8.80E-02
High Explosives									
9	TATB	3058-38-6	8	1	8.99E+01	8.99E+01	NA	--	8.99E+01
9	RDX	121-82-4	18	7	1.20E+00	6.10E+00	D	2.23E+00	2.23E+00
12	1,3-Dinitrobenzene	99-65-0	81	2	1.70E-01	2.20E+00	D	1.94E-01	1.94E-01
12	2,4-Dinitrotoluene	121-14-2	84	2	3.90E-01	7.70E-01	D	2.01E-01	2.01E-01
12	2,6-Dinitrotoluene	606-20-2	85	1	1.40E+00	1.40E+00	D	1.90E-01	1.90E-01
12	RDX	121-82-4	85	19	1.50E-01	9.70E+02	D	4.62E+01	4.62E+01
12	TNT	118-96-7	84	12	5.70E-01	3.20E+03	D	1.35E+02	1.35E+02
Metals									
12	Barium	7440-39-3	72	72	4.10E+01	2.74E+05	X	1.18E+04	1.18E+04
12	Cadmium	7440-43-9	60	10	2.11E-02	6.10E+00	D	7.10E-01	7.10E-01
12	Nickel	7440-02-0	60	60	4.56E+00	8.20E+02	X	4.92E+01	4.92E+01
Pesticides									
12	Dieldrin	60-57-1	63	3	9.66E-04	3.40E-01	D	2.98E-02	2.98E-02
Radionuclides									
12	^{238}U	7440-61-1	37	37	5.84E-02	1.20E+01	X	3.29E+00	3.29E+00
12	^{235}U	15117-96-1	37	4	1.26E-02	2.10E-01	D	1.76E-02	1.76E-02
Volatile Organic Compounds									
12	Acetone	67-64-1	73	50	2.00E-03	7.50E+02	X	2.77E+01	2.77E+01
High Explosives									
13	HMX	2691-41-0	96	46	8.80E-02	2.10E+04	D	8.83E+02	8.83E+02
13	RDX	121-82-4	104	46	5.70E-02	3.40E+04	D	1.24E+03	1.24E+03
13	TNT	118-96-7	97	8	6.30E-02	8.20E+04	D	3.40E+03	3.40E+03

Table A-9. Exposure Point Concentration Summary Soil (0-15 ft), Continued

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
Metals									
13	Barium	7440-39-3	77	77	5.10E+01	1.50E+05	X	7.93E+03	7.93E+03
13	Cadmium	7440-43-9	82	14	7.00E-02	6.60E+00	D	6.08E-01	6.08E-01
13	Mercury	7439-97-6	74	34	2.30E-02	1.50E+00	D	1.60E-01	1.60E-01
Radionuclides									
13	^{238}U	7440-61-1	29	29	9.23E-02	1.40E+00	X	4.11E-01	4.11E-01
High Explosives									
14	RDX	121-82-4	12	6	9.60E-02	4.20E+00	L	3.29E+00	3.29E+00
17	RDX	121-82-4	35	9	1.20E-01	2.10E+01	D	2.74E+00	2.74E+00
Metals									
17	Barium	7440-39-3	32	32	6.16E+01	1.83E+03	L	5.14E+02	5.14E+02
17	Cadmium	7440-43-9	32	7	7.00E-02	3.00E+01	D	3.08E+00	3.08E+00
17	Mercury	7439-97-6	32	18	2.40E-02	2.29E+01	X	2.84E+00	2.84E+00
Radionuclides									
17	^{238}U	7440-61-1	12	12	2.16E-01	4.89E+00	L	3.31E+00	3.31E+00
17	^{234}U	13966-29-5	12	12	1.85E-01	2.28E+01	X	5.74E+00	5.74E+00
17	Tritium	10028-17-8	7	3	7.16E-02	3.94E+00	NA	--	3.94E+00
High Explosives									
18	TATB	3058-38-6	26	7	1.69E-02	4.51E+01	D	4.81E+00	4.81E+00
18	2,4-Dinitrotoluene	121-14-2	93	8	1.90E-01	1.10E+00	D	3.36E+00	1.10E+00
18	2-Amino-4,6-Dinitrotoluene	35572-78-2	18	5	1.60E-01	2.70E+01	D	9.13E+00	9.13E+00
18	4-Amino-2,6-Dinitrotoluene	19406-51-0	93	12	1.20E-01	3.30E+01	D	2.21E+00	2.21E+00
18	HMX	2691-41-0	93	46	2.00E-01	2.00E+03	D	1.29E+02	1.29E+02
18	Nitrobenzene	98-95-3	93	3	1.40E+00	6.60E+00	D	3.45E+00	3.45E+00
18	RDX	121-82-4	93	59	5.00E-01	9.40E+04	X	3.03E+03	3.03E+03
18	TNT	118-96-7	93	19	1.90E-01	2.40E+05	D	7.25E+03	7.25E+03
Metals									
18	Barium	7440-39-3	76	76	4.82E+01	1.40E+05	X	5.64E+03	5.64E+03
Pesticides									
18	Aldrin	309-00-2	87	4	1.30E-03	1.20E-01	D	5.03E-03	5.03E-03
18	Alpha BHC	319-84-6	87	2	1.50E-02	6.90E-01	D	2.25E-02	2.25E-02
18	Beta BCH	319-85-7	87	4	1.50E-02	7.70E-01	D	2.59E-02	2.59E-02
18	Heptachlor Epoxide	1024-57-3	87	2	1.40E-03	1.80E-01	D	6.85E-03	6.85E-03

Table A-9. Exposure Point Concentration Summary Soil (0-15 ft), Continued

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
Radionuclides									
18	^{238}U	7440-61-1	35	35	9.98E-02	1.10E+00	X	2.80E-01	2.80E-01
Semi-Volatile Organic Compounds									
18	bis(2-Ethylhexyl) Phthalate	117-81-7	87	44	4.10E-02	2.00E+01	X	1.86E+00	1.86E+00
Radionuclides									
19	Tritium	10028-17-8	1	1	4.86E+00	4.86E+00	NA	--	4.86E+00
19	^{238}U	7440-61-1	1	1	1.10E+00	1.10E+00	NA	--	1.10E+00
High Explosives									
22	RDX	121-82-4	13	8	1.50E-01	3.20E+01	L	4.67E+02	3.20E+01
Metals									
22	Barium	7440-39-3	8	8	7.60E+01	1.50E+03	NA	--	1.50E+03
Radionuclides									
22	^{238}U	7440-61-1	8	8	8.15E-02	5.29E+00	NA	--	5.29E+00
High Explosives									
23	TATB	3058-38-6	13	3	8.64E-02	3.43E+03	D	7.67E+02	7.67E+02
23	HMX	2691-41-0	40	14	2.80E-02	1.20E+03	D	8.09E+01	8.09E+01
23	RDX	121-82-4	48	17	1.50E-01	1.30E+02	D	7.77E+00	7.77E+00
Metals									
23	Mercury	7439-97-6	37	10	2.22E-02	1.88E+01	D	1.70E+00	1.70E+00
Semi-Volatile Organic Compounds									
23	Benzo(a)Pyrene	50-32-8	25	1	8.80E-02	8.80E-02	D	1.95E-01	8.80E-02
Radionuclides									
23	^{238}U	7440-61-1	17	17	1.06E-01	1.00E+00	X	3.21E-01	3.21E-01
Metals									
28	Barium	7440-39-3	9	9	9.70E+01	1.10E+03	NA	--	1.10E+03
Radionuclides									
28	Tritium	10028-17-8	1	1	3.60E+00	3.60E+00	NA	--	3.60E+00
28	^{238}U	7440-61-1	2	2	1.30E+00	1.40E+00	NA	--	1.40E+00
Metals									
18a[1]	Barium	7440-39-3	98	98	4.10E+01	2.74E+05	X	1.42E+04	1.42E+04
18a[1]	Mercury	7439-97-6	88	45	1.12E-02	9.60E-01	X	8.82E-02	8.82E-02

Table A-9. Exposure Point Concentration Summary Soil (0-15 ft), Continued

Grid Cell	Contaminant	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
High Explosives									
18a[1]	1,3-Dinitrobenzene	99-65-0	127	4	7.50E-02	2.20E+00	D	1.16E+01	2.20E+00
18a[1]	2,4-Dinitrotoluene	121-14-2	128	8	1.90E-01	1.10E+00	D	1.24E+01	1.10E+00
18a[1]	2-Amino-4,6-Dinitrotoluene	35572-78-2	48	7	1.60E-01	2.70E+01	D	3.67E+00	3.67E+00
18a[1]	4-Amino-2,6-Dinitrotoluene	19406-51-0	121	12	1.20E-01	3.30E+01	D	1.27E+01	1.27E+01
18a[1]	HMX	2691-41-0	128	66	1.30E-01	2.10E+04	X	5.89E+02	5.89E+02
18a[1]	Nitrobenzene	98-95-3	129	3	1.40E+00	6.60E+00	D	1.23E+01	6.60E+00
18a[1]	RDX	121-82-4	136	67	1.60E-01	9.40E+04	D	2.63E+03	2.63E+03
18a[1]	TNT	118-96-7	129	29	1.90E-01	2.40E+05	D	6.70E+03	6.70E+03
Pesticides									
18a[1]	Aldrin	309-00-2	117	9	1.30E-03	1.20E-01	D	1.18E-02	1.18E-02
18a[1]	Alpha BHC	319-84-6	117	3	1.10E-02	6.90E-01	D	2.42E-02	2.42E-02
18a[1]	Beta BHC	319-85-7	109	4	1.50E-02	7.70E-01	D	2.89E-02	2.89E-02
18a[1]	Dieldrin	60-57-1	117	4	9.66E-04	3.40E-01	D	1.71E-02	1.71E-02
18a[1]	Heptachlor Epoxide	1024-57-3	109	5	1.40E-03	1.80E-01	D	1.57E-02	1.57E-02
Volatile Organic Compounds									
18a[1]	Acetone	67-64-1	102	59	2.00E-03	7.50E+02	X	1.98E+01	1.98E+01
Radionuclides									
18a[1]	^{235}U	15117-96-1	51	10	9.55E-03	2.10E-01	D	1.54E-02	1.54E-02
18a[1]	^{238}U	7440-61-1	51	51	1.06E-01	1.20E+01	X	2.34E+00	2.34E+00

CAS - Chemical Abstract Service
EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.
D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's *t*-statistic.
L - Distribution is lognormal. 95% UCL calculated using Land method.
N - Distribution is normal. 95% UCL calculated using Student's *t*-statistic.
NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.
X - Distribution is nonparametric. 95% UCL calculated using Student's *t*-statistic.
[1]Grid Cell 18a represents Grid Cell 18 shifted North and West to include SWMU 52, SWMU 47 to 51, and hotspot areas in the northern portion of Grid Cell 18.

Risk characterization integrates the findings of the exposure and toxicity assessments to quantitatively estimate the potential for adverse effects to a receptor as the result of COPC exposure (EPA, 1989). Individual COPC risk and cumulative risk was calculated for each grid cell and for the Playa 3 EA. Cumulative risk refers to the risks or hazards associated with all COPCs for all pathways and media in each grid cell and the Playa 3 EA. Measured concentrations for COPCs within source media (i.e., surface soil and subsurface soil) were used to calculate risks and hazards for current workers. Soil gas COPCs were eliminated from the risk characterization during the COPC evaluation step, as the measured concentrations do not cause air impacts for the onsite workers. Currently, no COPCs are present in potable (Ogallala) groundwater; therefore, no risk characterization is required for onsite or offsite receptors in the current time frame. Perched groundwater beneath the Burning Ground occurs wholly within the Plant boundary. The northernmost extent of perched saturation is approximately 2,200 ft (671 m) south of the boundary, and therefore, any COPCs occurring within or reaching perched groundwater beneath the Burning Ground cannot migrate offsite within perched groundwater. Therefore, future groundwater risk was only evaluated for the Ogallala Aquifer.

No future risk characterization was completed for potable groundwater. The fate and transport modeling of COPCs from soil to groundwater and from perched groundwater to the Ogallala Aquifer (potable groundwater) indicates no impacts will occur to potable groundwater from COPCs at the Burning Ground within a conservative 1,000-year time period. Additionally, the surface water-to-groundwater pathway was eliminated during the COPC evaluation step as the surface water COPCs did not exceed residential RBSVs at the surface and would not leach at higher concentrations to the groundwater.

Potential future offsite health effects were estimated from predicted future concentrations of COPCs based on air modeling. Predicted air concentrations were based on the emission of each COPC to air from COPC concentrations in surface soil for each grid cell. Based on the air model, it is estimated in 1,000 years the onsite surface soil will have eroded about 1.5 to 2 feet; basically the equivalent of the current surface soil depth. Because the emissions from the surface soil to air were based on COPC concentrations in the top 2 feet of soil as the source media, the modeled air concentrations obtained from these emissions will be the same for the current (0 to 70 years) and future scenarios. Two time periods are being evaluated in this risk assessment, the current plus 1,000 years.

Particulate emissions of onsite soil and subsequent offsite air concentrations and offsite deposition onto soil and crops were predicted from the air modeling. Modeling provided offsite particulate deposition rates that were used to calculate a risk resulting from resident farmer exposures to COPCs in soil and homegrown food (vegetables, fruits, meat, and cow milk). As the subsurface fate and transport modeling did not predict an impact to groundwater, offsite exposures to food pathways due to irrigation, water ingestion, and showering pathways were incomplete and no calculations are provided for those pathways.

A.5 RISK CHARACTERIZATION RESULTS

The COPC evaluation process applied in Section 4 removed grid cells 1-6, 10, 11, 15, 16, 19, 20, 21, 24, 27, and 29-35 from the risk characterization process as these cells do not contain COPCs that required further quantitative evaluation. Risk characterizations have been conducted for EAs with COPCs identified for further evaluation and include grid cells 7, 8, 9, 12, 13, 14, 17, 18, 22, 23, and 28, and the Playa 3 EA.

Table A-10. Summary of Cancer and Noncancer Risks for Pantex Workers

Grid Cell	Industrial Worker		Construction/Excavation Worker	
	Cumulative ILCR	HI	Cumulative ILCR	HI
7	6.5E-07	< 0.01	6.6E-07	0.6
8	9.1E-07	0.01	3.2E-07	**2.1**
9	**1.4E-06**	0.04	5.7E-08	0.2
12	**1.6E-05**	**2.2**	2.2E-07	**2.8**
13	**2.9E-04**	**29**	**4.4E-06**	**42**
14	1.6E-07	< 0.01	6.4E-09	0.01
17	**5.0E-06**	0.06	7.2E-08	0.1
18	**4.1E-03**	**123**	**1.0E-05**	**90**
19	7.9E-07	--	1.4E-08	--
22	**3.9E-06**	0.04	1.3E-07	0.2
23	**6.0E-05**	**1.8**	4.8E-07	**1.6**
28	1.0E-06	--	1.7E-08	0.1
Playa 3	1.4E-07	0.06	NA	NA

HI - hazard index
ILCR - incremental lifetime cancer risk
NA – not applicable (construction/excavation worker not evaluated for Playa 3)
-- no data available

Table A-11. Industrial Worker Cancer Risk Characterization by Pathway

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Cancer Ingestion URV_c	Cancer Dermal URV_c	Cancer Inhalation URV_c	Cancer External URV_c	Cancer Total URV_C	ILCR Ingestion	ILCR Dermal	ILCR Inhalation	ILCR External	ILCR Total	Percent of Total
7	Mercury	7439-97-6	1.20E+00	--	--	--	--	--	--	--	--	--	--	--
7	^{238}U	7440-61-1(+D)	9.00E-01	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	5.9E-08	--	2.3E-09	5.9E-07	6.5E-07	100.0%
								Total ILCR	5.9E-08	0.0E+00	2.3E-09	5.9E-07	6.5E-07	100.0%
8	RDX	121-82-4	1.13E+00	1.9E-08	1.9E-08	--	--	3.8E-08	2.2E-08	2.2E-08	--	--	4.3E-08	4.8%
8	Mercury	7439-97-6	2.76E+00	--	--	--	--	--	--	--	--	--	--	--
8	Tritium	10028-17-8	6.19E+00	2.9E-11	NAP	1.5E-14	--	2.9E-11	1.8E-10	--	9.5E-14	--	1.8E-10	0.0%
8	^{238}U	7440-61-1(+D)	1.20E+00	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	7.2E-08	--	2.8E-09	7.2E-07	8.7E-07	95.2%
								Total ILCR	9.4E-08	2.2E-08	2.8E-09	7.2E-07	9.1E-07	100.0%
9	TATB	3058-38-6	8.99E+01	5.2E-09	1.0E-08	--	0.0E+00	1.6E-08	4.7E-07	9.4E-07	--	--	**1.4E-06**	100.0%
								Total ILCR	4.7E-07	9.4E-07	--	--	**1.4E-06**	100.0%
12	2,4-Dinitrotoluene	121-14-2	2.57E-01	1.2E-07	1.4E-07	--	--	2.6E-07	3.1E-08	3.6E-08	--	--	6.6E-08	0.4%
12	RDX	121-82-4	1.27E+02	1.9E-08	1.9E-08	--	--	3.8E-08	**2.4E-06**	**2.4E-06**	--	--	**4.9E-06**	30.8%
12	TNT	118-96-7	3.92E+02	5.2E-09	8.7E-09	--	--	1.4E-08	**2.1E-06**	**3.4E-06**	--	--	**5.5E-06**	34.6%
12	Barium	7440-39-3	4.41E+04	--	--	--	--	--	--	--	--	--	--	--
12	^{238}U	7440-61-1(+D)	7.53E+00	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	4.9E-07	--	1.9E-08	**4.9E-06**	**5.4E-06**	34.2%
								Total ILCR	**5.0E-06**	**5.9E-06**	1.9E-08	**4.9E-06**	**1.6E-05**	100.0%
13	HMX	2691-41-0	2.35E+03	--	--	--	--	--	--	--	--	--	--	--
13	RDX	121-82-4	3.92E+03	1.9E-08	1.9E-08	--	--	3.8E-08	**7.5E-05**	**7.5E-05**	--	--	**1.5E-04**	51.7%
13	TNT	118-96-7	1.00E+04	5.2E-09	8.7E-09	--	--	1.4E-08	**5.3E-05**	**8.8E-05**	--	--	**1.4E-04**	48.1%
13	Barium	7440-39-3	2.12E+04	--	--	--	--	--	--	--	--	--	--	--
13	Cadmium	7440-43-9	9.20E-01	--	--	2.9E-09	--	2.9E-09	--	--	2.6E-09	--	2.6E-09	--
13	Mercury	7439-97-6	3.87E-01	--	--	--	--	--	--	--	--	--	--	--
13	^{238}U	7440-61-1(+D)	9.00E-01	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	5.9E-08	--	2.3E-09	5.9E-07	6.5E-07	0.2%
								Total ILCR	**1.3E-04**	**1.6E-04**	4.9E-09	5.9E-07	**2.9E-04**	100.0%
14	RDX	121-82-4	4.20E+00	1.9E-08	1.9E-08	--	--	3.8E-08	8.1E-08	8.1E-08	--	--	1.6E-07	100.0%
								Total ILCR	8.1E-08	8.1E-08	0.0E+00	0.0E+00	1.6E-07	100.0%
17	RDX	121-82-4	3.01E+00	1.9E-08	1.9E-08	--	--	3.8E-08	5.8E-08	5.8E-08	--	--	1.2E-07	2.3%
17	Barium	7440-39-3	7.58E+02	--	--	--	--	--	--	--	--	--	--	---
17	Cadmium	7440-43-9	5.78E+00	--	--	2.9E-09	--	2.9E-09	--	--	1.7E-08	--	1.7E-08	0.3%
17	Mercury	7439-97-6	6.00E+00	--	--	--	--	--	--	--	--	--	--	---

Table A-11. Industrial Worker Cancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Cancer Ingestion URV_c	Cancer Dermal URV_c	Cancer Inhalation URV_c	Cancer External URV_c	Cancer Total URV_c	ILCR Ingestion	ILCR Derma	ILCR Inhalation	ILCR Inhalation	ILCR Total	Percent of Total
17	Tritium	10028-17-8	3.94E+00	2.9E-11	NAP	1.5E-14	--	2.9E-11	1.1E-10	--	6.0E-14	--	1.1E-10	0.0%
17	^{234}U	13966-29-5	2.28E+01	4.9E-08	NAP	3.1E-09	1.4E-09	5.7E-08	1.1E-06	--	7.1E-08	3.3E-08	**1.3E-06**	26.2%
17	^{238}U	7440-61-1(+D)	4.89E+00	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	3.2E-07	--	1.2E-08	**3.2E-06**	**3.5E-06**	71.1%
								Total ILCR	1.4E-06	5.8E-08	1.0E-07	**3.2E-06**	**4.9E-06**	100.0%
18	TATB	3058-38-6	1.17E+01	5.2E-09	1.0E-08	--	--	1.6E-08	6.1E-08	1.2E-07	--	--	1.8E-07	--
18	2,4-Dinitrotoluene	121-14-2	1.10E+00	1.2E-07	1.4E-07	--	--	2.6E-07	1.3E-07	1.5E-07	--	--	2.8E-07	--
18	2-Amino-4,6-dinitrotoluene	35572-78-2	2.70E+01	1.7E-09	3.5E-09	--	--	5.2E-09	4.7E-08	9.4E-08	--	--	1.4E-07	--
18	4-Amino-2,6-dinitrotoluene	19406-51-0	9.57E+00	1.7E-09	3.5E-09	--	--	5.2E-09	1.7E-08	3.3E-08	--	--	5.0E-08	--
18	HMX	2691-41-0	2.00E+03	--	--	--	--	--	--	--	--	--	--	--
18	Nitrobenzene	98-95-3	6.60E+00	--	--	--	--	--	--	--	--	--	--	--
18	RDX	121-82-4	9.40E+04	1.9E-08	1.9E-08	--	--	3.8E-08	**1.8E-03**	**1.8E-03**	--	--	**3.6E-03**	88.3%
18	TNT	118-96-7	3.41E+04	5.2E-09	8.7E-09	--	--	1.4E-08	**1.8E-04**	**3.0E-04**	--	--	**4.8E-04**	11.6%
18	Barium	7440-39-3	2.93E+04	--	--	--	--	--	--	--	--	--	--	--
18	Aldrin	309-00-2	2.06E-02	3.0E-06	5.9E-06	7.8E-09	--	8.9E-06	6.1E-08	1.2E-07	1.6E-10	--	1.8E-07	--
18	Alpha BHC	319-84-6	1.13E-01	1.1E-06	4.5E-07	2.9E-09	--	1.6E-06	1.2E-07	5.1E-08	3.2E-10	--	1.8E-07	--
18	Beta BHC	319-85-7	1.30E-01	3.1E-07	1.4E-07	8.5E-10	--	4.5E-07	4.1E-08	1.8E-08	1.1E-10	--	5.9E-08	--
18	Heptachlor epoxide	1024-57-3	3.03E-02	1.6E-06	2.2E-06	4.2E-09	--	3.8E-06	4.8E-08	6.7E-08	1.3E-10	--	1.2E-07	--
								Total ILCR	**2.0E-03**	**2.1E-03**	7.2E-10	**--**	**4.1E-03**	100.0%
19	Tritium	10028-17-8	4.86E+00	2.9E-11	NAP	1.5E-14	--	2.9E-11	1.4E-10	--	7.4E-14	--	1.4E-10	0.02%
19	^{238}U	7440-61-1(D+)	1.1OE+00	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	7.2E-08	--	2.8E-09	7.2E-07	7.9E-07	100%
								Total ILCR	7.2E-08	--	2.8E-09	7.2E-07	7.9E-07	100.0%
22	RDX	121-82-4	3.80E+00	1.9E-08	1.9E-08	--	--	3.8E-08	7.3E-08	7.3E-08	--	--	1.5E-07	3.7%
22	Barium	7440-39-3	1.50E+03	--	--	--	--	--	--	--	--	--	--	--
22	^{238}U	7440-61-1(+D)	5.29E+00	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	3.5E-07	--	1.3E-08	**3.4E-06**	**3.8E-06**	96.3%
								Total ILCR	4.2E-07	7.3E-08	1.3E-08	**3.4E-06**	**3.9E-06**	100.0%
23	TATB	3058-38-6	3.43E+03	5.2E-09	1.0E-08	--	0.0E+00	1.6E-08	**1.8E-05**	**3.6E-05**	--	--	**5.4E-05**	90.0%
23	HMX	2691-41-0	1.20E+03	--	--	--	0.0E+00	--	--	--	--	--	--	---
23	RDX	121-82-4	1.30E+02	1.9E-08	1.9E-08	--	0.0E+00	3.8E-08	**2.5E-06**	**2.5E-06**	--	--	**5.0E-06**	8.3%

Table A-11. Industrial Worker Cancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Cancer Ingestion URV_c	Cancer Dermal URV_c	Cancer Inhalation URV_c	Cancer External URV_c	Cancer Total URV_c	ILCR Ingestion	ILCR Derma	ILCR Inhalation	ILCR Inhalation	ILCR Total	Percent of Total
23	Benzo(a)pyrene	50-32-8	8.80E-02	1.3E-06	1.9E-06	1.4E-09	0.0E+00	3.1E-06	1.1E-07	1.6E-07	1.2E-10	--	2.8E-07	0.5%
23	^{238}U	7440-61-1(+D)	1.00E+00	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	6.6E-08	--	2.5E-09	6.5E-07	7.2E-07	1.2%
								Total ILCR	**2.1E-05**	**3.9E-05**	2.6E-09	6.5E-07	**6.0E-05**	100.0%
28	Tritium	10028-17-8	3.6E+00	2.9E-11	NAP	1.5E-14	--	2.9E-11	1.0E-10	--	5.5E-14	--	1.0E-10	0.01%
28	^{238}U	7440-61-1(+D)	1.40E+00	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07	9.2E-08	--	3.6E-09	9.1E-07	1.0E-06	100.0%
								Total ILCR	9.2E-08	--	3.6E-09	9.1E-07	1.0E-06	100.0%
Playa 3	Barium	7440-39-3	2.94E+02	--	--	--	--	--	--	--	--	--	--	--
Playa 3	Thallium	7440-28-0	7.23E+00	--	--	--	--	--	--	--	--	--	--	--
Playa 3	^{3}H	10028-17-8	5.07E+00	2.9E-11	NAP	1.5E-14	--	2.9E-11	1.5E-10	--	7.8E-14	--	1.5E-10	0.1%
Playa 3	^{238}U	7440-61-1(+D)	2.20E+00	6.6E-08	NAP	2.5E-09	6.5E-07	6.6E-08	1.4E-07	--	5.6E-09	1.4E-06	1.4E-07	99.9%
								Total ILCR	1.4E-07	--	5.6E-09	1.4E-06	1.4E-07	100.0%
18a	2,4-Dinitrotoluene	121-14-2	1.10E+00	1.19E-07	1.40E-07	--	NAP	2.59E-07	1.3E-07	1.5E-07	--	--	2.8E-07	0.04%
18a	2-Amino-4,6-Dinitrotoluene	35572-78-2	9.17E+00	1.75E-09	3.49E-09	--	NAP	5.24E-09	1.6E-08	3.2E-08	--	--	4.8E-08	0.01%
18a	4-Amino-2,6-Dinitrotoluene	19406-51-0	3.30E+01	1.75E-09	3.49E-09	--	NAP	5.24E-09	5.8E-08	1.2E-07	--	--	1.7E-07	0.02%
18a	HMX	2691-41-0	2.13E+03	--	--	--	NAP	--	--	--	--	--	--	--
18a	Nitrobenzene	98-95-3	6.60E+00	--	--	--	NAP	--	--	--	--	--	--	--
18a	RDX	121-82-4	1.00E+04	1.92E-08	1.92E-08	--	NAP	3.84E-08	**1.9E-04**	**1.9E-04**	--	--	**3.8E-04**	52.5%
18a	TNT	118-96-7	2.45E+04	5.24E-09	8.74E-09	--	NAP	1.40E-08	**1.3E-04**	**2.1E-04**	--	--	**3.4E-04**	46.8%
18a	Barium	7440-39-3	4.61E+04	--	--	--	NAP	--	--	--	--	--	--	--
18a	Mercury	7439-97-6	1.85E-01	--	--	--	NAP	--	--	--	--	--	--	--
18a	Aldrin	309-00-2	2.75E-02	2.97E-06	5.94E-06	7.83E-09	NAP	8.92E-06	8.2E-08	1.6E-07	2.2E-10	--	2.5E-07	0.03%
18a	Alpha BHC	319-84-6	8.37E-02	1.10E-06	4.54E-07	2.88E-09	NAP	1.56E-06	9.2E-08	3.8E-08	2.4E-10		1.3E-07	0.02%

Table A-11. Industrial Worker Cancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Cancer Ingestion URV_c	Cancer Dermal URV_c	Cancer Inhalation URV_c	Cancer External URV_c	Cancer Total URV_c	ILCR Ingestion	ILCR Derma	ILCR Inhalation	ILCR Inhalation	ILCR Total	Percent of Total
18a	Beta BHC	319-85-7	9.43E-02	3.15E-07	1.38E-07	8.47E-10	NAP	4.54E-07	3.0E-08	1.3E-08	8.0E-11		4.3E-08	0.01%
18a	Heptachlor Epoxide	1024-57-3	3.43E-02	1.59E-06	2.21E-06	4.16E-09	NAP	3.80E-06	5.4E-08	7.6E-08	1.4E-10		1.3E-07	0.02%
18a	Uranium-238	7440-61-1(+D)	6.40E+00	6.56E-08	NAP	2.55E-09	6.51E-07	7.19E-07	4.2E-07	--	1.6E-08	**4.2E-06**	**4.6E-06**	0.6%
								Total ILCR	**3.2E-04**	**4.1E-04**	1.7E-08	**4.2E-06**	**7.3E-04**	100.0%

COPC – Contaminant of potential concern

CAS -chemical abstract service
EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.
ILCR - incremental lifetime cancer risk
NAP – not an applicable pathway
URV_c - cancer unit risk value
Bolded values exceed ILCR of 1E-6
-- no data available

Table A-12. Industrial Worker Noncancer Risk Characterization by Pathway

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_{nc}	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent of Total
7	Mercury	7439-97-6	1.20E+00	1.6E-03	2.3E-03	1.5E-05	4.0E-03	2.0E-03	2.8E-03	1.8E-05	4.8E-03	100.0%
7	^{238}U	7440-61-1(+D)	9.00E-01	--	--	--	--	--	--	--	--	--
							HI	2.0E-03	2.8E-03	1.8E-05	4.8E-03	100.0%
8	RDX	121-82-4	1.13E+00	1.6E-04	1.6E-04	9.0E-06	3.4E-04	1.8E-04	1.8E-04	1.0E-05	3.8E-04	3.3%
8	Mercury	7439-97-6	2.76E+00	1.6E-03	2.3E-03	1.5E-05	4.0E-03	4.5E-03	6.4E-03	4.1E-05	1.1E-02	96.7%
8	^{238}U	7440-61-1(+D)	1.10E+00	--	--	--	--	--	--	--	--	--
							HI	4.7E-03	6.6E-03	5.1E-05	1.1E-02	100.0%
9	TATB	3058-38-6	8.99E+01	1.6E-04	3.3E-04	2.2E-06	4.9E-04	1.5E-02	2.9E-02	2.0E-04	4.4E-02	100.0%
							HI	1.5E-02	2.9E-02	2.0E-04	4.4E-02	100.0%
12	2,4-Dinitrotoluene	121-14-2	2.57E-01	2.4E-04	2.9E-04	3.0E-05	5.6E-04	6.3E-05	7.4E-05	7.7E-06	1.4E-04	--
12	RDX	121-82-4	1.27E+02	1.6E-04	1.6E-04	9.0E-06	3.4E-04	2.1E-02	2.1E-02	1.1E-03	4.2E-02	1.9%
12	TNT	118-96-7	3.92E+02	9.8E-04	1.6E-03	4.5E-05	2.7E-03	3.8E-01	6.4E-01	1.8E-02	**1.0E+00**	46.7%
12	Barium	7440-39-3	4.41E+04	7.0E-06	1.0E-05	9.0E-06	2.6E-05	3.1E-01	4.4E-01	4.0E-01	**1.1E+00**	51.4%
12	^{238}U	7440-61-1(+D)	7.53E+00	--	--	--	--	--	--	--	--	--
							HI	7.1E-01	**1.1E+00**	4.1E-01	**2.2E+00**	100.0%
13	HMX	2691-41-0	2.35E+03	9.8E-06	6.5E-05	1.7E-06	7.7E-05	2.3E-02	1.5E-01	3.9E-03	1.8E-01	0.6%
13	RDX	121-82-4	3.92E+03	1.6E-04	1.6E-04	9.0E-06	3.4E-04	6.4E-01	6.4E-01	3.5E-02	**1.3E+00**	4.6%
13	TNT	118-96-7	1.00E+04	9.8E-04	1.6E-03	4.5E-05	2.7E-03	**9.8E+00**	**1.6E+01**	4.5E-01	**2.7E+01**	92.9%
13	Barium	7440-39-3	2.12E+04	7.0E-06	1.0E-05	9.0E-06	2.6E-05	1.5E-01	2.1E-01	1.9E-01	5.5E-01	1.9%
13	Cadmium	7440-43-9	9.20E-01	4.9E-04	2.0E-03	--	2.4E-03	4.5E-04	1.8E-03	--	2.2E-03	--
13	Mercury	7439-97-6	3.87E-01	1.6E-03	2.3E-03	1.5E-05	4.0E-03	6.3E-04	9.0E-04	5.8E-06	1.5E-03	--
13	^{238}U	7440-61-1(+D)	9.00E-01	--	--	--	--	--	--	--	--	--
							HI	**1.1E+01**	**1.7E+01**	6.8E-01	**2.9E+01**	100.0%
14	RDX	121-82-4	4.20E+00	1.6E-04	1.6E-04	9.0E-06	3.4E-04	6.8E-04	6.8E-04	3.8E-05	1.4E-03	100.0%
							HI	6.8E-04	6.8E-04	3.8E-05	1.4E-03	100.0%
17	RDX	121-82-4	3.01E+00	1.6E-04	1.6E-04	9.0E-06	3.4E-04	4.9E-04	4.9E-04	2.7E-05	1.0E-03	1.7%
17	Barium	7440-39-3	7.58E+02	7.0E-06	1.0E-05	9.0E-06	2.6E-05	5.3E-03	7.6E-03	6.8E-03	2.0E-02	33.5%
17	Cadmium	7440-43-9	5.78E+00	4.9E-04	2.0E-03	--	2.4E-03	2.8E-03	1.1E-02	--	1.4E-02	24.1%
17	Mercury	7439-97-6	6.00E+00	1.6E-03	2.3E-03	1.5E-05	4.0E-03	9.8E-03	1.4E-02	9.0E-05	2.4E-02	40.7%
17	^{238}U	7440-61-1(+D)	3.36E+00	--	--	--	--	--	--	--	--	--
							HI	1.8E-02	3.3E-02	6.9E-03	5.9E-02	100.0%
18	TATB	3058-38-6	1.17E+01	1.6E-04	3.3E-04	2.2E-06	4.9E-04	1.9E-03	3.8E-03	2.6E-05	5.8E-03	--
18	2,4-Dinitrotoluene	121-14-2	1.10E+00	2.4E-04	2.9E-04	3.0E-05	5.6E-04	2.7E-04	3.2E-04	3.3E-05	6.2E-04	--
18	2-Amino-4,6-dinitrotoluene	35572-78-2	2.70E+01	2.9E-03	5.9E-03	4.5E-05	8.9E-03	7.9E-02	1.6E-01	1.2E-03	2.4E-01	0.2%
18	4-Amino-2,6-dinitrotoluene	19406-51-0	9.57E+00	2.9E-03	5.9E-03	4.5E-05	8.9E-03	2.8E-02	5.6E-02	4.3E-04	8.5E-02	0.1%

Table A-12. Industrial Worker Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_{nc}	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent of Total
18	HMX	2691-41-0	2.00E+03	9.8E-06	6.5E-05	1.7E-06	7.7E-05	2.0E-02	1.3E-01	3.3E-03	1.5E-01	0.1%
18	Nitrobenzene	98-95-3	6.60E+00	9.8E-04	1.0E-03	9.0E-07	2.0E-03	6.5E-03	6.7E-03	5.9E-06	1.3E-02	--
18	RDX	121-82-4	9.40E+04	1.6E-04	1.6E-04	9.0E-06	3.4E-04	**1.5E+01**	**1.5E+01**	8.4E-01	**3.2E+01**	25.6%
18	TNT	118-96-7	3.41E+04	9.8E-04	1.6E-03	4.5E-05	2.7E-03	**3.3E+01**	**5.6E+01**	**1.5E+00**	**9.0E+01**	73.4%
18	Barium	7440-39-3	2.93E+04	7.0E-06	1.0E-05	9.0E-06	2.6E-05	2.1E-01	2.9E-01	2.6E-01	7.6E-01	0.6%
18	Aldrin	309-00-2	2.06E-02	1.6E-02	3.3E-02	--	4.9E-02	3.4E-04	6.7E-04	--	1.0E-03	--
18	Alpha BHC	319-84-6	1.13E-01	6.1E-05	2.5E-05	--	8.6E-05	6.9E-06	2.8E-06	--	9.7E-06	--
18	Beta BHC	319-85-7	1.30E-01	--	--	--	--	--	--	--	--	--
18	Heptachlor epoxide	1024-57-3	3.03E-02	3.8E-02	5.2E-02	--	9.0E-02	1.1E-03	1.6E-03	--	2.7E-03	--
							HI	**4.9E+01**	**7.2E+01**	**2.6E+00**	**1.2E+02**	100.0%
22	RDX	121-82-4	3.80E+00	1.6E-04	1.6E-04	9.0E-06	3.4E-04	6.2E-04	6.2E-04	3.4E-05	1.3E-03	3.2%
22	Barium	7440-39-3	1.50E+03	7.0E-06	1.0E-05	9.0E-06	2.6E-05	1.0E-02	1.5E-02	1.3E-02	3.9E-02	96.8%
22	^{238}U	7440-61-1(+D)	5.29E+00	--	--	--	--	--	--	--	--	--
							HI	1.1E-02	1.6E-02	1.3E-02	4.0E-02	100.0%
23	TATB	3058-38-6	3.43E+03	1.6E-04	3.3E-04	2.2E-06	4.9E-04	5.6E-01	**1.1E+00**	7.7E-03	**1.7E+00**	92.6%
23	HMX	2691-41-0	1.20E+03	9.8E-06	6.5E-05	1.7E-06	7.7E-05	1.2E-02	7.8E-02	2.0E-03	9.2E-02	5.1%
23	RDX	121-82-4	1.30E+02	1.6E-04	1.6E-04	9.0E-06	3.4E-04	2.1E-02	2.1E-02	1.2E-03	4.4E-02	2.4%
23	Benzo(a)pyrene	50-32-8	8.80E-02	--	--	--	--	--	--	--	--	--
							HI	5.9E-01	**1.2E+00**	1.1E-02	**1.8E+00**	100.0%
28	^{238}U	7440-61-1(+D)	1.30E+00	--	--	--	--	--	--	--	--	--
							HI	--	--	--	--	--
Playa 3	Barium	7440-39-3	2.94E+02	7.0E-06	1.0E-05	9.0E-06	2.6E-05	2.1E-03	2.9E-03	2.6E-03	7.6E-03	13.5%
Playa 3	Thallium	7440-28-0	7.23E+00	6.1E-03	6.1E-04	4.5E-05	6.8E-03	4.4E-02	4.4E-03	3.2E-04	4.9E-02	86.5%
Playa 3	^{3}H	10028-17-8	5.07E+00	--	--	--	--	--	--	--	--	--
Playa 3	^{238}U	7440-61-1(+D)	2.20E+00	--	--	--	--	--	--	--	--	--
							HI	4.6E-02	7.4E-03	3.0E-03	5.7E-02	100.0%
18a	2,4-Dinitrotoluene	121-14-2	1.10E+00	2.45E-04	2.88E-04	2.98E-05	5.62E-04	2.7E-04	3.2E-04	3.3E-05	6.2E-04	0.001%
18a	2-Amino-4,6-Dinitrotoluene	35572-78-2	9.17E+00	2.94E-03	5.87E-03	4.48E-05	8.85E-03	2.7E-02	5.4E-02	4.1E-04	8.1E-02	0.1%
18a	4-Amino-2,6-Dinitrotoluene	19406-51-0	3.30E+01	2.94E-03	5.87E-03	4.48E-05	8.85E-03	9.7E-02	1.9E-01	1.5E-03	2.9E-01	0.4%
18a	HMX	2691-41-0	2.13E+03	9.78E-06	6.52E-05	1.66E-06	7.67E-05	2.1E-02	1.4E-01	3.5E-03	1.6E-01	0.2%
18a	Nitrobenzene	98-95-3	6.60E+00	9.78E-04	1.01E-03	8.95E-07	1.99E-03	6.5E-03	6.7E-03	5.9E-06	1.3E-02	0.02%
18a	RDX	121-82-4	1.00E+04	1.63E-04	1.63E-04	8.95E-06	3.35E-04	**1.6E+00**	**1.6E+00**	9.0E-02	**3.4E+00**	4.8%
18a	TNT	118-96-7	2.45E+04	9.78E-04	1.63E-03	4.48E-05	2.65E-03	**2.4E+01**	**4.0E+01**	**1.1E+00**	**6.5E+01**	92.7%
18a	Barium	7440-39-3	4.61E+04	6.99E-06	9.98E-06	8.95E-06	2.59E-05	3.2E-01	4.6E-01	4.1E-01	**1.2E+00**	1.7%
18a	Mercury	7439-97-6	1.85E-01	1.63E-03	2.33E-03	1.49E-05	3.98E-03	3.0E-04	4.3E-04	2.8E-06	7.3E-04	0.001%
18a	Aldrin	309-00-2	2.75E-02	1.63E-02	3.26E-02	--	4.89E-02	4.5E-04	9.0E-04	--	1.3E-03	0.002%
18a	Alpha BHC	319-84-6	8.37E-02	6.12E-05	2.52E-05	--	8.64E-05	5.1E-06	2.1E-06	--	7.2E-06	0.00001%
18a	Beta BHC	319-85-7	9.43E-02	--	--	--	--	--	--	--	--	--
18a	Heptachlor Epoxide	1024-57-3	3.43E-02	3.76E-02	5.23E-02	--	8.99E-02	1.3E-03	1.8E-03	--	3.1E-03	0.004%
18a	Uranium-238	7440-61-1(+D)	6.40E+00	--	--	--	--	--	--	--	--	--
							HI	**2.6E+01**	**4.2E+01**	**1.6E+00**	**7.0E+01**	100.0%

Table A-12. Industrial Worker Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_{nc}	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent of Total

COPC – Contaminant of potential concern
CAS -chemical abstract service
EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.
HI - hazard index
HQ - hazard quotient
URV_{nc} - noncancer unit risk value
Bolded values exceed HQ or HI of 1
-- no data available

Table A-13. Construction/Excavation Worker Cancer Risk Characterization by Pathway

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_c	Dermal URV_c	Inhalation URV_c	External URV_c	Total URV_c	ILCR Ingestion	ILCR Dermal	ILCR Inhalation	ILCR External	ILCR	Percent Total
7	Barium	7440-39-3	4.48E+03	--	--	--	--	--	--	--	--	--	--	--
7	Cadmium	7440-43-9	2.33E+00	--	--	2.80E-11	--	2.80E-11	--	--	6.43E-11	--	6.43E-11	0.00%
7	Copper	7440-50-8	5.19E+02	--	--	--	--	--	--	--	--	--	--	--
7	Mercury	7439-97-6	4.30E-01	--	--	--	--	--	--	--	--	--	--	--
7	Silver	7440-22-4	7.72E+01	--	--	--	--	--	--	--	--	--	--	--
7	Uranium-238	7440-61-1(+D)	9.00E-01	6.00E-09	NAP	2.4E-11	6.20E-09	1.20E-08	5.44E-09	--	2.2E-11	5.61E-09	1.11E-08	1.70%
7	Benzo(a)anthracene	56-55-3	3.18E+00	1.20E-08	1.80E-09	1.30E-12	--	1.40E-08	3.73E-08	5.68E-09	4.29E-12	--	4.30E-08	6.50%
7	Benzo(a)pyrene	50-32-8	3.24E+00	1.20E-07	1.80E-08	1.30E-11	--	1.40E-07	3.80E-07	5.79E-08	4.37E-11	--	4.38E-07	66.00%
7	Benzo(b)fluoranthene	205-99-2	2.88E+00	1.20E-08	1.80E-09	1.30E-12	--	1.40E-08	3.38E-08	5.15E-09	3.89E-12	--	3.90E-08	5.90%
7	Benzo(k)fluoranthene	207-08-9	2.67E+00	1.20E-09	1.80E-10	1.30E-13	--	1.40E-09	3.14E-09	4.78E-10	3.61E-13	--	3.62E-09	0.50%
7	Dibenz(a,h)anthracene	53-70-3	7.31E-01	1.20E-07	1.80E-08	1.30E-11	--	1.40E-07	8.59E-08	1.31E-08	9.87E-12	--	9.90E-08	14.90%
7	Indeno(1,2,3-c,d)pyrene	193-39-5	2.19E+00	1.20E-08	1.80E-09	1.30E-12	--	1.40E-08	2.57E-08	3.91E-09	2.95E-12	--	2.96E-08	4.50%
								Total ILCR	5.71E-07	8.62E-08	1.51E-10	5.61E-09	6.63E-07	100.0%
8	TATB	3058-38-6	1.20E+01	4.80E-10	1.00E-10	--	--	5.80E-10	5.78E-09	1.20E-09	--	--	6.98E-09	2.20%
8	2,6-Dinitrotoluene	606-20-2	2.05E-01	1.10E-08	1.30E-09	--	--	1.20E-08	2.24E-09	2.75E-10	--	--	2.51E-09	0.80%
8	4-Amino-2,6-dinitrotoluene	19406-51-0	9.06E-01	1.60E-10	3.40E-11	--	--	1.90E-10	1.46E-10	3.04E-11	--	--	1.76E-10	0.10%
8	HMX	2691-41-0	1.76E+02	--	--	--	--	--	--	--	--	--	--	--
8	RDX	121-82-4	2.54E+01	1.80E-09	1.80E-10	--	--	2.00E-09	4.50E-08	4.69E-09	--	--	4.97E-08	15.60%
8	TNT	118-96-7	1.25E+02	4.80E-10	8.40E-11	--	--	5.70E-10	6.04E-08	1.05E-08	--	--	7.09E-08	22.30%
8	Barium	7440-39-3	2.78E+03	--	--	--	--	--	--	--	--	--	--	--
8	Cadmium	7440-43-9	4.08E+00	--	--	2.80E-11	--	2.80E-11	--	--	1.13E-10	--	1.13E-10	0.00%
8	Copper	7440-50-8	2.80E+02	--	--	--	--	--	--	--	--	--	--	--
8	Lead	7439-92-1	4.70E+01	--	--	--	--	--	--	--	--	--	--	--
8	Manganese	7439-96-5	5.59E+02	--	--	--	--	--	--	--	--	--	--	--
8	Mercury	7439-97-6	1.30E+00	--	--	--	--	--	--	--	--	--	--	--
8	Silver	7440-22-4	1.50E+01	--	--	--	--	--	--	--	--	--	--	--
8	Zinc	7440-66-6	9.29E+02	--	--	--	--	--	--	--	--	--	--	--
8	Perchlorate	14797-73-0	1.48E+00	--	--	--	--	--	--	--	--	--	--	--
8	Tritium	10028-17-8	9.6E-01	2.7E-12	NAP	1.5E-16	--	2.7E-12	2.6E-12	--	1.4E-16	--	2.6E-12	0.0%
8	^{235}U	15117-96-1	5.27E-02	4.7E-09	NAP	2.6E-11	3.0E-08	3.4E-08	2.5E-10	--	1.4E-12	1.6E-09	1.8E-09	0.6%
8	^{238}U	7440-61-1(+D)	3.45E+00	6.00E-09	NAP	2.4E-11	6.20E-09	1.20E-08	2.09E-08	--	8.4E-11	2.15E-08	4.2E-08	13.4%
8	4-Chlorophenyl phenyl ether	7005-72-3	4.50E-01	2.40E-07	5.00E-08	5.10E-11	--	2.90E-07	1.09E-07	2.26E-08	2.28E-11	--	1.31E-07	41.3%
8	Benzo(a)pyrene	50-32-8	8.80E-02	1.20E-07	1.80E-08	1.30E-11	--	1.40E-07	1.03E-08	1.57E-09	1.19E-12	--	1.19E-08	3.7%
								Total ILCR	2.54E-07	4.09E-08	2.22E-10	2.31E-08	3.17E-07	100%

Table A-13. Construction/Excavation Worker Cancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URVc	Dermal URVc	Inhalation URVc	External URVc	Total URVc	ILCR Ingestion	ILCR Dermal	ILCR Inhalation	ILCR External	ILCR	Percent Total
9	TATB	3058-38-6	8.99E+01	4.80E-10	1.00E-10	--	--	5.80E-10	4.34E-08	9.04E-09	--	--	5.24E-08	92.30%
9	RDX	121-82-4	2.23E+00	1.80E-09	1.80E-10	--	--	2.00E-09	3.94E-09	4.10E-10	--	--	4.35E-09	7.70%
								Total ILCR	4.70E-08	9.50E-09	--	--	5.70E-08	100.0%
12	1,3-Dinitrobenzene	99-65-0	1.94E-01	--	--	--	--	--	--	--	--	--	--	--
12	2,4-Dinitrotoluene	121-14-2	2.01E-01	1.10E-08	1.30E-09	--	--	1.20E-08	2.20E-09	2.70E-10	--	--	2.47E-09	1.1%
12	2,6-Dinitrotoluene	606-20-2	1.90E-01	1.10E-08	1.30E-09	--	--	1.20E-08	2.08E-09	2.55E-10	--	--	2.33E-09	1.0%
12	RDX	121-82-4	4.62E+01	1.80E-09	1.80E-10	--	--	2.00E-09	8.18E-08	8.52E-09	--	--	9.03E-08	40.6%
12	TNT	118-96-7	1.35E+02	4.80E-10	8.40E-11	--	--	5.70E-10	6.52E-08	1.13E-08	--	--	7.65E-08	34.4%
12	Barium	7440-39-3	1.18E+04	--	--	--	--	--	--	--	--	--	--	---
12	Cadmium	7440-43-9	7.10E-01	--	--	2.80E-11	--	2.80E-11	--	--	1.96E-11	--	1.96E-11	0.0%
12	Nickel	7440-02-0	4.92E+01	--	--	7.40E-12	--	7.40E-12	--	--	3.62E-10	--	3.62E-10	0.2%
12	Dieldrin	60-57-1	2.98E-02	2.60E-07	5.40E-08	7.10E-11	--	3.10E-07	7.67E-09	1.60E-09	2.10E-12	--	9.26E-09	4.2%
12	^{235}U	15117-96-1	1.76E-02	4.7E-09	NAP	2.6E-11	3.0E-08	3.4E-08	8.3E-11	--	4.6E-13	5.2E-10	6.1E-10	0.3%
12	^{238}U	7440-61-1(+D)	3.29E+00	6.00E-09	--	--	6.20E-09	1.20E-08	1.99E-08	--	8.0E-11	2.05E-08	4.05E-08	18.2%
12	Acetone	67-64-1	2.77E+01	--	--	--	--	--	--	--	--	--	--	--
								Total Cancer	3.85E-07	2.19E-08	4.64E-10	2.10E-08	2.20E-07	100%
13	HMX	2691-41-0	8.83E+02	--	--	--	--	--	--	--	--	--	--	--
13	RDX	121-82-4	1.24E+03	1.80E-09	1.80E-10	--	--	2.00E-09	**2.19E-06**	2.29E-07	--	--	**2.42E-06**	55.70%
13	TNT	118-96-7	3.40E+03	4.80E-10	8.40E-11	--	--	5.70E-10	**1.64E-06**	2.85E-07	--	--	**1.93E-06**	44.20%
13	Barium	7440-39-3	7.93E+03	--	--	--	--	--	--	--	--	--	--	--
13	Cadmium	7440-43-9	6.08E-01	--	--	2.80E-11	--	2.80E-11	--	--	1.68E-11	--	1.68E-11	0.00%
13	Mercury	7439-97-6	1.60E-01	--	--	--	--	--	--	--	--	--	--	--
13	^{238}U	7440-61-1(+D)	4.11E-01	6.00E-09	NAP	2.4E-11	6.20E-09	1.20E-08	2.48E-09	--	1.0E-11	2.56E-09	5.05E-09	0.10%
								Total Cancer	**3.80E-06**	5.10E-07	1.70E-11	2.60E-09	**4.40E-06**	100.0%
14	RDX	121-82-4	3.29E+00	1.80E-09	1.80E-10	--	--	2.00E-09	5.83E-09	6.07E-10	--	--	6.43E-09	100.00%
								Total Cancer	5.80E-09	6.10E-10	0.00E+00	0.00E+00	6.40E-09	100.0%
17	RDX	121-82-4	2.74E+00	1.80E-09	1.80E-10	--	--	2.00E-09	4.86E-09	5.06E-10	--	--	5.36E-09	7.4%
17	Barium	7440-39-3	5.14E+02	--	--	--	--	--	--	--	--	--	--	---
17	Cadmium	7440-43-9	3.08E+00	--	--	2.80E-11	--	2.80E-11	--	--	8.50E-11	--	8.50E-11	0.1%
17	Mercury	7439-97-6	2.84E+00	--	--	--	--	--	--	--	--	--	--	--
17	Tritium	10028-17-8	3.94E+00	2.7E-12	NAP	1.5E-16	--	2.7E-12	1.0E-11	--	5.7E-16	--	1.0E-11	0.0%
17	^{234}U	13966-29-5	5.74E+00	4.5E-09	NAP	3.0E-11	1.4E-11	4.6E-09	2.6E-08	--	1.7E-10	7.9E-11	2.6E-08	36.3%
17	^{238}U	7440-61-1(+D)	3.31E+00	6.00E-09	NAP	2.4E-11	6.20E-09	1.20E-08	2.0E-08	--	8.0E-11	2.1E-08	4.1E-08	56.1%

Table A-13. Construction/Excavation Worker Cancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URVc	Dermal URVc	Inhalation URVc	External URVc	Total URVc	ILCR Ingestion	ILCR Dermal	ILCR Inhalation	ILCR External	ILCR	Percent Total
								Total Cancer	5.09E-08	5.06E-10	3.35E-11	2.1E-08	7.2E-08	100.0%
18	TATB	3058-38-6	4.81E+00	4.80E-10	1.00E-10	--	--	5.80E-10	2.32E-09	4.84E-10	--	--	2.81E-09	0.00%
18	2,4-Dinitrotoluene	121-14-2	1.10E+00	1.10E-08	1.30E-09	--	--	1.20E-08	1.20E-08	1.48E-09	--	--	1.35E-08	0.10%
18	2-Amino-4,6-dinitrotoluene	35572-78-2	9.13E+00	1.60E-10	3.40E-11	--	--	1.90E-10	1.47E-09	3.06E-10	--	--	1.78E-09	0.00%
18	4-Amino-2,6-dinitrotoluene	19406-51-0	2.21E+00	1.60E-10	3.40E-11	--	--	1.90E-10	3.55E-10	7.40E-11	--	--	4.29E-10	0.00%
18	HMX	2691-41-0	1.29E+02	--	--	--	--	--	--	--	--	--	--	--
18	Nitrobenzene	98-95-3	3.45E+00	--	--	--	--	--	--	--	--	--	--	--
18	RDX	121-82-4	3.03E+03	1.80E-09	1.80E-10	--	--	2.00E-09	**5.37E-06**	5.59E-07	--	--	**5.93E-06**	58.90%
18	TNT	118-96-7	7.25E+03	4.80E-10	8.40E-11	--	--	5.70E-10	**3.50E-06**	6.08E-07	--	--	**4.11E-06**	40.80%
18	Barium	7440-39-3	5.64E+03	--	--	--	--	--	--	--	--	--	--	--
18	Aldrin	309-00-2	5.03E-03	2.70E-07	5.70E-08	7.50E-11	--	3.30E-07	1.38E-09	2.87E-10	3.78E-13	--	1.66E-09	0.00%
18	Alpha BHC	319-84-6	2.25E-02	1.00E-07	4.40E-09	2.80E-11	--	1.10E-07	2.28E-09	9.79E-11	6.21E-13	--	2.38E-09	0.00%
18	Beta BHC	319-85-7	2.59E-02	2.90E-08	1.30E-09	8.10E-12	--	3.00E-08	7.51E-10	3.44E-11	2.11E-13	--	7.85E-10	0.00%
18	Heptachlor epoxide	1024-57-3	6.85E-03	1.50E-07	2.10E-08	4.00E-11	--	1.70E-07	1.00E-09	1.45E-10	2.73E-13	--	1.15E-09	0.00%
18	^{238}U	7440-61-1(+D)	2.80E-01	6.00E-09	NAP	2.4E-11	6.20E-09	1.20E-08	1.69E-09	--	6.8E-12	1.75E-09	3.45E-09	0.00%
18	bis(2-Ethylhexyl) phthalate	117-81-7	1.86E+00	2.30E-10	1.20E-10	--	--	3.50E-10	4.19E-10	2.30E-10	--	--	6.49E-10	0.00%
								Total ILCR	**8.89E-06**	**1.17E-06**	8.28E-12	1.75E-09	**1.01E-05**	100%
19	Tritium	10028-17-8	4.86E+00	2.66E-12	NAP	1.46E-16	--	2.66E-12	1.29E-11	--	7.09E-16	--	1.29E-11	0.1%
19	^{238}U	7440-61-1(+D)	1.10E+00	6.04E-09	NAP	2.43E-11	6.24E-09	1.23E-08	6.65E-09	--	2.67E-11	6.86E-09	1.35E-08	99.9%
								Total ILCR	6.66E-09	--	2.67E-11	6.86E-09	1.35E-08	100.0%
22	RDX	121-82-4	3.20E+01	1.80E-09	1.80E-10	--	--	2.00E-09	5.66E-08	5.90E-09	--	--	6.25E-08	100.00%
22	Barium	7440-39-3	1.50E+03	--	--	--	--	--	--	--	--	--	--	--
22	^{238}U	7440-61-1(+D)	5.29E+00	6.04E-09	NAP	2.43E-11	6.24E-09	1.23E-08	3.20E-08	--	1.28E-10	3.30E-08	6.51E-08	51.0%
								Total Cancer	8.86E-08	5.90E-09	--	3.30E-08	1.3E-07	100.0%
23	TATB	3058-38-6	7.67E+02	4.80E-10	1.00E-10	--	--	5.80E-10	3.70E-07	7.72E-08	--	--	4.48E-07	93.5%
23	HMX	2691-41-0	8.09E+01	--	--	--	--	--	--	--	--	--	--	--
23	RDX	121-82-4	7.77E+00	1.80E-09	1.80E-10	--	--	2.00E-09	1.38E-08	1.43E-09	--	--	1.52E-08	3.2%
23	Mercury	7439-97-6	1.70E+00	--	--	--	--	--	--	--	--	--	--	--
23	^{238}U	7440-61-1(+D)	3.21E-01	6.04E-09	NAP	2.43E-11	6.24E-09	1.23E-08	1.94E-09	--	7.80E-12	2.00E-09	3.96E-09	0.8%
23	Benzo(a)pyrene	50-32-8	8.80E-02	1.20E-07	1.80E-08	1.30E-11	--	1.40E-07	1.03E-08	1.57E-09	1.19E-12	--	1.19E-08	2.5%
								Total Cancer	3.96E-07	8.02E-08	8.99E-12	2.00E-09	4.79E-07	100.0%
28	Barium	7440-39-3	1.10E+03	--	--	--	--	--	--	--	--	--	--	--
28	Tritium	10028-17-8	3.60E+00	2.66E-12	NAP	1.46E-16	--	2.66E-12	9.58E-12	--	5.25E-16	--	9.59E-12	0.1%

Table A-13. Construction/Excavation Worker Cancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URVc	Dermal URVc	Inhalation URVc	External URVc	Total URVc	ILCR Ingestion	ILCR Dermal	ILCR Inhalation	ILCR External	ILCR	Percent Total
28	^{238}U	7440-61-1(+D)	1.40E+00	6.04E-09	NAP	2.43E-11	6.24E-09	1.23E-08	8.46E-09	--	3.40E-11	8.73E-09	1.72E-08	99.9%
								Total Cancer	8.47E-09	--	3.40E-11	8. 73E-09	1.72E-08	100.0%
18a	1,3-Dinitrobenzene	99-65-0	2.20E+00	--	--	--	NAP	--	--	--	--	--	--	--
18a	2,4-Dinitrotoluene	121-14-2	1.10E+00	1.09E-08	1.34E-09	--	NAP	1.23E-08	1.2E-08	1.5E-09	--	--	1.4E-08	0.2%
18a	2-Amino-4,6-Dinitrotoluene	35572-78-2	3.67E+00	1.61E-10	3.35E-11	--	NAP	1.94E-10	5.9E-10	1.2E-10	--	--	7.1E-10	0.01%
18a	4-Amino-2,6-Dinitrotoluene	19406-51-0	1.27E+01	1.61E-10	3.35E-11	--	NAP	1.94E-10	2.0E-09	4.2E-10	--	--	2.5E-09	0.03%
18a	HMX	2691-41-0	5.89E+02	--	--	--	NAP	--	--	--	--	--	--	--
18a	Nitrobenzene	98-95-3	6.60E+00	--	--	--	NAP	--	--	--	--	--	--	--
18a	RDX	121-82-4	2.63E+03	1.77E-09	1.84E-10	--	NAP	1.95E-09	**4.7E-06**	4.8E-07	--	--	**5.1E-06**	57.1%
18a	TNT	118-96-7	6.70E+03	4.83E-10	8.38E-11	--	NAP	5.67E-10	**3.2E-06**	5.6E-07	--	--	**3.8E-06**	42.2%
18a	Barium	7440-39-3	1.42E+04	--	--	--	NAP	--	--	--	--	--	--	--
18a	Mercury	7439-97-6	8.82E-02	--	--	--	NAP	--	--	--	--	--	--	--
18a	Aldrin	309-00-2	1.18E-02	2.74E-07	5.70E-08	7.52E-11	NAP	3.31E-07	3.2E-09	6.7E-10	8.9E-13	--	3.9E-09	0.04%
18a	Alpha BHC	319-84-6	2.42E-02	1.01E-07	4.36E-09	2.76E-11	NAP	1.06E-07	2.5E-09	1.1E-10	6.7E-13	--	2.6E-09	0.03%
18a	Beta BHC	319-85-7	2.89E-02	2.90E-08	1.33E-09	8.13E-12	NAP	3.03E-08	8.4E-10	3.8E-11	2.3E-13	--	8.8E-10	0.01%
18a	Dieldrin	60-57-1	1.71E-02	2.57E-07	5.36E-08	7.06E-11	NAP	3.11E-07	4.4E-09	9.2E-10	1.2E-12	--	5.3E-09	0.1%
18a	Heptachlor Epoxide	1024-57-3	1.57E-02	1.46E-07	2.12E-08	3.99E-11	NAP	1.68E-07	2.3E-09	3.3E-10	6.3E-13	--	2.6E-09	0.03%
18a	Uranium-235	15117-96-1(+D)	1.54E-02	4.69E-09	NAP	2.62E-11	2.97E-08	3.44E-08	7.2E-11	--	4.0E-13	4.6E-10	5.3E-10	0.01%
18a	Uranium-238	7440-61-1(+D)	2.34E+00	6.04E-09	NAP	2.43E-11	6.24E-09	1.23E-08	1.4E-08	--	5.7E-11	1.5E-08	2.9E-08	0.3%
18a	Acetone	67-64-1	1.98E+01	--	--	--	NAP	--	--	--	--	--	--	--
								Total ILCR	**7.9E-06**	**1.1E-06**	6.1E-11	1.5E-08	**9.0E-06**	100.0%

COPC – Contaminant of potential concern
CAS -Chemical Abstract Service
EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.
ILCR - incremental lifetime cancer risk
NAP – not an applicable pathway
URV_c - cancer unit risk value
-- no data available

Table A-14. Construction/Excavation Worker Noncancer Risk Characterization by Pathway

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_{nc}	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent Total
7	Barium	7440-39-3	4.48E+03	7.00E-05	1.00E-05	9.30E-06	9.00E-05	3.10E-01	4.70E-02	4.20E-02	4.00E-01	64.80%
7	Cadmium	7440-43-9	2.33E+00	4.90E-03	2.00E-04	--	5.10E-03	1.10E-02	4.80E-04	--	1.20E-02	1.90%
7	Copper	7440-50-8	5.19E+02	1.20E-04	2.20E-06	4.70E-06	1.30E-04	6.40E-02	1.20E-03	2.40E-03	6.70E-02	10.80%
7	Mercury	7439-97-6	4.30E-01	1.60E-02	2.40E-03	1.60E-05	1.90E-02	7.00E-03	1.00E-03	6.70E-06	8.10E-03	1.30%
7	Silver	7440-22-4	7.72E+01	9.80E-04	2.60E-04	4.70E-04	1.70E-03	7.60E-02	2.00E-02	3.60E-02	1.30E-01	21.20%
7	^{238}U	7440-61-1(+D)	9.00E-01	--	--	--	--	--	--	--	--	--
7	Benzo(a)anthracene	56-55-3	3.18E+00	--	--	--	--	--	--	--	--	--
7	Benzo(a)pyrene	50-32-8	3.24E+00	--	--	--	--	--	--	--	--	--
7	Benzo(b)fluoranthene	205-99-2	2.88E+00	--	--	--	--	--	--	--	--	--
7	Benzo(k)fluoranthene	207-08-9	2.67E+00	--	--	--	--	--	--	--	--	--
7	Dibenz(a,h)anthracene	53-70-3	7.31E-01	--	--	--	--	--	--	--	--	--
7	Indeno(1,2,3-c,d)pyrene	193-39-5	2.19E+00	--	--	--	--	--	--	--	--	--
							HI	4.70E-01	6.90E-02	8.00E-02	6.20E-01	
8	TATB	3058-38-6	1.20E+01	1.60E-03	3.40E-04	2.30E-06	2.00E-03	2.00E-02	4.10E-03	2.80E-05	2.40E-02	1.10%
8	2,6-Dinitrotoluene	606-20-2	2.05E-01	4.90E-03	6.00E-04	3.10E-05	5.50E-03	1.00E-03	1.20E-04	6.40E-06	1.10E-03	0.10%
8	4-Amino-2,6-dinitrotoluene	19406-51-0	9.06E-01	2.90E-02	6.10E-03	4.70E-05	3.60E-02	2.70E-02	5.50E-03	4.20E-05	3.20E-02	1.50%
8	HMX	2691-41-0	1.76E+02	9.80E-05	6.80E-05	1.70E-06	1.70E-04	1.70E-02	1.20E-02	3.00E-04	2.90E-02	1.40%
8	RDX	121-82-4	2.54E+01	1.60E-03	1.70E-04	9.30E-06	1.80E-03	4.10E-02	4.30E-03	2.40E-04	4.60E-02	2.20%
8	TNT	118-96-7	1.25E+02	9.80E-03	1.70E-03	4.70E-05	1.20E-02	**1.20E+00**	2.10E-01	5.80E-03	**1.40E+00**	68.70%
8	Barium	7440-39-3	2.78E+03	7.00E-05	1.00E-05	9.30E-06	9.00E-05	1.90E-01	2.90E-02	2.60E-02	2.50E-01	11.90%
8	Cadmium	7440-43-9	4.08E+00	4.90E-03	2.00E-04	--	5.10E-03	2.00E-02	8.30E-04	--	2.10E-02	1.00%
8	Copper	7440-50-8	2.80E+02	1.20E-04	2.20E-06	4.70E-06	1.30E-04	3.40E-02	6.30E-04	1.30E-03	3.60E-02	1.70%
8	Lead	7439-92-1	4.70E+01	--	--	--	--	--	--	--	--	--
8	Manganese	7439-96-5	5.59E+02	3.50E-05	6.10E-06	9.30E-05	1.30E-04	2.00E-02	3.40E-03	5.20E-02	7.50E-02	3.60%
8	Mercury	7439-97-6	1.30E+00	1.60E-02	2.40E-03	1.60E-05	1.90E-02	2.10E-02	3.20E-03	2.00E-05	2.40E-02	1.20%
8	Silver	7440-22-4	1.50E+01	9.80E-04	2.60E-04	4.70E-04	1.70E-03	1.50E-02	3.80E-03	7.00E-03	2.60E-02	1.20%
8	Zinc	7440-66-6	9.29E+02	1.60E-05	8.50E-07	--	1.70E-05	1.50E-02	7.90E-04	--	1.60E-02	0.80%
8	Perchlorate	14797-73-0	1.48E+00	4.90E-02	2.60E-03	--	5.20E-02	7.20E-02	3.80E-03	--	7.60E-02	3.60%
8	^{238}U	7440-61-1(+D)	3.58E+00	--	--	--	--	--	--	--	--	--
8	4-Chlorophenyl phenyl ether	7005-72-3	4.50E-01	--	--	--	--	--	--	--	--	--
8	Benzo(a)pyrene	50-32-8	8.80E-02	--	--	--	--	--	--	--	--	--
							HI	**1.70E+00**	2.80E-01	9.30E-02	**2.10E+00**	
9	TATB	3058-38-6	8.99E+01	1.60E-03	3.40E-04	2.30E-06	2.00E-03	1.50E-01	3.10E-02	2.10E-04	1.80E-01	97.80%
9	RDX	121-82-4	2.23E+00	1.60E-03	1.70E-04	9.30E-06	1.80E-03	3.60E-03	3.80E-04	2.10E-05	4.00E-03	2.20%
							HI	1.50E-01	3.10E-02	2.30E-04	1.80E-01	

Table A-14. Construction/Excavation Worker Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URVnc	Dermal URVnc	Inhalation URVnc	Total URVnc	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent Total
12	1,3-Dinitrobenzene	99-65-0	1.94E-01	4.90E-02	7.80E-03	4.70E-06	5.70E-02	9.50E-03	1.50E-03	9.10E-07	1.10E-02	40.70%
12	2,4-Dinitrotoluene	121-14-2	2.01E-01	2.40E-03	3.00E-04	3.10E-05	2.80E-03	4.90E-04	6.00E-05	6.30E-06	5.60E-04	2.10%
12	2,6-Dinitrotoluene	606-20-2	1.90E-01	4.90E-03	6.00E-04	3.10E-05	5.50E-03	9.30E-04	1.10E-04	5.90E-06	1.10E-03	3.90%
12	RDX	121-82-4	4.62E+01	1.60E-03	1.70E-04	9.30E-06	1.80E-03	7.50E-02	7.90E-03	4.30E-04	8.40E-02	308.50%
12	TNT	118-96-7	1.35E+02	9.80E-03	1.70E-03	4.70E-05	1.20E-02	1.30E+00	2.30E-01	6.30E-03	**1.60E+00**	5742.30%
12	Barium	7440-39-3	1.18E+04	7.00E-05	1.00E-05	9.30E-06	9.00E-05	8.30E-01	1.20E-01	1.10E-01	**1.10E+00**	3901.20%
12	Cadmium	7440-43-9	7.10E-01	4.90E-03	2.00E-04	--	5.10E-03	3.50E-03	1.40E-04	--	3.60E-03	13.30%
12	Nickel	7440-02-0	4.92E+01	2.40E-04	6.40E-05	5.20E-05	3.60E-04	1.20E-02	3.10E-03	2.60E-03	1.80E-02	65.40%
12	Dieldrin	60-57-1	2.98E-02	9.80E-02	2.00E-02	--	1.20E-01	2.90E-03	6.10E-04	--	3.50E-03	13.00%
12	^{238}U	7440-61-1(+D)	3.29E+00	--	--	--	--	--	--	--	--	--
12	Acetone	67-64-1	2.77E+01	5.40E-06	0.00E+00	9.70E-04	9.80E-04	1.50E-04	--	2.70E-02	2.70E-02	100.00%
							HI	**2.30E+00**	3.70E-01	1.50E-01	**2.80E+00**	
13	HMX	2691-41-0	8.83E+02	9.80E-05	6.80E-05	1.70E-06	1.70E-04	8.60E-02	6.00E-02	1.50E-03	1.50E-01	0.30%
13	RDX	121-82-4	1.24E+03	1.60E-03	1.70E-04	9.30E-06	1.80E-03	**2.00E+00**	2.10E-01	1.20E-02	**2.20E+00**	5.30%
13	TNT	118-96-7	3.40E+03	9.80E-03	1.70E-03	4.70E-05	1.20E-02	**3.30E+01**	**5.80E+00**	1.60E-01	**3.90E+01**	92.70%
13	Barium	7440-39-3	7.93E+03	7.00E-05	1.00E-05	9.30E-06	9.00E-05	5.50E-01	8.30E-02	7.40E-02	7.10E-01	1.70%
13	Cadmium	7440-43-9	6.08E-01	4.90E-03	2.00E-04	--	5.10E-03	3.00E-03	1.20E-04	--	3.10E-03	0.00%
13	Mercury	7439-97-6	1.60E-01	1.60E-02	2.40E-03	1.60E-05	1.90E-02	2.60E-03	3.90E-04	2.50E-06	3.00E-03	0.00%
13	^{238}U	7440-61-1(+D)	4.11E-01	--	--	--	--	--	--	--	--	--
							HI	**3.60E+01**	**6.10E+00**	2.50E-01	**4.20E+01**	
14	RDX	121-82-4	3.29E+00	1.60E-03	1.70E-04	9.30E-06	1.80E-03	5.40E-03	5.60E-04	3.10E-05	6.00E-03	100.00%
							HI	5.40E-03	5.60E-04	3.10E-05	6.00E-03	
17	RDX	121-82-4	2.74E+00	1.60E-03	1.70E-04	9.30E-06	1.80E-03	4.50E-03	4.70E-04	2.60E-05	5.00E-03	4.10%
17	Barium	7440-39-3	5.14E+02	7.00E-05	1.00E-05	9.30E-06	9.00E-05	3.60E-02	5.40E-03	4.80E-03	4.60E-02	38.40%
17	Cadmium	7440-43-9	3.08E+00	4.90E-03	2.00E-04	--	5.10E-03	1.50E-02	6.30E-04	--	1.60E-02	13.10%
17	Mercury	7439-97-6	2.84E+00	1.60E-02	2.40E-03	1.60E-05	1.90E-02	4.60E-02	6.90E-03	4.40E-05	5.30E-02	44.30%
17	^{238}U	7440-61-1(+D)	2.17E+00	--	--	--	--	--	--	--	--	--
							HI	1.00E-01	1.30E-02	4.90E-03	1.20E-01	
18	TATB	3058-38-6	4.81E+00	1.60E-03	3.40E-04	2.30E-06	2.00E-03	7.90E-03	1.60E-03	1.10E-05	9.50E-03	0.00%
18	2,4-Dinitrotoluene	121-14-2	1.10E+00	2.40E-03	3.00E-04	3.10E-05	2.80E-03	2.70E-03	3.30E-04	3.40E-05	3.10E-03	0.00%
18	2-Amino-4,6-dinitrotoluene	35572-78-2	9.13E+00	2.90E-02	6.10E-03	4.70E-05	3.60E-02	2.70E-01	5.60E-02	4.30E-04	3.20E-01	0.40%
18	4-Amino-2,6-dinitrotoluene	19406-51-0	2.21E+00	2.90E-02	6.10E-03	4.70E-05	3.60E-02	6.50E-02	1.40E-02	1.00E-04	7.80E-02	0.10%
18	HMX	2691-41-0	1.29E+02	9.80E-05	6.80E-05	1.70E-06	1.70E-04	1.30E-02	8.80E-03	2.20E-04	2.20E-02	0.00%
18	Nitrobenzene	98-95-3	3.45E+00	9.80E-03	1.10E-03	9.30E-07	1.10E-02	3.40E-02	3.60E-03	3.20E-06	3.70E-02	0.00%
18	RDX	121-82-4	3.03E+03	1.60E-03	1.70E-04	9.30E-06	1.80E-03	**5.00E+00**	5.20E-01	2.80E-02	**5.50E+00**	6.10%
18	TNT	118-96-7	7.25E+03	9.80E-03	1.70E-03	4.70E-05	1.20E-02	**7.10E+01**	**1.20E+01**	3.40E-01	**8.40E+01**	92.80%

Table A-14. Construction/Excavation Worker Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URVnc	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent Total
18	Barium	7440-39-3	5.64E+03	7.00E-05	1.00E-05	9.30E-06	9.00E-05	3.90E-01	5.90E-02	5.30E-02	5.10E-01	0.60%
18	Aldrin	309-00-2	5.03E-03	1.60E-01	3.40E-02	--	2.00E-01	8.20E-04	1.70E-04	--	9.90E-04	0.00%
18	Alpha BHC	319-84-6	2.25E-02	6.10E-04	2.60E-05	--	6.40E-04	1.40E-05	5.90E-07	--	1.40E-05	0.00%
18	Beta BHC	319-85-7	2.59E-02	--	--	--	--	--	--	--	--	--
18	Heptachlor epoxide	1024-57-3	6.85E-03	3.80E-01	5.50E-02	--	4.30E-01	2.60E-03	3.70E-04	--	3.00E-03	0.00%
18	^{238}U	7440-61-1(+D)	2.80E-01	--	--	--	--	--	--	--	--	--
18	bis(2-Ethylhexyl) phthalate	117-81-7	1.86E+00	2.40E-04	1.30E-04	--	3.80E-04	4.60E-04	2.50E-04	--	7.10E-04	0.00%
							HI	**7.70E+01**	**1.30E+01**	4.20E-01	**9.00E+01**	
22	RDX	121-82-4	3.20E+01	1.60E-03	1.70E-04	9.30E-06	1.80E-03	5.20E-02	5.40E-03	3.00E-04	5.80E-02	30.10%
22	Barium	7440-39-3	1.50E+03	7.00E-05	1.00E-05	9.30E-06	9.00E-05	1.00E-01	1.60E-02	1.40E-02	1.30E-01	69.90%
22	^{238}U	7440-61-1(+D)	5.29E+00	--	--	--	--	--	--	--	--	--
							HI	1.60E-01	2.10E-02	1.40E-02	1.90E-01	
23	TATB	3058-38-6	7.67E+02	1.60E-03	3.40E-04	2.30E-06	2.00E-03	**1.30E+00**	2.60E-01	1.80E-03	**1.50E+00**	96.20%
23	HMX	2691-41-0	8.09E+01	9.80E-05	6.80E-05	1.70E-06	1.70E-04	7.90E-03	5.50E-03	1.40E-04	1.40E-02	0.90%
23	RDX	121-82-4	7.77E+00	1.60E-03	1.70E-04	9.30E-06	1.80E-03	1.30E-02	1.30E-03	7.30E-05	1.40E-02	0.90%
23	Mercury	7439-97-6	1.70E+00	1.60E-02	2.40E-03	1.60E-05	1.90E-02	2.80E-02	4.10E-03	2.60E-05	3.20E-02	2.00%
23	Benzo(a)pyrene	50-32-8	8.80E-02	--	--	--	--	--	--	--	--	--
							HI	**1.30E+00**	2.70E-01	2.00E-03	**1.60E+00**	
28	Barium	7440-39-3	1.10E+03	7.00E-05	1.00E-05	9.30E-06	9.00E-05	7.70E-02	1.10E-02	1.00E-02	9.90E-02	100.00%
28	^{238}U	7440-61-1(+D)	1.30E+00	--	--	--	--	--	--	--	--	--
							HI	7.70E-02	1.10E-02	1.00E-02	9.90E-02	
18a	1,3-Dinitrobenzene	99-65-0	2.20E+00	4.90E-02	7.85E-03	4.67E-06	5.68E-02	1.1E-01	1.7E-02	1.0E-05	1.3E-01	0.1%
18a	2,4-Dinitrotoluene	121-14-2	1.10E+00	2.45E-03	3.00E-04	3.11E-05	2.78E-03	2.7E-03	3.3E-04	3.4E-05	3.1E-03	0.004%
18a	2-Amino-4,6-Dinitrotoluene	35572-78-2	3.67E+00	2.94E-02	6.12E-03	4.67E-05	3.56E-02	1.1E-01	2.2E-02	1.7E-04	1.3E-01	0.2%
18a	4-Amino-2,6-Dinitrotoluene	19406-51-0	1.27E+01	2.94E-02	6.12E-03	4.67E-05	3.56E-02	3.7E-01	7.7E-02	5.9E-04	4.5E-01	0.5%
18a	HMX	2691-41-0	5.89E+02	9.80E-05	6.80E-05	1.73E-06	1.68E-04	5.8E-02	4.0E-02	1.0E-03	9.9E-02	0.1%
18a	Nitrobenzene	98-95-3	6.60E+00	9.80E-03	1.05E-03	9.34E-07	1.08E-02	6.5E-02	6.9E-03	6.2E-06	7.2E-02	0.1%
18a	RDX	121-82-4	2.63E+03	1.63E-03	1.70E-04	9.34E-06	1.81E-03	**4.3E+00**	4.5E-01	2.5E-02	**4.8E+00**	5.6%
18a	TNT	118-96-7	6.70E+03	9.80E-03	1.70E-03	4.67E-05	1.15E-02	**6.6E+01**	**1.1E+01**	3.1E-01	**7.7E+01**	91.8%
18a	Barium	7440-39-3	1.42E+04	7.00E-05	1.04E-05	9.34E-06	8.97E-05	9.9E-01	1.5E-01	1.3E-01	**1.3E+00**	1.5%
18a	Mercury	7439-97-6	8.82E-02	1.63E-02	2.43E-03	1.56E-05	1.88E-02	1.4E-03	2.1E-04	1.4E-06	1.7E-03	0.002%
18a	Aldrin	309-00-2	1.18E-02	1.63E-01	3.40E-02	--	1.97E-01	1.9E-03	4.0E-04	--	2.3E-03	0.003%

Table A-14. Construction/Excavation Worker Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URVnc	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent Total
18a	Alpha BHC	319-84-6	2.42E-02	6.12E-04	2.63E-05	--	6.39E-04	1.5E-05	6.4E-07	--	1.5E-05	0.00002%
18a	Beta BHC	319-85-7	2.89E-02	--	--	--	--	--	--	--	--	--
18a	Dieldrin	60-57-1	1.71E-02	9.80E-02	2.04E-02	--	1.18E-01	1.7E-03	3.5E-04	--	2.0E-03	0.002%
18a	Heptachlor Epoxide	1024-57-3	1.57E-02	3.77E-01	5.45E-02	--	4.31E-01	5.9E-03	8.6E-04	--	6.8E-03	0.008%
18a	Uranium-235	15117-96-1(+D)	1.54E-02	--	--	--	--	--	--	--	--	--
18a	Uranium-238	7440-61-1(+D)	2.34E+00	--	--	--	--	--	--	--	--	--
18a	Acetone	67-64-1	1.98E+01	5.44E-06	--	9.74E-04	9.80E-04	1.1E-04	--	1.9E-02	1.9E-02	0.02%
							HI	**7.2E+01**	**1.2E+01**	4.9E-01	**8.4E+01**	100.0%

COPC – Contaminant of potential concern
CAS -Chemical Abstract Service
URV $_{nc}$- noncancer unit risk value
HQ - hazard quotient
HI - hazard index
EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.
-- no data available

Table A-15. Offsite Resident Farmer Cancer Risk Characterization by Pathway

Grid Cell	COPC	CAS No.	Inhalation, Air URV_c	External, Air URV_c	Ingestion Root Vegetable, Air Deposition to Plant URV_c	Ingestion Other Vegetable, Air Deposition to Plant URV_c	Ingestion Meat, Air Deposition to Plant URV_c	Ingestion Milk, Air Deposition to Plant URV_c	Inhalation, Air Deposition to Soil URV_c	Ingestion, Air Deposition to Soil URV_c	Dermal, Air Deposition to Soil URV_c	External, Air Deposition to Soil URV_c	Ingestion Root Vegetable, Air Deposition to Soil URV_c	Ingestion Other Vegetable, Air Deposition to Soil URV_c	Ingestion Beef, Air Deposition to Soil URV_c	Ingestion Milk, Air Deposition to Soil URV_c
7	Mercury	7439-97-6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7	^{238}U	7440-61-1(D+)	2.6E-03	7.4E-12	9.80E-08	2.90E-07	1.10E-15	8.70E-09	2.7E-13	5.4E-12	--	4.7E-11	4.40E-14	4.80E-14	2.30E-10	7.70E-10
8	RDX	121-82-4	--	--	6.20E-05	1.80E-04	2.90E-10	1.30E-09	--	3.10E-09	1.90E-09	--	7.90E-08	1.10E-07	9.50E-13	2.50E-12
8	Mercury	7439-97-6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8	^{3}H	10028-17-8	1.57E-08	--	5.28E-11	1.57E-10	--	1.75E-10	1.64E-18	2.39E-15	--	--	--	--	--	1.55E-11
8	^{238}U	7440-61-1(D+)	2.6E-03	7.4E-12	9.80E-08	2.90E-07	1.1E-15	8.7E-09	2.7E-13	5.40E-12	--	4.7E-11	4.4E-14	4.8E-14	2.3E-10	7.7E-10
9	TATB	3058-38-6	--	--	1.70E-05	5.00E-05	5.30E-11	2.30E-10	--	8.50E-10	1.00E-09	--	2.70E-07	3.90E-08	2.20E-12	5.80E-12
12	2,4-Dinitrotoluene	121-14-2	--	--	3.80E-04	1.10E-03	3.60E-08	1.60E-07	--	1.90E-08	1.40E-08	--	1.40E-06	1.20E-07	3.40E-10	9.10E-10
12	RDX	121-82-4	--	--	6.20E-05	1.80E-04	2.90E-10	1.30E-09	--	3.10E-09	1.90E-09	--	7.90E-08	1.10E-07	9.50E-13	2.50E-12
12	TNT	118-96-7	--	--	1.70E-05	5.00E-05	1.00E-09	4.50E-09	--	8.50E-10	8.60E-10	--	8.70E-09	6.90E-09	1.40E-12	3.70E-12
12	Barium	7440-39-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12	^{238}U	7440-61-1(D+)	2.6E-03	7.4E-12	9.80E-08	2.90E-07	1.1E-15	8.7E-09	2.7E-13	5.40E-12	--	4.7E-11	4.4E-14	4.8E-14	2.3E-10	7.7E-10
13	HMX	2691-41-0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13	RDX	121-82-4	--	--	6.20E-05	1.80E-04	2.90E-10	1.30E-09	--	3.10E-09	1.90E-09	--	7.90E-08	1.10E-07	9.50E-13	2.50E-12
13	TNT	118-96-7	--	--	1.70E-05	5.00E-05	1.00E-09	4.50E-09	--	8.50E-10	8.60E-10	--	8.70E-09	6.90E-09	1.40E-12	3.70E-12
13	Barium	7440-39-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13	Cadmium	7440-43-9	9.90E-01	--	--	--	--	--	1.00E-10	--	--	--	--	--	--	--
13	Mercury	7439-97-6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13	^{238}U	7440-61-1(D+)	2.6E-03	7.4E-12	9.80E-08	2.90E-07	1.1E-15	8.7E-09	2.7E-13	5.40E-12	--	4.7E-11	4.4E-14	4.8E-14	2.3E-10	7.7E-10
14	RDX	121-82-4	--	--	6.20E-05	1.80E-04	2.90E-10	1.30E-09	--	3.10E-09	1.90E-09	--	7.90E-08	1.10E-07	9.50E-13	2.50E-12
17	RDX	121-82-4	--	--	6.20E-05	1.80E-04	2.90E-10	1.30E-09	--	3.10E-09	1.90E-09	--	7.90E-08	1.10E-07	9.50E-13	2.50E-12
17	Barium	7440-39-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17	Cadmium	7440-43-9	9.90E-01	--	--	--	--	--	1.00E-10	--	--	--	--	--	--	--
17	Mercury	7439-97-6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17	^{3}H	10028-17-8	1.57E-08	--	5.28E-11	1.57E-10	--	1.75E-10	1.64E-18	2.39E-15	--	--	--	--	--	1.55E-11
17	^{234}U	13966-29-5	3.19E-03	1.96E-11	7.75E-08	2.31E-07	8.43E-16	6.83E-09	1.67E-17	4.07E-12	--	1.56E-06	3.44E-14	3.76E-14	1.80E-10	6.07E-10
17	^{238}U	7440-61-1(D+)	2.6E-03	7.4E-12	9.80E-08	2.90E-07	1.1E-15	8.7E-09	2.7E-13	5.40E-12	--	4.7E-11	4.4E-14	4.8E-14	2.3E-10	7.7E-10
18	TATB	3058-38-6	--	--	1.70E-05	5.00E-05	5.30E-11	2.30E-10	--	8.50E-10	1.00E-09	--	2.70E-07	3.90E-08	2.20E-12	5.80E-12
18	2,4-Dinitrotoluene	121-14-2	--	--	3.80E-04	1.10E-03	3.60E-08	1.60E-07	--	1.90E-08	1.40E-08	--	1.40E-06	1.20E-07	3.40E-10	9.10E-10
18	2-Amino-4,6-Dinitrotoluene	35572-78-2	--	--	5.60E-06	1.70E-05	2.20E-09	9.70E-09	--	2.80E-10	3.40E-10	--	4.30E-09	7.90E-10	4.40E-12	1.20E-11
18	4-Amino-2,6-Dinitrotoluene	19406-51-0	--	--	5.60E-06	1.70E-05	1.50E-09	6.40E-09	--	2.80E-10	3.40E-10	--	5.20E-09	1.00E-09	3.50E-12	9.20E-12
18	HMX	2691-41-0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
18	Nitrobenzene	98-95-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
18	RDX	121-82-4	--	--	6.20E-05	1.80E-04	2.90E-10	1.30E-09	--	3.10E-09	1.90E-09	--	7.90E-08	1.10E-07	9.50E-13	2.50E-12
18	TNT	118-96-7	--	--	1.70E-05	5.00E-05	1.00E-09	4.50E-09	--	8.50E-10	8.60E-10	--	8.70E-09	6.90E-09	1.40E-12	3.70E-12
18	Barium	7440-39-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
18	Aldrin	309-00-2	2.70E+00	--	9.60E-03	2.80E-02	3.40E-02	1.50E-01	2.80E-10	4.80E-07	5.90E-07	--	8.00E-05	7.00E-09	7.20E-04	1.90E-03
18	Alpha BHC	319-84-6	9.90E-01	--	3.50E-03	1.10E-02	4.00E-05	1.80E-04	1.00E-10	1.80E-07	4.50E-08	--	1.30E-05	7.20E-08	3.90E-07	1.00E-06
18	Beta BHC	319-85-7	2.90E-01	--	1.00E-03	3.00E-03	1.10E-05	5.00E-05	3.00E-11	5.10E-08	1.40E-08	--	3.60E-06	2.00E-08	1.10E-07	2.80E-07
18	Heptachlor Epoxide	1024-57-3	1.40E+00	--	5.10E-03	1.50E-02	2.60E-04	1.10E-03	1.50E-10	2.60E-07	2.20E-07	--	1.10E-05	4.40E-08	1.40E-06	3.70E-06

Table A 15. Offsite Resident Farmer Cancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	Air Concentration (mg/m3)	Air Deposition (mg/m^2-day)	Inhalation, Air ILCR	External, Air ILCR	Ingestion Root Vegetable, Air Deposition to Plant ILCR	Ingestion Other Vegetable, Air Deposition to Plant ILCR	Ingestion Meat, Air Deposition to Plant ILCR	Ingestion Milk, Air Deposition to Plant ILCR	Inhalation, Air Deposition to Soil ILCR	Ingestion, Air Deposition to Soil ILCR	Dermal, Air Deposition to Soil ILCR	External, Air Deposition to Soil ILCR	Ingestion Root Vegetable, Air Deposition to Soil ILCR	Ingestion Other Vegetable, Air Deposition to Soil ILCR	Ingestion Beef, Air Deposition to Soil LCR	Ingestion Milk, Air Deposition to Soil ILCR	Total Cancer Risk
7	Mercury	7439-97-6	1.00E-09	2.60E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
7	^{238}U	7440-61-1(D+)	7.80E-07	2.00E-09	2.0E-09	5.8E-18	7.6E-14	2.3E-13	8.3E-22	6.7E-15	5.4E-22	1.1E-20	--	9.2E-20	8.60E-23	9.40E-23	4.5E-19	1.5E-18	
				Total ILCR	2.0E-09	5.8E-18	7.6E-14	2.3E-13	8.3E-22	6.7E-15	5.4E-22	1.1E-20	--	9.2E-20	8.60E-23	9.40E-23	4.5E-19	1.5E-18	2.0E-09
8	RDX	121-82-4	6.00E-10	1.50E-06	--	--	3.70E-14	1.10E-13	1.70E-19	7.60E-19	--	4.80E-15	2.90E-15	--	1.20E-13	1.70E-13	1.50E-18	3.90E-18	
8	Mercury	7439-97-6	2.40E-09	6.00E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
8	^{3}H	10028-17-8	2.81E-07	4.92E-09	4.4E-15	--	1.5E-17	4.4E-17	--	4.9E-17	8.1E-27	1.2E-23	--	--	--	--	--	7.6E-20	
8	^{238}U	7440-61-1(D+)	1.02E-06	2.59E-09	2.7E-09	7.6E-18	1.0E-13	3.0E-13	1.1E-21	8.8E-15	7.1E-22	1.4E-20	--	1.2E-19	1.1E-22	1.2E-22	5.9E-19	2.0E-18	
				Total ILCR	2.7E-09	7.6E-18	1.4E-13	4.1E-13	1.7E-19	8.9E-15	7.1E-22	4.8E-15	2.9E-15	1.2E-19	1.2E-13	1.7E-13	2.0E-18	6.0E-18	2.7E-09
9	TATB	3058-38-6	2.90E-08	7.40E-05	--	--	4.90E-13	1.50E-12	1.50E-18	6.70E-18	--	6.30E-14	7.70E-14	--	2.00E-11	2.90E-12	1.60E-16	4.30E-16	
				Total ILCR	--	--	4.90E-13	1.50E-12	1.50E-18	6.70E-18	--	6.30E-14	7.70E-14	--	2.00E-11	2.90E-12	1.60E-16	4.30E-16	2.5E-11
12	2,4-Dinitrotoluene	121-14-2	7.2E-11	1.7E-07	--	--	2.80E-14	8.20E-14	2.60E-18	1.10E-17	--	3.30E-15	2.30E-15	--	2.40E-13	2.10E-14	5.80E-17	1.50E-16	
12	RDX	121-82-4	3.0E-08	7.1E-05	--	--	1.90E-12	5.50E-12	8.60E-18	3.80E-17	--	2.20E-13	1.30E-13	--	5.60E-12	8.00E-12	6.70E-17	1.80E-16	
12	TNT	118-96-7	1.1E-07	2.5E-04	--	--	1.80E-12	5.40E-12	1.10E-16	4.90E-16	--	2.10E-13	2.20E-13	--	2.20E-12	1.70E-12	3.50E-16	9.30E-16	
12	Barium	7440-39-3	1.4E-05	3.2E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
12	^{238}U	7440-61-1(D+)	2.3E-06	5.4E-09	6.0E-09	1.7E-17	2.3E-13	6.7E-13	2.5E-21	2.0E-14	1.5E-21	2.9E-20	--	2.5E-19	2.4E-22	2.6E-22	1.2E-18	4.2E-18	
				Total ILCR	6.0E-09	1.7E-17	3.9E-12	1.2E-11	1.2E-16	2.0E-14	1.5E-21	4.4E-13	3.5E-13	2.5E-19	8.0E-12	9.8E-12	4.7E-16	1.3E-15	6.1E-09
13	HMX	2691-41-0	7.80E-09	1.80E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
13	RDX	121-82-4	1.80E-06	4.20E-03	--	--	1.10E-10	3.30E-10	5.10E-16	2.20E-15	--	1.30E-11	7.90E-12	--	3.30E-10	4.70E-10	3.90E-15	1.00E-14	
13	TNT	118-96-7	5.80E-06	1.40E-02	--	--	9.80E-11	2.90E-10	6.00E-15	2.60E-14	--	1.10E-11	1.20E-11	--	1.20E-10	9.40E-11	1.90E-14	5.00E-14	
13	Barium	7440-39-3	1.50E-05	3.60E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
13	Cadmium	7440-43-9	6.60E-10	1.60E-06	6.5E-10	--	--	--	--	--	1.60E-16	--	--	--	--	--	--	--	
13	Mercury	7439-97-6	2.80E-10	6.50E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
13	^{238}U	7440-61-1(D+)	6.50E-07	1.50E-09	1.7E-09	4.8E-18	6.4E-14	1.9E-13	6.9E-22	5.6E-15	4.2E-22	8.2E-21	--	7.1E-20	6.6E-23	7.2E-23	3.5E-19	1.2E-18	
				Total ILCR	2.40E-09	4.8E-18	2.10E-10	6.20E-10	6.50E-15	3.40E-14	1.60E-16	2.40E-11	2.00E-11	7.1E-20	4.50E-10	5.60E-10	2.30E-14	6.00E-14	4.2E-09
14	RDX	121-82-4	1.80E-09	4.20E-06	--	--	1.10E-13	3.30E-13	5.20E-19	2.30E-18	--	1.30E-14	7.90E-15	--	3.30E-13	4.70E-13	4.00E-18	1.10E-17	
				Totals	--	--	1.10E-13	3.30E-13	5.20E-19	2.30E-18	0.00E+00	1.30E-14	7.90E-15	--	3.30E-13	4.70E-13	4.00E-18	1.10E-17	1.3E-12
17	RDX	121-82-4	4.60E-10	9.90E-07	--	--	2.80E-14	8.40E-14	1.30E-19	5.70E-19	--	3.10E-15	1.90E-15	--	7.90E-14	1.10E-13	9.40E-19	2.50E-18	
17	Barium	7440-39-3	1.50E-07	3.20E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
17	Cadmium	7440-43-9	1.10E-09	2.50E-06	1.10E-09	--	--	--	--	--	2.50E-16	--	--	--	--	--	--	--	
17	Mercury	7439-97-6	1.20E-09	2.60E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
17	^{3}H	10028-17-8	4.00E-07	8.73E-10	6.3E-15	--	2.1E-17	6.3E-17	--	7.0E-17	1.4E-27	2.1E-24	--	--	--	--	--	1.4E-20	
17	^{234}U	13966-29-5	4.44E-06	9.68E-09	1.4E-08	8.7E-17	3.4E-13	1.0E-12	3.7E-21	3.0E-14	1.6E-25	3.9E-20	--	1.5E-14	3.3E-22	3.6E-22	1.7E-18	5.9E-18	
17	^{238}U	7440-61-1(D+)	9.51E-07	2.08E-09	2.5E-09	7.1E-18	9.3E-14	2.8E-13	1.0E-21	8.2E-15	5.7E-22	1.1E-20	--	9.7E-20	9.1E-23	9.9E-23	4.7E-19	1.6E-18	
				Total ILCR	1.8E-08	9.4E-17	4.7E-13	1.4E-12	1.4E-19	3.9E-14	2.5E-16	3.1E-15	1.9E-15	1.5E-14	7.9E-14	1.1E-13	3.2E-18	1.0E-17	1.8E-08
18	TATB	3058-38-6	3.40E-09	7.40E-06	--	--	5.70E-14	1.70E-13	1.80E-19	7.90E-19	--	6.20E-15	7.60E-15	--	2.00E-12	2.90E-13	1.60E-17	4.30E-17	
18	2,4-Dinitrotoluene	121-14-2	7.10E-10	1.50E-06	--	--	2.70E-13	8.00E-13	2.50E-17	1.10E-16	--	2.90E-14	2.10E-14	--	2.20E-12	1.90E-13	5.20E-16	1.40E-15	
18	2-Amino-4,6-Dinitrotoluene	35572-78-2	1.80E-08	3.80E-05	--	--	9.90E-14	2.90E-13	3.90E-17	1.70E-16	--	1.10E-14	1.30E-14	--	1.60E-13	3.00E-14	1.70E-16	4.50E-16	
18	4-Amino-2,6-Dinitrotoluene	19406-51-0	6.20E-09	1.40E-05	--	--	3.50E-14	1.00E-13	9.10E-18	4.00E-17	--	3.80E-15	4.70E-15	--	7.00E-14	1.40E-14	4.70E-17	1.20E-16	
18	HMX	2691-41-0	7.00E-09	1.50E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
18	Nitrobenzene	98-95-3	4.70E-09	1.00E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
18	RDX	121-82-4	4.50E-05	9.70E-02	--	--	2.80E-09	8.20E-09	1.30E-14	5.60E-14	--	3.00E-10	1.80E-10	--	7.60E-09	1.10E-08	9.20E-14	2.40E-13	
18	TNT	118-96-7	2.10E-05	4.50E-02	--	--	3.50E-10	1.00E-09	2.10E-14	9.30E-14	--	3.80E-11	3.80E-11	--	3.90E-10	3.10E-10	6.20E-14	1.60E-13	
18	Barium	7440-39-3	2.00E-05	4.80E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
18	Aldrin	309-00-2	1.60E-11	3.40E-08	4.20E-11	--	1.50E-13	4.40E-13	5.20E-13	2.30E-12	9.40E-18	1.60E-14	2.00E-14	--	2.70E-12	2.40E-16	2.40E-11	6.50E-11	
18	Alpha BHC	319-84-6	8.50E-11	1.80E-07	8.40E-11	--	3.00E-13	8.90E-13	3.40E-15	1.50E-14	1.90E-17	3.30E-14	8.20E-15	--	2.40E-12	1.30E-14	7.10E-14	1.90E-13	
18	Beta BHC	319-85-7	9.80E-11	2.10E-07	2.80E-11	--	9.90E-14	2.90E-13	1.10E-15	4.90E-15	6.50E-18	1.10E-14	2.90E-15	--	7.60E-13	4.40E-15	2.20E-14	6.00E-14	
18	Heptachlor Epoxide	1024-57-3	2.30E-11	5.00E-08	3.30E-11	--	1.20E-13	3.50E-13	5.90E-15	2.60E-14	7.40E-18	1.30E-14	1.10E-14	--	5.40E-13	2.20E-15	7.00E-14	1.90E-13	
				Total ILCR	1.90E-10	--	3.10E-09	9.20E-09	5.60E-13	2.50E-12	4.20E-17	3.40E-10	2.20E-10	--	8.00E-09	1.10E-08	2.50E-11	6.50E-11	3.2E-08

Table A 15. Offsite Resident Farmer Cancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	Air Concentration (mg/m3)	Air Deposition (mg/m^2-day)	Inhalation, Air ILCR	External, Air ILCR	Ingestion Root Vegetable, Air Deposition to Plant ILCR	Ingestion Other Vegetable, Air Deposition to Plant ILCR	Ingestion Meat, Air Deposition to Plant ILCR	Ingestion Milk, Air Deposition to Plant ILCR	Inhalation, Air Deposition to Soil ILCR	Ingestion, Air Deposition to Soil ILCR	Dermal, Air Deposition to Soil ILCR	External, Air Deposition to Soil ILCR	Ingestion Root Vegetable, Air Deposition to Soil ILCR	Ingestion Other Vegetable, Air Deposition to Soil ILCR	Ingestion Beef, Air Deposition to Soil LCR	Ingestion Milk, Air Deposition to Soil ILCR	Total Cancer Risk
22	RDX	121-82-4	2.50E-10	5.10E-05	--	--	1.60E-14	4.60E-14	7.20E-20	3.20E-19	--	1.60E-13	9.60E-14	--	4.00E-12	5.80E-12	4.80E-17	1.30E-16	
22	Barium	7440-39-3	1.30E-07	2.60E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
22	^{238}U	7440-61-1(D+)	4.50E-07	9.10E-10	1.20E-09	3.4E-18	4.40E-14	1.30E-13	4.80E-22	3.90E-15	2.5E-22	4.90E-21	--	4.3E-20	4.00E-23	4.30E-23	2.10E-19	7.00E-19	
				Total ILCR	1.20E-09	3.4E-18	6.00E-14	1.80E-13	7.30E-20	3.90E-15	2.5E-22	1.60E-13	9.60E-14	4.3E-20	4.00E-12	5.80E-12	4.80E-17	1.30E-16	1.20E-09
23	TATB	3058-38-6	5.40E-07	1.10E-03	--	--	9.20E-12	2.70E-11	2.90E-17	1.30E-16	--	9.40E-13	1.10E-12	--	3.00E-10	4.30E-11	2.40E-15	6.40E-15	
23	HMX	2691-41-0	2.30E-09	4.70E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
23	RDX	121-82-4	3.40E-08	6.90E-05	--	--	2.10E-12	6.20E-12	9.60E-18	4.20E-17	--	2.10E-13	1.30E-13	--	5.40E-12	7.80E-12	6.50E-17	1.70E-16	
23	Benzo(a)pyrene	50-32-8	3.60E-11	7.40E-08	1.70E-11	--	1.50E-13	4.40E-13	1.20E-13	5.20E-13	3.70E-18	1.50E-14	1.40E-14	--	4.10E-14	5.20E-16	8.50E-14	2.30E-13	
23	^{238}U	7440-61-1(D+)	4.11E-07	8.40E-10	1.1E-09	3.1E-18	4.0E-14	1.2E-13	4.4E-22	3.6E-15	2.3E-22	4.5E-21	--	3.9E-20	3.7E-23	4.0E-23	1.9E-19	6.5E-19	
				Total ILCR	1.1E-09	3.1E-18	1.1E-11	3.4E-11	1.2E-13	5.3E-13	3.7E-18	1.2E-12	1.3E-12	3.9E-20	3.0E-10	5.1E-11	8.7E-14	2.3E-13	1.5E-09
28	^{3}H	10028-17-8	3.58E-07	6.89E-10	5.6E-15	--	1.9E-17	5.6E-17	--	6.3E-17	1.1E-27	1.6E-24	--	--	--	--	--	1.1E-20	
28	^{238}U	7440-61-1(D+)	3.79E-07	7.31E-10	9.9E-10	2.8E-18	3.7E-14	1.1E-13	4.0E-22	3.3E-15	2.0E-22	4.0E-21	--	3.4E-20	3.2E-23	3.5E-23	1.7E-19	5.6E-19	
				Total ILCR	9.9E-10	2.8E-18	3.7E-14	1.1E-13	4.0E-22	3.3E-15	2.0E-22	4.0E-21		3.4E-20	3.2E-23	3.5E-23	1.7E-19	5.7E-19	9.9E-10

COPC – Contaminant of potential concern
EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.
CAS -Chemical Abstract Service
URV_{cc} - Caner Unit Risk Value
ILCR - incremental lifetime cancer risk
-- no data available

Table A-16. Offsite Resident Farmer Adult Noncancer Risk Characterization by Pathway

Grid Cell	COPC	CAS No.	Inhalation, Air Adult URV_{nc}	Ingestion Root Vegetable, Air Deposition to Plant Adult URV_{nc}	Ingestion Other Vegetable, Air Deposition to Plant Adult URV_{nc}	Ingestion Meat, Air Deposition to Plant Adult URV_{nc}	Ingestion Milk, Air Deposition to Plant Adult URV_{nc}	Inhalation, Air Deposition to Soil Adult URV_{nc}	Ingestion, Air Deposition to Soil Adult URV_{nc}	Dermal, Air Deposition to Soil Adult URV_{nc}	Ingestion Root Vegetable, Air Deposition to Soil Adult URV_{nc}	Ingestion Other Vegetable, Air Deposition to Soil Adult URV_{nc}	Ingestion Beef, Air Deposition to Soil Adult URV_{nc}	Ingestion Milk, Air Deposition to Soil Adult URV_{nc}
7	Mercury	7439-97-6	3.19E+03	4.30E+02	1.28E+03	2.22E+01	2.40E-01	1.11E-06	7.31E-05	1.19E-04	9.08E-02	9.95E-02	1.21E-02	8.01E-05
7	^{238}U	7440-61-1(D+)	--	--	--	--	--	--	--	--	--	--	--	--
8	RDX	121-82-4	1.92E+03	2.91E-01	8.67E-01	1.38E-06	3.01E-06	1.00E-06	7.31E-06	8.34E-06	3.71E-04	5.36E-04	4.54E-09	6.06E-09
8	Mercury	7439-97-6	3.19E+03	4.30E+02	1.28E+03	2.22E+01	2.40E-01	1.11E-06	7.31E-05	1.19E-04	9.08E-02	9.95E-02	1.21E-02	8.01E-05
8	^{238}U	7440-61-1(D+)	--	--	--	--	--	--	--	--	--	--	--	--
9	TATB	3058-38-6	4.79E+02	2.91E-01	8.67E-01	9.31E-07	2.03E-06	--	7.31E-06	1.67E-05	4.62E-03	6.72E-04	3.82E-08	5.10E-08
12	2,4-Dinitrotoluene	121-14-2	6.39E+03	4.36E-01	1.30E+00	4.18E-05	9.12E-05	6.67E-07	1.10E-05	1.47E-05	1.60E-03	1.41E-04	3.97E-07	5.30E-07
12	RDX	121-82-4	1.92E+03	2.91E-01	8.67E-01	1.38E-06	3.01E-06	1.00E-06	7.31E-06	8.34E-06	3.71E-04	5.36E-04	4.54E-09	6.06E-09
12	TNT	118-96-7	9.58E+03	1.75E+00	5.20E+00	1.10E-04	2.40E-04	5.00E-08	4.39E-05	8.34E-05	8.98E-04	7.21E-04	1.46E-07	1.95E-07
12	Barium	7440-39-3	1.92E+03	1.84E+00	5.49E+00	9.51E-04	1.05E-03	5.00E-09	3.13E-07	5.10E-07	3.89E-06	4.26E-06	5.19E-09	3.50E-09
12	^{238}U	7440-61-1(D+)	--	--	--	--	--	--	--	--	--	--	--	--
13	HMX	2691-41-0	3.55E+02	1.75E-02	5.20E-02	5.59E-10	1.22E-09	2.00E-08	4.39E-07	3.33E-06	3.02E-02	5.77E-04	2.50E-09	3.34E-09
13	RDX	121-82-4	1.92E+03	2.91E-01	8.67E-01	1.38E-06	3.01E-06	1.00E-06	7.31E-06	8.34E-06	3.71E-04	5.36E-04	4.54E-09	6.06E-09
13	TNT	118-96-7	9.58E+03	1.75E+00	5.20E+00	1.10E-04	2.40E-04	5.00E-08	4.39E-05	8.34E-05	8.98E-04	7.21E-04	1.46E-07	1.95E-07
13	Barium	7440-39-3	1.92E+03	1.84E+00	5.49E+00	9.51E-04	1.05E-03	5.00E-09	3.13E-07	5.10E-07	3.89E-06	4.26E-06	5.19E-09	3.50E-09
13	Cadmium	7440-43-9	--	1.29E+02	3.84E+02	3.11E+00	1.53E-01	--	2.19E-05	1.00E-05	1.27E-02	1.39E-02	7.91E-04	2.39E-05
13	Mercury	7439-97-6	3.19E+03	4.30E+02	1.28E+03	2.22E+01	2.40E-01	1.11E-06	7.31E-05	1.19E-04	9.08E-02	9.95E-02	1.21E-02	8.01E-05
13	^{238}U	7440-61-1(D+)	--	--	--	--	--	--	--	--	--	--	--	--
14	RDX	121-82-4	1.92E+03	2.91E-01	8.67E-01	1.38E-06	3.01E-06	1.00E-06	7.31E-06	8.34E-06	3.71E-04	5.36E-04	4.54E-09	6.06E-09
17	RDX	121-82-4	1.92E+03	2.91E-01	8.67E-01	1.38E-06	3.01E-06	1.00E-06	7.31E-06	8.34E-06	3.71E-04	5.36E-04	4.54E-09	6.06E-09
17	Barium	7440-39-3	1.92E+03	1.84E+00	5.49E+00	9.51E-04	1.05E-03	5.00E-09	3.13E-07	5.10E-07	3.89E-06	4.26E-06	5.19E-09	3.50E-09
17	Cadmium	7440-43-9	--	1.29E+02	3.84E+02	3.11E+00	1.53E-01	--	2.19E-05	1.00E-05	1.27E-02	1.39E-02	7.91E-04	2.39E-05
17	Mercury	7439-97-6	3.19E+03	4.30E+02	1.28E+03	2.22E+01	2.40E-01	1.11E-06	7.31E-05	1.19E-04	9.08E-02	9.95E-02	1.21E-02	8.01E-05
17	^{238}U	7440-61-1(D+)	--	--	--	--	--	--	--	--	--	--	--	--

Table A 16. Offsite Resident Farmer Adult Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	Air Concentration (mg/m3)	Air Deposition (mg/m2-day)	Inhalation, Air Adult HQ	Ingestion Root Vegetable, Air Deposition to Plant Adult HQ	Ingestion Other Vegetable, Air Deposition to Plant Adult HQ	Ingestion Meat, Air Deposition to Plant Adult HQ	Ingestion Milk, Air Deposition to Plant Adult HQ	Inhalation, Air Deposition to Soil Adult HQ	Ingestion, Air Deposition to Soil Adult HQ	Dermal, Air Deposition to Soil Adult HQ	Ingestion Root Vegetable, Air Deposition to Soil Adult HQ	Ingestion Other Vegetable, Air Deposition to Soil Adult HQ	Ingestion Beef, Air Deposition to Soil Adult HQ	Ingestion Milk, Air Deposition to Soil Adult HQ	Total HI Adult
7	Mercury	7439-97-6	1.00E-09	2.60E-06	3.30E-06	4.50E-07	1.30E-06	2.30E-08	2.50E-10	2.90E-12	1.90E-10	3.10E-10	2.40E-07	2.60E-07	3.20E-08	2.10E-10	5.7E-06
7	^{238}U	7440-61-1(D+)	7.80E-07	2.00E-09	--	--	--	--	--	--	--	--	--	--	--	--	--
				Total HI by pathway	3.30E-06	4.50E-07	1.30E-06	2.30E-08	2.50E-10	2.90E-12	1.90E-10	3.10E-10	2.40E-07	2.60E-07	3.20E-08	2.10E-10	5.70E-06
8	RDX	121-82-4	6.00E-10	1.50E-06	1.20E-06	1.80E-10	5.20E-10	8.30E-16	1.80E-15	1.50E-12	1.10E-11	1.30E-11	5.70E-10	8.30E-10	7.00E-15	9.30E-15	1.20E-06
8	Mercury	7439-97-6	2.40E-09	6.00E-06	7.50E-06	1.00E-06	3.00E-06	5.20E-08	5.60E-10	6.60E-12	4.40E-10	7.10E-10	5.40E-07	5.90E-07	7.20E-08	4.80E-10	1.28E-05
8	^{238}U	7440-61-1(D+)	9.30E-07	2.40E-09	--	--	--	--	--	--	--	--	--	--	--	--	--
				Total HI by pathway	8.70E-06	1.00E-06	3.00E-06	5.20E-08	5.60E-10	8.20E-12	4.50E-10	7.20E-10	5.40E-07	5.90E-07	7.20E-08	4.80E-10	1.40E-05
9	TATB	3058-38-6	2.90E-08	7.40E-05	1.40E-05	8.50E-09	2.50E-08	2.70E-14	5.90E-14	--	5.40E-10	1.20E-09	3.40E-07	5.00E-08	2.80E-12	3.80E-12	1.4E-05
				Total HI by pathway	1.40E-05	8.50E-09	2.50E-08	2.70E-14	5.90E-14	0.00E+00	5.40E-10	1.20E-09	3.40E-07	5.00E-08	2.80E-12	3.80E-12	1.40E-05
12	2,4-Dinitrotoluene	121-14-2	7.20E-11	1.70E-07	4.60E-07	3.20E-11	9.40E-11	3.00E-15	6.60E-15	1.10E-13	1.90E-12	2.50E-12	2.70E-10	2.40E-11	6.70E-14	9.00E-14	4.60E-07
12	RDX	121-82-4	3.00E-08	7.10E-05	5.80E-05	8.80E-09	2.60E-08	4.10E-14	9.10E-14	7.10E-11	5.20E-10	5.90E-10	2.60E-08	3.80E-08	3.20E-13	4.30E-13	5.81E-05
12	TNT	118-96-7	1.10E-07	2.50E-04	1.00E-03	1.90E-07	5.60E-07	1.20E-11	2.60E-11	1.30E-11	1.10E-08	2.10E-08	2.30E-07	1.80E-07	3.70E-11	4.90E-11	1.00E-03
12	Barium	7440-39-3	1.40E-05	3.20E-02	2.60E-02	2.50E-05	7.40E-05	1.30E-08	1.40E-08	1.60E-10	9.90E-09	1.60E-08	1.20E-07	1.30E-07	1.60E-10	1.10E-10	2.61E-02
12	^{238}U	7440-61-1(D+)	2.30E-06	5.40E-09	--	--	--	--	--	--	--	--	--	--	--	--	--
				Total HI by pathway	2.70E-02	2.50E-05	7.50E-05	1.30E-08	1.40E-08	2.40E-10	2.10E-08	3.80E-08	3.80E-07	3.50E-07	2.00E-10	1.60E-10	2.70E-02
13	HMX	2691-41-0	7.80E-09	1.80E-05	2.80E-06	1.40E-10	4.10E-10	4.40E-18	9.60E-18	3.70E-13	8.00E-12	6.10E-11	5.50E-07	1.10E-08	4.60E-14	6.10E-14	3.36E-06
13	RDX	121-82-4	1.80E-06	4.20E-03	3.40E-03	5.20E-07	1.50E-06	2.50E-12	5.40E-12	4.20E-09	3.00E-08	3.50E-08	1.50E-06	2.20E-06	1.90E-11	2.50E-11	3.41E-03
13	TNT	118-96-7	5.80E-06	1.40E-02	5.50E-02	1.00E-05	3.00E-05	6.30E-10	1.40E-09	6.80E-10	5.90E-07	1.10E-06	1.20E-05	9.70E-06	2.00E-09	2.60E-09	5.51E-02
13	Barium	7440-39-3	1.50E-05	3.60E-02	2.90E-02	2.80E-05	8.40E-05	1.50E-08	1.60E-08	1.80E-10	1.10E-08	1.80E-08	1.40E-07	1.50E-07	1.90E-10	1.30E-10	2.91E-02
13	Cadmium	7440-43-9	6.60E-10	1.60E-06	--	8.60E-08	2.60E-07	2.10E-09	1.00E-10	--	3.40E-11	1.60E-11	2.00E-08	2.20E-08	1.20E-09	3.70E-11	3.91E-07
13	Mercury	7439-97-6	2.80E-10	6.50E-07	8.90E-07	1.20E-07	3.60E-07	6.20E-09	6.70E-11	7.30E-13	4.80E-11	7.80E-11	5.90E-08	6.50E-08	7.90E-09	5.20E-11	1.51E-06
13	^{238}U	7440-61-1(D+)	6.50E-07	1.50E-09	--	--	--	--	--	--	--	--	--	--	--	--	--
				Total HI by pathway	8.80E-02	3.90E-05	1.20E-04	2.30E-08	1.80E-08	5.00E-09	6.30E-07	1.20E-06	1.40E-05	1.20E-05	1.10E-08	2.90E-09	8.80E-02
14	RDX	121-82-4	1.80E-09	4.20E-06	3.40E-06	5.20E-10	1.60E-09	2.50E-15	5.40E-15	4.20E-12	3.10E-11	3.50E-11	1.60E-09	2.20E-09	1.90E-14	2.50E-14	3.50E-06
				Total HI by pathway	3.40E-06	5.20E-10	1.60E-09	2.50E-15	5.40E-15	4.20E-12	3.10E-11	3.50E-11	1.60E-09	2.20E-09	1.90E-14	2.50E-14	3.50E-06
17	RDX	121-82-4	4.60E-10	9.90E-07	8.70E-07	1.30E-10	3.90E-10	6.30E-16	1.40E-15	9.90E-13	7.30E-12	8.30E-12	3.70E-10	5.30E-10	4.50E-15	6.00E-15	8.71E-07
17	Barium	7440-39-3	1.50E-07	3.20E-04	2.80E-04	2.70E-07	8.10E-07	1.40E-10	1.60E-10	1.60E-12	1.00E-10	1.60E-10	1.30E-09	1.40E-09	1.70E-12	1.10E-12	2.81E-04
17	Cadmium	7440-43-9	1.10E-09	2.50E-06	--	1.40E-07	4.30E-07	3.50E-09	1.70E-10	--	5.40E-11	2.50E-11	3.10E-08	3.40E-08	1.90E-09	5.80E-11	6.41E-07
17	Mercury	7439-97-6	1.20E-09	2.60E-06	3.70E-06	5.00E-07	1.50E-06	2.60E-08	2.80E-10	2.80E-12	1.90E-10	3.00E-10	2.30E-07	2.50E-07	3.10E-08	2.00E-10	6.24E-06
17	^{238}U	7440-61-1(D+)	6.50E-07	1.40E-09	--	--	--	--	--	--	--	--	--	--	--	--	--
				Total HI by pathway	2.90E-04	9.20E-07	2.70E-06	3.00E-08	6.10E-10	5.40E-12	3.50E-10	5.00E-10	2.60E-07	2.90E-07	3.30E-08	2.60E-10	2.90E-04

Table A 16. Offsite Resident Farmer Adult Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	Inhalation, Air Adult URV_{nc}	Ingestion Root Vegetable, Air Deposition to Plant Adult URV_{nc}	Ingestion Other Vegetable, Air Deposition to Plant Adult URV_{nc}	Ingestion Meat, Air Deposition to Plant Adult URV_{nc}	Ingestion Milk, Air Deposition to Plant Adult URV_{nc}	Inhalation, Air Deposition to Soil Adult URV_{nc}	Ingestion, Air Deposition to Soil Adult URV_{nc}	Dermal, Air Deposition to Soil Adult URV_{nc}	Ingestion Root Vegetable, Air Deposition to Soil Adult URV_{nc}	Ingestion Other Vegetable, Air Deposition to Soil Adult URV_{nc}	Ingestion Beef, Air Deposition to Soil Adult URV_{nc}	Ingestion Milk, Air Deposition to Soil Adult URV_{nc}
18	TATB	3058-38-6	4.79E+02	2.91E-01	8.67E-01	9.31E-07	2.03E-06	--	7.31E-06	1.67E-05	4.62E-03	6.72E-04	3.82E-08	5.10E-08
18	2,4-Dinitrotoluene	121-14-2	6.39E+03	4.36E-01	1.30E+00	4.18E-05	9.12E-05	6.67E-07	1.10E-05	1.47E-05	1.60E-03	1.41E-04	3.97E-07	5.30E-07
18	2-Amino-4,6-Dinitrotoluene	35572-78-2	9.58E+03	5.24E+00	1.56E+01	2.11E-03	4.61E-03	1.00E-06	1.32E-04	3.00E-04	4.01E-03	7.39E-04	4.18E-06	5.58E-06
18	4-Amino-2,6-Dinitrotoluene	19406-51-0	9.58E+03	5.24E+00	1.56E+01	1.39E-03	3.05E-03	3.71E-08	1.32E-04	3.00E-04	4.79E-03	9.39E-04	3.30E-06	4.40E-06
18	HMX	2691-41-0	3.55E+02	1.75E-02	5.20E-02	5.59E-10	1.22E-09	2.00E-08	4.39E-07	3.33E-06	3.02E-02	5.77E-04	2.50E-09	3.34E-09
18	Nitrobenzene	98-95-3	1.92E+02	1.75E+00	5.20E+00	7.21E-05	1.57E-04	9.09E-09	4.39E-05	5.16E-05	1.74E-03	9.19E-04	1.86E-07	2.48E-07
18	RDX	121-82-4	1.92E+03	2.91E-01	8.67E-01	1.38E-06	3.01E-06	1.00E-06	7.31E-06	8.34E-06	3.71E-04	5.36E-04	4.54E-09	6.06E-09
18	TNT	118-96-7	9.58E+03	1.75E+00	5.20E+00	1.10E-04	2.40E-04	5.00E-08	4.39E-05	8.34E-05	8.98E-04	7.21E-04	1.46E-07	1.95E-07
18	Barium	7440-39-3	1.92E+03	1.84E+00	5.49E+00	9.51E-04	1.05E-03	5.00E-09	3.13E-07	5.10E-07	3.89E-06	4.26E-06	5.19E-09	3.50E-09
18	Aldrin	309-00-2	--	2.91E+01	8.67E+01	1.04E+02	2.28E+02	--	7.31E-04	1.67E-03	2.42E-01	2.14E-05	2.24E+00	2.99E+00
18	Alpha BHC	319-84-6	--	1.09E-01	3.25E-01	1.26E-03	2.76E-03	1.43E-07	2.74E-06	1.29E-06	4.04E-04	2.21E-06	1.21E-05	1.61E-05
18	Beta BHC	319-85-7	--	--	--	--	--	1.43E-07	--	--	--	--	--	--
18	Heptachlor Epoxide	1024-57-3	--	6.71E+01	2.00E+02	3.45E+00	7.53E+00	--	1.69E-03	2.67E-03	1.41E-01	5.75E-04	1.88E-02	2.50E-02
22	RDX	121-82-4	1.92E+03	2.91E-01	8.67E-01	1.38E-06	3.01E-06	1.00E-06	7.31E-06	8.34E-06	3.71E-04	5.36E-04	4.54E-09	6.06E-09
22	Barium	7440-39-3	1.92E+03	1.84E+00	5.49E+00	9.51E-04	1.05E-03	5.00E-09	3.13E-07	5.10E-07	3.89E-06	4.26E-06	5.19E-09	3.50E-09
22	^{238}U	7440-61-1(D+)	--	--	--	--	--	--	--	--	--	--	--	--
23	TATB	3058-38-6	4.79E+02	2.91E-01	8.67E-01	9.31E-07	2.03E-06	--	7.31E-06	1.67E-05	4.62E-03	6.72E-04	3.82E-08	5.10E-08
23	HMX	2691-41-0	3.55E+02	1.75E-02	5.20E-02	5.59E-10	1.22E-09	2.00E-08	4.39E-07	3.33E-06	3.02E-02	5.77E-04	2.50E-09	3.34E-09
23	RDX	121-82-4	1.92E+03	2.91E-01	8.67E-01	1.38E-06	3.01E-06	1.00E-06	7.31E-06	8.34E-06	3.71E-04	5.36E-04	4.54E-09	6.06E-09
23	Benzo(a)pyrene	50-32-8	--	--	--	--	--	--	--	--	--	--	--	--
28	^{238}U	7440-61-1(D+)	--	--	--	--	--	--	--	--	--	--	--	--

Table A 16. Offsite Resident Farmer Adult Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	Air Concentration (mg/m3)	Air Deposition (mg/m2-day)	Inhalation, Air Adult HQ	Ingestion Root Vegetable, Air Deposition to Plant Adult HQ	Ingestion Other Vegetable, Air Deposition to Plant Adult HQ	Ingestion Meat, Air Deposition to Plant Adult HQ	Ingestion Milk, Air Deposition to Plant Adult HQ	Inhalation, Air Deposition to Soil Adult HQ	Ingestion, Air Deposition to Soil Adult HQ	Dermal, Air Deposition to Soil Adult HQ	Ingestion Root Vegetable, Air Deposition to Soil Adult HQ	Ingestion Other Vegetable, Air Deposition to Soil Adult HQ	Ingestion Beef, Air Deposition to Soil Adult HQ	Ingestion Milk, Air Deposition to Soil Adult HQ	Total HI Adult
18	TATB	3058-38-6	3.40E-09	7.40E-06	1.60E-06	9.90E-10	2.90E-09	3.20E-15	6.90E-15	--	5.40E-11	1.20E-10	3.40E-08	5.00E-09	2.80E-13	3.80E-13	1.64E-06
18	2,4-Dinitrotoluene	121-14-2	7.10E-10	1.50E-06	4.50E-06	3.10E-10	9.20E-10	2.90E-14	6.40E-14	1.00E-12	1.70E-11	2.30E-11	2.50E-09	2.20E-10	6.10E-13	8.10E-13	4.50E-06
18	2-Amino-4,6-Dinitrotoluene	35572-78-2	1.80E-08	3.80E-05	1.70E-04	9.20E-08	2.70E-07	3.70E-11	8.10E-11	3.80E-11	5.00E-09	1.10E-08	1.50E-07	2.80E-08	1.60E-10	2.10E-10	1.71E-04
18	4-Amino-2,6-Dinitrotoluene	19406-51-0	6.20E-09	1.40E-05	5.90E-05	3.20E-08	9.70E-08	8.60E-12	1.90E-11	5.00E-13	1.80E-09	4.10E-09	6.50E-08	1.30E-08	4.40E-11	5.90E-11	5.92E-05
18	HMX	2691-41-0	7.00E-09	1.50E-05	2.50E-06	1.20E-10	3.60E-10	3.90E-18	8.50E-18	3.00E-13	6.60E-12	5.00E-11	4.60E-07	8.70E-09	3.80E-14	5.00E-14	2.97E-06
18	Nitrobenzene	98-95-3	4.70E-09	1.00E-05	9.00E-07	8.20E-09	2.40E-08	3.40E-13	7.40E-13	9.30E-14	4.50E-10	5.30E-10	1.80E-08	9.40E-09	1.90E-12	2.50E-12	9.61E-07
18	RDX	121-82-4	4.50E-05	9.70E-02	8.50E-02	1.30E-05	3.90E-05	6.10E-11	1.30E-10	9.70E-08	7.10E-07	8.10E-07	3.60E-05	5.20E-05	4.40E-10	5.90E-10	8.51E-02
18	TNT	118-96-7	2.10E-05	4.50E-02	2.00E-01	3.60E-05	1.10E-04	2.30E-09	4.90E-09	2.20E-09	2.00E-06	3.70E-06	4.00E-05	3.20E-05	6.50E-09	8.70E-09	2.00E-01
18	Barium	7440-39-3	2.00E-05	4.80E-02	3.80E-02	3.70E-05	1.10E-04	1.90E-08	2.10E-08	2.40E-10	1.50E-08	2.50E-08	1.90E-07	2.00E-07	2.50E-10	1.70E-10	3.81E-02
18	Aldrin	309-00-2	1.60E-11	3.40E-08	--	4.50E-10	1.30E-09	1.60E-09	3.50E-09	--	2.50E-11	5.60E-11	8.10E-09	7.20E-13	7.50E-08	1.00E-07	1.90E-07
18	Alpha BHC	319-84-6	8.50E-11	1.80E-07	--	9.20E-12	2.80E-11	1.10E-13	2.30E-13	2.60E-14	5.00E-13	2.40E-13	7.40E-11	4.10E-13	2.20E-12	3.00E-12	1.18E-10
18	Beta BHC	319-85-7	9.80E-11	2.10E-07	--	--	--	--	--	3.00E-14	--	--	--	--	--	--	--
18	Heptachlor Epoxide	1024-57-3	2.30E-11	5.00E-08	--	1.50E-09	4.60E-09	7.90E-11	1.70E-10	--	8.40E-11	1.30E-10	7.00E-09	2.90E-11	9.30E-10	1.20E-09	1.57E-08
				Total HI by pathway	3.20E-01	8.60E-05	2.50E-04	2.30E-08	3.00E-08	9.90E-08	2.70E-06	4.60E-06	7.70E-05	8.40E-05	8.40E-08	1.10E-07	3.20E-01
22	RDX	121-82-4	2.50E-10	5.10E-05	4.80E-07	7.30E-11	2.20E-10	3.50E-16	7.60E-16	5.10E-11	3.70E-10	4.20E-10	1.90E-08	2.70E-08	2.30E-13	3.10E-13	5.27E-07
22	Barium	7440-39-3	1.30E-07	2.60E-04	2.50E-04	2.40E-07	7.10E-07	1.20E-10	1.40E-10	1.30E-12	8.10E-11	1.30E-10	1.00E-09	1.10E-09	1.30E-12	9.10E-13	2.51E-04
22	^{238}U	7440-61-1(D+)	4.50E-07	9.10E-10	--	--	--	--	--	--	--	--	--	--	--	--	--
				Total HI by pathway	2.50E-04	2.40E-07	7.10E-07	1.20E-10	1.40E-10	5.20E-11	4.50E-10	5.60E-10	2.00E-08	2.80E-08	1.60E-12	1.20E-12	2.50E-04
23	TATB	3058-38-6	5.40E-07	1.10E-03	2.60E-04	1.60E-07	4.70E-07	5.10E-13	1.10E-12	--	8.10E-09	1.90E-08	5.10E-06	7.50E-07	4.20E-11	5.70E-11	2.67E-04
23	HMX	2691-41-0	2.30E-09	4.70E-06	8.10E-07	4.00E-11	1.20E-10	1.30E-18	2.80E-18	9.30E-14	2.00E-12	1.60E-11	1.40E-07	2.70E-09	1.20E-14	1.60E-14	9.53E-07
23	RDX	121-82-4	3.40E-08	6.90E-05	6.40E-05	9.80E-09	2.90E-08	4.60E-14	1.00E-13	6.90E-11	5.00E-10	5.70E-10	2.60E-08	3.70E-08	3.10E-13	4.20E-13	6.41E-05
23	Benzo(a)pyrene	50-32-8	3.60E-11	7.40E-08	--	--	--	--	--	--	--	--	--	--	--	--	--
				Total HI by pathway	3.30E-04	1.70E-07	5.00E-07	5.50E-13	1.20E-12	6.90E-11	8.60E-09	1.90E-08	5.30E-06	7.90E-07	4.30E-11	5.70E-11	3.30E-04
28	^{238}U	7440-61-1(D+)	3.50E-07	6.80E-10	--	--	--	--	--	--	--	--	--	--	--	--	--
				Total HI by pathway	--	--	--	--	--	--	--	--	--	--	--	--	--

COPC – Contaminant of potential concern
CAS -Chemical Abstract Service
URV_nc - Non-cancer Unit Risk Value
HQ - Hazard Quotient
HI - Hazard Index

Table A-17. Offsite Resident Farmer Child Noncancer Risk Characterization by Pathway

Grid Cell	COPC	CAS No.	Inhalation, Air Child URV_{nc}	Ingestion Root Vegetable, Air Deposition to Plant Child URV_{nc}	Ingestion Other Vegetable, Air Deposition to Plant Child URV_{nc}	Ingestion Meat, Air Deposition to Plant Child URV_{nc}	Ingestion Milk, Air Deposition to Plant Child URV_{nc}	Inhalation, Air Deposition to Soil Child URV_{nc}	Ingestion, Air Deposition to Soil Child URVnc	Dermal, Air Deposition to Soil Child URVnc	Ingestion Root Vegetable, Air Deposition to Soil Child URV_{nc}	Ingestion Other Vegetable, Air Deposition to Soil Child URV_{nc}	Ingestion Beef, Air Deposition to Soil Child URV_{nc}	Ingestion Milk, Air Deposition to Soil Child URV_{nc}
7	Mercury	7439-97-6	3.20E+03	5.40E+00	1.60E+01	3.80E+01	2.20E+00	1.10E-06	6.80E-04	2.80E-04	1.10E-03	1.20E-03	2.10E-02	7.25E-04
7	^{238}U	7440-61-1(D+)	---	---	---	---	---	---	---	---	---	---	---	---
8	RDX	121-82-4	1.90E+03	5.40E-01	1.60E+00	2.30E-06	2.70E-05	1.00E-06	6.80E-05	2.00E-05	6.90E-04	9.80E-04	7.70E-09	5.49E-08
8	Mercury	7439-97-6	3.20E+03	5.40E+00	1.60E+01	3.80E+01	2.20E+00	1.10E-06	6.80E-04	2.80E-04	1.10E-03	1.20E-03	2.10E-02	7.25E-04
8	^{238}U	7440-61-1(D+)	---	---	---	---	---	---	---	---	---	---	---	---
9	TATB	3058-38-6	4.80E+02	5.40E-01	1.60E+00	1.60E-06	1.80E-05	---	6.80E-05	4.00E-05	8.60E-03	1.20E-03	6.50E-08	4.62E-07
12	2,4-Dinitrotoluene	121-14-2	6.40E+03	8.10E-01	2.40E+00	7.10E-05	8.30E-04	6.70E-07	1.00E-04	3.50E-05	3.00E-03	2.60E-04	6.80E-07	4.79E-06
12	RDX	121-82-4	1.90E+03	5.40E-01	1.60E+00	2.30E-06	2.70E-05	1.00E-06	6.80E-05	2.00E-05	6.90E-04	9.80E-04	7.70E-09	5.49E-08
12	TNT	118-96-7	9.60E+03	3.30E+00	9.50E+00	1.90E-04	2.20E-03	5.00E-08	4.10E-04	2.00E-04	1.70E-03	1.30E-03	2.50E-07	1.76E-06
12	Barium	7440-39-3	1.90E+03	2.30E-02	6.80E-02	1.60E-03	9.50E-03	5.00E-09	2.90E-06	1.20E-06	4.90E-08	5.30E-08	8.80E-09	3.17E-08
12	^{238}U	7440-61-1(D+)	---	---	---	---	---	---	---	---	---	---	---	---
13	HMX	2691-41-0	3.50E+02	3.30E-02	9.50E-02	9.50E-10	1.10E-08	2.00E-08	4.10E-06	7.90E-06	5.60E-02	1.10E-03	4.30E-09	3.02E-08
13	RDX	121-82-4	1.90E+03	5.40E-01	1.60E+00	2.30E-06	2.70E-05	1.00E-06	6.80E-05	2.00E-05	6.90E-04	9.80E-04	7.70E-09	5.49E-08
13	TNT	118-96-7	9.60E+03	3.30E+00	9.50E+00	1.90E-04	2.20E-03	5.00E-08	4.10E-04	2.00E-04	1.70E-03	1.30E-03	2.50E-07	1.76E-06
13	Barium	7440-39-3	1.90E+03	2.30E-02	6.80E-02	1.60E-03	9.50E-03	5.00E-09	2.90E-06	1.20E-06	4.90E-08	5.30E-08	8.80E-09	3.17E-08
13	Cadmium	7440-43-9	---	1.60E+00	4.70E+00	5.30E+00	1.40E+00	---	2.00E-04	2.40E-05	1.60E-04	1.70E-04	1.30E-03	2.16E-04
13	Mercury	7439-97-6	3.20E+03	5.40E+00	1.60E+01	3.80E+01	2.20E+00	1.10E-06	6.80E-04	2.80E-04	1.10E-03	1.20E-03	2.10E-02	7.25E-04
13	^{238}U	7440-61-1(D+)	---	---	---	---	---	---	---	---	---	---	---	---
14	RDX	121-82-4	1.90E+03	5.40E-01	1.60E+00	2.30E-06	2.70E-05	1.00E-06	6.80E-05	2.00E-05	6.90E-04	9.80E-04	7.70E-09	5.49E-08
17	RDX	121-82-4	1.90E+03	5.40E-01	1.60E+00	2.30E-06	2.70E-05	1.00E-06	6.80E-05	2.00E-05	6.90E-04	9.80E-04	7.70E-09	5.49E-08
17	Barium	7440-39-3	1.90E+03	2.30E-02	6.80E-02	1.60E-03	9.50E-03	5.00E-09	2.90E-06	1.20E-06	4.90E-08	5.30E-08	8.80E-09	3.17E-08
17	Cadmium	7440-43-9	---	1.60E+00	4.70E+00	5.30E+00	1.40E+00	---	2.00E-04	2.40E-05	1.60E-04	1.70E-04	1.30E-03	2.16E-04
17	Mercury	7439-97-6	3.20E+03	5.40E+00	1.60E+01	3.80E+01	2.20E+00	1.10E-06	6.80E-04	2.80E-04	1.10E-03	1.20E-03	2.10E-02	7.25E-04
17	^{238}U	7440-61-1(D+)	---	---	---	---	---	---	---	---	---	---	---	---

Table A 17. Offsite Resident Farmer Child Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	Air Concentration (mg/m3)	Air Deposition (mg/m2-day)	Inhalation, Air Child HQ	Ingestion Root Vegetable, Air Deposition to Plant Child HQ	Ingestion Other Vegetable, Air Deposition to Plant Child HQ	Ingestion Meat, Air Deposition to Plant Child HQ	Ingestion Milk, Air Deposition to Plant Child HQ	Inhalation, Air Deposition to Soil Child HQ	Ingestion, Air Deposition to Soil Child HQ	Dermal, Air Deposition to Soil Child HQ	Ingestion Root Vegetable, Air Deposition to Soil Child HQ	Ingestion Other Vegetable, Air Deposition to Soil Child HQ	Ingestion Beef, Air Deposition to Soil Child HQ	Ingestion Milk, Air Deposition to Soil Child HQ	Total HI Child
7	Mercury	7439-97-6	1.00E-09	2.60E-06	3.30E-06	5.60E-09	1.60E-08	3.90E-08	2.30E-09	2.90E-12	1.80E-09	7.50E-10	3.00E-09	3.20E-09	5.40E-08	1.90E-09	
7	^{238}U	7440-61-1(D+)	7.80E-07	2.00E-09	--	--	--	--	--	--	--	--	--	--	--	--	
				Total HI by pathway	3.30E-06	5.60E-09	1.60E-08	3.90E-08	2.30E-09	2.90E-12	1.80E-09	7.50E-10	3.00E-09	3.20E-09	5.40E-08	1.90E-09	3.50E-06
8	RDX	121-82-4	6.00E-10	1.50E-06	1.20E-06	3.30E-10	9.50E-10	1.40E-15	1.60E-14	1.50E-12	1.10E-10	3.00E-11	1.10E-09	1.50E-09	1.20E-14	8.50E-14	
8	Mercury	7439-97-6	2.40E-09	6.00E-06	7.50E-06	1.30E-08	3.70E-08	8.90E-08	5.10E-09	6.60E-12	4.10E-09	1.70E-09	6.80E-09	7.30E-09	1.20E-07	4.30E-09	
8	^{238}U	7440-61-1(D+)	9.30E-07	2.40E-09	--	--	--	--	--	--	--	--	--	--	--	--	
				Total HI by pathway	8.70E-06	1.30E-08	3.80E-08	8.90E-08	5.10E-09	8.20E-12	4.20E-09	1.70E-09	7.90E-09	8.80E-09	1.20E-07	4.30E-09	9.00E-06
9	TATB	3058-38-6	2.90E-08	7.40E-05	1.40E-05	1.60E-08	4.60E-08	4.60E-14	5.40E-13	--	5.10E-09	2.90E-09	6.40E-07	9.10E-08	4.80E-12	3.40E-11	
				Total HI by pathway	1.40E-05	1.60E-08	4.60E-08	4.60E-14	5.40E-13	0.00E+00	5.10E-09	2.90E-09	6.40E-07	9.10E-08	4.80E-12	3.40E-11	1.50E-05
12	2,4-Dinitrotoluene	121-14-2	7.20E-11	1.70E-07	4.60E-07	5.90E-11	1.70E-10	5.20E-15	6.00E-14	1.10E-13	1.70E-11	5.90E-12	5.10E-10	4.40E-11	1.10E-13	8.10E-13	
12	RDX	121-82-4	3.00E-08	7.10E-05	5.80E-05	1.60E-08	4.80E-08	7.10E-14	8.20E-13	7.10E-11	4.80E-09	1.40E-09	4.90E-08	6.90E-08	5.50E-13	3.90E-12	
12	TNT	118-96-7	1.10E-07	2.50E-04	1.00E-03	3.50E-07	1.00E-06	2.00E-11	2.30E-10	1.30E-11	1.00E-07	5.00E-08	4.20E-07	3.30E-07	6.30E-11	4.40E-10	
12	Barium	7440-39-3	1.40E-05	3.20E-02	2.60E-02	3.10E-07	9.20E-07	2.20E-08	1.30E-07	1.60E-10	9.20E-08	3.80E-08	1.60E-09	1.70E-09	2.80E-10	1.00E-09	
12	^{238}U	7440-61-1(D+)	2.30E-06	5.40E-09	--	--	--	--	--	--	--	--	--	--	--	--	
				Total HI by pathway	2.70E-02	6.80E-07	2.00E-06	2.20E-08	1.30E-07	2.40E-10	2.00E-07	9.00E-08	4.70E-07	4.00E-07	3.40E-10	1.50E-09	2.70E-02
13	HMX	2691-41-0	7.80E-09	1.80E-05	2.80E-06	2.60E-10	7.40E-10	7.50E-18	8.70E-17	3.70E-13	7.50E-11	1.40E-10	1.00E-06	1.90E-08	7.80E-14	5.50E-13	
13	RDX	121-82-4	1.80E-06	4.20E-03	3.40E-03	9.70E-07	2.80E-06	4.20E-12	4.80E-11	4.20E-09	2.80E-07	8.20E-08	2.90E-06	4.10E-06	3.20E-11	2.30E-10	
13	TNT	118-96-7	5.80E-06	1.40E-02	5.50E-02	1.90E-05	5.50E-05	1.10E-09	1.30E-08	6.80E-10	5.50E-06	2.70E-06	2.30E-05	1.80E-05	3.40E-09	2.40E-08	
13	Barium	7440-39-3	1.50E-05	3.60E-02	2.90E-02	3.60E-07	1.00E-06	2.50E-08	1.50E-07	1.80E-10	1.00E-07	4.30E-08	1.80E-09	1.90E-09	3.20E-10	1.10E-09	
13	Cadmium	7440-43-9	6.60E-10	1.60E-06	--	1.10E-09	3.20E-09	3.50E-09	9.20E-10	--	3.20E-10	3.70E-11	2.50E-10	2.70E-10	2.10E-09	3.30E-10	
13	Mercury	7439-97-6	2.80E-10	6.50E-07	8.90E-07	1.50E-09	4.40E-09	1.10E-08	6.10E-10	7.30E-13	4.50E-10	1.80E-10	7.50E-10	8.00E-10	1.30E-08	4.70E-10	
13	^{238}U	7440-61-1(D+)	6.50E-07	1.50E-09	--	--	--	--	--	--	--	--	--	--	--	--	
				Total HI by pathway	8.80E-02	2.00E-05	5.90E-05	4.00E-08	1.60E-07	5.00E-09	5.90E-06	2.80E-06	2.70E-05	2.20E-05	1.90E-08	2.60E-08	8.80E-02
14	RDX	121-82-4	1.80E-09	4.20E-06	3.40E-06	9.80E-10	2.80E-09	4.20E-15	4.90E-14	4.20E-12	2.90E-10	8.30E-11	2.90E-09	4.10E-09	3.20E-14	2.30E-13	
				Total HI by pathway	3.40E-06	9.80E-10	2.80E-09	4.20E-15	4.90E-14	4.20E-12	2.90E-10	8.30E-11	2.90E-09	4.10E-09	3.20E-14	2.30E-13	3.50E-06
17	RDX	121-82-4	4.60E-10	9.90E-07	8.70E-07	2.50E-10	7.20E-10	1.10E-15	1.20E-14	9.90E-13	6.80E-11	2.00E-11	6.90E-10	9.70E-10	7.70E-15	5.50E-14	
17	Barium	7440-39-3	1.50E-07	3.20E-04	2.80E-04	3.40E-09	1.00E-08	2.40E-10	1.40E-09	1.60E-12	9.40E-10	3.90E-10	1.60E-11	1.70E-11	2.90E-12	1.00E-11	
17	Cadmium	7440-43-9	1.10E-09	2.50E-06	--	1.80E-09	5.30E-09	5.90E-09	1.60E-09	--	5.00E-10	5.80E-11	3.90E-10	4.20E-10	3.30E-09	5.30E-10	
17	Mercury	7439-97-6	1.20E-09	2.60E-06	3.70E-06	6.40E-09	1.90E-08	4.40E-08	2.50E-09	2.80E-12	1.70E-09	7.20E-10	2.90E-09	3.10E-09	5.30E-08	1.80E-09	
17	^{238}U	7440-61-1(D+)	6.50E-07	1.40E-09	--	--	--	--	--	--	--	--	--	--	--	--	
				Total HI by pathway	2.90E-04	1.20E-08	3.50E-08	5.00E-08	5.50E-09	5.40E-12	3.30E-09	1.20E-09	4.00E-09	4.50E-09	5.60E-08	2.40E-09	2.90E-04

Table A 17. Offsite Resident Farmer Child Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	Inhalation, Air Child URV_{nc}	Ingestion Root Vegetable, Air Deposition to Plant Child URV_{nc}	Ingestion Other Vegetable, Air Deposition to Plant Child URV_{nc}	Ingestion Meat, Air Deposition to Plant Child URV_{nc}	Ingestion Milk, Air Deposition to Plant Child URV_{nc}	Inhalation, Air Deposition to Soil Child URV_{nc}	Ingestion, Air Deposition to Soil Child URV_{nc}	Dermal, Air Deposition to Soil Child URV_{nc}	Ingestion Root Vegetable, Air Deposition to Soil Child URV_{nc}	Ingestion Other Vegetable, Air Deposition to Soil Child URV_{nc}	Ingestion Beef, Air Deposition to Soil Child URV_{nc}	Ingestion Milk, Air Deposition to Soil Child URV_{nc}
18	TATB	3058-38-6	4.80E+02	5.40E-01	1.60E+00	1.60E-06	1.80E-05	---	6.80E-05	4.00E-05	8.60E-03	1.20E-03	6.50E-08	4.62E-07
18	2,4-Dinitrotoluene	121-14-2	6.40E+03	8.10E-01	2.40E+00	7.10E-05	8.30E-04	6.70E-07	1.00E-04	3.50E-05	3.00E-03	2.60E-04	6.80E-07	4.79E-06
18	2-Amino-4,6-Dinitrotoluene	35572-78-2	9.60E+03	9.80E+00	2.80E+01	3.60E-03	4.20E-02	1.00E-06	1.20E-03	7.10E-04	7.50E-03	1.30E-03	7.10E-06	5.05E-05
18	4-Amino-2,6-Dinitrotoluene	19406-51-0	9.60E+03	9.80E+00	2.80E+01	2.40E-03	2.80E-02	3.70E-08	1.20E-03	7.10E-04	8.90E-03	1.70E-03	5.60E-06	3.98E-05
18	HMX	2691-41-0	3.50E+02	3.30E-02	9.50E-02	9.50E-10	1.10E-08	2.00E-08	4.10E-06	7.90E-06	5.60E-02	1.10E-03	4.30E-09	3.02E-08
18	Nitrobenzene	98-95-3	1.90E+02	3.30E+00	9.50E+00	1.20E-04	1.40E-03	9.10E-09	4.10E-04	1.20E-04	3.20E-03	1.70E-03	3.20E-07	2.24E-06
18	RDX	121-82-4	1.90E+03	5.40E-01	1.60E+00	2.30E-06	2.70E-05	1.00E-06	6.80E-05	2.00E-05	6.90E-04	9.80E-04	7.70E-09	5.49E-08
18	TNT	118-96-7	9.60E+03	3.30E+00	9.50E+00	1.90E-04	2.20E-03	5.00E-08	4.10E-04	2.00E-04	1.70E-03	1.30E-03	2.50E-07	1.76E-06
18	Barium	7440-39-3	1.90E+03	2.30E-02	6.80E-02	1.60E-03	9.50E-03	5.00E-09	2.90E-06	1.20E-06	4.90E-08	5.30E-08	8.80E-09	3.17E-08
18	Aldrin	309-00-2	---	5.40E+01	1.60E+02	1.80E+02	2.10E+03	---	6.80E-03	4.00E-03	4.50E-01	3.90E-05	3.80E+00	2.70E+01
18	Alpha BHC	319-84-6	---	2.00E-01	5.90E-01	2.20E-03	2.50E-02	1.40E-07	2.60E-05	3.10E-06	7.50E-04	4.00E-06	2.10E-05	1.46E-04
18	Beta BHC	319-85-7	---	---	---	---	---	1.40E-07	---	---	---	---	---	---
18	Heptachlor Epoxide	1024-57-3	---	1.30E+02	3.70E+02	5.90E+00	6.80E+01	0.00E+00	1.60E-02	6.30E-03	2.60E-01	1.00E-03	3.20E-02	2.26E-01
22	RDX	121-82-4	1.90E+03	5.40E-01	1.60E+00	2.30E-06	2.70E-05	1.00E-06	6.80E-05	2.00E-05	6.90E-04	9.80E-04	7.70E-09	5.49E-08
22	Barium	7440-39-3	1.90E+03	2.30E-02	6.80E-02	1.60E-03	9.50E-03	5.00E-09	2.90E-06	1.20E-06	4.90E-08	5.30E-08	8.80E-09	3.17E-08
22	^{238}U	7440-61-1(D+)	---	---	---	---	---	---	---	---	---	---	---	---
23	TATB	3058-38-6	4.80E+02	5.40E-01	1.60E+00	1.60E-06	1.80E-05	---	6.80E-05	4.00E-05	8.60E-03	1.20E-03	6.50E-08	4.62E-07
23	HMX	2691-41-0	3.50E+02	3.30E-02	9.50E-02	9.50E-10	1.10E-08	2.00E-08	4.10E-06	7.90E-06	5.60E-02	1.10E-03	4.30E-09	3.02E-08
23	RDX	121-82-4	1.90E+03	5.40E-01	1.60E+00	2.30E-06	2.70E-05	1.00E-06	6.80E-05	2.00E-05	6.90E-04	9.80E-04	7.70E-09	5.49E-08
23	Benzo(a)pyrene	50-32-8	---	---	---	---	---	---	---	---	---	---	---	---
28	^{238}U	7440-61-1(D+)	---	---	---	---	---	---	---	---	---	---	---	---

Table A 17. Offsite Resident Farmer Child Noncancer Risk Characterization by Pathway (continued)

Grid Cell	COPC	CAS No.	Air Concentration (mg/m3)	Air Deposition (mg/m2-day)	Inhalation, Air Child HQ	Ingestion Root Vegetable, Air Deposition to Plant Child HQ	Ingestion Other Vegetable, Air Deposition to Plant Child HQ	Ingestion Meat, Air Deposition to Plant Child HQ	Ingestion Milk, Air Deposition to Plant Child HQ	Inhalation, Air Deposition to Soil Child HQ	Ingestion, Air Deposition to Soil Child HQ	Dermal, Air Deposition to Soil Child HQ	Ingestion Root Vegetable, Air Deposition to Soil Child HQ	Ingestion Other Vegetable, Air Deposition to Soil Child HQ	Ingestion Beef, Air Deposition to Soil Child HQ	Ingestion Milk, Air Deposition to Soil Child HQ	Total HI Child
18	TATB	3058-38-6	3.40E-09	7.40E-06	1.60E-06	1.80E-09	5.40E-09	5.40E-15	6.30E-14	--	5.00E-10	2.90E-10	6.40E-08	9.10E-09	4.80E-13	3.40E-12	
18	2,4-Dinitrotoluene	121-14-2	7.10E-10	1.50E-06	4.50E-06	5.70E-10	1.70E-09	5.00E-14	5.80E-13	1.00E-12	1.60E-10	5.30E-11	4.60E-09	3.90E-10	1.00E-12	7.30E-12	
18	2-Amino-4,6-Dinitrotoluene	35572-78-2	1.80E-08	3.80E-05	1.70E-04	1.70E-07	5.00E-07	6.30E-11	7.30E-10	3.80E-11	4.70E-08	2.70E-08	2.80E-07	5.10E-08	2.70E-10	1.90E-09	
18	4-Amino-2,6-Dinitrotoluene	19406-51-0	6.20E-09	1.40E-05	5.90E-05	6.10E-08	1.80E-07	1.50E-11	1.70E-10	5.00E-13	1.70E-08	9.60E-09	1.20E-07	2.30E-08	7.60E-11	5.40E-10	
18	HMX	2691-41-0	7.00E-09	1.50E-05	2.50E-06	2.30E-10	6.60E-10	6.60E-18	7.70E-17	3.00E-13	6.20E-11	1.20E-10	8.50E-07	1.60E-08	6.40E-14	4.60E-13	
18	Nitrobenzene	98-95-3	4.70E-09	1.00E-05	9.00E-07	1.50E-08	4.50E-08	5.80E-13	6.70E-12	9.30E-14	4.20E-09	1.20E-09	3.30E-08	1.70E-08	3.20E-12	2.30E-11	
18	RDX	121-82-4	4.50E-05	9.70E-02	8.50E-02	2.40E-05	7.00E-05	1.00E-10	1.20E-09	9.70E-08	6.60E-06	1.90E-06	6.70E-05	9.50E-05	7.50E-10	5.30E-09	
18	TNT	118-96-7	2.10E-05	4.50E-02	2.00E-01	6.70E-05	1.90E-04	3.80E-09	4.50E-08	2.20E-09	1.80E-05	8.80E-06	7.50E-05	5.90E-05	1.10E-08	7.90E-08	
18	Barium	7440-39-3	2.00E-05	4.80E-02	3.80E-02	4.60E-07	1.40E-06	3.20E-08	1.90E-07	2.40E-10	1.40E-07	5.80E-08	2.40E-09	2.50E-09	4.20E-10	1.50E-09	
18	Aldrin	309-00-2	1.60E-11	3.40E-08	--	8.40E-10	2.50E-09	2.80E-09	3.20E-08	--	2.30E-10	1.30E-10	1.50E-08	1.30E-12	1.30E-07	9.10E-07	
18	Alpha BHC	319-84-6	8.50E-11	1.80E-07	--	1.70E-11	5.00E-11	1.80E-13	2.10E-12	2.60E-14	4.70E-12	5.60E-13	1.40E-10	7.40E-13	3.80E-12	2.70E-11	
18	Beta BHC	319-85-7	9.80E-11	2.10E-07	--	--	--	--	--	3.00E-14	--	--	--	--	--	--	
18	Heptachlor Epoxide	1024-57-3	2.30E-11	5.00E-08	--	2.90E-09	8.40E-09	1.30E-10	1.60E-09	0.00E+00	7.80E-10	3.20E-10	1.30E-08	5.20E-11	1.60E-09	1.10E-08	
				Total HI by pathway	3.20E-01	9.20E-05	2.70E-04	3.90E-08	2.70E-07	9.90E-08	2.50E-05	1.10E-05	1.40E-04	1.50E-04	1.40E-07	1.00E-06	3.20E-01
22	RDX	121-82-4	2.50E-10	5.10E-05	4.80E-07	1.40E-10	4.00E-10	5.90E-16	6.90E-15	5.10E-11	3.50E-09	1.00E-09	3.50E-08	5.00E-08	3.90E-13	2.80E-12	
22	Barium	7440-39-3	1.30E-07	2.60E-04	2.50E-04	3.00E-09	8.70E-09	2.10E-10	1.20E-09	1.30E-12	7.60E-10	3.10E-10	1.30E-11	1.40E-11	2.30E-12	8.20E-12	
22	^{238}U	7440-61-1(D+)	4.50E-07	9.10E-10	--	--	--	--	--	--	--	--	--	--	--	--	
				Total HI by pathway	2.50E-04	3.10E-09	9.10E-09	2.10E-10	1.20E-09	5.20E-11	4.20E-09	1.30E-09	3.50E-08	5.00E-08	2.70E-12	1.10E-11	2.50E-04
23	TATB	3058-38-6	5.40E-07	1.10E-03	2.60E-04	2.90E-07	8.60E-07	8.60E-13	1.00E-11	--	7.60E-08	4.40E-08	9.60E-06	1.40E-06	7.20E-11	5.10E-10	
23	HMX	2691-41-0	2.30E-09	4.70E-06	8.10E-07	7.50E-11	2.20E-10	2.20E-18	2.50E-17	9.30E-14	1.90E-11	3.70E-11	2.60E-07	4.90E-09	2.00E-14	1.40E-13	
23	RDX	121-82-4	3.40E-08	6.90E-05	6.40E-05	1.80E-08	5.30E-08	7.90E-14	9.20E-13	6.90E-11	4.70E-09	1.40E-09	4.80E-08	6.70E-08	5.30E-13	3.80E-12	
23	Benzo(a)pyrene	50-32-8	3.60E-11	7.40E-08	--	--	--	--	--	--	--	--	--	--	--	--	
				Total HI by pathway	3.30E-04	3.10E-07	9.10E-07	9.40E-13	1.10E-11	6.90E-11	8.00E-08	4.50E-08	9.90E-06	1.40E-06	7.30E-11	5.20E-10	3.40E-04
28	^{238}U	7440-61-1(D+)	3.50E-07	6.80E-10	--	--	--	--	--	--	--	--	--	--	--	--	
				Total HI by pathway	--	--	--	--	--	--	--	--	--	--	--	--	--

COPC – Contaminant of potential concern
CAS -Chemical Abstract Service
URV_{nenc} - Non-cancer Unit Risk Value
HI - Hazard Index
HQ - Hazard Quotient

Table A-18. Summary of Uncertainty for Burning Ground Human Health Risk Assessment

Source of Uncertainty	Adjustment	Magnitude and Impact of Uncertainty
Grid Placement Sensitivity Analysis		
Alternate Placement of Original 6-Acre Worker Exposure Area		
Location of 6-acre EA	Alternative placement of 6-acre EAs	Moderate impact, alternative 6-acre EAs underestimate risk compared to original 6-acre EA.
Size, Orientation, and Shape of Grid Cells		
6-acre EA based upon documented worker activity patterns within Sheridan Drive loop	Replicated 6-acre EA over Burning Ground area	Low impact, reasonable maximum exposure and risk based upon documented worker activity patterns.
Code Verification		
Governing equations in model codes	Verification	Low impact, code verification indicated subsurface models capable of solving equations governing subsurface flow and transport under conditions at Pantex Plant.
Input Parameter Uncertainty in Subsurface Model		
Hydraulic Conductivity	Most Conductive Type Section Used for Analysis	Moderate impact, affects rate of migration. Used most conductive material in column studies to be most conservative. Used calibrated models in 3-D analysis. Varied source size in 3-D to assess uncertainty. Overestimates impact and therefore risk via groundwater pathway.
Unsaturated Zone Properties	Most Representative	Low impact, affects the amount of water content in soils for a given recharge. Amount of water content affects flow velocity of a factor on velocity of ± ½. Using most representative values does not overestimate or underestimate risks.
Recharge Rates	Highest calibrated	Moderate impact, increased recharge affects rate of material migration and dilution of material. Interplaya recharge rate from calibration of site-wide model used. Other estimates of interplaya recharge were less.
Transport Properties—Retardation/Decay	None used for base calculations	High impact, retardation will slow any material plume movement by the amount it reacts with the soil. Decay reduces concentration by destruction. Conservative calculations (no retardation/decay) overestimate risk.
Distance to Receptor	No adjustment made	Moderate impact, overestimates risk. Shorter distances to receptor, with all other aspects held constant, will reduce the DAF. DAF_{EPA} assumes receptor is located at the edge of the source area; hence including distance would increase the DAF.
Shallow zone soil gas and residual NAPL source term	No adjustment made	Low impact, slightly overestimates risk. Used upper end estimate of residual NAPL mass, beyond what is reasonably expected.

Table A 18. Sources of Uncertainty for Burning Ground Human Health Risk Assessment (continued)

Source of Uncertainty	Adjustment	Magnitude and Impact of Uncertainty
Intermediate zone soil gas	No adjustment made	Low impact. Evaluated with shallow zone modeling results and post-SVE data. Migration of soil gas through the FGZ is not indicated except associated with PTX01-1003.
Deep zone soil gas	No adjustment made	Moderate impact, overestimates risk. Used maximum measured value in deep zone soil gas and calculated impact at water table surface with no further transport.
Future Conditions	Current observed conditions used as basis for future impacts	Moderate impact, overestimates risk as travel times to and within the Ogallala Aquifer are likely to increase as Ogallala water levels decline.
Atmospheric Model Sensitivity Analysis		
Air Dispersion Model Sensitivity		
Atmospheric flow and turbulent velocity field	No adjustment made	Moderate impact, may overestimate or underestimate modeled concentration by 50 percent.
Sensitivity of Predicted Concentrations	Adjusted particle size from 2 to 20 µm and 2 to 200 µm	Low impact, representative site values used. Increasing particle size from 2 to 20 µm reduces concentration at boundary 24 percent; increasing particle size 2 to 200 µm reduces concentration at boundary 87 percent.
Sensitivity of Receptor Grid Placement	Adjusted particle size from 2 to 20 µm and 2 to 200 µm	Low impact, representative site values used. Increasing particle size from 2 to 20 µm increases deposition by a factor of 28; increasing particle size from 2 to 200 µm increases deposition by a factor of 177.
Risk Assessment		
Uncertainty Related to Data Collection and Analysis		
Variability in contaminant distributions.	Used lower of maximum detected value or 95% UCL to estimate risk	Moderate impact, tends to overestimate COPC concentration and risk.
Sampling locations focused in areas of potential contamination.	No adjustment made.	Moderate impact, overestimates COPC concentration and risk.
Uncertainty in Exposure Assessment		
Use of TCEQ default for exposure duration for Burning Ground and Playa 3 industrial workers.	No adjustments made.	Low impact, overestimates risk. Site-specific worker activity patterns show Burning Ground operators are exposed about 20 hr/wk, or half the TCEQ default. Workers are rarely present in Playa 3.

Table A 18. Sources of Uncertainty for Burning Ground Human Health Risk Assessment (continued)

Use of 6-acre exposure area for onsite receptors.	No adjustments made.	Low-moderate impact. Outdoor work at the Burning Ground is largely confined to a 6-acre area within the circular road. This assumption is realistic within the road loop and should not result in an over- or underestimation of the actual risks. This is conservative for the area surrounding the active work area as the only workers (groundskeepers, samplers, and subcontractors) present will contact larger areas of the site; therefore, risk is overestimated.
Age-adjusting applied in estimating chronic intakes for carcinogenic COPCs for the off-site resident farmer. Child receptor selected to estimate potential noncarcinogenic health effects for offsite resident farmers.	For the composite receptor, exposure parameters were age-adjusted to account for a 6-year exposure duration as a child and a 34-year exposure duration as an adult. For noncarcinogenic COPCs, both a child and an adult farmer were evaluated for risk.	Low impact, increases estimate of risk because the child receptor is often a more sensitive receptor for exposure to noncarcinogenic toxicants. The duration of the age-adjusted adult farmer is high to account for potential for increased carcinogenic risk.
Uncertainty Related to Toxicity Information		
Uncertainty inherent within the toxicity assessment primarily due to differences in study design, species, sex, routes of exposure, or dose-response relationships.	EPA approved toxicity values were used for the chemical and radiological risk assessment.	Moderate impact, overestimates risk. Toxicity values are adjusted to ensure they are high-end estimators of risk.
Use of the TEF approach to assess risk due to exposure to complex environmental mixtures of PCDDs, PCDFs and PCBs.	To apply the TEF concept, the TEF of each congener present in a mixture was multiplied by the representative mass concentration and the products summed to represent the 2,3,7,8-TCDD TEQ.	Moderate impact, overestimates risk. The presence of PCDDs, PCDFs and PCBs in the environment does not necessarily result in exposure or risk. TEFs are selected to account for uncertainties and to avoid underestimating risk. TEFs are public health conservative values.
Uncertainty Related to Risk Characterization		
Addition of cancer risks from chemical and radiological COPCs	Risk from non-radionuclides and radionuclides were assessed separately but added to estimate cumulative cancer risk.	Moderate impact, overestimates cumulative risk. EPCs for radionuclides and non-radionuclides incorporate different assumptions and RAGS cautions against combining radiological and non-radiological risks. In addition, natural background radiation is ubiquitous at levels exceeding typical risk targets and natural variability may preclude the ability to quantify small incremental risks due to contamination (EPA, 1996c). Despite these differences, a dose conversion factor for radiological exposures was used to calculate lifetime committed effective dose equivalents.

A.6 BURNING GROUND HHRA SUMMARY AND CONCLUSION

The risk characterization identified areas of the Burning Ground that result in unacceptable risks/hazards to onsite workers from exposure to soils. Exceedances of acceptable risk/hazard target levels for the onsite worker were found in Grid Cells 12, 13, 17, 18, 22, and 23. The predominant COCs identified for Burning Ground include RDX, TNT, and ^{238}U. Grid Cells 13 and 18 presented the highest risk/hazard to workers. The COCs identified in this HHRA will be the focus for the CMS and other remedial activities for the Burning Ground.

Soil and soil gas COPCs evaluated using fate and transport models were found to not impact onsite or offsite receptors evaluated for the Ogallala Aquifer, and no COPCs were currently identified in the Ogallala Aquifer based on the current monitoring network. Therefore, the groundwater pathway is incomplete, and risks/hazard evaluation was not conducted. Analysis of volatilization of soil gas COPCs to the air resulted in values lower than conservative risk-based screening levels; therefore, risk was not calculated for this pathway. Evaluation of soil particulate emissions from the Burning Ground to the offsite resident farmer were below acceptable target risk levels.

Although the risk assessment does not indicate impacts to the Ogallala Aquifer, long-term monitoring will continue at the Burning Ground due to uncertainties in knowledge of the hydrogeologic system and the extent of contamination (including the presence of residual NAPL), as well as uncertainties in the risk assessment methodology.

Table A-19. Summary of Pantex Burning Ground HHRA Characterization

Grid Cell	Cumulative ILCR>1E-6, HI>1, or TEQ>5ppb/Receptor	Risk/Hazard Levels > Acceptable Levels[a]	COCs (ILCR>1E-6 or HI>1)
7	Not exceeded	No	None
8	HI=2.1/Construction Worker[b] TEQ=5.8 ppb/Construction Worker[c]	No	None
9	Cumulative ILCR=1.4E-6/Industrial Worker[d]	No	None
12	HI=2.2/Industrial Worker[e] Cumulative ILCR=1.6E-5/Industrial Worker HI=2.8/Construction Worker[f]	Yes	RDX TNT ^{238}U
13	Cumulative ILCR=2.9E-4 and HI=29/Industrial Worker Cumulative ILCR=4.4E-6 and HI=42/Construction Worker	Yes	RDX TNT
14	Not exceeded	No	None
17	Cumulative ILCR=5.0E-6/Industrial Worker[g]	Yes	^{238}U
18	Cumulative ILCR=4.1E-3 and HI=123/Industrial Worker Cumulative ILCR=1.0E-5 and HI=90/Construction Worker	Yes	RDX TNT
22	Cumulative ILCR=3.9E-6/Industrial Worker	Yes	^{238}U
23	Cumulative ILCR=6.0E-5 and HI=1.8/Industrial Worker[h] HI=1.6/Construction Worker[h]	Yes	RDX
28	Not exceeded	No	None
Playa 3	Not exceeded	No	None

[a]TCEQ and EPA unacceptable level for multiple COPCs is: cumulative ILCR > 1E-4 or HI > 1; unacceptable level for individual COPCs is: ILCR > 1E-6 or HQ > 1; unacceptable level for individual radionuclides is: ILCR>1E-4, unless the radionuclide adds to the cumulative chemical risk, then 1E-6 is used and radionuclide also carried forward.
[b]TNT contributes 68% of HI (1.4), HI approximately equal to 1; TNT not additive to other detected noncarcinogenic COPCs; TNT removed as a COC.
[c]The 5.8 ppb occurs in subsurface soils that are not contacted by workers at the Burning Ground and the value is driven by high detection limits; other TEQ values in the same location at different depths were below the 5 ppb limit; dioxins for the one location were removed as a COC.
[d]TATB ILCR contribution to slightly elevated cumulative cancer risk is 100%; uncertainty with regard to derived toxicity values; removed as a COC.
[e]TNT and barium HQs=1.0 and 1.1 respectively; effects are not cumulative; both are approximately equal to 1; TNT and barium not considered as COCs.
[f]Only TNT considered as a COC for noncancer effects; barium HQ=1.1 – approximately equal to 1; removed as a COC.
[g] ^{234}U removed as a COC due to inclusion of a single anomalous high result in older compliance data (1994). All data collected at that location since that time are below residential PRGs.
[h]TATB primary contributor to slightly elevated non-cancer (93%) and cancer risk (91%), uncertainty with regard to derived toxicity values, uncertainty with regard to removal of TATB during an interim corrective measure, removed as a COC.
COC – contaminant of concern
COPC - contaminant of potential concern
EPA – United States Environmental Protection Agency
HI – hazard index
HQ - hazard quotient
ILCR – incremental lifetime cancer risk
TCEQ - Texas Commission on Environmental Quality
TEQ - toxicity equivalency quotient

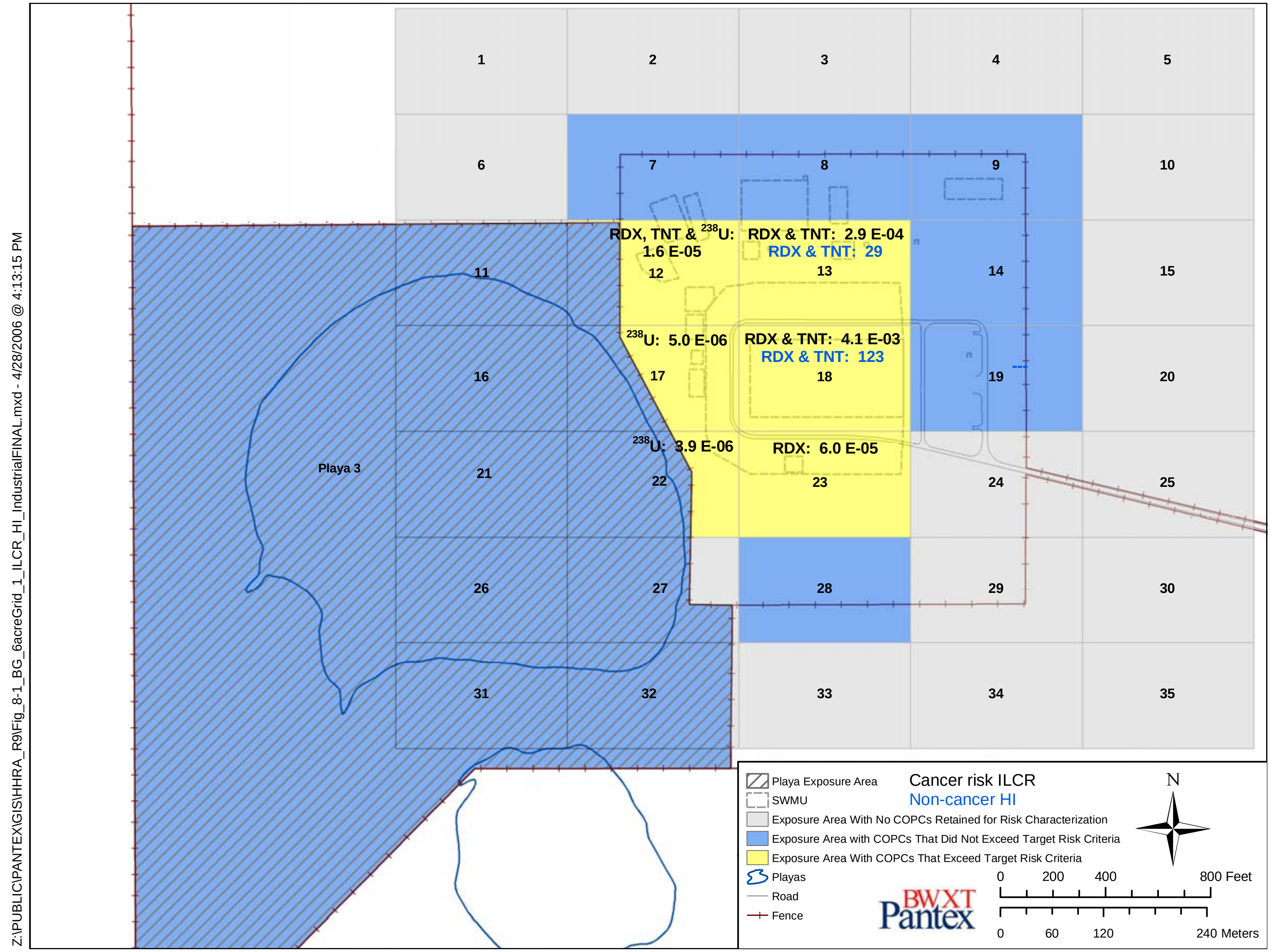

Figure A-2. Burning Ground Risk Results and COCs for Pantex Plant Industrial Worker, Surface Soil (0-2 ft)

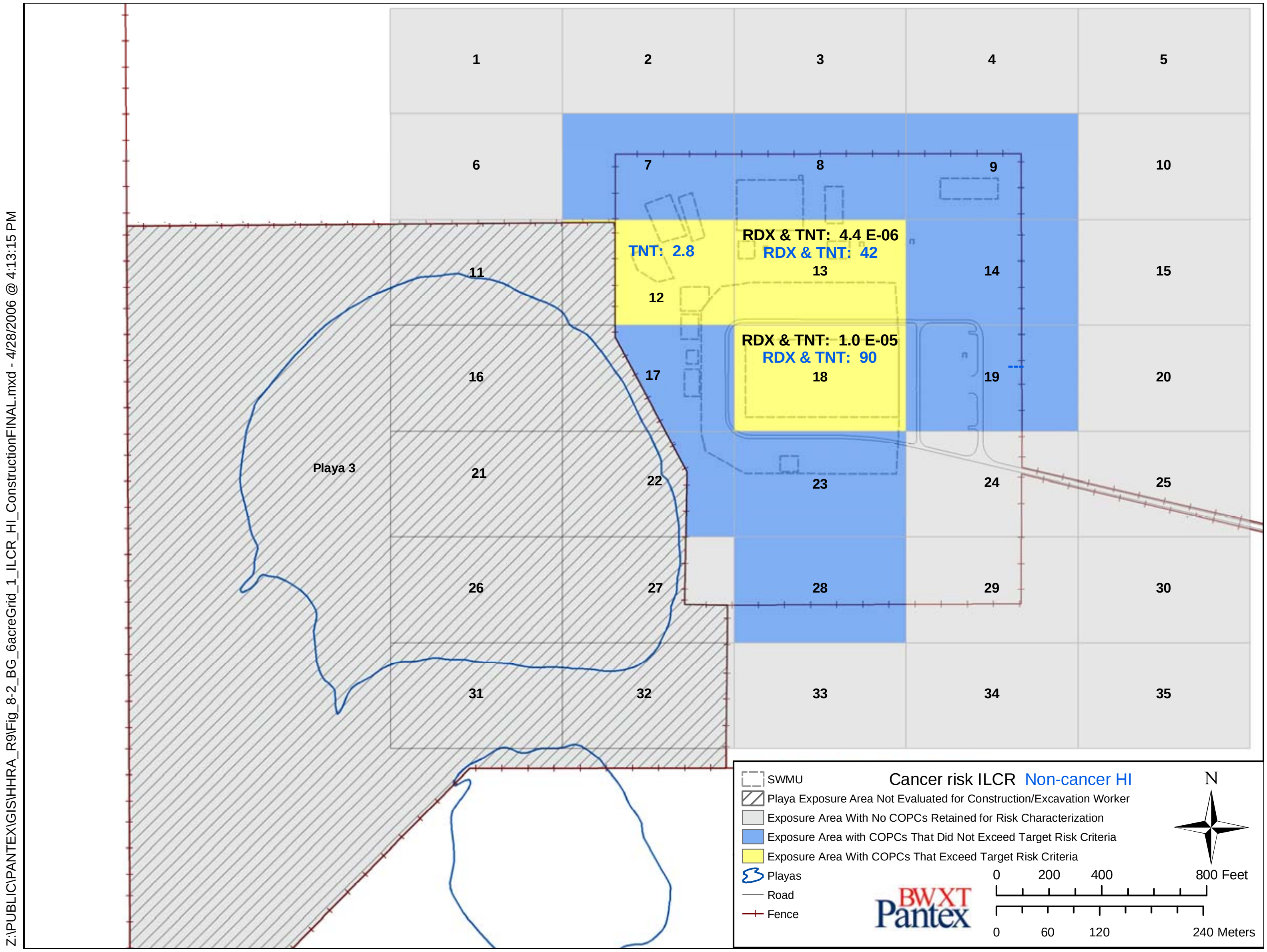

Figure A-3. Burning Ground

Appendix B

Zone 10 Release Units Requiring Remedial Action

SWMU 60: Landfill 9
SWMU 61: Landfill 10
SVS 5: Landfill East of Pad 11-13

SWMU 68d: Sanitary Landfill
SVS 8: Abandoned Zone 10 Landfill
Unassigned AOC: Zone 10 Landfills West and Southwest of SWMU 84 Scrap and Salvage Yard

Contains modified excerpts from Appendix A of the
Baseline HHRA Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groundwater (BWXT Pantex and SAIC, December 2006)

RELEASE OF INFORMATION TO THE PUBLIC
DOCUMENTED REVIEW PROCESS
(Ref. WI 02.04.02.02.03)

Document Title Baseline Human Health Risk Assessment Report for Zones 10, 11, and 12 , Fire Training Area, Ditches and Playas, Independent Sites, and Groudnwater – Volumes I and II Date 12/9/2005
Document Author Michelle Bolwahnn Type of Doc Report

Document Due Date 12-22-2005 Blanket Release Expires ____________

This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☒ No ☐	[signature] for M.G. Knight	DEC 0 9 2005
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐	[signature]	12/13/05
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐	[signature]	12/13/05
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐	[signature]	12/12/05
Legal 12-72 Legal	Legal	Yes ☑ No ☐	[signature]	01/09/05
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐	[signature] J. Kelly	01/10/2005

After all signatures are obtained, forward copy via email or plant mail to the Classification Officer and OSTI Transmittal Officer

Comments: **Please call Marlon Smith (x4058) or Michelle Bolwahnn (6326) for pickup after signature**

Please see attached comments J x6616
* with revised Exe. Summary and various changes already made

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B.0 ZONE 10 RELEASE UNITS REQUIRING REMEDIAL ACTION

Figure B-1. Zone 10 Release Units and Exposure Area Grid

Table B-1. Crosswalk of Grid Cells to Release Units Requiring Remedial Action

Units Requiring Remedial Action	**Grid Cell(s)**
SWMU 68d: Sanitary Landfill	17, 18, 19, 21, 22, 23
SVS 8: Abandoned Zone 10 Landfill	4, 6, 7, 10, 11, 14, 15
Unassigned AOC: Zone 10 Landfills West and Southwest of SWMU 84 Scrap and Salvage Yard	25, 26, 29

Table B-2. Complete Starting List of Soil, Gas, and Groundwater COPCs at Zone 10

COPC	*Zone 10 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
HEs			
1,3-Dinitrobenzene	--	--	√[b]
2,4-Dinitrotoluene	√	--	√[b]
2,6-Dinitrotoluene	--	--	√[b]
2-Amino-4,6-dinitrotoluene	√	--	√[b]
4-Amino-2,6-dinitrotoluene	√	--	√[b]
HMX	√	--	√[b]
RDX	--	--	√[b]
1,3,5-Trinitrobenzene	√	--	√[b]
TNT	√	--	√[b]
1,3,5-Triamino-2,4,6-trinitrobenzene	√	--	--
Metals			
Aluminum	√	--	--
Antimony	√[c]	--	--
Arsenic	√	--	--
Barium	√	--	--
Beryllium	√	--	--
Boron	√	--	√[b]
Cadmium	√	--	--
Chromium, Total	√	--	√[b]
Chromium, Hexavalent	√	--	√[b]
Cobalt	√	--	--
Copper	√	--	--
Lead	√	--	--
Lithium	√[c]	--	--
Manganese	√	--	--
Mercury	√	--	--
Molybdenum	√[c]	--	--
Nickel	√	--	√[b]
Selenium	√[c]	--	√[b]

Table B-2. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at Zone 10[a] (continued)

COPC	*Zone 10 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
Silver	√	--	--
Strontium	√	--	--
Pesticides			
Aldrin	√	--	--
Alpha BHC	√	--	--
Delta BHC	√	--	--
Gamma BHC	√	--	--
Chlordane	√	--	--
Alpha-Chlordane	√	--	--
Beta-Chlordane	√	--	--
4,4'-DDD	√	--	--
4,4'-DDE	√	--	--
4,4'-DDT	√	--	--
Dieldrin	√	--	--
Endrin	√	--	--
Heptachlor	√	--	--
Methoxychlor	√	--	--
Silvex	√[e]	--	--
PCBs			
PCB-1242	√	--	--
PCB-1254	√	--	--
PCB-1260	√	--	--
Radionuclides			
Tritium[d]	√	--	--
^{235}U[d]	√	--	--
SVOCs			
Acenaphthene	√	--	--
Acenaphthylene	√	--	--
Anthracene	√	--	--
Butylbenzylphthalate	√	--	--
Bromodichloromethane	√[e]	--	--
bis(2-Ethylhexyl)phthalate	√	--	--

Table B-2. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at Zone 10[a] (continued)

COPC	*Zone 10 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
Benzo(a)anthracene	√	--	--
Benzoic Acid	√	--	--
Benzo(a)pyrene	√	--	--
Benzo(b)fluoranthene	√	--	--
Benzo(g,h,i)perylene	√	--	--
Benzo(k)fluoranthene	√	--	--
Carbazole	√	--	--
Chrysene	√	--	--
Dibenz(a,h)anthracene	√	--	--
Dibenzofuran	√	--	--
1,2-Dichloroethane	--	--	√[b]
di-n-Butyl phthalate	√	--	--
Dinoseb	√[e]	--	--
Fluorene	√	--	--
Fluoranthene	√	--	--
Indeno-1,2,3-pyrene	√	--	--
2-Methylphenol	√[e]	--	--
Naphthalene	√	--	--
Phenanthrene	√	--	--
Phenol	√	--	--
Pyrene	√	--	--
VOCs			
Acetone	√	√	--
Benzene	--	√	--
Bromomethane	√[e]	--	--
Carbon Disulfide	--	√	--
Carbon Tetrachloride	√[e]	--	--
Chlorobenzene	√[e]	--	--
Chloroethane	√[e]	--	--
Chloroform	--	√	√[b]
Chloromethane	--	√	--

Table B-2. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at Zone 10[a] (continued)

COPC	*Zone 10 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
1,4-Dichlorobenzene	--	√	--
1,1-Dichloroethane	--	√	--
1,1-Dichloroethene	--	√	--
1,2-Dichloroethene	√[e]	--	--
Dichlorodifluoromethane	--	√	--
1,2-Dichloropropane	√[e]	--	--
Ethylbenzene	√	√	--
Freon-113	--	√	--
Freon-114	--	√	--
2-Hexanone	--	√	--
Isopropanol	√	--	--
Methyl ethyl ketone	√	√	--
Methylene chloride	√	√	--
Styrene	√	√	--
Tetrachloroethylene	√	√	√[b]
Toluene	√	√	--
1,1,1-Trichloroethane	--	√	--
1,1,2-Trichloroethane	√[e]	--	--
Trichloroethene	--	√	√[b]
Trichlorofluoromethane	√	√	--
1,2,4-Trimethylbenzene	--	√	--
1,2,3-Trichloropropane	√	√	--
1,2,3-Trinitrobenzene	--	√	--
Xylenes	√	--	--
m,p-Xylenes	--	√	--
o-Xylenes	--	√	--
Vinyl chloride	√[e]	--	--

COPC list is for all release units in Zone 10.

[a]Unless otherwise noted, all chemicals are from the COPC list included as Enclosure 3 to the TCEQ *Zone 10 RFIR* Approval Letter (soil and soil gas).
[b]The *Groundwater RFIR* did not identify any groundwater COPCs for Zone 10. All COPCs listed were identified as site-wide groundwater COPCs in Appendix I.
[c]Metal was added to COPC list because all detected metals are re-evaluated based on availability of new background RRS 1 values.

Table B-2. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at Zone 10[a] (continued)

COPC	*Zone 10 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater

[d]Some Zone 10 release sites are potentially radiologically impacted sites by the *RI Report* (BWXT Pantex, 2004); these constituents were added to the starting list because they are listed as COPCs in the *RI Report* for these Zone 10 sites.
[e]These COPCs were specifically added to the Zone 10 list by the TCEQ *Zone 10 RFIR* Approval Letter (TCEQ, 2003).

√ COPC for unit

-- not a COPC for unit

Table B-3. COPCs Retained for Further Evaluation in the Zone 10 HHRA Surface Soil (0-2 ft) for Industrial Worker Evaluation

Retained COPCs	COPCs Retained by Grid Cell[a]								
	7	14	30	32	33	34	35	37	38
HEs									
TNT	--	--	--	--	√	--	--	--	--
Metals									
Antimony	√	--	--	√	√	√	--	√	√
Cadmium	--	--	--	--	--	√	--	--	--
Mercury	--	√	--	--	--	--	--	--	--
Pesticides									
Beta-chlordane	√	--	--	--	--	--	--	--	--
SVOCs									
Benzo(a)pyrene	√	--	√	--	--	--	√	--	--

[a]No COPCs identified for further investigation in Grid Cells 1-6, 8-13, 15-29, 31, 36, and 39.

√ COPC for grid cell

-- not a COPC for grid cell

**Table B-4. COPCs Retained for Further Evaluation in the Zone 10 HHRA
Soil (0-15 ft) for Construction/Excavation Worker Evaluation**

COPC	COPCs Retained by Grid Cell[a]																	
	3	4	7	11	13	14	15	17	18	20	21	30	32	33	34	35	37	38
HEs																		
2,4-Dinitrotoluene	--	--	--	--	--	--	--	--	--	--	--	--	--	√	--	--	--	--
TNT	--	--	--	--	--	--	--	--	--	--	--	--	--	√	--	--	--	--
Metals																		
Aluminum	--	--	--	--	--	--	--	--	√	√	√	--	--	--	--	--	--	--
Antimony	--	--	√	--	--	--	--	--	--	--	--	--	√	√	√	--	√	√
Barium	√	√	√	√	√	--	--	--	√	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	√	--	--	--	--	--	--	√	--	--	--
Mercury	--	--	--	--	--	√	--	--	--	--	√	--	--	--	--	--	--	--
Zinc	--	--	--	--	--	--	--	--	--	--	√	--	--	--	--	--	--	--
Pesticides																		
Beta-Chlordane	--	--	√	--	--	--	--	√	--	--	√	--	--	--	--	--	--	--
SVOCs																		
Benzo(a)anthracene	--	--	--	√	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	√	√	--	--	√	--	--	--	--	√	--	--	√	√	--	--
Benzo(b)fluoranthene	--	--	--	√	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	--	--	--	√	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Carbazole	--	--	--	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	√	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	--	--	--	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	√	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--

[a]No COPCs identified for further investigation in Grid Cells 1, 2, 5, 6, 8-10, 12, 16, 19, 22-29, 31, 36, and 39.

√ COPC for grid cell

-- not a COPC for grid cell

Table B-5. COPCs Retained for Further Evaluation in the Zone 10 HHRA Soil-to-Groundwater Pathway

COPC	
Zone 10	
HEs	
2,4-Dinitrotoluene	4-Amino-2,6-dinitrotoluene
TNT	
Metals	
Antimony	Barium
Cadmium	Chromium
Lead	Manganese
Mercury	Total Uranium
Zinc	
PCBs	
PCB-1242 (Aroclor-1242)[a]	PCB-1260 (Aroclor-1260)[a]
PCB-1254 (Aroclor-1254)[a]	
Pesticides	
4,4'-DDD	4,4'-DDE
4,4'-DDT	Aldrin
Alpha-Chlordane	Beta-Chlordane
Delta BHC	Dieldrin
SVOCs	
Acenaphthene	Benzo(a)anthracene
Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(k)fluoranthene	bis(2-Ethylhexyl)phthalate
Carbazole	Chrysene
Dibenz(a,h)anthracene	Indeno(1,2,3)pyrene
VOCs	
1,2,3-Trichloropropane	Methylene Chloride
Unassigned SWMU - Zone 10 Berms	
Pesticides	
Alpha BHC	Delta BHC
Gamma BHC (Lindane)	

[a] Individual PCBs were detected in soil (all depths) and are listed above as COPCs retained for evaluation of the soil-to-groundwater pathway, even though PCBs were evaluated as total PCBs in the COPC evaluation (see Table 2A-4). This is because TCEQ's GWP-Res value, which was used to evaluate PCBs for this pathway, is derived based on total PCBs.

Table B-6. COPCs Retained for Further Evaluation in the Zone 10 HHRA Soil Gas-to-Groundwater

COPC	Shallow	Intermediate
VOCs		
Acetone	√	√
Freon-114	√	--
Tetrachloroethylene (PCE)	√	--
Trichloroethene	√	--

√ COPC for unit

-- not a COPC for unit

Table B-7. Zone 10 EPC Evaluation for Surface Soil (0-2 ft)

Grid Cell	COPC	CAS No.	Total # of Samples	Total # of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals									
7	Antimony	7440-36-0	4	1	7.90E+00	7.90E+00	NA	--	7.90E+00
Pesticides									
7	Beta-Chlordane	5103-74-2	6	1	1.40E-03	1.40E-03	NA	--	1.40E-03
SVOCs									
7	Benzo(a)Pyrene	50-32-8	9	3	4.84E-02	1.90E-01	NA	--	1.90E-01
Metals									
14	Mercury	7439-97-6	7	1	5.40E+00	5.40E+00	NA	--	5.40E+00
SVOCs									
30	Benzo(a)Pyrene	50-32-8	12	3	5.20E-02	1.40E-01	D	2.03E-01	1.40E-01
Metals									
32	Antimony	7440-36-0	6	1	1.00E+01	1.00E+01	NA	--	1.00E+01
HEs									
33	TNT	118-96-7	20	9	5.60E-02	1.30E+01	D	2.27E+00	2.27E+00
Metals									
33	Antimony	7440-36-0	11	9	8.90E+00	9.70E+00	X	9.29E+00	9.29E+00
Metals									
34	Antimony	7440-36-0	22	17	8.60E+00	1.20E+01	X	9.14E+00	9.14E+00
34	Cadmium	7440-43-9	37	14	1.10E-01	1.54E+01	D	1.82E+00	1.82E+00
SVOCs									
35	Benzo(a)Pyrene	50-32-8	5	1	2.20E-01	2.20E-01	NA	--	2.20E-01
Metals									
37	Antimony	7440-36-0	7	7	8.30E+00	9.70E+00	NA	--	9.70E+00
Metals									
38	Antimony	7440-36-0	4	4	9.80E+00	1.00E+01	NA	--	1.00E+01

All concentrations in mg/kg.

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

-- 95% UCL not determined due to less than 10 total samples.

Table B-8. Zone 10 EPC Evaluation for Soil (0-15 ft)

Grid Cell	COPC	CAS No.	Total # of Samples	Total # of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
					Metals				
3	Barium	7440-39-3	4	4	7.75E+01	1.26E+03	NA	--	1.26E+03
					Metals				
4	Barium	7440-39-3	8	8	7.70E+01	1.80E+03	NA	--	1.80E+03
					Metals				
7	Antimony	7440-36-0	11	2	7.50E+00	7.90E+00	D	8.16E+00	7.90E+00
7	Barium	7440-39-3	15	15	8.80E+01	5.00E+03	X	1.10E+03	1.10E+03
					Pesticides				
7	Beta-Chlordane	5103-74-2	13	3	1.40E-03	2.60E-02	D	7.52E-03	7.52E-03
					SVOCs				
7	Benzo(a)Pyrene	50-32-8	20	3	4.84E-02	1.90E-01	D	3.83E-01	1.90E-01
					Metals				
11	Barium	7440-39-3	17	17	8.70E+01	1.10E+03	L	3.82E+02	3.82E+02
					SVOCs				
11	Benzo(a)Anthracene	56-55-3	13	4	4.90E-02	3.60E+01	D	8.53E+00	8.53E+00
11	Benzo(a)Pyrene	50-32-8	13	3	5.50E-02	3.80E+01	D	8.97E+00	8.97E+00
11	Benzo(b)Fluoranthene	205-99-2	13	3	6.30E-02	3.40E+01	D	8.13E+00	8.13E+00
11	Benzo(k)Fluoranthene	207-08-9	13	3	6.20E-02	3.10E+01	D	7.50E+00	7.50E+00
11	Dibenz(a,h)Anthracene	53-70-3	13	1	6.90E+00	6.90E+00	D	2.78E+00	2.78E+00
11	Indeno(1,2,3-c,d)Pyrene	193-39-5	13	1	2.20E+01	2.20E+01	D	5.65E+00	5.65E+00
					Metals				
13	Barium	7440-39-3	6	6	1.19E+02	3.80E+03	NA	--	3.80E+03
					Metals				
14	Mercury	7439-97-6	10	3	1.00E-01	5.40E+00	D	1.63E+00	1.63E+00
					SVOCs				
15	Benzo(a)Anthracene	56-55-3	10	1	5.30E+02	5.30E+02	D	1.50E+02	1.50E+02
15	Benzo(a)Pyrene	50-32-8	10	1	4.50E+02	4.50E+02	D	1.28E+02	1.28E+02
15	Benzo(b)Fluoranthene	205-99-2	10	1	4.50E+02	4.50E+02	D	1.28E+02	1.28E+02
15	Benzo(k)Fluoranthene	207-08-9	10	1	2.50E+02	2.50E+02	D	7.10E+01	7.10E+01
15	Carbazole	86-74-8	10	1	2.20E+02	2.20E+02	D	6.25E+01	6.25E+01
15	Chrysene	218-01-9	10	1	5.30E+02	5.30E+02	D	1.50E+02	1.50E+02
15	Dibenz(a,h)Anthracene	53-70-3	10	1	2.60E+02	2.60E+02	D	7.38E+01	7.38E+01
15	Dibenzofuran	132-64-9	10	1	2.00E+02	2.00E+02	D	5.68E+01	5.68E+01
15	Fluoranthene	206-44-0	10	1	1.50E+03	1.50E+03	D	4.25E+02	4.25E+02
15	Indeno(1,2,3-c,d)Pyrene	193-39-5	10	1	2.60E+02	2.60E+02	D	7.38E+01	7.38E+01
15	Naphthalene	91-20-3	10	1	3.50E+02	3.50E+02	D	9.93E+01	9.93E+01
15	Phenanthrene	85-01-8	10	1	1.60E+03	1.60E+03	D	4.53E+02	4.53E+02
15	Pyrene	129-00-0	10	1	1.50E+03	1.50E+03	D	4.25E+02	4.25E+02
					Metals				
17	Cadmium	7440-43-9	16	2	6.90E-02	2.27E+01	D	4.12E+00	4.12E+00

Table B-8. Zone 10 EPC Evaluation for Soil (0-15 ft) continued

Grid Cell	COPC	CAS No.	Total # of Samples	Total # of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
				Pesticides					
17	Beta-Chlordane	5103-74-2	13	1	3.00E-03	3.00E-03	D	9.15E-03	3.00E-03
				Metals					
18	Aluminum	7429-90-5	19	19	6.30E+03	2.97E+04	L	1.60E+04	1.60E+04
18	Barium	7440-39-3	20	20	6.60E+01	7.90E+03	X	1.32E+03	1.32E+03
				Metals					
20	Aluminum	7429-90-5	2	2	1.31E+04	2.94E+04	NA	--	2.94E+04
				Metals					
21	Aluminum	7429-90-5	11	11	6.04E+03	5.49E+04	X	2.16E+04	2.16E+04
21	Mercury	7439-97-6	10	3	1.40E-01	1.20E+00	D	3.95E-01	3.95E-01
21	Zinc	7440-66-6	10	10	2.50E+01	7.14E+03	X	2.05E+03	2.05E+03
				Pesticides					
21	Beta-Chlordane	5103-74-2	5	1	7.40E-03	7.40E-03	NA	--	7.40E-03
				SVOCs					
30	Benzo(a)Pyrene	50-32-8	28	3	5.20E-02	1.40E-01	D	1.94E-01	1.40E-01
				Metals					
32	Antimony	7440-36-0	21	11	9.00E+00	1.60E+01	X	8.78E+00	8.78E+00
				HEs					
33	2,4-Dinitrotoluene	121-14-2	43	2	1.50E+00	2.70E+00	D	2.87E-01	2.87E-01
33	TNT	118-96-7	49	14	5.60E-02	1.30E+01	D	1.03E+00	1.03E+00
				Metals					
33	Antimony	7440-36-0	28	26	8.90E+00	1.70E+01	X	1.02E+01	1.02E+01
				Metals					
34	Antimony	7440-36-0	46	37	3.30E-01	2.20E+01	X	9.81E+00	9.81E+00
34	Cadmium	7440-43-9	73	16	1.10E-01	1.54E+01	D	1.20E+00	1.20E+00
				SVOCs					
34	Benzo(a)Pyrene	50-32-8	72	2	7.07E-02	1.60E-01	D	1.93E+01	1.60E-01
				SVOCs					
35	Benzo(a)Pyrene	50-32-8	15	2	5.60E-02	2.20E-01	D	5.30E+01	2.20E-01
				Metals					
37	Antimony	7440-36-0	12	12	8.30E+00	1.00E+01	N	9.52E+00	9.52E+00
				Metals					
38	Antimony	7440-36-0	4	4	9.80E+00	1.00E+01	NA	--	1.00E+01

All concentrations in mg/kg.

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

N - Distribution is normal. 95% UCL calculated using Student's t-statistic.

-- 95% UCL not determined due to less than 10 total samples.

B.1 RISK CHARACTERIZATION FOR ONSITE RECEPTORS AT ZONE 10

Three onsite media of concern were identified for Zone 10: soil, air, and groundwater.

B.1.1 Risk Characterization for Onsite Soil and Air at Zone 10

Two onsite exposure scenarios are quantitatively evaluated for Zone 10:

- Current/future industrial worker exposed to surface soil (0 to 2 ft) via ingestion, dermal contact, and inhalation of contaminants emitted to air.
- Current/future construction worker exposed to soil (0 to 15 ft) via ingestion, dermal contact, and inhalation of contaminants emitted to air.

Current and future risks were evaluated for these receptors/pathways for each grid cell at Zone 10 from EPCs (95% UCL on the mean or maximum detected concentration) calculated from measured soil concentrations.

Individual and cumulative ILCRs and HQs/HIs are calculated for COPCs for each grid cell and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0). Grid cell results fall into three categories:

- Grid cells with no COPCs: No surface soil (0 to 2 ft) or soil (0 to 15 ft) COPCs were identified in twenty-one grid cells (Grid Cells 1, 2, 5, 6, 8-10, 12, 16, 19, 22-29, 31, 36, and 39) and the Zone 10 Berms; therefore, these areas are not contaminated or represent negligible risk and are not evaluated further.

- Grid cells with risks below acceptable target risk criteria: COPCs were identified for surface soil (0 to 2 ft) and/or soil (0 to 15 ft) at sixteen grid cells (Grid Cells 3, 4, 7, 13, 14, 17, 18, 20, 21, 30, 32-35, 37, and 38). ILCR and HI results for these grid cells are below the TCEQ and EPA acceptable target risk criteria.

- Grid cells with risks equal to or above acceptable target risk criteria: Cumulative ILCR and/or HI results exceed target risk criteria at two grid cells (Grid Cells 11 and 15).

Risk characterization results for Grid Cells 11 and 15 are summarized below:

Unit	Industrial Worker Scenario[a]		Construction Worker Scenario[b]	
	ILCR	HI	ILCR	HI
Grid Cell 11	No COPCs	No COPCs	**1.9E-06**	0.034
Grid Cell 15	No COPCs	No COPCs	**3.2E-05**	0.34

Bold values exceed ILCR of 1.0E-06 or HQ/HI of 1.0.
[a]Industrial worker exposed to surface soil (0-2 ft bgs).
[b]Construction worker exposed to soil (0-15 ft bgs).

B.1.2 Onsite Groundwater at Zone 10

Future industrial and construction/excavation worker exposure to COPCs in groundwater (Ogallala Aquifer) is dependent on COPCs in soil, soil gas, and/or perched groundwater reaching Pantex Plant production wells in the Ogallala Aquifer. The potential for COPCs in soil, soil gas, and/or perched groundwater at Zone 10 to migrate to the Pantex Plant production wells is evaluated using the Tier 2 and Tier 3 approach presented in Section 4.4 of the *Baseline HHRA Report* (BWXT Pantex and SAIC, December 2006).

The following transport pathways were evaluated for Zone 10:

- Soil-to-Ogallala Aquifer
- Soil gas-to-Ogallala Aquifer
- Perched groundwater-to-Ogallala Aquifer POE
- Ogallala Aquifer to Pantex Plant production wells.

For Zone 10, Tier 1 COPC evaluation results are presented in Section A.3 and summarized in Table A-5 for soil-to-groundwater and Table A-6 for soil gas-to-groundwater. No perched groundwater COPCs were retained for Tier 2 analysis. No groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network. Results of the Tier 2 and Tier 3 analysis for soil-to-Ogallala Aquifer and soil gas-to-Ogallala Aquifer are summarized below for Zone 10 soil and soil gas and Zone 10 Berms Soil.

<u>Zone 10</u>:

- Tier 2 analysis identified twelve soil COPCs, including three HEs (2,4-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and TNT), two metals (antimony and manganese), one PCB (PCB-1242), one pesticide (beta-chlordane), three SVOCs [benzo(a)anthracene, benzo(b)fluoranthene, and carbazole], and two VOCs (methylene chloride and 1,2,3-trichloropropane) predicted to exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an onsite exposure location (Pantex Plant production wells) within 1000 years.

- Tier 2 analysis indicates one soil gas COPC (Freon-114) is predicted to exceed it's $RBSV_{GW}$ following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates Freon-114 is not predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

<u>Zone 10 Berms Soil</u>:

- Tier 2 analysis identified one COPC (alpha-BHC) predicted to exceed the $RBSV_{GW}$ following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates alpha-BHC is not predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

Results of the Tier 2 and Tier 3 analysis indicate exposure of onsite workers to groundwater COPCs originating from Zone 10 is an incomplete pathway because COPCs at Zone 10 will not reach the Pantex Plant production wells within 1,000 years. Therefore, groundwater does not contribute to risk to onsite receptors.

B.1.3 Risk Characterization for Receptors due to COPC Transport from Zone 10

Potential risks to offsite receptors were evaluated for two transport mechanisms:

- Airborne transport of COPCs in surface soil to offsite air, with subsequent deposition to offsite soil and crops

- Groundwater transport to offsite exposure locations.

B.1.3.1 Risks from Atmospheric Transport from the Landfills to Offsite Receptors

Risks from atmospheric transport of surface soil COPCs from Zone 10 to offsite receptor locations are estimated based on modeling conducted for the *Burning Ground HHRA* (BWXT Pantex, 2005a). The Burning Ground is considered a worst-case analysis for atmospheric transport because 1) it has higher surface soil concentrations of most COPCs than other units at Pantex Plant, and 2) it is closest to the downwind (northern) Pantex Plant boundary. The results of atmospheric transport modeling for the Burning Ground showed negligible offsite risks. Thus, quantitative atmospheric transport modeling is not conducted for other corrective action units at Pantex Plant. Instead, the quantitative results for the Burning Ground are used in a semi-quantitative evaluation to demonstrate that the offsite risk due to air dispersion of COPCs from Zone 10 is negligible. The semi-quantitative evaluation is completed by comparing conditions at the Burning Ground to each corrective action unit or zone, as described in Appendix O of the *Baseline HHRA Report* (BWXT Pantex and SAIC, December 2006). The semi-quantitative evaluation is summarized below.

The predominant wind direction at Pantex Plant is from south to north. The Burning Ground is located approximately 2,750 ft south of the northern Plant boundary. Zone 10 is located more than 2 miles from the northern Plant boundary and approximately 2,700 ft north of the southern Plant boundary, which is the nearest Plant boundary to this zone.

Risks were calculated for 11 grid cells at the Burning Ground with a total ILCR for all grid cells of 4.5E-03 and a total HI of 156. The onsite COPC concentrations associated with these high onsite risks resulted in negligible offsite risks (cumulative ILCR=5.3E-08, HI=0.44).

Risks were calculated for 9 grid cells for surface soil (0 to 2 ft) at Zone 10 with a total ILCR for all grid cells of 1.8E-06 and a total HI of 0.14. Because Zone 10 is farther from the Plant boundary and has lower surface soil risks than the Burning Ground, offsite risks due to atmospheric transport from Zone 10 would be less than those predicted for the Burning Ground (i.e., ILCR<5.3E-08 and HI<0.44). Semi-quantitative analysis (Appendix O) using the relative distance and direction to the Plant boundary for Burning Ground and Zone 10 indicates offsite risks from Zone 10 would be on the order of ILCR=1.5E-11 and HI=0.0003.

B.1.3.2 Risks from Groundwater Transport from Zone 10 to Offsite Receptors

The potential for COPCs in soil, soil gas, and/or perched groundwater to migrate to offsite locations in the perched groundwater or the Ogallala Aquifer was evaluated using the Tier 2 and Tier 3 fate and transport approach presented in Section 4.4 of the *Baseline HHRA Report* (BWXT Pantex and SAIC, December 2006). The results of this modeling are summarized for Zone 10 here.

The following transport pathways were evaluated for Zone 10 groundwater:

- Soil-to-perched groundwater
- Soil-to-Ogallala Aquifer

- Soil gas-to-perched groundwater
- Soil gas-to-Ogallala Aquifer
- Perched groundwater to offsite POE
- Perched groundwater-to-Ogallala Aquifer POE.

No perched groundwater COPCs were retained for Tier 2 evaluation. No groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network. Results of the Zone 10 soil and soil gas and Zone 10 Berms soil Tier 2 and Tier 3 fate and transport evaluation are summarized below.

Zone 10:

- Tier 2 analysis identified twenty soil COPCs, including three HEs (2,4-dinitrotoluene, 4-amino-2,6-dinitrotoluene, TNT); four metals (antimony, cadmium, lead, and manganese); one pesticides (beta-chlordane); one PCB (PCB-1242); nine SVOCs [acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene] and two VOCs (1,2,3-trichloropropane and methylene chloride) predicted to exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite POE south of the Plant boundary in perched groundwater within 1,000 years.

- Tier 2 analysis identified twelve soil COPCs, including three HEs (2,4-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and TNT), two metals (antimony and manganese), one PCB (PCB-1242), one pesticide (beta-chlordane), three SVOCs [benzo(a)anthracene, benzo(b)flouranthene and carbazole], and two VOC (methylene chloride and 1,2,3-trichloropropane) predicted to exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point within 1,000 years.

- Tier 2 analysis identified two soil gas COPCs, both VOCs, (tetrachloroethene and Freon-114) predicted to exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates neither trichloroethene or Freon-114 is predicted to reach an offsite exposure point south of the Plant boundary in perched groundwater within 1,000 years.

- Tier 2 analysis identified one soil gas COPC (Freon-114) predicted to exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates Freon-114 is not predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Zone 10 is located west of the perched groundwater flow divide; therefore, COPCs in soil and soil gas at Zone 10 will not migrate offsite to the east in perched groundwater.

Zone 10 Berms Soil:

- Tier 2 analysis indicated two COPCs (alpha-BHC and gamma-BHC) predicted to exceed the RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates alpha-BHC is not predicted to reach an offsite exposure point south of Pantex Plant in perched groundwater within 1,000 years.

- Tier 2 analysis identified one COPC (alpha-BHC) predicted to exceed the RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates alpha-BHC is not predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Zone 10 Berms are located west of the perched groundwater flow divide; therefore, COPCs in soil at the Zone 10 Berms will not migrate offsite to the east in the perched groundwater.

- As a result of Tier 2 analysis, no COPCs are retained for Tier 3 analysis for the soil-to-Ogallala Aquifer pathway.

Based on these results, exposure of offsite receptors to groundwater COPCs (perched groundwater or Ogallala Aquifer) originating from Zone 10 is an incomplete pathway, and therefore, does not contribute to risk to offsite receptors to the south of Pantex Plant or offsite receptors for the Ogallala Aquifer.

Table B-9. Zone 10 Summary of Risk Calculations for Industrial Worker Surface Soil (0-2 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
7	Antimony	7440-36-0	4	7.90E+00	--	7.90E+00	--	--	--	2.0E-03	0.016	100.0%
7	Beta-Chlordane	5103-74-2	6	1.40E-03	--	1.40E-03	1.8E-07	2.6E-10	0.0%	2.9E-03	4.1E-06	0.0%
7	Benzo(a)pyrene	50-32-8	9	1.90E-01	--	1.90E-01	3.1E-06	6.0E-07	100.0%	--	--	--
							Cumulative ILCR	6.0E-07	100.0%	**HI**	0.016	100.0%
14	Mercury	7439-97-6	7	5.40E+00	--	5.40E+00	--	--	--	4.0E-03	0.021	100.0%
							Cumulative ILCR	--	--	**HI**	0.021	100.0%
30	Benzo(a)pyrene	50-32-8	12	1.40E-01	2.03E-01	1.40E-01	3.1E-06	4.4E-07	100.0%	--	--	--
							Cumulative ILCR	4.4E-07	100.0%	**HI**	--	--
32	Antimony	7440-36-0	6	1.00E+01	--	1.00E+01	--	--	--	2.0E-03	0.020	100.0%
							Cumulative ILCR	--	--	**HI**	0.020	100.0%
33	TNT	118-96-7	20	1.30E+01	2.27E+00	2.27E+00	1.4E-08	3.2E-08	100.0%	2.7E-03	0.006	24.1%
33	Antimony	7440-36-0	11	9.7E+00	9.29E+00	9.29E+00	--	--	--	2.0E-03	0.019	75.9%
							Cumulative ILCR	3.2E-08	100.0%	**HI**	0.025	100.0%
34	Antimony	7440-36-0	22	1.20E+01	9.14E+00	9.14E+00	--	--	--	2.0E-03	0.019	93.8%
34	Cadmium	7440-43-9	37	1.54E+01	1.82E+00	1.82E+00	2.9E-09	5.2E-09	100.0%	6.8E-04	0.0012	6.2%
							Cumulative ILCR	5.2E-09	100.0%	**HI**	0.020	100.0%
35	Benzo(a)pyrene	50-32-8	5	2.20E-01	--	2.20E-01	3.1E-06	6.9E-07	100.0%	--	--	--
							Cumulative ILCR	6.9E-07	100.0%	**HI**	--	--
37	Antimony	7440-36-0	7	9.70E+00	--	9.70E+00	--	--	--	2.0E-03	0.020	100.0%
							Cumulative ILCR	--	--	**HI**	0.020	100.0%
38	Antimony	7440-36-0	4	1.00E+01	--	1.00E+01	--	--	--	2.0E-03	0.020	100.0%
							Cumulative ILCR	--	--	**HI**	0.020	100.0%

Table B-10. Summary of Risk Calculations for Construction/Excavation Worker
Soil (0-15 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
3	Barium	7440-39-3	4	1.26E+03	--	1.26E+03	--	--	--	9.0E-05	0.11	100.0%
							Cumulative ILCR	--	--	**HI**	0.11	100.0%
4	Barium	7440-39-3	8	1.80E+03	--	1.80E+03	--	--	--	9.0E-05	0.16	100.0%
							Cumulative ILCR	--	--	**HI**	0.16	100.0%
7	Antimony	7440-36-0	11	7.90E+00	8.16E+00	7.90E+00	--	--	--	1.3E-02	0.10	51.1%
7	Barium	7440-39-3	15	5.00E+03	1.10E+03	1.10E+03	--	--	--	9.0E-05	0.099	48.8%
7	Beta-Chlordane	57-74-9	13	2.60E-02	7.52E-03	7.52E-03	6.8E-09	5.1E-11	0.2%	1.2E-02	0.000089	0.0%
7	Benzo(a)pyrene	50-32-8	20	1.90E-01	3.83E-01	1.90E-01	1.4E-07	2.6E-08	99.8%	--	--	--
							Cumulative ILCR	2.6E-08	100.0%	**HI**	0.20	100.0%
11	Barium	7440-39-3	17	1.10E+03	3.82E+02	3.82E+02	--	--	--	9.0E-05	0.034	100.0%
11	Benzo(a)anthracene	56-55-3	13	3.60E+01	8.53E+00	8.53E+00	1.4E-08	1.2E-07	6.1%	--	--	--
11	Benzo(a)pyrene	50-32-8	13	3.80E+01	8.97E+00	8.97E+00	1.4E-07	**1.2E-06**	63.8%	--	--	--
11	Benzo(b)fluoranthene	205-99-2	13	3.40E+01	8.13E+00	8.13E+00	1.4E-08	1.1E-07	5.8%	--	--	--
11	Benzo(k)fluoranthene	207-08-9	13	3.10E+01	7.50E+00	7.50E+00	1.4E-09	1.0E-08	0.5%	--	--	--
11	Dibenz(a,h)anthracene	53-70-3	13	6.90E+00	2.78E+00	2.78E+00	1.4E-07	3.8E-07	19.8%	--	--	--
11	Indeno(1,2,3-c,d)pyrene	193-39-5	13	2.20E+01	5.65E+00	5.65E+00	1.4E-08	7.6E-08	4.0%	--	--	--
							Cumulative ILCR	**1.9E-06**	100.0%	**HI**	0.034	100.0%
13	Barium	7440-39-3	6	3.80E+03	--	3.80E+03	--	--	--	9.0E-05	0.34	100.0%
							Cumulative ILCR	--	--	**HI**	0.34	100.0%
14	Mercury	7439-97-6	10	5.40E+00	1.63E+00	1.63E+00	--	--	--	1.9E-02	0.031	100.0%
							Cumulative ILCR	--	--	**HI**	0.031	100.0%
15	Benzo(a)anthracene	56-55-3	10	5.30E+02	1.50E+02	1.50E+02	1.4E-08	**2.0E-06**	6.3%	--	--	--
15	Benzo(a)pyrene	50-32-8	10	4.50E+02	1.28E+02	1.28E+02	1.4E-07	**1.7E-05**	53.7%	--	--	--
15	Benzo(b)fluoranthene	205-99-2	10	4.50E+02	1.28E+02	1.28E+02	1.4E-08	**1.7E-06**	5.4%	--	--	--
15	Benzo(k)fluoranthene	207-08-9	10	2.50E+02	7.10E+01	7.10E+01	1.4E-09	9.6E-08	0.3%	--	--	--
15	Carbazole	86-74-8	10	2.20E+02	6.25E+01	6.25E+01	3.7E-10	2.3E-08	0.1%	--	--	--

Table B-10. Zone 10 Summary of Risk Calculations for Construction/Excavation Worker (continued)
Soil (0-15 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
15	Chrysene	218-01-9	10	5.30E+02	1.50E+02	1.50E+02	1.4E-10	2.0E-08	0.1%	--	--	--
15	Dibenz(a,h)anthracene	53-70-3	10	2.60E+02	7.38E+01	7.38E+01	1.4E-07	**1.0E-05**	31.1%	--	--	--
15	Dibenzofuran	132-64-9	10	2.00E+02	5.68E+01	5.68E+01	--	--	--	1.5E-03	0.084	24.9%
15	Fluoranthene	206-44-0	10	1.50E+03	4.25E+02	4.25E+02	--	--	--	1.4E-04	0.060	17.8%
15	Indeno(1,2,3-c,d)pyrene	193-39-5	10	2.60E+02	7.38E+01	7.38E+01	1.4E-08	**1.0E-06**	3.1%	--	--	--
15	Naphthalene	91-20-3	10	3.50E+02	9.93E+01	9.93E+01	--	--	--	2.8E-04	0.028	8.3%
15	Phenanthrene	85-01-8	10	1.60E+03	4.53E+02	4.53E+02	--	--	--	1.9E-04	0.085	25.3%
15	Pyrene	129-00-0	10	1.50E+03	4.25E+02	4.25E+02	--	--	--	1.9E-04	0.080	23.7%
							Cumulative ILCR	**3.2E-05**	100.0%	**HI**	0.34	100.0%
17	Cadmium	7440-43-9	16	2.27E+01	4.12E+00	4.12E+00	2.8E-11	1.1E-10	84.8%	5.1E-03	0.021	99.8%
17	Beta-Chlordane	5103-74-2	13	3.00E-03	9.15E-03	3.00E-03	6.8E-09	2.0E-11	15.2%	1.2E-02	3.6E-05	0.2%
							Cumulative ILCR	1.3E-10	100.0%	**HI**	0.021	100.0%
18	Aluminum	7429-90-5	19	2.97E+04	1.60E+04	1.60E+04	--	--	--	6.3E-06	0.10	46.2%
18	Barium	7440-39-3	20	7.90E+03	1.32E+03	1.32E+03	--	--	--	9.0E-05	0.12	53.8%
							Cumulative ILCR	--	--	**HI**	0.22	100.0%
20	Aluminum	7429-90-5	2	2.94E+04	--	2.94E+04	--	--	--	6.3E-06	0.19	100.0%
							Cumulative ILCR	--	--	**HI**	0.19	100.0%
21	Aluminum	7429-90-5	11	5.49E+04	2.16E+04	2.16E+04	--	--	--	6.3E-06	0.14	76.2%
21	Mercury	7439-97-6	10	1.20E+00	3.95E-01	3.95E-01	--	--	--	1.9E-02	0.0074	4.1%
21	Zinc	7440-66-6	10	7.14E+03	2.05E+03	2.05E+03	--	--	--	1.7E-05	0.035	19.6%
21	Beta-Chlordane	5103-74-2	5	7.40E-03	--	7.40E-03	6.8E-09	5.0E-11	100.0%	1.2E-02	0.000088	0.0%
							Cumulative ILCR	5.0E-11	100.0%	**HI**	0.18	100.0%
30	Benzo(a)pyrene	50-32-8	28	1.40E-01	1.94E-01	1.40E-01	1.4E-07	1.9E-08	100.0%	--	--	--
							Cumulative ILCR	1.9E-08	100.0%	**HI**	--	--
32	Antimony	7440-36-0	21	1.60E+01	8.78E+00	8.78E+00	--	--	--	1.3E-02	0.12	100.0%
							Cumulative ILCR	--	--	**HI**	0.12	100.0%
33	2,4-Dinitrotoluene	121-14-2	43	2.70E+00	2.87E-	2.87E-	1.2E-08	3.6E-09	85.9%	2.8E-03	0.0008	0.5%

Table B-10. Zone 10 Summary of Risk Calculations for Construction/Excavation Worker (continued)
Soil (0-15 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
					01	01						
33	TNT	118-96-7	49	1.30E+01	1.03E+00	1.03E+00	5.7E-10	5.8E-10	14.1%	1.2E-02	0.012	8.1%
33	Antimony	7440-36-0	28	1.70E+01	1.02E+01	1.02E+01	--	--	--	1.3E-02	0.13	91.3%
							Cumulative ILCR	4.1E-09	100.0%	**HI**	0.15	100.0%
34	Antimony	7440-36-0	46	2.20E+01	9.81E+00	9.81E+00	--	--	--	1.3E-02	0.13	95.4%
34	Cadmium	7440-43-9	73	1.54E+01	1.20E+00	1.20E+00	2.8E-11	3.3E-11	0.2%	5.1E-03	0.0061	4.6%
34	Benzo(a)pyrene	50-32-8	72	1.60E-01	1.93E+01	1.60E-01	1.4E-07	2.2E-08	99.8%	--	--	--
							Cumulative ILCR	2.2E-08	100.0%	**HI**	0.13	100.0%
35	Benzo(a)pyrene	50-32-8	15	2.20E-01	5.30E+01	2.20E-01	1.4E-07	3.0E-08	100.0%	--	--	--
							Cumulative ILCR	3.0E-08	100.0%	**HI**	--	--
37	Antimony	7440-36-0	12	1.00E+01	9.52E+00	9.52E+00	--	--	--	1.3E-02	0.12	100.0%
							Cumulative ILCR	--	--	**HI**	0.12	100.0%
38	Antimony	7440-36-0	4	1.00E+01	--	1.00E+01	--	--	--	1.3E-02	0.13	100.0%
							Cumulative ILCR	--	--	**HI**	0.13	100.0%

Table B-11. Sources of Uncertainty Specific to the Zone 10 HHRA

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Uncertainty in Data Collection and Analysis		
Sampling Locations		
Soil sample locations at Zone 10 are biased toward areas of highest COPC concentration.	Samples were collected at areas known or suspected to have a constituent release (i.e., corrective action units) and targeted to identify source areas.	Moderate impact: overestimates risk, especially for grid cells with large uncontaminated areas with few samples.
Several SWMUs in the southern portion of Zone 10 are south of existing perched monitoring wells.	Particle tracking indicates COPCs in the southern portion of Zone 10 will not migrate offsite within 1,000 years.	Low impact. TCEQ has agreed these sites are to be managed as a groundwater uncertainty through a groundwater monitoring program.
Uncertainty in Exposure Assessment		
EPCs		
Exposure area grid placement.	Grid placement based on active landfill areas adjacent to SVS 8. Six-acre grid used for entire Zone 10 area regardless of operational use of the area.	Low impact: overestimates risk. Most areas in Zone 10 are not actively used and workers are not present. Grid captures the highest risk configuration for Zone 10.
PAHs not detected in a “twin” sample.	EPCs and risks were calculated using the sample in which PAHs were detected.	High impact: overestimates risk. Concentrations of PAHs driving risks at Grid Cell 15 could not be confirmed by twinned sample.
Exposure Assumptions		
Standard default worker exposure parameters are used for onsite receptors; however, actual worker activity patterns vary by grid cell, by worker, and by time of year as well as from year to year.	Actual exposure of Zone 10 workers is expected to be much less than estimated by standard default exposure parameters.	High impact: overestimates risk to actual Pantex Plant workers.
Uncertainty in Toxicity Information		
Toxicity values are not available for beta-chlordane.	Chlordane is used as a surrogate for beta-chlordane.	Low impact: over- or underestimates risk.
TNTis not evaluated for the inhalation pathway for the cancer endpoint because inhalation slope factors are not available.	Direct ingestion represents the primary exposure pathway for onsite receptors exposed to COPCs in soil; therefore, the lack of inhalation toxicity values for some COPCs is not a major source of uncertainty.	Low impact: underestimates risk.

Table B-10. Sources of Uncertainty Specific to the Zone 10 HHRA (continued)

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Uncertainty in Risk Characterization		
Airborne transport of onsite surface soil COPCs to offsite receptors.	Airborne transport to offsite receptors is evaluated qualitatively.	Negligible impact. High uncertainty in the qualitative method does not impact conclusions because of the extremely low risks predicted offsite at the Burning Ground and the much lower onsite risks at Zone 10 than those predicted at the Burning Ground.
Transport of onsite groundwater COPCs to onsite production wells or offsite receptors east of Pantex Plant	The potential for COPCs to migrate to onsite production wells or offsite in the Ogallala Aquifer is based on the assumed continuity of the FGZ and the location of Zone 10 west of the flow divide.	Negligible impact. Breaks or preferential pathways through the FGZ would be reflected in the observed water level data. The subsurface model reproduces what is seen in observed data; therefore, the permeability assumptions used in the model are considered realistic and this uncertainty is unlikely to impact the conclusions of the risk characterization. Location of Zone 10 west of the flow divide precludes migration to offsite POE east of Pantex Plant.
Transport of onsite COPCs to offsite groundwater south of Pantex Plant.	The potential for COPCs to migrate offsite to the south is influenced by presumed radial flow from Playa 4.	Moderate impact: may underestimate potential from migration pathway to be complete.
Uncertainty in Fate and Transport Modeling		
Assumed continuity of the fine-grained zone	Evaluated investigation data, water levels, water quality, borehole data, and hydraulic conductivity testing data.	Low impact: indicates the FGZ beneath Zone 10 is competent (i.e., it is continuous and possesses hydraulic properties adequate to prevent vertical migration to the Ogallala Aquifer directly beneath Zone 10)
Monitoring well locations only present around landfills on the north side of Zone 10	Uncertainty in potential groundwater impacts under other areas at Zone 10.	Moderate impact: may underestimate risk if COPCs are present in groundwater, although travel time analysis indicates that impacts from this area to Onsite or offsite locations would take a long period of time. Pantex has agreed to long-term groundwater monitoring and will install a new well south of Zone 10 to address this uncertainty.

B.1.4 Summary of Conclusions for Zone 10

The risk characterization identified two areas in Zone 10 resulting in potentially unacceptable risks/hazards to onsite workers from exposure to soils; however, consideration of the conservative nature of the HHRA and conflicting sampling information indicates the calculated risks/hazards to be overestimates of actual risks/hazards. The findings of this HHRA demonstrate the effectiveness of the ICMs conducted throughout numerous areas within Zone 10.

However, potentially elevated risk was identified in Grid Cell 11 and 15 for the construction/excavation worker. Therefore, COCs are identified for these two grid cells in Zone 10 so that risk management options can be evaluated in the CMS. Figures A-12 and A-13 present the conclusions of the Zone 10 HHRA for the industrial worker (0 to 2 ft) and construction/excavation worker (0 to 15 ft) exposed to soil, respectively.

Conclusions for Zone 10 are summarized below:

- Soil COCs were identified in Grid Cell 11 and 15
    - The Grid Cell 11 COC is benzo(a)pyrene
    - The Grid Cell 15 COCs include benzo(a)pyrene, dibenz(a,h)anthracene, benzo(a)anthracene, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene

- No COCs were identified for Zone 10 soil gas

- No COPCs are identified for perched groundwater.

- Subsurface fate and transport modeling indicates residual contamination in soil and soil gas will not reach any onsite or offsite receptor locations within 1,000 years (Appendix I); therefore, no COPCs are identified for groundwater with low uncertainty (high confidence) to the north and east and a higher uncertainty (lower confidence) to the south.

USDOE/NNSA has agreed to a LTM program to address uncertainty in the potential for COPC migration to groundwater south of Pantex Plant.

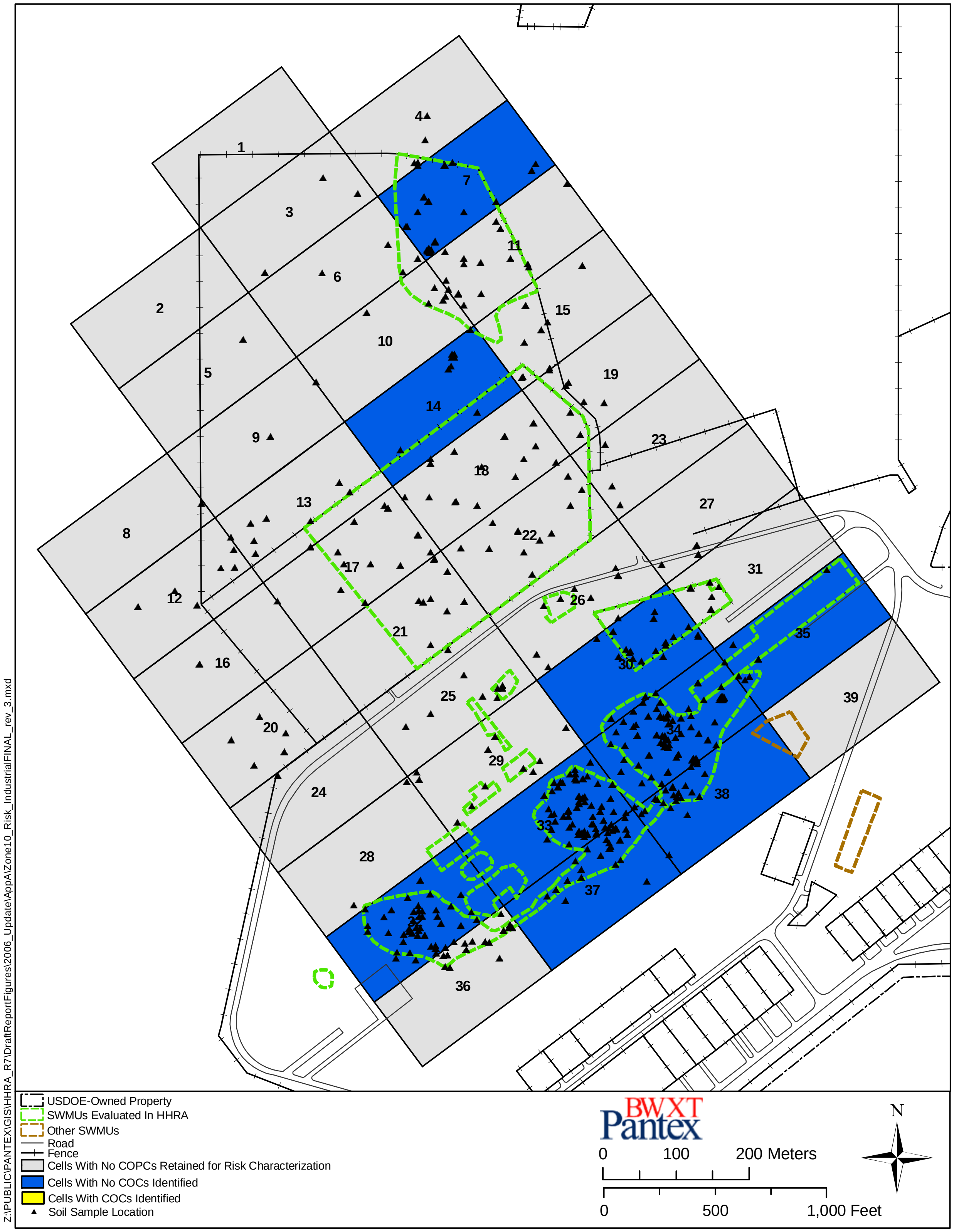

Figure B-2. Zone 10 Summary of COCs and Risk Results for Industrial Worker

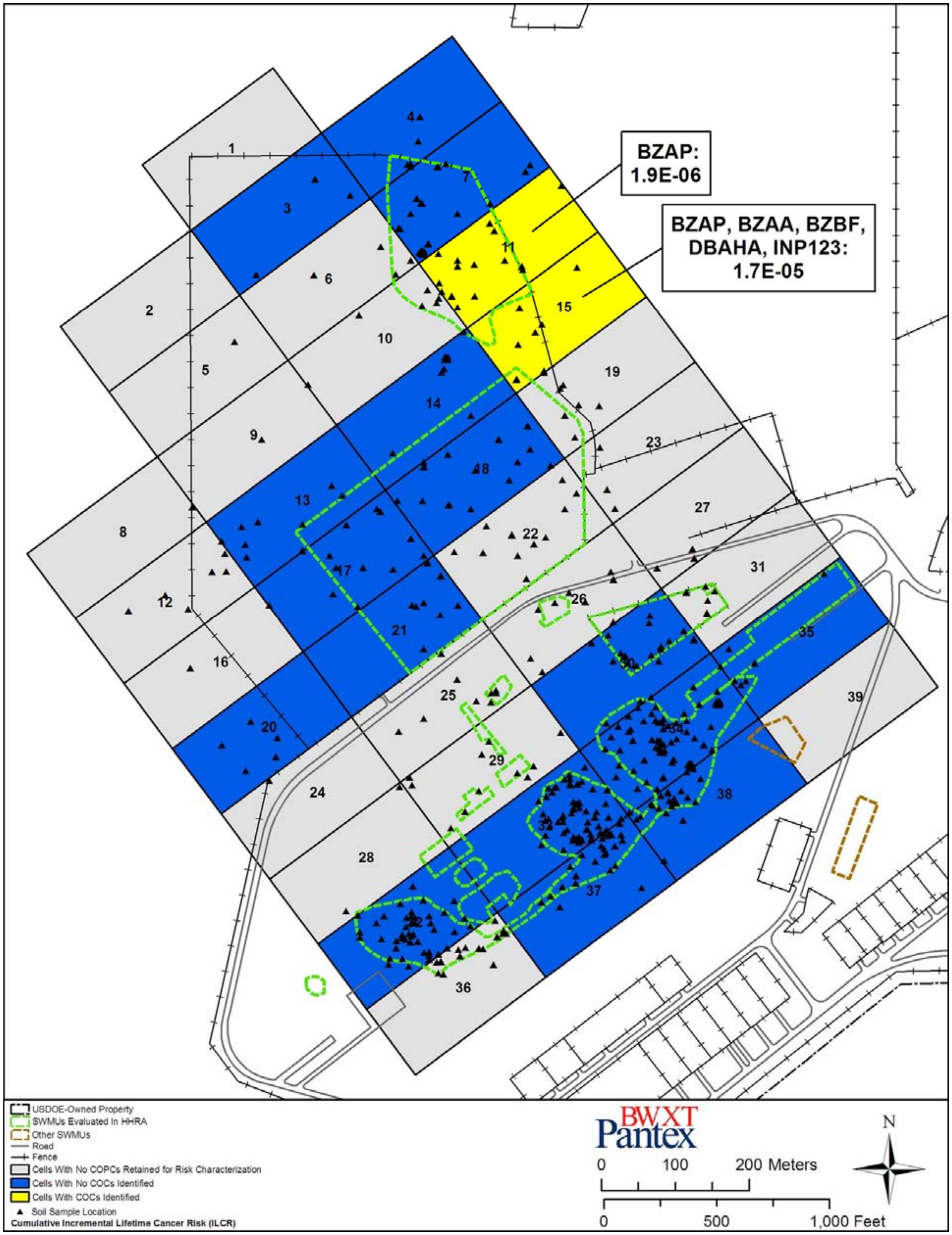

Figure B-3. Zone 10 Summary of COCs and Risk Results for Construction/Excavation Worker

Appendix C

Zone 11 Release Units Requiring Remedial Action

SWMU 60: Landfill 9
SWMU 61: Landfill 10
SVS 5: Landfill East of Pad 11-13

SWMU 68d: Sanitary Landfill
SVS 8: Abandoned Zone 10 Landfill
Unassigned AOC: Zone 10 Landfills West and Southwest of SWMU 84 Scrap and Salvage Yard

Contains modified excerpts from Appendix A of the
Baseline HHRA Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groundwater (BWXT Pantex and SAIC, December 2006)

RELEASE OF INFORMATION TO THE PUBLIC
DOCUMENTED REVIEW PROCESS
(Ref. WI 02.04.02.02.03)

Index Number PX-2209
Page Number 1 of 1
Issue Number 7

Document Title Baseline Human Health Risk Assessment Report for Zones 10, 11, and 12 , Fire Training Area, Ditches and Playas, Independent Sites, and Groudnwater – Volumes I and II Date 12/9/2005
Document Author Michelle Bolwahnn Type of Doc Report

Document Due Date 12-22-2005 Blanket Release Expires

This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☒ No ☐	for M.G.Knight	DEC 0 9 2005
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐		12/13/05
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐		12/13/05
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐		12/12/05
Legal 12-72 Legal	Legal	Yes ☑ No ☐		01/09/05
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐	J. Kelly	01/10/2025

After all signatures are obtained, forward copy via email or plant mail to the Classification Officer and OSTI Transmittal Officer

Comments: **Please call Marlon Smith (x4058) or Michelle Bolwahnn (6326) for pickup after signature**

Please see attached comments J x6616

* with revised Exec. Summary and various changes already made

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C.0 ZONE 11 RELEASE UNITS AND EXPOSURE AREA GRIDS

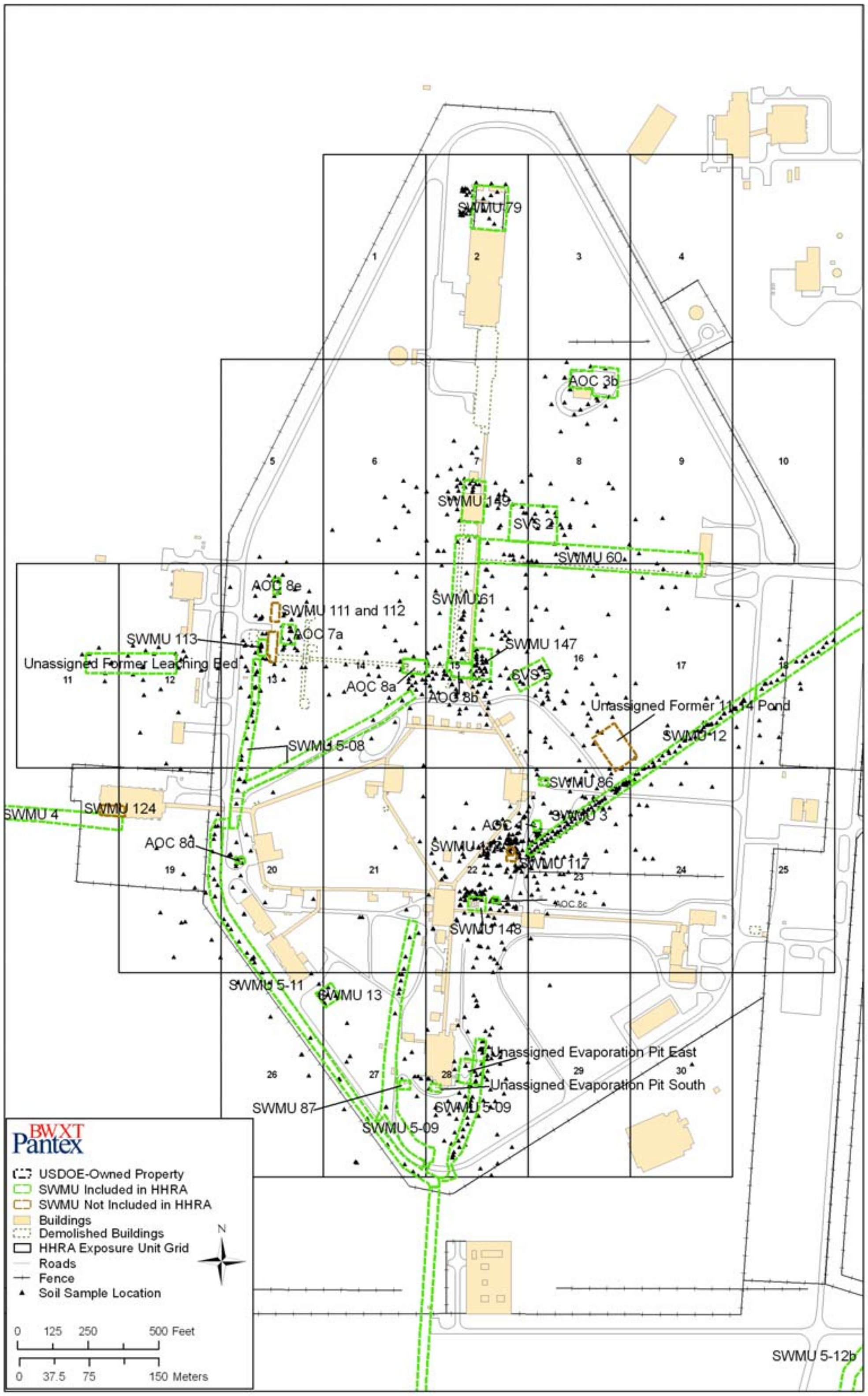

Figure C-1. Zone 11 Release Units and Exposure Area Grids

Table C-1. Crosswalk of Grid Cells to Release Units Requiring Remedial Action

Units Requiring Remedial Action	Grid Cell(s)
SWMU 60: Landfill 9	7, 8, 9, 16, 17
SWMU 61: Landfill 10	7, 15
SVS 5: Landfill East of Pad 11-13	15, 16

Table C-2. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at Zone 11[a]

COPC	*Zone 11 Soil RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Perched Groundwater[b]
HEs			
1,3-Dinitrobenzene	--	--	√[c]
1,3,5-Trinitrobenzene	√	--	√[c]
2,4-Dinitrotoluene	√	--	√[c]
2,6-Dinitrotoluene	√	--	√
2-Amino-4,6-dinitrotoluene	√	--	√[c]
2-Nitrotoluene	--	--	R
3-Nitrotoluene	√[d]	--	--
4-Amino-2,6-dinitrotoluene	√	--	√
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	√	--	√
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	√	--	√
Tetryl	--	--	R
TNT (2,4,6-Trinitrotoluene)	√	--	√
Metals			
Aluminum	√[e]	--	--
Antimony	√	--	--
Arsenic	√	--	--
Barium	√	--	--
Beryllium	√[e]	--	--
Boron	√[e]	--	√[c]
Cadmium	√	--	--
Total Chromium	√	--	√
Hexavalent Chromium	√[e]	--	√[c]
Cobalt	√[e]	--	--
Copper	√	--	--
Lead	√	--	--
Manganese	√[e]	--	--
Mercury	√	--	--
Molybdenum	√[e]	--	--

Table C-2. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at Zone 11[a] (continued)

COPC	*Zone 11 Soil RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Perched Groundwater[b]
Nickel	√[e]	--	R
Selenium	√[e]	--	√[c]
Silver	√	--	--
Strontium	√	--	R
Thallium	√[e]	--	--
Vanadium	√	--	--
Zinc	√	--	--
Miscellaneous			
Nitrate as N	--	--	√[c]
Perchlorate	√	--	√[c]
PCBs			
PCB-1248 (Aroclor-1248)	√	--	--
PCB-1254 (Aroclor-1254)	√	--	--
PCB-1260 (Aroclor-1260)	√	--	--
Pesticides			
4,4'-DDE (1,1-bis(chlorophenyl)-2,2-dichloroethene)	√	--	--
4,4'-DDT (1,1-bis(chlorophenyl)-2,2,2-trichloroethane	√	--	--
Aldrin	√	--	--
Chlordane, technical	√	--	--
Delta BHC (Delta Hexachlorocyclohexane)	√	--	--
Dieldrin	√	--	--
Heptachlor	√	--	--
SVOCs			
1,2,4-Trichlorobenzene	√	--	--
1,2-Cyclohexanediol	√	--	--
1,4-Dichlorobenzene	√	--	--
2-Chlorophenol	√	--	--
Acenaphthene	√	--	--
Anthracene	√	--	--
Benzo(a)anthracene	√	--	--
Benzo(a)pyrene	√	--	--
Benzo(b)fluoranthene	√	--	--

Table C-2. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at Zone 11[a] (continued)

COPC	*Zone 11 Soil RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Perched Groundwater[b]
Benzo(g,h,i)perylene	√	--	--
Benzo(k)fluoranthene	√	--	--
bis (2-Ethylhexyl) phthalate	√	--	--
Butylbenzylphthalate	√	--	--
Chlorocyclohexanol	√	--	--
Chrysene	√	--	--
Cyclohexanol	√	--	--
Dibenz(a,h)anthracene	√	--	--
Dibenzofuran	√	--	--
Di-n-butyl phthalate	√	--	--
Diphenylamine	√	--	--
Fluoranthene	√	--	--
Fluorene	√	--	--
Indeno(1,2,3-c,d)pyrene	√	--	--
Naphthalene	√	--	--
Pentachlorophenol	√	--	--
Phenanthrene	√	--	--
Phenol, total	√	--	--
Pyrene	√	--	--
VOCs			
1,1,1-Trichloroethane	√	√	--
1,1,2,2-Tetrachloroethane	√	--	--
1,1-Dichloroethene	√	√	--
1,2,3-Trichloropropane	√	--	--
1,2,4-Trimethylbenzene	--	√	--
1,2-Dichloroethane	--	√	√
1,3,5-Trimethylbenzene	--	√	--
Acetone	√	√	--
Benzene	√	√	--
Carbon Tetrachloride	--	√	--

Table C-2. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at Zone 11[a] (continued)

COPC	*Zone 11 Soil RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Perched Groundwater[b]
Chlorobenzene	√	--	--
Chloroform	--	√	√
Chloromethane	√	√	--
cis-1,2-Dichloroethene	--	√	--
Dichlorodifluoromethane	√	√	--
Ethylbenzene	--	√	--
Freon-113 (1,1,2-Trichloro-1,2,2-Trifluoroethane)	--	√	--
Isopropanol	√	--	--
Methyl Ethyl Ketone	--	√	--
Methyl Isobutyl Ketone	--	√	--
Methylene Chloride	√	√	--
n-Hexane	√	--	--
Nonanal	√	--	--
Styrene	--	√	--
Tetrachloroethylene	√	√	√
Toluene	√	√	--
Trichloroethene	√	√	√
Trichlorofluoromethane	--	√	--
m,p-Xylene	--	√	--
o-Xylene	--	√	--
Xylenes, total	√	--	--

[a]Unless otherwise noted, all chemicals identified as COPCs are from the COPC list included as Enclosure 3 to the *Zone 11 RFIR* Approval Letter (soil and soil gas) or the CSM for Zone 11 (Figure 13.2-2) in the *Groundwater RFIR* (Stoller, 2004).
[b]No COPCs were identified for the Ogallala Aquifer in the *Groundwater RFIR*.
[c]*Groundwater RFIR* CSM for Zone 11 did not list this compound as a groundwater COPC. It is included here as a site-wide groundwater COPC; see discussion in Appendix I.
[d]3-Nitrotoluene was included as a COPC in the *Zone 11 RFIR* but not in the TCEQ Conditional Approval Letter. This chemical was the only difference between those two COPC lists.
[e]Metal was added to COPC list because all detected metals are re-evaluated based on availability of new background RRS 1 values.

√ COPC for this medium -- not a COPC in this medium R - COPC removed for this medium.

Table C-3. COPCs Retained for Further Evaluation in the Zone 11 HHRA Surface Soil (0-2 ft) for Industrial Worker Evaluation

COPCs	COPCs Retained by Grid Cell[a]										
	8	12	13	15	20	21	22	23	24	27	28
HEs											
2,4-Dinitrotoluene	--	--	√	--	--	--	--	--	--	--	--
4-Amino-2,6-dinitrotoluene	--	--	--	√	--	--	--	--	--	--	--
HMX	--	--	--	--	--	--	√	√	--	--	--
RDX	--	--	√	--	--	--	--	--	--	--	--
TNT	--	--	--	√	--	--	--	--	--	--	--
Metals											
Antimony	√	--	√	--	√	√	√	--	√	√	√
Mercury	--	--	--	--	--	--	--	--	--	--	√
Vanadium	--	--	--	--	--	--	--	--	--	√	--
SVOCs											
Benzo(a)anthracene	--	--	--	--	--	--	√	--	--	--	--
Benzo(a)pyrene	√	√	√	√	--	--	√	√	--	--	√
Benzo(b)fluoranthene	--	--	--	--	--	--	√	--	--	--	--
Chlorocyclohexanol[b]	--	--	--	--	--	--	--	--	--	--	√
Dibenz(a,h)anthracene	--	--	--	--	--	--	√	--	--	--	√
Indeno(1,2,3-c,d)pyrene	--	--	--	--	--	--	√	--	--	--	--
Pentachlorophenol	--	--	--	√	--	--	--	--	--	--	--

[a]No COPCs identified for further evaluation in Grid Cells 1-7, 9-11, 14, 16-19, 25, 26, 29, and 30.
[b]As a conservative measure, chlorocyclohexanol was retained as a COPC for further evaluation in this Baseline HHRA because TCEQ has no health-based screening level.

√ COPC for grid cell

-- not a COPC for grid cell

Table C-4. COPCs Retained for Further Evaluation in the Zone 11 HHRA Soil (0-15 ft) for Construction/Excavation Worker Evaluation

COPC	COPCs Retained by Grid Cell[a]															
	8	12	13	15	16	17	19	20	21	22	23	24	26	27	28	30
HEs																
2,4-Dinitrotoluene	--	--	√	√	--	--	--	--	--	--	--	--	--	--	--	--
4-Amino-2,6-dinitrotoluene	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--	--
HMX	--	--	--	--	--	--	--	--	--	√	√	--	--	--	--	--
RDX	--	--	√	--	--	--	--	--	--	--	--	--	--	--	--	--
TNT	--	--	--	√	--	--	--	--	--	√	--	--	--	--	--	--
Metals																
Aluminum	√	--	--	√	--	--	--	--	--	--	--	--	--	--	--	--
Antimony	√	--	√	--	--	--	--	√	√	√	--	√	--	√	√	--
Barium	√	--	--	--	√	√	--	--	--	--	--	--	--	√	--	√
Mercury	--	--	--	--	--	--	--	--	--	√	--	--	√	--	√	--
Thallium	--	--	--	--	--	--	√	--	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--	√	--	--
SVOCs																
Benzo(a)anthracene	--	--	--	√	--	--	--	--	--	√	--	--	--	--	√	--
Benzo(a)pyrene	√	√	√	√	--	--	--	--	--	√	√	--	--	--	√	--
Benzo(b)fluoranthene	--	--	--	√	--	--	--	--	--	√	--	--	--	--	√	--
Chlorocyclohexanol[b]	--	--	√	--	--	√	√	--	--	--	--	--	--	--	√	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	√	--	--	--	--	√	--
Indeno(1,2,3-c,d)pyrene	--	--	--	--	--	--	--	--	--	√	--	--	--	--	√	--
Pentachlorophenol	--	--	--	√	--	--	--	--	--	--	--	--	--	--	--	--

[a]No COPCs retained for further evaluation in Grid Cells 1-7, 9-11, 14, 18, 25, and 29.
[b]As a conservative measure, chlorocyclohexanol was retained as a COPC for further evaluation in this Baseline HHRA because TCEQ has established no health-based screening levels.

√ COPC for grid cell

-- not a COPC for grid cell

Table C-5. COPCs Retained for Further Evaluation in the Zone 11 HHRA Soil-to-Groundwater Pathway

COPCs	
HEs	
2,4-Dinitrotoluene	HMX
2,6-Dinitrotoluene	RDX
2-Amino-4,6-dinitrotoluene	TNT
4-Amino-2,6-dinitrotoluene	
Metals	
Antimony	Lead
Arsenic	Manganese
Barium	Mercury
Cadmium	Thallium
Chromium, hexavalent	Vanadium
Chromium, total	Uranium, Total
PCBs	
PCB-1248 (Aroclor-1248)[a]	PCB-1260 (Aroclor-1260)[a]
PCB-1254 (Aroclor-1254)[a]	
Pesticides	
4,4'-DDT	Delta BHC
Aldrin	Dieldrin
SVOCs	
1,2-Cyclohexanediol	Chrysene
Benzo(k)fluoranthene	Dibenz(a,h)anthracene
bis(2-Ethylhexyl) phthalate	Indeno(1,2,3-c,d)pyrene
Chlorocyclohexanol	Pentachlorophenol
VOCs	
Methylene chloride	Tetrachloroethylene (PCE)

[a] Individual PCBs were detected in soil (all depths) and are listed above as COPCs retained for evaluation of the soil-to-groundwater pathway, even though PCBs were evaluated as total PCBs in the COPC evaluation (see Table 2B-3). This is because TCEQ's GWP-Res value, which was used to evaluate PCBs for this pathway, is derived based on total PCBs

Table C-6. COPCs Retained for Further Evaluation in the Zone 11 HHRA Soil Gas-to-Groundwater Pathway

COPC	COPCs									
	Shallow					Intermediate				
	Source Area A	Source Area B	Source Area C	Source Area D	Unassigned[a]	Source Area A	Source Area B	Source Area C	Source Area D	Unassigned[a]
VOCs										
1,2-Dichloroethane	√	--	--	--	√	√	√	--	--	√
Acetone	√	--	--	√	--	√	--	--	--	--
Carbon tetrachloride	√	√	--	--	√	√	√	--	--	√
Chloroform	--	--	--	--	√	--	--	--	--	--
Methylene chloride	√	--	--	√	--	√	√	--	--	--
Tetrachloroethylene (PCE)	√	--	√	--	√	√	√	√	--	√
Toluene	√	--	--	--	--	--	--	--	--	--
Trichloroethene	√	√	√	√	√	√	√	√	√	√

[a]Unassigned source area represents those sampling locations that are not associated with a specific source as defined in the *Zone 11 RFIR* (Stoller, 2003).

√ COPC for area

-- not a COPC for area

Table C-7. COPCs Retained for Further Evaluation in the Zone 11 HHRA Perched Groundwater

COPC	Filtered	Unfiltered
HEs		
2,6-Dinitrotoluene	NA	√
4-Amino-2,6-dinitrotoluene	NA	√
RDX	NA	√
TNT	NA	√
Metals		
Boron	√	√
Chromium, total	--	√
Miscellaneous		
Perchlorate	NA	√
VOCs		
1,2-Dichloroethane	NA	√
Chloroform	NA	√
Tetrachloroethylene (PCE)	NA	√
Trichloroethene	NA	√

NA - not applicable, filtered results available for metals analysis only

√ COPC for medium

-- not a COPC for medium

Table C-8. Zone 11 EPC Evaluation for Surface Soil (0-2 ft)

Grid Cell	COPC	CAS No.	Total # of Samples	Total # of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
					Metals				
8	Antimony	7440-36-0	12	1	7.80E+00	7.80E+00	D	3.91E+00	3.91E+00
					SVOCs				
8	Benzo(a)Pyrene	50-32-8	19	4	4.80E-02	2.40E-01	D	2.43E-01	2.40E-01
					SVOCs				
12	Benzo(a)Pyrene	50-32-8	8	2	6.90E-02	1.10E-01	NA	--	1.10E-01
					HEs				
13	2,4-Dinitrotoluene	121-14-2	31	1	3.50E+00	3.50E+00	D	4.30E-01	4.30E-01
13	RDX	121-82-4	32	6	5.90E-01	5.80E+00	D	9.59E-01	9.59E-01
					Metals				
13	Antimony	7440-36-0	23	11	1.00E-01	3.00E+01	D	4.38E+00	4.38E+00
					SVOCs				
13	Benzo(a)Pyrene	50-32-8	20	1	2.20E-01	2.20E-01	D	1.99E-01	1.99E-01
					HEs				
15	4-Amino-2,6-Dinitrotoluene	19406-51-0	34	5	4.85E-02	3.10E+00	D	3.09E-01	3.09E-01
15	TNT	118-96-7	38	8	7.70E-02	9.10E+01	D	6.57E+00	6.57E+00
					SVOCs				
15	Benzo(a)Pyrene	50-32-8	32	3	5.80E-02	2.60E-01	D	1.97E-01	1.97E-01
15	Pentachlorophenol	87-86-5	32	1	6.60E+00	6.60E+00	D	1.39E+00	1.39E+00
					Metals				
20	Antimony	7440-36-0	6	2	4.36E-01	1.14E+01	NA	--	1.14E+01
					Metals				
21	Antimony	7440-36-0	1	1	1.10E+01	1.10E+01	NA	--	1.10E+01
					HEs				
22	HMX	2691-41-0	47	31	4.79E-02	4.30E+02	L	7.26E+01	7.26E+01
					Metals				
22	Antimony	7440-36-0	15	1	2.30E+01	2.30E+01	D	6.87E+00	6.87E+00
					SVOCs				
22	Benzo(a)Anthracene	56-55-3	56	12	4.20E-02	5.80E+00	D	5.89E-01	5.89E-01
22	Benzo(a)Pyrene	50-32-8	56	9	4.90E-02	4.90E+00	D	6.22E-01	6.22E-01
22	Benzo(b)Fluoranthene	205-99-2	56	9	4.70E-02	4.34E+00	D	5.33E-01	5.33E-01
22	Dibenz(a,h)Anthracene	53-70-3	54	4	2.00E-02	3.51E+00	D	4.08E-01	4.08E-01

Grid Cell	COPC	CAS No.	Total # of Samples	Total # of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
22	Indeno(1,2,3-c,d)Pyrene	193-39-5	55	9	4.78E-02	5.01E+00	D	5.67E-01	5.67E-01
HEs									
23	HMX	2691-41-0	43	40	9.00E-02	2.90E+02	L	1.07E+02	1.07E+02
SVOCs									
23	Benzo(a)Pyrene	50-32-8	4	2	4.00E-02	2.55E-01	NA	--	2.55E-01
Metals									
24	Antimony	7440-36-0	5	5	7.00E-01	1.00E+01	NA	--	1.00E+01
Metals									
27	Antimony	7440-36-0	8	6	3.52E+00	1.40E+01	NA	--	1.40E+01
27	Vanadium	7440-62-2	18	18	2.10E+01	5.50E+01	L	3.94E+01	3.94E+01
Metals									
28	Antimony	7440-36-0	47	33	1.00E-01	3.70E+01	X	4.93E+00	4.93E+00
28	Mercury	7439-97-6	26	13	2.90E-02	6.10E-01	X	1.15E-01	1.15E-01
SVOCs									
28	Benzo(a)Pyrene	50-32-8	17	8	4.80E-02	2.70E-01	D	1.03E+00	2.70E-01
28	Chlorocyclohexanol	1561-86-0	1	1	4.60E+00	4.60E+00	NA	--	4.60E+00
28	Dibenz(a,h)Anthracene	53-70-3	16	2	5.60E-02	6.50E-02	D	1.10E+00	6.50E-02

All concentrations in mg/kg.
EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.
D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.
L - Distribution is lognormal. 95% UCL calculated using Land's H method.
N - Distribution is normal. 95% UCL calculated using Student's t-statistic.
X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.
NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table C-9. Zone 11 EPC Evaluation for Soil (0-15 ft)

Grid Cell	COPC	CAS No.	Total # of Samples	Total # of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
				Metals					
8	Aluminum	7429-90-5	11	11	6.25E+03	2.69E+04	X	1.74E+04	1.74E+04
8	Antimony	7440-36-0	31	3	3.10E-01	7.80E+00	D	2.95E+00	2.95E+00
8	Barium	7440-39-3	42	42	7.90E+01	6.70E+03	X	6.37E+02	6.37E+02
				SVOCs					
8	Benzo(a)Pyrene	50-32-8	59	4	4.80E-02	2.40E-01	D	2.33E-01	2.33E-01
				SVOCs					
12	Benzo(a)Pyrene	50-32-8	29	3	6.90E-02	1.30E-01	D	1.89E-01	1.30E-01
				HEs					
13	2,4-Dinitrotoluene	121-14-2	98	1	3.50E+00	3.50E+00	D	2.30E-01	2.30E-01
13	RDX	121-82-4	91	6	5.90E-01	5.80E+00	D	5.18E-01	5.18E-01
				Metals					
13	Antimony	7440-36-0	62	33	1.00E-01	3.00E+01	X	2.76E+00	2.76E+00
				SVOCs					
13	Benzo(a)Pyrene	50-32-8	63	1	2.20E-01	2.20E-01	D	2.26E-01	2.20E-01
13	Chlorocyclohexanol	1561-86-0	1	1	5.40E-01	5.40E-01	NA	--	5.40E-01
				HEs					
15	2,4-Dinitrotoluene	121-14-2	127	4	5.74E-02	9.60E-01	D	2.57E-01	2.57E-01
15	4-Amino-2,6-Dinitrotoluene	19406-51-0	68	7	4.85E-02	3.10E+00	D	3.56E-01	3.56E-01
15	TNT	118-96-7	100	24	2.93E-02	1.30E+02	D	5.01E+00	5.01E+00
				Metals					
15	Aluminum	7429-90-5	13	13	7.83E+03	3.20E+04	L	2.31E+04	2.31E+04
				SVOCs					
15	Benzo(a)Anthracene	56-55-3	84	4	4.50E-02	3.20E+00	D	2.95E-01	2.95E-01
15	Benzo(a)Pyrene	50-32-8	84	6	4.50E-02	9.20E-01	D	2.14E-01	2.14E-01
15	Benzo(b)Fluoranthene	205-99-2	84	7	5.40E-02	1.90E+00	D	2.44E-01	2.44E-01
15	Pentachlorophenol	87-86-5	84	1	6.60E+00	6.60E+00	D	1.10E+00	1.10E+00
				Metals					
16	Barium	7440-39-3	35	35	8.01E+01	1.09E+03	L	3.19E+02	3.19E+02

Table C 9. Zone 11 EPC Evaluation for Soil (0-15 ft) (continued)

Grid Cell	COPC	CAS No.	Total # of Samples	Total # of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
				Metals					
17	Barium	7440-39-3	10	10	1.10E+02	1.05E+03	X	4.19E+02	4.19E+02
				SVOCs					
17	Chlorocyclohexanol	1561-86-0	1	1	4.80E-04	4.80E-04	NA	--	4.80E-04
				Metals					
19	Thallium	7440-28-0	9	5	5.40E-01	1.10E+02	NA	--	1.10E+02
				SVOCs					
19	Chlorocyclohexanol	1561-86-0	1	1	2.90E-01	2.90E-01	NA	--	2.90E-01
				Metals					
20	Antimony	7440-36-0	9	2	4.36E-01	1.14E+01	NA	--	1.14E+01
				Metals					
21	Antimony	7440-36-0	1	1	1.10E+01	1.10E+01	NA	--	1.10E+01
				HEs					
22	HMX	2691-41-0	130	70	4.65E-02	4.30E+02	X	1.29E+01	1.29E+01
22	TNT	118-96-7	96	16	2.34E-02	2.10E+01	D	7.84E-01	7.84E-01
				Metals					
22	Antimony	7440-36-0	34	2	1.00E-01	2.30E+01	D	6.24E+00	6.24E+00
22	Mercury	7439-97-6	99	12	2.90E-02	9.00E-01	D	7.50E-02	7.50E-02
				SVOCs					
22	Benzo(a)Anthracene	56-55-3	111	12	4.20E-02	5.80E+00	D	3.91E-01	3.91E-01
22	Benzo(a)Pyrene	50-32-8	111	9	4.90E-02	4.90E+00	D	4.09E-01	4.09E-01
22	Benzo(b)Fluoranthene	205-99-2	111	9	4.70E-02	4.34E+00	D	3.63E-01	3.63E-01
22	Dibenz(a,h)Anthracene	53-70-3	109	4	2.00E-02	3.51E+00	D	2.98E-01	2.98E-01
22	Indeno(1,2,3-c,d)Pyrene	193-39-5	110	9	4.78E-02	5.01E+00	D	3.79E-01	3.79E-01
				HEs					
23	HMX	2691-41-0	71	53	9.00E-02	2.90E+02	X	2.69E+01	2.69E+01
				SVOCs					
23	Benzo(a)Pyrene	50-32-8	6	3	1.58E-02	2.55E-01	NA	--	2.55E-01
				Metals					
24	Antimony	7440-36-0	15	15	2.00E-01	1.00E+01	L	2.88E+00	2.88E+00

Table C 9. Zone 11 EPC Evaluation for Soil (0-15 ft) (continued)

Grid Cell	COPC	CAS No.	Total # of Samples	Total # of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
				Metals					
26	Mercury	7439-97-6	9	4	2.10E-02	7.10E-01	NA	--	7.10E-01
				Metals					
27	Antimony	7440-36-0	11	6	3.52E+00	1.40E+01	N	1.45E+01	1.40E+01
27	Barium	7440-39-3	20	20	1.30E+02	2.20E+03	X	5.37E+02	5.37E+02
27	Vanadium	7440-62-2	26	26	1.36E+01	5.50E+01	L	3.53E+01	3.53E+01
				Metals					
28	Antimony	7440-36-0	103	65	1.00E-01	7.85E+01	X	4.30E+00	4.30E+00
28	Mercury	7439-97-6	70	14	2.90E-02	6.10E-01	D	6.67E-02	6.67E-02
				SVOCs					
28	Benzo(a)Anthracene	56-55-3	69	12	5.40E-02	2.00E+00	D	4.56E-01	4.56E-01
28	Benzo(a)Pyrene	50-32-8	69	11	4.80E-02	1.70E+00	D	4.42E-01	4.42E-01
28	Benzo(b)Fluoranthene	205-99-2	69	13	4.70E-02	2.00E+00	D	4.44E-01	4.44E-01
28	Chlorocyclohexanol	1561-86-0	1	1	4.60E+00	4.60E+00	NA	--	4.60E+00
28	Dibenz(a,h)Anthracene	53-70-3	65	3	5.60E-02	3.10E-01	D	4.13E-01	3.10E-01
28	Indeno(1,2,3-c,d)Pyrene	193-39-5	68	9	4.00E-02	9.30E-01	D	4.04E-01	4.04E-01
				Metals					
30	Barium	7440-39-3	3	3	1.30E+02	1.50E+03	NA	--	1.50E+03

All concentrations in mg/kg.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

N - Distribution is normal. 95% UCL calculated using Student's t-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

-- 95% UCL not determined due to less than 10 total samples.

C.1 RISK CHARACTERIZATION RESULTS FOR ZONE 11

This section provides the quantitative risk results for onsite and offsite receptors that may be exposed to contaminated media from Zone 11.

The numerical risk and hazard estimates presented in this section must be interpreted in the context of the uncertainties and assumptions associated with the risk assessment process and with the data upon which the risk estimates are based. The uncertainty discussion for Zone 11 is included in a table at the end of this section.

C.1.1 Risk Characterization for Onsite Receptors at Zone 11

Three onsite media of concern were identified for Zone 11: soil, air, and groundwater.

C.1.1.1 Risk Characterization for Onsite Soil and Air at Zone 11

Two onsite exposure scenarios are quantitatively evaluated for Zone 11:

- Current/future industrial worker exposed to surface soil (0 to 2 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air.

- Current/future construction worker exposed to soil (0 to 15 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air.

Current and future risks were evaluated for these receptors/pathways for each grid cell at Zone 11 from EPCs (95% UCL on the mean or maximum detected concentration) calculated from measured soil concentrations.

Individual and cumulative ILCRs and HQs/HIs are calculated for COPCs for each grid cell and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0). Grid cell results fall into three categories:

- <u>Grid cells with no COPCs (no data available or no COPCs retained for evaluation)</u>: No surface soil (0 to 2 ft) or soil (0 to 15 ft) COPCs were identified in Grid Cells 1-7, 9-11, 14, 18, 25, and 29; therefore, these areas are uncontaminated or represent negligible risk and are not evaluated further.

- <u>Grid cells with risks below acceptable target risk criteria</u>: COPCs were retained for further evaluation in the HHRA for surface soil (0 to 2 ft) and soil (0 to 15 ft) at Grid Cells 8, 12, 13, 15, 16 (0 to15 ft only), 17 (0 to 15 ft only), 20, 21, 23, 24, 26 (0 to 15 ft only), 27, and 30 (0 to 15 ft only). Individual and cumulative ILCR and HQ/HI results for these grid cells (shaded dark blue [surface soil 0 to 2 ft] and [soil 0 to 15 ft]) are below the TCEQ and EPA acceptable target risk criteria.

- <u>Grid cells with risks equal to or above acceptable target risk criteria</u>: Estimated cumulative ILCRs for Grid Cells 22 and 28 exceed the target risk criteria for the industrial worker scenario. The estimated total HI for Grid Cell 19 exceeds the target risk criteria for the construction/excavation worker scenario.

Risk characterization results for Grid Cells 19, 22, and 28 are summarized below.

Grid Cell	Industrial Worker Scenario[a]		Construction Worker Scenario[b]	
	ILCR	HI	ILCR	HI
Grid Cell 19	No COPCs	No COPCs	No COPCs	**6.8**
Grid Cell 22	**3.8E-06**	0.046	1.1E-07	0.09
Grid Cell 28	**1.1E-06**	0.01	1.2E-07	0.06

[a]Industrial worker exposed to surface soil (0-2 ft bgs).
[b]Construction worker exposed to soil (0-15 ft bgs).
Bold values exceed ILCR of 1.0E-06 or HQ/HI of 1.0.

C.1.1.2 Risk Characterization for Onsite Groundwater at Zone 11

Future Industrial and construction/excavation worker exposure to COPCs in groundwater (Ogallala Aquifer) is dependant on COPCs in soil, soil gas, and/or perched groundwater reaching Pantex Plant production wells in the Ogallala Aquifer. The potential for COPCs in soil, soil gas, and/or perched groundwater at Zone 11 to migrate to the Pantex Plant production wells is evaluated using the Tier 2 and Tier 3 approach presented in Section 4.4 of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006).

The following transport pathways were evaluated for Zone 11:

- Soil-to-Ogallala Aquifer
- Soil gas-to-Ogallala Aquifer
- Perched groundwater-to-Ogallala Aquifer (where perched groundwater is known to exist)
- Ogallala Aquifer to Pantex Plant production wells.

COPCs carried forward for Tier 2 and Tier 3 analysis are listed in previous table. No groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network. Results for the Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer; soil gas-to-Ogallala; perched groundwater-to-Ogallala Aquifer; and Ogallala Aquifer-to-Pantex Plant production wells are summarized as follows:.

- Tier 2 analysis indicates eighteen soil COPCs, including seven HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, HMX, RDX, TNT), four metals (antimony, arsenic, manganese, thallium), three PCBs (PCB-1248, PCB-1254, PCB-1260), three SVOCs (1,2-cyclohexanediol, chlorocyclohexanol, pentachlorophenol), and one VOC (methylene chloride) may exceed the RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an onsite exposure point in the Ogallala Aquifer (Pantex Plant production wells) within 1,000 years.

- Tier 2 COPC identified six soil gas COPCs (acetone, carbon tetrachloride, 1,2-dichloroethane, methylene chloride, tetrachlorethene, and trichloroethene) that may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates no COPCs are predicted to reach an onsite or offsite exposure point in the Ogallala Aquifer within 1,000 years. COPCs in soil gas may potentially reach the Ogallala Aquifer in the area where perched groundwater is not present (along and adjacent to the western portion of Zone 11). However, these COPCs are not predicted to reach an onsite exposure point in the Ogallala Aquifer (Pantex Plant production wells) within 1,000 years. Gas phase modeling of trichloroethene, tetrachloroethylene, and 1,2-dichloroethane was also conducted for Zone 11 as discussed in Appendix N, Section N.6. Acetone, carbon tetrachloride, and methylene chloride were not modeled, but the concentrations and toxicities of these COPCs were compared to the modeled COPCs for qualitative evaluation.

- Tier 2 COPC analysis identified five perched groundwater COPCs, including two HEs (4-amino-2,6-dinitrotoluene and RDX), one metal (total chromium), one VOC (trichloroethene) and perchlorate that may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicate no COPCs are predicted to reach an onsite exposure point in the Ogallala Aquifer (Pantex Plant production wells) within 1,000 years.

Results of the Tier 3 analysis indicate exposure of onsite workers to groundwater COPCs originating from Zone 11 is an incomplete pathway because COPCs at Zone 11 will not reach the Pantex Plant production wells within 1,000 years. Therefore, groundwater at Zone 11 does not contribute to risk to onsite receptors.

C.1.2 Risk Characterization for Offsite Receptors Due to COPC Transport from Zone 11

Potential risks to offsite receptors were evaluated for two transport mechanisms:

- Airborne transport of COPCs in surface soil to offsite air with subsequent deposition to offsite soil and crops

- Groundwater transport to offsite exposure locations.

C.1.2.1 Risks from Atmospheric Transport from Zone 11 to Offsite Receptors

Risks from atmospheric transport of surface soil COPCs from Zone 11 to offsite receptor locations are estimated based on modeling conducted for the Burning Ground HHRA (BWXT Pantex, 2005). The Burning Ground is considered a worst-case analysis for atmospheric transport because 1) it has higher surface soil concentrations of most COPCs than other units at Pantex Plant and 2) it is closest to the downwind (northern) Pantex Plant boundary. The results of atmospheric transport modeling for the Burning Ground showed negligible offsite risks. Thus, quantitative atmospheric transport modeling was not conducted for other corrective action units at Pantex Plant. Instead, the quantitative results for the Burning Ground are used in a semi-quantitative evaluation by comparing conditions at the Burning Ground to each corrective action unit or zone, as described in Appendix O of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006).

The predominant wind direction at Pantex Plant is from south to north. The Burning Ground is located approximately 2,750 ft south of the northern plant boundary. Zone 11 is located more than 2 miles from the northern plant boundary and approximately 3,300 ft north of the southern plant boundary, which is the nearest plant boundary to this zone.

Risks were calculated for 11 grid cells at the Burning Ground with a total ILCR for all grid cells of 4.5E-03 and a total HI of 156. The onsite COPC concentrations associated with these high onsite risks resulted in negligible offsite risks (cumulative ILCR=5.3E-08, HI=0.44).

Risks were calculated for 11 grid cells at Zone 11 with a total ILCR for all grid cells of 8.4E-06 and a total HI of 0.20. Because Zone 11 is farther from the plant boundary and has much lower surface soil risks than the Burning Ground, offsite risks due to atmospheric transport from Zone 11 would be less than those predicted for the Burning Ground (i.e., ILCR<5.3E-08 and HI<0.44). Semi-quantitative analysis (Appendix O) using the relative distance and direction to the Plant boundary for Burning Ground and Zone 11 indicates offsite risks from Zone 11 would be on the order of ILCR=5.22E-11 and HI=0.0003.

C.1.2.2 Risks from Groundwater Transport from Zone 11 to Offsite Receptors

The potential for COPCs in soil, soil gas, and/or perched groundwater to migrate to offsite receptor locations in perched groundwater or the Ogallala Aquifer was evaluated using the Tier 2 and Tier 3 fate and transport approach presented in Section 4.4 of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006). The results of this modeling are summarized for Zone 11 here.

The following transport pathways were evaluated for groundwater:

- Soil-to-perched groundwater (where perched groundwater is known to exist)
- Soil-to-Ogallala Aquifer
- Soil gas-to-perched groundwater (where perched groundwater is known to exist)
- Soil gas-to-Ogallala Aquifer
- Perched groundwater to offsite POE (where perched groundwater is known to exist)
- Perched groundwater-to-Ogallala Aquifer (where perched groundwater is known to exist)
- Ogallala Aquifer to offsite POE.

Results of the Tier 1 COPC evaluation are presented in previous tables. No groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network. Results of the Tier 2 and Tier 3 fate and transport evaluation are detailed in Appendix I, Section I.3.5 and summarized below:

- Tier 2 analysis indicates twenty soil COPCs, including seven HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, HMX, RDX, and TNT); five metals (antimony, arsenic, lead, manganese, and vanadium); three PCBs (PCB-1248, PCB-1254, and PCB-1260); three SVOCs (1,2-cyclohexanediol, chlorocyclohexanol, and pentachlorophenol); and two VOCs (methylene chloride and tetrachloroethylene); may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point south of the Plant boundary within 1,000 years.

- Tier 2 analysis indicates that eighteen soil COPCs, including seven HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, HMX, RDX, TNT), four metals (antimony, arsenic, manganese, thallium), three PCBs (PCB-1248, PCB-1254, PCB-1260), three SVOCs (1,2-cyclohexanediol, chlorocyclohexanol, pentachlorophenol), and one VOC (methylene chloride) may exceed the RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala within 1,000 years.

- Tier 2 analysis indicates four soil gas COPCs (carbon tetrachloride, methylene chloride, tetrachloroethylene and trichloroethene) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater south of the Plant boundary within 1,000 years.

- Tier 2 analysis indicates six soil gas COPCs (acetone, carbon tetrachloride, 1,2-dichloroethane, methylene chloride, tetrachlorethylene, and trichloroethene) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these

COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates eleven perched groundwater COPCs, including four HEs (2,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and TNT); two metals (boron and total chromium); perchlorate; and four VOCs (1,2-dichloroethane, chloroform, tetrachloroethylene, and trichloroethene); may exceed RBSVGW in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south of the Plant boundary within 1,000 years.

- Tier 2 analysis indicates five perched groundwater COPCs, including two HEs (4-amino-2,6-dinitrotoluene and RDX), one metal (total chromium), one VOC (trichloroethene), and perchlorate may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Zone 11 is located west of the perched groundwater flow divide; therefore, COPCs in soil, soil gas, and perched groundwater at Zone 11 will not migrate offsite to the east in the perched groundwater.

Based on these results, exposure of offsite receptors east of Pantex Plant to groundwater COPCs originating from Zone 11 is an incomplete pathway, and therefore, does not contribute to risk to offsite receptors east of Pantex Plant.

Table C-10. Zone 11 Summary of Risk Calculations for Industrial Worker Surface Soil (0-2 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg)	95% UCL (mg/kg)	EPC (mg/kg)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
8	Antimony	7440-36-0	12	7.8E+00	3.9E+00	3.9E+00	--	--	--	2.0E-03	0.008	100.0%
8	Benzo(a)pyrene	50-32-8	19	2.4E-01	2.4E-01	2.4E-01	3.1E-06	7.5E-07	100.0%	--	--	--
							Cumulative ILCR	7.5E-07	100.0%	**HI**	0.008	100.0%
12	Benzo(a)pyrene	50-32-8	8	1.1E-01	--	1.1E-01	3.1E-06	3.5E-07	100.0%	--	--	--
							Cumulative ILCR	3.5E-07	100.0%	**HI**	--	--
13	2,4-Dinitrotoluene	121-14-2	31	3.5E+00	4.3E-01	4.3E-01	2.6E-07	1.1E-07	14.4%	5.6E-04	0.00024	2.5%
13	RDX	121-82-4	32	5.8E+00	9.6E-01	9.6E-01	3.8E-08	3.7E-08	4.8%	3.4E-04	0.00032	3.4%
13	Antimony	7440-36-0	23	3.0E+01	4.4E+00	4.4E+00	--	--	--	2.0E-03	0.009	94.1%
13	Benzo(a)pyrene	50-32-8	20	2.2E-01	2.0E-01	2.0E-01	3.1E-06	6.2E-07	80.8%	--	--	--
							Cumulative ILCR	7.7E-07	100.0%	**HI**	0.0095	100.0%
15	4-Amino-2,6-Dinitrotoluene	19406-51-0	34	3.1E+00	3.1E-01	3.1E-01	5.2E-09	1.6E-09	0.2%	8.9E-03	0.0027	13.5%
15	TNT	118-96-7	38	9.1E+01	6.6E+00	6.6E+00	1.4E-08	9.2E-08	10.9%	2.7E-03	0.017	86.0%
15	Benzo(a)pyrene	50-32-8	32	2.6E-01	2.0E-01	2.0E-01	3.1E-06	6.2E-07	73.9%	--	--	--
15	Pentachlorophenol	87-86-5	32	6.6E+00	1.4E+00	1.4E+00	9.0E-08	1.3E-07	14.9%	7.9E-05	0.00011	0.5%
							Cumulative ILCR	8.4E-07	100.0%	**HI**	0.02	100.0%
20	Antimony	7440-36-0	6	1.1E+01	--	1.1E+01	--	--	--	2.0E-03	0.023	100.0%
							Cumulative ILCR	--	--	**HI**	0.023	100.0%
21	Antimony	7440-36-0	1	1.1E+01	--	1.1E+01	--	--	--	2.0E-03	0.023	100.0%
							Cumulative ILCR	--	--	**HI**	0.023	100.0%
22	HMX	2691-41-0	47	4.3E+02	7.3E+01	7.3E+01	--	--	--	7.7E-05	0.0056	28.4%
22	Antimony	7440-36-0	15	2.3E+01	6.9E+00	6.9E+00	--	--	--	2.0E-03	0.014	71.6%
22	Benzo(a)anthracene	56-55-3	56	5.8E+00	5.9E-01	5.9E-01	3.1E-07	1.9E-07	4.9%	--	--	--
22	Benzo(a)pyrene	50-32-8	56	4.9E+00	6.2E-01	6.2E-01	3.1E-06	**2.0E-06**	51.9%	--	--	--
22	Benzo(b)fluoranthene	205-99-2	56	4.3E+00	5.3E-01	5.3E-01	3.1E-07	1.7E-07	4.5%	--	--	--
22	Dibenz(a,h)anthracene	53-70-3	54	3.5E+00	4.1E-01	4.1E-01	3.1E-06	**1.3E-06**	34.0%	--	--	--

Table C-10. Zone 11 Summary of Risk Calculations for Industrial Worker (continued)
Surface Soil (0-2 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg)	95% UCL (mg/kg)	EPC (mg/kg)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
22	Indeno(1,2,3-c,d)pyrene	193-39-5	55	5.0E+00	5.7E-01	5.7E-01	3.1E-07	1.8E-07	4.7%	--	--	--
							Cumulative ILCR	**3.8E-06**	100.0%	**HI**	0.02	100.0%
23	HMX	2691-41-0	43	2.9E+02	1.1E+02	1.1E+02	--	--	--	7.7E-05	0.0082	100.0%
23	Benzo(a)pyrene	50-32-8	4	2.5E-01	--	2.5E-01	3.1E-06	8.0E-07	100.0%	--	--	--
							Cumulative ILCR	8.0E-07	100.0%	**HI**	0.0082	100.0%
24	Antimony	7440-36-0	5	1.0E+01	--	1.0E+01	--	--	--	2.0E-03	0.02	100.0%
							Cumulative ILCR	--	--	**HI**	0.02	100.0%
27	Antimony	7440-36-0	8	1.4E+01	--	1.4E+01	--	--	--	2.0E-03	0.029	62.9%
27	Vanadium	7440-62-2	18	5.5E+01	3.9E+01	3.9E+01	--	--	--	4.3E-04	0.017	37.1%
							Cumulative ILCR	--	--	**HI**	0.046	100.0%
28	Antimony	7440-36-0	47	3.7E+01	4.9E+00	4.9E+00	--	--	--	2.0E-03	0.01	95.7%
28	Mercury	7439-97-6	26	6.1E-01	1.1E-01	1.1E-01	--	--	--	4.0E-03	0.00046	4.3%
28	Benzo(a)pyrene	50-32-8	17	2.7E-01	1.0E+00	2.7E-01	3.1E-06	8.5E-07	80.6%	--	--	--
28	Chlorocyclohexanol	1561-86-0	1	4.6E+00	--	4.6E+00	--	--	--	--	--	--
28	Dibenz(a,h)anthracene	53-70-3	16	6.5E-02	1.1E+00	6.5E-02	3.1E-06	2.0E-07	19.4%	--	--	--
							Cumulative ILCR	**1.1E-06**	100.0%	**HI**	0.011	100.0%

Bolded values exceed ILCR of 1.0E-06 or HI of 1.0.
-- no value available

Table C-11. Zone 11 Summary of Risk Calculations for Construction/Excavation Worker Soil (0-15 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg)	95% UCL (mg/kg)	EPC (mg/kg)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
8	Aluminum	7429-90-5	11	2.7E+04	1.7E+04	1.7E+04	--	--	--	6.3E-06	0.11	53.6%
8	Antimony	7440-36-0	31	7.8E+00	3.0E+00	3.0E+00	--	--	--	1.3E-02	0.039	18.8%
8	Barium	7440-39-3	42	6.7E+03	6.4E+02	6.4E+02	--	--	--	9.0E-05	0.057	27.7%
8	Benzo(a)pyrene	50-32-8	59	2.4E-01	2.3E-01	2.3E-01	1.4E-07	3.2E-08	100.0%	--	--	--
							Cumulative ILCR	3.2E-08	100.0%	**HI**	0.21	100.0%
12	Benzo(a)pyrene	50-32-8	29	1.3E-01	1.9E-01	1.3E-01	1.4E-07	1.8E-08	100.0%	--	--	--
							Cumulative ILCR	1.8E-08	100.0%	**HI**	--	--
13	2,4-Dinitrotoluene	121-14-2	98	3.5E+00	2.3E-01	2.3E-01	1.2E-08	2.8E-09	8.4%	2.8E-03	0.00064	1.7%
13	RDX	121-82-4	91	5.8E+00	5.2E-01	5.2E-01	2.0E-09	1.0E-09	3.0%	1.8E-03	0.00094	2.5%
13	Antimony	7440-36-0	62	3.0E+01	2.8E+00	2.8E+00	--	--	--	1.3E-02	0.036	95.8%
13	Benzo(a)pyrene	50-32-8	63	2.2E-01	2.3E-01	2.2E-01	1.4E-07	3.0E-08	88.6%	--	--	--
13	Chlorocyclohexanol	1561-86-0	1	5.4E-01	--	5.4E-01	--	--	--	--	--	--
							Cumulative ILCR	3.4E-08	100.0%	**HI**	0.038	100.0%
15	2,4-Dinitrotoluene	121-14-2	127	9.6E-01	2.6E-01	2.6E-01	1.2E-08	3.2E-09	7.0%	2.8E-03	0.00071	0.3%
15	4-Amino-2,6-Dinitrotoluene	19406-51-0	68	3.1E+00	3.6E-01	3.6E-01	1.9E-10	6.9E-11	0.2%	3.6E-02	0.013	5.8%
15	TNT	118-96-7	100	1.3E+02	5.0E+00	5.0E+00	5.7E-10	2.8E-09	6.3%	1.2E-02	0.058	26.5%
15	Aluminum	7429-90-5	13	3.2E+04	2.3E+04	2.3E+04	--	--	--	6.3E-06	0.15	67.3%
15	Benzo(a)anthracene	56-55-3	84	3.2E+00	2.9E-01	2.9E-01	1.4E-08	4.0E-09	8.8%	--	--	--
15	Benzo(a)pyrene	50-32-8	84	9.2E-01	2.1E-01	2.1E-01	1.4E-07	2.9E-08	64.1%	--	--	--
15	Benzo(b)fluoranthene	205-99-2	84	1.9E+00	2.4E-01	2.4E-01	1.4E-08	3.3E-09	7.3%	--	--	--
15	Pentachlorophenol	87-86-5	84	6.6E+00	1.1E+00	1.1E+00	2.6E-09	2.9E-09	6.3%	2.3E-04	0.00025	0.1%
							Cumulative ILCR	4.5E-08	100.0%	**HI**	0.22	100.0%
16	Barium	7440-39-3	35	1.1E+03	3.2E+02	3.2E+02	--	--	--	9.0E-05	0.029	100.0%
							Cumulative ILCR	--	--	**HI**	0.029	100.0%
17	Barium	7440-39-3	10	1.1E+03	4.2E+02	4.2E+02	--	--	--	9.0E-05	0.038	100.0%
17	Chlorocyclohexanol	1561-86-0	1	4.8E-04	--	4.8E-04	--	--	--	--	--	--
							Cumulative ILCR	--	--	**HI**	0.038	100.0%

Table C-11. Zone 11 Summary of Risk Calculations for Construction/Excavation Worker (continued)
Soil (0-15 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg)	95% UCL (mg/kg)	EPC (mg/kg)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
19	Thallium	7440-28-0	9	1.1E+02	--	1.1E+02	--	--	--	6.2E-02	**6.8**	100.0%
19	Chlorocyclohexanol	1561-86-0	1	2.9E-01	--	2.9E-01	--	--	--	--	--	--
							Cumulative ILCR	--	--	**HI**	**6.8**	100.0%
20	Antimony	7440-36-0	9	1.1E+01	--	1.1E+01	--	--	--	1.3E-02	0.15	100.0%
							Cumulative ILCR	--	--	**HI**	0.15	100.0%
21	Antimony	7440-36-0	1	1.1E+01	--	1.1E+01	--	--	--	1.3E-02	0.14	100.0%
							Cumulative ILCR	--	--	**HI**	0.14	100.0%
22	HMX	2691-41-0	130	4.3E+02	1.3E+01	1.3E+01	--	--	--	1.7E-04	0.0022	2.3%
22	TNT	118-96-7	96	2.1E+01	7.8E-01	7.8E-01	5.7E-10	4.4E-10	0.4%	1.2E-02	0.009	9.6%
22	Antimony	7440-36-0	34	2.3E+01	6.2E+00	6.2E+00	--	--	--	1.3E-02	0.082	86.6%
22	Mercury	7439-97-6	99	9.0E-01	7.5E-02	7.5E-02	--	--	--	1.9E-02	0.0014	1.5%
22	Benzo(a)anthracene	56-55-3	111	5.8E+00	3.9E-01	3.9E-01	1.4E-08	5.3E-09	4.8%	--	--	--
22	Benzo(a)pyrene	50-32-8	111	4.9E+00	4.1E-01	4.1E-01	1.4E-07	5.5E-08	49.6%	--	--	--
22	Benzo(b)fluoranthene	205-99-2	111	4.3E+00	3.6E-01	3.6E-01	1.4E-08	4.9E-09	4.4%	--	--	--
22	Dibenzo(a,h)anthracene	53-70-3	109	3.5E+00	3.0E-01	3.0E-01	1.4E-07	4.0E-08	36.2%	--	--	--
22	Indeno(1,2,3-c,d)pyrene	193-39-5	110	5.0E+00	3.8E-01	3.8E-01	1.4E-08	5.1E-09	4.6%	--	--	--
							Cumulative ILCR	1.1E-07	100.0%	**HI**	0.094	100.0%
23	HMX	2691-41-0	71	2.9E+02	2.7E+01	2.7E+01	--	--	--	1.7E-04	0.0045	100.0%
23	Benzo(a)pyrene	50-32-8	6	2.5E-01	--	2.5E-01	1.4E-07	3.5E-08	100.0%	--	--	--
							Cumulative ILCR	3.5E-08	100.0%	**HI**	0.0045	100.0%
24	Antimony	7440-36-0	15	1.0E+01	2.9E+00	2.9E+00	--	--	--	1.3E-02	0.038	100.0%
							Cumulative ILCR	--	--	**HI**	0.038	100.0%
26	Mercury	7439-97-6	9	7.1E-01	--	7.1E-01	--	--	--	1.9E-02	0.013	100.0%
							Cumulative ILCR	--	--	**HI**	0.013	100.0%
27	Antimony	7440-36-0	11	1.4E+01	1.4E+01	1.4E+01	--	--	--	1.3E-02	0.18	68.1%
27	Barium	7440-39-3	20	2.2E+03	5.4E+02	5.4E+02	--	--	--	9.0E-05	0.048	17.9%
27	Vanadium	7440-62-2	26	5.5E+01	3.5E+01	3.5E+01	--	--	--	1.1E-03	0.038	14.0%
							Cumulative ILCR	--	--	**HI**	0.27	100.0%

Table C-11. Zone 11 Summary of Risk Calculations for Construction/Excavation Worker (continued)
Soil (0-15 ft)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg)	95% UCL (mg/kg)	EPC (mg/kg)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
28	Antimony	7440-36-0	103	7.9E+01	4.3E+00	4.3E+00	--	--	--	1.3E-02	0.056	97.8%
28	Mercury	7439-97-6	70	6.1E-01	6.7E-02	6.7E-02	--	--	--	1.9E-02	0.0013	2.2%
28	Benzo(a)anthracene	56-55-3	69	2.0E+00	4.6E-01	4.6E-01	1.4E-08	6.2E-09	5.2%	--	--	--
28	Benzo(a)pyrene	50-32-8	69	1.7E+00	4.4E-01	4.4E-01	1.4E-07	6.0E-08	50.1%	--	--	--
28	Benzo(b)fluoranthene	205-99-2	69	2.0E+00	4.4E-01	4.4E-01	1.4E-08	6.0E-09	5.0%	--	--	--
28	Chlorocyclohexanol	1561-86-0	1	4.6E+00	--	4.6E+00	--	--	--	--	--	--
28	Dibenz(a,h)anthracene	53-70-3	65	3.1E-01	4.1E-01	3.1E-01	1.4E-07	4.2E-08	35.1%	--	--	--
28	Indeno(1,2,3-c,d)pyrene	193-39-5	68	9.3E-01	4.0E-01	4.0E-01	1.4E-08	5.5E-09	4.6%	--	--	--
							Cumulative ILCR	1.2E-07	100.0%	**HI**	0.058	100.0%
30	Barium	7440-39-3	3	1.5E+03	--	1.5E+03	--	--	--	9.0E-05	0.13	100.0%
							Cumulative ILCR	--	--	**HI**	0.13	100.0%

Bolded values exceed ILCR of 1.0E-06 or HI of 1.0.
-- no value available

Table C-12. Sources of Uncertainty Specific to the Zone 11 HHRA

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Uncertainty in Data Collection and Analysis		
Sampling Locations		
Soil sample locations at Zone 11 are biased toward areas of highest COPC concentration.	Samples collected at areas known or suspected to have a constituent release (i.e., corrective action units) and targeted to identify source areas.	Moderate impact: overestimates risk, especially for grid cells with large uncontaminated areas with few or no samples.
Identification of COPCs		
Identification of naturally occurring inorganic COPCs exceeding background concentrations	Thallium was detected in one sample at Zone 11 above the background criteria. This single sample is not considered indicative of thallium contamination.	Low impact: overestimates site-related risk.
Uncertainty in Exposure Assessment		
Exposure Assumptions		
Standard default worker exposure parameters are used; however, actual worker activity patterns vary by grid cell, by worker, and by time of year as well as from year to year.	Actual exposure of Zone 11 workers is expected to be much less than estimated by standard default exposure parameters.	High impact: overestimates risk to Pantex Plant workers.
Uncertainty in Toxicity Information		
Low confidence and high uncertainty factor in toxicity studies used to derive the oral RfD for thallium.	Uncertainty factors are intended to ensure risks are over- rather than underestimated.	Moderate impact: overestimates risk.
Slope factors are not available for PAHs other than benzo(a)pyrene.	RPFs are used to evaluate other potentially carcinogenic PAHs.	Low impact: over- or underestimates risk.
Toxicity values are not available for chlorocyclohexanal.	Because all but one of the Zone 11 COPCs evaluated in this Baseline HHRA have toxicity values or surrogates, lack of toxicity information is not a significant source of uncertainty in this risk assessment.	Low impact: underestimates risk.
Several chemicals (2,4-dinitrotoluene, RDX, 4-amino-2,6-dinitrotoluene, 2,4,6-trinitrotoluene, and pentachlorophenol) are not evaluated for the inhalation pathway for the cancer endpoint because inhalation slope factors are not available.	Direct ingestion represents the primary exposure pathway for onsite receptors exposed to COPCs in soil; therefore, the lack of inhalation toxicity values for some COPCs is not a major source of uncertainty.	Low impact: underestimates risk.
Uncertainty in Risk Characterization		
Airborne transport of onsite surface soil COPCs to offsite receptors.	Airborne transport to offsite receptors is evaluated qualitatively.	Negligible impact. High uncertainty in the qualitative method does not impact conclusions because of the extremely low risks predicted offsite at the Burning Ground and the much lower onsite risks at Zone 11 than those predicted at the Burning Ground.

Table C-11. Sources of Uncertainty Specific to the Zone 11 HHRA (continued)

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Transport of onsite groundwater COPCs to onsite production wells or offsite receptors east of Pantex Plant	The potential for COPCs in the perched groundwater to migrate to onsite production wells or offsite in the Ogallala Aquifer is based on the assumed continuity of the FGZ and the location of Zone 11 west of the flow divide.	Negligible impact. Breaks or preferential pathways through the FGZ would be reflected in the observed water level data. The subsurface model reproduces what is seen in observed data; therefore, the permeability assumptions used in the model are considered realistic and this uncertainty is unlikely to impact the conclusions of the risk characterization. Location of Zone 11 west of the flow divide precludes migration to offsite POE east of Pantex Plant.
Transport of onsite groundwater COPCs to offsite receptors south of Pantex Plant.	The potential for COPCs in the perched groundwater to migrate offsite to the south is influenced by presumed radial flow from Playa 4.	Moderate impact: may underestimate potential from migration pathway to be complete. Pantex has agreed to set up a long-term monitoring network for the Zone 11 area and to treat the plume extending from Zone 11 to the TTU boundary.

C.1.3 Summary of Conclusions for Zone 11

The risk characterization identified three areas in Zone 11 resulting in potentially unacceptable risks/hazards to onsite workers from exposure to soils; however, consideration of the conservative nature of the HHRA reveals the calculated risks/hazards to be overestimates of actual risks/hazards. The findings of this HHRA demonstrate the effectiveness of the ICMs conducted throughout numerous areas within Zone 11.

COCs identified for Zone 11 exposure media are summarized in the figures below for the industrial worker (0 to 2 ft) and construction/excavation worker (0 to 15 ft) exposed to soil, respectively.

Conclusions for Zone 11 are summarized below:

- Two PAHs [benzo(a)pyrene and dibenz(a,h)anthracene] are identified as COCs for evaluation in the CMS for surface soil at Grid Cell 22. This grid cell is located in the center of Zone 11 and includes a portion of WMG 2 including AOC 8c and SWMUs 117, 118, 119a, 120a, and 148, and part of the Former 11-15 Pond. No other COCs are identified for soil.

Subsurface fate and transport modeling indicates residual COPCs in soil, soil gas, and perched groundwater will not reach any onsite or offsite (north or east) receptor locations within 1,000 years; therefore, no COCs are identified for groundwater. The offsite receptor location was only defined at the eastern boundary. However, Pantex will provide remedial action for the plume that is moving toward TTU property, south of Zone 11.

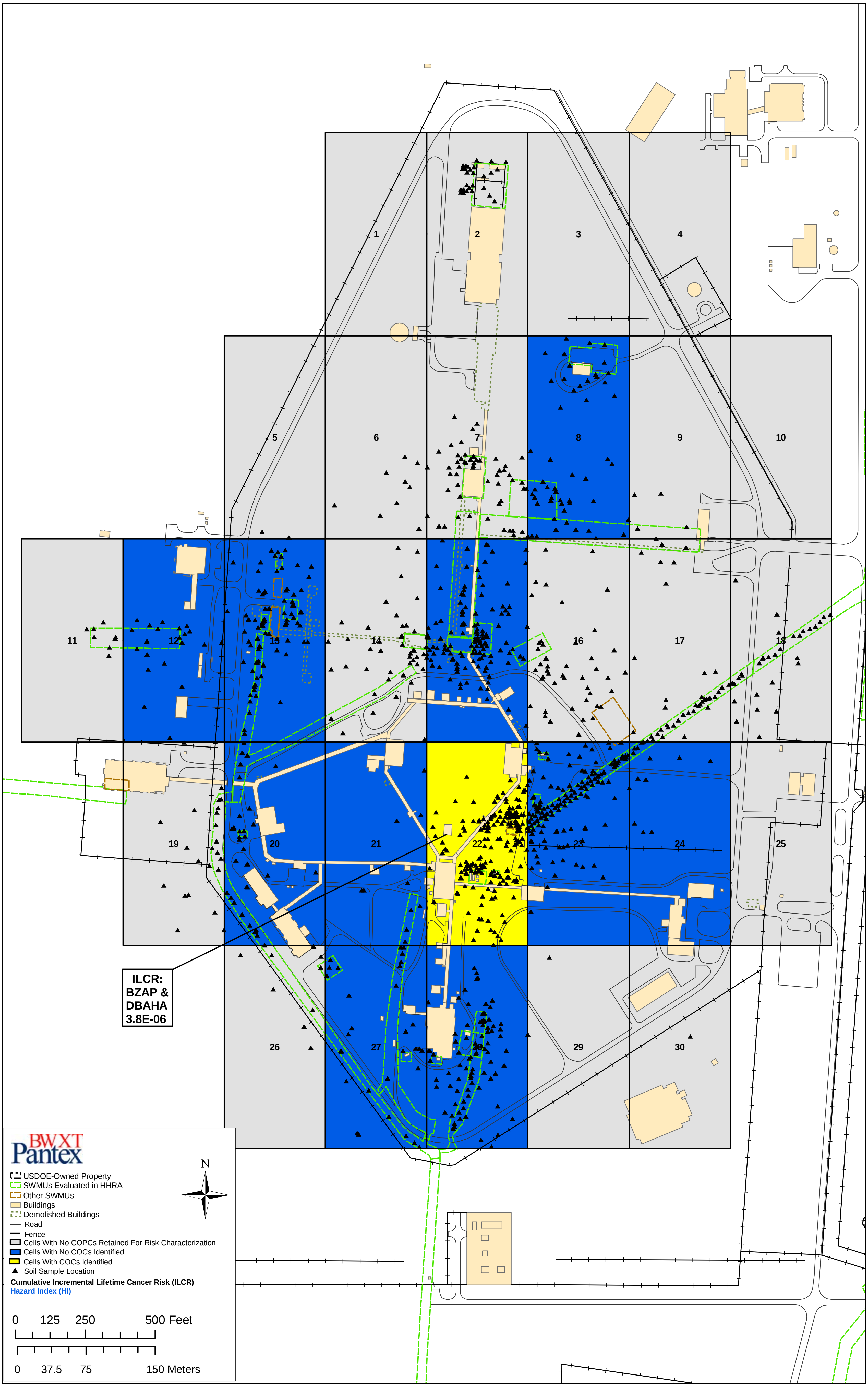

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Figure C-2. Zone 11 Summary of COCs and Risk Results for Industrial Worker

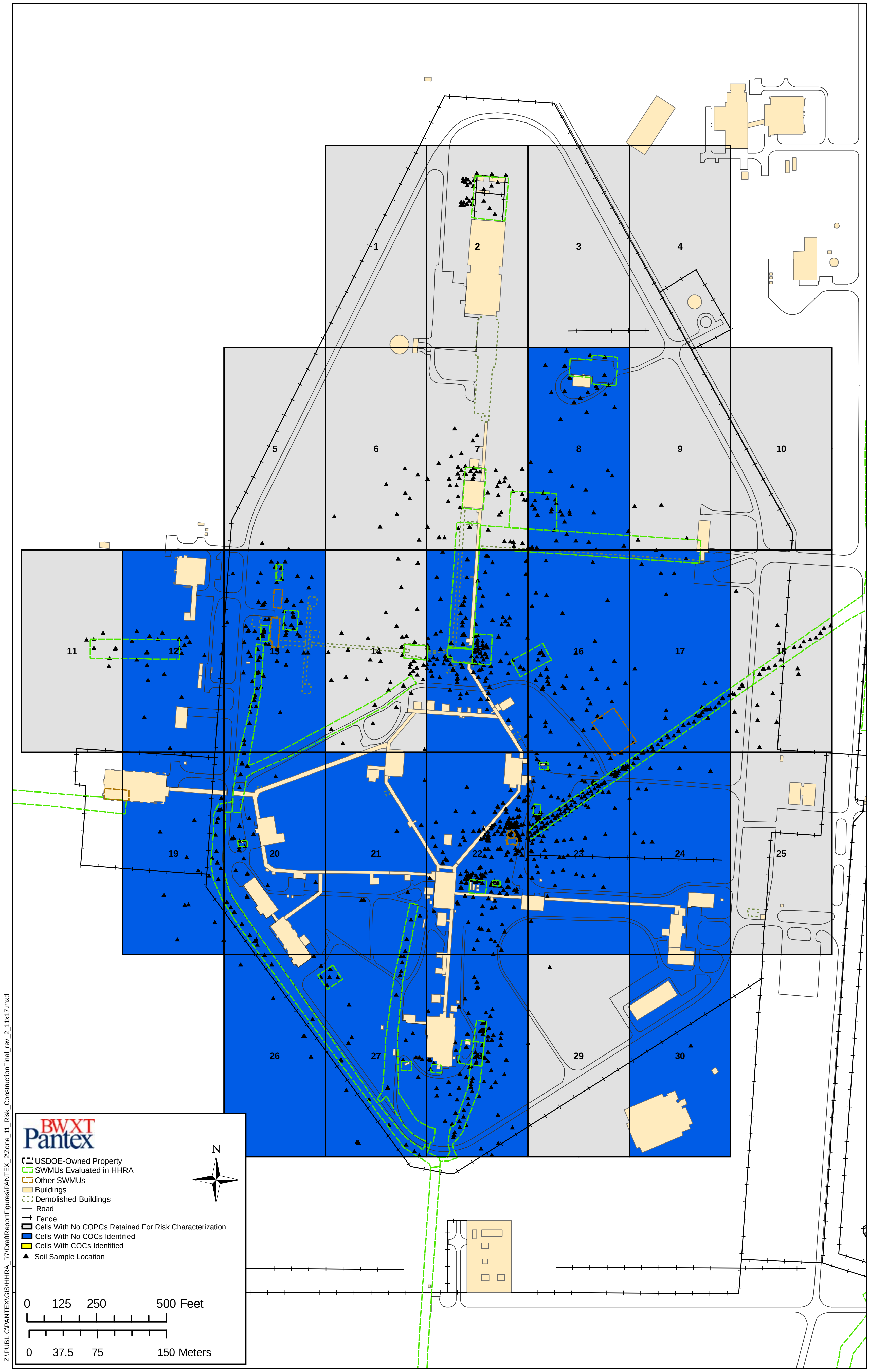

Figure C-3. Zone 11 Summary of COCs and Risk Results for Construction/Excavation Worker

Appendix D

Zone 12 Release Units Requiring Remedial Action

SWMU 2: Building 12-43 Drainage Ditch
SWMU 5-05: Buildings 12-21 and 12-24 Drainage Ditches
SWMU 5-12a: Zone 12 Main Perimeter Ditch
SWMU 54: Landfill 3
SWMU 55: Landfill 4
SWMU 56: Landfill 5
SWMU 57: Landfill 6
SWMU 68a: Original Landfill

SWMU 68d: Sanitary Landfill
SVS 8: Abandoned Zone 10 Landfill
Unassigned AOC: Zone 10 Landfills West and Southwest of SWMU 84 Scrap and Salvage Yard

Contains modified excerpts from Appendix A of the
Baseline HHRA Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groundwater (BWXT Pantex and SAIC, December 2006)

RELEASE OF INFORMATION TO THE PUBLIC
DOCUMENTED REVIEW PROCESS
(Ref. WI 02.04.02.02.03)

Document Title Baseline Human Health Risk Assessment Report for Zones 10, 11, and 12 , Fire Training Area, Ditches and Playas, Independent Sites, and Groudnwater – Volumes I and II Date 12/9/2005
Document Author Michelle Bolwahnn Type of Doc Report

Document Due Date 12-22-2005 Blanket Release Expires

This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☒ No ☐	[signature] for M.G.Knight	DEC 0 9 2005
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐	[signature]	12/13/05
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐	[signature]	12/13/05
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐	[signature]	12/12/05
Legal 12-72 Legal	Legal	Yes ☑ No ☐	[signature]	01/09/05
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐	[signature] J. Kelly	01/10/2025

After all signatures are obtained, forward copy via email or plant mail to the Classification Officer and OSTI Transmittal Officer

Comments: **Please call Marlon Smith (x4058) or Michelle Bolwahnn (6326) for pickup after signature**

Please see attached comments x6616

* with revised Exec. Summary and various changes already made

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LIST OF FIGURES

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D.0 ZONE 12 RELEASE UNITS REQUIRING REMEDIAL ACTION

Figure D-1. Zone 12 Release Units

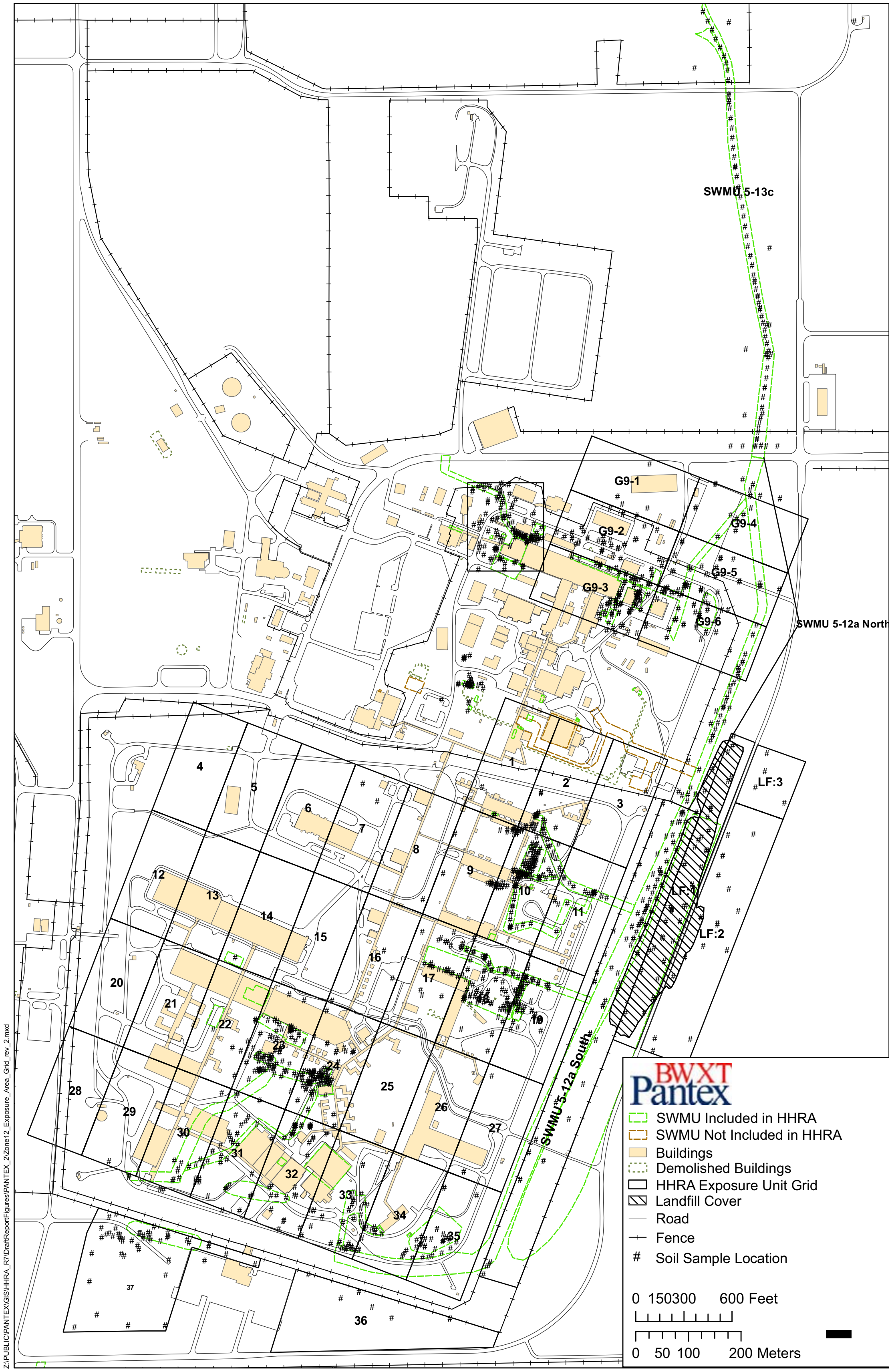

Figure D-2. Zone 12 Exposure Area Grid

Table D-1. Crosswalk of Grid Cells to Release Units Requiring Remedial Action

Release Unit	Grid Cells
SWMU 2: Building 12-43 Drainage Ditch	19
SWMU 5-05: Buildings 12-21 and 12-24 Drainage Ditches	17, 18, 19
SWMU 5-12a: Zone 12 Main Perimeter Ditch	SWMU 5-12a North and SWMU 5-12a South
SWMU 54: Landfill 3	LF:1, LF:2, LF:3
SWMU 55: Landfill 4	35, 36
SWMU 56: Landfill 5	37
SWMU 57: Landfill 6	23
SWMU 68a: Original Landfill	31, 32, 37

Table D-2. Complete Starting List of Soil and Groundwater COPCs at SWMU 5-12a North, SWMU 5-12a South, and Landfill 3 (SWMU 54)a

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter	*Groundwater RFIR* (Stoller, 2004)
	Soil	Groundwater
HEs		
1,3-Dinitrobenzene	--	√
2,4-Dinitrotoluene	√	√
2,6-Dinitrotoluene	--	√
2-Amino-4,6-Dinitrotoluene	√	√
4-Amino-2,6-Dinitrotoluene	√	√
HMX	√	√[b]
3-Nitrotoluene	√	--
RDX	√	√
1,3,5-Triamino-2,4,6-Trinitrobenzene	√	√
Tetryl	√	R[c]
1,3,5-Trinitrobenzene	√	√
TNT	√	√
Metals		
Aluminum	√	--
Antimony	√	--
Arsenic	√	--
Barium	√	--
Boron	√	√
Beryllium	√	--
Cadmium	√	--
Chromium, Total	√	√
Chromium, Hexavalent	√	√
Cobalt	√[d]	--
Copper	√	--
Lead	√	--
Lithium	√[d]	--
Manganese	√	--
Mercury	√	--

Table D-2. Complete Starting List of Soil and Groundwater COPCs at SWMU 5-12a North, SWMU 5-12a South, and Landfill 3 (SWMU 54)[a] (continued)

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter	*Groundwater RFIR* (Stoller, 2004)
	Soil	Groundwater
Molybdenum	√	--
Nickel	√[d]	R[c]
Selenium	√[d]	√[b]
Silver	√	--
Strontium	√	R[c]
Tin	√	--
Titanium	√[d]	--
Thallium	√[d]	--
Vanadium	√	--
Zinc	√	--
Miscellaneous		
Cyanide	--	R[c]
Nitrate as N	--	√[b]
Perchlorate	--	√[b]
Pesticides		
2,4-D (Dichlorophenoxyacetic Acid)	√	--
Gamma BHC (Lindane)	√	--
4,4'-DDE	√	--
Dinoseb	√	--
Endosulfan Sulfate	√	--
Heptachlor	√	--
Heptachlor Epoxide	√	--
SVOCs		
Acenaphthene	√	--
Acenapthylene	√	--
Anthracene	√	--
bis(2-Ethylhexyl)phthalate	√	--
Benzo(a)anthracene	√	--
Benzo(a)pyrene	√	--
Benzo(b)fluoranthene	√	--

Table D-2. Complete Starting List of Soil and Groundwater COPCs at SWMU 5-12a North, SWMU 5-12a South, and Landfill 3 (SWMU 54)[a] (continued)

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter	*Groundwater RFIR* (Stoller, 2004)
	Soil	Groundwater
Benzo(g,h,i)perylene	√	--
Benzo(k)fluoranthene	√	--
Carbazole	√	--
Chrysene	√	--
Cyclohexanone	√	--
Dibenz(a,h)anthracene	√	--
Dibenzofuran	√	--
Di-n-Butyl phthalate	√	--
1,2-Diphenylhydrazine	√	--
Fluorene	√	--
Fluoranthene	√	--
Indeno(1,2,3-c,d)pyrene	√	--
2-Methylnaphthalene	√	--
Naphthalene	√	--
Phenanthrene	√	--
Phenol, Total	√	--
Pyrene	√	--

Table D-2. Complete Starting List of Soil and Groundwater COPCs at SWMU 5-12a North, SWMU 5-12a South, and Landfill 3 (SWMU 54)[a] (continued)

COPC	***Zone 12 RFIR*** **(Stoller, 2003) and TCEQ Approval Letter**	***Groundwater RFIR*** **(Stoller, 2004)**
	Soil	**Groundwater**
VOCs		
Acetone	√	--
trans-1,4-Dichloro-2-Butene	√	--
Chloroform	--	√
1,2-Dichloroethane	--	√
1,1-Dichloroethene	√	--
Freon-113	--	R[c]
Isopropanol	√	--
Methylene Chloride	√	--
Nonanal	√	--
Tetrachloroethylene	--	√[b]
Trichloroethene	--	√
Trichlorofluoromethane	--	R[c]
Styrene	√	--
Xylenes	√	--

[a] Unless otherwise noted, all soil and soil gas COPCs are listed in Enclosure 3 of the *Zone 12 RFIR* Approval Letter. Using this comprehensive Zone 12 COPC list and Tables 7.2-1 and 7.2-2 of the *Zone 12 RFIR* (Stoller, 2003), a specific COPC list for SWMU 5-12a North, 5-12a South, and Landfill 3 (SWMU 54) are given. Unless otherwise noted, all groundwater COPCs are from the CSM for Zone 12 (Figure 13.2-4) from the *Groundwater RFIR* (Stoller, 2004).

[b] Compound was not listed in the CSM for Zone 12 in the *Groundwater RFIR*, but it is a site-wide groundwater COPC. See discussion in Appendix I.

[c] Groundwater COPC is from the CSM Figure 13.2-4 of the *Groundwater RFIR*, but it is not a site-wide groundwater COPC in Appendix I.

[d] Metal was added to soil COPC list because all detected metals are reevaluated based on availability of new background RRS 1 values.

√ COPC for this media

-- not a COPC for this media

R - COPC removed for this medium

Table D-3. Complete Starting List of Soil and Groundwater COPCs at WMG 5a

	Zone 12 RFIR **(Stoller, 2003) and TCEQ Approval Letter**	***Groundwater RFIR*** **(Stoller, 2004)**
COPC	**Soil**	**Groundwater**
	HEs	
1,3-Dinitrobenze	--	√
2,4-Dinitrotoluene	--	√
2,6-Dinitrotoluene	--	√
2-Amino-4,6-dinitrotoluene	--	√
4-Amino-2,6-dinitrotoluene	--	√
HMX	--	√[b]
RDX	--	√
Tetryl	--	R[c]
1,3,5-Trinitrobenzene	--	√
TNT	--	√
	Metals	
Aluminum	√	--
Antimony	√	--
Arsenic	√	--
Barium	√	--
Beryllium	√[d]	--
Boron	--	√
Cadmium	√	--
Chromium, Total	√	√
Chromium, Hexavalent	√	√
Cobalt	√[d]	--
Copper	√	--
Lead	√	--
Manganese	√	--
Mercury	√	--
Molybdenum	√	--
Nickel	√	R[c]
Selenium	√[d]	√[b]
Silver	√	--
Strontium	√	R[c]

Table D-3. Complete Starting List of Soil and Groundwater COPCs at WMG 5[a] (continued)

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter	*Groundwater RFIR* (Stoller, 2004)
	Soil	Groundwater
Thallium	√[d]	--
Uranium, Total	√[e]	--
Miscellaneous		
Cyanide	--	R[c]
Nitrate as N	--	√[b]
Perchlorate	--	√[b]
Pesticides		
Heptachlor	√	--
SVOCs		
Anthracene	√	--
Butylbenzylphthalate	√	--
Benzo(a)anthracene	√	--
Benzo(a)pyrene	√	--
Benzo(b)fluoranthene	√	--
Benzo(g,h,i)perylene	√	--
Benzo(k)fluoranthene	√	--
Chrysene	√	--
Di-n-Butyl phthalate	√	--
Fluorene	√	--
Fluoranthene	√	--
Indeno(1,2,3-c,d)pyrene	√	--
2-Methylnaphthalene	√	--
Phenanthrene	√	--
Pyrene	√	--
VOCs		
Acetone	√	--
Chloroform	--	√
1,2-Dichloroethane	--	√
Freon-113	--	R[c]
Tetrachloroethylene	--	√[b]
Trichloroethene	--	√
Trichlorofluoromethane	--	R[c]

Table D-3. Complete Starting List of Soil and Groundwater COPCs at WMG 5[a] (continued)

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter	*Groundwater RFIR* (Stoller, 2004)
	Soil	Groundwater
Radionuclides		
^{239}Pu	√[e]	
Tritium	√[e]	
^{234}U	√[e]	
^{235}U	√[e]	
^{238}U	√[e]	

[a] Unless otherwise noted all soil COPCs are listed in Enclosure 3 of the TCEQ *Zone 12 RFIR* Approval Letter. Using this comprehensive Zone 12 COPC list and Table 6.2-1 in the *Zone 12 RFIR* (Stoller, 2003), a specific list of COPCs for WMG 5 is given. Unless otherwise noted, all groundwater COPCs are from the CSM for Zone 12 (Figure 13.2-4) from the *Groundwater RFIR* (Stoller, 2004).
[b] Compound was not listed in the CSM for Zone 12 in the *Groundwater RFIR*, but it is a site-wide groundwater COPC. See discussion in Appendix I.
[c] Groundwater COPC is from the CSM Figure 13.2-4 of the *Groundwater RFIR*, but it is not a site-wide groundwater COPC in Appendix I.
[d] Metal was added to soil COPC list because all detected metals are reevaluated based on availability of new background RRS 1 values.
[e]COPCs designated from the *RI Report*, BWXT Pantex, January 2004 – see Section C.2.2 for full description of radiological sites

√ COPC for medium

-- not a COPC for medium

R - COPC removed for medium

Table D-4. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at WMG 6/7 West of SWMU 5-12a[a]

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
HEs			
1,3-Dinitrobenze	--	--	√
2,4-Dinitrotoluene	√	--	√
2,6-Dinitrotoluene	--	--	√
2-Amino-4,6-dinitrotoluene	√	--	√
4-Amino-2,6-dinitrotoluene	√	--	√
HMX	√	--	√[b]
3-Nitrotoluene	√	--	--
RDX	√	--	√
1,3,5-Triamino-2,4,6-trinitrobenzene	√	--	--
Tetryl	√	--	R[c]
1,3,5-Trinitrobenzene	√	--	√
TNT	√	--	√

Table D-4. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at WMG 6/7 West of SWMU 5-12a[a] (continued)

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
Metals			
Aluminum	√	--	--
Antimony	√	--	--
Arsenic	√	--	--
Barium	√	--	--
Boron	√	--	√
Beryllium	√	--	--
Cadmium	√	--	--
Chromium, Total	√	--	√
Chromium, Hexavalent	√	--	√
Cobalt	√[d]	--	--
Copper	√	--	--
Lead	√	--	--
Lithium	√[d]	--	--
Manganese	√	--	--
Mercury	√	--	--
Molybdenum	√	--	--
Nickel	√[d]	--	R[c]
Miscellaneous			
Cyanide	--	--	R[c]
Nitrate as N	--	--	√[b]
Perchlorate	--	--	√[b]
Pesticides			
2,4-D (Dichlorophenoxyacetic Acid)	√	--	--
Dinoseb	√	--	--
Gamma BHC (Lindane)	√	--	--
4,4'-DDE	√	--	--
Endosulfan sulfate	√	--	--
Heptachlor	√	--	--

Table D-4. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at WMG 6/7 West of SWMU 5-12a[a] (continued)

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
Heptachlor epoxide	√	--	--
SVOCs			
Acenaphthene	√	--	--
Acenapthylene	√	--	--
Anthracene	√	--	--
bis(2-Ethylhexyl)phthalate	√	--	--
Benzo(a)anthracene	√	--	--
Benzo(a)pyrene	√	--	--
Benzo(b)fluoranthene	√	--	--
Benzo(g,h,i)perylene	√	--	--
Benzo(k)fluoranthene	√	--	--
Carbazole	√	--	--
Chrysene	√	--	--
Cyclohexanone	√	--	--
Dibenz(a,h)anthracene	√	--	--
Dibenzofuran	√	--	--
Di-n-butyl phthalate	√	--	--
1,2-Diphenylhydrazine	√	--	--
Fluorene	√	--	--
Fluoranthene	√	--	--
Indeno(1,2,3-c,d)pyrene	√	--	--
2-Methylnaphthalene	√	--	--
Naphthalene	√	--	--
Phenanthrene	√	--	--
Phenol, Total	√	--	--
Pyrene	√	--	--

Table D-4. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at WMG 6/7 West of SWMU 5-12a[a] (continued)

COPC	*Zone 12 RFIR* (Stoller, 2003) and TCEQ Approval Letter		*Groundwater RFIR* (Stoller, 2004)
	Soil	**Soil Gas**	**Groundwater**
VOCs			
Acetone	√	√	--
Benzene	--	√	--
Carbon disulfide	--	√	--
Chloroform	--	√	√
1,4-Dichlorobenzene	--	√	--
trans-1,4-Dichloro-2-butene	√	--	--
Dichlorodifluoromethane	--	√	--
1,2-Dichloroethane	--	√	√
cis-1,2-Dichloroethane	--	√	--
1,1-Dichloroethene	√	√	--
Freon-113	--	√	R[d]
Isopropanol	√	--	--
Methylene chloride	√	√	--
Methyl ethyl ketone	--	√	--
Nonanal	√	--	--
Styrene	√	--	--
Tetrachloroethylene	--	√	√[b]
Toluene	--	√	--
Trichloroethene	--	√	√
Trichlorotrifluoromethane	--	√	R[d]
m,p-Xylenes	--	√	--
Xylenes	√	--	--

[a] Unless otherwise noted, all soil and soil gas COPCs are listed in Enclosure 3 of the *Zone 12 RFIR* Approval Letter. Using this comprehensive Zone 12 COPC list and Tables 7.2-1 and 7.2-2 in the *Zone 12 RFIR* (Stoller, 2003), specific COPC lists for WMG 6/7 West of SWMU 5-12a are given. Unless otherwise noted, all groundwater COPCs are from the CSM for Zone 12 (Figure 13.2-4) from the *Groundwater RFIR* (Stoller, 2004).
[b] Compound was not listed in the CSM for Zone 12 in the *Groundwater RFIR*, but it is a site-wide groundwater COPC. See discussion in Appendix I.
[c] Groundwater COPC is from the CSM Figure 13.2-4 of the *Groundwater RFIR*, but it is not a site-wide groundwater COPC in Appendix I.
[d] Metal was added to soil COPC list because all detected metals are reevaluated based on availability of new background RRS 1 values.

√ COPC for medium

-- not a COPC for medium
R - COPC removed for medium

Table D-5. COPCs Retained for Further Evaluation at Units Without Grid Cells in the Zone 12 HHRA Surface Soil (0-2 ft) for Industrial Worker Evaluation

COPCs	Retained COPCs for Zone 12 Units Without Grid Cells				
	SWMU 5-13c	SWMU 5-12a South	SWMU 5-12a North	SWMU 136	WMG 10
HEs					
HMX	--	√	--	--	--
RDX	--	√	--	--	--
Metals					
Antimony	√	√	√	--	√
Barium	√	--	√	--	--
Mercury	√	--	--	--	--
Silver	--	√	--	--	--
SVOCs					
Benzo(a)anthracene	--	--	--	--	√
Benzo(a)pyrene	√	√	√	--	√
Benzo(b)fluoranthene	--	--	--	--	√
bis(2-Ethylhexyl)phthalate	--	--	--	√	--
Dibenz(a,h)anthracene	--	--	√	--	--
Indeno(1,2,3-c,d)pyrene	--	--	--	--	√

√ COPC for unit

-- not a COPC for unit

Table D-6. COPCs Retained for Further Evaluation at Landfill 3 (SWMU 54) in the Zone 2 HHRA Surface Soil (0-2 ft) for the Industrial Worker Evaluation

COPC	COPCs Retained by Grid Cell[a]
	LF-1
HEs	
RDX	√
Metals	
Antimony	√
Barium	√
SVOCs	
Benzo(a)pyrene	√

[a] No COPCs were retained for further evaluation in Grid Cells LF-2 and LF-3 in Landfill 3 (SWMU 54).

√ COPC for grid cell

Table D-7. COPCs Retained for Further Evaluation at WMG 5 in the Zone 12 HHRA Surface Soil (0-2 ft) for the Industrial Worker Evaluation[a]

COPC	COPCs Retained by Grid Cell[b]				
	23	24	31	32[c]	37
Metals					
Antimony	√	--	--	--	--
Barium	--	--	√	√	--
Cadmium	√	√	--	√	--
Lead	--	√	--	√	--
Mercury	--	--	√	--	--
Nickel	--	--	--	√	--
Radionuclides					
^{238}U	--	√	--	--	--
SVOCs					
Benzo(a)anthracene	√	--	--	--	--
Benzo(a)pyrene	√	√	--	--	√
Benzo(b)fluoranthene	√	--	--	--	--

[a] WMG 5 includes Grid Cells 12-16, 20-24, 28-32, and 37.
[b] No COPCs were retained for further evaluation in Grid Cells 12-16, 20-22, and 28-30.
[c] Grid cell 32 includes data from WMG5 and WMG6/7

√ COPC for grid cell

-- not a COPC for grid cell

Table D-8. COPCs Retained for Further Evaluation at WMG 6/7 West of SWMU 5-12a in the Zone 12 HHRA Surface Soil (0-2 ft) for the Industrial Worker Evaluation[a]

COPCs	COPCs Retained by Grid Cell[b]								
	2	10	11	17	18	19	33[c]	34	35
HEs									
1,3,5-Triamino-2,4,6-trinitrobenzene	--	√	--	--	--	--	--	--	--
HMX	--	--	--	--	√	√	--	--	--
RDX	--	--	--	√	√	√	--	--	--
TNT	--	--	--	--	√	--	--	--	--
Metals									
Antimony	--	√	--	√	√	√	--	--	√
Barium	√	√	--	√	--	√	--	--	--
Cadmium	--	--	--	√	√	√	√	√	--
Silver	--	--	--	√	√	√	--	--	--
Vanadium	√	--	--	--	--	--	--	--	--
SVOCs									
Benzo(a)anthracene	√	√	√	√	√	√	--	--	--
Benzo(a)pyrene	√	√	√	√	√	√	--	--	√
Benzo(b)fluoranthene	√	√	√	√	√	√	--	--	--
Benzo(k)fluoranthene	--	--	--	--	√	--	--	--	--
Carbazole	--	--	--	--	√	--	--	--	--
Dibenz(a,h)anthracene	--	--	√	√	√	√	--	--	--
Indeno(1,2,3-c,d)pyrene	--	√	--	√	√	√	--	--	--
Naphthalene	--	--	--	--	√	--	--	--	--

[a] WMG 6/7 West of SWMU 5-12a includes Grid Cells 1-11, 17-19, 25-27, and 33-36.

[b] No COPCs were retained for further evaluation in Grid Cells 1, 3-9, 25-27, and 36.

[c] Grid Cell 33 includes data from WMG 5 and WMG 6/7.

√ COPC for grid cell

-- not a COPC for grid cell

Table D-9. COPCs Retained for Further Evaluation at WMG 6/7 West of SWMU 5-12a in the Zone 12 HHRA Surface Soils (0 -2 ft) with SWMU 5-05 Lined for the Industrial Worker Evaluation[a]

COPCs	COPCs Retained by Grid Cell		
	17	18	19
WMG 6/7 West of SWMU 5-12a with Ditch Lining of SWMU 5-05			
HEs			
HMX	--	√	√
RDX	√	√	√
TNT	--	√	--
Metals			
Barium	√	--	√
Cadmium	√	√	√
Silver	√	--	--
SVOCs			
Benzo(a)anthracene	√	√	√
Benzo(a)pyrene	√	√	√
Benzo(b)fluoranthene	√	√	√
Benzo(k)fluoranthene	--	√	--
Carbazole	--	√	--
Dibenz(a,h)anthracene	√	√	√
Indeno(1,2,3-c,d)pyrene	√	√	√
Naphthalene	--	√	--

[a] Data for SWMU 5-05 only affect Grid Cells 17-19. These data represent the data set for those grid cells with the samples collected under the ditch liner Excluded.

√ COPC for grid cell

-- not a COPC for grid cell

Table D-10. COPCs Retained for Further Evaluation at Units Without Grid Cells in the Zone 12 HHRA Soil (0-15 ft) for the Construction/Excavation Worker Evaluation

COPCs	Retained COPCs for Zone 12 Units Without Grid Cells				
	SWMU 5-13c	SWMU 5-12a South	SWMU 5-12a North	SWMU 136	WMG 10
HEs					
HMX	--	√	--	--	--
RDX	√	√	√	--	--
Metals					
Aluminum	--	--	√	--	--
Antimony	√	√	√	--	√
Barium	√	√	√	--	--
Mercury	√	--	--	√	--
Silver	--	√	--	--	--
Pesticides					
Chlordane	--	--	--	--	√
SVOCs					
Benzo(a)anthracene	--	--	--	--	√
Benzo(a)pyrene	√	√	√	--	√
Benzo(b)fluoranthene	--	--	--	--	√
bis(2-Ethylhexyl)phthalate	--	--	--	√	--
Dibenz(a,h)anthracene	--	--	√	--	√
Indeno(1,2,3-c,d)pyrene	--	--	--	--	√

√ COPC for unit

-- not a COPC for unit

Table D-11. COPCs Retained for Further Evaluation at Landfill 3 (SWMU 54) in the Zone 12 HHRA Soil (0-15 ft) for the Construction/Excavation Worker Evaluation

COPCs	COPCs Retained by Grid Cell[a]	
	LF-1	LF-2
HEs		
RDX	√	--
Metals		
Antimony	√	--
Barium	√	--
Silver	--	√
SVOCs		
Benzo(a)pyrene	√	--

[a]No COPCs were retained for further evaluation in Grid Cell LF-3.

√ COPC for grid cell

-- not a COPC for grid cell

Table D-12. COPCs Retained for Further Evaluation at WMG 5 in the Zone 12 HHRA Soil (0-15 ft) for the Construction/Excavation Worker Evaluation[a]

COPCs	COPCs Retained by Grid Cell[b]				
	23	24	31	32[c]	37
Metals					
Aluminum	--	--	--	√	--
Antimony	√	--	√	--	--
Barium	--	--	√	√	√
Cadmium	√	√	--	√	--
Copper	--	--	--	--	√
Lead	--	√	--	√	--
Mercury	--	--	√	--	--
Nickel	--	--	--	√	--
Radionuclides					
^{235}U	--	√	--	--	--
^{238}U	--	√	--	--	--
SVOCs					
Benzo(a)anthracene	√	--	--	--	--
Benzo(a)pyrene	√	√	--	√	√
Benzo(b)fluoranthene	√	--	--	--	--
Indeno(1,2,3-c,d)pyrene	√	--	--	--	--

[a] WMG 5 includes Grid Cells 12-16, 20-24, 28-32, and 37.

[b] No COPCs were retained for further evaluation in Grid Cells 12-16, 20-22, and 28-30.

[c] Grid Cell 32 includes data from WMG 5 and WMG 6/7.

√ COPC for grid cell

-- not a COPC for grid cell

Table D-13. COPCs Retained for Further Evaluation at WMG 6/7 West of SWMU 5-12a in the Zone 12 HHRA Soil (0-15 ft) for the Construction/Excavation Worker Evaluation

COPCs	COPCs Retained by Grid Cell[a]									
	2	**10**	**11**	**17**	**18**	**19**	**33[b]**	**34**	**35**	**36**
WMG 6/7 West of SWMU 5-12a without Ditch Lining										
HEs										
1,3,5-Triamino-2,4,6-Trinitrobenzene	--	√	--	--	--	--	--	--	--	--
HMX	--	--	--	--	√	√	--	--	--	--
RDX	--	--	--	√	√	√	--	--	--	--
TNT	--	--	--	--	√	--	--	--	--	--
Metals										
Antimony	--	√	--	√	√	√	√	--	√	√
Barium	√	√	√	√	--	√	--	--	--	--
Cadmium	--	--	--	√	√	√	√	√	--	--
Silver	--	--	--	√	√	√	--	--	--	--
Vanadium	√	--	--	--	--	--	--	--	--	--
SVOCs										
Benzo(a)anthracene	√	√	√	√	√	√	--	--	--	--
Benzo(a)pyrene	√	√	√	√	√	√	--	--	√	--
Benzo(b)fluoranthene	√	√	√	√	√	√	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	√	--	--	--	--	--
Carbazole	--	--	--	--	√	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	√	√	√	√	--	--	--	--
Indeno(1,2,3-c,d)pyrene	--	√	--	√	√	√	--	--	--	--
Naphthalene	--	--	--	--	√	--	--	--	--	--

[a] No COPCs were retained for further evaluation in Grid Cells 1, 3-9, and 25-27.
[b] Grid Cell 33 includes data from WMG 5 and WMG 6/7.

√ COPC for grid cell

-- not a COPC for grid cell

Table D-14. COPCs Retained for Further Evaluation at Units without Grid Cells in the Zone 12 HHRA Soil-to-Groundwater Pathway

COPCs	Retained COPCs for Zone 12 Units Without Grid Cells				
	SWMU 5-13c	SWMU 5-12a North	SWMU 5-12a South	SWMU 136	WMG 10
HEs					
HMX	--	--	√	--	--
RDX	√	√	√	--	--
Metals					
Antimony	√	√	√	--	√
Arsenic	--	√	√	--	--
Barium	√	√	√	√	√
Cadmium	√	√	√	√	√
Chromium	√	--	--	--	√
Lead	√	√	√	√	√
Manganese	√	√	√	--	--
Mercury	√	--	--	--	--
Silver	√	--	--	--	--
Pesticides					
Chlordane	--	--	--	--	√
Dieldrin	--	--	--	--	√
PCBs[a]					
PCB-1254	√	--	--	--	√
PCB-1260	√	--	--	--	√
SVOCs					
Benzo(a)anthracene	√	--	--	--	--
Benzo(a)pyrene	√	--	--	--	--
Benzo(k)fluoranthene	--	--	√	--	√
bis(2-Ethylhexyl)phthalate	--	--	√	√	--
Chrysene	--	--	--	--	√
Dibenz(a,h)anthracene	--	√	√	--	√
Indeno(1,2,3-c,d)pyrene	--	√	√	--	√
VOCs					
Benzene	--	--	--	--	√
Methylene Chloride	--	--	--	--	√
Toluene	--	--	--	--	√

[a]Individual PCBs were detected in soil (all depths) and are listed above as COPCs retained for evaluation of the soil-to-groundwater pathway, even though PCBs were evaluated as total PCBs in the COPC evaluation (see Table 2B-3). This is because TCEQ's GWP-Res value, which was used to evaluate PCBs for this pathway, is derived based on total PCBs.

√ COPC for unit

-- not a COPC for unit

Table D-15. COPCs Retained for Further Evaluation at Landfill 3 (SWMU 54) in the Zone 12 HHRA Soil-to-Groundwater Pathway

Retained COPCs	
HEs	
RDX	
Metals	
Antimony	Cadmium
Arsenic	Lead
Barium	Manganese

Table D-16. COPCs Retained for Further Evaluation at WMG 5 in the Zone 12 HHRA Soil-to-Groundwater Pathway

Retained COPCs	
Metals	
Antimony	Lead
Arsenic	Manganese
Barium	Mercury
Cadmium	Nickel
Chromium, Total	Zinc
Copper	
SVOCs	
Chrysene	

Table D-17. COPCs Retained for Further Evaluation at WMG 6/7 West of SWMU 5-12a in the Zone 12 HHRA Soil-to-Groundwater Pathway

Retained COPCs	
HEs	
1,3,5-Triamino-2,4,6-Trinitrobenzene	HMX
1,3,5-Trinitrobenzene	RDX
2,4-Dinitrotoluene	TNT
2-Amino-4,6-Dinitrotoluene	
Herbicides	
2,4-D (Dichlorophenoxyacetic Acid)	Dinoseb
Metals	
Antimony	Lead
Barium	Manganese
Cadmium	Silver
Chromium, Total	Vanadium
	Zinc
SVOCs	
1,2-Diphenylhydrazine	bis(2-Ethylhexyl)phthalate
Benzo(a)pyrene	Chrysene
Benzo(b)fluoranthene	Dibenz(a,h)anthracene
Benzo(k)fluoranthene	Indeno(1,2,3-c,d)pyrene
VOCs	
Methylene Chloride	trans-1,4-Dichloro-2-Butene

Table D-18. COPCs Retained for Further Evaluation in the Zone 12 HHRA Soil Gas-to-Groundwater Pathway

	Shallow			Intermediate		
COPCs	SWMU 136	WMG 6/7 West of SWMU 5-12a	WMG 10	SWMU 136	WMG 6/7 West of SWMU 5-12a	WMG 10
1,1-Dichloroethene	--	--	√	--	--	√
1,2-Dichloroethane	√	--	--	√	--	--
Benzene	--	--	--	--	--	--
Carbon tetrachloride	--	--	--	√	--	√
Chloroform	√	--	--	√	--	--
Methyl ethyl ketone	--	--	--	--	--	√
Methylene chloride	√	--	--	√	√	√
Tetrachloroethylene	--	--	√	--	--	√
Trichloroethene	√	√	√	√	√	√

√ COPC for unit

-- not a COPC for unit

Table D-19. COPCs Retained for Further Evaluation at Units Without Grid Cells in the Zone 12 HHRA Perched Groundwater Pathway

COPC	COPCs Retained for Perched Groundwater in Units Without Grid Cells									
	SWMU 5-13c		SWMU 5-12a North		SWMU 5-12a South		SWMU 136		WMG 10	
	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
HEs										
1,3,5-Trinitrobenzene	NA	--	NA	√	NA	√	NA	--	NA	--
1,3-Dinitrobenzene	NA	√	NA	√	NA	√	NA	--	NA	--
2,4-Dinitrotoluene	NA	√	NA	√	NA	√	NA	--	NA	--
2,6-Dinitrotoluene	NA	√	NA	√	NA	√	NA	--	NA	--
2-Amino-4,6-Dinitrotoluene	NA	√	NA	√	NA	√	NA	√	NA	√
4-Amino-2,6-Dinitrotoluene	NA	√	NA	√	NA	√	NA	√	NA	√
HMX	NA	√	NA	√	NA	√	NA	--	NA	--
RDX	NA	√	NA	√	NA	√	NA	√	NA	√
TNT	NA	√	NA	√	NA	√	NA	--	NA	--
Metals										
Boron	√	√	√	√	√	√	--	√	√	√
Chromium, Hexavalent	--	--	√	√	√	√	--	√	--	√
Chromium, Total	--	--	√	√	√	√	√	√	√	√
Miscellaneous										
Perchlorate	NA	--	NA	√	NA	√	NA	√	NA	√
VOCs										
1,2-Dichloroethane	NA	--	NA	√	NA	√	NA	√	NA	√
Trichloroethene	NA	--	NA	√	NA	√	NA	√	NA	√

√ COPC for unit

-- not a COPC for unit

NA - not applicable, filtered results available for metals analysis only

Table D-20. COPCs Retained for Further Evaluation at Landfill 3 (SWMU 54) in the Zone 12 HHRA Perched Groundwater Pathway

COPC	Filtered	Unfiltered
HEs		
1,3,5-Trinitrobenzene	NA	√
1,3-Dinitrobenzene	NA	√
2,4-Dinitrotoluene	NA	√
2,6-Dinitrotoluene	NA	√
2-Amino-4,6-Dinitrotoluene	NA	√
4-Amino-2,6-Dinitrotoluene	NA	√
HMX	NA	√
RDX	NA	√
TNT	NA	√
Metals		
Boron	√	√
Chromium, Hexavalent	√	√
Chromium, Total	√	√
Miscellaneous		
Perchlorate	NA	√
VOCs		
1,2-Dichloroethane	NA	√
Trichloroethene	NA	√

√ COPC for medium

-- not a COPC for medium
NA - not applicable, filtered results available for metals analysis only

Table D-21. COPCs Retained for Further Evaluation at WMG 5 in the Zone 12 HHRA Perched Groundwater Pathway

COPC	Filtered	Unfiltered
HEs		
2,4-Dinitrotoluene	NA	√
2,6-Dinitrotoluene	NA	√
2-Amino-4,6-Dinitrotoluene	NA	√
4-Amino-2,6-Dinitrotoluene	NA	√
RDX	NA	√
Metals		
Boron	--	√
Chromium, Hexavalent	√	√
Chromium, Total	--	√
Miscellaneous		
Perchlorate	NA	√
VOCs		
1,2-Dichloroethane	NA	√

√ COPC for medium

-- not a COPC for medium

NA – not applicable, filtered results available for metals analysis only

Table D-22. COPCs Retained for Further Evaluation at WMG 6/7 West of SWMU 5-12a in the Zone 12 Perched Groundwater Pathway

COPC	Filtered	Unfiltered
HEs		
1,3,5-Trinitrobenzene	NA	√
1,3-Dinitrobenzene	NA	√
2,4-Dinitrotoluene	NA	√
2,6-Dinitrotoluene	NA	√
2-Amino-4,6-Dinitrotoluene	NA	√
4-Amino-2,6-Dinitrotoluene	NA	√
HMX	NA	√
RDX	NA	√
TNT	NA	√
Metals		
Boron	√	√
Chromium, Hexavalent	√	√
Chromium, Total	√	√
Miscellaneous		
Perchlorate	NA	√
VOCs		
1,2-Dichloroethane	NA	√
Trichloroethene	NA	√

√ COPC for medium

-- not a COPC for medium
NA - not applicable, filtered results available for metals analysis only

Table D-23. EPC Evaluation Surface Soil (0-2 ft) WMG 5 and 6/7 (Zone 12)

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
					Metals					
2	Barium	7440-39-3	5	5	mg/kg	1.15E+02	1.30E+03	NA	--	1.30E+03
2	Vanadium	7440-62-2	5	5	mg/kg	2.54E+01	7.00E+01	NA	--	7.00E+01
					SVOCs					
2	Benzo(a)Anthracene	56-55-3	3	1	mg/kg	1.40E+00	1.40E+00	NA	--	1.40E+00
2	Benzo(a)Pyrene	50-32-8	7	2	mg/kg	7.20E-01	1.30E+00	NA	--	1.30E+00
2	Benzo(b)Fluoranthene	205-99-2	3	1	mg/kg	2.30E+00	2.30E+00	NA	--	2.30E+00
					HEs					
10	1,3,5-Triamino-2,4,6-Trinitrobenzene	3058-38-6	3	3	mg/kg	1.11E-01	1.78E+01	NA	--	1.78E+01
					Metals					
10	Antimony	7440-36-0	35	16	mg/kg	2.00E-01	1.70E+01	X	4.16E+00	4.16E+00
10	Barium	7440-39-3	33	33	mg/kg	1.11E+02	1.71E+03	X	4.21E+02	4.21E+02
					SVOCs					
10	Benzo(a)Anthracene	56-55-3	18	3	mg/kg	1.20E-02	2.50E+00	D	1.18E+00	1.18E+00
10	Benzo(a)Pyrene	50-32-8	33	10	mg/kg	1.80E-01	3.40E+00	D	1.03E+00	1.03E+00
10	Benzo(b)Fluoranthene	205-99-2	18	3	mg/kg	6.30E-01	2.44E+00	D	1.19E+00	1.19E+00
10	Indeno(1,2,3-c,d)Pyrene	193-39-5	18	2	mg/kg	1.28E+00	1.50E+00	D	1.05E+00	1.05E+00
11	Benzo(a)Anthracene	56-55-3	11	4	mg/kg	1.90E-02	9.70E-01	D	3.50E-01	3.50E-01
11	Benzo(a)Pyrene	50-32-8	15	4	mg/kg	1.20E-02	9.20E-01	D	2.59E-01	2.59E-01
11	Benzo(b)Fluoranthene	205-99-2	11	4	mg/kg	1.50E-02	2.00E+00	D	6.06E-01	6.06E-01
11	Dibenz(a,h)Anthracene	53-70-3	11	1	mg/kg	1.40E-01	1.40E-01	D	2.01E-01	1.40E-01
					HEs					
17	RDX	121-82-4	23	7	mg/kg	5.00E-02	1.22E+03	D	1.47E+02	1.47E+02
					Metals					
17	Antimony	7440-36-0	22	12	mg/kg	3.00E-01	1.92E+01	L	1.44E+01	1.44E+01
17	Barium	7440-39-3	23	23	mg/kg	1.75E+01	1.50E+03	X	3.71E+02	3.71E+02
17	Cadmium	7440-43-9	27	24	mg/kg	2.50E-01	1.80E+01	L	7.14E+00	7.14E+00
17	Silver	7440-22-4	26	23	mg/kg	1.00E-02	4.72E+02	X	1.07E+02	1.07E+02
					SVOCs					
17	Benzo(a)Anthracene	56-55-3	30	10	mg/kg	8.40E-02	5.70E+00	D	1.60E+00	1.60E+00
17	Benzo(a)Pyrene	50-32-8	28	8	mg/kg	1.60E-02	5.70E+00	D	1.64E+00	1.64E+00

Table D-23. EPC Evaluation Surface Soil (0-2 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
17	Benzo(b)Fluoranthene	205-99-2	28	8	mg/kg	2.70E-01	4.10E+00	D	1.45E+00	1.45E+00
17	Dibenz(a,h)Anthracene	53-70-3	26	5	mg/kg	2.60E-02	2.10E+00	D	1.19E+00	1.19E+00
17	Indeno(1,2,3-c,d)Pyrene	193-39-5	26	5	mg/kg	7.80E-02	3.50E+00	D	1.33E+00	1.33E+00
					HEs					
18	HMX	2691-41-0	81	56	mg/kg	4.00E-02	2.70E+03	X	1.45E+02	1.45E+02
18	RDX	121-82-4	74	27	mg/kg	4.00E-02	3.10E+04	D	1.17E+03	1.17E+03
18	TNT	118-96-7	52	14	mg/kg	1.20E-01	1.40E+04	D	7.23E+02	7.23E+02
					Metals					
18	Antimony	7440-36-0	67	29	mg/kg	3.00E-01	2.35E+01	D	5.69E+00	5.69E+00
18	Cadmium	7440-43-9	67	34	mg/kg	2.10E-01	7.10E+00	X	1.12E+00	1.12E+00
18	Silver	7440-22-4	68	37	mg/kg	2.00E-02	2.77E+02	X	3.12E+01	3.12E+01
					SVOCs					
18	Benzo(a)Anthracene	56-55-3	69	24	mg/kg	1.65E-01	5.40E+01	D	3.78E+00	3.78E+00
18	Benzo(a)Pyrene	50-32-8	69	25	mg/kg	1.68E-01	4.50E+01	D	3.36E+00	3.36E+00
18	Benzo(b)Fluoranthene	205-99-2	67	23	mg/kg	1.53E-01	3.30E+01	D	2.85E+00	2.85E+00
18	Benzo(k)Fluoranthene	207-08-9	66	19	mg/kg	1.30E-01	3.80E+01	D	3.03E+00	3.03E+00
18	Carbazole	86-74-8	34	8	mg/kg	2.30E-01	2.70E+01	D	2.88E+00	2.88E+00
18	Dibenz(a,h)Anthracene	53-70-3	68	14	mg/kg	1.90E-01	1.80E+01	D	1.72E+00	1.72E+00
18	Indeno(1,2,3-c,d)Pyrene	193-39-5	67	19	mg/kg	1.07E-01	2.60E+01	D	2.27E+00	2.27E+00
18	Naphthalene	91-20-3	38	6	mg/kg	2.20E-01	3.20E+01	D	3.31E+00	3.31E+00
					HEs					
19	HMX	2691-41-0	53	47	mg/kg	6.00E-02	7.54E+04	L	2.51E+04	2.51E+04
19	RDX	121-82-4	53	20	mg/kg	1.00E-02	2.06E+02	D	7.46E+01	7.46E+01
					Metals					
19	Antimony	7440-36-0	44	33	mg/kg	3.00E-01	3.89E+01	L	4.74E+00	4.74E+00
19	Barium	7440-39-3	42	42	mg/kg	7.06E+01	2.55E+03	X	6.96E+02	6.96E+02
19	Cadmium	7440-43-9	47	38	mg/kg	3.70E-01	8.40E+00	X	1.88E+00	1.88E+00
19	Silver	7440-22-4	46	24	mg/kg	7.00E-02	7.60E+01	X	7.82E+00	7.82E+00
					SVOCs					
19	Benzo(a)Anthracene	56-55-3	47	8	mg/kg	3.80E-02	2.00E+00	D	6.41E-01	6.41E-01
19	Benzo(a)Pyrene	50-32-8	47	10	mg/kg	2.90E-02	8.95E+00	D	9.49E-01	9.49E-01

Table D-23. EPC Evaluation Surface Soil (0-2 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
19	Benzo(b)Fluoranthene	205-99-2	47	9	mg/kg	3.00E-02	3.90E+00	D	7.21E-01	7.21E-01
19	Dibenz(a,h)Anthracene	53-70-3	47	4	mg/kg	4.40E-02	2.10E-01	D	5.07E-01	2.10E-01
19	Indeno(1,2,3-c,d)Pyrene	193-39-5	47	7	mg/kg	1.70E-02	9.40E-01	D	5.56E-01	5.56E-01
Metals										
23	Antimony	7440-36-0	24	14	mg/kg	1.00E-01	2.36E+01	L	6.77E+00	6.77E+00
23	Cadmium	7440-43-9	26	16	mg/kg	1.73E-01	1.80E+01	X	2.22E+00	2.22E+00
SVOCs										
23	Benzo(a)Anthracene	56-55-3	13	4	mg/kg	9.00E-02	9.50E+00	D	2.19E+00	2.19E+00
23	Benzo(a)Pyrene	50-32-8	24	5	mg/kg	7.70E-02	7.30E+00	D	9.94E-01	9.94E-01
23	Benzo(b)Fluoranthene	205-99-2	13	4	mg/kg	8.40E-02	8.40E+00	D	1.95E+00	1.95E+00
Metals										
24	Cadmium	7440-43-9	50	37	mg/kg	2.79E-01	1.27E+01	X	2.73E+00	2.73E+00
24	Lead	7439-92-1	39	39	mg/kg	3.00E+00	5.51E+02	X	6.95E+01	6.95E+01
SVOCs										
24	Benzo(a)Pyrene	50-32-8	13	2	mg/kg	9.80E-02	2.10E-01	D	2.01E-01	2.01E-01
Metals										
31	Barium	7440-39-3	10	10	mg/kg	1.17E+02	4.88E+03	X	1.53E+03	1.53E+03
31	Mercury	7439-97-6	12	1	mg/kg	9.80E+00	9.80E+00	D	2.32E+00	2.32E+00
32	Barium	7440-39-3	8	8	mg/kg	1.47E+02	2.83E+03	NA	--	2.83E+03
32	Cadmium	7440-43-9	9	3	mg/kg	2.80E-01	1.86E+01	NA	--	1.86E+01
32	Lead	7439-92-1	8	7	mg/kg	7.90E+00	5.25E+03	NA	--	5.25E+03
32	Nickel	7440-02-0	7	6	mg/kg	1.10E+01	2.87E+02	NA	--	2.87E+02
33	Cadmium	7440-43-9	39	34	mg/kg	3.00E-01	6.60E+00	X	2.80E+00	2.80E+00
34	Cadmium	7440-43-9	40	36	mg/kg	2.00E-01	6.60E+00	L	3.30E+00	3.30E+00
35	Antimony	7440-36-0	3	1	mg/kg	1.20E+01	1.20E+01	NA	--	1.20E+01
SVOCs										
35	Benzo(a)Pyrene	50-32-8	2	1	mg/kg	1.20E-01	1.20E-01	NA	--	1.20E-01
37	Benzo(a)Pyrene	50-32-8	6	1	mg/kg	2.40E-01	2.40E-01	NA	--	2.40E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table D-23. EPC Evaluation Surface Soil (0-2 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table 3C-2. EPC Evaluation Soil (0-15 ft)
WMG 5 and 6/7 (Zone 12)
Pantex Plant, Amarillo, Texas

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals										
2	Barium	7440-39-3	48	48	mg/kg	7.91E+01	1.30E+03	X	3.21E+02	3.21E+02
2	Vanadium	7440-62-2	48	48	mg/kg	1.21E+01	7.00E+01	X	2.59E+01	2.59E+01
SVOCs										
2	Benzo(a)Anthracene	56-55-3	46	1	mg/kg	1.40E+00	1.40E+00	D	2.57E-01	2.57E-01
2	Benzo(a)Pyrene	50-32-8	50	2	mg/kg	7.20E-01	1.30E+00	D	2.53E-01	2.53E-01
2	Benzo(b)Fluoranthene	205-99-2	46	1	mg/kg	2.30E+00	2.30E+00	D	3.08E-01	3.08E-01
HEs										
10	1,3,5-Triamino-2,4,6-Trinitrobenzene	3058-38-6	7	7	mg/kg	1.11E-01	1.78E+01	NA	--	1.78E+01
Metals										
10	Antimony	7440-36-0	108	57	mg/kg	6.00E-02	3.00E+01	X	4.02E+00	4.02E+00
10	Barium	7440-39-3	181	181	mg/kg	6.13E+01	2.42E+03	X	3.94E+02	3.94E+02
SVOCs										
10	Benzo(a)Anthracene	56-55-3	119	4	mg/kg	1.20E-02	2.50E+00	D	3.10E-01	3.10E-01
10	Benzo(a)Pyrene	50-32-8	134	11	mg/kg	1.80E-01	3.40E+00	D	3.79E-01	3.79E-01
10	Benzo(b)Fluoranthene	205-99-2	118	4	mg/kg	6.30E-01	2.44E+00	D	3.17E-01	3.17E-01
10	Indeno(1,2,3-c,d)Pyrene	193-39-5	119	2	mg/kg	1.28E+00	1.50E+00	D	2.92E-01	2.92E-01
Metals										
11	Barium	7440-39-3	51	51	mg/kg	5.80E+01	1.57E+03	X	3.20E+02	3.20E+02
SVOCs										
11	Benzo(a)Anthracene	56-55-3	51	4	mg/kg	1.90E-02	9.70E-01	D	2.14E-01	2.14E-01
11	Benzo(a)Pyrene	50-32-8	55	4	mg/kg	1.20E-02	9.20E-01	D	2.01E-01	2.01E-01
11	Benzo(b)Fluoranthene	205-99-2	51	4	mg/kg	1.50E-02	2.00E+00	D	2.66E-01	2.66E-01
11	Dibenz(a,h)Anthracene	53-70-3	51	1	mg/kg	1.40E-01	1.40E-01	D	1.93E-01	1.40E-01

Table D-23. EPC Evaluation Surface Soil (0-2 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
					HEs					
17	RDX	121-82-4	106	34	mg/kg	1.00E-02	1.22E+03	D	3.24E+01	3.24E+01
					Metals					
17	Antimony	7440-36-0	88	60	mg/kg	1.00E-01	3.60E+01	X	4.86E+00	4.86E+00
17	Barium	7440-39-3	91	91	mg/kg	1.48E+01	1.50E+03	X	2.12E+02	2.12E+02
17	Cadmium	7440-43-9	96	75	mg/kg	4.00E-02	2.67E+01	X	2.20E+00	2.20E+00
17	Silver	7440-22-4	95	82	mg/kg	1.00E-02	4.89E+02	L	8.76E+01	8.76E+01
					SVOCs					
17	Benzo(a)Anthracene	56-55-3	101	13	mg/kg	8.40E-02	5.70E+00	D	7.28E-01	7.28E-01
17	Benzo(a)Pyrene	50-32-8	99	11	mg/kg	1.60E-02	5.70E+00	D	7.09E-01	7.09E-01
17	Benzo(b)Fluoranthene	205-99-2	98	10	mg/kg	2.70E-01	4.10E+00	D	6.39E-01	6.39E-01
17	Dibenz(a,h)Anthracene	53-70-3	95	5	mg/kg	2.60E-02	2.10E+00	D	4.85E-01	4.85E-01
17	Indeno(1,2,3-c,d)Pyrene	193-39-5	96	7	mg/kg	7.80E-02	3.50E+00	D	5.62E-01	5.62E-01
					HEs					
18	HMX	2691-41-0	263	160	mg/kg	1.00E-02	2.70E+03	X	4.94E+01	4.94E+01
18	RDX	121-82-4	255	103	mg/kg	1.00E-02	3.10E+04	D	3.73E+02	3.73E+02
18	TNT	118-96-7	116	17	mg/kg	1.00E-01	1.40E+04	D	3.25E+02	3.25E+02
					Metals					
18	Antimony	7440-36-0	219	118	mg/kg	1.00E-01	4.63E+01	X	4.16E+00	4.16E+00
18	Cadmium	7440-43-9	219	140	mg/kg	2.00E-02	7.90E+00	X	8.02E-01	8.02E-01
18	Silver	7440-22-4	220	118	mg/kg	2.00E-02	2.77E+02	X	1.16E+01	1.16E+01
					SVOCs					
18	Benzo(a)Anthracene	56-55-3	217	27	mg/kg	1.65E-01	5.40E+01	D	1.39E+00	1.39E+00
18	Benzo(a)Pyrene	50-32-8	217	27	mg/kg	1.68E-01	4.50E+01	D	1.26E+00	1.26E+00
18	Benzo(b)Fluoranthene	205-99-2	214	25	mg/kg	1.53E-01	3.30E+01	D	1.08E+00	1.08E+00
18	Benzo(k)Fluoranthene	207-08-9	212	19	mg/kg	1.30E-01	3.80E+01	D	1.13E+00	1.13E+00
18	Carbazole	86-74-8	78	8	mg/kg	2.30E-01	2.70E+01	D	1.36E+00	1.36E+00
18	Dibenz(a,h)Anthracene	53-70-3	214	14	mg/kg	1.90E-01	1.80E+01	D	7.27E-01	7.27E-01
18	Indeno(1,2,3-c,d)Pyrene	193-39-5	213	19	mg/kg	1.07E-01	2.60E+01	D	8.96E-01	8.96E-01
18	Naphthalene	91-20-3	85	6	mg/kg	2.20E-01	3.20E+01	D	1.59E+00	1.59E+00
					HEs					

Table D-23. EPC Evaluation Surface Soil (0-2 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
19	HMX	2691-41-0	219	182	mg/kg	2.00E-02	7.54E+04	X	1.01E+03	1.01E+03
19	RDX	121-82-4	221	100	mg/kg	1.00E-02	2.06E+02	D	1.98E+01	1.98E+01
					Metals					
19	Antimony	7440-36-0	201	151	mg/kg	1.00E-01	5.66E+01	X	3.79E+00	3.79E+00
19	Barium	7440-39-3	194	194	mg/kg	5.53E+01	4.41E+03	X	5.57E+02	5.57E+02
19	Cadmium	7440-43-9	209	165	mg/kg	1.00E-02	8.40E+00	X	9.67E-01	9.67E-01
19	Silver	7440-22-4	208	110	mg/kg	2.00E-02	7.60E+01	X	2.39E+00	2.39E+00
					SVOCs					
19	Benzo(a)Anthracene	56-55-3	208	8	mg/kg	3.80E-02	2.00E+00	D	2.92E-01	2.92E-01
19	Benzo(a)Pyrene	50-32-8	208	10	mg/kg	2.90E-02	8.95E+00	D	3.61E-01	3.61E-01
19	Benzo(b)Fluoranthene	205-99-2	208	9	mg/kg	3.00E-02	3.90E+00	D	3.10E-01	3.10E-01
19	Dibenz(a,h)Anthracene	53-70-3	207	4	mg/kg	4.40E-02	2.10E-01	D	2.63E-01	2.10E-01
19	Indeno(1,2,3-c,d)Pyrene	193-39-5	207	7	mg/kg	1.70E-02	9.40E-01	D	2.73E-01	2.73E-01
					Metals					
23	Antimony	7440-36-0	33	23	mg/kg	1.00E-01	2.36E+01	L	6.53E+00	6.53E+00
23	Cadmium	7440-43-9	38	21	mg/kg	8.00E-02	1.80E+01	X	1.62E+00	1.62E+00
					SVOCs					
23	Benzo(a)Anthracene	56-55-3	42	14	mg/kg	5.20E-02	9.50E+00	D	8.96E-01	8.96E-01
23	Benzo(a)Pyrene	50-32-8	53	15	mg/kg	4.50E-02	7.30E+00	D	6.26E-01	6.26E-01
23	Benzo(b)Fluoranthene	205-99-2	42	14	mg/kg	5.00E-02	8.40E+00	D	8.34E-01	8.34E-01
23	Indeno(1,2,3-c,d)Pyrene	193-39-5	34	11	mg/kg	4.60E-02	1.10E+00	D	2.91E-01	2.91E-01
					Metals					
24	Cadmium	7440-43-9	100	53	mg/kg	2.70E-01	1.27E+01	X	1.70E+00	1.70E+00
24	Lead	7439-92-1	87	87	mg/kg	3.00E+00	5.51E+02	X	3.84E+01	3.84E+01
					SVOCs					
24	Benzo(a)Pyrene	50-32-8	36	2	mg/kg	9.80E-02	2.10E-01	D	1.97E-01	1.97E-01
					Metals					
31	Antimony	7440-36-0	55	31	mg/kg	1.00E-01	7.25E+03	X	3.56E+02	3.56E+02
31	Barium	7440-39-3	21	21	mg/kg	7.50E+01	4.88E+03	X	8.22E+02	8.22E+02
31	Mercury	7439-97-6	22	2	mg/kg	1.00E-01	9.80E+00	D	1.26E+00	1.26E+00
32	Aluminum	7429-90-5	13	13	mg/kg	7.28E+03	2.68E+04	L	1.99E+04	1.99E+04

Table D-23. EPC Evaluation Surface Soil (0-2 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
32	Barium	7440-39-3	17	17	mg/kg	7.54E+01	2.83E+03	L	8.90E+02	8.90E+02
32	Cadmium	7440-43-9	22	7	mg/kg	2.00E-01	1.86E+01	D	2.82E+00	2.82E+00
32	Lead	7439-92-1	18	17	mg/kg	6.20E+00	5.25E+03	X	8.09E+02	8.09E+02
32	Nickel	7440-02-0	16	13	mg/kg	1.09E+01	2.87E+02	X	6.15E+01	6.15E+01
SVOCs										
32	Benzo(a)Pyrene	50-32-8	27	1	mg/kg	6.70E-02	6.70E-02	D	1.96E-01	6.70E-02
Metals										
33	Antimony	7440-36-0	9	3	mg/kg	2.24E-01	6.85E+02	NA	--	6.85E+02
33	Cadmium	7440-43-9	70	55	mg/kg	2.00E-01	6.60E+00	X	1.75E+00	1.75E+00
34	Cadmium	7440-43-9	101	90	mg/kg	1.80E-01	6.60E+00	L	2.00E+00	2.00E+00
35	Antimony	7440-36-0	9	1	mg/kg	1.20E+01	1.20E+01	NA	--	1.20E+01
SVOCs										
35	Benzo(a)Pyrene	50-32-8	6	2	mg/kg	6.70E-02	1.20E-01	NA	--	1.20E-01
Metals										
36	Antimony	7440-36-0	5	2	mg/kg	2.60E+01	2.80E+02	NA	--	2.80E+02
37	Barium	7440-39-3	38	38	mg/kg	8.87E+01	5.55E+03	X	6.67E+02	6.67E+02
37	Copper	7440-50-8	42	40	mg/kg	7.60E+00	1.54E+03	X	1.35E+02	1.35E+02
SVOCs										
37	Benzo(a)Pyrene	50-32-8	23	2	mg/kg	1.00E-01	2.40E-01	D	1.96E-01	1.96E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table D-24. EPC Evaluation Soil (0-15 ft) WMG 5 and 6/7 (Zone 12)

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
					Metals					
2	Barium	7440-39-3	48	48	mg/kg	7.91E+01	1.30E+03	X	3.21E+02	3.21E+02
2	Vanadium	7440-62-2	48	48	mg/kg	1.21E+01	7.00E+01	X	2.59E+01	2.59E+01
					SVOCs					
2	Benzo(a)Anthracene	56-55-3	46	1	mg/kg	1.40E+00	1.40E+00	D	2.57E-01	2.57E-01
2	Benzo(a)Pyrene	50-32-8	50	2	mg/kg	7.20E-01	1.30E+00	D	2.53E-01	2.53E-01
2	Benzo(b)Fluoranthene	205-99-2	46	1	mg/kg	2.30E+00	2.30E+00	D	3.08E-01	3.08E-01
					HEs					
10	1,3,5-Triamino-2,4,6-Trinitrobenzene	3058-38-6	7	7	mg/kg	1.11E-01	1.78E+01	NA	--	1.78E+01
					Metals					
10	Antimony	7440-36-0	108	57	mg/kg	6.00E-02	3.00E+01	X	4.02E+00	4.02E+00
10	Barium	7440-39-3	181	181	mg/kg	6.13E+01	2.42E+03	X	3.94E+02	3.94E+02
					SVOCs					
10	Benzo(a)Anthracene	56-55-3	119	4	mg/kg	1.20E-02	2.50E+00	D	3.10E-01	3.10E-01
10	Benzo(a)Pyrene	50-32-8	134	11	mg/kg	1.80E-01	3.40E+00	D	3.79E-01	3.79E-01
10	Benzo(b)Fluoranthene	205-99-2	118	4	mg/kg	6.30E-01	2.44E+00	D	3.17E-01	3.17E-01
10	Indeno(1,2,3-c,d)Pyrene	193-39-5	119	2	mg/kg	1.28E+00	1.50E+00	D	2.92E-01	2.92E-01
					Metals					
11	Barium	7440-39-3	51	51	mg/kg	5.80E+01	1.57E+03	X	3.20E+02	3.20E+02
					SVOCs					
11	Benzo(a)Anthracene	56-55-3	51	4	mg/kg	1.90E-02	9.70E-01	D	2.14E-01	2.14E-01
11	Benzo(a)Pyrene	50-32-8	55	4	mg/kg	1.20E-02	9.20E-01	D	2.01E-01	2.01E-01
11	Benzo(b)Fluoranthene	205-99-2	51	4	mg/kg	1.50E-02	2.00E+00	D	2.66E-01	2.66E-01
11	Dibenz(a,h)Anthracene	53-70-3	51	1	mg/kg	1.40E-01	1.40E-01	D	1.93E-01	1.40E-01
					HEs					
17	RDX	121-82-4	106	34	mg/kg	1.00E-02	1.22E+03	D	3.24E+01	3.24E+01
					Metals					
17	Antimony	7440-36-0	88	60	mg/kg	1.00E-01	3.60E+01	X	4.86E+00	4.86E+00
17	Barium	7440-39-3	91	91	mg/kg	1.48E+01	1.50E+03	X	2.12E+02	2.12E+02

Table D-24. EPC Evaluation Soil (0-15 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
17	Cadmium	7440-43-9	96	75	mg/kg	4.00E-02	2.67E+01	X	2.20E+00	2.20E+00
17	Silver	7440-22-4	95	82	mg/kg	1.00E-02	4.89E+02	L	8.76E+01	8.76E+01
					SVOCs					
17	Benzo(a)Anthracene	56-55-3	101	13	mg/kg	8.40E-02	5.70E+00	D	7.28E-01	7.28E-01
17	Benzo(a)Pyrene	50-32-8	99	11	mg/kg	1.60E-02	5.70E+00	D	7.09E-01	7.09E-01
17	Benzo(b)Fluoranthene	205-99-2	98	10	mg/kg	2.70E-01	4.10E+00	D	6.39E-01	6.39E-01
17	Dibenz(a,h)Anthracene	53-70-3	95	5	mg/kg	2.60E-02	2.10E+00	D	4.85E-01	4.85E-01
17	Indeno(1,2,3-c,d)Pyrene	193-39-5	96	7	mg/kg	7.80E-02	3.50E+00	D	5.62E-01	5.62E-01
					HEs					
18	HMX	2691-41-0	263	160	mg/kg	1.00E-02	2.70E+03	X	4.94E+01	4.94E+01
18	RDX	121-82-4	255	103	mg/kg	1.00E-02	3.10E+04	D	3.73E+02	3.73E+02
18	TNT	118-96-7	116	17	mg/kg	1.00E-01	1.40E+04	D	3.25E+02	3.25E+02
					Metals					
18	Antimony	7440-36-0	219	118	mg/kg	1.00E-01	4.63E+01	X	4.16E+00	4.16E+00
18	Cadmium	7440-43-9	219	140	mg/kg	2.00E-02	7.90E+00	X	8.02E-01	8.02E-01
18	Silver	7440-22-4	220	118	mg/kg	2.00E-02	2.77E+02	X	1.16E+01	1.16E+01
					SVOCs					
18	Benzo(a)Anthracene	56-55-3	217	27	mg/kg	1.65E-01	5.40E+01	D	1.39E+00	1.39E+00
18	Benzo(a)Pyrene	50-32-8	217	27	mg/kg	1.68E-01	4.50E+01	D	1.26E+00	1.26E+00
18	Benzo(b)Fluoranthene	205-99-2	214	25	mg/kg	1.53E-01	3.30E+01	D	1.08E+00	1.08E+00
18	Benzo(k)Fluoranthene	207-08-9	212	19	mg/kg	1.30E-01	3.80E+01	D	1.13E+00	1.13E+00
18	Carbazole	86-74-8	78	8	mg/kg	2.30E-01	2.70E+01	D	1.36E+00	1.36E+00
18	Dibenz(a,h)Anthracene	53-70-3	214	14	mg/kg	1.90E-01	1.80E+01	D	7.27E-01	7.27E-01
18	Indeno(1,2,3-c,d)Pyrene	193-39-5	213	19	mg/kg	1.07E-01	2.60E+01	D	8.96E-01	8.96E-01
18	Naphthalene	91-20-3	85	6	mg/kg	2.20E-01	3.20E+01	D	1.59E+00	1.59E+00
					HEs					
19	HMX	2691-41-0	219	182	mg/kg	2.00E-02	7.54E+04	X	1.01E+03	1.01E+03
19	RDX	121-82-4	221	100	mg/kg	1.00E-02	2.06E+02	D	1.98E+01	1.98E+01
					Metals					
19	Antimony	7440-36-0	201	151	mg/kg	1.00E-01	5.66E+01	X	3.79E+00	3.79E+00

Table D-24. EPC Evaluation Soil (0-15 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
19	Barium	7440-39-3	194	194	mg/kg	5.53E+01	4.41E+03	X	5.57E+02	5.57E+02
19	Cadmium	7440-43-9	209	165	mg/kg	1.00E-02	8.40E+00	X	9.67E-01	9.67E-01
19	Silver	7440-22-4	208	110	mg/kg	2.00E-02	7.60E+01	X	2.39E+00	2.39E+00
SVOCs										
19	Benzo(a)Anthracene	56-55-3	208	8	mg/kg	3.80E-02	2.00E+00	D	2.92E-01	2.92E-01
19	Benzo(a)Pyrene	50-32-8	208	10	mg/kg	2.90E-02	8.95E+00	D	3.61E-01	3.61E-01
19	Benzo(b)Fluoranthene	205-99-2	208	9	mg/kg	3.00E-02	3.90E+00	D	3.10E-01	3.10E-01
19	Dibenz(a,h)Anthracene	53-70-3	207	4	mg/kg	4.40E-02	2.10E-01	D	2.63E-01	2.10E-01
19	Indeno(1,2,3-c,d)Pyrene	193-39-5	207	7	mg/kg	1.70E-02	9.40E-01	D	2.73E-01	2.73E-01
Metals										
23	Antimony	7440-36-0	33	23	mg/kg	1.00E-01	2.36E+01	L	6.53E+00	6.53E+00
23	Cadmium	7440-43-9	38	21	mg/kg	8.00E-02	1.80E+01	X	1.62E+00	1.62E+00
SVOCs										
23	Benzo(a)Anthracene	56-55-3	42	14	mg/kg	5.20E-02	9.50E+00	D	8.96E-01	8.96E-01
23	Benzo(a)Pyrene	50-32-8	53	15	mg/kg	4.50E-02	7.30E+00	D	6.26E-01	6.26E-01
23	Benzo(b)Fluoranthene	205-99-2	42	14	mg/kg	5.00E-02	8.40E+00	D	8.34E-01	8.34E-01
23	Indeno(1,2,3-c,d)Pyrene	193-39-5	34	11	mg/kg	4.60E-02	1.10E+00	D	2.91E-01	2.91E-01
Metals										
24	Cadmium	7440-43-9	100	53	mg/kg	2.70E-01	1.27E+01	X	1.70E+00	1.70E+00
24	Lead	7439-92-1	87	87	mg/kg	3.00E+00	5.51E+02	X	3.84E+01	3.84E+01
SVOCs										
24	Benzo(a)Pyrene	50-32-8	36	2	mg/kg	9.80E-02	2.10E-01	D	1.97E-01	1.97E-01
Metals										
31	Antimony	7440-36-0	55	31	mg/kg	1.00E-01	7.25E+03	X	3.56E+02	3.56E+02
31	Barium	7440-39-3	21	21	mg/kg	7.50E+01	4.88E+03	X	8.22E+02	8.22E+02
31	Mercury	7439-97-6	22	2	mg/kg	1.00E-01	9.80E+00	D	1.26E+00	1.26E+00
32	Aluminum	7429-90-5	13	13	mg/kg	7.28E+03	2.68E+04	L	1.99E+04	1.99E+04
32	Barium	7440-39-3	17	17	mg/kg	7.54E+01	2.83E+03	L	8.90E+02	8.90E+02
32	Cadmium	7440-43-9	22	7	mg/kg	2.00E-01	1.86E+01	D	2.82E+00	2.82E+00
32	Lead	7439-92-1	18	17	mg/kg	6.20E+00	5.25E+03	X	8.09E+02	8.09E+02
32	Nickel	7440-02-0	16	13	mg/kg	1.09E+01	2.87E+02	X	6.15E+01	6.15E+01

Table D-24. EPC Evaluation Soil (0-15 ft) WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
SVOCs										
32	Benzo(a)Pyrene	50-32-8	27	1	mg/kg	6.70E-02	6.70E-02	D	1.96E-01	6.70E-02
Metals										
33	Antimony	7440-36-0	9	3	mg/kg	2.24E-01	6.85E+02	NA	--	6.85E+02
33	Cadmium	7440-43-9	70	55	mg/kg	2.00E-01	6.60E+00	X	1.75E+00	1.75E+00
34	Cadmium	7440-43-9	101	90	mg/kg	1.80E-01	6.60E+00	L	2.00E+00	2.00E+00
35	Antimony	7440-36-0	9	1	mg/kg	1.20E+01	1.20E+01	NA	--	1.20E+01
SVOCs										
35	Benzo(a)Pyrene	50-32-8	6	2	mg/kg	6.70E-02	1.20E-01	NA	--	1.20E-01
Metals										
36	Antimony	7440-36-0	5	2	mg/kg	2.60E+01	2.80E+02	NA	--	2.80E+02
37	Barium	7440-39-3	38	38	mg/kg	8.87E+01	5.55E+03	X	6.67E+02	6.67E+02
37	Copper	7440-50-8	42	40	mg/kg	7.60E+00	1.54E+03	X	1.35E+02	1.35E+02
SVOCs										
37	Benzo(a)Pyrene	50-32-8	23	2	mg/kg	1.00E-01	2.40E-01	D	1.96E-01	1.96E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table D-25. EPC Evaluation Surface Soil (0-2 ft) Ditch Lining WMG 5 and 6/7 (Zone 12)

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
					HE					
17	RDX	121-82-4	6	3	mg/kg	4.38E+00	1.22E+03	NA	--	1.22E+03
					Metals					
17	Barium	7440-39-3	3	3	mg/kg	1.85E+02	1.50E+03	NA	--	1.50E+03
17	Silver	7440-22-4	3	1	mg/kg	--	1.00E+02	NA	--	1.00E+02
					SVOCs					
17	Benzo(a)Anthracene	56-55-3	13	9	mg/kg	8.40E-02	5.70E+00	L	9.59E+00	5.70E+00
17	Benzo(a)Pyrene	50-32-8	11	7	mg/kg	1.60E-02	5.70E+00	L	4.61E+01	5.70E+00
17	Benzo(b)Fluoranthene	205-99-2	11	7	mg/kg	2.70E-01	4.10E+00	L	8.33E+00	4.10E+00
17	Dibenz(a,h)Anthracene	53-70-3	9	5	mg/kg	2.60E-02	2.10E+00	NA	--	2.10E+00
17	Indeno(1,2,3-c,d)Pyrene	193-39-5	9	5	mg/kg	7.80E-02	3.50E+00	NA	--	3.50E+00
					HEs					
18	HMX	2691-41-0	51	48	mg/kg	1.30E-01	2.70E+03	L	1.26E+03	1.26E+03
18	RDX	121-82-4	44	26	mg/kg	2.90E-01	3.10E+04	X	1.96E+03	1.96E+03
18	TNT	118-96-7	42	14	mg/kg	1.20E-01	1.40E+04	D	8.98E+02	8.98E+02
					SVOCs					
18	Benzo(a)Anthracene	56-55-3	42	17	mg/kg	6.60E-01	5.40E+01	D	5.50E+00	5.50E+00
18	Benzo(a)Pyrene	50-32-8	42	19	mg/kg	4.90E-01	4.50E+01	D	4.85E+00	4.85E+00
18	Benzo(b)Fluoranthene	205-99-2	40	17	mg/kg	4.50E-01	3.30E+01	D	4.02E+00	4.02E+00
18	Benzo(k)Fluoranthene	207-08-9	39	14	mg/kg	5.50E-01	3.80E+01	D	4.40E+00	4.40E+00
18	Carbazole	86-74-8	34	8	mg/kg	2.30E-01	2.70E+01	D	2.88E+00	2.88E+00
18	Dibenz(a,h)Anthracene	53-70-3	41	14	mg/kg	1.90E-01	1.80E+01	D	2.14E+00	2.14E+00
18	Indeno(1,2,3-c,d)Pyrene	193-39-5	40	15	mg/kg	4.20E-01	2.60E+01	D	3.06E+00	3.06E+00
18	Naphthalene	91-20-3	31	5	mg/kg	3.90E-01	3.20E+01	D	3.36E+00	3.36E+00
					HEs					
19	HMX	2691-41-0	15	13	mg/kg	2.20E-01	4.60E+03	L	1.13E+06	4.60E+03
19	RDX	121-82-4	15	8	mg/kg	1.10E-01	2.06E+02	X	1.12E+02	1.12E+02
					Metals					
19	Barium	7440-39-3	4	4	mg/kg	3.30E+02	2.55E+03	NA	--	2.55E+03

Table D-25. Evaluation Surface Soil (0-2 ft) Ditch Lining WMG 5 and 6/7 (Zone 12) Continued

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
19	Cadmium	7440-43-9	8	5	mg/kg	7.30E-01	8.40E+00	NA	--	8.40E+00
SVOCs										
19	Benzo(a)Anthracene	56-55-3	12	5	mg/kg	1.80E-01	2.00E+00	D	1.20E+00	1.20E+00
19	Benzo(a)Pyrene	50-32-8	12	7	mg/kg	1.80E-01	8.95E+00	L	4.48E+00	4.48E+00
19	Benzo(b)Fluoranthene	205-99-2	12	6	mg/kg	3.30E-01	3.90E+00	L	2.72E+00	2.72E+00
19	Dibenz(a,h)Anthracene	53-70-3	12	3	mg/kg	4.40E-02	2.10E-01	D	6.81E-01	2.10E-01
19	Indeno(1,2,3-c,d)Pyrene	193-39-5	12	4	mg/kg	3.30E-01	9.40E-01	D	8.74E-01	8.74E-01

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land method.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table D-26. EPC Evaluation Surface Soil (0-2 ft) Landfill 3 (Zone 12)

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
HEs										
LF-1	RDX	121-82-4	33	9	mg/kg	4.60E-02	5.45E+01	D	8.05E+00	8.05E+00
Metals										
LF-1	Antimony	7440-36-0	10	1	mg/kg	8.50E+00	8.50E+00	D	4.36E+00	4.36E+00
LF-1	Barium	7440-39-3	10	9	mg/kg	1.91E+02	9.18E+02	X	4.17E+02	4.17E+02
SVOCs										
LF-1	Benzo(a)Pyrene	50-32-8	9	1	mg/kg	1.70E-01	1.70E-01	NA	--	1.70E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table D-27. EPC Evaluation Soil (0-15 ft) Landfill 3 (Zone 12)

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
					HEs					
LF-1	RDX	121-82-4	90	20	mg/kg	4.60E-02	5.45E+01	D	4.15E+00	4.15E+00
					Metals					
LF-1	Antimony	7440-36-0	24	3	mg/kg	6.70E+00	8.50E+00	D	3.99E+00	3.99E+00
LF-1	Barium	7440-39-3	24	21	mg/kg	9.41E+01	1.22E+03	X	4.35E+02	4.35E+02
					SVOCs					
LF-1	Benzo(a)Pyrene	50-32-8	21	2	mg/kg	8.80E-02	1.70E-01	D	1.97E-01	1.70E-01
					Metals					
LF-2	Silver	7440-22-4	13	4	mg/kg	3.50E-02	5.09E+01	D	1.12E+01	1.12E+01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table D-28. EPC Evaluation Surface Soil (0-2 ft) SWMU 5-12a North (Zone 12)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
				Metals					
Antimony	7440-36-0	17	9	mg/kg	3.30E-01	2.20E+01	L	2.74E+01	2.20E+01
Barium	7440-39-3	47	47	mg/kg	8.20E+01	2.43E+03	L	6.24E+02	6.24E+02
				SVOCs					
Benzo(a)Pyrene	50-32-8	16	3	mg/kg	2.00E-05	9.70E-02	D	2.27E-01	9.70E-02
Dibenz(a,h)Anthracene	53-70-3	16	1	mg/kg	5.00E-01	5.00E-01	D	2.88E-01	2.88E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

Table D-29. Table 3C-11. EPC Evaluation Soil (0-15 ft) SWMU 5-12a North (Zone 12)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
				HEs					
RDX	121-82-4	36	9	mg/kg	7.40E-02	1.60E+01	D	1.49E+00	1.49E+00
				Metals					
Aluminum	7429-90-5	22	22	mg/kg	9.63E+03	2.73E+04	L	1.87E+04	1.87E+04
Antimony	7440-36-0	31	12	mg/kg	2.80E-01	2.20E+01	D	4.09E+00	4.09E+00
Barium	7440-39-3	95	95	mg/kg	4.50E+01	3.47E+03	L	7.64E+02	7.64E+02
				SVOCs					
Benzo(a)Pyrene	50-32-8	32	3	mg/kg	2.00E-05	9.70E-02	D	1.90E-01	9.70E-02
Dibenz(a,h)Anthracene	53-70-3	32	2	mg/kg	5.00E-01	1.36E+00	D	3.21E-01	3.21E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

Table D-30. EPC Evaluation Surface Soil (0-2 ft) SWMU 5-12a South (Zone 12)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
				HEs					
HMX	2691-41-0	38	23	mg/kg	5.50E-02	2.10E+03	X	3.46E+02	3.46E+02
RDX	121-82-4	104	46	mg/kg	1.00E-02	9.00E+02	D	6.75E+01	6.75E+01
				Metals					
Antimony	7440-36-0	23	8	mg/kg	2.80E-01	1.40E+01	D	4.03E+00	4.03E+00
Silver	7440-22-4	101	72	mg/kg	6.00E-02	9.90E+01	X	8.13E+00	8.13E+00
				SVOCs					
Benzo(a)Pyrene	50-32-8	89	6	mg/kg	1.60E-02	3.40E-01	D	1.93E-01	1.93E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table D-31. EPC Evaluation Soil (0-15 ft) SWMU 5-12a South (Zone 12)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
HEs									
HMX	2691-41-0	80	34	mg/kg	5.50E-02	2.10E+03	D	1.66E+02	1.66E+02
RDX	121-82-4	405	215	mg/kg	1.00E-02	1.25E+03	X	3.14E+01	3.14E+01
Metals									
Antimony	7440-36-0	46	16	mg/kg	2.80E-01	1.40E+01	D	2.59E+00	2.59E+00
Barium	7440-39-3	46	46	mg/kg	8.27E+01	3.07E+03	X	4.73E+02	4.73E+02
Silver	7440-22-4	396	295	mg/kg	2.00E-02	9.90E+01	X	2.87E+00	2.87E+00
SVOCs									
Benzo(a)Pyrene	50-32-8	369	6	mg/kg	1.60E-02	3.40E-01	D	1.99E-01	1.99E-01

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table D-32. EPC Evaluation Surface Soil (0-2 ft) WMG 5 (Zone 12) Radiological

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Radionuclides										
24	Uranium-238	7440-61-1	2	2	pCi/g	9.17E-01	1.50E+00	NA	--	1.50E+00

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table D-33. EPC Evaluation Soil (0-15 ft) WMG 5 (Zone 12) Radiological

Grid Cell	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Radionuclides										
24	Uranium-235	15117-96-1	13	4	pCi/g	4.08E-02	2.20E-01	D	1.73E-01	1.73E-01
24	Uranium-238	7440-61-1	13	13	pCi/g	5.40E-01	2.10E+00	L	1.20E+00	1.20E+00

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

D.1 RISK EVALUATION RESULTS FOR ZONE 12

This section provides the qualitative and quantitative risk results for onsite and offsite receptors that may be exposed to contaminated media from Zone 12. Results of the risk evaluation for the onsite and offsite receptors potentially exposed to COPCs identified in soil and perched groundwater at Zone 12 are presented below.

The numerical risk and hazard estimates presented in this section must be interpreted in the context of the uncertainties and assumptions associated with the risk assessment process and with the data upon which the risk estimates are based. Uncertainties are provided in a table at the end of this section.

D.1.1 Risk Characterization for Onsite Receptors at Zone 12

Three onsite media of concern were identified for Zone 12: soil, air, and groundwater. Potential risks associated with exposure to soil and air are presented in Section C.5.1.1. Potential dose risks associated with radiological exposure are presented in Section C.5.1.2. Potential risks associated with exposure to groundwater are presented in Section C.5.1.3.

Nine areas are evaluated in Zone 12.

- SWMU 5-12a North
- SWMU 5-12a South
- SWMU 5-13c
- Landfill 3
- WMG 5
- WMG 6/7 West of SWMU 5-12a
- WMG 9
- WMG 10
- SWMU 136.

The risk characterization results for each of these Zone 12 areas are provided below.

D.1.1.1 Risk Characterization for Onsite Soil and Air at Zone 12

Two onsite exposure scenarios are quantitatively evaluated for soil at Zone 12:

- Current/future industrial worker exposed to surface soil (0 to 2 ft) via ingestion, dermal contact, inhalation of COPCs emitted to air, and external exposure to radiation

- Current/future construction worker exposed to soil (0 to 15 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air, and external exposure to radiation.

Current and future risks were evaluated for these receptors/pathways for each area at Zone 12 from EPCs (95% UCL on the mean or maximum detected concentration) calculated from measured soil concentrations. Surface soil EPCs are provided in the above tables.

Detailed hazard and risk results for the two onsite receptors are summarized here and in tables following this text for each area and the two onsite receptors.

Onsite Soil at SWMU 5-12a North, SWMU 5-12a South, and SWMU 5-13c

SWMU 5-12a and SWMU 5-13c comprise the drainage ditch from the east side of Zone 12 to Playa 1. The primary ditches leading to the playas are rarely accessed by Pantex Plant personnel. Since exposures within ditches are likely to occur within a long and narrow area, the EA for ditches is generally set as the entire length of the ditch within the inactive area. SWMU 5-12a is evaluated in two sections (5 12a North and 5-12a South) because the southern half of this ditch is located between two security fences and access is strictly controlled. SWMU 5-13c is located outside Zone 12 but is a continuation of SWMU 5-12a; therefore, it is included in this Zone 12 evaluation.

At least one COPC was identified for evaluation in the HHRA in soil for each of these three ditch segments. Individual and cumulative ILCRs and HQs/HIs are calculated for COPCs for each ditch segment and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0). Results are summarized in Tables C-32 and C-33 and fall into two categories:

- Ditch segments with risks below acceptable target risk criteria: COPCs were identified for surface soil (0 to 2 ft) and soil (0 to 15 ft) at SWMU 5-13c; however, cumulative ILCR and HIs results are below the TCEQ and EPA acceptable target risk criteria.

- Ditch segments with risks equal to or above acceptable target risk criteria: Cumulative ILCR results exceed target risk criteria at SWMU 5-12a North and 5-12a South. The calculated HIs are below the acceptable target risk criteria at both these segments.

Risk characterization results for SWMU 5-12a North and 5-12a South are summarized below.

Grid Cell/SWMU	Industrial Worker Scenario[a]		Construction Worker Scenario[b]	
	ILCR	HI	ILCR	HI
SWMU 5-12a North	**1.2E-06**	0.061	5.9E-08	0.24
SWMU 5-12a South	**3.2E-06**	0.064	8.8E-08	0.17

[a]Industrial worker exposed to surface soil (0-2 ft bgs).
[b]Construction worker exposed to soil (0-15 ft bgs).
Bold values exceed ILCR of 1.0E-06 or HQ/HI of 1.0.

Onsite Soil at Landfill 3

Landfill 3 is an inactive landfill and was divided into three grid cells, each less than 12 acres. COPCs were identified for evaluation in the HHRA for surface soil (0 to 2 ft) and soil (0 to 15 ft) in two of the three grid cells at Landfill 3; however, the cumulative ILCRs and HIs are below the TCEQ and EPA acceptable target risk criteria for both workers in these grid cells.

Onsite Soil at WMG 5 and WMG 6/7 West of SWMU 5-12a

WMG 5 and WMG 6/7 are active operational areas that together make up the southern half of Zone 12 and lay primarily inside the Zone 12 security fence. This area is divided into thirty-seven grid cells. Thirty-five of these grid cells are within the Zone 12 security fence and two (Grid Cells 36 and 37) are located south of the fence. Three grid cells (16, 32, and 33) contain data from both WMG 5 and WMG 6/7. SWMU 5-12a and Landfill 3 are part of WMG 6/7; however, these areas are evaluated separately because of the different activity patterns at the ditch, the landfill, and the remainder of WMG 6/7 West of SWMU 5-12a.

Individual and cumulative ILCRs and HQs/HIs are calculated for COPCs for each grid cell and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0). Results fall into three categories:

- Grid cells with no COPCs retained for further evaluation in the HHRA: No surface soil (0 to 2 ft) or soil (0 to 15 ft) COPCs were identified in twenty-two grid cells (Grid Cells 1, 3-9, 12-16, 20-22, and 25-30); therefore, these areas are uncontaminated or represent negligible risk and are not evaluated further.

- Grid cells with risks below acceptable target risk criteria: COPCs were identified for surface soil (0 to 2 ft) and/or soil (0 to 15 ft) at four grid cells (Grid Cells 32, 34, 35, and 37). ILCR and HI results for these grid cells are below the TCEQ and EPA acceptable target risk criteria.

- Grid cells with risks equal to or above acceptable target risk criteria: Cumulative ILCR and/or HI results exceed target risk criteria at eleven grid cells (Grid Cells 2, 10, 11, 17-19, 23, 24, 31, 33, and 36).

Risk characterization results for Grid Cells 2, 10, 11, 17-19, 23, 24, 31, 33, and 36 are summarized below and presented in Figures C-9 and C-10. The SWMU 5-05 drainage ditch was lined as an ICM. The area around this ditch (Grid Cells 17-19) is elevated both with and without the ditch lining.

Grid Cell/SWMU	Industrial Worker Scenario[a]		Construction Worker Scenario[b]	
	ILCR	HI	ILCR	HI
Grid Cell 2	**5.2E-06**	0.064	4.2E-08	0.057
Grid Cell 10	**4.6E-06**	0.028	7.4E-08	0.12
Grid Cell 11	**1.6E-06**	No COPCs	5.3E-08	0.029
Grid Cell 17	**1.6E-05**	0.18	2.5E-07	0.30
Grid Cell 18	**7.4E-05**	**2.4**	**1.2E-06**	**4.5**
Grid Cell 19	**7.2E-06**	**2.0**	1.3E-07	0.31
Grid Cell 17 (SWMU 5-05 lined)	**7.6E-05**	0.53	NA	NA
Grid Cell 18 (SWMU 5-05 lined)	**1.1E-04**	**3.1**	NA	NA
Grid Cell 19 (SWMU 5-05 lined)	**2.1E-05**	0.48	NA	NA
Grid Cell 23	**4.4E-06**	0.015	1.1E-07	0.094
Grid Cell 24	**1.7E-06**	0.0019	4.7E-08	0.0087
Grid Cell 31	No COPCs	0.049	No COPCs	**4.8**
Grid Cell 33	8.1E-09	0.0019	4.8E-11	**9.0**
Grid Cell 36	No COPCs	No COPCs	No COPCs	**3.7**

[a]Industrial worker exposed to surface soil (0-2 ft bgs).
[b]Construction worker exposed to soil (0-15 ft bgs).
NA - not applicable
NO COPCs - no carcinogenic or noncarcinogenic COPCs identified for this grid cell and soil depth.
Bold values exceed ILCR of 1.0E-06 or HQ/HI of 1.0.
Risk estimates for SWMU 5-05 lined Grid Cells exclude the samples beneath the ditch liner.

Onsite Soil at WMG 9

WMG 9 is an active operational area approximately 13 acres in size; this area is divided into six 6-acre grid cells. Individual and cumulative ILCRs and HQs/HIs are calculated for COPCs for each grid cell and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0). Results fall into three categories:

- Grid cells with no COPCs retained for further evaluation in the HHRA: No surface soil (0 to 2 ft) or soil (0 to 15 ft) COPCs were identified in three grid cells (Grid Cells G9-1, G9-4, and G9-6); therefore, these areas are uncontaminated or represent negligible risk and are not evaluated further.

- Grid cells with risks below acceptable target risk criteria: COPCs were identified for surface soil (0 to 2 ft) and/or soil (0 to 15 ft) at two grid cells (Grid Cells G9-2 and G9-5). ILCR and HI results for these grid cells are below the TCEQ and EPA acceptable target risk criteria.

- Grid cells with risks equal to or above acceptable target risk criteria: Cumulative ILCR and/or HI results exceed target risk criteria at one grid cell (Grid Cell G9-3).

Risk characterization results for Grid Cell G9-3 are summarized below.

Grid Cell/SWMU	Industrial Worker Scenario[a]		Construction Worker Scenario[b]	
	ILCR	HI	ILCR	HI
Grid Cell G9-3	**3.0E-06**	0.18	3.4E-08	0.59

[a]Industrial worker exposed to surface soil (0-2 ft bgs).
[b]Construction worker exposed to soil (0-15 ft bgs).
No COPCs – no noncarcinogenic COPCs identified for this grid cell and soil depth.
Bold values exceed ILCR of 1.0E-06 or HQ/HI of 1.0.

Onsite Soil at WMG 10

WMG 10 is an active operational area less than 6-acres; therefore, it was evaluated as a single EA. A cumulative ILCR of 2.6E-06 was estimated for the industrial worker scenario at WMG 10, which slightly exceeds the lower limit of the TCEQ and EPA acceptable target risk range (1.0E-06). Benzo(a)pyrene is the primary contributor (ILCR = 2.0E-06) to the cumulative cancer risk. The total HI for WMG 10 (0.0058) is well below the TCEQ and EPA acceptable target value of 1.0; therefore, risks to the industrial worker are negligible for noncarcinogenic COPCs in surface soil at WMG 10. The cumulative ILCR and HI for the construction/excavation worker at WMG 10 are 1.3E-07 and 0.057, respectively. These are less than the TCEQ and EPA acceptable target risk criteria; therefore, risks to the construction/excavation worker are negligible for soil.

Onsite Soil at SWMU 136

SWMU 136 is an active operational area less than 6-acres; therefore, it was evaluated as a single EA.

A cumulative ILCR of 1.3E-06 was estimated for the industrial worker scenario at SWMU 136, which slightly exceeds the lower limit of the TCEQ and EPA acceptable target risk range (1.0E-06). Bis(2 ethylhexyl)phthalate is the only contributor (ILCR=1.3E-06) to the cumulative cancer risk. The total HI for SWMU 136 (0.013) is well below the TCEQ and EPA acceptable target value of 1.0; therefore, risks to the industrial worker are negligible for noncarcinogenic COPCs in surface soil at SWMU 136. The cumulative ILCR and HI for the construction/excavation worker at SWMU 136 are 3.0E-08 and 0.046, respectively. These are less than the TCEQ and EPA acceptable target risk criteria; therefore, risks to the construction/excavation worker are negligible for soil.

Risk Characterization for Onsite Groundwater at Zone 12

Future industrial and construction/excavation worker exposure to COPCs in groundwater (Ogallala Aquifer) is dependant on COPCs in soil, soil gas, and/or perched groundwater reaching Pantex Plant production wells in the Ogallala Aquifer. The potential for COPCs in soil, soil gas, and/or perched groundwater at Zone 12 to migrate to the Pantex Plant production wells is evaluated using the Tier 2 and Tier 3 approach presented in Section 4.4 of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006).

The following transport pathways were evaluated for Zone 12:

- Soil-to-Ogallala Aquifer
- Soil gas-to-Ogallala Aquifer (for SWMU 136, WMG 6/7, and WMG 10 only)
- Perched groundwater-to-Ogallala Aquifer POE
- Ogallala Aquifer-to-Pantex Plant production wells.

For all Zone 12 units, no groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network. Results of the Tier 2 and 3 analyses are summarized below by SWMU or WMG.

SWMU 5-12a North

For SWMU 5-12a North, Tier 1 COPC evaluation results are presented in tables above; soil gas data are not applicable to this SWMU. Results for Tier 2 and 3 evaluations for soil-to-Ogallala Aquifer and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates three soil COPCs, one HE (RDX) and two metals (antimony and manganese), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates these COPCs are not predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates nine perched groundwater COPCs, including six HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and TNT), two metals (hexavalent chromium and total chromium), and one VOC (trichloroethene), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

SWMU 5-12a South

For SWMU 5-12a South, Tier 1 COPC evaluation results are presented in tables above; soil gas data were not applicable to this SWMU. Results for Tier 2 and 3 evaluations for soil-to-Ogallala Aquifer and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates four soil COPCs, two metals (antimony and manganese) and two HEs (HMX and RDX) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.
- Tier 2 analysis indicates nine perched groundwater COPCs, including six HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene,

RDX, and TNT), two metals (hexavalent chromium and total chromium), and one VOC (trichloroethene) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

<u>SWMU 5-13c</u>

For SWMU 5-13c, Tier 1 COPC evaluation results are presented in tables above; soil gas data are not applicable to this SWMU. Results for Tier 2 and 3 evaluations for soil-to-Ogallala Aquifer and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates four soil COPCs, including one HE (RDX) and three metals (antimony, silver, and manganese), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates four perched groundwater COPCs, (2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and RDX), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

<u>Landfill 3</u>

For Landfill 3, Tier 1 COPC evaluation results are presented in tables above; soil gas data were not applicable to this SWMU. Results for Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates two soil COPC, one HE (RDX) and 1 metal (manganese), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates these COPCs are not predicted to reach Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates nine perched groundwater COPCs, including six HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and TNT), two metals (hexavalent chromium and total chromium), and one VOC (trichloroethene), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

<u>SWMU 136</u>

For SWMU 136, Tier 1 COPC evaluation results are presented in tables above. Results for Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer, soil gas-to-Ogallala Aquifer, and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- As a result of Tier 2 analysis no soil COPCs were retained for Tier 3 travel time analysis for the soil-to-Ogallala Aquifer pathway.

- Tier 2 COPC analysis indicated one soil gas COPC (1,2-dichloroethane) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates this COPC is not predicted to reach Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates three perched groundwater COPCs, including two metals (hexavalent chromium and total chromium) and one HE (RDX), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

WMG 5

For WMG 5, Tier 1 COPC evaluation results are presented in tables above; soil gas data are not applicable to this SWMU. Results for Tier 2 and 3 evaluations for soil-to-Ogallala Aquifer and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates three soil COPCs (antimony, lead and manganese) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates four perched groundwater COPCs, including two HEs (4-amino-2,6-dinitrotoluene and RDX) and two metals (hexavalent chromium and total chromium), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

WMG 6/7

For WMG 6/7, Tier 1 COPC evaluation results are presented in tables above. Results for Tier 2 and 3 evaluations for soil-to-Ogallala Aquifer, soil gas-to-Ogallala Aquifer, and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates thirteen soil COPCs, including seven HEs (1,3,5-triamino-2,4,6-trinitrobenzene, 1,3,5-trinitrobenzene, 2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene, HMX, RDX, and TNT), three metals (antimony, manganese, and silver), one SVOC (1,2-diphenylhydrazine) and two VOCs (methylene chloride and trans-1,4-dichloro-2-butene), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

- As a result of Tier 2 evaluation, no soil gas COPCs were retained for Tier 3 travel time analysis for the soil gas-to-Ogallala Aquifer pathway.

- Tier 2 analysis indicates nine perched groundwater COPCs, including six HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and TNT), two metals (hexavalent chromium and total chromium), and one VOC (trichloroethene) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

WMG 9

For WMG 9, Tier 1 COPC evaluation results are presented in tables above; soil gas data are not applicable to this WMG. Results for Tier 2 and 3 evaluations for soil-to-Ogallala Aquifer and perched groundwater-to-Ogallala Aquifer are summarized as follows:

- Tier 2 analysis indicates four soil COPCs, including two pesticides (Silvex (2,4,5-TP) and dinoseb) and two PCBs (PCB-1254 and PCB-1260), may exceed RBSVGW following dilution in the Ogallala Aquifer: however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates one perched groundwater COPC (RDX) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates RDX is not predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

WMG 10

For WMG 10, Tier 1 COPC evaluation results are presented in tables above. Results for Tier 2 and 3 evaluations for soil-to-Ogallala Aquifer, soil gas-to-Ogallala Aquifer, and perched groundwater-to-Ogallala Aquifer are summarized as follows:

- Tier 2 analysis indicates three soil COPCs, including one metal (antimony) and two VOCs (benzene and methylene chloride), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates neither of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates that one COPC (trichloroethene) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates this COPC is not predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years..

- Tier 2 analysis indicates five perched groundwater COPCs, including two HEs (4-amino-2,6-dinitrotoluene and RDX), two metals (total chromium and hexavalent chromium), and perchlorate, may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach the Pantex Plant production wells in the Ogallala Aquifer within 1,000 years.

Summary of Risk Characterization for Onsite Groundwater at Zone 12

For all Zone 12 units, no groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network. Results of Tier 2 and Tier 3 analysis indicate exposure of onsite workers to groundwater COPCs originating from Zone 12 is an incomplete pathway, because COPCs at Zone 12 will not reach the Pantex Plant production wells within 1,000 years. Therefore, groundwater does not contribute to risk to onsite receptors.

D.1.2 Risk Characterization for Offsite Receptors Due to COPC Transport from Zone 12

Potential risks to offsite receptors were evaluated for two transport mechanisms:

- Airborne transport of COPCs in surface soil to offsite air with subsequent deposition to offsite soil and crops
- Groundwater transport to offsite exposure locations.

D.1.2.1 Risks from Atmospheric Transport from Zone 12 to Offsite Receptors

Risks from atmospheric transport of surface soil COPCs from Zone 12 to offsite receptor locations are estimated based on modeling conducted for the Burning Ground HHRA (BWXT Pantex, 2005). The Burning Ground is considered a worst-case analysis for atmospheric transport because 1) it has higher surface soil concentrations of most COPCs than other units at Pantex Plant and 2) it is closest to a downwind (northern) Pantex Plant boundary. The results of atmospheric transport modeling for the Burning Ground showed negligible offsite risks. Thus, quantitative atmospheric transport modeling is not conducted for other corrective action units at Pantex Plant. Instead, the quantitative results for the Burning Ground are used in a semi-quantitative evaluation to demonstrate that the offsite risk due to air dispersion of COPCs from Zone 12 is negligible. The semi-quantitative evaluation is completed by comparing conditions at the Burning Ground to each corrective action unit or zone as described in Appendix O. The semi-quantitative evaluation is summarized below.

The predominant wind direction at Pantex Plant is from south to north. The Burning Ground is located approximately 2,750 ft south of the northern Plant boundary. Zone 12 is located more than 2 miles from the northern Plant boundary and approximately 5,100 ft west of the eastern Plant boundary, which is the nearest Plant boundary to this zone.

Risks were calculated for 11 grid cells at the Burning Ground with a total ILCR for all grid cells of 4.5E-03 and a total HI of 156. The onsite COPC concentrations associated with these high onsite risks resulted in negligible offsite risks (cumulative ILCR=5.3E-08, HI = 0.44).

Risks were calculated for 22 grid cells and miscellaneous SWMUs at Zone 12 with a total ILCR for all grid cells/SWMUs of 1.5E-04 and a total HI of 6. Because Zone 12 is farther from the Plant boundary and has much lower surface soil risks than the Burning Ground offsite risks due to atmospheric transport from Zone 12 would be less than those predicted for the Burning Ground (i.e., ILCR<5.3E-08 and HI<0.44). Semi-quantitative analysis (Appendix O) using the relative distance and direction to the Plant boundary for Burning Ground and Zone 12 indicates offsite risks from Zone 12 would be on the order of ILCR=1.9E-10 and HI=0.002.

D.1.2.2 Risks from Groundwater Transport from Zone 12 to Offsite Receptors

The potential for COPCs in soil, soil gas, and/or perched groundwater to migrate to offsite locations in perched groundwater or the Ogallala Aquifer was evaluated using the Tier 2 and Tier 3 fate and transport approach presented in Section 4.4 of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006).

The following transport pathways were evaluated for Zone 12 groundwater:

- Soil-to-perched groundwater

- Soil-to-Ogallala Aquifer
- Soil gas-to-perched groundwater
- Soil gas-to-Ogallala Aquifer
- Perched groundwater-to-offsite POE
- Perched groundwater-to-Ogallala Aquifer POE.

Results of the Tier 2 and Tier 3 fate and transport evaluation are summarized below. It is assumed that all Zone 12 units are to the east of the perched groundwater divide, which allows for migration of COPCs from Zone 12 to offsite exposure points to the east of the Pantex Plant boundary. No groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network.

SWMU 5-12a North

For SWMU 5-12a North, Tier 1 COPC evaluation results are presented in in tables above; soil gas data were not applicable to this SWMU. Results for Tier 2 and 3 evaluations for soil-to-perched groundwater; soil-to-Ogallala Aquifer; perched groundwater-to-offsite POE; and perched groundwater-to-Ogallala Aquifer POE pathways are summarized as follows:

- Tier 2 analysis indicates four soil COPCs, including one HE (RDX) and three metals (antimony, arsenic, and manganese) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the perched groundwater within 1,000 years.

- Tier 2 analysis indicates three soil COPCs, one HE (RDX) and two metals (antimony and manganese), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates fourteen perched groundwater COPCs, including nine HEs (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, HMX, RDX, and TNT), three metals (boron, total chromium, and hexavalent chromium), and two VOCs (1,2-dichloroethane and trichloroethene), may exceed RBSVGW in the perched groundwater. All fourteen of these COPCs have been detected in offsite perched monitoring wells (both east and south of the Plant) assigned to this site. These COPCs are included in the quantitative sitewide groundwater risk characterization.

- Tier 2 analysis indicates nine perched groundwater COPCs, including six HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and TNT), two metals (hexavalent chromium and total chromium), and one VOC (trichloroethene), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

SWMU 5-12a South

For SWMU 5-12a South, Tier 1 COPC evaluation results are presented in tables above; soil gas data were not applicable to this SWMU. Results for Tier 2 and 3 evaluations for soil-to-perched groundwater; soil-to-Ogallala Aquifer; perched groundwater-to-offsite POE; and perched groundwater-to-Ogallala Aquifer POE pathways are summarized as follows:

- Tier 2 analysis indicates five soil COPCs, including two HEs (HMX and RDX) and three metals (antimony, arsenic, and manganese), may exceed RBSVGW following dilution in the perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates four soil COPCs, two metals (antimony and manganese) and two HEs (HMX and RDX), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates fourteen perched groundwater COPCs, including nine HEs (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, HMX, RDX, and TNT), three metals (boron, total chromium, and hexavalent chromium), and two VOCs (1,2-dichloroethane and trichloroethene), may exceed RBSVGW in the perched groundwater. All fourteen of these COPCs have been detected in offsite perched monitoring wells (both east and south of the Plant) assigned to this site. These COPCs are included in the quantitative sitewide groundwater risk characterization..

- Tier 2 analysis indicates nine perched groundwater COPCs, including six HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and TNT), two metals (hexavalent chromium and total chromium), and one VOC (trichloroethene), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

<u>SWMU 5-13c</u>

For SWMU 5-13c, Tier 1 COPC evaluation results are presented in tables above; soil gas data are not applicable to this SWMU. Results for Tier 2 and 3 evaluations for soil-to-perched groundwater; soil-to-Ogallala Aquifer; perched-to-offsite POE; and perched groundwater-to-Ogallala Aquifer POE pathways are summarized as follows:

- Tier 2 analysis indicates four soil COPCs, including one HE (RDX) and three metals (antimony, manganese, and silver) may exceed RBSVGW following dilution in the perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates four soil COPCs, including one HE (RDX) and three metals (antimony, silver, and manganese) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates nine perched groundwater COPCs, including eight HEs (1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-

2,6-dinitrotoluene, HMX, RDX, and TNT) and one metal (boron), may exceed RBSVGW in the perched groundwater. Tier 3 travel time analysis is not necessary because all nine of these COPCs have been detected in offsite perched groundwater monitoring wells both south and east of the Plant boundary.

- Tier 2 analysis indicates four perched groundwater COPCs, (2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and RDX), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure location in the Ogallala Aquifer within 1,000 years.

Landfill 3

For Landfill 3, Tier 1 COPC evaluation results are presented in tables above; soil gas data were not applicable to this SWMU. Results for Tier 2 and Tier 3 evaluations are summarized below for soil-to-perched groundwater; soil-to-Ogallala Aquifer; perched groundwater to offsite receptor locations at the Plant boundary; and perched groundwater to Ogallala Aquifer.

- Tier 2 analysis indicates five soil COPCs, including one HE (RDX) and four metals (antimony, arsenic, lead, and manganese), may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates two soil COPC, one HE (RDX) and one metal (manganese), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates neither of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates fourteen perched groundwater COPCs, including nine HEs (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, HMX, RDX, and TNT), three metals (boron, total chromium, and hexavalent chromium), and two VOCs (1,2-dichloroethane and trichloroethene), may exceed RBSVGW in the perched groundwater. All fourteen of these COPCs have been detected in offsite perched monitoring wells (both east and south of the Plant) assigned to this site. These COPCs are included in the quantitative sitewide groundwater risk characterization.

- Tier 2 analysis indicates nine perched groundwater COPCs, including six HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and TNT), two metals (hexavalent chromium and total chromium), and one VOC (trichloroethene), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of those COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

SWMU 136

For SWMU 136, Tier 1 COPC evaluation results are presented in tables above. Results for Tier 2 and Tier 3 evaluations for soil-to-perched groundwater; soil-to-Ogallala Aquifer; soil gas-to-perched groundwater; soil gas-to-Ogallala; perched groundwater to offsite receptor locations at the Plant boundary; and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates one soil COPC (bis(2-ethylhexyl)phthalate) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates this COPCs is not predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates no soil COPCs may exceed RBSVGW following dilution in the Ogallala Aquifer; thus, Tier 3 analysis is not required.

- Tier 2 analysis indicates three soil gas COPCs (1,2-dichloroethane, chloroform, and methylene chloride) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 COPC analysis indicates one soil gas COPC (1,2-dichloroethane) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates this COPC is not predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates nine perched groundwater COPCs, including three HEs (2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and RDX), three metals (boron, total chromium, and hexavalent chromium), two VOCs (1,2-dichloroethane and trichloroethene), and perchlorate, may exceed RBSVGW in perched groundwater; Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates three perched groundwater COPCs, including one HE (RDX) and two metals (hexavalent chromium and total chromium), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years

<u>WMG 5</u>

For WMG 5, Tier 1 COPC evaluation results are presented in tables above; soil gas data are not applicable to this SWMU. Results for Tier 2 and 3 evaluations for soil-to-perched groundwater; soil-to-Ogallala Aquifer; perched groundwater-to-offsite POE; and perched groundwater-to-Ogallala Aquifer POE pathways are summarized as follows:

- Tier 2 analysis indicates six soil COPCs (antimony, arsenic, copper, nickel, lead, and manganese) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates three soil COPCs (antimony, lead, and manganese) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of those COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates ten perched groundwater COPCs, including five HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and RDX), three metals (boron, total chromium, and hexavalent chromium), one VOC (1,2-dichloroethane), and perchlorate, may exceed RBSVGW in perched groundwater. Tier 3 travel time analysis indicates one of these COPCs (2-amino-4,6-dinitrotoluene and RDX) are predicted to reach an offsite exposure point in perched groundwater to the south of the Pantex Plant boundary within 1,000 years and nine COPCs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, boron, total chromium, hexavalent chromium, perchlorate, and 1,2-dichloroethane) have been detected in offsite monitoring wells to the south of the Plant boundary.

- Tier 2 analysis indicates four perched groundwater COPCs, including two HEs (4-amino-2,6-dinitrotoluene and RDX) and two metals (hexavalent chromium and total chromium), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure location in the Ogallala Aquifer within 1,000 years. The Tier 3 evaluation initiated particles near the onsite source of the hexavalent chromium impacts. Particles from this location did not reach a POE in the Ogallala Aquifer within 1,000 years. Particles were not initiated at the leading edge of the plume; therefore, the hexavalent chromium plume was evaluated in the focused transport model (FTM) (Appendix N).

WMG 6/7

For WMG 6/7, Tier 1 COPC evaluation results are presented in tables above. Results for Tier 2 and 3 evaluations for soil-to-perched groundwater; soil-to-Ogallala Aquifer, soil gas-to-perched groundwater; soil gas-to-Ogallala Aquifer; perched groundwater-to-offsite POE; and perched groundwater-to-Ogallala Aquifer POE pathways are summarized as follows:

- Tier 2 analysis indicates nineteen soil COPCs, including seven HEs (1,3,5-triamino-2,4,6-trinitrobenzene, 1,3,5-trinitrobenzene, 2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene, HMX, RDX, and TNT), six metals (antimony, cadmium, chromium, manganese, silver, and vanadium), two pesticides (dinoseb and 2,4-D), two SVOCs (1,2-diphenylhydrazine and benzo(b)fluoranthene), and two VOCs (methylene chloride and trans-1,4-dichloro-2-butene), may exceed RBSVGW following dilution in perched groundwater. Tier 3 travel time analysis indicates twelve of these COPCs (1,3,5-triamino-2,4,6-trinitrobenzene, 2,4-D, dinoseb, antimony, cadmium, chromium, manganese, silver, vanadium, 1,2-diphenylhydrazine, benzo(b)fluoranthene and trans-1,4-dichloro-2-butene) will not reach an offsite exposure point in perched groundwater to the south or east; however, seven COPCs (1,3,5-trinitrobenzene, 2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene, HMX, RDX, TNT, and methylene chloride) are predicted to reach an offsite exposure point in perched groundwater to the south (but not to the east) of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates thirteen soil COPCs, including seven HEs (1,3,5-triamino-2,4,6-trinitrobenzene, 1,3,5-trinitrobenzene, 2,4-dinitrotoluene, 2-amino-4,6-trinitrotoluene, HMX, RDX, and TNT), three metals (antimony, manganese, and silver), one SVOC (1,2-diphenylhydrazine) and two VOCs (methylene chloride and trans-1,4-dichloro-2-butene), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 COPC analysis indicates one soil gas COPC (trichlorethene) is predicted to exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates this COPCs is not predicted to reach an offsite exposure point south of the Plant boundary in perched groundwater within 1,000 years.

- As a result of Tier 2 evaluation, no soil gas COPCs were retained for Tier 3 travel time analysis for the Ogallala Aquifer pathway.

- Tier 2 analysis indicates fourteen perched groundwater COPCs, including nine HEs (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, HMX, RDX, and TNT), three metals (boron, total chromium, and hexavalent chromium), and two VOCs (1,2-dichloroethane and trichloroethene), may exceed RBSVGW in perched groundwater. All fourteen of these COPCs have been detected in offsite perched monitoring wells (both east and south of the Plant) assigned to this site. These COPCs are included in the quantitative sitewide groundwater risk characterization.

- Tier 2 analysis indicates nine perched groundwater COPCs, including six HEs (2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, and TNT), two metals (hexavalent chromium and total chromium), and one VOC (trichloroethene) are predicted to exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years. However, since COPCs in wells assigned to SWMU 122b are currently at the Plant boundary or offsite to the east, the COPCs were evaluated in the focused transport model (Appendix N).

<u>WMG 9</u>

For WMG 9, Tier 1 COPC evaluation results are presented in tables above; soil gas data are not applicable to this WMG. Results for Tier 2 and 3 evaluations for soil-to-perched groundwater; soil-to-Ogallala Aquifer; perched groundwater-to-offsite POE; and perched groundwater-to-Ogallala Aquifer POE are summarized as follows:

- Tier 2 analysis indicates seven soil COPCs, including three pesticides (Silvex (2,4,5-TP), 2,4-D and dinoseb), two metals (arsenic and lead), and two PCBs (PCB-1254 and PCB-1260), may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates four soil COPCs, including two pesticides (Silvex (2,4,5-TP) and dinoseb) and two PCBs (PCB-1254 , PCB-1260), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of those COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates five perched groundwater COPCs, including one pesticide (2,4-D), three HEs (2,4-dinitrotoluene, 4-amino-2,6-dinitrotoluene and RDX), and one metal (boron), may exceed RBSVGW in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates one perched groundwater COPC (RDX) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates RDX is not predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

WMG 10

For WMG 10, Tier 1 COPC evaluation results are presented tables above. Results for Tier 2 and 3 evaluations for soil-to-perched groundwater; soil-to-Ogallala Aquifer; soil gas-to-perched groundwater; soil gas-to-Ogallala Aquifer; perched groundwater-to-offsite receptors locations at Plant boundary; and perched groundwater-to-Ogallala Aquifer are summarized as follows:

- Tier 2 analysis indicates six soil COPCs, including two metals (antimony and lead), one pesticide (chlordane), and three VOCs (benzene, methylene chloride, and toluene) may exceed RBSVGW following dilution in the perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates three soil COPCs, including one metal (antimony) and two VOCs (benzene and methylene chloride), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of those COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates one soil gas COPC (trichloroethene) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates trichloroethene is not predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates one COPC (trichloroethene) is predicted to exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates this COPC is not predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years.

- Tier 2 analysis indicates nine perched groundwater COPCs, including three HEs (2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and RDX), three metals (boron, total chromium, and hexavalent chromium), two VOCs (1,2-dichloroethane and trichloroethene), and perchlorate, may exceed RBSVGW in the perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater to the south or east of the Pantex Plant boundary within 1,000 years. Perchlorate is not associated with WMG 10; however, wells used in the evaluation of WMG are also associated with releases from SWMU 5-13a ditch which received industrial wastewater discharge from the point where perchlorate was released. Perchlorate is not expected to travel offsite east to a POE because it is west of the flow divide.

- Tier 2 analysis indicates five perched groundwater COPCs, including two HEs (4-amino-2,6-dinitrotoluene and RDX), two metals (total chromium and hexavalent chromium), and perchlorate, may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier

3 travel time analysis indicates none of those COPCs are predicted to reach an offsite exposure point in the Ogallala Aquifer within 1,000 years. As noted above, perchlorate is not associated with WMG 10 releases.

Summary of Risks from Groundwater Transport from Zone 12 to Offsite Receptors

Results of the Tier 2 and Tier 3 fate and transport evaluation migration of COPCs from soil, soil gas, and perched groundwater at Zone 12 to an offsite POE in perched groundwater or the Ogallala Aquifer are summarized below:

- Tier 2 analysis indicates several soil COPCs may exceed RBSVGW in both perched groundwater and the Ogallala Aquifer directly beneath Zone 12. Tier 3 travel time analysis indicates some of these soil COPCs could then migrate to an offsite POE south of Pantex Plant (under TTU property) in perched groundwater, but none will migrate offsite in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates several soil gas COPCs may exceed RBSVGW in perched groundwater directly beneath Zone 12. Tier 3 travel time analysis indicates no soil gas COPCs would reach an offsite POE south or east of Pantex Plant in perched groundwater within 1,000 years. Based on Tier 2 analysis, no soil gas COPCs are predicted to exceed RBSVGW in the Ogallala Aquifer at Zone 12.

- Tier 2 analysis indicates several perched groundwater COPCs exceed RBSVGW in perched groundwater. Tier 3 travel time analysis indicates some of these COPCs may migrate to an offsite POE south and/or east of Pantex Plant in perched groundwater. Several of these COPCs are already present in offsite (south and east) perched groundwater.

- Tier 2 analysis indicates several perched groundwater COPCs directly beneath Zone 12, specifically in areas with past sources of focused recharge (SWMUs 5-12a North and South, SWMU 5-13c, WMG 5, and WMG 6/7 west of SWMU 5-12a), may exceed RBSVGW in the Ogallala Aquifer. Travel time analysis (Tier 3) indicates COPCs will not migrate offsite in the Ogallala Aquifer within 1,000 years from locations where particles were initiated. Particle tracking was not completed in areas of perched groundwater impacts at the leading edge of the plume where impacts to the Ogallala Aquifer are likely within 1,000 years.

In addition to these screening results, model predictions and trending of groundwater data near sources in Zone 12 indicate residual pore water under Zone 12 will continue to act as a source of COPCs to perched groundwater offsite to the east of Pantex Plant, but at lower concentrations than currently observed in perched groundwater.

COPCs identified for migration offsite to the east and to TTU are included in the site-wide groundwater quantitative risk characterization. The site-wide groundwater risk characterization is presented in a separate section for groundwater.

Table D-34. Risk Calculations for Industrial Worker Exposure to Surface Soil in Zone 12

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
					WMG 5							
23	Antimony	7440-36-0	24	2.36E+01	6.77E+00	6.77E+00	--	**--**	--	2.0E-03	1.4E-02	90.1%
23	Cadmium	7440-43-9	26	1.80E+01	2.22E+00	2.22E+00	2.9E-09	6.4E-09	0.1%	6.8E-04	1.5E-03	9.9%
23	Benzo(a)Anthracene	56-55-3	13	9.50E+00	2.19E+00	2.19E+00	3.1E-07	6.9E-07	15.5%	--	--	--
23	Benzo(a)Pyrene	50-32-8	24	7.30E+00	9.94E-01	9.94E-01	3.1E-06	**3.1E-06**	70.5%	--	--	--
23	Benzo(b)Fluoranthene	205-99-2	13	8.40E+00	1.95E+00	1.95E+00	3.1E-07	6.1E-07	13.8%	--	--	--
							Cumulative ILCR	**4.4E-06**	100.0%	**HI**	1.5E-02	100.0%
24	Cadmium	7440-43-9	50	1.27E+01	2.73E+00	2.73E+00	2.9E-09	7.8E-09		6.8E-04	1.9E-03	100.0%
24	Lead	7439-92-1	39	5.51E+02	6.95E+01	6.95E+01	--	**--**		--	--	--
24	Benzo(a)Pyrene	50-32-8	13	2.10E-01	2.01E-01	2.01E-01	3.1E-06	6.3E-07		--	--	--
24	Uranium-238	7440-61-1	2	1.50E+00	--	1.50E+00	7.2E-07	**1.08E-06**		--	--	--
							Cumulative ILCR	**1.7E-06**	100.0%	**HI**	1.9E-03	100.0%
31	Barium	7440-39-3	10	4.88E+03	1.53E+03	1.53E+03	--	**--**	--	2.6E-05	4.0E-02	81.1%
31	Mercury	7439-97-6	12	9.80E+00	2.32E+00	2.32E+00	--	**--**	--	4.0E-03	9.2E-03	18.9%
							Cumulative ILCR	**--**	--	**HI**	4.9E-02	100.0%
32[a]	Barium	7440-39-3	8	2.83E+03	--	2.83E+03	--	**--**	--	2.6E-05	7.3E-02	58.7%
32[a]	Cadmium	7440-43-9	9	1.86E+01	--	1.86E+01	2.9E-09	5.4E-08	19.6%	6.8E-04	1.3E-02	10.2%
32[a]	Lead	7439-92-1	8	5.25E+03	--	5.25E+03	--	**--**	--	--	---	--
32[a]	Nickel	7440-02-0	7	2.87E+02	--	2.87E+02	7.7E-10	2.2E-07	80.4%	1.4E-04	3.9E-02	31.1%
							Cumulative ILCR	2.7E-07	100.0%	**HI**	1.2E-01	100.0%
37	Benzo(a)Pyrene	50-32-8	6	2.40E-01	--	2.40E-01	3.1E-06	7.5E-07	100.0%	--	--	--
							Cumulative ILCR	7.5E-07	100.0%	**HI**	--	--

Table D-34. Risk Calculations for Industrial Worker Exposure to Surface Soil I Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
WMG 6/7 West of SWMU 5-12a - Including all RFI sample locations												
2	Barium	7440-39-3	5	1.30E+03	--	1.30E+03	--	--	--	2.6E-05	3.4E-02	52.9%
2	Vanadium	7440-62-2	5	7.00E+01	--	7.00E+01	--	--	--	4.3E-04	3.0E-02	47.1%
2	Benzo(a)Anthracene	56-55-3	3	1.40E+00	--	1.40E+00	3.1E-07	4.4E-07	8.4%	--	--	--
2	Benzo(a)Pyrene	50-32-8	7	1.30E+00	--	1.30E+00	3.1E-06	**4.1E-06**	77.8%	--	--	--
2	Benzo(b)Fluoranthene	205-99-2	3	2.30E+00	--	2.30E+00	3.1E-07	7.2E-07	13.8%	--	--	--
							Cumulative ILCR	**5.2E-06**	100.0%	**HI**	6.4E-02	100.0%
10	1,3,5-Triamino-2,4,6-Trinitrobenzene	3058-38-6	3	1.78E+01	--	1.78E+01	1.6E-08	2.8E-07	6.1%	4.9E-04	8.7E-03	1.0%
10	Antimony	7440-36-0	35	1.70E+01	4.16E+00	4.16E+00	--	--	--	2.0E-03	8.5E-03	30.2%
10	Barium	7440-39-3	33	1.71E+03	4.21E+02	4.21E+02	--	--	--	2.6E-05	1.1E-02	38.7%
10	Benzo(a)Anthracene	56-55-3	18	2.50E+00	1.18E+00	1.18E+00	3.1E-07	3.7E-07	8.1%	--	--	--
10	Benzo(a)Pyrene	50-32-8	33	3.40E+00	1.03E+00	1.03E+00	3.1E-06	**3.2E-06**	70.5%	--	--	--
10	Benzo(b)Fluoranthene	205-99-2	18	2.44E+00	1.19E+00	1.19E+00	3.1E-07	3.7E-07	8.2%	--	--	--
10	Indeno(1,2,3-c,d)Pyrene	193-39-5	18	1.50E+00	1.05E+00	1.05E+00	3.1E-07	3.3E-07	7.2%	--	--	--
							Cumulative ILCR	**4.6E-06**	100.0%	**HI**	2.8E-02	100.0%
11	Benzo(a)Anthracene	56-55-3	11	9.70E-01	3.50E-01	3.50E-01	3.1E-07	1.1E-07	7.1%	--	--	--
11	Benzo(a)Pyrene	50-32-8	15	9.20E-01	2.59E-01	2.59E-01	3.1E-06	8.1E-07	52.3%	--	--	--
11	Benzo(b)Fluoranthene	205-99-2	11	2.00E+00	6.06E-01	6.06E-01	3.1E-07	1.9E-07	12.3%	--	--	--
11	Dibenz(a,h)Anthracene	53-70-3	11	1.40E-01	2.01E-01	1.40E-01	3.1E-06	4.4E-07	28.3%	--	--	--
							Cumulative ILCR	**1.6E-06**	100.0%	**HI**	--	--
17	RDX	121-82-4	23	1.22E+03	1.47E+02	1.47E+02	3.8E-08	**5.7E-06**	35.6%	3.4E-04	4.9E-02	27.8%
17	Antimony	7440-36-0	22	1.92E+01	1.44E+01	1.44E+01	---	--	--	2.0E-03	2.9E-02	16.6%
17	Barium	7440-39-3	23	1.50E+03	3.71E+02	3.71E+02	---	--	--	2.6E-05	9.6E-03	5.4%
17	Cadmium	7440-43-9	27	1.80E+01	7.14E+00	7.14E+00	2.9E-09	2.1E-08	0.1%	6.8E-04	4.9E-03	2.7%
17	Silver	7440-22-4	26	4.72E+02	1.07E+02	1.07E+02	---	--	--	7.9E-04	8.4E-02	47.5%
17	Benzo(a)Anthracene	56-55-3	30	5.70E+00	1.60E+00	1.60E+00	3.1E-07	5.0E-07	3.1%	--	--	--
17	Benzo(a)Pyrene	50-32-8	28	5.70E+00	1.64E+00	1.64E+00	3.1E-06	**5.1E-06**	32.3%	--	--	--
17	Benzo(b)Fluoranthene	205-99-2	28	4.10E+00	1.45E+00	1.45E+00	3.1E-07	4.5E-07	2.9%	--	--	--
17	Dibenz(a,h)Anthracene	53-70-3	26	2.10E+00	1.19E+00	1.19E+00	3.1E-06	**3.7E-06**	23.4%	--	--	--
17	Indeno(1,2,3-c,d)Pyrene	193-39-5	26	3.50E+00	1.33E+00	1.33E+00	3.1E-07	4.2E-07	2.6%	--	--	--
							Cumulative ILCR	**1.6E-05**	100.0%	**HI**	1.8E-01	100.0%

Table D-34. Risk Calculations for Industrial Worker Exposure to Surface Soil I Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
18	HMX	2691-41-0	81	2.70E+03	1.45E+02	1.45E+02	---	--	--	7.7E-05	1.1E-02	0.5%
18	RDX	121-82-4	74	3.10E+04	1.17E+03	1.17E+03	3.8E-08	**4.5E-05**	60.8%	3.4E-04	3.9E-01	16.6%
18	TNT	118-96-7	52	1.40E+04	7.23E+02	7.23E+02	1.4E-08	**1.0E-05**	13.7%	2.7E-03	**1.9E+00**	81.4%
18	Antimony	7440-36-0	67	2.35E+01	5.69E+00	5.69E+00	---	--	--	2.0E-03	1.2E-02	0.5%
18	Cadmium	7440-43-9	67	7.10E+00	1.12E+00	1.12E+00	2.9E-09	--	--	6.8E-04	7.7E-04	0.0%
18	Silver	7440-22-4	68	2.77E+02	3.12E+01	3.12E+01	---	--	--	7.9E-04	2.5E-02	1.0%
18	Benzo(a)Anthracene	56-55-3	69	5.40E+01	3.78E+00	3.78E+00	3.1E-07	**1.2E-06**	1.6%	--	--	--
18	Benzo(a)Pyrene	50-32-8	69	4.50E+01	3.36E+00	3.36E+00	3.1E-06	**1.1E-05**	14.3%	--	--	--
18	Benzo(b)Fluoranthene	205-99-2	67	3.30E+01	2.85E+00	2.85E+00	3.1E-07	8.9E-07	1.2%	--	--	--
18	Benzo(k)Fluoranthene	207-08-9	66	3.80E+01	3.03E+00	3.03E+00	3.1E-08	9.5E-08	0.1%	--	--	--
18	Carbazole	86-74-8	34	2.70E+01	2.88E+00	2.88E+00	8.5E-09	2.4E-08	0.0%	--	--	--
18	Dibenz(a,h)Anthracene	53-70-3	68	1.80E+01	1.72E+00	1.72E+00	3.1E-06	**5.4E-06**	7.3%	--	--	--
18	Indeno(1,2,3-c,d)Pyrene	193-39-5	67	2.60E+01	2.27E+00	2.27E+00	3.1E-07	7.1E-07	1.0%	--	--	--
18	Naphthalene	91-20-3	38	3.20E+01	3.31E+00	3.31E+00	---	--	--	6.2E-05	2.0E-04	0.0%
							Cumulative ILCR	**7.4E-05**	100.0%	**HI**	**2.4E+00**	100.0%
19	HMX	2691-41-0	53	7.54E+04	2.51E+04	2.51E+04	--	--	--	7.7E-05	**1.9E+00**	97.0%
19	RDX	121-82-4	53	2.06E+02	7.46E+01	7.46E+01	3.8E-08	**2.9E-06**	40.7%	3.4E-04	2.5E-02	1.3%
19	Antimony	7440-36-0	44	3.89E+01	4.74E+00	4.74E+00	--	--	--	2.0E-03	9.7E-03	0.5%
19	Barium	7440-39-3	42	2.55E+03	6.96E+02	6.96E+02	--	--	--	2.6E-05	1.8E-02	0.9%
19	Cadmium	7440-43-9	47	8.40E+00	1.88E+00	1.88E+00	2.9E-09	5.4E-09	0.1%	2.4E-03	4.6E-03	0.1%
19	Silver	7440-22-4	46	7.60E+01	7.82E+00	7.82E+00	--	--	--	7.9E-04	6.2E-03	0.3%
19	Benzo(a)Anthracene	56-55-3	47	2.00E+00	6.41E-01	6.41E-01	3.1E-07	2.0E-07	2.8%	--	--	--
19	Benzo(a)Pyrene	50-32-8	47	8.95E+00	9.49E-01	9.49E-01	3.1E-06	**3.0E-06**	41.6%	--	--	--
19	Benzo(b)Fluoranthene	205-99-2	47	3.90E+00	7.21E-01	7.21E-01	3.1E-07	2.3E-07	3.2%	--	--	--
19	Dibenz(a,h)Anthracene	53-70-3	47	2.10E-01	5.07E-01	2.10E-01	3.1E-06	6.6E-07	9.2%	--	--	--
19	Indeno(1,2,3-c,d)Pyrene	193-39-5	47	9.40E-01	5.56E-01	5.56E-01	3.1E-07	1.7E-07	2.4%	--	--	--
							Cumulative ILCR	**7.2E-06**	100.0%	**HI**	**2.0E+00**	100%
33[b]	Cadmium	7440-43-9	39	6.60E+00	2.80E+00	2.80E+00	6.8E-04	8.1E-09	100.0%	2.4E-03	1.9E-03	100.0%
							Cumulative ILCR	8.1E-09	100.0%	**HI**	1.9E-03	100.0%
34	Cadmium	7440-43-9	40	6.60E+00	3.30E+00	3.30E+00	2.9E-09	9.5E-09	100.0%	2.4E-03	8.1E-03	100.0%
							Cumulative ILCR	9.5E-09	100.0%	**HI**	8.1E-03	100.0%

Table D-34. Risk Calculations for Industrial Worker Exposure to Surface Soil I Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
35	Antimony	7440-36-0	3	1.20E+01	--	1.20E+01	--	--	--	2.0E-03	2.5E-02	100.0%
35	Benzo(a)Pyrene	50-32-8	2	1.20E-01	--	1.20E-01	3.1E-06	3.8E-07	100.0%	--	--	--
							Cumulative ILCR	3.8E-07	100.0%	**HI**	2.5E-02	100.0%
	WMG 6/7 West of SWMU 5-12a - With samples under Ditch 5-05 Lining Excluded											
17	RDX	121-82-4	6	1.22E+03	--	1.22E+03	3.8E-08	**4.7E-05**	62.1%	3.4E-04	4.1E-01	77.6%
17	Barium	7440-39-3	3	1.50E+03	--	1.50E+03	--	--	--	2.6E-05	3.9E-02	7.4%
17	Silver	7440-22-4	3	1.00E+02	--	1.00E+02	--	--	--	7.9E-04	7.9E-02	15.0%
17	Benzo(a)Anthracene	56-55-3	13	5.70E+00	9.59E+00	5.70E+00	3.1E-07	**1.8E-06**	2.4%	--	--	--
17	Benzo(a)Pyrene	50-32-8	11	5.70E+00	4.61E+01	5.70E+00	3.1E-06	**1.8E-05**	23.7%	--	--	--
17	Benzo(b)Fluoranthene	205-99-2	11	4.10E+00	8.33E+00	4.10E+00	3.1E-07	**1.3E-06**	1.7%	--	--	--
17	Dibenz(a,h)Anthracene	53-70-3	9	2.10E+00	--	2.10E+00	3.1E-06	**6.6E-06**	8.7%	--	--	--
17	Indeno(1,2,3-c,d)Pyrene	193-39-5	9	3.50E+00	--	3.50E+00	3.1E-07	**1.1E-06**	1.5%	--	--	--
							Cumulative ILCR	**7.6E-05**	100.0%	**HI**	5.3E-01	100.0%
18	HMX	2691-41-0	51	2.70E+03	1.26E+03	1.26E+03	--	--	--	7.7E-05	9.7E-02	3.1%
18	RDX	121-82-4	44	3.10E+04	1.96E+03	1.96E+03	3.8E-08	**7.5E-05**	66.2%	3.4E-04	6.6E-01	21.0%
18	TNT	118-96-7	42	1.40E+04	8.98E+02	8.98E+02	1.4E-08	**1.3E-05**	11.0%	2.7E-03	**2.4E+00**	76.0%
18	Benzo(a)Anthracene	56-55-3	42	5.40E+01	5.50E+00	5.50E+00	3.1E-07	**1.7E-06**	1.5%	--	--	--
18	Benzo(a)Pyrene	50-32-8	42	4.50E+01	4.85E+00	4.85E+00	3.1E-06	**1.5E-05**	13.3%	--	--	--
18	Benzo(b)Fluoranthene	205-99-2	40	3.30E+01	4.02E+00	4.02E+00	3.1E-07	**1.3E-06**	1.1%	--	--	--
18	Benzo(k)Fluoranthene	207-08-9	39	3.80E+01	4.40E+00	4.40E+00	3.1E-08	1.4E-07	0.1%	--	--	--
18	Carbazole	86-74-8	34	2.70E+01	2.88E+00	2.88E+00	8.5E-09	2.4E-08	0.0%	--	--	--
18	Dibenz(a,h)Anthracene	53-70-3	41	1.80E+01	2.14E+00	2.14E+00	3.1E-06	**6.7E-06**	5.9%	--	--	--
18	Indeno(1,2,3-c,d)Pyrene	193-39-5	40	2.60E+01	3.06E+00	3.06E+00	3.1E-07	9.6E-07	0.8%	--	--	--
18	Naphthalene	91-20-3	31	3.20E+01	3.36E+00	3.36E+00	--	--	--	6.2E-05	2.1E-04	0.0%
							Cumulative ILCR	**1.1E-04**	100.0%	**HI**	**3.1E+00**	100.0%
19	HMX	2691-41-0	15	4.60E+03	1.13E+06	4.60E+03	--	--	--	7.7E-05	3.5E-01	73.5%
19	RDX	121-82-4	15	2.06E+02	1.12E+02	1.12E+02	3.8E-08	**4.3E-06**	20.9%	3.4E-04	4.0E-02	8.4%
19	Barium	7440-39-3	4	2.55E+03	--	2.55E+03	--	--	--	2.6E-05	6.6E-02	13.8%
19	Cadmium	7440-43-9	8	8.40E+00	--	8.40E+00	2.9E-09	2.4E-08	0.1%	2.4E-03	2.1E-02	4.3%
19	Benzo(a)Anthracene	56-55-3	12	2.00E+00	1.20E+00	1.20E+00	3.1E-07	3.8E-07	1.8%	--	--	--
19	Benzo(a)Pyrene	50-32-8	12	8.95E+00	4.48E+00	4.48E+00	3.1E-06	**1.4E-05**	68.4%	--	--	--
19	Benzo(b)Fluoranthene	205-99-2	12	3.90E+00	2.72E+00	2.72E+00	3.1E-07	8.6E-07	4.2%	--	--	--
19	Dibenz(a,h)Anthracene	53-70-3	12	2.10E-01	6.81E-01	2.10E-01	3.1E-06	6.6E-07	3.2%	--	--	--
19	Indeno(1,2,3-c,d)Pyrene	193-39-5	12	9.40E-01	8.74E-01	8.74E-01	3.1E-07	2.7E-07	1.3%	--	--	--

Table D-34. Risk Calculations for Industrial Worker Exposure to Surface Soil I Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
							Cumulative ILCR	**2.1E-05**	100.0%	**HI**	4.8E-01	100.0%
					WMG 9							
G9-2	4,4-DDE	72-55-9	26	2.00E+00	6.28E-01	6.28E-01	8.5E-08	5.3E-08	38.1%	---	---	---
G9-2	4,4-DDT	50-29-3	23	6.00E+00	1.02E+00	1.02E+00	8.5E-08	8.7E-08	61.9%	**1.4E-03**	1.4E-03	100.0%
							Cumulative ILCR	1.4E-07	100.0%	**HI**	1.4E-03	100.0%
G9-3	Benzo(a)Pyrene	50-32-8	8	7.30E-01	--	7.30E-01	3.1E-06	**2.3E-06**	77.7%	---	---	---
G9-3	Benzo(b)Fluoranthene	205-99-2	8	2.10E+00	--	2.10E+00	3.1E-07	6.6E-07	22.3%	---	---	---
							Cumulative ILCR	**3.0E-06**	100.0%	**HI**	---	---
G9-5	Aluminum	7429-90-5	3	4.61E+04	--	4.61E+04	---	---	---	1.9E-06	8.6E-02	48.8%
G9-5	Barium	7440-39-3	3	3.16E+03	--	3.16E+03	---	---	---	2.6E-05	8.2E-02	46.3%
G9-5	Cadmium	7440-43-9	37	7.00E+00	3.40E+00	3.40E+00	2.9E-09	9.8E-09	3.2%	2.4E-03	8.3E-03	4.7%
G9-5	Chlordane	57-74-9	35	1.70E+00	1.40E-01	1.40E-01	1.8E-07	2.6E-08	8.4%	2.9E-03	4.1E-04	0.2%
G9-5	Benzo(a)Pyrene	50-32-8	29	3.70E-01	7.61E-02	7.61E-02	3.1E-06	2.4E-07	77.9%	---	---	---
G9-5	Benzo(b)Fluoranthene	205-99-2	30	7.20E-01	1.03E-01	1.03E-01	3.1E-07	3.2E-08	10.6%	---	---	---
							Cumulative ILCR	3.1E-07	100.0%	**HI**	1.8E-01	100.0%
					WMG 10							
--	Antimony	7440-36-0	51	1.27E+01	2.85E+00	2.85E+00	--	--	--	2.0E-03	5.8E-03	100.0%
--	Benzo(a)Anthracene	56-55-3	80	2.39E+00	6.16E-01	6.16E-01	3.1E-07	1.9E-07	7.5%	--	--	--
--	Benzo(a)Pyrene	50-32-8	94	6.45E+00	6.32E-01	6.32E-01	3.1E-06	**2.0E-06**	76.5%	--	--	--
--	Benzo(b)Fluoranthene	205-99-2	80	3.42E+00	6.52E-01	6.52E-01	3.1E-07	2.0E-07	7.9%	--	--	--
--	Indeno(1,2,3-c,d)Pyrene	193-39-5	73	4.37E+00	6.77E-01	6.77E-01	3.1E-07	2.1E-07	8.2%	--	--	--
							Cumulative ILCR	**2.6E-06**	100.0%	**HI**	5.8E-03	100.0%
					Landfill 3 (SWMU 54)							
LF3-1	RDX	121-82-4	33	5.45E+01	8.05E+00	8.05E+00	3.8E-08	3.1E-07	36.7%	3.4E-04	2.7E-03	12.0%
LF3-1	Antimony	7440-36-0	10	8.50E+00	4.36E+00	4.36E+00	--	--	--	2.0E-03	8.9E-03	39.8%
LF3-1	Barium	7440-39-3	10	9.18E+02	4.17E+02	4.17E+02	--	--	--	2.6E-05	1.1E-02	48.1%
LF3-1	Benzo(a)Pyrene	50-32-8	9	1.70E-01	--	1.70E-01	3.1E-06	5.3E-07	63.3%	--	--	--
							Cumulative ILCR	8.4E-07	100.0%	**HI**	2.2E-02	100.0%

Table D-34. Risk Calculations for Industrial Worker Exposure to Surface Soil I Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
					SWMU 136							
--	bis(2-Ethylhexyl)Phthalate	117-81-7	5	8.50E+01	--	8.50E+01	1.5E-08	**1.3E-06**	100.0%	1.5E-04	1.3E-02	100.0%
							Cumulative ILCR	**1.3E-06**	--	**HI**	1.3E-02	100.0%
					SWMU 5-12a South Ditch							
--	HMX	2691-41-0	38	2.10E+03	3.46E+02	3.46E+02	--	--	--	7.7E-05	2.7E-02	41.6%
--	RDX	121-82-4	104	9.00E+02	6.75E+01	6.75E+01	3.8E-08	**2.6E-06**	81.0%	3.4E-04	2.3E-02	35.4%
--	Antimony	7440-36-0	23	1.40E+01	4.03E+00	4.03E+00	--	--	--	2.0E-03	8.3E-03	12.9%
--	Silver	7440-22-4	101	9.90E+01	8.13E+00	8.13E+00	--	--	--	7.9E-04	6.4E-03	10.1%
--	Benzo(a)Pyrene	50-32-8	89	3.40E-01	1.93E-01	1.93E-01	3.1E-06	6.1E-07	19.0%	--	--	--
							Cumulative ILCR	**3.2E-06**	100.0%	**HI**	6.4E-02	100.0%
					SWMU 5-12a North Ditch							
--	Antimony	7440-36-0	17	2.20E+01	2.74E+01	2.20E+01	--	--	--	2.0E-03	4.5E-02	73.6%
--	Barium	7440-39-3	47	2.43E+03	6.24E+02	6.24E+02	--	--	--	2.6E-05	1.6E-02	26.4%
--	Benzo(a)Pyrene	50-32-8	16	9.70E-02	2.27E-01	9.70E-02	3.1E-06	3.0E-07	25.2%	--	--	--
--	Dibenz(a,h)Anthracene	53-70-3	16	5.00E-01	2.88E-01	2.88E-01	3.1E-06	9.0E-07	74.8%	--	--	--
							Cumulative ILCR	**1.2E-06**	100.0%	**HI**	6.1E-02	100.0%
					SWMU 5-13c Ditch							
--	Antimony	7440-36-0	113	4.70E+01	3.84E+00	3.84E+00	--	--	--	2.0E-03	7.9E-03	33.8%
--	Barium	7440-39-3	119	4.19E+03	5.61E+02	5.61E+02	--	--	--	2.6E-05	1.5E-02	62.5%
--	Mercury	7439-97-6	16	1.10E+00	2.18E-01	2.18E-01	--	--	--	4.0E-03	8.7E-04	3.7%
--	Benzo(a)Pyrene	50-32-8	5	1.00E-01	--	1.00E-01	3.1E-06	3.1E-07	100.0%	--	--	--
							Cumulative ILCR	3.1E-07	100.0%	**HI**	2.3E-02	100.0%

[a] Calculations for EPCs and risks in Grid Cell 32 include data from both WMG 5 and WMG 6/7.
[b] Calculations for EPCs and risks in Grid Cell 33 include data from both WMG 5 and WMG 6/7.
Bold indicates ILCR > 1E-06 or HQ/HI > 1.0.
NAP Not applicable pathway
-- No value available.

Table D-35. Risk Calculations for Construction/Excavation Worker Exposure to Soil in Zone 12

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV	Total ILCR	Percent Cumulative ILCR	Total URV	Total HQ/HI	Percent of HI
					WMG 5							
23	Benzo(a)anthracene	56-55-3	42	9.50E+00	8.96E-01	8.96E-01	1.4E-08	1.2E-08	10.6%	--	--	--
23	Benzo(a)pyrene	50-32-8	53	7.30E+00	6.26E-01	6.26E-01	1.4E-07	8.5E-08	75.8%	--	--	--
23	Benzo(b)fluoranthene	205-99-2	42	8.40E+00	8.34E-01	8.34E-01	1.4E-08	1.1E-08	9.9%	--	--	--
23	Indeno(1,2,3-c,d)pyrene	193-39-5	34	1.10E+00	2.91E-01	2.91E-01	1.4E-08	3.9E-09	3.7%	--	--	--
23	Antimony	7440-36-0	33	2.36E+01	6.53E+00	6.53E+00	--	--	--	1.3E-02	8.6E-02	91.2%
23	Cadmium	7440-43-9	38	1.80E+01	1.62E+00	1.62E+00	2.8E-11	4.5E-11	0.0%	5.1E-03	8.3E-03	8.8%
							Cumulative ILCR	1.1E-07	100.0%	**HI**	9.4E-02	100.0%
24	Cadmium	7440-43-9	100	1.27E+01	1.70E+00	1.70E+00	2.8E-11	4.7E-11	0.1%	5.1E-03	8.7E-03	100.0%
24	Lead	7439-92-1	87	5.51E+02	3.84E+01	3.84E+01	--	--	--	--	--	--
24	Benzo(a)pyrene	50-32-8	36	2.10E-01	1.97E-01	1.97E-01	1.4E-07	2.7E-08	56.3%	--	--	--
24	Uranium-235	15117-96-1	13	2.20E-01	1.73E-01	1.73E-01	3.4E-08	5.96E-09	12.5%	--	--	--
24	Uranium-238	7440-61-1	13	2.10E+00	1.20E+00	1.20E+00	1.2E-08	1.48E-08	31.1%	--	--	--
							Cumulative ILCR	4.7E-08	100.0%	**HI**	8.7E-03	100.0%
31	Antimony	7440-36-0	55	7.25E+03	3.56E+02	3.56E+02	--	--	--	1.3E-02	**4.7E+00**	98.0%
31	Barium	7440-39-3	21	4.88E+03	8.22E+02	8.22E+02	--	--	--	9.0E-05	7.4E-02	1.5%
31	Mercury	7439-97-6	22	9.80E+00	1.26E+00	1.26E+00	--	--	--	1.9E-02	2.4E-02	0.5%
							Cumulative ILCR	--	--	**HI**	**4.8E+00**	100.0%
32[a]	Aluminum	7429-90-5	13	2.68E+04	1.99E+04	1.99E+04	--	---	---	6.3E-06	1.3E-01	52.1%
32[a]	Barium	7440-39-3	17	2.83E+03	8.90E+02	8.90E+02	--	---	---	9.0E-05	8.0E-02	32.9%
32[a]	Cadmium	7440-43-9	22	1.86E+01	2.82E+00	2.82E+00	2.8E-11	7.8E-11	0.8%	5.1E-03	1.4E-02	5.9%
32[a]	Lead	7439-92-1	18	5.25E+03	8.09E+02	8.09E+02	--	---	---	--	---	---
32[a]	Nickel	7440-02-0	16	2.87E+02	6.15E+01	6.15E+01	7.4E-12	4.5E-10	4.7%	3.6E-04	2.2E-02	9.1%
32[a]	Benzo(a)pyrene	50-32-8	27	6.70E-02	1.96E-01	6.70E-02	1.4E-07	9.1E-09	94.5%	--	---	---
							Cumulative ILCR	9.6E-09	100.0%	**HI**	2.4E-01	100.0%

Table D-35. Risk Calculations for Construction/Excavation Worker Exposure to Soil in Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV	Total ILCR	Percent Cumulative ILCR	Total URV	Total HQ/HI	Percent of HI
37	Barium	7440-39-3	38	5.55E+03	6.67E+02	6.67E+02	--	--	--	9.0E-05	6.0E-02	77.4%
37	Copper	7440-50-8	42	1.54E+03	1.35E+02	1.35E+02	--	--	--	1.3E-04	1.7E-02	22.6%
37	Benzo(a)pyrene	50-32-8	23	2.40E-01	1.96E-01	1.96E-01	1.4E-07	2.6E-08	100.0%	--	--	--
							Cumulative ILCR	2.6E-08	100.0%	**HI**	7.7E-02	100.0%
				WMG 6/7 West of Ditch 5-12a								
2	Barium	7440-39-3	48	1.30E+03	3.21E+02	3.21E+02	--	--	--	9.0E-05	2.9E-02	50.9%
2	Vanadium	7440-62-2	48	7.00E+01	2.59E+01	2.59E+01	--	--	--	1.1E-03	2.8E-02	49.1%
2	Benzo(a)anthracene	56-55-3	46	1.40E+00	2.57E-01	2.57E-01	1.4E-08	3.5E-09	8.3%	--	--	--
2	Benzo(a)pyrene	50-32-8	50	1.30E+00	2.53E-01	2.53E-01	1.4E-07	3.4E-08	81.7%	--	--	--
2	Benzo(b)fluoranthene	205-99-2	46	2.30E+00	3.08E-01	3.08E-01	1.4E-08	4.2E-09	10.0%	--	--	--
							Cumulative ILCR	4.2E-08	100.0%	**HI**	5.7E-02	100.0%
10	1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	7	1.78E+01	--	1.78E+01	5.8E-10	1.0E-08	14.0%	2.0E-03	3.5E-02	28.5%
10	Antimony	7440-36-0	108	3.00E+01	4.02E+00	4.02E+00	--	--	--	1.3E-02	5.3E-02	42.7%
10	Barium	7440-39-3	181	2.42E+03	3.94E+02	3.94E+02	--	--	--	9.0E-05	3.5E-02	28.7%
10	Benzo(a)anthracene	56-55-3	119	2.50E+00	3.10E-01	3.10E-01	1.4E-08	4.2E-09	5.7%	--	--	--
10	Benzo(a)pyrene	50-32-8	134	3.40E+00	3.79E-01	3.79E-01	1.4E-07	5.1E-08	69.2%	--	--	--
10	Benzo(b)fluoranthene	205-99-2	118	2.44E+00	3.17E-01	3.17E-01	1.4E-08	4.3E-09	5.8%	--	--	--
10	Indeno(1,2,3-c,d)pyrene	193-39-5	119	1.50E+00	2.92E-01	2.92E-01	1.4E-08	4.0E-09	5.3%	--	--	--
							Cumulative ILCR	7.4E-08	100.0%	**HI**	1.2E-01	100.0%
11	Barium	7440-39-3	51	1.57E+03	3.20E+02	3.20E+02	--	--	--	9.0E-05	2.9E-02	100.0%
11	Benzo(a)anthracene	56-55-3	51	9.70E-01	2.14E-01	2.14E-01	1.4E-08	2.9E-09	5.5%	--	--	--
11	Benzo(a)pyrene	50-32-8	55	9.20E-01	2.01E-01	2.01E-01	1.4E-07	2.7E-08	51.6%	--	--	--
11	Benzo(b)fluoranthene	205-99-2	51	2.00E+00	2.66E-01	2.66E-01	1.4E-08	3.6E-09	6.8%	--	--	--
11	Dibenz(a,h)anthracene	53-70-3	51	1.40E-01	1.93E-01	1.40E-01	1.4E-07	1.9E-08	36.0%	--	--	--
							Cumulative ILCR	5.3E-08	100.0%	**HI**	2.9E-02	100.0%
17	RDX	121-82-4	106	1.22E+03	3.24E+01	3.24E+01	2.0E-09	6.3E-08	25.2%	1.8E-03	5.9E-02	19.5%
17	Antimony	7440-36-0	88	3.60E+01	4.86E+00	4.86E+00	---	--	--	1.3E-02	6.4E-02	21.1%
17	Barium	7440-39-3	91	1.50E+03	2.12E+02	2.12E+02	---	--	--	9.0E-05	1.9E-02	6.3%
17	Cadmium	7440-43-9	96	2.67E+01	2.20E+00	2.20E+00	2.8E-11	6.1E-11	0.0%	5.1E-03	1.1E-02	3.7%
17	Silver	7440-22-4	95	4.89E+02	8.76E+01	8.76E+01	---	--	--	1.7E-03	1.5E-01	49.4%
17	Benzo(a)anthracene	56-55-3	101	5.70E+00	7.28E-01	7.28E-01	1.4E-08	9.8E-09	3.9%	---	--	--

Table D-35. Risk Calculations for Construction/Excavation Worker Exposure to Soil in Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV	Total ILCR	Percent Cumulative ILCR	Total URV	Total HQ/HI	Percent of HI
17	Benzo(a)pyrene	50-32-8	99	5.70E+00	7.09E-01	7.09E-01	1.4E-07	9.6E-08	38.2%	---	--	--
17	Benzo(b)fluoranthene	205-99-2	98	4.10E+00	6.39E-01	6.39E-01	1.4E-08	8.7E-09	3.4%	---	--	--
17	Dibenz(a,h)anthracene	53-70-3	95	2.10E+00	4.85E-01	4.85E-01	1.4E-07	6.6E-08	26.1%	---	--	--
17	Indeno(1,2,3-c,d)pyrene	193-39-5	96	3.50E+00	5.62E-01	5.62E-01	1.4E-08	7.6E-09	3.0%	---	--	--
							Cumulative ILCR	2.5E-07	100.0%	**HI**	3.0E-01	100.0%
18	HMX	2691-41-0	263	2.70E+03	4.94E+01	4.94E+01	---	--	--	1.7E-04	8.3E-03	0.2%
18	RDX	121-82-4	255	3.10E+04	3.73E+02	3.73E+02	2.0E-09	7.3E-07	59.3%	1.8E-03	6.8E-01	15.0%
18	TNT	118-96-7	116	1.40E+04	3.25E+02	3.25E+02	5.7E-10	1.8E-07	15.0%	1.2E-02	**3.7E+00**	83.1%
18	Antimony	7440-36-0	219	4.63E+01	4.16E+00	4.16E+00	---	--	--	1.3E-02	5.4E-02	1.2%
18	Cadmium	7440-43-9	219	7.90E+00	8.02E-01	8.02E-01	2.8E-11	2.2E-11	0.0%	5.1E-03	4.1E-03	0.1%
18	Silver	7440-22-4	220	2.77E+02	1.16E+01	1.16E+01	---	--	--	1.7E-03	2.0E-02	0.4%
18	Benzo(a)anthracene	56-55-3	217	5.40E+01	1.39E+00	1.39E+00	1.4E-08	1.9E-08	1.5%	---	--	--
18	Benzo(a)pyrene	50-32-8	217	4.50E+01	1.26E+00	1.26E+00	1.4E-07	1.7E-07	13.9%	---	--	--
18	Benzo(b)fluoranthene	205-99-2	214	3.30E+01	1.08E+00	1.08E+00	1.4E-08	1.5E-08	1.2%	---	--	--
18	Benzo(k)fluoranthene	207-08-9	212	3.80E+01	1.13E+00	1.13E+00	1.4E-09	1.5E-09	0.1%	---	--	--
18	Carbazole	86-74-8	78	2.70E+01	1.36E+00	1.36E+00	3.7E-10	5.0E-10	0.0%	---	--	--
18	Dibenz(a,h)anthracene	53-70-3	214	1.80E+01	7.27E-01	7.27E-01	1.4E-07	9.8E-08	8.0%	---	--	--
18	Indeno(1,2,3-c,d)pyrene	193-39-5	213	2.60E+01	8.96E-01	8.96E-01	1.4E-08	1.2E-08	1.0%	---	--	--
18	Naphthalene	91-20-3	85	3.20E+01	1.59E+00	1.59E+00	---	--	--	2.8E-04	4.5E-04	0.0%
							Cumulative ILCR	**1.2E-06**	100.0%	**HI**	**4.5E+00**	100.0%
19	HMX	2691-41-0	219	7.54E+04	1.01E+03	1.01E+03	--	--	--	1.7E-04	1.7E-01	54.0%
19	RDX	121-82-4	221	2.06E+02	1.98E+01	1.98E+01	2.0E-09	3.9E-08	30.3%	1.8E-03	3.6E-02	11.4%
19	Antimony	7440-36-0	201	5.66E+01	3.79E+00	3.79E+00	--	--	--	1.3E-02	5.0E-02	15.8%
19	Barium	7440-39-3	194	4.41E+03	5.57E+02	5.57E+02	--	--	--	9.0E-05	5.0E-02	15.9%
19	Cadmium	7440-43-9	209	8.40E+00	9.67E-01	9.67E-01	2.8E-11	2.7E-11	0.0%	5.1E-03	4.9E-03	1.6%
19	Silver	7440-22-4	208	7.60E+01	2.39E+00	2.39E+00	--	--	--	1.7E-03	4.1E-03	1.3%
19	Benzo(a)anthracene	56-55-3	208	2.00E+00	2.92E-01	2.92E-01	1.4E-08	4.0E-09	3.1%	--	--	--
19	Benzo(a)pyrene	50-32-8	208	8.95E+00	3.61E-01	3.61E-01	1.4E-07	4.9E-08	38.2%	--	--	--
19	Benzo(b)fluoranthene	205-99-2	208	3.90E+00	3.10E-01	3.10E-01	1.4E-08	4.2E-09	3.3%	--	--	--
19	Dibenz(a,h)anthracene	53-70-3	207	2.10E-01	2.63E-01	2.10E-01	1.4E-07	2.8E-08	22.2%	--	--	--
19	Indeno(1,2,3-c,d)pyrene	193-39-5	207	9.40E-01	2.73E-01	2.73E-01	1.4E-08	3.7E-09	2.9%	--	--	--
							Cumulative ILCR	1.3E-07	100.0%	**HI**	3.1E-01	100.0%

Table D-35. Risk Calculations for Construction/Excavation Worker Exposure to Soil in Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV	Total ILCR	Percent Cumulative ILCR	Total URV	Total HQ/HI	Percent of HI
33[b]	Antimony	7440-36-0	9	6.85E+02	--	6.85E+02	--	--	--	1.3E-02	**9.0E+00**	99.9%
33[b]	Cadmium	7440-43-9	70	6.60E+00	1.75E+00	1.75E+00	2.8E-11	4.8E-11	100.0%	5.1E-03	8.9E-03	0.1%
							Cumulative ILCR	4.8E-11	100.0%	**HI**	**9.0E+00**	100.0%
34	Cadmium	7440-43-9	101	6.60E+00	2.00E+00	2.00E+00	2.8E-11	5.5E-11	100.0%	5.1E-03	1.0E-02	100.0%
							Cumulative ILCR	5.5E-11	100.0%	**HI**	1.0E-02	100.0%
35	Antimony	7440-36-0	9	1.20E+01	--	1.20E+01	--	--	--	1.3E-02	1.6E-01	100.0%
35	Benzo(a)pyrene	50-32-8	6	1.20E-01	--	1.20E-01	1.4E-07	1.6E-08	100.0%	--	--	--
							Cumulative ILCR	1.6E-08	100.0%	**HI**	1.6E-01	100.0%
36	Antimony	7440-36-0	5	2.80E+02	--	2.80E+02	--	--	--	1.3E-02	**3.7E+00**	100.0%
							Cumulative ILCR	--	--	**HI**	**3.7E+00**	100.0%
					WMG 9							
G9-2	4,4-DDE	72-55-9	39	2.00E+00	1.72E-01	1.72E-01	5.7E-09	9.8E-10	20.0%	---	---	---
G9-2	4,4-DDT	50-29-3	34	6.00E+00	6.90E-01	6.90E-01	5.7E-09	3.9E-09	80.0%	**1.0E-02**	7.1E-03	100.0%
							Cumulative ILCR	4.9E-09	100.0%	**HI**	7.1E-03	100.0%
G9-3	Barium	7440-39-3	29	1.40E+03	4.58E+02	4.58E+02	---	---	---	**9.0E-05**	4.1E-02	100.0%
G9-3	Benzo(a)pyrene	50-32-8	26	7.30E-01	2.15E-01	2.15E-01	1.4E-07	2.9E-08	86.0%	---	---	---
G9-3	Benzo(b)fluoranthene	205-99-2	26	2.10E+00	3.50E-01	3.50E-01	1.4E-08	4.7E-09	14.0%	---	---	---
							Cumulative ILCR	3.4E-08	100.0%	**HI**	4.1E-02	100.0%
G9-5	Aluminum	7429-90-5	6	4.61E+04	--	4.61E+04	---	---	---	6.3E-06	2.9E-01	49.4%
G9-5	Barium	7440-39-3	5	3.16E+03	--	3.16E+03	---	---	---	9.0E-05	2.8E-01	47.9%
G9-5	Cadmium	7440-43-9	45	7.00E+00	2.89E+00	2.89E+00	2.8E-11	8.0E-11	0.7%	5.1E-03	1.5E-02	2.5%
G9-5	Chlordane	57-74-9	47	1.70E+00	1.05E-01	1.05E-01	6.8E-09	7.1E-10	6.0%	1.2E-02	1.2E-03	0.2%
G9-5	Benzo(a)pyrene	50-32-8	33	3.70E-01	7.29E-02	7.29E-02	1.4E-07	9.9E-09	82.6%	---	---	---
G9-5	Benzo(b)fluoranthene	205-99-2	35	7.20E-01	9.56E-02	9.56E-02	1.4E-08	1.3E-09	10.8%	---	---	---
							Cumulative ILCR	1.2E-08	100.0%	**HI**	5.9E-01	100.0%

Table D-35. Risk Calculations for Construction/Excavation Worker Exposure to Soil in Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV	Total ILCR	Percent Cumulative ILCR	Total URV	Total HQ/HI	Percent of HI
WMG 10												
--	Antimony	7440-36-0	196	2.07E+01	2.54E+00	2.54E+00	--	--	--	1.3E-02	3.3E-02	58.1%
--	Chlordane	57-74-9	48	2.00E+01	2.03E+00	2.03E+00	6.8E-09	1.4E-08	10.4%	1.2E-02	2.4E-02	41.9%
--	Benzo(a)anthracene	56-55-3	257	5.70E+00	3.63E-01	3.63E-01	1.4E-08	4.9E-09	3.7%	--	--	--
--	Benzo(a)pyrene	50-32-8	271	1.60E+01	4.80E-01	4.80E-01	1.4E-07	6.5E-08	49.1%	--	--	--
--	Benzo(b)fluoranthene	205-99-2	257	4.80E+00	3.90E-01	3.90E-01	1.4E-08	5.3E-09	4.0%	--	--	--
--	Dibenz(a,h)anthracene	53-70-3	248	2.80E-01	3.36E-01	2.80E-01	1.4E-07	3.8E-08	28.6%	--	--	--
--	Indeno(1,2,3-c,d)pyrene	193-39-5	252	9.10E+00	4.12E-01	4.12E-01	1.4E-08	5.6E-09	4.2%	--	--	--
							Cumulative ILCR	1.3E-07	100.0%	**HI**	5.7E-02	100.0%
Landfill 3 (SWMU 54)												
LF3-1	RDX	121-82-4	90	5.45E+01	4.15E+00	4.15E+00	2.0E-09	8.1E-09	26.1%	1.8E-03	7.5E-03	7.6%
LF3-1	Antimony	7440-36-0	24	8.50E+00	3.99E+00	3.99E+00	--	--	--	1.3E-02	5.2E-02	52.9%
LF3-1	Barium	7440-39-3	24	1.22E+03	4.35E+02	4.35E+02	--	--	--	9.0E-05	3.9E-02	39.5%
LF3-1	Benzo(a)pyrene	50-32-8	21	1.70E-01	1.97E-01	1.70E-01	1.4E-07	2.3E-08	73.9%	--	--	--
							Cumulative ILCR	3.1E-08	100.0%	**HI**	9.9E-02	100.0%
LF3-2	Silver	7440-22-4	13	5.09E+01	1.12E+01	1.12E+01	--	--	--	1.7E-03	1.9E-02	100.0%
							Cumulative ILCR	--	--	**HI**	1.9E-02	100.0%
SWMU 136												
--	Mercury	7439-97-6	28	5.40E+00	7.18E-01	7.18E-01	--	--	--	1.9E-02	1.3E-02	29.5%
--	bis(2-Ethylhexyl)phthalate	117-81-7	7	8.50E+01	--	8.50E+01	3.5E-10	3.0E-08	100.0%	3.8E-04	3.2E-02	70.5%
							Cumulative ILCR	3.0E-08	100.0%	**HI**	4.6E-02	100.0%
SWMU 5-12a South Ditch												
--	HMX	2691-41-0	80	2.10E+03	1.66E+02	1.66E+02	--	--	--	1.7E-04	2.8E-02	16.8%
--	RDX	121-82-4	405	1.25E+03	3.14E+01	3.14E+01	2.0E-09	6.1E-08	69.5%	1.8E-03	5.7E-02	34.2%
--	Antimony	7440-36-0	46	1.40E+01	2.59E+00	2.59E+00	--	--	--	1.3E-02	3.4E-02	20.5%
--	Barium	7440-39-3	46	3.07E+03	4.73E+02	4.73E+02	--	--	--	9.0E-05	4.2E-02	25.6%
--	Silver	7440-22-4	396	9.90E+01	2.87E+00	2.87E+00	--	--	--	1.7E-03	4.9E-03	2.9%
--	Benzo(a)pyrene	50-32-8	369	3.40E-01	1.99E-01	1.99E-01	1.4E-07	2.7E-08	30.5%	--	--	--
							Cumulative ILCR	8.8E-08	100.0%	**HI**	1.7E-01	100.0%

Table D-35. Risk Calculations for Construction/Excavation Worker Exposure to Soil in Zone 12 (continued)

Grid Cell	COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV	Total ILCR	Percent Cumulative ILCR	Total URV	Total HQ/HI	Percent of HI
SWMU 5-12a North Ditch												
--	RDX	121-82-4	36	1.60E+01	1.49E+00	1.49E+00	2.0E-09	2.9E-09	4.9%	1.8E-03	2.7E-03	1.1%
--	Aluminum	7429-90-5	22	2.73E+04	1.87E+04	1.87E+04	--	--	--	6.3E-06	1.2E-01	48.7%
--	Antimony	7440-36-0	31	2.20E+01	4.09E+00	4.09E+00	--	--	--	1.3E-02	5.4E-02	22.0%
--	Barium	7440-39-3	95	3.47E+03	7.64E+02	7.64E+02	--	--	--	9.0E-05	6.9E-02	28.2%
--	Benzo(a)pyrene	50-32-8	32	9.70E-02	1.90E-01	9.70E-02	1.4E-07	1.3E-08	22.1%	--	--	--
--	Dibenz(a,h)anthracene	53-70-3	32	1.36E+00	3.21E-01	3.21E-01	1.4E-07	4.3E-08	73.0%	--	--	--
							Cumulative ILCR	5.9E-08	100.0%	**HI**	2.4E-01	100.0%
SWMU 5-13c Ditch												
--	RDX	121-82-4	40	1.20E+01	1.13E+00	1.13E+00	2.0E-09	2.2E-09	14.1%	1.8E-03	2.1E-03	2.2%
--	Antimony	7440-36-0	244	4.70E+01	3.25E+00	3.25E+00	--	--	--	1.3E-02	4.3E-02	44.7%
--	Barium	7440-39-3	269	4.19E+03	5.45E+02	5.45E+02	--	--	--	9.0E-05	4.9E-02	51.3%
--	Mercury	7439-97-6	42	1.10E+00	9.80E-02	9.80E-02	--	--	--	1.9E-02	1.8E-03	1.9%
--	Benzo(a)pyrene	50-32-8	11	1.00E-01	2.01E-01	1.00E-01	1.4E-07	1.4E-08	85.9%	--	--	--
							Cumulative ILCR	1.6E-08	100.0%	**HI**	9.5E-02	100.0%

[a] Calculations for EPCs and risks in Grid Cell 32 include data from both WMG 5 and WMG 6/7.
[b] Calculations for EPCs and risks in Grid Cell 33 include data from both WMG 5 and WMG 6/7.
Bold indicates ILCR > 1E-06 or HQ/HI > 1.0.
NAP Not applicable pathway
-- No value available.

Table D-36. Sources of Uncertainty Specific to the Zone 12 HHRA

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Uncertainty in Data Collection and Analysis (Section C.6.1)		
Sampling Locations		
Soil sample locations at Zone 12 are biased toward areas of highest contaminant concentration.	Samples were collected at areas known or suspected to have a contaminant release (i.e., corrective action units) and targeted to identify source areas.	Moderate impact: overestimates risk, especially for grid cells with large uncontaminated areas with few samples.
Surface soil sample depths.	Samples collected from any interval with starting depths of 0 to 2 ft are included in surface soil interval. Industrial workers are more likely exposed to top few inches.	Low impact: generally overestimates risk. Previous analysis indicates concentrations are the same or higher in the 6 in to 2 ft interval than the 0 to 6 inch interval.
Monitoring wells associated with Zone 12 SWMUs may reflect migration of COPCs from other upgradient SWMUs.	The identification of representative monitoring wells for each WMG/SWMU is based on proximity to the unit and the location of the well in the observed June 2003 perched flow field.	Low to high impact: overestimates risk from the unit if COPCs are from another source. This is a large source of uncertainty regarding the source of COPCs in groundwater but does not impact the conclusions regarding risk to receptors from that groundwater contamination
Analytical Error		
One anomalously high detection of antimony was reported in each of three Grid Cells (31, 33, and 36).	As noted in the *Landfills RFIR* (Jacobs, 1995), high antimony concentrations in WMG 5 (Grid Cells 31 and 33) could be false positives due to spectral interference by calcium. No spectral interference was reported for WMG 6/7 (Grid Cell 36); therefore, the cause of this antimony concentration is unknown.	Moderate impact: overestimates risk. Without these anomalous detections, antimony is generally less than background and has risks below acceptable target criteria at all three of these grid cells.
Uncertainty in Exposure Assessment		
Exposure Point Concentrations		
Uncertainty with twinned sample of ^{238}U	^{238}U was detected in one sample (0-2 ft) at location PTX11-2145 at SWMU 5-06 in 1995 at a concentration of 1.5 pCi/g, which was used as the EPC used in the risk assessment. The risk (1.1E-06) only slightly exceeds the acceptable level of 1.0 E-06. Isotopic ratios of the sample did not clearly identify the sample as containing DU, which is the SRC of concern at Pantex. The isotopic ratio or ^{234}U to ^{238}U was 1.5, where naturally occurring ratios are approximately 1, and depleted uranium is approximately 2. Because of the uncertainty, a second sample was collected to verify the ^{238}U activity at that location in 2003 with a reported ^{238}U activity of 0.97 pCi/g.	Low impact: may overestimate risk if the ^{238}U is actually within natural background concentrations. ^{238}U was retained as a COC in surface soil for Grid Cell 24.
Benzo(a)pyrene not detected in a “twin” sample.	EPCs and risks were calculated using the sample in which benzo(a)pyrene was detected.	Moderate impact: overestimates risk. Concentrations of benzo(a)pyrene driving risks at Grid Cell 23 could not be confirmed by twinned sample.

Table D-36. Sources of Uncertainty Specific to the Zone 12 HHRA (continued)

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
	Exposure Assumptions	
Standard default worker exposure parameters are used for onsite receptors; however, actual worker activity patterns vary by grid cell, by worker, and by time of year as well as from year to year.	Actual exposure of Zone 12 workers is expected to be much less than estimated by standard default exposure parameters.	Moderate to high impact depending on location: overestimates risk to actual Pantex Plant workers. Zone 12 South (including SWMU 5-12a South, WMG 5, and WMG 6/7 West of SWMU 5-12a [with the exception of Grid Cells 36 and 37]) is a highly restricted area. Security fences prevent entrance by unauthorized personnel and outdoor movement by workers within the security fence is highly limited. Other areas (outside the Zone 12 South security fence) have slightly higher levels of worker activity but still less than is assumed by default exposure factors.
	Uncertainty in Toxicity Information	
Slope factors are not available for PAHs other than benzo(a)pyrene.	RPFs are used to evaluate other potentially carcinogenic PAHs	Low impact: over- or under-estimates risk.
Some chemicals (e.g., RDX, TNT) are not evaluated for the inhalation pathway for the cancer endpoint because inhalation slope factors are not available.	Direct ingestion represents the primary exposure pathway for onsite receptors exposed to COPCs in soil; therefore, the lack of inhalation toxicity values for some COPCs is not a major source of uncertainty.	Low impact: under-estimates risk.
	Uncertainty in Risk Characterization	
Transport of onsite groundwater COPCs to onsite production wells.	The potential for COPCs in the perched groundwater to migrate to onsite production wells is based on the particle tracking analysis.	Negligible impact. Breaks or preferential pathways through the FGZ would be reflected in the observed water level data. The subsurface model reproduces what is seen in observed data; therefore, the permeability assumptions used in the model are considered realistic and this uncertainty is unlikely to impact the conclusions of the risk characterization.
Transport of onsite groundwater COPCs to offsite POE east or south of Pantex Plant	The potential for COPCs in the perched groundwater to migrate offsite to the east in perched groundwater and the Ogallala Aquifer is based on observed concentrations currently offsite in perched groundwater.	Negligible impact. Low uncertainty in the conclusion that COPCs may migrate offsite to the east since COPCs are present in offsite monitoring wells and plume is well defined in this area.

D.1.3 Summary of Conclusions for Zone 12

The Zone 12 operational area occupies the southeast portion of Pantex Plant. The southern half of Zone 12 (Zone 12 South) including SWMU 5-12a South, WMG 5, and WMG 6/7 west of SWMU 5-12a is a highly restricted area. Security fences and security police officers prevent entrance by unauthorized personnel and outdoor movement by workers within the security fence is highly restricted. Worker activity outside the Zone 12 South security fence is similar to other inactive operational areas at Pantex Plant. Nine areas are evaluated in Zone 12: SWMU 5-12a (North and South) and SWMU 5-13c, Landfill 3, WMG 5 and WMG 6/7 west of SWMU 5-12a, WMG 9, WMG 10, and SWMU 136.

- SWMU 5-12a (North and South) and 5-13c comprise the main drainage ditch from the east side of Zone 12 to Playa 1. RDX is identified as a COC in surface soil at SWMU 5-12a South. The cumulative ILCR at SWMU 5-12a South is 3.2E-06. RDX is a site-related contaminant and is wide-spread along this ditch; however, SWMU 5-12a South is accessed by Pantex Plant personnel even less than other ditches because of its highly restricted location between the security fences on the eastern side of Zone 12; therefore, risks are overestimated in this area.

- WMG 5 and WMG 6/7 are active operational areas that lie primarily within Zone 12 south. This area is divided into thirty-seven grid cells (Plates 4 and 5). Risk characterization results exceed target risk criteria in eleven of these grid cells. Based on the uncertainty analysis of these results, COCs are identified at Grid Cells 2, 10, 17, 18, 19, 23, 24, 31, 33, and 36.

Grid Cells 2 and 10 are located adjacent to one another in the northern portion of WMG 6/7 near the former Cooling Tower area. These three grid cells include AOC 13a and 13b, and SWMUs 1, 5-04, 11, and 97 and part of WMG 8. Cumulative ILCRs of 5.2E-06 and 4.6E-06 are calculated for surface soil (0 to 2 ft bgs) at these grid cells. Elevated concentrations of several PAHs are associated with a potential source area at the head of SWMU 1 (Building 12-17 Drainage Ditch). Benzo(a)pyrene is identified as a COC in surface soil for Grid Cells 2 and 10. Other PAHs [benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene] also contribute to elevated risk at this location.

Grid Cells 17, 18, and 19, adjacent to one another in the central portion of WMG 6/7, include AOC 10a and SWMUs 2, 122b, 123, and 5-05. Including all the RFI sample locations, the cumulative ILCRs are as high as 7.4E-05 and the HIs are up to 2.4 for surface soil at these grid cells. However, assuming the ditch-lining is in place (i.e., the samples located under the SWMU 5-05 lining are removed from the dataset) and is representative of current conditions, the cumulative ILCRs are as high as 1.1E-04 and the HIs are up to 3.1 for surface soil. Two HEs (RDX and TNT) and five PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) are identified as COCs in surface soil (0 to 2 ft bgs). Although the cumulative ILCR for the construction worker at Grid Cell 18 (1.2E-06) exceeds the lower limit of the TCEQ and EPA acceptable target risk range (1.0E-06), all individual ILCR values were below criteria with only RDX as a primary contributor (individual ILCR=7.3E-07) to the cumulative cancer risk. However, the HI exceeds the lower limit of the TCEQ and EPA acceptable target risk criterion (1.0) for Grid Cells 18 (HI = 4.5) with TNT the primary contributor at 3.7. Therefore, TNT is identified as a COC in soil (0 to 15 ft bgs) for Grid Cell 18. These COPCs may be associated with an elevated wastewater flume system at SWMU 122b. This system has been removed.

Grid Cell 23, in the south central portion of WMG 5, includes SWMU 57 and 5-06 and AOC 7c. Although there is uncertainty with regard to the data, benzo(a)pyrene is identified as a COC in Grid Cell 23 for the industrial worker, based on a sample collected at one location. Three additional samples collected for SPLP anlaysis at location ST-AC7C-0004 did not confirm the original detection of benzo(a)pyrene. This introduces uncertainty as to whether or not benzo(a)pyrene is actually present. At a minimum, it is apparent that any elevated concentration is very limited in extent.

Grid Cell 24 is in the northeast portion of WMG 5 and includes SWMUs 135 and 103 and portions of the SWMU 5-06 drainage ditch. 238U was detected in one sample (0-2 ft) at location PTX11-2145 at SWMU 5-06 in 1995 at a concentration of 1.5 pCi/g, which was used as the EPC used in the risk assessment. The risk (1.1E-06) only slightly exceeds the acceptable level of 1.0 E-06. Isotopic ratios of the sample did not clearly identify the sample as containing DU, which is the SRC of concern at Pantex. The isotopic ratio or 234U to 238U was 1.5, where naturally occurring ratios are approximately 1, and depleted uranium is approximately 2. Because of the uncertainty, a second sample was collected to verify the 238U activity at that location in 2003 with a reported 238U activity of 0.97 pCi/g. This introduces uncertainty as to whether or not 238U is actually present at the higher activity originally reported.

Although there is uncertainty regarding the presence of elevated 238U and the risk only slightly exceeds 1.0E06, it is retained as a COC in surface soil for Grid Cell 24.

Grid Cells 31, 33, and 36, in the southeast corner of Zone 12 South with Grid Cell 36 south of the Zone 12 fence, includes SWMUs 100, 5-07, 5-12a, and 55. Although there is uncertainty with regard to the data, antimony is identified as a COC in Grid Cells 31, 33, and 36 for the construction worker. As noted in the Landfills RFIR (Jacobs, 1995), high antimony concentrations in WMG 5 could be false positives due to spectral interference by calcium. The elevated risk was a result of a single high detection of antimony in each of these grid cells. In Grid Cell 36, no landfill contents were found in the area of investigation.

- WMG 9 is an active operational area approximately 13 acres in size; this area is divided into six 6-acre grid cells (Plates 4 and 5). Risk characterization results exceed target risk criteria in one of these grid cells. A cumulative ILCR of 3.0E-06 was calculated for surface soil (0 to 2 ft bgs) and benzo(a)pyrene was identified as the primary risk driver. Benzo(a)pyrene was detected in one out of eight surface soil samples at WMG 9 and the detection was taken from a sample beneath a paved parking area. Due to the small dataset, the maximum concentration (and only detection) was assumed as the EPC. Although benzo(a)pyrene may be anthropogenic, is is retained as a COC for WMG 9 to be evaluated for risk management options in the CMS.

- WMG 10 is an active operational area less than 6-acres in size; therefore, it was evaluated as a single EA. A cumulative ILCR of 2.6E-06 was calculated for surface soil (0 to 2 ft bgs) and benzo(a)pyrene was identified as the primary risk driver. The detections are below 1.0 ft, in an excavation that has been backfilled with clean soil. However, benzo(a)pyrene is identified as COCs in surface soil for WMG 10 to be evaluated for risk management options in the CMS.

- SWMU 136 is an active operational area less than 6-acres in size; therefore, it was evaluated as a single EA. A cumulative ILCR of 1.3E-06 was calculated for surface soil (0 to 2 ft bgs) and bis(2-ethylhexyl)phthalate is the only contributor. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant. Because bis(2-ethylhexyl)phthalate was detected in only 1 of 5 surface soil samples and its ILCR is very close to 1.0E-06, it is not retained as a COC.

- All calculated soil risks are below target risk criteria at Landfill 3; therefore, no COCs are identified for this SWMU.

COPCs originating from Zone 12 have impacted perched groundwater east of the Pantex Plant boundary. COPCs in perched groundwater originating from Zone 12 (specifically WMG 6/7 (SWMU 122b area and SWMU 5-12a) and associated surface drainage features (SWMU 5-13c and Playa 1) will continue to impact perched groundwater east of the Pantex Plant boundary. Additionally, modeling of future conditions, in the absence of remediation, indicates concentrations of RDX and 2,4-dinitrotoluene may exceed RBSVGW in the Ogallala Aquifer. Risks to offsite receptors exposed to current measured concentrations of COPCs in perched groundwater and future modeled concentrations of COPCs in perched groundwater and the Ogallala Aquifer were calculated sitewide and are presented in a separate groundwater section of this appendix.

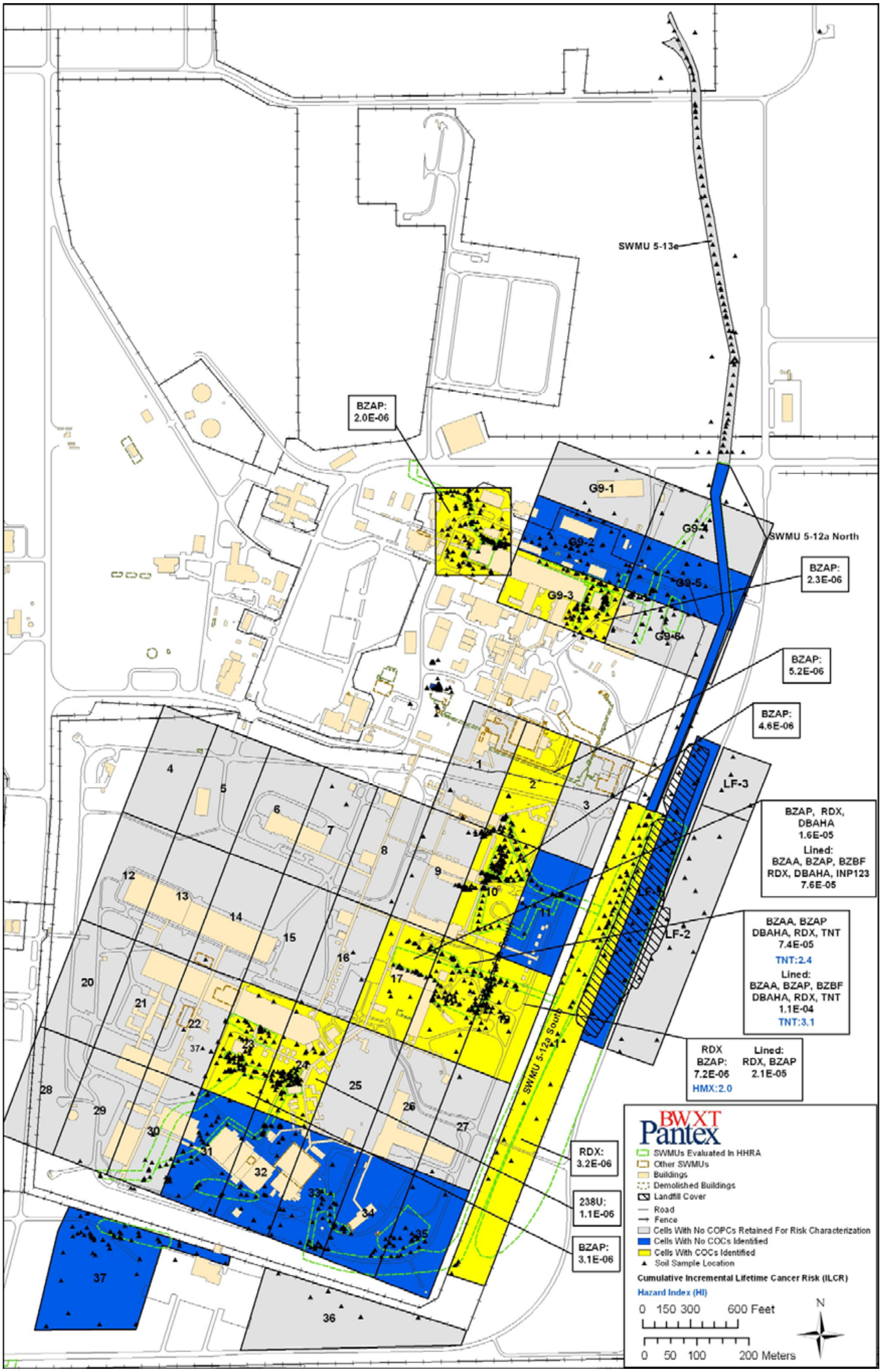

Figure D-3. Zone 12 Risk Results and COCs for Pantex Plant Industrial Worker, Surface Soil (0-2 ft)

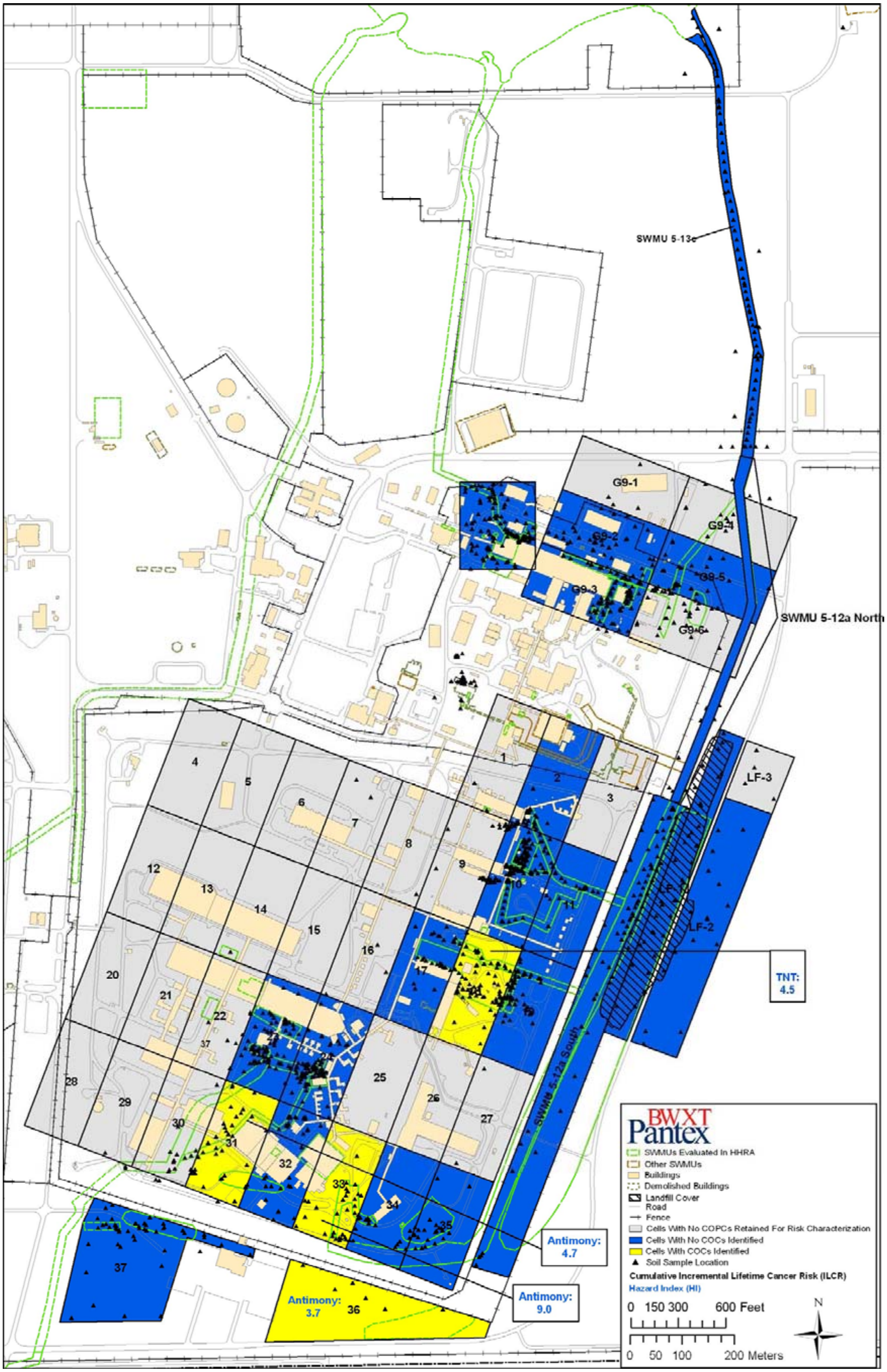

Figure D-4. Zone 12 Risk Results and COCs for Pantex Plant Construction/Excavation Worker, Soil (0-15 ft)

Appendix E

FTA Release Units Requiring Remedial Action

SWMU58: Landfill 7

Contains modified excerpts from Appendix D of the
Baseline HHRA Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groundwater (BWXT Pantex and SAIC, December 2006)

RELEASE OF INFORMATION TO THE PUBLIC
DOCUMENTED REVIEW PROCESS
(Ref. WI 02.04.02.02.03)

Document Title Baseline Human Health Risk Assessment Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groudnwater – Volumes I and II Date 12/9/2005
Document Author Michelle Bolwahnn Type of Doc Report

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This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☒ No ☐	[signature] for M.G. Knight	DEC 0 9 2005
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐	[signature]	12/13/05
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐	[signature]	12/13/05
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐	[signature]	12/12/05
Legal 12-72 Legal	Legal	Yes ☑ No ☐	Dean A Cooke	01/09/05
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐	[signature] J. Kelly	01/10/2005

After all signatures are obtained, forward copy via email or plant mail to the Classification Officer and OSTI Transmittal Officer

Comments: **Please call Marlon Smith (x4058) or Michelle Bolwahnn (6326) for pickup after signature**

Please see attached comments J x6616

* with revised Exy. Summary and various changes already made

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E.0 FTA RELEASE UNITS REQUIRING REMEDIAL ACTION

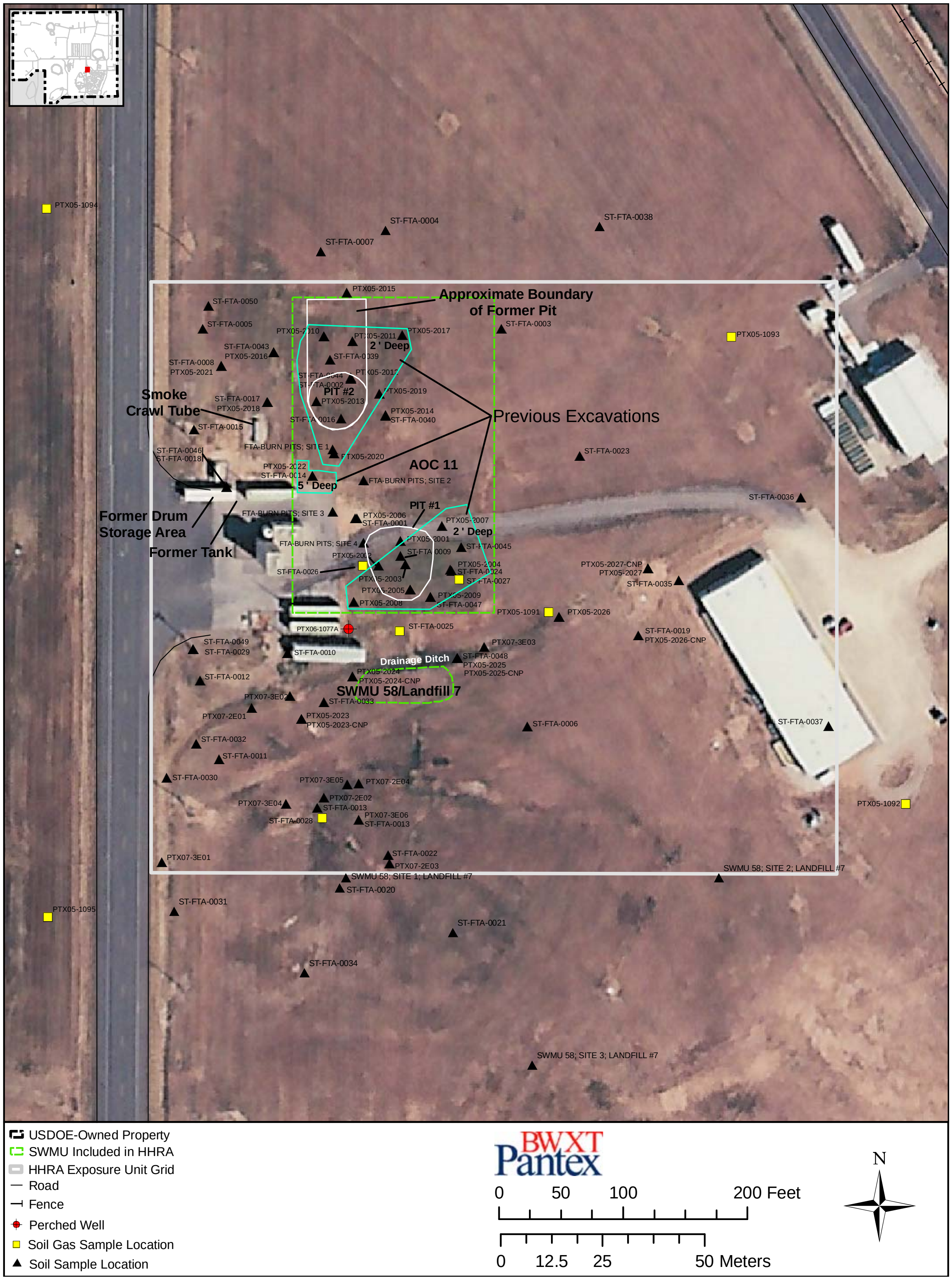

Figure E-1. FTA Sample Locations and Exposure Area Grid Configuration

Table E-1. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at FTA[a]

COPC	*FTA RFIR* (Stoller, 2002)		*Groundwater RFIR* (Stoller, 2004)
	Soil	**Soil Gas**	**Groundwater**
Dioxins and Furans			
Heptachlorinated dibenzodioxin	√	--	--
Octochlorodibenzo-p-dioxin	√	--	--
Pentachlorinated dibenzofurans	√	--	--
HEs			
1,3-Dinitrobenzene	--	--	√[b]
2,4-Dinitrotoluene	--	--	√[b]
2,6-Dinitrotoluene	--	--	√[b]
2-Amino-4,6-dinitrotoluene	--	--	√[b]
4-Amino-2,6-dinitrotoluene	--	--	√[b]
HMX	--	--	√[b]
RDX	--	--	√[b]
1,3,5-Trinitrobenzene	--	--	√[b]
TNT	--	--	√[b]
Metals			
Aluminum	√[c]	--	--
Antimony	√[c]	--	--
Arsenic	√	--	--
Barium	√	--	--
Boron	--	--	√[b]
Beryllium	√[c]	--	--
Cadmium	√	--	--
Chromium, Total	√	--	√[b]
Chromium, Hexavalent	--	--	√[b]
Cobalt	√	--	--
Copper	√	--	--
Lead	√	--	--
Manganese	√	--	--
Mercury	√[c]	--	--
Molybdenum	√[c]	--	--
Nickel	√	--	--

Table E-1. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at FTA[a] (continued)

COPC	*FTA RFIR[a]* (Stoller, 2002)		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
Selenium	√	--	√[b]
Silver	√	--	--
Strontium	√	--	--
Thallium	√	--	--
Uranium, Total[d]	√	--	--
Vanadium	√	--	--
Zinc	√	--	--
Miscellaneous			
Nitrate as Nitrogen	--	--	√[b]
Perchlorate	--	--	√[b]
Pesticides			
Aldrin	√	--	--
Alpha BHC	√	--	--
Beta BHC	√	--	--
Delta BHC	√	--	--
Gamma BHC	√	--	--
4,4'-DDD (1,1-bis(Chlorophenyl)-2,2-dichloroethene)	√	--	--
Dieldrin	√	--	--
Endrin	√	--	--
Heptachlor	√	--	--
Heptachlor epoxide	√	--	--
Radionuclides			
^{235}U[d]	√	--	--
SVOCs			
Acenaphthene	√	--	--
bis(2-Ethylhexyl) phthalate	√	--	--
Cyclohexanol	√	--	--
Cyclohexanone	√	--	--
Diethyl phthalate	√	--	--
Fluorene	√	--	--
2-Methylnaphthalene	√	--	--

Table E-1. Complete Starting List of Soil, Soil Gas, and Groundwater COPCs at FTA[a] (continued)

COPC	*FTA RFIR[a]* (Stoller, 2002)		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas	Groundwater
Naphthalene	√	--	--
Phenanthrene	√	--	--
Pyrene	√	--	--
VOCs			
Acetone	√	√	--
Benzene	√	√	--
1,1-Dichlroethane	√	√	--
1,2-Dichloroethane	√	√	√[b]
cis-1,2-Dichloroethene	√	√	--
trans-1,2-Dichloroethene	√	--	--
Dichlorodifluoromethane	√	√	--
Ethylbenzene	√	--	--
Freon-113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	--	√	R[e]
Methyl ethyl ketone (2-Butanone)	√	√	--
Methyl isobutyl ketone (4-Methyl-2-pentanone)	√	--	--
Methylene chloride	√	--	--
Nonanal	√	--	--
Tetrachloroethylene	√	√	√[b]
Toluene	√	√	--
1,1,1-Trichloroethane	√	√	--
Trichloroethene	√	√	√
Vinyl chloride	--	--	--
Xylenes, total	√	--	--

[a]Unless otherwise noted, all chemicals identified as COPCs are from the *FTA RFIR* (soil and soil gas) or the CSM for FTA (*Groundwater RFIR*, Figure 13.2-3) (Stoller, 2004).
[b]Compound was not listed in the CSM for FTA in the *Groundwater RFIR*, but it is a sitewide groundwater COPC. See discussion in Appendix I.
[c]Metal was added to COPC list to because all detected metals are re-evaluated based on availability of new background RRS 1 values.
[d]FTA was designated as a potential radiological site by the *RI Report* (BWXT, 2004) due to uncertainties in previously collected data. ^{235}U designated as a COPC because no background criteria exists.
[e]Groundwater COPC is from the CSM Figure 13.2-3 of the *Groundwater RFIR*, but it is not a sitewide groundwater COPC in Appendix I.
R - COPC removed from starting list
√ COPC for medium
-- not a COPC in medium

Table E-2. COPCs Retained for Further Evaluation in the FTA HHRA Surface Soil (0-2 ft) for Industrial Worker Evaluation

COPCs	
Metals	
Barium	Thallium
Vanadium	
Dioxins and Furans [a]	
Heptachlorinated dibenzodioxin	Octochlorodibenzo-p-dioxin
Pentachlorinated dibenzofurans	

[a] Dioxins and furans were not compared to risk-based screening criteria, but were retained for further evaluation because they were detected in FTA soil. Dioxins and furans are included in the risk evaluation presented in Section D.5.1.1.

Table E-3. COPCs Retained for Further Evaluation in the FTA HHRA Soil (0-15 ft) for Construction/Excavation Worker Evaluation

COPCs	
Metals	
Arsenic	Barium
Thallium	Vanadium
Pesticides	
Alpha-BHC	Heptachlor
Heptachlor epoxide	
Dioxins and Furans [a]	
Heptachlorinated dibenzodioxin	Octochlorodibenzo-p-dioxin
Pentachlorinated dibenzofurans	

[a] Dioxins and furans were not compared to risk-based screening criteria, but were retained for further evaluation because they were detected in FTA soil. Dioxins and furans are included in the risk evaluation presented in Section D.5.1.1.

Table E-4. COPCs Retained for Further Evaluation in the FTA HHRA Soil-to-Groundwater Pathway

COPCs	
Metals	
Arsenic	Manganese
Barium	Selenium
Cadmium	Thallium
Lead	Vanadium
Pesticides	
Aldrin	Dieldrin
Alpha-BHC	Gamma-BHC
Beta-BHC	Heptachlor
Delta-BHC	Heptachlor epoxide
SVOCs	
bis(2-Ethylhexyl)phthalate	
VOCs	
Tetrachloroethylene (PCE)	Trichloroethene

Table E-5. COPCs Retained for Further Evaluation in the FTA HHRA
Soil Gas-to-Groundwater Pathway

Retained COPCs	
Shallow	**Intermediate**
Trichloroethene	Trichloroethene

Table E-6. COPCs Retained for Further Evaluation in the FTA HHRA
Perched Groundwater

COPC	Filtered[a]	Unfiltered
Miscellaneous		
Perchlorate	NA	√
VOCs		
Trichloroethene	NA	√

[a] Filtered samples collected for metals only.
NA - not applicable, filtered results available for metals analysis only
√ COPC for medium
-- not a COPC for medium

Table E-7. EPC Evaluation Surface Soil (0-2 ft) FTA

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals									
Barium	7440-39-3	43	43	mg/kg	1.10E+02	1.20E+03	X	2.52E+02	2.52E+02
Thallium	7440-28-0	26	9	mg/kg	2.70E-01	3.20E+01	D	9.00E+00	9.00E+00
Vanadium	7440-62-2	27	27	mg/kg	2.70E+01	5.80E+01	L	4.42E+01	4.42E+01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table E-8. EPC Evaluation Soil (0-15 ft) FTA

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals									
Arsenic	7440-38-2	115	115	mg/kg	2.90E+00	4.00E+01	X	7.11E+00	7.11E+00
Barium	7440-39-3	137	137	mg/kg	7.16E+01	1.21E+03	X	2.54E+02	2.54E+02
Thallium	7440-28-0	115	22	mg/kg	2.70E-01	3.20E+01	D	6.80E+00	6.80E+00
Vanadium	7440-62-2	116	116	mg/kg	1.70E+01	5.80E+01	N	3.79E+01	3.79E+01
Pesticides									
Alpha BHC	319-84-6	125	12	mg/kg	3.70E-04	1.10E-01	D	4.63E-03	4.63E-03
Heptachlor	76-44-8	128	19	mg/kg	7.00E-05	1.30E-01	D	4.87E-03	4.87E-03
Heptachlor Epoxide	1024-57-3	125	33	mg/kg	1.50E-04	5.90E-02	D	4.24E-03	4.24E-03

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

E.1 RISK CHARACTERIZATION RESULTS FOR FTA

This section provides the quantitative risk results for onsite and offsite receptors that may be exposed to contaminated media from FTA. Results of the risk evaluation for the onsite and offsite receptors potentially exposed to COPCs identified in soil and perched groundwater at FTA are presented below.

The numerical risk and hazard estimates presented in this section must be interpreted in the context of the uncertainties and assumptions associated with the risk assessment process and with the data upon which the risk estimates are based. Integration of the risk characterization results and uncertainty analysis are presented in the Conclusions Section at the end.

E.1.1 Risk Characterization for Onsite Receptors at FTA

Three onsite media of concern were identified for FTA: soil, air, and groundwater.

E.1.1.1 Risk Characterization for Onsite Soil and Air at FTA

Two onsite exposure scenarios are quantitatively evaluated for FTA:

- Current/future industrial worker exposed to surface soil (0 to 2 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air.

- Current/future construction worker exposed to soil (0 to 15 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air.

Current and future risks were evaluated for these receptors/pathways at FTA from EPCs (95% UCL on the mean or maximum detected concentration) calculated from measured soil concentrations. Surface soil (0 to 2 ft) EPCs and soil (0 to 15 ft) EPCs are presented in tables following this text section.

Detailed hazard and risk results for the two onsite receptors are summarized below.

Individual and cumulative ILCRs and HQs/HIs are calculated for COPCs and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0).

E.1.1.2 Current and Future Industrial Worker Scenario

No carcinogenic COPCs were identified in surface soil; therefore, no ILCRs were calculated for this receptor. The total HI (0.086) is well below the TCEQ and EPA acceptable target value of 1.0; therefore, risks to the industrial worker are negligible for noncarcinogenic COPCs in surface soil at FTA.

The maximum 2,3,7,8-TCDD TEQ estimated for this area (0.043 ppb) is less than the TCEQ industrial value of 5 ppb. Therefore, risk from potential exposure to dioxins and furans is negligible for an industrial worker.

E.1.1.3 Current and Future Construction/Excavation Worker Scenario

The cumulative ILCR and HI for this receptor are 1.6E-09 and 0.49, respectively. These are less than the TCEQ and EPA acceptable target risk criteria; therefore, risks to the construction/excavation worker are negligible for soil at FTA.

The maximum 2,3,7,8-TCDD TEQ estimated for this area (0.043 ppb) is the same as that for surface soil and is less than the TCEQ industrial value of 5 ppb. Therefore, risk from potential exposure to dioxins and furans is negligible for a construction/excavation worker.

E.1.1.4 Risk Characterization for Onsite Groundwater at FTA

Future industrial and construction/excavation worker exposure to COPCs in groundwater (Ogallala Aquifer) is dependant on COPCs in soil, soil gas, and/or perched groundwater reaching Pantex Plant production wells in the Ogallala Aquifer. The potential for COPCs in soil, soil gas, and/or perched groundwater at FTA to migrate to the Pantex Plant production wells is evaluated using the Tier 2 and Tier 3 approach presented in the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006).

The following transport pathways were evaluated for FTA:

- Soil-to-Ogallala Aquifer
- Soil gas-to-Ogallala Aquifer
- Perched groundwater-to-Ogallala Aquifer POE.
- Ogallala Aquifer-to-Pantex Plant production wells.

Tier 1 COPC evaluation results are presented below. Results for the Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer, soil gas-to-Ogallala Aquifer, perched groundwater-to-Ogallala Aquifer, and Ogallala Aquifer-to-Pantex Plant production wells are summarized as follows:

- Tier 2 analysis indicates six soil COPCs, including three metals (arsenic, manganese, and thallium), one pesticide (alpha-BHC), and two VOCs (tetrachloroethylene and trichloroethene) may exceed the RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates these COPCs are not predicted to reach an onsite exposure location (Pantex Plant production wells) within 1,000 years.

- As a result of Tier 2 analysis, no soil gas COPCs were retained for Tier 3 evaluation for the soil gas-to-Ogallala Aquifer pathway.

- As a result of Tier 2 analysis, no perched groundwater COPCs were retained for Tier 3 evaluation for the perched groundwater-to-Ogallala Aquifer pathway.

- No groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network.

Results of the Tier 2 and Tier 3 analysis indicate exposure of onsite workers to groundwater COPCs originating from FTA is an incomplete pathway because COPCs at FTA will not reach the Pantex Plant production wells within 1,000 years. Therefore, groundwater does not contribute to risk to onsite receptors.

E.1.2 Risk Characterization for Offsite Receptors Due to COPC Transport from FTA

Potential risks to offsite receptors were evaluated for two transport mechanisms:

- Airborne transport of COPCs in surface soil to offsite air with subsequent deposition to offsite soil and crops.

- Groundwater transport to offsite exposure locations.

E.1.2.1 Risks from Atmospheric Transport from FTA to Offsite Receptors

Risks from atmospheric transport of surface soil COPCs from FTA to offsite receptor locations are estimated based on modeling conducted for the Burning Ground HHRA (BWXT Pantex, 2005). The Burning Ground is considered a worst-case analysis for atmospheric transport because 1) it has higher surface soil concentrations of most COPCs than other units at Pantex Plant and 2) it is closest to a downwind (northern) Pantex Plant boundary. The results of atmospheric transport modeling for the Burning Ground showed negligible offsite risks. Thus, quantitative atmospheric transport modeling is not conducted for other corrective action units at Pantex Plant. Instead, the quantitative results for the Burning Ground are used in a semi-quantitative evaluation to demonstrate that the offsite risk due to air dispersion of COPCs from FTA is negligible. The semi-quantitative evaluation is completed by comparing conditions at the Burning Ground to each corrective action unit or zone, as described in Appendix O of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006).

The predominant wind direction at Pantex Plant is from south to north. The Burning Ground is located approximately 2,750 ft south of the northern Plant boundary. FTA is located more than 2 miles from the northern Plant boundary and approximately 5,800 ft north of the southern Plant boundary, which is the nearest Plant boundary to this zone.

Risks were calculated for 11 grid cells within the Burning Ground with a total ILCR for all grid cells of 4.5E-03 and a total HI of 156. The onsite COPC concentrations associated with these high onsite risks resulted in negligible offsite risks (cumulative ILCR = 5.3E-08, HI = 0.44).

Risks were calculated for one grid cell at FTA with a total HI of 0.086. No carcinogenic surface soil COPCs were identified for evaluation in the risk assessment; therefore, no ILCR was calculated. Because the FTA is farther from the Plant boundary and has much lower surface soil risks than the Burning Ground, offsite risks due to atmospheric transport from FTA would be less than those predicted for the Burning Ground (i.e., HI<0.44). Semi-quantitative analysis using the relative distance and direction to the Plant boundary for Burning Ground and FTA indicates the offsite HI from the FTA would be on the order of 0.000055.

E.1.2.2 Risks from Groundwater Transport from FTA to Offsite Receptors

The potential for COPCs in soil, soil gas, and/or perched groundwater to migrate to an offsite location in the perched groundwater or the Ogallala Aquifer was quantitatively evaluated using the Tier 2 and Tier 3 fate and transport approach presented in the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006). The results of this modeling are summarized for FTA here.

The following transport pathways were evaluated for FTA groundwater:

- Soil-to-perched groundwater
- Soil-to-Ogallala Aquifer
- Soil gas-to-perched groundwater
- Soil gas-to-Ogallala Aquifer
- Perched groundwater-to-offsite POE
- Perched groundwater-to-Ogallala Aquifer POE.

Results of the Tier 1 COPC evaluation are summarized below.

- Tier 2 analysis indicates thirteen soil COPCs, including five pesticides (alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, and dieldrin), six metals (arsenic, lead, manganese, selenium, thallium, and vanadium), and two VOCs (tetrachloroethylene and trichlorethene), may exceed the RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure location in perched groundwater south of Pantex Plant within 1,000 years.

- Tier 2 analysis indicates six soil COPCs, including three metals (arsenic, manganese, and thallium), one pesticide (alpha-BHC), and two VOCs (tetrachloroethylene and trichloroethene) may exceed the RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates these COPCs are not predicted to reach an offsite exposure location (Plant boundary) within 1,000 years.

- As a result of Tier 2 analysis, no soil gas COPCs were retained for Tier 3 evaluation for either the soil gas-to-perched groundwater or soil gas-to-Ogallala Aquifer pathways.

- Tier 2 analysis indicates two perched groundwater COPCs (perchlorate and trichloroethene) may exceed RBSVGW in perched groundwater; however, Tier 3 travel time analysis indicates neither of these COPCs are predicted to reach an offsite exposure location in perched groundwater south of Pantex Plant within 1,000 years.

- As a result of Tier 2 analysis, no perched groundwater COPCs were retained for Tier 3 evaluation for migration to the Ogallala Aquifer.

FTA is located west of the perched groundwater flow divide; therefore, COPCs in soil, soil gas, and perched groundwater at FTA will not migrate offsite to the east in the perched groundwater.

- No groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network.

Based on these results, exposure of offsite receptors to groundwater COPCs originating from FTA is an incomplete pathway, and therefore, does not contribute to risk to offsite receptors.

Table E-9. FTA Summary of Risk Calculations for Industrial Worker Surface Soil (0-2 ft)

COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg)	EPC (mg/kg)	95% UCL (mg/kg)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
Barium	7440-39-3	43	1.20E+03	2.52E+02	2.52E+02	--	--	--	2.6E-05	6.5E-03	7.6%
Thallium	7440-28-0	26	3.20E+01	9.00E+00	9.00E+00	--	--	--	6.8E-03	6.1E-02	70.5%
Vanadium	7440-62-2	27	5.80E+01	4.42E+01	4.42E+01	--	--	--	4.3E-04	1.9E-02	21.9%
						Cumulative ILCR	--	--	**HI**	8.6E-02	100.0%

-- value not available

Table E-10. FTA Summary of Risk Calculations for Construction/Excavation Worker Soil (0-15 ft)

COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg)	EPC (mg/kg)	95% UCL (mg/kg)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
Arsenic	7440-38-2	115	4.00E+01	7.11E+00	7.11E+00	--	--	--	--	--	--
Barium	7440-39-3	137	1.21E+03	2.54E+02	2.54E+02	--	--	--	9.0E-05	2.3E-02	4.7%
Thallium	7440-28-0	115	3.20E+01	6.80E+00	6.80E+00	--	--	--	6.2E-02	4.2E-01	86.6%
Vanadium	7440-62-2	116	5.80E+01	3.79E+01	3.79E+01	--	--	--	1.1E-03	4.1E-02	8.4%
Alpha BHC	319-84-6	125	1.10E-01	4.63E-03	4.63E-03	1.1E-07	4.9E-10	32.4%	6.4E-04	3.0E-06	0%
Heptachlor	76-44-8	128	1.30E-01	4.87E-03	4.87E-03	8.3E-08	4.0E-10	24.7%	1.1E-02	5.5E-05	0%
Heptachlor epoxide	1024-57-3	125	5.90E-02	4.24E-03	4.24E-03	1.7E-07	7.1E-10	42.9%	4.3E-01	1.8E-03	0%
						Cumulative ILCR	1.6E-09	100.0%	**HI**	4.9E-01	100.0%

-- value not available

Table E-11. Sources of Uncertainty Specific to the FTA HHRA

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Uncertainty in Data Collection and Analysis		
Sampling Locations		
Soil sample locations at FTA are biased toward areas of highest COPC concentration.	Samples collected at areas known or suspected to have a constituent release (i.e., corrective action units) and targeted to identify source areas.	Moderate impact: overestimates risk.
Uncertainty in Exposure Assessment		
Exposure Point Concentrations		
Exposure area placement - Exclusion of some peripheral soil sampling locations from exposure area.	FTA is less than 6 acres, and therefore is bound by a single grid cell. Several sample locations lie outside this grid cell. COPC and EPC evaluations were conducted with and without these samples.	Low impact: overestimates risks. Exclusion of sample results outside the 6-acre grid cell results in higher EPCs than those calculated with all samples included.
Exposure Assumptions		
Standard default worker exposure parameters are used; however, actual worker activity patterns vary by site, by worker, and by time of year, as well as from year to year.	Actual exposures to FTA workers are expected to be much less than estimated by standard default exposure parameters.	High impact: overestimates risk to Pantex Plant workers.
Uncertainty in Toxicity Information		
Toxicity values are not available through TCEQ for quantifying risks to due to arsenic.	EPA toxicity values were used to estimate a total risk and HI for arsenic exposures to construction workers (Section D.6.3.1.1).	Low impact: underestimates risk. The total site risk and HI estimated both with and without arsenic are below TCEQ and EPA acceptable target criteria. Therefore, even though risk is underestimated, the conclusions are unaffected.
Toxicity values are not available through TCEQ for quantifying risks to due to dioxins and furans.	TCEQ's TEF approach was used to calculate a total 2,3,7,8-TCDD TEQ, then compared to the TRRP industrial soil PCL.	Low impact: underestimates cancer risks; however, because TEQ values are much less than the industrial soil PCL, the magnitude of underestimated risks are negligible.
Several COPCs (alpha-BHC, heptachlor, and heptachlor epoxide) are not evaluated for the inhalation pathway for the noncancer endpoint for the construction worker because inhalation RfDs are not available.	Direct ingestion represents the primary exposure pathway for onsite receptors exposed to COPCs in soil; therefore, the lack of inhalation toxicity values for some COPCs is not a major source of uncertainty.	Low impact: underestimates risk.
Uncertainty in Risk Characterization		
Groundwater transport of onsite COPCs in soil, soil gas, and perched groundwater to onsite and offsite receptors in perched groundwater and Ogallala Aquifer.	Tier 2 dilution screening and Tier 3 travel time analysis indicate no COPCs will reach an offsite POE.	Negligible impact. Uncertainty in the Tier 2 and Tier 3 analysis is high but is not expected to impact the conclusion that COPCs will not reach an onsite or offsite POE within 1000 years because the model is consistent with the site investigation data and other evidence supports the results of the analysis at FTA.

E.2 CONCLUSIONS AND COCS FOR FTA

This section integrates the risk characterization results and uncertainty analysis to identify exposure media/receptor combinations that may represent an unacceptable risk at FTA. COCs are documented where potential unacceptable risks are identified.

COCs are defined as COPCs having an individual ILCR greater than 1.0E-06 and/or an HQ greater than 1 or substantially contributing to a cumulative ILCR greater than 1.0E-06 and/or an HI greater than 1, unless weight of evidence factors indicate this chemical does not represent an unacceptable risk, as noted below.

E.2.1 Conclusions and COCs for FTA Onsite Receptors

E.2.1.1 Onsite Soil

Two onsite exposure scenarios are quantitatively evaluated for FTA:

- Current/future industrial worker exposed to surface soil (0 to 2 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air.

- Current/future construction worker exposed to soil (0 to 15 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air.

Current and future risks were evaluated for these receptors/pathways at FTA. All calculated risks and hazards are below target risk criteria; therefore, no COCs are identified for onsite soil (0 to 2 ft and 0 to 15 ft depth intervals).

E.2.1.2 Onsite Groundwater

Future industrial and construction/excavation workers exposure to COPCs in groundwater (Ogallala Aquifer) is dependant on COPCs in soil and/or perched groundwater migrating to Pantex Plant production wells in the Ogallala Aquifer. Results of the subsurface transport modeling indicate exposure of onsite workers to groundwater COPCs originating from FTA is an incomplete pathway and, therefore, does not contribute to risk to these receptors.

Due to the presence of a construction debris landfill at the FTA, there is some uncertainty with regard to future ponding or focused recharge of surface water if the landfill cover is not maintained. For this reason, Pantex has agreed to include all landfills in the long-term stewardship program to maintain the landfill covers.

Appendix F

Landfill Release Units Requiring Remedial Action

SWMU 54: Landfill 13
SWMU 55: Landfill 2
SWMU 56: Landfill 13
SWMU 57: Landfill 15
SVS 6: Unnumbered Zone 7 Landfills
SVS 7a&b: Magazine Demolition Debris Landfills (Zones 4 & 5)

Contains excerpts from Appendix G of the
Baseline HHRA Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groundwater (BWXT Pantex and SAIC, December 2006)

Contains modified excerpts from Appendix A of the
Baseline HHRA Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groundwater (BWXT Pantex and SAIC, December 2006)

RELEASE OF INFORMATION TO THE PUBLIC
DOCUMENTED REVIEW PROCESS
(Ref. WI 02.04.02.02.03)

Document Title Baseline Human Health Risk Assessment Report for Zones 10, 11, and 12 , Fire Training Area, Ditches and Playas, Independent Sites, and Groudnwater – Volumes I and II Date 12/9/2005
Document Author Michelle Bolwahnn Type of Doc Report

Document Due Date 12-22-2005 Blanket Release Expires

This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☒ No ☐	[signature] for M.G. Knight	DEC 0 9 2005
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐	[signature]	12/13/05
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐	[signature]	12/13/05
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐	[signature]	12/12/05
Legal 12-72 Legal	Legal	Yes ☑ No ☐	Dean A. Cooke	01/09/05
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐	[signature] T. Kelly	01/10/2005

After all signatures are obtained, forward copy via email or plant mail
to the Classification Officer and OSTI Transmittal Officer

Comments: **Please call Marlon Smith (x4058) or Michelle Bolwahnn (6326) for pickup after signature**

Please see attached comments J x6616
* with revised Exy. Summary and various changes already made

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F.0 LANDFILL RELEASE UNITS REQUIRING REMEDIAL ACTION

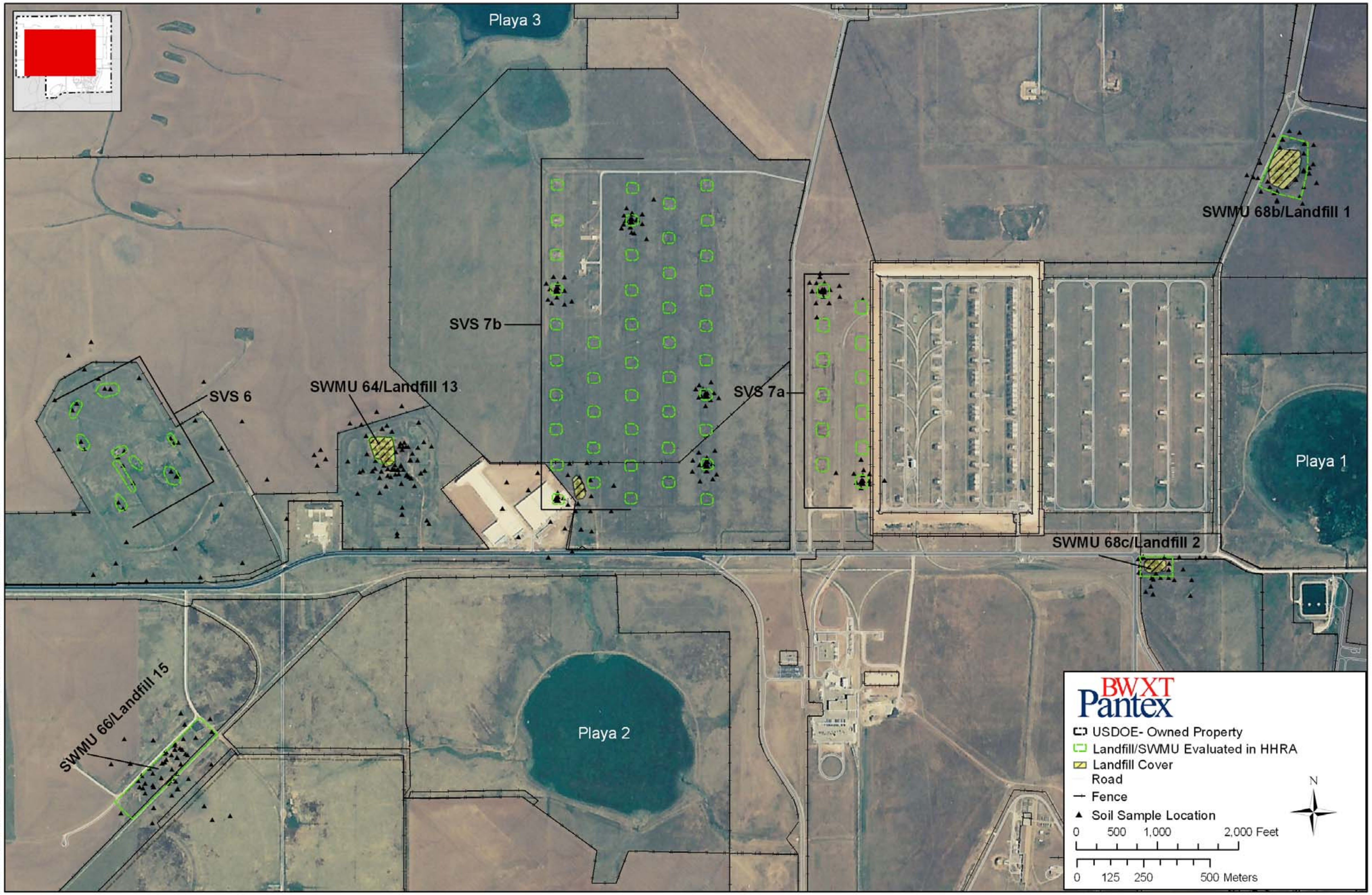

Figure F-1. Landfill

Table F-1. Complete Starting List of Soil and Groundwater COPCs at Landfill 1 (SWMU 68b) and Landfill 2 (SWMU 68c)[a]

COPC	*Ditches and Playas RFIR* (Stoller, 2003)		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas[b]	Groundwater
HEs			
1,3-Dinitrobenzene	--	--	√[c]
2,4-Dinitrotoluene	--	--	√
2,6-Dinitrotoluene	--	--	√[c]
2-Amino-4,6-dinitrotoluene	--	--	√
4-Amino-2,6-dinitrotoluene	--	--	√
HMX	√	--	√[c]
RDX	√	--	√
Tetryl	--	--	--
1,3,5-Trinitrobenzene	√	--	√
TNT	√	--	√
Metals			
Aluminum	√	--	--
Antimony	√	--	--
Arsenic	√	--	--
Barium	√	--	--
Beryllium	√	--	--
Boron	R[d]	--	√
Cadmium	√	--	--
Chromium, Total	√	--	√
Chromium, Hexavalent	√	--	√
Cobalt	√	--	--
Copper	√	--	--
Lead	√	--	--
Mercury	√	--	--
Manganese	√	--	--
Molybdenum	√	--	--
Nickel	√	--	R[e]
Selenium	√[f]	--	√[c]
Silver	√	--	--

Table F-1. Complete Starting List of Soil and Groundwater COPCs at Landfill 1 (SWMU 68b) and Landfill 2 (SWMU 68c)[a] (continued)

	***Ditches and Playas RFIR* (Stoller, 2003)**		***Groundwater RFIR* (Stoller, 2004)**
COPC	**Soil**	**Soil Gas[b]**	**Groundwater**
Strontium	√	--	--
Tin	R[d]	--	R[e]
Thallium	√[f]	--	--
Total Uranium	√[g]	--	--
Vanadium	√	--	--
Zinc	√	--	--
Miscellaneous			
Cyanide	--	--	R[e]
Nitrate as N	--	--	√[c]
Perchlorate	--	--	√[c]
Pesticides			
Aldrin	√	--	--
Beta-BHC	√	--	--
Delta-BHC	√	--	--
Gamma-BHC	√	--	--
Alpha-Chlordane	√	--	--
Beta-Chlordane	√	--	--
4,4'-DDD	√	--	--
4,4'-DDE	√	--	--
4,4'-DDT	√	--	--
Dieldrin	√	--	--
Endosulfan sulfate	√	--	--
Endrin	√	--	--
Endrin aldehyde	√	--	--
Endrin ketone	√	--	--
Heptachlor	√	--	--
Heptachlor epoxide	√	--	--
Methoxychlor	√	--	--
PCBs			
PCB-1242	√	--	--
PCB-1248	√	--	--

Table F-1. Complete Starting List of Soil and Groundwater COPCs at Landfill 1 (SWMU 68b) and Landfill 2 (SWMU 68c)[a] (continued)

COPC	*Ditches and Playas RFIR* (Stoller, 2003)		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas[b]	Groundwater
PCB-1254	√	--	--
Radionuclides			
Tritium	√[g]	--	--
$^{233/234}U$	R[h]	--	--
^{235}U	√[g]	--	--
^{238}U	R[h]	--	--
SVOCs			
Acenaphthene	√	--	--
Acenaphthylene	√	--	--
Anthracene	√	--	--
bis(2-Chloroethyl)ether	√	--	--
bis(2-Ethylhexyl)phthalate	√	--	--
Benzo(a)anthracene	√	--	--
Benzo(a)pyrene	√	--	--
Benzo(b)fluoranthene	√	--	--
Benzo(g,h,i)perylene	√	--	--
Benzo(k)fluoranthene	√	--	--
Butylbenzylphthalate	√	--	--
Carbazole	√	--	--
Chrysene	√	--	--
Dibenz(a,h)anthracene	√	--	--
Dibenzofuran	√	--	--
1,4-Dichlorobenzene	√	--	--
Diethyl phthalate	√	--	--
Di-n-butyl phthalate	√	--	--
Fluorene	√	--	--
Fluoranthene	√	--	--
Indeno(1,2,3-c,d)pyrene	√	--	--
4-Methylphenol	√	--	--
2-Methylnaphthalene	√	--	--
Naphthalene	√	--	--

Table F-1. Complete Starting List of Soil and Groundwater COPCs at Landfill 1 (SWMU 68b) and Landfill 2 (SWMU 68c)[a] (continued)

COPC	*Ditches and Playas RFIR* (Stoller, 2003)		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas[b]	Groundwater
Phenanthrene	√	--	--
Phenol	√	--	--
Pyrene	√	--	--
VOCs			
Acetone	√	√	--
Acrylonitrile	R[d]	--	--
Benzene	--	√	--
Bromomethane	√	--	--
Carbon disulfide	--	√	--
Chloroethane	√	--	--
Chloroform	--	√	√[c]
Chloromethane	√	--	--
1,2-Dichlorobenzene	√	--	--
Dichlorodifluoromethane	--	√	--
1,1-Dichloroethane	--	√	√[c]
1,1-Dichloroethene	√	√	--
Cis-1,2-Dichloroethene	--	√	--
Ethylbenzene	√	√	--
Freon-113	--	√	--
Freon-114	--	√	--
2-Hexanone	√	--	--
Methyl ethyl ketone	--	√	--
Methyl isobutyl ketone	√	--	--
Methylene chloride	√	√	--
Nonanal	R[d]	--	--
Styrene	--	√	--
Tetrachloroethylene	--	√	√[c]
Toluene	--	√	--
1,1,1-Trichloroethane	--	√	--
Trichloroethene	--	√	√[c]

Table F-1. Complete Starting List of Soil and Groundwater COPCs at Landfill 1 (SWMU 68b) and Landfill 2 (SWMU 68c)[a] (continued)

COPC	*Ditches and Playas RFIR* (Stoller, 2003)		*Groundwater RFIR* (Stoller, 2004)
	Soil	Soil Gas[b]	Groundwater
Trichlorofluoromethane	--	√	--
1,2,4-Trimethylbenzene	--	√	--
Vinyl chloride	√	--	--
M,p-Xylene	--	√	--
o-Xylenes	--	√	--
Xylenes	√	--	--

[a] Unless otherwise stated, all soil and soil gas COPCs come from the Table 6.2-1 and 6.2.2 in the *Ditches and Playas RFIR* (Stoller, 2004) and all groundwater COPCs are listed in Figure 13.2-9 in the *Groundwater RFIR* (Stoller, 2004).
[b] Soil gas COPCs are only applicable for Landfill 1 (SWMU 68b).
[c] Compound was not listed in the CSM for Ditches and Playas in the *Groundwater RFIR* (Stoller, 2004), but it is a sitewide groundwater COPC. See discussion in Appendix I.
[d] Compound was identified for WMG 11 in the *Ditches and Playas RFIR* (Stoller, 2004), but was removed from the starting list because the WMG 11 data for these compounds exist outside the boundaries of these SWMUs.
[e] Groundwater COPC is from the CSM Figure 13.2-9 of the *Groundwater RFIR* (Stoller, 2004), but it is not a sitewide groundwater COPC in Appendix I.
[f] Metal was added to COPC list because all detected metals are re-evaluated based on availability of new background RRS 1 values.
[g] Tritium, total uranium, and ^{235}U have no background for comparison to determine if they are a COPC and have been carried forward to this evaluation.
[h] Compound was not identified in the *RI Report* (BWXT Pantex, 2004) as a radiological COPC for Landfills 1 and 2.

√ COPC for medium

-- not a COPC for medium

R - Removed from COPC evaluation starting list.

Table F-2. Complete Starting List of Soil and Groundwater COPCs at Landfill 13 (SWMU 64)[a]

COPC	*Independent Sites RFIR* (Stoller, 2004)	*Groundwater RFIR* (Stoller, 2004)
	Soil	Groundwater
HEs		
1,3-Dinitrobenzene	--	√[b]
2,4-Dinitrotoluene	--	√[b]
2,6-Dinitrotoluene	--	√[b]
2-Amino-4,6-dinitrotoluene	--	√[b]
4-Amino-2,6-dinitrotoluene	--	√[b]
HMX	√	√[b]
RDX	√	√[b]
Tetryl	√	--
1,3,5-Trinitrobenzene	--	√[b]
TNT	--	√[b]
Metals		
Arsenic	√	--
Barium	√	--
Boron	--	√[b]
Cadmium	√	--
Chromium, Total	√	√[b]
Chromium, Hexavalent	--	√[b]
Copper	√	--
Lead	√	--
Mercury	√	--
Manganese	√	--
Nickel	√	--
Selenium	√	√[b]
Silver	√	--
Total Uranium	√[c]	--
Zinc	√	--
Miscellaneous		
Nitrate as N	--	√[b]
Perchlorate	--	√[b]

Table F-2. Complete Starting List of Soil and Groundwater COPCs at Landfill 13 (SWMU 64)[a] (continued)

COPC	*Independent Sites RFIR* (Stoller, 2004) Soil	*Groundwater RFIR* (Stoller, 2004) Groundwater
Pesticides		
Alpha-BHC	√	--
Delta-BHC	√	--
Gamma-BHC	√	--
Beta-Chlordane	√	--
4,4'-DDD	√	--
4,4'-DDE	√	--
4,4'-DDT	√	--
Dieldrin	√	--
Endosulfan sulfate	√	--
Endrin	√	--
Endrin aldehyde	√	--
Endrin ketone	√	--
Heptachlor	√	--
Heptachlor epoxide	√	--
Methoxychlor	√	--
Radionuclides		
^{235}U	√[c]	--
SVOCs		
Acenaphthene	√	--
Anthracene	√	--
bis(2-Ethylhexyl)phthalate	√	--
Benzo(a)anthracene	√	--
Benzo(a)pyrene	√	--
Benzo(b)fluoranthene	√	--
Benzo(g,h,i)perylene	√	--
Benzo(k)fluoranthene	√	--
Carbazole	√	--
Chrysene	√	--
Dibenz(a,h)anthracene	√	--

Table F-2. Complete Starting List of Soil and Groundwater COPCs at Landfill 13 (SWMU 64)[a] (continued)

COPC	*Independent Sites RFIR* (Stoller, 2004)	*Groundwater RFIR* (Stoller, 2004)
	Soil	Groundwater
Dibenzofuran	√	--
Diethyl phthalate	√	--
2,4-Dimethylphenol	√	--
Di-n-butyl phthalate	√	--
Fluorene	√	--
Fluoranthene	√	--
Indeno(1,2,3-c,d)pyrene	√	--
4-Methylphenol	√	--
2-Methylnaphthalene	√	--
Naphthalene	√	--
n-Nitrosodiphenylamine	√	--
Pentachlorophenol	√	--
Phenanthrene	√	--
Phenol	√	--
Pyrene	√	--
VOCs		
Acetone	√	--
1,2-Dichloroethane	--	√[b]
Chloroform	--	√[b]
Ethylbenzene	√	--
Methylene chloride	√	--
Tetrachloroethylene	--	√[b]
Toluene	√	--
Trichloroethene	--	√[b]
Xylenes	√	--

[a] Unless otherwise stated, all starting list COPCs come from the *Independent Sites RFIR* (Stoller, 2004).
[b] The *Groundwater RFIR* (Stoller, 2004) did not identify any groundwater COPCs for the Independent Sites. All groundwater COPCs listed come from the sitewide groundwater COPC list explained in Appendix I.
[c] Total Uranium and ^{235}U have no background for comparison as a COPC and have been carried forward to this evaluationfor SWMU 64 (Landfill 13).

√ COPC for medium

-- not a COPC for medium
R - Removed from COPC evaluation starting list.

Table F-3. Complete Starting List of Soil and Groundwater COPCs at Landfill 15 (SWMU 66)[a]

COPC	*Independent Sites RFIR* (Stoller, 2004) Soil	*Groundwater RFIR* (Stoller, 2004) Groundwater
HEs		
1,3-Dinitrobenzene	--	√[b]
2,4-Dinitrotoluene	--	√[b]
2,6-Dinitrotoluene	--	√[b]
2-Amino-4,6-dinitrotoluene	--	√[b]
4-Amino-2,6-dinitrotoluene	--	√[b]
HMX	--	√[b]
RDX	--	√[b]
1,3,5-Trinitrobenzene	--	√[b]
TNT	--	√[b]
Metals		
Aluminum	√	--
Barium	√	--
Boron	--	√[b]
Cadmium	√	--
Chromium, Total	--	√[b]
Chromium, Hexavalent	--	√[b]
Lead	√	--
Manganese	√	--
Selenium	--	√[b]
Strontium	√	--
Zinc	√	--
Miscellaneous		
Nitrate as N	--	√[b]
Perchlorate	--	√[b]
Pesticides		
Alpha-Chlordane	√	--
SVOCs		
Benzo(g,h,i)perylene	√	--
Benzyl alcohol	√	--
bis(2-Ethylhexyl)phthalate	√	--

Table F-3. Complete Starting List of Soil and Groundwater COPCs at Landfill 15 (SWMU 66)[a] (continued)

COPC	*Independent Sites RFIR* (Stoller, 2004) Soil	*Groundwater RFIR* (Stoller, 2004)[b] Groundwater
Fluoranthene	√	--
Phenanthrene	√	--
Pyrene	√	--
VOCs		
1,2-Dichloroethane	--	√[b]
Chloroform	--	√[b]
Ethyl benzene	√	--
Methylene chloride	√	--
Tetrachloroethylene	--	√[b]
Toluene	√	--
Trichloroethene	--	√[b]
Styrene	√	--
Xylenes	√	--

[a] Unless otherwise stated, all starting list COPCs come from the *Independent Sites RFIR* (Stoller, 2004).
[b] The *Groundwater RFIR* (Stoller, 2004) did not identify any groundwater COPCs for the Independent Sites. All groundwater COPCs listed come from the sitewide groundwater COPC list explained in Appendix I.
√ COPC for medium
-- not a COPC for medium
R - Removed from COPC evaluation starting list.

Table F-4. Complete Starting List of Soil and Groundwater COPCs at SVS 6[a]

COPC	*Independent Sites RFIR* (Stoller, 2004) Soil	*Groundwater RFIR* (Stoller, 2004) Groundwater
HEs		
1,3-Dinitrobenzene	--	√[b]
2,4-Dinitrotoluene	--	√[b]
2,6-Dinitrotoluene	--	√[b]
2-Amino-4,6-dinitrotoluene	--	√[b]
4-Amino-2,6-dinitrotoluene	--	√[b]
HMX	--	√[b]
RDX	--	√[b]
1,3,5-Trinitrobenzene	--	√[b]
TNT	--	√[b]
Metals		
Barium	√	--
Boron	--	√[b]
Cadmium	√	--
Chromium, Total	--	√[b]
Chromium, Hexavalent	--	√[b]
Lead	√	--
Selenium	--	√[b]
Miscellaneous		
Nitrate as N	--	√[b]
Perchlorate	--	√[b]
SVOCs		
bis(2-Ethylhexyl)phthalate	√	--
Benzo(b)fluoranthene	√	--
Benzo(k)fluoranthene	√	--
Chrysene	√	--
Fluoranthene	√	--
Pyrene	√	--
VOCs		

Table F-4. Complete Starting List of Soil and Groundwater COPCs at SVS 6[a] (continued)

COPC	*Independent Sites RFIR* (Stoller, 2004) Soil	*Groundwater RFIR* (Stoller, 2004) Groundwater
1,2-Dichloroethane	--	√[b]
Chloroform	--	√[b]
Tetrachloroethylene	--	√[b]
Trichloroethene	--	√[b]
Toluene	√	--

[a] Unless otherwise stated, all soil COPCs are listed in Table 6.2-1 in the *Independent Sites RFIR* (Stoller, 2004).
[b] The *Groundwater RFIR* (Stoller, 2004) did not identify any groundwater COPCs for the Independent Sites. All groundwater COPCs listed come from the sitewide groundwater COPC list explained in Appendix I.
√ COPC for medium
-- not a COPC for medium
R - Removed from COPC evaluation starting list

Table F-5. Complete Starting List of Soil and Groundwater COPCs at SVS 7a[a]

COPC	*Independent Sites RFIR* (Stoller, 2004)	*Groundwater RFIR* (Stoller, 2004)
	Soil	Groundwater
	HEs	
1,3-Dinitrobenzene	--	√[b]
2,4-Dinitrotoluene	--	√[b]
2,6-Dinitrotoluene	--	√[b]
2-Amino-4,6-dinitrotoluene	--	√[b]
4-Amino-2,6-dinitrotoluene	--	√[b]
HMX	--	√[b]
RDX	--	√[b]
1,3,5-Trinitrobenzene	--	√[b]
TNT	--	√[b]
	Metals	
Boron	--	√[b]
Chromium, Total	--	√[b]
Chromium, Hexavalent	--	√[b]
Lead	√	--
Selenium	--	√[b]
	Miscellaneous	
Nitrate as N	--	√[b]
Perchlorate	--	√[b]
	VOCs	
Acetone	√	--
Chloroform	--	√[b]
1,2-Dichloroethane	--	√[b]
Methylene Chloride	√	--
Tetrachloroethylene	--	√[b]
Trichloroethene	--	√[b]

[a] Unless otherwise stated, all soil COPCs are listed in Table 6.2-1 in the *Independent Sites RFIR* (Stoller, 2004).
[b] The *Groundwater RFIR* (Stoller, 2004) did not identify any groundwater COPCs for the Independent Sites. All groundwater COPCs listed come from the sitewide groundwater COPC list explained in Appendix I.

√ COPC for medium

-- not a COPC for medium

R - Removed from COPC evaluation starting list

Table F-6. Complete Starting List of Soil and Groundwater COPCs at SVS 7b[a]

COPC	*Independent Sites RFIR* (Stoller, 2004) Soil	*Groundwater RFIR* (Stoller, 2004) Groundwater
HEs		
1,3-Dinitrobenzene	--	√[b]
2,4-Dinitrotoluene	--	√[b]
2,6-Dinitrotoluene	--	√[b]
2-Amino-4,6-dinitrotoluene	--	√[b]
4-Amino-2,6-dinitrotoluene	--	√[b]
HMX	--	√[b]
RDX	--	√[b]
1,3,5-Trinitrobenzene	--	√[b]
TNT	--	√[b]
Metals		
Barium	√	--
Boron	--	√[b]
Cadmium	√	--
Chromium, Total	--	√[b]
Chromium, Hexavalent	--	√[b]
Lead	√	--
Selenium	--	√[b]
Miscellaneous		
Nitrate as N	--	√[b]
Perchlorate	--	√[b]
SVOCs		
Acenaphthene	√	--
Anthracene	√	--
Benzo(a)anthracene	√	--
Benzo(a)pyrene	√	--
Benzo(b)fluoranthene	√	--
Benzo(g,h,i)perylene	√	--
Chrysene	√	--
Fluorene	√	--

Table F-6. Complete Starting List of Soil and Groundwater COPCs at SVS 7b[a] (continued)

COPC	*Independent Sites RFIR* (Stoller, 2004)[a] Soil	*Groundwater RFIR* (Stoller, 2004) Groundwater
Fluoranthene	√	--
Indeno(1,2,3-c,d)pyrene	√	--
Naphthalene	√	--
Phenanthrene	√	--
Pyrene	√	--
	VOCs	
Acetone	√	--
Chloroform	--	√[b]
1,2-Dichloroethane	--	√[b]
Ethylbenzene	√	--
Methylene Chloride	√	--
Methyl ethyl ketone	√	--
Tetrachloroethylene	--	√[b]
Toluene	√	--
Trichloroethene	--	√[b]
Xylenes	√	--

[a] Unless otherwise stated, all soil COPCs are listed in Table 6.2-1 in the *Independent Sites RFIR* (Stoller, 2004).
[b] The *Groundwater RFIR* (Stoller, 2004) did not identify any groundwater COPCs for the Independent Sites. All groundwater COPCs listed come from the sitewide groundwater COPC list explained in Appendix I.

√ COPC for medium

-- not a COPC for medium
R - Removed from COPC evaluation starting list.

Table F-7. COPCs Retained for Further Evaluation in the Landfills HHRA Surface Soils (0-2 ft) for the Industrial Worker

COPCs	COPCs Retained by SWMU						
	SWMU 68b	SWMU 68c	SWMU 64	SWMU 66[a]	SVS 6[a]	SVS 7a[a]	SVS 7b
Metals							
Mercury	--	--	√	--	--	--	--
Uranium, Total	√	--	--	--	--	--	--
Pesticides							
Beta-Chlordane	--	√	--	--	--	--	--
Radionuclides							
^{235}U	--	√	--	--	--	--	--
SVOCs							
Benzo(a)anthracene	√	--	√	--	--	--	√
Benzo(a)pyrene	√	√	√	--	--	--	√
Benzo(b)fluoranthene	√	--	√	--	--	--	√
Dibenz(a,h)anthracene	√	√	√	--	--	--	--
Indeno(1,2,3-c,d)pyrene	√	--	√	--	--	--	√

[a] No COPCs were retained for further evaluation.

√ COPC for medium

-- Not a COPC for medium

Table F-8. COPCs Retained for Further Evaluation in the Landfills HHRA Soils (0-15 ft) for the Construction/Excavation Worker

COPCs	COPCs Retained by SWMU						
	SWMU 68b	SWMU 68c	SWMU 64	SWMU 66	SVS 6	SVS 7a[a]	SVS 7b
HEs							
RDX	√	--	√	--	--	--	--
Metals							
Aluminum	√	--	--	--	--	--	--
Arsenic	√	--	--	--	--	--	--
Barium	√	--	√	√	√	--	√
Beryllium	√	--	--	--	--	--	--
Cadmium	√	√	√	--	--	--	--
Copper	√	--	√	--	--	--	--
Lead	√	--	--	--	--	--	--
Mercury	√	√	√	--	--	--	--
Uranium, Total	√	--	--	--	--	--	--
Vanadium	√	--	--	--	--	--	--
Pesticides							
Aldrin	√	√	--	--	--	--	--
Alpha-BHC	--	--	√	--	--	--	--
Beta-chlordane	√	√	√	--	--	--	--
Dieldrin	--	--	√	--	--	--	--
Heptachlor	--	√	√	--	--	--	--
Radionuclides							
^{235}U	--	√	--	--	--	--	--
SVOCs							
2-Methylnaphthalene	--	--	√	--	--	--	--
4-Methylphenol (p-Cresol)	--	--	√	--	--	--	--
Acenaphthene	--	--	√	--	--	--	--
Benzo(a)anthracene	√	√	√	--	--	--	√
Benzo(a)pyrene	√	√	√	--	--	--	√
Benzo(b)fluoranthene	√	√	√	--	--	--	√
Benzo(g,h,i)perylene	--	--	√	--	--	--	--
Benzo(k)fluoranthene	--	--	√	--	--	--	--
Carbazole	--	--	√	--	--	--	--

Table F-8. COPCs Retained for Further Evaluation in the Landfills HHRA Soils (0-15 ft) for the Construction/Excavation Worker (continued)

COPCs	COPCs Retained by SWMU						
	SWMU 68b	SWMU 68c	SWMU 64	SWMU 66	SVS 6	SVS 7a[a]	SVS 7b
Chrysene	--	--	√	--	--	--	--
Dibenz(a,h)Anthracene	√	√	√	--	--	--	--
Dibenzofuran	--	--	√	--	--	--	--
Fluoranthene	--	--	√	--	--	--	--
Fluorene	--	--	√	--	--	--	--
Indeno(1,2,3-c,d)Pyrene	√	√	√	--	--	--	√
Naphthalene	--	--	√	--	--	--	--
Phenanthrene	--	--	√	--	--	--	--
Pyrene	--	--	√	--	--	--	--
VOCs							
Bromomethane	--	√	--	--	--	--	--
Chloromethane	--	√	--	--	--	--	--
Vinyl Chloride	--	√	--	--	--	--	--

[a] No COPCs were retained for further evaluation.

√ COPC for medium

-- Not a COPC for medium

Table F-9. COPCs Retained for Further Evaluation in the Landfills HHRA Soil-to-Groundwater Pathway

COPCs	COPCs Retained by SWMU						
	SWMU 68b	SWMU 68c	SWMU 64	SWMU 66	SVS 6	SVS 7a	SVS 7b
HEs							
RDX	√	--	√	--	--	--	--
Metals							
Arsenic	√	√	√	--	--	--	--
Barium	√	√	√	√	√	--	√
Cadmium	√	√	√	√	√	--	√
Chromium, Total	√	--	√	--	--	--	--
Copper	√	--	√	--	--	--	--
Lead	√	√	√	√	√	√	√
Manganese	√	√	√	√	--	--	--
Uranium, Total	√	√	√	--	--	--	--
Vanadium	√	--	--	--	--	--	--
Zinc	√	--	√	--	--	--	--
PCBs							
Total PCB	√	√	--	--	--	--	--
Pesticides							
4,4'-DDD	√	--	√	--	--	--	--
4,4'-DDE	√	--	√	--	--	--	--
4,4'-DDT	√	√	√	--	--	--	--
Aldrin	√	√	--	--	--	--	--
Alpha-BHC	--	--	√	--	--	--	--
Beta-chlordane	√	√	√	--	--	--	--
Delta-BHC	--	√	√	--	--	--	--
Dieldrin	√	√	√	--	--	--	--
Endrin	--	--	√	--	--	--	--
Gamma-BHC	--	√	√	--	--	--	--
Heptachlor	--	√	√	--	--	--	--
Heptachlor epoxide	--	--	√	--	--	--	--
SVOCs							
4-Methylphenol	--	--	√	--	--	--	--

Table F-9. COPCs Retained for Further Evaluation in the Landfills HHRA Soil-to-Groundwater Pathway (continued)

COPCs	COPCs Retained by SWMU						
	SWMU 68b	SWMU 68c	SWMU 64	SWMU 66	SVS 6	SVS 7a	SVS 7b
1,4-Dichlorobenzene	--	√	--	--	--	--	--
Acenaphthene	--	--	√	--	--	--	--
Benzo(a)anthracene	--	--	√	--	--	--	--
Benzo(a)pyrene	--	--	√	--	--	--	--
Benzo(b)fluoranthene	--	--	√	--	--	--	--
Benzo(k)fluoranthene	--	--	√	--	--	--	--
bis(2-Ethylhexyl)phthalate	√	√	--	√	√	--	--
Carbazole	--	--	√	--	--	--	--
Chrysene	√	--	√	--	--	--	--
Dibenz(a,h)anthracene	--	--	√	--	--	--	--
Indeno(1,2,3-c,d)pyrene	√	--	√	--	--	--	--
Pentachlorophenol	--	--	√	--	--	--	--
VOCs							
Methylene chloride	--	√	--	--	--	--	--
Vinyl chloride	--	√	--	--	--	--	--

√ COPC for medium

-- Not a COPC for medium

Table F-10. COPCs Retained for Further Evaluation at Landfill 1 (SWMU 68b) in the Landfills HHRA[a] Soil Gas-to-Groundwater Pathway

COPC	Shallow	Intermediate
Freon-114	√	--
Trichloroethene	√	--

[a] No other unit included in Appendix G has soil gas data.

√ COPC for medium

-- Not a COPC for medium

Table F-11. COPCs Retained for Further Evaluation in the Landfills HHRA Perched Groundwater

COPC	SWMU 68b		SWMU 68c		SWMU 64		SWMU 66		SVS 6		SVS 7a		SVS 7b	
	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
HEs														
2,6-Dinitrotoluene	NA	√	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
RDX	NA	√	NA	√	NA	--	NA	--	NA	--	NA	--	NA	--
Metals														
Boron	--	√	√	√	--	--	--	--	--	--	--	--	--	--

NA – not applicable, filtered results available for metals analysis only

√ COPC for medium

-- not a COPC for medium

Table F-12. EPC Evaluation Surface Soil (0-2 ft) SWMU 68b (Landfill 1)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals									
Uranium, Total	7440-61-1	5	5	mg/kg	1.15E+00	2.84E+02	NA	--	2.84E+02
SVOCs									
Benzo(a)Anthracene	56-55-3	14	2	mg/kg	9.50E+00	1.10E+01	D	3.39E+00	3.39E+00
Benzo(a)Pyrene	50-32-8	14	2	mg/kg	7.70E+00	9.30E+00	D	2.84E+00	2.84E+00
Benzo(b)Fluoranthene	205-99-2	14	2	mg/kg	1.20E+01	1.20E+01	D	3.93E+00	3.93E+00
Dibenz(a,h)Anthracene	53-70-3	14	1	mg/kg	1.60E+00	1.60E+00	D	5.13E-01	5.13E-01
Indeno(1,2,3-c,d)Pyrene	193-39-5	14	2	mg/kg	4.70E+00	4.80E+00	D	1.65E+00	1.65E+00

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table F-13. EPC Evaluation Soil (0-15 ft) SWMU 68b (Landfill 1)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
HEs									
RDX	121-82-4	54	10	mg/kg	1.90E-01	3.72E+02	D	2.23E+01	2.23E+01
Metals									
Aluminum	7429-90-5	61	61	mg/kg	4.19E+03	1.00E+05	L	2.57E+04	2.57E+04
Arsenic	7440-38-2	67	66	mg/kg	4.30E-01	1.31E+02	X	1.17E+01	1.17E+01
Barium	7440-39-3	64	63	mg/kg	7.50E+01	6.68E+03	X	5.16E+02	5.16E+02
Beryllium	7440-41-7	64	33	mg/kg	2.00E-01	1.10E+01	X	1.06E+00	1.06E+00
Cadmium	7440-43-9	83	33	mg/kg	3.00E-01	1.20E+03	D	4.39E+01	4.39E+01
Copper	7440-50-8	64	56	mg/kg	5.90E+00	2.04E+05	X	8.55E+03	8.55E+03
Lead	7439-92-1	96	82	mg/kg	5.30E+00	4.80E+04	X	1.80E+03	1.80E+03
Mercury	7439-97-6	70	20	mg/kg	2.10E-02	1.80E+00	D	1.90E-01	1.90E-01
Uranium, Total	7440-61-1	30	29	mg/kg	9.60E-01	2.84E+02	X	3.79E+01	3.79E+01
Vanadium	7440-62-2	60	59	mg/kg	1.34E+01	1.31E+04	X	6.15E+02	6.15E+02
Pesticides									
Aldrin	309-00-2	76	5	mg/kg	3.27E-04	3.60E-02	D	2.58E-03	2.58E-03
Beta-Chlordane	5103-74-2	31	6	mg/kg	5.80E-04	1.70E-02	D	2.56E-03	2.56E-03
SVOCs									
Benzo(a)Anthracene	56-55-3	66	7	mg/kg	3.80E-02	1.10E+01	D	8.64E-01	8.64E-01
Benzo(a)Pyrene	50-32-8	66	6	mg/kg	5.40E-02	9.30E+00	D	7.52E-01	7.52E-01
Benzo(b)Fluoranthene	205-99-2	66	7	mg/kg	4.00E-02	1.20E+01	D	9.92E-01	9.92E-01
Dibenz(a,h)Anthracene	53-70-3	66	1	mg/kg	1.60E+00	1.60E+00	D	2.45E-01	2.45E-01
Indeno(1,2,3-c,d)Pyrene	193-39-5	66	6	mg/kg	3.90E-02	4.80E+00	D	4.94E-01	4.94E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table F-14. EPC Evaluation Surface Soil (0-2 ft) SWMU 68c (Landfill 2)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Pesticides									
Beta-Chlordane	5103-74-2	8	3	mg/kg	7.03E-03	1.82E-02	NA	--	1.82E-02
SVOCs									
Benzo(a)Pyrene	50-32-8	9	1	mg/kg	3.40E-01	3.40E-01	NA	--	3.40E-01
Dibenz(a,h)Anthracene	53-70-3	9	1	mg/kg	6.40E-02	6.40E-02	NA	--	6.40E-02
Radionuclides									
^{235}U	15117-96-1	11	8	pCi/g	5.20E-02	2.01E-01	L	1.17E-01	1.17E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table F-15. EPC Evaluation Soil (0-15 ft) SWMU 68c (Landfill 2)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals									
Cadmium	7440-43-9	31	6	mg/kg	4.00E-01	5.70E+00	D	8.62E-01	8.62E-01
Mercury	7439-97-6	32	4	mg/kg	2.70E-01	2.90E+00	D	3.26E-01	3.26E-01
Pesticides									
Aldrin	309-00-2	35	4	mg/kg	1.47E-03	1.33E-01	D	1.52E-02	1.52E-02
Beta-Chlordane	5103-74-2	20	5	mg/kg	4.03E-03	1.82E-02	D	5.84E-03	5.84E-03
Heptachlor	76-44-8	32	4	mg/kg	1.59E-03	1.29E-01	D	1.69E-02	1.69E-02
Radionuclides									
^{235}U	15117-96-1	22	19	pCi/g	3.65E-02	2.01E-01	L	9.75E-02	9.75E-02
SVOCs									
Benzo(a)Anthracene	56-55-3	30	3	mg/kg	4.40E-02	3.10E+00	D	7.94E-01	7.94E-01
Benzo(a)Pyrene	50-32-8	30	2	mg/kg	3.40E-01	2.70E+00	D	7.75E-01	7.75E-01
Benzo(b)Fluoranthene	205-99-2	30	2	mg/kg	2.70E-01	2.00E+00	D	7.34E-01	7.34E-01
Dibenz(a,h)Anthracene	53-70-3	30	2	mg/kg	6.40E-02	7.00E-01	D	6.79E-01	6.79E-01
Indeno(1,2,3-c,d)Pyrene	193-39-5	30	2	mg/kg	1.80E-01	1.40E+00	D	7.02E-01	7.02E-01
VOCs									
Bromomethane	74-83-9	38	1	mg/kg	1.20E+00	1.20E+00	D	1.26E-01	1.26E-01
Chloromethane	74-87-3	38	1	mg/kg	2.00E+00	2.00E+00	D	1.78E-01	1.78E-01
Vinyl Chloride	75-01-4	40	1	mg/kg	1.80E+00	1.80E+00	D	1.57E-01	1.57E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

Table F-16. EPC Evaluation Surface Soil (0-2 ft) SWMU 64 (Landfill 13)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals									
Mercury	7439-97-6	53	10	mg/kg	2.00E-02	7.00E-01	D	9.09E-02	9.09E-02
SVOCs									
Benzo(a)Anthracene	56-55-3	15	3	mg/kg	4.50E-02	4.60E+00	D	9.77E-01	9.77E-01
Benzo(a)Pyrene	50-32-8	15	3	mg/kg	4.00E-02	3.10E+00	D	6.95E-01	6.95E-01
Benzo(b)Fluoranthene	205-99-2	15	3	mg/kg	4.70E-02	5.50E+00	D	1.14E+00	1.14E+00
Dibenz(a,h)Anthracene	53-70-3	15	1	mg/kg	4.70E-01	4.70E-01	D	2.18E-01	2.18E-01
Indeno(1,2,3-c,d)Pyrene	193-39-5	15	1	mg/kg	2.00E+00	2.00E+00	D	4.99E-01	4.99E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

Table F-17. EPC Evaluation Soil (0-15 ft) SWMU 64 (Landfill 13)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
HEs									
RDX	121-82-4	83	2	mg/kg	1.50E+00	9.20E+00	D	1.14E+00	1.14E+00
Metals									
Barium	7440-39-3	110	110	mg/kg	5.30E+01	1.16E+03	X	2.60E+02	2.60E+02
Cadmium	7440-43-9	105	15	mg/kg	1.90E-01	1.17E+03	D	3.01E+01	3.01E+01
Copper	7440-50-8	102	102	mg/kg	6.00E+00	1.88E+03	X	6.16E+01	6.16E+01
Mercury	7439-97-6	116	21	mg/kg	1.00E-02	2.90E+00	D	2.06E-01	2.06E-01
Pesticides									
Alpha BHC	319-84-6	39	2	mg/kg	2.77E-02	1.02E-01	D	8.71E-03	8.71E-03
Beta-Chlordane	5103-74-2	9	1	mg/kg	5.61E-03	5.61E-03	NA	--	5.61E-03
Dieldrin	60-57-1	39	2	mg/kg	2.08E-02	6.46E-01	D	5.02E-02	5.02E-02
Heptachlor	76-44-8	39	3	mg/kg	7.79E-03	1.27E-01	D	1.19E-02	1.19E-02
SVOCs									
2-Methylnaphthalene	91-57-6	57	8	mg/kg	2.00E-01	8.50E+02	D	5.21E+01	5.21E+01
4-Methylphenol (p-Cresol)	106-44-5	26	2	mg/kg	5.70E+01	1.40E+02	D	2.09E+01	2.09E+01
Acenaphthene	83-32-9	26	9	mg/kg	4.60E-01	1.40E+03	D	2.02E+02	2.02E+02
Benzo(a)Anthracene	56-55-3	61	14	mg/kg	4.50E-02	2.20E+03	D	1.54E+02	1.54E+02
Benzo(a)Pyrene	50-32-8	61	15	mg/kg	4.00E-02	1.80E+03	D	1.18E+02	1.18E+02
Benzo(b)Fluoranthene	205-99-2	61	15	mg/kg	4.70E-02	2.90E+03	D	1.71E+02	1.71E+02
Benzo(g,h,i)Perylene	191-24-2	57	13	mg/kg	1.90E-01	1.20E+03	D	8.73E+01	8.73E+01
Benzo(k)Fluoranthene	207-08-9	57	12	mg/kg	3.60E-02	4.20E+02	D	3.33E+01	3.33E+01
Carbazole	86-74-8	47	7	mg/kg	1.90E-01	4.10E+02	D	3.46E+01	3.46E+01
Chrysene	218-01-9	57	14	mg/kg	4.70E-02	2.10E+03	D	1.46E+02	1.46E+02
Dibenz(a,h)Anthracene	53-70-3	57	6	mg/kg	4.70E-01	5.30E+02	D	3.84E+01	3.84E+01
Dibenzofuran	132-64-9	57	10	mg/kg	2.20E-01	9.30E+02	D	6.32E+01	6.32E+01
Fluoranthene	206-44-0	61	15	mg/kg	1.20E-01	5.80E+03	D	4.44E+02	4.44E+02
Fluorene	86-73-7	57	11	mg/kg	4.00E-01	1.60E+03	D	1.06E+02	1.06E+02
Indeno(1,2,3-c,d)Pyrene	193-39-5	61	12	mg/kg	3.00E-01	1.10E+03	D	7.10E+01	7.10E+01

Table F-17. EPC Evaluation Soil (0-15 ft) SWMU 64 (Landfill 13) Continued

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Naphthalene	91-20-3	57	10	mg/kg	4.60E-01	3.30E+03	D	2.18E+02	2.18E+02
Phenanthrene	85-01-8	58	16	mg/kg	8.70E-02	6.30E+03	D	5.11E+02	5.11E+02
Pyrene	129-00-0	57	15	mg/kg	1.00E-01	4.30E+03	D	2.86E+02	2.86E+02

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

NA - Distribution not determined due to less than 10 total samples. 95% UCL not calculated; EPC default to maximum detect.

Table F-18. EPC Evaluation Soil (0-15 ft) SWMU 66 (Landfill 15)

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
					Metals				
Barium	7440-39-3	68	68	mg/kg	6.86E+01	1.22E+03	X	2.48E+02	2.48E+02

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table F-19. EPC Evaluation Soil (0-15 ft) SVS 6

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals									
Barium	7440-39-3	89	89	mg/kg	8.88E+01	1.77E+03	X	3.29E+02	3.29E+02

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table F-20. EPC Evaluation Surface Soil (0-2 ft) SVS 7b

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
SVOCs									
Benzo(a)Anthracene	56-55-3	40	6	mg/kg	3.00E-02	8.60E-01	D	2.23E-01	2.23E-01
Benzo(a)Pyrene	50-32-8	40	10	mg/kg	2.00E-02	8.00E-01	D	2.07E-01	2.07E-01
Benzo(b)Fluoranthene	205-99-2	43	6	mg/kg	2.00E-02	1.10E+00	D	2.38E-01	2.38E-01
Indeno(1,2,3-c,d)Pyrene	193-39-5	40	6	mg/kg	2.00E-02	6.90E-01	D	2.12E-01	2.12E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

Table F-21. EPC Evaluation Soil (0-15 ft) SVS 7b

COPC	CAS No.	Total Number of Samples	Total Number of Detections	Units	Minimum Detected Concentration	Maximum Detected Concentration	Distribution	95% UCL	EPC
Metals									
Barium	7440-39-3	174	174	mg/kg	5.74E+01	3.29E+03	X	3.46E+02	3.46E+02
SVOCs									
Benzo(a)Anthracene	56-55-3	108	15	mg/kg	2.00E-02	3.40E+01	D	1.32E+00	1.32E+00
Benzo(a)Pyrene	50-32-8	108	23	mg/kg	2.00E-02	3.00E+01	D	1.19E+00	1.19E+00
Benzo(b)Fluoranthene	205-99-2	111	15	mg/kg	1.00E-02	2.40E+01	D	1.01E+00	1.01E+00
Indeno(1,2,3-c,d)Pyrene	193-39-5	108	15	mg/kg	1.00E-02	1.80E+01	D	7.73E-01	7.73E-01

EPC - Exposure point concentration is lesser of 95% UCL and maximum detection.

D - Distribution not determined due to less than 50% frequency of detection or less than 4 total detects. 95% UCL calculated using Student's t-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

F.1 RISK CHARACTERIZATION RESULTS FOR THE LANDFILLS

This section provides the quantitative risk results for onsite and offsite receptors that may be exposed to contaminated media from the landfills.

The numerical risk and hazard estimates presented in this section must be interpreted in the context of the uncertainties and assumptions associated with the risk assessment process and with the data upon which the risk estimates are based. Uncertainties are presented in Tables at the end of this section. The summary of conclusions section presents the conclusions of the quantitative risk assessment, which considers the uncertainty with the results.

F.1.1 Risk Characterization for Onsite Receptors at the Landfills

Three onsite media of concern were identified for the landfills: soil, air, and groundwater.

F.1.2 Risk Characterization for Onsite Soil and Air at the Landfills

Two onsite exposure scenarios are quantitatively evaluated for the landfills:

- Current/future industrial worker exposed to surface soil (0 to 2 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air.

- Current/future construction worker exposed to soil (0 to 15 ft) via ingestion, dermal contact, and inhalation of COPCs emitted to air.

Current and future risks were evaluated for these receptors/pathways for each landfill from EPCs (95% UCL of the mean or maximum detected concentration) calculated from measured soil concentrations. Surface soil (0 to 2 ft) EPCs are presented in tables above.

Detailed hazard and risk results for the two onsite receptors are summarized for each landfill unit below and in tables that follow.

Individual and cumulative ILCRs and HQs/HIs were calculated for COPCs for each landfill unit and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0). The landfill results fall into three categories:

- Landfills with no COPCs retained for evaluation: No COPCs were identified for evaluation in the risk assessment in soil at SVS 7a; therefore, this area represents negligible risk and is not evaluated further.

- Landfills with risks below acceptable target risk criteria: Individual and cumulative ILCR and HQ/HI results for SWMU66 (Landfill 15), SVS 6, and SVS 7b (shaded dark blue in the follow figures for surface soil 0-2 ft and soil 0-15 ft) are below the TCEQ and EPA acceptable target risk criteria.

- Landfills with risks equal to or above acceptable target risk criteria: Estimated cumulative ILCRs for SWMU 68b (Landfill 1), SWMU 68c (Landfill 2), and SWMU 64 (Landfill 13) exceed the target risk criteria for the industrial worker scenario. The estimated total HI at

SWMU 68b (Landfill 1) and the estimated cumulative ILCRs for SWMU 64 (Landfill 13) exceed the target risk criteria for the construction/excavation worker scenario.

Risk characterization results for SWMU 68b (Landfill 1), SWMU 68c (Landfill 2), and SWMU 64 (Landfill 13) are summarized below.

	Industrial Worker Scenario[a]		*Construction Worker Scenario*[b]	
Unit	*ILCR*	*HI*	*ILCR*	*HI*
SWMU 68b (Landfill 1)	**1.3E-05**	0.056	2.1E-07	**2.3**
SWMU 68c (Landfill 2)	**1.6E-06**	0.000054	2.4E-07	0.18
SWMU 64 (Landfill 13)	**3.7E-06**	0.00036	**2.7E-05**	0.71

Bold values exceed ILCR of 1.0E-06 or HQ/HI of 1.0.
[a]Industrial worker exposed to surface soil (0-2 ft bgs).
[b]Construction worker exposed to soil (0-15 ft bgs).

F.1.2.1 Risk Characterization for Onsite Groundwater at the Landfills

Future industrial and construction/excavation worker exposure to COPCs in groundwater (Ogallala Aquifer) is dependant on COPCs in soil, soil gas, and/or perched groundwater reaching Pantex Plant production wells in the Ogallala Aquifer. The potential for COPCs in soil, soil gas, and/or perched groundwater at the landfills to migrate to the Pantex Plant production wells is evaluated using the Tier 2 and Tier 3 approach presented in Section 4.4 of the Baseline HHRA Report (BWXT Pantex and SAIC, Dece,ber 2006).

The following transport pathways were evaluated for the landfills:

- Soil-to-Ogallala Aquifer
- Soil gas-to-Ogallala Aquifer (for SWMU 68b)
- Perched groundwater-to-Ogallala Aquifer
- Ogallala Aquifer-to-Pantex Plant production wells.

Results of the Tier 2 and Tier 3 evaluations are detailed in Appendix I, Section I.3 and summarized below by SWMU.

SWMU 68b - Landfill 1

Tier 1 COPC evaluation results for SWMU 68b are presented tables above. Results for Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer, soil gas-to-Ogallala Aquifer, and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates eleven soil COPCs, including one HE (RDX), six metals (arsenic, cadmium, copper, lead, manganese, and vanadium), three PCBs (PCB-1242, PCB-1248, and PCB-1254), and one pesticide (beta-chlordane), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

- Tier 2 analysis indicates one soil gas COPC (Freon-114) may exceed it's RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates Freon-114 is not predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

- Tier 2 analysis indicates one perched groundwater COPC (RDX) may exceed it's RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates RDX is not predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

SWMU 68c - Landfill 2

Tier 1 COPC evaluation results for SWMU 68c are presented in tables above; soil gas data were not applicable to this SWMU. Results for Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer and perched groundwater-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates four soil COPCs, including one PCB (PCB-1242), one pesticide (beta-chlordane), and two VOCs (methylene chloride and vinyl chloride), may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

- Tier 2 analysis indicates one perched groundwater COPC (RDX) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates RDX is not predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

SWMU 64 - Landfill 13

Tier 1 COPC evaluation results for SWMU 64 are presented in tables above. Soil gas data were not applicable to this SWMU and no perched groundwater COPCs were retained for Tier 2 evaluation. Results for Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer are summarized as follows:

- Tier 2 analysis indicates identified fourteen soil COPCs, including one HE (RDX), two metals (manganese, cadmium), three pesticides (alpha BHC, beta-chlordane and dieldrin), and eight SVOCs [acenaphthene, 4-methylphenol, benzo(a)anthracene, benzo(b)fluoranthene, carbazole, indeno(1,2,3-c,d)pyrene, benzo(a)pyrene, and pentachlorophenol], may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

SWMU 66 - Landfill 15

Tier 1 COPC evaluation results for SWMU 66 are presented intables above. Soil gas data are not applicable to this SWMU. Landfill 15 is located west of the sitewide model domain in an area of interplaya recharge where perched groundwater is not known to exist; therefore, perched groundwater is not evaluated. Results for Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer are summarized as follows:

- Tier 2 analysis indicates one soil COPC (manganese) may exceed it's RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates manganese is not predicted to reach an exposure location (Pantex Plant production wells) within 1,000 years.

<u>SVS 6, SVS 7a, and 7b</u>

Tier 1 COPC evaluation results for SVS 6, SVS 7a, and 7b are presented in Section tables above. As a result of Tier 2 analysis, no soil COPCs were retained for Tier 3 evaluation for SVS 6, SVS 7a and SVS 7b. Soil gas data were not applicable to these units. No perched groundwater COPCs were retained for Tier 2 evaluation at SVS 7a and 7b. SVS 6 is located west of the sitewide model domain in an area of interplaya recharge where perched groundwater is not known to exist; therefore, perched groundwater is not evaluated for SVS 6.

For all of the landfills evaluated in this HHRA, no groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network. Results of the Tier 2 and Tier 3 analysis indicate exposure of onsite workers to groundwater COPCs originating from the landfills is an incomplete pathway because COPCs at the landfills will not reach the Pantex Plant production wells within 1,000 years. Therefore, groundwater does not contribute to risk to onsite receptors.

F.1.3 Risk Characterization for Offsite Receptors Due to COPC Transport from the Landfills

Potential risks to offsite receptors was evaluated for two transport mechanisms:

- Airborne transport of COPCs in surface soil to offsite air with subsequent deposition to offsite soil and crops

- Groundwater transport to offsite exposure locations.

F.1.3.1 Risks from Atmospheric Transport from the Landfills to Offsite Receptors

Risks from atmospheric transport of surface soil COPCs from the landfills to offsite receptor locations are estimated based on modeling conducted for the Burning Ground HHRA (BWXT Pantex, 2005a). The Burning Ground is considered a worst-case analysis for atmospheric transport because 1) it has higher surface soil concentrations of most COPCs than other units at Pantex Plant, and 2) it is closest to a downwind (northern) Pantex Plant boundary. The results of atmospheric transport modeling for the Burning Ground showed negligible offsite risks. Thus, quantitative atmospheric transport modeling is not conducted for other corrective action units at Pantex Plant. Instead, the quantitative results for the Burning Ground are used in a semi-quantitative evaluation by comparing conditions at the Burning Ground to each corrective action unit or zone as described in Appendix O of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006). This semi-quantitative evaluation was performed for a subset of the landfills and is summarized below. Landfill 15, SVS 6, and SVS 7a have no surface soil COPCs and risks to onsite receptors at SVS 7b are negligible; therefore, these landfills were not evaluated for offsite atmospheric transport.

The predominant wind direction at Pantex Plant is from south to north. The Burning Ground is located approximately 2,750 ft south of the northern Plant boundary. The distances to the nearest Plant boundary for Landfills 1 and 2 are 4,922 ft and 6,530 ft east, respectively. The distance to the closest Plant boundary for Landfill 13 is 3,786 ft south.

Risks were calculated for 11 grid cells within the Burning Ground with a total ILCR for all grid cells of 4.5E-03 and a total HI of 156. The onsite COPC concentrations associated with these high onsite risks resulted in negligible offsite risks (cumulative ILCR=5.3E-08, HI=0.44).

The highest total ILCR and total HI for surface soil at the landfills are 1.3E-05 and 0.056 respectively at Landfill 1. Because the landfills are farther from the Plant boundary and have much lower surface soil risks than the Burning Ground, offsite risks due to atmospheric transport from the landfills would be less than those predicted for the Burning Ground. Semi-quantitative analysis (Appendix O) using the relative distance and direction to the Plant boundary for Burning Ground and landfills indicates offsite risks from landfills are much lower with the ILCRs for Landfills 1, 2, and 13 ranging from 1.05E-12 to 1.61E-11 and HIs ranging from 8.47E-09 to 1.66E-05.

F.1.3.2 Risks from Groundwater Transport from the Landfills to Offsite Receptors

The potential for COPCs in soil, soil gas, and/or perched groundwater to migrate to an offsite location in the perched groundwater or the Ogallala Aquifer was evaluated using the Tier 2 and Tier 3 fate and transport approach presented in Section 4.4 of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006). The results of this modeling are summarized for the landfills here.
The following transport pathways were evaluated for groundwater:

- Soil-to-perched groundwater
- Soil-to-Ogallala Aquifer
- Soil gas-to-perched groundwater (SWMU 68b)
- Soil gas-to-Ogallala Aquifer (SWMU 68b)
- Perched groundwater-to-Ogallala Aquifer
- Perched groundwater-to-offsite POE
- Ogallala Aquifer-to-offsite POE.

Results of the Tier 2 and Tier 3 evaluations are summarized below by SWMU.

<u>SWMU 68b - Landfill 1</u>

Tier 1 COPC evaluation results for SWMU 68b are presented in tables above. Results for Tier 2 and Tier 3 evaluations for the above pathways are summarized as follows:

- Tier 2 analysis indicates twelve soil COPCs, including one HE (RDX), two pesticides (beta-chlordane and dieldrin), six metals (arsenic, cadmium, copper, lead, manganese, and vanadium), and three PCBs (PCB-1242, PCB-1248 and PCB-1254) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater south of the Plant boundary within 1,000 years.

- Tier 2 analysis indicates eleven soil COPCs, including one HE (RDX), six metals (arsenic, cadmium, copper, lead, manganese, and vanadium), three PCBs (PCB-1242, PCB-1248, and PCB-1254), and one pesticide (beta-chlordane) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure location in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates one soil gas COPC (Freon-114) may exceed RBSVGW following dilution in both perched groundwater and in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates Freon-114 is not predicted to reach an offsite exposure point in perched groundwater south of the Plant boundary or in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates three perched groundwater COPCs, including two HEs (RDX and 2,6-dinitrotoluene) and one metal (boron) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater south of the Plant boundary within 1,000 years.

- Tier 2 analysis indicates one perched groundwater COPC (RDX) may exceed it's RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates RDX is not predicted to reach an offsite exposure location in the Ogallala Aquifer within 1,000 years.
- SWMU 68b (Landfill 1) is located west of the perched groundwater flow divide; therefore, COPCs in soil, soil gas, and perched groundwater at SWMU 68b will not migrate offsite to the east in the perched groundwater.

Based on these results, exposure of offsite receptors to groundwater COPCs originating from soil, soil gas, and perched groundwater at SWMU 68b is an incomplete pathway, and therefore, does not contribute to risk to offsite receptors.

SWMU 68c - Landfill 2

Tier 1 COPC evaluation results for SWMU 68c are presented in tables above; soil gas data were not applicable to this SWMU. Results for Tier 2 and Tier 3 evaluations for the above pathways are summarized as follows:

- Tier 2 analysis indicates ten soil COPCs, including three pesticides (gamma BHC, beta-chlordane and aldrin), three metals (arsenic, lead, and manganese), one PCB (PCB-1242), one SVOC (1,4-dichlorobenzene), and two VOCs (methylene chloride and vinyl chloride) may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater south of the Plant boundary within 1,000 years.

- Tier 2 analysis indicates four soil COPCs, including one PCB (PCB-1242), one pesticide (beta-chlordane), and two VOCs (methylene chloride and vinyl chloride) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure location in the Ogallala Aquifer within 1,000 years.

- Tier 2 analysis indicates two perched groundwater COPCs, including one HE (RDX) and one metal (boron) may exceed RBSVGW following dilution in Perched groundwater; however, Tier 3 travel time analysis indicates neither of these COPCs are predicted to reach an offsite exposure point in perched groundwater south of the Plant boundary within 1,000 years.

- Tier 2 analysis indicates one perched groundwater COPC (RDX) may exceed it's RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates RDX is not predicted to reach an offsite exposure location in the Ogallala Aquifer within 1,000 years.

- SWMU 68c (Landfill 2) is located west of the perched groundwater flow divide; therefore, COPCs in soil, soil gas, and perched groundwater at SWMU 68b will not migrate offsite to the east in the perched groundwater.

Based on these results, exposure of offsite receptors to groundwater COPCs originating from soil, soil gas, and perched groundwater at SWMU 68c is an incomplete pathway, and therefore, does not contribute to risk to offsite receptors.

SWMU 64 - Landfill 13

Tier 1 COPC evaluation results for SWMU 64 are presented in tables above. Soil gas data were not applicable to this SWMU and no perched groundwater COPCs were retained for Tier 2 evaluation. Results for Tier 2 and Tier 3 evaluations for soil-to-perched groundwater and soil-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates twenty-one soil COPCs, including one HE (RDX), five metals (arsenic, cadmium, copper, lead, and manganese), four pesticides (alpha-BHC, beta-chlordane, dieldrin, and gamma-BHC), and eleven SVOCs [4-methylphenol, acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and pentachlorophenol] may exceed RBSVGW following dilution in perched groundwater; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure point in perched groundwater south of the Plant boundary within 1,000 years.

- Tier 2 analysis indicates fourteen soil COPCs, including one HE (RDX), two metals (manganese, cadmium), three pesticides (alpha BHC, beta-chlordane and dieldrin), and eight SVOCs [acenaphthene, 4-methylphenol, benzo(a)anthracene, benzo(b)fluoranthene, carbazole, indeno(1,2,3-c,d)pyrene, benzo(a)pyrene, and pentachlorophenol] may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates none of these COPCs are predicted to reach an offsite exposure location in the Ogallala Aquifer within 1,000 years.

- SWMU 64 (Landfill 13) is located west of the perched groundwater flow divide; therefore, COPCs in soil and perched groundwater at SWMU 68b will not migrate offsite to the east in the perched groundwater.

Based on these results, exposure of offsite receptors to groundwater COPCs originating from soil, soil gas, and perched groundwater at SWMU 64 is an incomplete pathway, and therefore, does not contribute to risk to offsite receptors.

SWMU 66 - Landfill 15

Tier 1 COPC evaluation results for SWMU 66 are presented in tables above. Landfill 15 is located west of the sitewide model domain in an area of interplaya recharge where perched groundwater is not known to exist; therefore, this pathway is not evaluated. Soil gas data were not applicable to this SWMU. Results for Tier 2 and Tier 3 evaluations for soil-to-Ogallala Aquifer pathways are summarized as follows:

- Tier 2 analysis indicates one soil COPC (manganese) may exceed RBSVGW following dilution in the Ogallala Aquifer; however, Tier 3 travel time analysis indicates manganese is not predicted to reach an offsite exposure location in the Ogallala Aquifer within 1,000 years.

Based on these results, exposure of offsite receptors to groundwater COPCs originating from soil at SWMU 66 is an incomplete pathway, and therefore, does not contribute to risk to offsite receptors.

SVS 6, SVS 7a and 7b

Tier 1 COPC evaluation results for SVS 6, SVS 7a and SVS 7b are presented in tables above. Soil gas data were not applicable to these units. No perched groundwater COPCs were retained for Tier 2 evaluation at SVS 7a and SVS 7b. SVS 6 is located west of the sitewide model domain in an area of interplaya recharge where perched groundwater is not known to exist; therefore, perched groundwater is not evaluated for SVS 6. As a result of Tier 2 analysis, no soil COPCs were retained for Tier 3 evaluation for SVS 6, SVS 7a, and 7b. Additionally, these landfills are located west of the perched groundwater flow divide; therefore, COPCs in soil and perched groundwater will not migrate offsite to the east in the perched groundwater. Based on these results, exposure of offsite receptors to groundwater COPCs originating from soil and perched groundwater at SVS 6, 7a, and 7b is an incomplete pathway, and therefore, does not contribute to risk to offsite receptors.

For all of the landfills evaluated in this HHRA, no groundwater COPCs were evaluated for the Ogallala Aquifer because no COPCs were identified in the RFI for this aquifer based on the current monitoring network. Results of the Tier 2 and Tier 3 analysis indicate exposure of offsite receptors to groundwater COPCs originating from the landfills is an incomplete pathway because COPCs at the landfills will not reach an offsite POE within 1,000 years. Therefore, groundwater does not contribute to risk to offsite receptors.

Table F-22. Landfills Summary of Risk Calculations for Industrial Worker Surface Soil (0-2 ft)

COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
Landfill 1 (SWMU 68b)											
Uranium, Total	7440-61-1	5	2.84E+02	--	2.84E+02	--	--	--	2.0E-04	5.6E-02	100.0%
Benzo(a)Anthracene	56-55-3	14	1.10E+01	3.39E+00	3.39E+00	3.1E-07	**1.1E-06**	8.0%	--	--	--
Benzo(a)Pyrene	50-32-8	14	9.30E+00	2.84E+00	2.84E+00	3.1E-06	**8.9E-06**	66.8%	--	--	--
Benzo(b)Fluoranthene	205-99-2	14	1.20E+01	3.93E+00	3.93E+00	3.1E-07	**1.2E-06**	9.3%	--	--	--
Dibenz(a,h)Anthracene	53-70-3	14	1.60E+00	5.13E-01	5.13E-01	3.1E-06	**1.6E-06**	12.1%	--	--	--
Indeno(1,2,3-c,d)Pyrene	193-39-5	14	4.80E+00	1.65E+00	1.65E+00	3.1E-07	5.2E-07	3.9%	--	--	--
						Cumulative ILCR	**1.3E-05**	100.0%	**HI**	5.6E-02	100.0%
Landfill 2 (SWMU 68c)											
Beta-Chlordane	57-74-9	8	1.82E-02	--	1.82E-02	1.8E-07	3.3E-09	0.2%	2.9E-03	5.4E-05	100.0%
Benzo(a)Pyrene	50-32-8	9	3.40E-01	--	3.40E-01	3.1E-06	**1.1E-06**	65.1%	--	--	--
Dibenz(a,h)Anthracene	53-70-3	9	6.40E-02	--	6.40E-02	3.1E-06	2.0E-07	12.3%	--	--	--
^{235}U	15117-96-1(+D)	11	2.01E-01	1.17E-01	1.17E-01	3.2E-06	3.7E-07	22.5%	--	--	--
						Cumulative ILCR	**1.6E-06**	100.0%	**HI**	5.4E-05	100.0%
Landfill 13 (SWMU 64)											
Benzo(a)Anthracene	56-55-3	15	4.60E+00	9.77E-01	9.77E-01	3.1E-07	3.1E-07	8.3%	--	--	--
Benzo(a)Pyrene	50-32-8	15	3.10E+00	6.95E-01	6.95E-01	3.1E-06	**2.2E-06**	59.2%	--	--	--
Benzo(b)Fluoranthene	205-99-2	15	5.50E+00	1.14E+00	1.14E+00	3.1E-07	3.6E-07	9.7%	--	--	--
Dibenz(a,h)Anthracene	53-70-3	15	4.70E-01	2.18E-01	2.18E-01	3.1E-06	6.8E-07	18.5%	--	--	--
Indeno(1,2,3-c,d)Pyrene	193-39-5	15	2.00E+00	4.99E-01	4.99E-01	3.1E-07	1.6E-07	4.2%	--	--	--
Mercury	7439-97-6	53	7.00E-01	9.09E-02	9.09E-02	--	--	--	4.0E-03	3.6E-04	100.0%
						Cumulative ILCR	**3.7E-06**	100.0%	**HI**	3.6E-04	100.0%

Table F-22. Landfills Summary of Risk Calculations for Industrial Worker Surface Soil (0-2 ft) (continued)

COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
Landfill 15 (SWMU 66)											
No COPCs Identified											
SVS 6											
No COPCs Identified											
SVS 7a											
No COPCs Identified											
SVS 7b											
Benzo(a)Anthracene	56-55-3	40	8.60E-01	2.23E-01	2.23E-01	3.1E-07	7.0E-08	8.1%	--	--	--
Benzo(a)Pyrene	50-32-8	40	8.00E-01	2.07E-01	2.07E-01	3.1E-06	6.5E-07	75.5%	--	--	--
Benzo(b)Fluoranthene	205-99-2	43	1.10E+00	2.38E-01	2.38E-01	3.1E-07	7.5E-08	8.7%	--	--	--
Indeno(1,2,3-c,d)Pyrene	193-39-5	40	6.90E-01	2.12E-01	2.12E-01	3.1E-07	6.7E-08	7.7%	--	--	--
						Cumulative ILCR	8.6E-07	100.0%	**HI**	--	--

-- Not available due to lack of toxicity criteria for pathway.
Bold values exceed ILCR of 1.0E-06 or HQ/HI of 1.0.

Table F-23. Landfills Summary of Risk Calculations for Construction/Excavation Worker Soils (0-15 ft)

COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ/HI	Percent of HI
Landfill 1 (SWMU 68b)											
RDX	121-82-4	54	3.72E+02	2.23E+01	2.23E+01	2.0E-09	4.4E-08	20.5%	1.8E-03	4.0E-02	1.7%
Aluminum	7429-90-5	61	1.00E+05	2.57E+04	2.57E+04	--	--	--	6.3E-06	1.6E-01	7.0%
Arsenic	7440-38-2	67	1.31E+02	1.17E+01	1.17E+01	--	--	--	--	--	--
Barium	7440-39-3	64	6.68E+03	5.16E+02	5.16E+02	--	--	--	9.0E-05	4.6E-02	2.0%
Beryllium	7440-41-7	64	1.10E+01	1.06E+00	1.06E+00	3.7E-14	3.9E-14	0.0%	6.3E-03	6.7E-03	0.3%
Cadmium	7440-43-9	83	1.20E+03	4.39E+01	4.39E+01	2.8E-11	1.2E-09	0.6%	5.1E-03	2.2E-01	9.7%
Copper	7440-50-8	64	2.04E+05	8.55E+03	8.55E+03	--	--	--	1.3E-04	**1.1E+00**	47.8%
Lead	7439-92-1	96	4.80E+04	1.80E+03	1.80E+03	--	--	--	--	--	--
Mercury	7439-97-6	70	1.80E+00	1.90E-01	1.90E-01	--	--	--	1.9E-02	3.6E-03	0.2%
Uranium, Total	7440-61-1	30	2.84E+02	3.79E+01	3.79E+01	--	--	--	1.7E-03	6.3E-02	2.7%
Vanadium	7440-62-2	60	1.31E+04	6.15E+02	6.15E+02	--	--	--	1.1E-03	6.6E-01	29%
Aldrin	309-00-2	76	3.60E-02	2.58E-03	2.58E-03	3.3E-07	8.5E-10	0.4%	2.0E-01	5.1E-04	0.0%
Beta-Chlordane	5103-74-2	31	1.70E-02	2.56E-03	2.56E-03	6.8E-09	1.7E-11	0.0%	1.2E-02	3.0E-05	0.0%
Benzo(a)Anthracene	56-55-3	66	1.10E+01	8.64E-01	8.64E-01	1.4E-08	1.2E-08	5.5%	--	--	--
Benzo(a)Pyrene	50-32-8	66	9.30E+00	7.52E-01	7.52E-01	1.4E-07	1.0E-07	47.9%	--	--	--
Benzo(b)Fluoranthene	205-99-2	66	1.20E+01	9.92E-01	9.92E-01	1.4E-08	1.3E-08	6.3%	--	--	--
Dibenz(a,h)Anthracene	53-70-3	66	1.60E+00	2.45E-01	2.45E-01	1.4E-07	3.3E-08	15.6%	--	--	--
Indeno(1,2,3-c,d)Pyrene	193-39-5	66	4.80E+00	4.94E-01	4.94E-01	1.4E-08	6.7E-09	3.1%	--	--	--
						Cumulative ILCR	2.1E-07	100.0%	**HI**	**2.3E+00**	100.0%
Landfill 2 (SWMU 68c)											
Cadmium	7440-43-9	31	5.70E+00	8.62E-01	8.62E-01	2.8E-11	2.4E-11	0.0%	5.1E-03	4.4E-03	2.5%
Mercury	7439-97-6	32	2.90E+00	3.26E-01	3.26E-01	--	--	--	1.9E-02	6.1E-03	3.5%
Aldrin	309-00-2	35	1.33E-01	1.52E-02	1.52E-02	3.3E-07	5.0E-09	2.1%	2.0E-01	3.0E-03	1.7%
Beta-Chlordane	57-74-9	20	1.82E-02	5.84E-03	5.84E-03	6.8E-09	4.0E-11	0.0%	1.2E-02	6.9E-05	0.0%
Heptachlor	76-44-8	32	1.29E-01	1.69E-02	1.69E-02	8.3E-08	1.4E-09	0.6%	1.1E-02	1.9E-04	0.1%
^{235}U	15117-96-1(+D)	22	2.01E-01	9.75E-02	9.75E-02	3.4E-08	3.4E-09	1.4%	--	--	--

Table F-23. Landfills Summary of Risk Calculations for Construction/Excavation Worker Soils (0-15 ft) (continued)

COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ	Percent of HI
Landfill 2 (SWMU 68c) (continued)											
Benzo(a)Anthracene	56-55-3	30	3.10E+00	7.94E-01	7.94E-01	1.4E-08	1.1E-08	4.5%	--	--	--
Benzo(a)Pyrene	50-32-8	30	2.70E+00	7.75E-01	7.75E-01	1.4E-07	1.0E-07	43.6%	--	--	--
Benzo(b)Fluoranthene	205-99-2	30	2.00E+00	7.34E-01	7.34E-01	1.4E-08	9.9E-09	4.1%	--	--	--
Dibenz(a,h)Anthracene	53-70-3	30	7.00E-01	6.79E-01	6.79E-01	1.4E-07	9.2E-08	38.2%	--	--	--
Indeno(1,2,3-c,d)Pyrene	193-39-5	30	1.40E+00	7.02E-01	7.02E-01	1.4E-08	9.5E-09	4.0%	--	--	--
Bromomethane	74-83-9	38	1.20E+00	1.26E-01	1.26E-01	--	--	--	1.0E+00	1.3E-01	73.7%
Chloromethane	74-87-3	38	2.00E+00	1.78E-01	1.78E-01	2.6E-10	4.7E-11	0.0%	1.0E-01	1.8E-02	10.2%
Vinyl Chloride	75-01-4	40	1.80E+00	1.57E-01	1.57E-01	2.4E-08	3.8E-09	1.6%	9.4E-02	1.5E-02	8.3%
						Cumulative ILCR	2.4E-07	100.0%	**HI**	1.8E-01	100.0%
Landfill 13 (SWMU 64)											
RDX	121-82-4	83	9.20E+00	1.14E+00	1.14E+00	2.0E-09	2.2E-09	0.0%	1.8E-03	2.1E-03	0.3%
Barium	7440-39-3	110	1.16E+03	2.60E+02	2.60E+02	--	--	--	9.0E-05	2.3E-02	3.6%
Cadmium	7440-43-9	105	1.17E+03	3.01E+01	3.01E+01	2.8E-11	8.3E-10	0.0%	5.1E-03	1.5E-01	23.5%
Copper	7440-50-8	102	1.88E+03	6.16E+01	6.16E+01	--	--	--	1.3E-04	8.0E-03	1.2%
Mercury	7439-97-6	116	2.90E+00	2.06E-01	2.06E-01	--	--	--	1.9E-02	3.9E-03	0.6%
Alpha BHC	319-84-6	39	1.02E-01	8.71E-03	8.71E-03	1.1E-07	9.2E-10	0.0%	6.4E-04	5.6E-06	0.0%
Beta-Chlordane	57-74-9	9	5.61E-03	--	5.61E-03	6.8E-09	3.8E-11	0.0%	1.2E-02	6.6E-05	0.0%
Dieldrin	60-57-1	39	6.46E-01	5.02E-02	5.02E-02	3.1E-07	1.6E-08	0.1%	1.2E-01	5.9E-03	0.9%
Heptachlor	76-44-8	39	1.27E-01	1.19E-02	1.19E-02	8.3E-08	9.9E-10	0.0%	1.1E-02	1.3E-04	0.0%
2-Methylnaphthalene	91-57-6	57	8.50E+02	5.21E+01	5.21E+01	--	--	--	1.4E-03	7.4E-02	10.3%
4-Methylphenol (p-Cresol)	106-44-5	26	1.40E+02	2.09E+01	2.09E+01	--	--	--	1.1E-03	2.4E-02	3.6%
Acenaphthene	83-32-9	26	1.40E+03	2.02E+02	2.02E+02	--	--	--	9.4E-05	1.9E-02	2.9%
Benzo(a)Anthracene	56-55-3	61	2.20E+03	1.54E+02	1.54E+02	1.4E-08	**2.1E-06**	7.8%	--	--	--
Benzo(a)Pyrene	50-32-8	61	1.80E+03	1.18E+02	1.18E+02	1.4E-07	**1.6E-05**	60.1%	--	--	--

Table F-23. Landfills Summary of Risk Calculations for Construction/Excavation Worker Soils (0-15 ft) (continued)

COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ	Percent of HI
Benzo(b)Fluoranthene	205-99-2	61	2.90E+03	1.71E+02	1.71E+02	1.4E-08	**2.3E-06**	8.7%	--	--	--
Benzo(g,h,i)Perylene	191-24-2	57	1.20E+03	8.73E+01	8.73E+01	--	--	--	1.9E-04	1.6E-02	2.5%
Benzo(k)Fluoranthene	207-08-9	57	4.20E+02	3.33E+01	3.33E+01	1.4E-09	4.5E-08	0.2%	--	--	--
Carbazole	86-74-8	47	4.10E+02	3.46E+01	3.46E+01	3.7E-10	1.3E-08	0.0%	--	--	--
Chrysene	218-01-9	57	2.10E+03	1.46E+02	1.46E+02	1.4E-10	2.0E-08	0.1%	--	--	--
Dibenz(a,h)Anthracene	53-70-3	57	5.30E+02	3.84E+01	3.84E+01	1.4E-07	**5.2E-06**	19.5%	--	--	--
Dibenzofuran	132-64-9	57	9.30E+02	6.32E+01	6.32E+01	--	--	--	1.5E-03	9.3E-02	14.3%
Fluoranthene	206-44-0	61	5.80E+03	4.44E+02	4.44E+02	--	--	--	1.4E-04	6.3E-02	9.6%
Fluorene	86-73-7	57	1.60E+03	1.06E+02	1.06E+02	--	--	--	1.4E-04	1.5E-02	2.3%
Indeno(1,2,3-c,d)Pyrene	193-39-5	61	1.10E+03	7.10E+01	7.10E+01	1.4E-08	9.6E-07	3.6%	--	--	--
Naphthalene	91-20-3	57	3.30E+03	2.18E+02	2.18E+02	--	--	--	2.8E-04	6.2E-02	9.5%
Phenanthrene	85-01-8	58	6.30E+03	5.11E+02	5.11E+02	--	--	--	1.9E-04	9.6E-02	14.7%
Pyrene	129-00-0	57	4.30E+03	2.86E+02	2.86E+02	--	--	--	1.9E-04	5.4E-02	8.2%
						Cumulative ILCR	**2.7E-05**	100.0%	**HI**	7.1E-01	100.0%
Landfill 15 (SWMU 66)											
Barium	7440-39-3	68	1.22E+03	2.48E+02	2.48E+02	--	--	--	9.0E-05	2.2E-02	100.0%
						Cumulative ILCR	--	--	**HI**	2.2E-02	100.0%
SVS 6											
Barium	7440-39-3	89	1.77E+03	3.29E+02	3.29E+02	--	--	--	9.0E-05	3.0E-02	100.0%
						Cumulative ILCR	--	--	**HI**	3.0E-02	100.0%
SVS 7a											
No COPCs Identified											

Table F-23. Landfills Summary of Risk Calculations for Construction/Excavation Worker Soils (0-15 ft) (continued)

COPC	CAS No.	Total Number of Samples	Maximum Detected Concentration (mg/kg or pCi/g)	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)	Total URV Cancer	Total ILCR	Percent of Cumulative ILCR	Total URV Noncancer	Total HQ	Percent of HI
SVS 7b											
Barium	7440-39-3	174	3.29E+03	3.46E+02	3.46E+02	--	--	--	9.0E-05	3.1E-02	100.0%
Benzo(a)Anthracene	56-55-3	108	3.40E+01	1.32E+00	1.32E+00	1.4E-08	1.8E-08	8.8%	--	--	--
Benzo(a)Pyrene	50-32-8	108	3.00E+01	1.19E+00	1.19E+00	1.4E-07	1.6E-07	79.4%	--	--	--
Benzo(b)Fluoranthene	205-99-2	111	2.40E+01	1.01E+00	1.01E+00	1.4E-08	1.4E-08	6.7%	--	--	--
Indeno(1,2,3-c,d)Pyrene	193-39-5	108	1.80E+01	7.73E-01	7.73E-01	1.4E-08	1.0E-08	5.1%	--	--	--
						Cumulative ILCR	2.0E-07	100.0%	**HI**	3.1E-02	100.0%

-- Not available due to lack of toxicity criteria for pathway.

Bold values exceed ILCR of 1.0E-06 or HQ/HI of 1.0.

Table F-24. Sources of Uncertainty Specific to the Landfills HHRA

Sources of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Uncertainty in Data Collection and Analysis (Section G.6.1)		
Sampling Locations		
Numerous surface soil samples at Landfills 1, 2, and 13 are located under administrative covers placed on these landfills after RFI sampling.	Samples located under administrative covers are unavailable for contact by industrial workers while the cover is in place.	Low to high impact: overestimates risk. Landfill 1 – High impact. Samples with detected concentrations of PAHs that drive risk results are all located under the cover. Landfill 2 – Low impact. Sample with detected concentrations of PAHs that drive risk results are located outside the cover. Landfill 13 – Moderate impact. One of three samples with detected concentrations of PAHs that drive risk results is located under the cover.
Monitoring wells associated with the landfills may reflect migration of COPCs from other upgradient zones/WMGs/corrective action units.	The identification of representative monitoring wells for each landfill is based on proximity to the landfill and the location of the well in the observed June 2003 perched flow field.	Low to high impact: overestimates risk from the landfill if COPCs are from another source. This is a large source of uncertainty regarding the source of COPCs in groundwater but does not impact the conclusions regarding risk to receptors from that groundwater contamination.
Uncertainty in Exposure Assessment		
Exposure Assumptions		
Standard default worker exposure parameters are used; however, actual worker activity patterns vary by site, by worker, and by time of year as well as from year to year.	Actual exposure of workers visiting the landfills is expected to be much less than estimated by standard default exposure parameters.	High impact: overestimates risk. Workers are very rarely at the landfills and no construction/excavation activities are anticipated at the landfills.
Uncertainty in Toxicity Information		
SFs are not available for PAHs other than benzo(a)pyrene.	RPFs are used to evaluate other potentially carcinogenic PAHs	Low impact: over- or underestimates risk.
Several chemicals (2-methylnaphthalene, acenaphthene, benzo(g,h,i)perylene, carbozole, fluoranthene, fluorene, phenanthrene, and pyrene) are not evaluated for the inhalation pathway for the cancer or noncancer endpoints because inhalation toxicity information is not available.	Direct ingestion represents the primary exposure pathway for onsite receptors exposed to COPCs in soil; therefore, the lack of toxicity values for some COPCs is not a major source of uncertainty.	Low impact: Underestimates risk.

Table F-24. Sources of Uncertainty Specific to the Landfills HHRA (continued)

Sources of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Toxicity values are not available for evaluating lead.	EPA's TRW soil lead model used to calculate an industrial RGO for protection of a hypothetical fetus of an occupationally exposed mother. The lead EPC (1800 mg/kg) for the construction/excavation worker at Landfill 1 exceeds the calculated industrial worker RGO (1600 mg/kg).	Moderate impact: overestimates risk. The lead model is not appropriate for the short exposure duration (60 days/year) of the construction worker because lead has a biological half-life of approximately 30 days requires a constant lead intake over a duration of 90 days to reach quasi-steady state.
Toxicity values are not available through TCEQ for quantifying risks to due to arsenic.	EPA toxicity values were used to estimate a total risk and HI for arsenic exposure.	Low impact: underestimates risk. Cumulative ILCR and HI estimated both with and without arsenic are below TCEQ and EPA acceptable target criteria.
	Uncertainty in Risk Characterization	
Airborne transport of onsite surface soil COPCs to offsite receptors.	Airborne transport to offsite receptors is evaluated qualitatively.	Negligible impact. High uncertainty in the qualitative method does not impact conclusions because of the extremely low risks predicted offsite at the Burning Ground and the much lower onsite risks at the landfills than those predicted at the Burning Ground.
Groundwater transport of onsite COPCs in soil, soil gas, and perched groundwater to offsite receptors in perched groundwater and Ogallala Aquifer.	Tier 2 dilution screening and Tier 3 travel time analysis indicate no COPCs will reach an offsite POE.	Negligible impact. Uncertainty in the Tier 2 and Tier 3 analysis is high but is not expected to impact the conclusion that COPCs will not reach an onsite or offsite POE within 1,000 years because the model is consistent with the site investigation data and other evidence supports the results of the analysis at the landfills.

F.1.4 Summary of Conclusions for the Landfills

The risk characterization identified three landfills resulting in potentially unacceptable risks/hazards to onsite workers from exposure to soils; however, consideration of the conservative nature of the HHRA reveals the calculated risks/hazards to be overestimates of actual risks/hazards. Groundwater fate and transport analysis indicates exposure to COPCs potentially migrating from soil, soil gas, and/or perched groundwater to onsite and offsite POEs in perched groundwater or the Ogallala Aquifer is an incomplete pathway and does not contribute risk to onsite or offsite receptors.

Conclusions for the landfills are summarized below:

- No soil COPCs were identified for evaluation in the risk assessment in soil at SVS 7a; therefore, soil in this area represents negligible risk.
- Soil COPCs were retained for evaluation in the risk assessment at Landfill 15, SVS 6, and SVS 7b; however, individual and cumulative ILCR and HQ/HI results for exposure to soil at these landfills are below the TCEQ and EPA acceptable target risk criteria.
- No radiological COCs were identified at the landfills. The risks from the radiological COPCs carried into this evaluation showed negligible risk
- PAHs are identified as soil COCs for evaluation in the CMS for surface soil at Landfill 1.
- Lead is identified as a soil COC for evaluation in the CMS for soil (0 to 15 ft) at Landfill 1.
- PAHs are identified as COCs for evaluation in the CMS for both surface soil (0 to 2 ft) and soil (0 to 15 ft) at Landfill 13.
- Benzo(a)pyrene is identified as a soil COC at Landfill 2.
- No COPCs are identified for soil gas.
- Subsurface fate and transport modeling indicates residual COPCs in soil, soil gas, and perched groundwater will not reach any onsite or offsite receptor locations within 1,000 years (Appendix I); therefore, no COCs are identified for groundwater.
- Because of uncertainty with the future integrity of the landfill covers to prevent ponding and infiltration of water through the landfills, Pantex has agreed to maintain landfill covers as part of it’s long-term stewardship plan.

COCs identified for the landfill exposure media are summarized for soil at the landfills for the industrial worker (0 to 2 ft) and construction/excavation worker (0 to 15 ft), respectively in figures below.

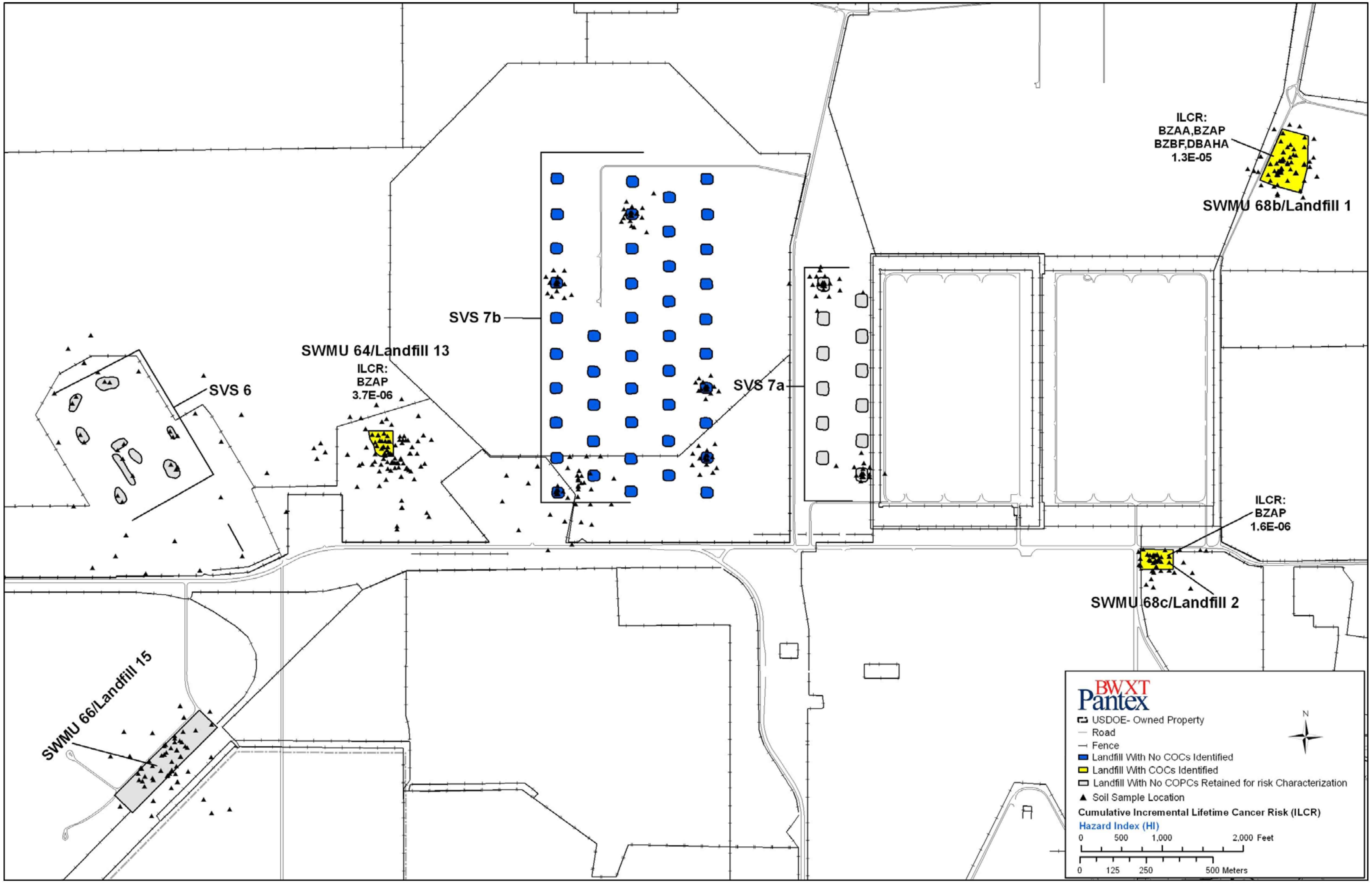

Figure F-2. Landfills Risk Results and COCs for Pantex Plant Industrial Worker, Surface Soil (0-2 ft)

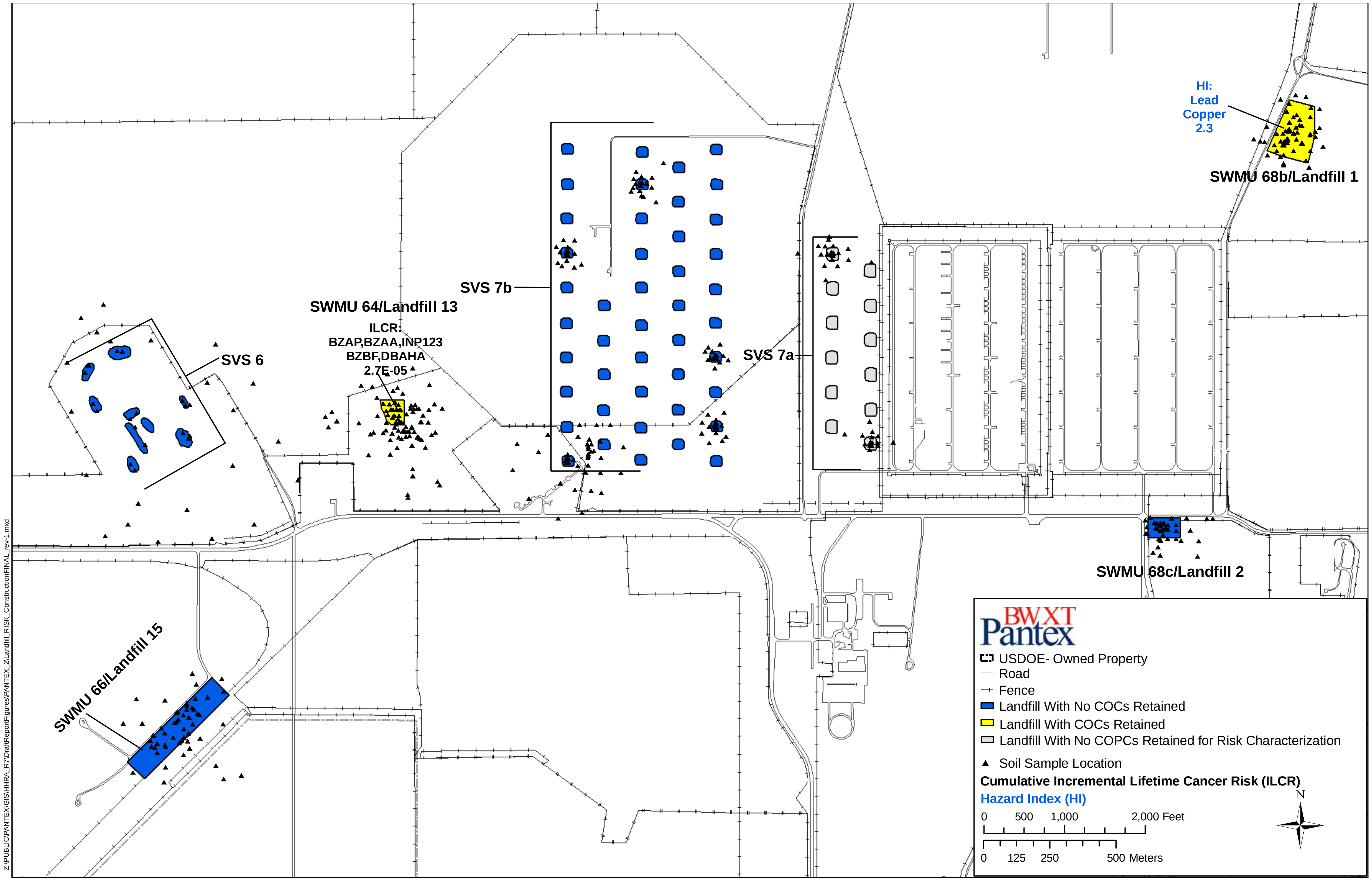

Figure F-3. Landfills COCs for Pantex Plant Construction/Excavation Worker, Soil (0-15 ft)

Appendix G

Groundwater Risk Summary for Release Units Requiring Remedial Action

Current and Future Perched Groundwater at Texas Tech University Research Farm (TTURF) And Future Ogallala Groundwater at TTURF

This section contains modified excerpts from the Baseline HHRA Report (December 2006), Appendices I, N, and R

RELEASE OF INFORMATION TO THE PUBLIC
DOCUMENTED REVIEW PROCESS
(Ref. WI 02.04.02.02.03)

Document Title Baseline Human Health Risk Assessment Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groudnwater – Volumes I and II Date 12/9/2005
Document Author Michelle Bolwahnn Type of Doc Report

Document Due Date 12-22-2005 Blanket Release Expires

This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☒ No ☐	for M.G.Knight	DEC 0 9 2005
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐		12/13/05
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐		12/13/05
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐		12/12/05
Legal 12-72 Legal	Legal	Yes ☑ No ☐		01/09/05
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐	T. Kelly	01/10/2005

After all signatures are obtained, forward copy via email or plant mail
to the Classification Officer and OSTI Transmittal Officer

Comments: **Please call Marlon Smith (x4058) or Michelle Bolwahnn (6326) for pickup after signature**

Please see attached comments x6616
+ with revised Exy. Summary and various changes already made

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G.0 GROUNDWATER RISK SUMMARY FOR RELEASE UNITSREQUIRING REMEDIAL ACTION

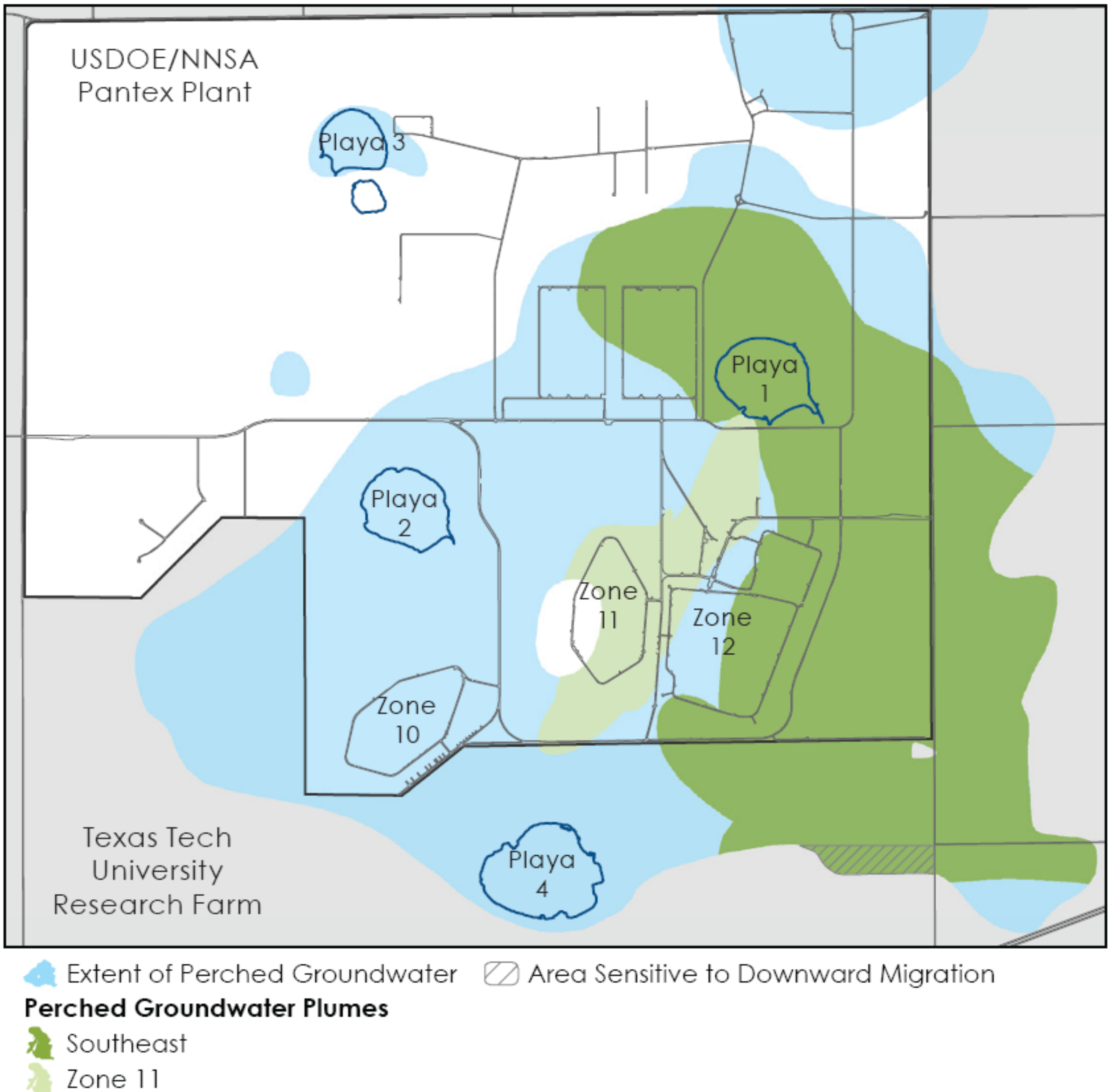

Figure G-1. Zone 11 and Zone 12 (Southeast) Perched Groundwater Plumes

G.1 SUMMARY OF GROUNDWATER RISKS

For this summary, the results of the evaluation of risks from the TTU property will be presented. Offsite east locations were the original focus for the current and future perched groundwater pathways of the HHRA (BWXT Pantex and SAIC, December 2006) because the property was privately owned. As part of the long-term stewardship for Pantex, the property was purchased to ensure access for monitoring and well drilling. TTU risks provide an overview of all risks for perched groundwater as risks at TTU are similar or higher than predicted risks along the eastern boundary of Pantex. Where differences occur, they will be noted in this summary. Future Ogallala risks were only calculated along the eastern boundary of Pantex and those results are summarized here.

G.2 OVERVIEW OF HISTORICAL SOURCES AND CURRENT CONDITIONS

Historical activities at Pantex Plant released COPCs to environmental media, resulting in the observed soil, soil gas, and perched groundwater COPCs now present. The sources of COPCs have been identified in the various RFIs completed for the different zones at Pantex Plant. Most are associated with past HE formulation and processing activities in Zones 11 and 12, specifically, wastewater discharges associated with these activities. Contaminants were released in wastewaters to ditches, playas, sumps, leach pits, dry wells, surface impoundments, and to land surface surrounding many of the facilities. The wastewaters provided the driving force for leaching of contaminants through the thick unsaturated zone to the underlying perched groundwater and greatly expanded the extent and volume of perched groundwater that occurred prior to Pantex Plant operations. Perched groundwater COPCs occur beneath much of Zone 12 and areas south and east of Zone 12 and Playa 1, extending offsite to the east and south. Perched groundwater COPCs also occur northwest and southwest of Playa 1, but at a much lower magnitude and extent relative to the Zone 12 area. The historical waste management practices that resulted in perched groundwater impacts, specifically the release of treated and untreated wastewaters to the ditches, were completely discontinued by 1999 with completion of a project to reroute steam condensate release lines.

Because wastewater discharges have been eliminated, the driving force for further leaching of COPCs to perched groundwater has been greatly reduced or eliminated. Recharge beneath the ditches and playas still occurs, but at rates representative of infiltration associated with precipitation and stormwater runoff as opposed to the historical average of 224,000 gpd released to ditches on the east side of Zone 12. The only remaining sources of contamination with the potential to impact offsite perched groundwater or the Ogallala Aquifer at POEs are contaminated perched groundwater and residual impacted pore water in the vadose zone. Because of the low recharge rates at Pantex Plant, COPCs in soils are not expected to impact perched groundwater in the future. COPCs in soil gas may continue to migrate to groundwater in the future through gaseous diffusion. However, the magnitude and locations are such that future migration to POEs above risk-based or detectable levels is unlikely.

G.3 COPC EVALUATION

The COPCs identified in the Groundwater RFIR (Stoller, 2004b) are the basis for the COPC dataset evaluated in this HHRA. The COPCs are evaluated based on the current observed extent in perched groundwater. Monitoring and extraction wells on the TTURF property are used for this analysis and are depicted in the figure below.

Because these areas are not controlled by Pantex Plant (outside of the Plant boundary), they are potential POEs. TTURF receives water from the Pantex Plant distribution lines as part of the lease and service agreement between TTU and USDOE. This water originates at the Pantex Plant production wells and is used to support mutually beneficial land management activities. No supply wells currently exist on TTURF property, and USDOE/NNSA is currently pursuing an agreement with TTU as an additional restriction of future groundwater use in this area. In lieu of a binding agreement with TTU, POEs for the groundwater pathway are comprised of areas of perched saturation to the south of Pantex Plant and west of FM 2373.

G.3.1 Data Evaluation

Groundwater data collected from 2002 to 2004 were used for COPC evaluation. This timeframe was chosen based on trending analysis of the wells. Trending analysis of the TTURF wells is provided in a table below.

G.3.2 Selection of COPCs for Evaluation in TTURF Groundwater

For the TTURF evaluation, a COPC list was developed that includes the perched groundwater COPCs from the groundwater RFIR and a listing of all detected data in the TTURF wells. The list is included the table below. This list of COPCs is the starting list for the Tier 1 COPC Evaluation step.

G.3.3 Filtered and Unfiltered Sample Results

Datasets containing COPCs screened for groundwater pathways discussed in this section contained some data from filtered groundwater samples. Filtering of groundwater samples is commonly performed in the field during collection of aqueous samples to minimize the amount of solids in the sample. Metals tend to sorb to solids; therefore, the concentration of metals in unfiltered aqueous samples can be biased high. Because the unfiltered sample results generally provide a more conservative concentration than filtered results, only the unfiltered results are used for COPC evaluation and risk characterization.

G.3.4 Results of COPC Evaluation

To determine which COPCs from perched groundwater have the potential for impacting exposure points in perched groundwater, each COPC was evaluated using the tiered subsurface contaminant migration assessment described in detail in Section 4.4 of the Baseline HHRA Report (BWXT Pantex and SAIC, December 2006), only the current perched pathway is evaluated here. Future predictions for the Ogallala Aquifer follow the risk evaluation for the perched groundwater. The Tier 1 initial screening used at TTURF is described below.

Tier 1 Initial Screening: Maximum detected concentration in perched groundwater is compared to applicable risk based screening criteria (RBSVGW). If any COPC has a maximum detected concentration greater than the applicable risk-based screening criteria, it is retained for further risk evaluation.

All detected COPCs were evaluated through the Tier 1 process and the results are presented in the following tables.

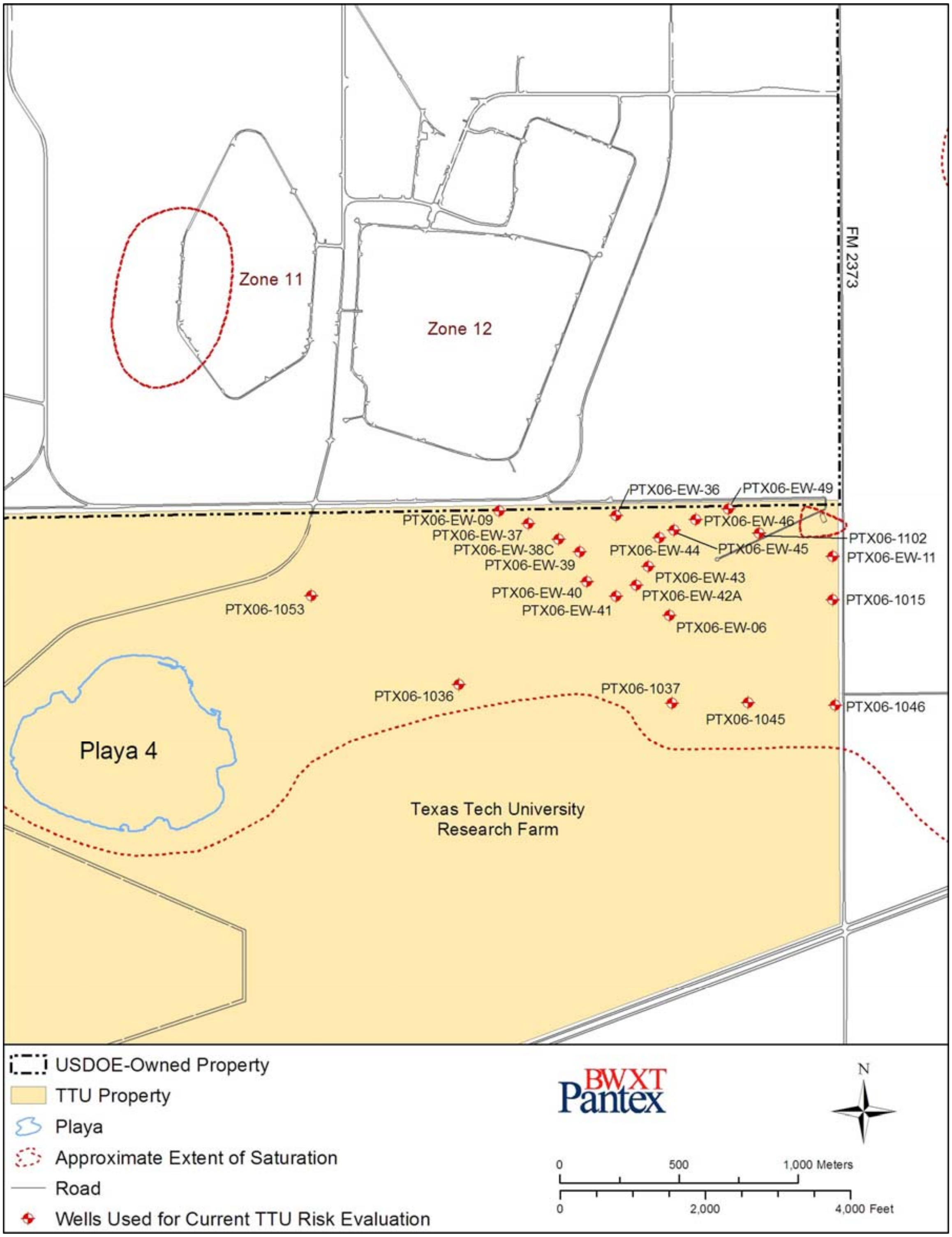

Figure G-2. Wells Used for Evaluation of Current TTURF Perched Groundwater

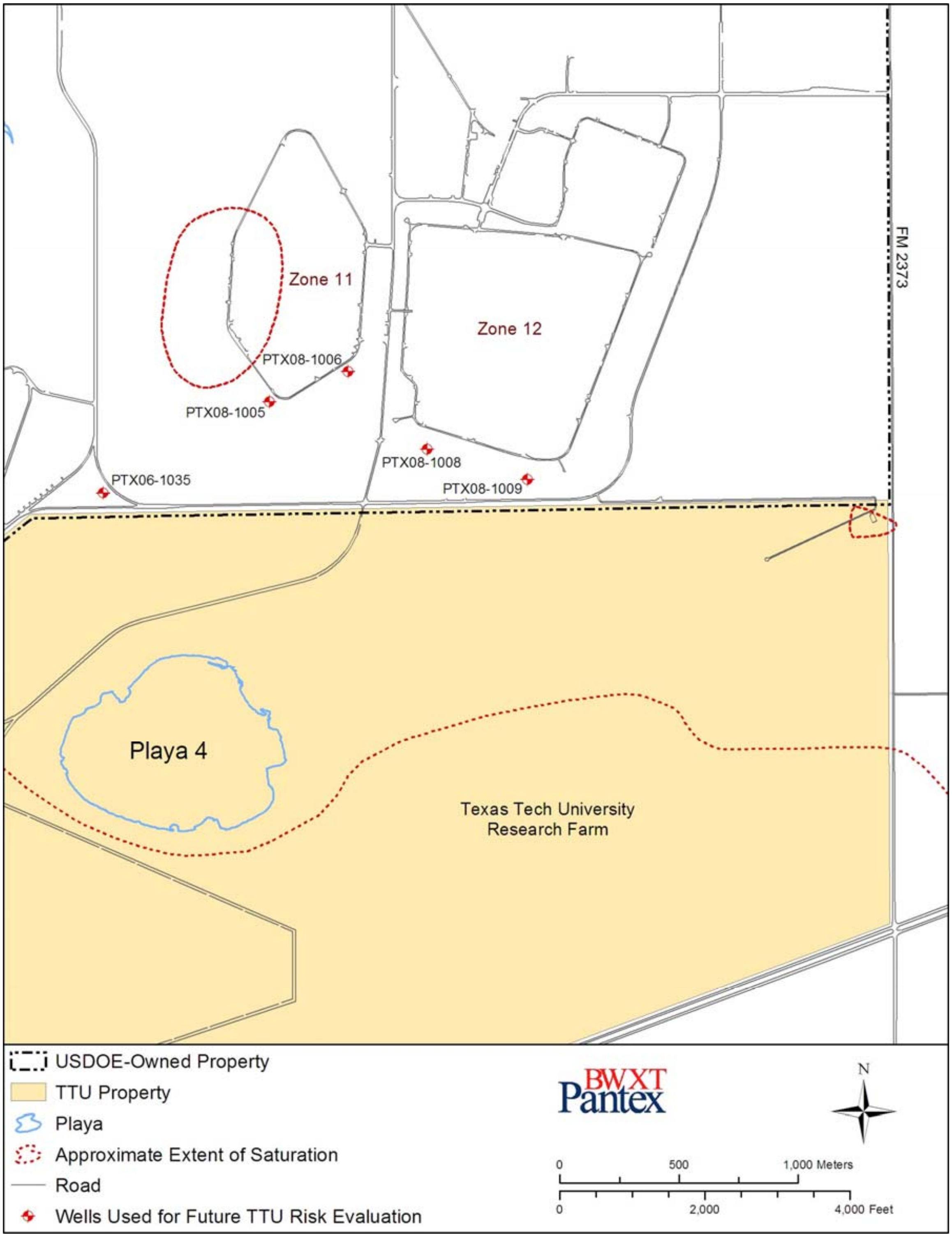

Figure G-3. Wells Used For Evaluation of Future TTURF Groundwater

Table G-1. Starting List of COPCs in TTURF Groundwater

COPC	Groundwater RFIR[a]	TTURF Detects- Filtered[b]	TTURF Detects- Unfiltered[b]
Metals			
Boron	√		√
Chromium, Hexavalent	√	√	√
Chromium, total	√		√
Selenium			√
Strontium	√		
Miscellaneous			
Perchlorate	√		√
Cyanide	√		
Nitrate As N			√
HEs			
1,3,5-Trinitrobenzene	√		√
1,3-Dinitrobenzene	√		
2,4-Dinitrotoluene	√		√
2,6-Dinitrotoluene	√		√
2-Amino-4,6-dinitrotoluene	√		√
4-Amino-2,6-dinitrotoluene	√		√
2-Nitrotoluene	√		
HMX	√		√
RDX	√		√
Tetryl	√		
TNT	√		√
VOCs			
1,2-Dichloroethane	√		√
Chloroform	√		√
Freon-113	√		
Tetrachloroethene (PCE)	√		√
Trichloroethene	√		√

[a]From *Groundwater RCRA Facility Investigation Report* (Stoller, 2004b).
[b]Based on review of data collected at TTURF wells from 2002-2004.
√ COPC for medium

Table G-2. COPCs Retained for Further Evaluation of Current and Future Risks at TTURF

COPC	Filtered	Unfiltered
Metals		
Boron		√
Chromium, Hexavalent	√	√
Chromium, total		√
Selenium		
Miscellaneous		
Perchlorate		√
Nitrate As N		
HEs		
1,3,5-Trinitrobenzene		√[a]
1,3-Dinitrobenzene		√
2,4-Dinitrotoluene		√
2,6-Dinitrotoluene		√
2-Amino-4,6-dinitrotoluene		√
4-Amino-2,6-dinitrotoluene		√
2-Nitrotoluene		
HMX		√
RDX		√
TNT		√
VOCs		
1,2-Dichloroethane		√
Chloroform		√[a]
Tetrachloroethene (PCE)		√[a]
Trichloroethene		√

[b]This COPC retained for future evaluation only at TTU.

G.3.5 Results of Trending Analysis and Current EPC Calculation

Trending analysis was performed for all perched groundwater monitoring wells and extraction wells at TTURF. Those trending results are presented in the above table for current EPCs.

As detailed above, a total of 148 COPCs/well pairs could be evaluated. Of those, 127 had sufficient data to evaluate trends; 20 of the COPC/well pairs had upward trends and 39 had downward trends. Statistical analysis of all other COPC/well pairs indicated that there was no significant trend.

G.3.6 Summary of Current EPCs

The process by which current perched groundwater EPCs were determined can be summarized as follows:

- EPCs were calculated for each perched groundwater COPC/well pair.
- For each COPC/well pair, trending analysis was performed and EPCs were statistically determined based on data distribution.

- EPCs were determined for evaluation of health impacts from data for USDOE/NNSA wells located on TTURF property.

- Any EPCs that were less than the EPA MCL were not evaluated for current perched groundwater risks to offsite resident farmers.

- A total of 14 COPCs were evaluated for current perched groundwater EPCs.

G.3.7 R.3.7 Future Exposure Point Concentrations

The activities that resulted in perched groundwater contamination have ceased at Pantex Plant. Discharges to ditches, playas, and other areas of focused recharge to the subsurface have been discontinued. Numerous ICMs have also been implemented (excavations along ditches, SVE system in Zone 11, ditch linings, groundwater pump and treat system) that reduce potential future impacts to the underlying perched groundwater and the Ogallala Aquifer.

Impacts to perched groundwater beneath source areas are expected to persist into the future as impacted pore water drains from the overlying partially-saturated formation sediments (residual contamination). Observed groundwater analytical results from these areas show concentrations that are lower than those observed in downgradient areas for most COPCs, including RDX. Trend analyses of groundwater COPC data do not show increasing COPC levels beneath or immediately downgradient of the source areas. Therefore, potential future impacts from residual pore water contamination are expected to continue in the future, but at lower concentrations than those currently observed in downgradient areas.

Some areas of higher concentration in the perched groundwater at Pantex have not reached TTURF. Therefore, in some cases, future risks are expected to increase. The future perched groundwater plume movement was modeled for determination of offsite east impacts. With the exception of 1, 3, 5-trinitrobenzene, those impacts are not expected to be higher than current risks at the eastern boundary because much of the perched groundwater plume has high concentrations along the eastern boundary. However, perched groundwater plumes from Zone 11 and the southwestern portion of Zone 12 will continue to impact TTURF in the future. Plumes from these areas were not modeled for future impacts to TTURF. For this reason, the wells inside the Pantex boundary that were not previously evaluated for impacts to perched groundwater beneath TTURF will be evaluated here. For this evaluation, further modeling will not be completed; instead, the trending information and EPCs from the Pantex wells will be evaluated and used to calculate future risk at TTURF. This evaluation assumes that the COPC concentrations in these wells will not change, through either degradation or dispersion, as they move onto TTURF. This assumption may be conservative for some of the COPCs because degradation has been observed for TNT and is expected for RDX and TCE as well.

For comparison, future risk will be calculated for the onsite Pantex wells and then compared to the offsite wells on TTURF. This comparison ensures the maximum risk will be identified at TTURF for all future COPCs.

The future Ogallala Aquifer EPCs were evaluated through modeling, as discussed in Appendices I and N of the Baseline HHRA Report (December 2006), and the details of the Ogallala modeling are not repeated here. Future risks for TTURF are calculated and presented here.

G.3.8 Wells Chosen for Evaluation of Future Risks

Wells along the Pantex boundary and along the southern portions of Zone 11 and southwestern Zone 12 were chosen for the evaluation of future risk.

The Pantex wells used to determine future risks at TTU are depicted in above and include:

PTX06-1035	PTX08-1005
PTX08-1008	PTX08-1009.
PTX08-1006	

Well PTX06-1012, south of Zone 11, was not used for this analysis because the data reviewed for the risk assessment does not indicate the presence of COPCs in this well. Therefore, the upgradient well, PTX08-1005 was used for this analysis.

G.3.9 Summary of Future Exposure Point Concentrations

G.3.9.1 Perched Groundwater

The process by which future perched groundwater EPCs were determined can be summarized as follows:

- For each COPC, the EPC was calculated from the trending analysis performed for each well listed and depicted above. The maximum EPC from the wells depicted is used to calculate risk.
- A total of 15 COPCs were evaluated for future perched groundwater EPCs.
- Because modeling of perched groundwater indicated that only 1,3,5-trinitrobenzene will increase offsite in the future, the maximum future concentration for 1,3,5-trinitrobenzene at 1,000 years is used for this COPC, rather than using wells from onsite as the predicted future concentrations.

G.3.9.2 Ogallala Aquifer

The process by which future Ogallala Aquifer groundwater EPCs were determined can be summarized as follows:

- Future Ogallala EPCs were calculated for 14 COPCs, based on fate and transport modeling.
- Calculation and modeling of future EPCs focused on areas where movement of COPCs in perched groundwater could impact the Ogallala at an offsite POE – along the eastern boundary. Therefore the modeling focused on the Zone 12 (southeast) perched groundwater plume.
- For each COPC, future EPCs are determined at the location of the predicted maximum impact offsite (along the eastern boundary) regardless of location along the eastern boundary within a period of 1,000 years. The location of impact was determined to be on TTU, near the southeastern boundary of TTU. The EPCs and modeled impacts along the eastern boundary are slightly lower than directly beneath the point of impact, and the time of maximum impact is also longer than directly beneath the point of impact. However, predicted risks would be very similar, because the difference in EPCs is less than a factor of 2.

- Fate and transport modeling was performed for ten COPCs over 1,000 years. The ten modeled COPCs include: 1,3,5-trinitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, HMX, RDX, TNT, boron, hexavalent chromium, 1,2-dichloroethane, and trichloroethene.

- EPCs were determined to be the maximum modeled concentration that occurred within 1,000 years.

- Maximum future concentrations for 2-amino-4, 6-dinitrotoluene and 4-amino-2, 6-dinitrotoluene were not modeled, but are assumed to occur at the same time as their parent compound (TNT). Future maximum concentrations were then conservatively calculated by applying the ratio of degradation product to parent compound from concentrations measured in current perched groundwater.

- Total chromium was estimated from modeling results for hexavalent chromium.

- 1,3-dinitrobenzene was determined from modeling performed for the 2,6-dinitrotoluene, which is similar in magnitude and extent to 1,3-dinitrobenzene.

- A total of 14 COPCs were evaluated for future Ogallala Aquifer groundwater EPCs; however, only 11 of these COPCs were evaluated for future risks to offsite resident farmers. Predicted future EPCs for hexavalent chromium, trichloroethene, and 1,2-dichloroethane are less than their EPA MCLs. Therefore, no future risk to offsite receptors was calculated for these COPCs.

Table G-3. Results of Trending Analyses and EPC Calculation for Current TTURF Perched Groundwater Wells

Location Code	Filtered, (Y/N?)	Group	COPC	CAS #	Total Number of Samples	Total Number of Detects	Minimum Detection (mg/L)	Maximum Detection (mg/L)	p	Direction	EPC (mg/L)
PTX06-1015	N	HE	RDX	121-82-4	8	8	2.20E-02	5.30E-01	8.37E-04	Upward	5.30E-01
PTX06-1015	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	8	8	3.60E-03	2.23E-02	7.11E-01	NS	2.23E-02
PTX06-1015	N	HE	2,6-Dinitrotoluene	606-20-2	8	4	2.30E-04	1.00E-03	4.54E-01	NS	1.00E-03
PTX06-1036	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	9	6	2.40E-04	1.10E-03	2.95E-01	NS	1.10E-03
PTX06-1037	N	HE	RDX	121-82-4	4	4	1.03E+00	2.80E+00	--	NA	2.80E+00
PTX06-1037	N	MET	Chromium, Total	7440-47-3	4	4	2.28E-02	1.05E-01	--	NA	1.05E-01
PTX06-1037	Y	MET	Chromium, Hexavalent	18540-29-9	1	1	1.09E-01	1.09E-01	--	NA	1.09E-01
PTX06-1037	N	MET	Boron	7440-42-8	4	4	1.01E+00	1.20E+00	--	NA	1.20E+00
PTX06-1037	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	4	3	9.30E-03	2.00E-02	--	NA	2.00E-02
PTX06-1037	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	4	1	3.50E-03	3.50E-03	--	NA	3.50E-03
PTX06-1037	N	HE	2,6-Dinitrotoluene	606-20-2	5	1	5.90E-04	5.90E-04	--	NA	5.90E-04
PTX06-1045	N	HE	RDX	121-82-4	9	9	1.04E+00	1.90E+00	2.51E-01	NS	1.90E+00
PTX06-1045	N	MET	Boron	7440-42-8	9	9	3.67E-01	6.65E-01	1.23E-03	Upward	6.65E-01
PTX06-1045	N	HE	2,6-Dinitrotoluene	606-20-2	9	3	6.10E-04	7.90E-04	--	NA	7.90E-04
PTX06-1045	N	VOC	1,2-Dichloroethane	107-06-2	9	7	2.70E-03	6.50E-03	1.00E+00	NS	6.50E-03
PTX06-1046	N	HE	RDX	121-82-4	11	11	4.50E-01	7.60E-01	8.12E-03	Upward	7.60E-01
PTX06-1046	N	MET	Boron	7440-42-8	11	11	1.80E-01	3.49E-01	9.92E-05	Upward	3.49E-01
PTX06-1046	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	11	5	1.00E-04	1.22E-02	--	NA	5.76E-03
PTX06-1046	N	HE	2,6-Dinitrotoluene	606-20-2	10	3	5.90E-04	1.20E-03	--	NA	1.20E-03
PTX06-1046	N	VOC	1,2-Dichloroethane	107-06-2	10	9	1.80E-03	5.60E-03	9.28E-01	NS	4.22E-03
PTX06-1053	N	MISC	Perchlorate	14797-73-0	10	4	4.28E-03	5.72E-03	--	NA	5.72E-03
PTX06-1053	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	11	7	2.00E-04	1.90E-03	2.70E-02	Upward	1.90E-03
PTX06-EW-11	N	HE	RDX	121-82-4	15	15	5.90E-01	1.30E+00	9.55E-05	Downward	5.90E-01
PTX06-EW-11	N	MET	Chromium, Total	7440-47-3	17	17	6.00E-03	2.03E+00	1.08E-01	NS	3.51E-01
PTX06-EW-11	N	MET	Boron	7440-42-8	16	16	3.57E-01	6.94E-01	1.17E-03	Downward	3.57E-01
PTX06-EW-11	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	16	15	9.12E-03	1.50E-02	7.53E-04	Upward	1.20E-02
PTX06-EW-11	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	15	11	2.90E-04	1.80E-03	9.06E-02	NS	8.40E-04
PTX06-EW-11	N	HE	2,4-Dinitrotoluene	121-14-2	16	1	3.90E-04	3.90E-04	--	NA	2.68E-04

Table G-3. Results of Trending Analysis and EPC Calculation for TTURF Perched Groundwater Wells, Continued

Location Code	Filtered, (Y/N?)	Group	COPC	CAS #	Total Number of Samples	Total Number of Detects	Minimum Detection (mg/L)	Maximum Detection (mg/L)	p	Direction	EPC (mg/L)
PTX06-EW-11	N	VOC	1,2-Dichloroethane	107-06-2	14	12	6.00E-04	1.00E-02	7.01E-01	NS	6.15E-03
PTX06-EW-14	N	HE	RDX	121-82-4	10	10	3.70E-01	1.36E+00	8.58E-01	NS	9.44E-01
PTX06-EW-14	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	11	10	6.60E-03	2.30E-02	6.96E-01	NS	1.60E-02
PTX06-EW-36	N	VOC	Trichloroethene	79-01-6	13	12	8.00E-03	8.10E-02	1.42E-01	NS	5.84E-02
PTX06-EW-36	N	HE	TNT	118-96-7	12	9	7.40E-03	4.60E-02	3.34E-01	NS	3.31E-02
PTX06-EW-36	N	HE	RDX	121-82-4	15	15	1.20E-01	3.60E+00	2.82E-03	Downward	8.00E-01
PTX06-EW-36	N	HE	HMX	2691-41-0	15	15	2.90E-03	2.60E-01	5.20E-02	NS	1.97E-01
PTX06-EW-36	N	MET	Chromium, Total	7440-47-3	15	15	1.00E-02	2.78E-01	1.38E-01	NS	1.85E-01
PTX06-EW-36	N	MET	Chromium, Hexavalent	18540-29-9	15	14	1.00E-02	2.70E-01	1.38E-01	NS	1.72E-01
PTX06-EW-36	N	MET	Boron	7440-42-8	14	14	5.53E-01	1.00E+00	1.84E-06	Downward	5.53E-01
PTX06-EW-36	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	13	13	3.60E-03	1.50E-02	5.45E-02	NS	1.16E-02
PTX06-EW-36	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	15	15	4.10E-03	1.90E-02	1.50E-03	Downward	5.20E-03
PTX06-EW-36	N	HE	2,4-Dinitrotoluene	121-14-2	13	12	1.50E-03	3.90E-02	5.86E-02	NS	2.28E-02
PTX06-EW-37	N	VOC	Trichloroethene	79-01-6	14	13	4.80E-03	2.20E-02	3.46E-03	Downward	5.40E-03
PTX06-EW-37	N	HE	RDX	121-82-4	13	13	6.50E-04	4.00E-01	2.57E-03	Upward	1.90E-02
PTX06-EW-37	N	MISC	Perchlorate	14797-73-0	7	1	1.80E-02	1.80E-02	--	NA	1.80E-02
PTX06-EW-37	N	MET	Chromium, Total	7440-47-3	15	15	3.33E-01	1.50E+00	4.99E-05	Downward	3.56E-01
PTX06-EW-37	N	MET	Chromium, Hexavalent	18540-29-9	16	16	2.81E-01	1.40E+00	1.51E-03	Downward	2.81E-01
PTX06-EW-37	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	13	13	5.90E-04	4.80E-03	7.40E-01	NS	2.07E-03
PTX06-EW-37	N	HE	2,4-Dinitrotoluene	121-14-2	14	2	1.10E-03	2.30E-02	--	NA	4.80E-03
PTX06-EW-38C	N	VOC	Trichloroethene	79-01-6	13	13	7.40E-03	2.40E-02	4.08E-01	NS	2.00E-02
PTX06-EW-38C	N	HE	TNT	118-96-7	13	13	1.20E-02	2.00E-01	4.17E-02	Downward	1.20E-02
PTX06-EW-38C	N	HE	RDX	121-82-4	13	13	1.50E-02	6.80E+00	4.25E-02	Downward	1.70E-01
PTX06-EW-38C	N	MET	Chromium, Total	7440-47-3	14	14	2.80E-01	8.98E-01	6.22E-01	NS	6.32E-01
PTX06-EW-38C	N	MET	Chromium, Hexavalent	18540-29-9	15	15	2.46E-01	1.09E+00	4.28E-01	NS	7.26E-01

Table G-3. Results of Trending Analysis and EPC Calculation for TTURF Perched Groundwater Wells, Continued

Location Code	Filtered, (Y/N?)	Group	COPC	CAS #	Total Number of Samples	Total Number of Detects	Minimum Detection (mg/L)	Maximum Detection (mg/L)	p	Direction	EPC (mg/L)
PTX06-EW-38C	N	MET	Boron	7440-42-8	12	12	2.89E-01	5.00E-01	1.57E-03	Downward	2.89E-01
PTX06-EW-38C	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	13	12	2.10E-03	6.70E-03	4.09E-01	NS	4.94E-03
PTX06-EW-38C	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	13	13	7.30E-04	2.70E-02	3.69E-02	Downward	1.10E-03
PTX06-EW-38C	N	HE	2,4-Dinitrotoluene	121-14-2	13	12	7.80E-04	3.50E-01	2.17E-03	Downward	5.80E-03
PTX06-EW-39	N	VOC	Trichloroethene	79-01-6	16	14	6.10E-03	2.00E-02	1.66E-02	Downward	6.10E-03
PTX06-EW-39	N	HE	TNT	118-96-7	16	13	3.80E-04	2.00E-02	7.72E-01	NS	1.13E-02
PTX06-EW-39	N	HE	RDX	121-82-4	17	17	2.90E-02	1.30E+00	5.95E-01	NS	8.82E-01
PTX06-EW-39	N	MET	Chromium, Total	7440-47-3	17	17	3.40E-02	6.81E-01	5.64E-01	NS	2.11E-01
PTX06-EW-39	N	MET	Chromium, Hexavalent	18540-29-9	18	17	2.84E-02	7.03E-01	1.57E-02	Upward	3.98E-02
PTX06-EW-39	N	MET	Boron	7440-42-8	16	16	3.00E-01	1.09E+00	1.25E-01	NS	8.18E-01
PTX06-EW-39	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	17	17	3.10E-03	2.00E-02	1.32E-02	Downward	5.50E-03
PTX06-EW-39	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	17	16	5.00E-04	1.00E-02	5.19E-01	NS	5.64E-03
PTX06-EW-39	N	HE	2,4-Dinitrotoluene	121-14-2	14	10	2.50E-04	1.60E-02	9.60E-01	NS	4.61E-03
PTX06-EW-40	N	VOC	Trichloroethene	79-01-6	14	14	6.50E-03	2.20E-02	5.09E-01	NS	1.84E-02
PTX06-EW-40	N	HE	TNT	118-96-7	13	12	8.20E-03	3.20E-02	4.26E-01	NS	2.16E-02
PTX06-EW-40	N	HE	RDX	121-82-4	14	14	2.20E-01	7.10E+00	9.51E-02	NS	2.43E+00
PTX06-EW-40	N	MET	Chromium, Total	7440-47-3	15	15	6.00E-03	1.70E+00	2.35E-01	NS	1.12E+00
PTX06-EW-40	N	MET	Chromium, Hexavalent	18540-29-9	15	14	1.00E-02	2.05E+00	4.74E-03	Upward	1.74E-01
PTX06-EW-40	N	MET	Boron	7440-42-8	13	13	5.33E-01	1.30E+00	8.71E-03	Downward	5.33E-01
PTX06-EW-40	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	14	13	7.50E-03	1.70E-02	1.05E-02	Downward	7.50E-03
PTX06-EW-40	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	14	14	2.80E-03	5.20E-02	1.78E-03	Downward	4.00E-03
PTX06-EW-40	N	HE	2,4-Dinitrotoluene	121-14-2	13	13	1.30E-03	2.40E-01	6.20E-04	Downward	1.70E-03
PTX06-EW-41	N	VOC	Trichloroethene	79-01-6	10	10	1.20E-02	3.30E-02	4.74E-01	NS	2.55E-02
PTX06-EW-41	N	HE	TNT	118-96-7	10	9	6.40E-03	2.40E-01	2.10E-01	NS	2.40E-01
PTX06-EW-41	N	HE	RDX	121-82-4	10	10	3.30E-01	1.50E+01	1.27E-01	NS	6.85E+00
PTX06-EW-41	N	MET	Chromium, Total	7440-47-3	11	11	3.60E-02	1.05E+00	6.40E-01	NS	6.94E-01

Table G-3. Results of Trending Analysis and EPC Calculation for TTURF Perched Groundwater Wells, Continued

Location Code	Filtered, (Y/N?)	Group	COPC	CAS #	Total Number of Samples	Total Number of Detects	Minimum Detection (mg/L)	Maximum Detection (mg/L)	p	Direction	EPC (mg/L)
PTX06-EW-41	N	MET	Chromium, Hexavalent	18540-29-9	11	9	2.20E-02	1.75E-01	2.41E-01	NS	9.63E-02
PTX06-EW-41	N	MET	Boron	7440-42-8	9	9	6.69E-01	1.10E+00	5.55E-02	NS	1.10E+00
PTX06-EW-41	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	10	9	2.20E-03	2.70E-02	9.28E-01	NS	1.92E-02
PTX06-EW-41	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	10	10	1.20E-03	1.00E-01	1.23E-02	Downward	4.30E-03
PTX06-EW-41	N	HE	2,4-Dinitrotoluene	121-14-2	9	9	1.00E-03	7.30E-01	1.65E-02	Downward	2.10E-03
PTX06-EW-42A	N	VOC	Trichloroethene	79-01-6	16	13	2.20E-04	1.80E-02	2.20E-01	NS	1.80E-02
PTX06-EW-42A	N	HE	TNT	118-96-7	15	9	2.10E-04	1.10E-02	2.62E-02	Upward	2.00E-03
PTX06-EW-42A	N	HE	RDX	121-82-4	16	16	5.20E-02	8.10E+00	1.51E-05	Downward	8.10E-02
PTX06-EW-42A	N	HE	HMX	2691-41-0	16	16	3.20E-03	1.00E+00	1.53E-04	Downward	3.60E-03
PTX06-EW-42A	N	MET	Boron	7440-42-8	15	15	6.35E-01	2.20E+00	3.91E-05	Downward	6.35E-01
PTX06-EW-42A	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	16	15	4.10E-04	4.90E-01	1.89E-03	Downward	1.90E-03
PTX06-EW-42A	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	15	15	1.60E-03	2.40E-01	2.51E-06	Downward	1.70E-03
PTX06-EW-42A	N	HE	2,4-Dinitrotoluene	121-14-2	14	11	8.20E-04	1.50E-02	2.07E-01	NS	1.36E-02
PTX06-EW-43	N	VOC	Trichloroethene	79-01-6	12	11	5.50E-04	1.60E-02	3.04E-01	NS	1.39E-02
PTX06-EW-43	N	HE	TNT	118-96-7	11	4	3.60E-03	8.30E-03	--	NA	4.13E-03
PTX06-EW-43	N	HE	RDX	121-82-4	13	13	7.00E-01	5.30E+00	2.46E-01	NS	3.44E+00
PTX06-EW-43	N	HE	HMX	2691-41-0	13	12	1.70E-02	3.80E-01	2.22E-01	NS	2.68E-01
PTX06-EW-43	N	MET	Chromium, Total	7440-47-3	13	13	9.00E-03	1.97E-01	6.20E-04	Upward	1.97E-01
PTX06-EW-43	N	MET	Chromium, Hexavalent	18540-29-9	14	11	7.00E-03	2.37E-01	2.06E-02	Upward	2.37E-01
PTX06-EW-43	N	MET	Boron	7440-42-8	12	12	7.86E-01	1.90E+00	1.57E-03	Downward	8.35E-01
PTX06-EW-43	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	13	12	2.90E-03	2.30E-02	2.78E-02	Downward	8.90E-03
PTX06-EW-43	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	13	12	1.50E-03	5.60E-02	2.40E-02	Downward	6.70E-03
PTX06-EW-43	N	HE	2,4-Dinitrotoluene	121-14-2	12	9	4.30E-04	2.10E-02	7.83E-01	NS	2.10E-02
PTX06-EW-44	N	VOC	Trichloroethene	79-01-6	15	15	2.00E-03	1.90E-02	5.02E-06	Upward	1.90E-02
PTX06-EW-44	N	HE	TNT	118-96-7	14	12	6.50E-03	2.20E-02	9.07E-04	Upward	2.20E-02
PTX06-EW-44	N	HE	RDX	121-82-4	16	16	4.30E-01	2.50E+01	5.89E-01	NS	7.54E+00

Table G-3. Results of Trending Analysis and EPC Calculation for TTURF Perched Groundwater Wells, Continued

Location Code	Filtered, (Y/N?)	Group	COPC	CAS #	Total Number of Samples	Total Number of Detects	Minimum Detection (mg/L)	Maximum Detection (mg/L)	p	Direction	EPC (mg/L)
PTX06-EW-44	N	HE	HMX	2691-41-0	16	16	1.20E-02	3.30E+00	2.78E-01	NS	9.06E-01
PTX06-EW-44	N	MET	Boron	7440-42-8	15	15	1.10E+00	2.00E+00	3.73E-01	NS	1.68E+00
PTX06-EW-44	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	15	15	1.20E-02	1.80E-01	7.01E-02	NS	4.73E-02
PTX06-EW-44	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	16	15	2.40E-03	2.60E-01	3.91E-01	NS	6.23E-02
PTX06-EW-44	N	HE	2,4-Dinitrotoluene	121-14-2	14	14	3.00E-03	1.80E-01	8.92E-02	NS	1.04E-01
PTX06-EW-45	N	VOC	Trichloroethene	79-01-6	14	13	3.00E-03	1.10E-02	9.91E-05	Upward	1.10E-02
PTX06-EW-45	N	HE	TNT	118-96-7	12	8	3.30E-03	1.80E-02	4.06E-04	Upward	1.60E-02
PTX06-EW-45	N	HE	RDX	121-82-4	15	15	9.10E-01	4.90E+00	7.26E-01	NS	4.18E+00
PTX06-EW-45	N	HE	HMX	2691-41-0	15	15	8.80E-02	4.60E-01	1.10E-02	Upward	3.70E-01
PTX06-EW-45	N	MET	Boron	7440-42-8	14	14	1.23E+00	1.70E+00	9.68E-02	NS	1.62E+00
PTX06-EW-45	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	15	14	2.20E-03	2.30E-02	5.84E-01	NS	1.81E-02
PTX06-EW-45	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	15	15	7.10E-03	3.10E-02	4.83E-01	NS	2.35E-02
PTX06-EW-45	N	HE	2,4-Dinitrotoluene	121-14-2	12	12	5.80E-04	2.40E-02	1.69E-01	NS	2.40E-02
PTX06-EW-45	N	VOC	1,2-Dichloroethane	107-06-2	13	13	3.00E-03	1.40E-02	5.05E-02	NS	7.49E-03
PTX06-EW-46	N	HE	RDX	121-82-4	17	17	1.30E-01	8.60E+00	1.57E-01	NS	2.39E+00
PTX06-EW-46	N	HE	HMX	2691-41-0	17	17	2.60E-02	1.10E+00	2.98E-01	NS	3.26E-01
PTX06-EW-46	N	MET	Chromium, Total	7440-47-3	18	17	2.00E-03	1.20E-01	5.95E-01	NS	2.27E-02
PTX06-EW-46	N	MET	Boron	7440-42-8	16	16	4.80E-01	7.22E-01	9.64E-01	NS	6.21E-01
PTX06-EW-46	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	17	17	2.20E-03	9.90E-02	8.22E-03	Downward	4.20E-03
PTX06-EW-46	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	17	17	6.60E-03	5.50E-02	7.22E-03	Downward	7.70E-03
PTX06-EW-46	N	HE	2,4-Dinitrotoluene	121-14-2	14	13	1.10E-03	6.60E-03	2.46E-02	Downward	1.10E-03
PTX06-EW-49	N	HE	RDX	121-82-4	16	16	1.60E-01	1.00E+01	1.61E-01	NS	2.72E+00
PTX06-EW-49	N	MET	Boron	7440-42-8	15	15	3.47E-01	5.20E-01	3.31E-02	Downward	4.10E-01
PTX06-EW-49	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	16	15	1.10E-03	1.90E-01	4.54E-02	Downward	1.20E-02
PTX06-EW-49	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	16	10	2.10E-04	6.80E-02	2.04E-02	Upward	9.40E-04
PTX06-EW-49	N	HE	2,4-Dinitrotoluene	121-14-2	16	2	2.80E-04	1.30E-01	--	NA	2.26E-02

Table G-3. Results of Trending Analysis and EPC Calculation for TTURF Perched Groundwater Wells, Continued

Location Code	Filtered, (Y/N?)	Group	COPC	CAS #	Total Number of Samples	Total Number of Detects	Minimum Detection (mg/L)	Maximum Detection (mg/L)	p	Direction	EPC (mg/L)
PTX06-EW-6	N	HE	RDX	121-82-4	12	12	4.30E-01	5.92E+00	1.64E-02	Downward	1.50E+00
PTX06-EW-6	N	MISC	Perchlorate	14797-73-0	5	1	1.98E-02	1.98E-02	--	NA	1.98E-02
PTX06-EW-6	N	MET	Boron	7440-42-8	12	12	9.28E-01	2.34E+00	1.59E-02	Downward	9.28E-01
PTX06-EW-6	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	12	11	6.40E-03	4.75E-02	2.30E-02	Downward	6.40E-03
PTX06-EW-6	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	12	12	6.90E-03	3.36E-02	1.08E-02	Downward	1.40E-02
PTX06-EW-6	N	HE	2,4-Dinitrotoluene	121-14-2	12	3	4.30E-04	2.30E-03	--	NA	7.50E-04
PTX06-EW-8	N	HE	RDX	121-82-4	9	9	1.51E-01	1.21E+00	4.66E-01	NS	1.21E+00
PTX06-EW-8	N	MET	Chromium, Total	7440-47-3	10	10	1.00E-02	5.30E-01	5.92E-01	NS	4.29E-01
PTX06-EW-8	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	9	7	4.10E-04	8.51E-03	7.54E-01	NS	8.51E-03
PTX06-EW-8	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	9	3	2.40E-04	4.20E-03	--	NA	4.20E-03
PTX06-EW-8	N	HE	2,6-Dinitrotoluene	606-20-2	9	3	2.30E-04	3.40E-03	--	NA	3.40E-03
PTX06-EW-8	N	HE	1,3-Dinitrobenzene	99-65-0	9	2	1.33E-03	1.40E-03	--	NA	1.40E-03
PTX06-EW-9	N	VOC	Trichloroethene	79-01-6	12	12	2.61E-03	1.40E-02	7.79E-04	Upward	1.40E-02
PTX06-EW-9	N	HE	RDX	121-82-4	12	10	1.20E-03	1.70E-02	6.85E-03	Upward	1.70E-02
PTX06-EW-9	N	MET	Chromium, Total	7440-47-3	14	14	1.30E+00	2.50E+00	2.57E-03	Downward	1.30E+00
PTX06-EW-9	N	MET	Chromium, Hexavalent	18540-29-9	14	14	2.44E-03	3.00E+00	4.11E-01	NS	2.05E+00
PTX06-EW-9	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	12	10	6.40E-04	2.70E-03	1.00E+00	NS	2.10E-03

The results of the trending are defined as follows:

NA - No trending performed due to insufficient data (<4 samples or <50% detect). EPC = the lesser of 95% UCL if sample size ≥ 10 or the maximum detected concentration. If sample size < 10, maximum detect used as EPC.

NS - Sufficient data were available for trending analysis; however, no statistically significant trend was evident. EPC = the lesser of 95% UCL if sample size ≥ 10 or the maximum detected concentration. If sample size < 10, maximum detect used as EPC.

Upward - Statistically upward trend was determined for the dataset over time. EPC = last detect in data set.

Downward **-** Statistically downward trend was determined for the dataset over time**.** EPC = last detect in data set.

Table G-4. Results of Trending Analyses and EPC Calculation for Future Perched Groundwater Concentrations at TTURF

Location Code	Filtered Y/N?	Group	COPC	CAS #	Total Number of Samples	Total Number of Detects	Minimum Detection (mg/L)	Maximum Detection (mg/L)	p	Direction	EPC (mg/L)
Wells on Pantex Plant											
PTX06-1035	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	7	5	3.19E-04	2.30E-03	7.64E-01	NS	2.30E-03
PTX08-1009	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	4	1	6.80E-04	6.80E-04	--	NA	6.80E-04
PTX08-1009	N	HE	RDX	121-82-4	4	3	1.70E-04	2.10E-03	--	NA	2.10E-03
PTX08-1009	N	MET	Chromium, Total	7440-47-3	6	6	2.72E-02	2.70E-01	2.60E-01	NS	2.70E-01
PTX08-1008	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	6	4	2.50E-04	8.20E-04	8.48E-01	NS	8.20E-04
PTX08-1008	N	MET	Chromium, Hexavalent	18540-29-9	9	9	6.00E-02	1.40E+01	2.95E-01	NS	1.40E+01
PTX08-1008	N	MET	Chromium, Total	7440-47-3	9	9	3.48E-03	1.64E+01	1.18E-01	NS	1.64E+01
PTX08-1005	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	5	5	9.60E-04	2.30E-03	8.06E-01	NS	2.30E-03
PTX08-1005	N	HE	TNT	118-96-7	5	1	3.40E-03	3.40E-03	--	NA	3.40E-03
PTX08-1005	N	MISC	Perchlorate	14797-73-0	5	5	6.61E-02	3.86E-01	2.75E-02	Downward	6.61E-02
PTX08-1005	N	VOC	1,2-Dichloroethane	107-06-2	5	5	1.15E-02	1.80E-02	8.06E-01	NS	1.80E-02
PTX08-1005	N	VOC	Chloroform	67-66-3	5	5	1.84E-02	8.18E-02	8.64E-02	NS	8.18E-02
PTX08-1005	N	VOC	Trichloroethene	79-01-6	5	5	3.65E-02	6.15E-02	2.75E-02	Upward	6.15E-02
PTX08-1006	N	HE	2,6-Dinitrotoluene	606-20-2	5	2	2.50E-04	3.60E-04	--	NA	3.60E-04
PTX08-1006	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	5	5	2.31E-02	5.09E-02	2.75E-02	Downward	2.31E-02
PTX08-1006	N	HE	RDX	121-82-4	5	5	3.50E-03	3.08E-02	2.75E-02	Upward	3.08E-02
PTX08-1006	N	MISC	Perchlorate	14797-73-0	5	5	1.68E-01	4.08E-01	4.62E-01	NS	4.08E-01
PTX08-1006	N	VOC	1,2-Dichloroethane	107-06-2	5	5	8.20E-03	1.23E-02	1.00E+00	NS	1.23E-02
PTX08-1006	N	VOC	Tetrachloroethene (PCE)	127-18-4	5	4	1.10E-03	1.47E-02	8.06E-01	NS	1.47E-02
PTX08-1006	N	VOC	Trichloroethene	79-01-6	5	5	2.40E-03	7.40E-03	1.00E+00	NS	7.40E-03
PTX08-1006	N	VOC	1,4-Dioxane	123-91-1	4	4	4.10E-02	6.84E-02	--	NA	6.84E-02

The results of the trending are defined as follows:

NA - No trending performed due to insufficient data (<4 samples or <50% detect). EPC = the lesser of 95% UCL if sample size ≥ 10 or the maximum detected concentration. If sample size < 10, maximum detect used as EPC.

NS - Sufficient data were available for trending analysis; however, no statistically significant trend was evident. EPC = the lesser of 95% UCL if sample size ≥ 10 or the maximum detected concentration. If sample size < 10, maximum detect used as EPC.

Upward - Statistically upward trend was determined for the dataset over time. EPC = last detect in data set.

Downward - Statistically downward trend was determined for the dataset over time. EPC = last detect in data set.

Table G-5. Future Ogallala Exposure Point Concentrations

COPC	CAS No.	Time of Maximum Concentration[a] (years)	Future EPC[a] (mg/L)
1,3,5-Trinitrobenzene	99-35-4	1000	2.50E-03
1,3-Dinitrobenzene	99-65-0	260	5.0E-05 [b]
2,4-Dinitrotoluene	121-14-2	560	1.60E-04
2,6-Dinitrotoluene	606-20-2	260	5.00E-05
2-Amino-4,6-dinitrotolune	572-78-2	360	1.8E-04 [c]
4-Amino-2,6-dinitrotoluene	19406-51-0	360	2.0E-04 [c]
HMX	2691-41-0	200	3.30E-03
RDX	121-82-4	160	9.00E-02
TNT	118-96-7	360	4.30E-04
Boron	7440-42-8	160	5.10E-02
Chromium, Hexavalent	18540-29-9	320	< MCL
Chromium, Total	7440-47-3	--	<MCL [d]
1,2-Dichloroethane	107-06-2	--	<MCL
Trichloroethene	79-01-6	--	<MCL

< MCL - EPC is less than maximum contaminant level (MCL) for COPC available at: http://www.tnrcc.state.tx.us/permitting/remed/techsupp/rrrtoxchph.xls

[a] Future EPC and time of maximum future concentration predicted from FTM as described in Appendix N of the *Baseline HHRA Report* (December 2006), unless otherwise noted.

[b] COPC not modeled, but assumed the maximum concentration estimated from 2,6-dinitrotoluene results.

[c] COPC not modeled, but assumed the maximum concentration occurs at the same time as the parent compound (TNT). EPC was estimated by applying the ratio of the relative concentrations measured in current perched groundwater of 2-amino-4,6-dinitrotoluene to TNT or 4-amino-2,6-dinitrotoluene to TNT, as applicable.

[d] Total chromium was not modeled for future concentrations in the Ogallala Aquifer maximum; EPC for total chromium was estimated from hexavalent chromium results.

G.4 RISK CHARACTERIZATION RESULTS FOR TTURF

This section provides the quantitative risk results for offsite receptors that may be exposed to COPCs identified in perched groundwater (current and future) and the Ogallala Aquifer (future only) at TTURF, if a well was installed in the future.

The numerical risk and hazard estimates presented in this section must be interpreted in the context of the uncertainties and assumptions associated with the risk assessment process and with the data on which the risk estimates are based. Integration of the risk characterization results and uncertainty analysis are presented in the conclusions at the end of this section.

All public and most private wells surrounding Pantex Plant are completed in the Ogallala Aquifer; however, some private wells are completed in localized perched groundwater. COPCs are present in the perched groundwater at TTURF. No private wells currently exist in this area; therefore, offsite exposure to COPCs in perched groundwater is not currently a complete pathway. However, this pathway could become complete if a well is placed in this area in the future. Risk characterization results are summarized below for current (i.e., near-future based on current concentrations) and future timeframes.

G.4.1 Current Risk Characterization Results

ILCRs and HQs/HIs were calculated using current EPCs from analytical data collected from 13 monitoring and extraction wells completed in perched groundwater at TTURF. Current risk calculations are provided in tables below.

Individual ILCRs and HQs/HIs were calculated for 14 COPCs at the well location with the maximum EPC and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0). COPCs with risks or hazards exceeding the TCEQ and EPA acceptable target risk criteria were identified for 14 COPCs. Although risks were not elevated for total chromium, total chromium exceeds the EPA MCL.

Individual ILCRs exceed the lower limit of the TCEQ and EPA acceptable target risk range for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, RDX, TNT, 1,2-dichloroethane, and trichloroethene (TCE) with individual ILCRs ranging from 1.7E-05 to 1.8E-02.

HQs exceed 1.0 for 2,4-dinitrotoluene, 4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, HMX, RDX, TNT, 1,3-dintrobenzene, perchlorate, boron, and hexavalent chromium with ranges of 1.8 to 82.9 for the adult and 1.1 to 181 for the child.

G.4.2 Future Risk Characterization Results

Future ILCRs and HQs/HIs were calculated for offsite resident farmer exposure to COPCs in perched groundwater and the Ogallala Aquifer. Perched groundwater EPCs were calculated from existing wells at Pantex Plant that are south of Zone 11 and Zone 12, as described above. Additionally, the modeled EPC for 1,3,5-trinitrobenzene is evaluated for offsite impacts because previous modeling results indicated that this was the only COPC that increases in concentration in offsite perched groundwater in the future for areas to the south and east of Zone 12. EPCs for the Ogallala Aquifer were calculated using subsurface fate and transport modeling,. The subsurface modeling is described in Appendix N of the Baseline HHRA Report (December 2006) and future EPCs are presented above.

G.4.2.1 Perched Groundwater

ILCRs and HQs were calculated using EPCs estimated from five existing wells on Pantex Plant beneath Zones 11 and 12, as well as the modeled concentration for 1,3,5-trinitrobenzene. For each COPC and well, an EPC was quantified to represent a concentration in perched groundwater at onsite wells that may impact TTURF in the future. COPC-specific hazard and risk results for a resident farmer using perched groundwater for potable and agricultural purposes are provided below.

Individual ILCRs exceed the lower limit of the TCEQ and EPA acceptable target risk range for 2-6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, TNT, 1,2-dichloroethane, chloroform, trichloroethene (TCE), and tetrachloroethene (PCE) with individual ILCRs ranging from 2.3E-06 to 5.2E-04.

HQs exceed 1.0 for 4-amino-2,6-dinitrotoluene, 1,3,5-trintrobenzene, perchlorate, and chloroform, with ranges of 1.7 to 638 for the adult and 1.2 to 1450 for the child.

Ingestion of drinking water is the predominant contributor to exposure and risk. The agricultural pathways (e.g., ingestion of irrigated vegetables and beef/dairy products) contribute less because HEs and perchlorate are not highly bioaccumulated.

Although several current COPCs are not represented in the list of future COPCs, current COPCs will continue to impact TTURF in the future and those COPCs that currently exceed risk criteria will also be considered as a COCs for the future.

G.4.2.2 Ogallala Aquifer

Future ILCRs and HQs/HIs were calculated for offsite resident farmer exposures to Ogallala Aquifer groundwater using future EPCs calculated using subsurface fate and transport modeling. For each perched groundwater COPC, a future EPC was quantified that represents a baseline maximum concentration in Ogallala groundwater due to migration from perched groundwater in the absence of remediation over a 1,000-year period. The maximum concentration of each COPC is predicted to occur at different locations and at different times; therefore, it is not appropriate to calculate cumulative ILCRs and HIs. COPC-specific hazard and risk results for a resident farmer using Ogallala Aquifer groundwater for potable and agricultural purposes are provided below. A total of 14 COPCs were evaluated for future risks.

Individual ILCRs exceed the lower limit of the TCEQ and EPA acceptable target risk range for 2,4-dinitrotoluene and RDX with an individual ILCR of 3.0E-06 and 3.7E-04, respectively. The other 12 COPCs were either predicted below the RBSV, or were less than 1.0E-06 (2,6-dinitrotoluene and trichloroethene).

The only COPC with an individual HQ that exceeds 1.0 is RDX (adult=1.7 and child=3.7).

Ingestion of drinking water is the predominant contributor to exposure and risk. The agricultural pathways (e.g., ingestion of irrigated vegetables and beef/dairy products) contribute less because the HEs are not highly bioaccumulated.

Table G-6. Current Carcinogenic Risk Results for Perched Groundwater at TTURF

Location Code	Group	COPC	CAS #	Maximum Detection (mg/L)	EPC (mg/L)	MCL (mg/L)	Total Cancer GW URV	ILCR
PTX06-EW-45	**VOC**	**1,2-Dichloroethane**	**107-06-2**	**1.40E-02**	**7.49E-03**	**NA**	**9.20E-03**	**6.89E-05**
PTX06-EW-44	**HE**	**2,4-Dinitrotoluene**	**121-14-2**	**1.80E-01**	**1.04E-01**	**NA**	**1.60E-02**	**1.66E-03**
PTX06-1046	**HE**	**2,6-Dinitrotoluene**	**606-20-2**	**1.20E-03**	**1.20E-03**	**NA**	**1.60E-02**	**1.92E-05**
PTX06-EW-44	**HE**	**2-Amino-4,6-Dinitrotoluene**	**35572-78-2**	**2.60E-01**	**6.23E-02**	**NA**	**2.70E-04**	**1.68E-05**
PTX06-EW-44	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**1.80E-01**	**4.73E-02**	**NA**	**2.60E-04**	**1.23E-05**
PTX06-EW-44	MET	Boron	7440-42-8	2.00E+00	1.68E+00	NA	--	--
PTX06-EW-9	MET	Chromium, Hexavalent	18540-29-9	3.00E+00	2.05E+00	0.1	--	--
PTX06-EW-9	MET	Chromium, Total	7440-47-3	2.50E+00	1.30E+00	0.1	--	--
PTX06-EW-44	HE	HMX	2691-41-0	3.30E+00	9.06E-01	NA	--	--
PTX06-EW-6	MISC	Perchlorate	14797-73-0	1.98E-02	1.98E-02	NA	--	--
PTX06-EW-44	**HE**	**RDX[1]**	**121-82-4**	**2.50E+01**	**7.54E+00**	**NA**	**2.40E-03**	**1.79E-02**
PTX06-EW-41	**HE**	**TNT**	**118-96-7**	**2.40E-01**	**2.40E-01**	**NA**	**6.80E-04**	**1.63E-04**
PTX06-EW-36	**VOC**	**Trichloroethene**	**79-01-6**	**8.10E-02**	**5.84E-02**	**0.005**	**7.30E-04**	**4.26E-05**
PTX06-EW-8	HE	1,3-Dinitrobenzene	99-65-0	1.40E-03	1.40E-03	NA	--	--

[1]The risk for this COPC was evaluated using the One-Hit Equation from EPA, 1989.

-- No value available.

Bolded rows indicate COPCs with ILCRs > 1.0E-06.

Table G-7. Current Noncarcinogenic Hazard Results for Perched Groundwater at TTURF, Adult

Location Code	Group	COPC	CAS #	Maximum Detection (mg/L)	EPC (mg/L)	MCL (mg/L)	Total GW HI URV Adult	HI Adult
PTX06-EW-45	VOC	1,2-Dichloroethane	107-06-2	0.014	0.007	NA	0.20	<0.01
PTX06-EW-44	**HE**	**2,4-Dinitrotoluene**	**121-14-2**	**0.18**	**0.10**	**NA**	**17**	**1.8**
PTX06-1046	HE	2,6-Dinitrotoluene	606-20-2	0.00	0.00	NA	34	0.04
PTX06-EW-44	**HE**	**2-Amino-4,6-Dinitrotoluene**	**35572-78-2**	**0.26**	**0.06**	**NA**	**240**	**14.9**
PTX06-EW-44	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**0.18**	**0.05**	**NA**	**230**	**10.9**
PTX06-EW-44	MET	Boron	7440-42-8	2.00	1.68	NA	0.37	0.6
PTX06-EW-9	**MET**	**Chromium, Hexavalent**	**18540-29-9**	**3.00**	**2.05**	**0.1**	**12**	**24.6**
PTX06-EW-9	MET	Chromium, Total	7440-47-3	2.50	1.30	0.1	0.02	0.03
PTX06-EW-44	HE	HMX	2691-41-0	3.30	0.91	NA	1.1	1.0
PTX06-EW-6	MISC	Perchlorate	14797-73-0	0.02	0.02	NA	40.3	0.8
PTX06-EW-44	**HE**	RDX	**121-82-4**	**25.00**	**7.54**	**NA**	**11**	**82.9**
PTX06-EW-41	**HE**	**TNT**	**118-96-7**	**0.24**	**0.24**	**NA**	**67**	**16.1**
PTX06-EW-36	VOC	Trichloroethene	79-01-6	0.08	0.06	0.005	5.9	0.3
PTX06-EW-8	HE	1,3-Dinitrobenzene	99-65-0	.0014	.0014	NA	330	0.5

Bolded rows indicate COPCs with HIs > 1.

Table G-8. Current Noncarcinogenic Hazard Results for Perched Groundwater at TTURF, Child

Location Code	Group	COPC	CAS #	Maximum Detection (mg/L)	EPC (mg/L)	MCL (mg/L)	Total GW HI URV Child	HI Child
PTX06-EW-45	VOC	1,2-Dichloroethane	107-06-2	0.01	0.01	NA	0.20	0.00
PTX06-EW-44	**HE**	**2,4-Dinitrotoluene**	**121-14-2**	**0.18**	**0.10**	**NA**	**39**	**4.06**
PTX06-1046	HE	2,6-Dinitrotoluene	606-20-2	0.00	0.00	NA	77	0.09
PTX06-EW-44	**HE**	**2-Amino-4,6-Dinitrotoluene**	**35572-78-2**	**0.26**	**0.06**	**NA**	**540**	**33.64**
PTX06-EW-44	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**0.18**	**0.05**	**NA**	**520**	**24.60**
PTX06-EW-44	**MET**	**Boron**	**7440-42-8**	**2.00**	**1.68**	**NA**	**0.90**	**1.51**
PTX06-EW-9	**MET**	**Chromium, Hexavalent**	**18540-29-9**	**3.00**	**2.05**	**0.1**	**27**	**55.35**
PTX06-EW-9	MET	Chromium, Total	7440-47-3	2.50	1.30	0.1	0.05	0.07
PTX06-EW-44	**HE**	**HMX**	**2691-41-0**	**3.30**	**0.91**	**NA**	**2.3**	**2.08**
PTX06-EW-6	**MISC**	**Perchlorate**	**14797-73-0**	**0.02**	**0.02**	**NA**	**94.5**	**1.87**
PTX06-EW-44	**HE**	**RDX**	**121-82-4**	**25.00**	**7.54**	**NA**	**24**	**180.96**
PTX06-EW-41	**HE**	**TNT**	**118-96-7**	**0.24**	**0.24**	**NA**	**150**	**36.00**
PTX06-EW-36	VOC	Trichloroethene	79-01-6	0.081	.058	0.005	0.46	0.027
PTX06-EW-8	**HE**	**1,3-Dinitrobenzene**	99-65-0	**.0014**	**.0014**	**NA**	**760**	**1.064**

Bolded rows indicate COPCs with HIs > 1.

Table G-9. Future Carcinogenic Risk Results for Perched Groundwater at TTURF

Location Code	Filtered, Y/N?	Group	COPC	CAS #	Maximum Detection (mg/L)	EPC (mg/L)	MCL (mg/L)	Total Cancer GW URV	Total ILCR
Wells on Pantex Plant									
PTX06-1035	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	2.30E-03	2.30E-03	NA	2.60E-04	5.98E-07
PTX08-1009	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	6.80E-04	6.80E-04	NA	2.70E-04	1.84E-07
PTX08-1009	**N**	**HE**	**RDX**	**121-82-4**	**2.10E-03**	**2.10E-03**	**NA**	**2.40E-03**	**5.04E-06**
PTX08-1009	N	MET	Chromium, Total	7440-47-3	2.70E-01	2.70E-01	0.1	--	--
PTX08-1008	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	8.20E-04	8.20E-04	NA	2.60E-04	2.13E-07
PTX08-1008	N	MET	Chromium, Hexavalent	18540-29-9	1.40E+01	1.40E+01	0.1	--	--
PTX08-1008	N	MET	Chromium, Total	7440-47-3	1.64E+01	1.64E+01	0.1	--	--
PTX08-1005	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	2.30E-03	2.30E-03	NA	2.60E-04	5.98E-07
PTX08-1005	**N**	**HE**	**TNT**	**118-96-7**	**3.40E-03**	**3.40E-03**	**NA**	**6.80E-04**	**2.31E-06**
PTX08-1005	N	MISC	Perchlorate	14797-73-0	3.86E-01	6.61E-02	NA	--	--
PTX08-1005	**N**	**VOC**	**1,2-Dichloroethane**	**107-06-2**	**1.80E-02**	**1.80E-02**	**0.005**	**9.20E-03**	**1.66E-04**
PTX08-1005	**N**	**VOC**	**Chloroform**	**67-66-3**	**8.18E-02**	**8.18E-02**	**NA**	**6.30E-03**	**5.15E-04**
PTX08-1005	**N**	**VOC**	**Trichloroethene**	**79-01-6**	**6.15E-02**	**6.15E-02**	**NA**	**7.30E-04**	**4.49E-05**
PTX08-1006	**N**	**HE**	**2,6-Dinitrotoluene**	**606-20-2**	**3.60E-04**	**3.60E-04**	**NA**	**1.60E-02**	**5.76E-06**
PTX08-1006	**N**	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**5.09E-02**	**2.31E-02**	**NA**	**2.60E-04**	**6.01E-06**
PTX08-1006	**N**	**HE**	**RDX**	**121-82-4**	**3.08E-02**	**3.08E-02**	**NA**	**2.40E-03**	**7.39E-05**
PTX08-1006	N	MISC	Perchlorate	14797-73-0	4.08E-01	4.08E-01	NA	--	--
PTX08-1006	**N**	**VOC**	**1,2-Dichloroethane**	**107-06-2**	**1.23E-02**	**1.23E-02**	**0.005**	**9.20E-03**	**1.13E-04**
PTX08-1006	**N**	**VOC**	**Tetrachloroethene (PCE)**	**127-18-4**	**1.47E-02**	**1.47E-02**	**0.005**	**1.50E-03**	**2.21E-05**
PTX08-1006	**N**	**VOC**	**Trichloroethene**	**79-01-6**	**7.40E-03**	**7.40E-03**	**0.005**	**7.30E-04**	**5.40E-06**
PTX08-1006	**N**	**VOC**	**1,4-Dioxane**	**123-91-1**	**0.0684**	**0.0684**	**NA**	**2.1E-02**	**1.43E-03**
Modeled	NA	HE	1,3,5-Trinitrobenzene[1]	99-35-4	NA	5.80E+02	NA	--	--

[1] 1,3,5-trinitrobenzene value obtained from Table N-5 of the *Baseline HHRA Report* (December 2006).

-- No value available.

Bolded rows indicate COPCs with ILCRs > 1.0E-06.

Table G-10. Future Noncarcinogenic Hazard Results for Perched Groundwater at TTURF, Adult

Location Code	Filtered, Y/N?	Group	COPC	CAS #	Maximum Detection (mg/L)	EPC (mg/L)	MCL (mg/L)	Total GW HI URV Adult	HI Adult
Wells on Pantex Plant									
PTX06-1035	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	0.002	0.002	NA	230	0.5
PTX08-1009	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	0.001	0.001	NA	240	0.2
PTX08-1009	N	HE	RDX	121-82-4	0.002	0.002	NA	11	0.02
PTX08-1009	N	MET	Chromium, Total	7440-47-3	0.270	0.270	0.1	0.02	0.01
PTX08-1008	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	0.001	0.001	NA	230	0.2
PTX08-1008	**N**	**MET**	**Chromium, Hexavalent**	**18540-29-9**	**14.000**	**14.000**	**0.1**	**12**	**168**
PTX08-1008	N	MET	Chromium, Total	7440-47-3	16.400	16.400	0.1	0.02	0.4
PTX08-1005	**N**	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**0.002**	**0.002**	**NA**	**744.3**	**1.7**
PTX08-1005	N	HE	TNT	118-96-7	0.003	0.003	NA	67	0.2
PTX08-1005	**N**	**MISC**	**Perchlorate**	**14797-73-0**	**0.386**	**0.066**	**NA**	**40.3**	**2.7**
PTX08-1005	N	VOC	1,2-Dichloroethane	107-06-2	0.018	0.018	0.005	0.2	<0.01
PTX08-1005	N	VOC	Chloroform	67-66-3	0.082	0.082	NA	8.6	0.7
PTX08-1005	N	VOC	Trichloroethene	79-01-6	0.062	0.062	NA	5.9	0.4
PTX08-1006	N	HE	2,6-Dinitrotoluene	606-20-2	3.60E-04	3.60E-04	NA	34	0.01
PTX08-1006	**N**	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**5.09E-02**	**2.31E-02**	**NA**	**230**	**5.3**
PTX08-1006	N	HE	RDX	121-82-4	3.08E-02	3.08E-02	NA	11	0.3
PTX08-1006	**N**	**MISC**	**Perchlorate**	**14797-73-0**	**4.08E-01**	**4.08E-01**	**NA**	**40.3**	**16.4**
PTX08-1006	N	VOC	1,2-Dichloroethane	107-06-2	1.23E-02	1.23E-02	0.005	0.2	<0.01
PTX08-1006	N	VOC	Tetrachloroethene (PCE)	127-18-4	1.47E-02	1.47E-02	0.005	5.5	0.1
PTX08-1006	N	VOC	Trichloroethene	79-01-6	7.40E-03	7.40E-03	0.005	5.9	0.04
Modeled	**NA**	**HE**	**1,3,5-Trinitrobenzene[1]**	**99-35-4**	**NA**	**5.80E+02**	**NA**	**1.1**	**638**

[1] 1,3,5-trinitrobenzene value obtained from Table N-5 of the *Baseline HHRA Report* (December 2006).

Bolded rows indicate COPCs with HIs > 1.

Table G-11. Future Noncarcinogenic Hazard Results for Perched Groundwater at TTURF, Child

Location Code	Filtered, Y/N?	Group	COPC	CAS #	Maximum Detection (mg/L)	EPC (mg/L)	MCL (mg/L)	Total GW HI URV Child	HI Child
Wells on Pantex Plant									
PTX06-1035	**N**	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**0.002**	**0.002**	**NA**	**520**	**1.20**
PTX08-1009	N	HE	2-Amino-4,6-Dinitrotoluene	35572-78-2	0.001	0.001	NA	540	0.37
PTX08-1009	N	HE	RDX	121-82-4	0.002	0.002	NA	24	0.05
PTX08-1009	N	MET	Chromium, Total	7440-47-3	0.270	0.270	0.1	0.05	0.01
PTX08-1008	N	HE	4-Amino-2,6-Dinitrotoluene	19406-51-0	0.001	0.001	NA	520	0.43
PTX08-1008	**N**	**MET**	**Chromium, Hexavalent**	**18540-29-9**	**14.000**	**14.000**	**0.1**	**27**	**378**
PTX08-1008	N	MET	Chromium, Total	7440-47-3	16.400	16.400	0.1	0.05	0.84
PTX08-1005	**N**	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**0.002**	**0.002**	**NA**	**520**	**1.2**
PTX08-1005	N	HE	TNT	118-96-7	0.003	0.003	NA	150	0.51
PTX08-1005	**N**	**MISC**	**Perchlorate**	**14797-73-0**	**0.386**	**0.066**	**NA**	**94.5**	**6.25**
PTX08-1005	N	VOC	1,2-Dichloroethane	107-06-2	0.018	0.018	0.005	0.2	<0.01
PTX08-1005	**N**	**VOC**	**Chloroform**	**67-66-3**	**0.082**	**0.082**	**NA**	**13**	**1.06**
PTX08-1005	N	VOC	Trichloroethene	79-01-6	0.062	0.062	NA	13	0.80
PTX08-1006	N	HE	2,6-Dinitrotoluene	606-20-2	.00036	.00036	NA	77	0.03
PTX08-1006	**N**	**HE**	**4-Amino-2,6-Dinitrotoluene**	**19406-51-0**	**.051**	**.023**	**NA**	**520**	**12.01**
PTX08-1006	N	HE	RDX	121-82-4	.0308	.0308	NA	24	0.74
PTX08-1006	**N**	**MISC**	**Perchlorate**	**14797-73-0**	**.408**	**.408**	**NA**	**94.5**	**38.56**
PTX08-1006	N	VOC	1,2-Dichloroethane	107-06-2	.012	.012	0.005	0.2	<0.01
PTX08-1006	N	VOC	Tetrachloroethene (PCE)	127-18-4	.014	.014	0.005	10	0.15
PTX08-1006	N	VOC	Trichloroethene	79-01-6	.0074	.0074	0.005	13	0.10
Modeled	**NA**	**HE**	**1,3,5-Trinitrobenzene[1]**	**99-35-4**	**NA**	**580**	**NA**	**2.5**	**1450**

[1]1,3,5-trinitrobenzene value obtained from Table N-5 of the *Baseline HHRA Report* (December 2006).

Bolded rows indicate COPCs with His > 1.

Table G-12. Future Carcinogenic Ogallala Risk Results at TTURF

COPC	RRS 1 (mg/L)	RBSV (mg/L)	Maximum Predicted Concentration TTURF (mg/L)	Time Step for Maximum Concentration at TTURF (years)	Total Cancer GW URV	Total ILCR
RDX	**0.001**	**0.000774**	**0.1551**	**60**	**2.40E-03**	**3.72E-04**
TNT	0.001	0.00183	<RBSV	240	--	--
1,3,5-Trinitrobenzene	0.001	0.11	<RBSV	1000	--	--
2,4-Dinitrotoluene	**0.001**	**0.000125**	**0.00019**	**400**	**1.60E-02**	**3.04E-06**
2,6-dinitrotoluene	0.001	0.000125	0.00006	160	1.60E-02	9.60E-07
HMX	0.001	0.183	<RBSV	60	--	--
Boron	0.19	0.329	<RBSV	60	--	--
Hexavalent Chromium	0.01	0.1	<RBSV	280	--	--
1,2-Dichloroethane	0.005	0.005	<RBSV	60	--	--
Trichloroethene	0.005	0.005	0.00037	200	7.30E-04	2.70E-07
Concentrations Estimated from FTM Results for COPCs Not Modeled						
2-amino-4,6-dinitrotoluene[a]	0.001	0.000608	<RBSV	240	--	--
4-amino-2,6-dinitrotoluene[b]	0.001	0.000608	<RBSV	240	--	--
1,3-dinitrobenzene[c]	0.001	0.000365	<RBSV	--	--	--
Total chromium	0.0318	0.1	<RBSV	--	--	--

[a] Maximum concentration estimated by 2-amino-4,6-dintrotoluene : trinitrotoluene ratio = 0.42

[b] Maximum concentration estimated by 4-amino-2,6-dintrotoluene : trinitrotoluene ratio = 0.45

[c] Maximum concentration estimated through comparison of FTM results for COPCs with similar initial concentrations

All predicted maximum concentrations from Appendix N, Table N-6, of the *Baseline HHRA Report* (December 2006).

Bolded rows indicate COPCs with ILCRs > 1.0E-06.

Table G-13. Future Noncarcinogenic Ogallala Hazard Results at TTURF, Adult

COPC	RRS 1 (mg/L)	RBSV (mg/L)	Maximum Predicted Concentration TTURF (mg/L)	Time Step for Maximum Concentration at TTURF (years)	Total GW HI URV	Total HI
RDX	0.001	0.000774	0.1551	**60**	**11.00**	**1.71**
TNT	0.001	0.00183	<RBSV	240	67.00	--
1,3,5-Trinitrobenzene	0.001	0.11	<RBSV	1000	1.10	--
2,4-Dinitrotoluene	0.001	0.000125	0.00019	400	17.00	0.00
2,6-dinitrotoluene	0.001	0.000125	0.00006	160	34.00	0.00
HMX	0.001	0.183	<RBSV	60	1.10	--
Boron	0.19	0.329	<RBSV	60	0.37	--
Hexavalent Chromium	0.01	0.1	<RBSV	280	12.00	--
1,2-Dichloroethane	0.005	0.005	<RBSV	60	0.20	--
Trichloroethene	0.005	0.005	0.00037	200	5.90	0.00
Concentrations Estimated from FTM Results for COPCs Not Modeled						
2-amino-4,6-dinitrotoluene[a]	0.001	0.000608	<RBSV	240	240.00	--
4-amino-2,6-dinitrotoluene[b]	0.001	0.000608	<RBSV	240	230.00	--
1,3-dinitrobenzene[c]	0.001	0.000365	<RBSV	--	330.00	--
Total chromium	0.0318	0.1	<RBSV	--	0.02	--

[a] Maximum concentration estimated by 2-amino-4,6-dintrotoluene : trinitrotoluene ratio = 0.42
[b] Maximum concentration estimated by 4-amino-2,6-dintrotoluene : trinitrotoluene ratio = 0.45
[c] Maximum concentration estimated through comparison of FTM results for COPCs with similar initial concentrations
All predicted maximum concentrations from Appendix N, Table N-6, of the *Baseline HHRA Report* (December 2006).
Bolded rows indicate COPCs with HIs > 1.0

Table G-14. Future Noncarcinogenic Ogallala Hazard Results at TTURF, Child

COPC	RRS 1 (mg/L)	RBSV (mg/L)	Maximum Concentration TTURF (mg/L)	Time Step for Maximum Concentration at TTURF (years)	Total GW HI URV	Total HI
RDX	**0.001**	**0.000774**	**0.1551**	**60**	**24.00**	**3.72**
TNT	0.001	0.00183	<RBSV	240	150.00	--
1,3,5-Trinitrobenzene	0.001	0.11	<RBSV	1000	2.50	--
2,4-Dinitrotoluene	0.001	0.000125	0.00019	400	39.00	0.01
2,6-dinitrotoluene	0.001	0.000125	0.00006	160	77.00	0.00
HMX	0.001	0.183	<RBSV	60	2.30	--
Boron	0.19	0.329	<RBSV	60	0.90	--
Hexavalent Chromium	0.01	0.1	<RBSV	280	27.00	--
1,2-Dichloroethane	0.005	0.005	<RBSV	60	0.20	--
Trichloroethene	0.005	0.005	0.00037	200	0.46	0.00
Concentrations Estimated from FTM Results for COPCs Not Modeled						
2-amino-4,6-dinitrotoluene[a]	0.001	0.000608	<RBSV	240	540.00	--
4-amino-2,6-dinitrotoluene[b]	0.001	0.000608	<RBSV	240	520.00	--
1,3-dinitrobenzene[c]	0.001	0.000365	<RBSV	--	760.00	--
Total chromium	0.0318	0.1	<RBSV	--	0.05	--

[a] Maximum concentration estimated by 2-amino-4,6-dintrotoluene : trinitrotoluene ratio = 0.42

[b] Maximum concentration estimated by 4-amino-2,6-dintrotoluene : trinitrotoluene ratio = 0.45

[c] Maximum concentration estimated through comparison of FTM results for COPCs with similar initial concentrations

All predicted maximum concentrations from Appendix N, Table N-6, of the *Baseline HHRA Report* (December 2006).

Bolded rows indicate COPCs with HIs > 1.0

Table G-15. Sources of Uncertainty Specific to TTURF Groundwater HHRA

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Uncertainty in Data Collection and Analysis		
Laboratory Analysis		
Perchlorate detected in monitoring well PXT06-1015, PTX06-EW-6, and PTX06-EW-37.	Result included in data set because perchlorate is potentially present at TTURF south of Zone 11 and results are likely representative of current risks.	Low impact: under-estimates risk if perchlorate is actually present.
1,4-dioxane, TCE, perchlorate, and chloroform not modeled for impacts to TTURF from Zone 11.	Included in analysis using the maximum measured concentrations as EPC.	Low impact: may overestimate risk because these COPCs will not impact TTURF until the future and reactive transport will likely decrease future concentrations and risk at TTURF.
Sampling Locations		
Onsite and offsite monitoring wells were installed into the perched zone and Ogallala Aquifer at areas located downgradient of corrective action units.	Wells located downgradient of corrective action units are used to determine the presence of current impacts and to facilitate monitoring/trend analyses and prediction of future impacts at potential points of exposure.	Moderate impact: overestimates risk, especially for areas not located directly downgradient of onsite source areas where few or no samples have been collected.
Areas with few monitoring wells present at TTURF and Zone 11.	Onsite concentrations indicate that the groundwater plumes are just beginning to move to TTURF south of Zone 11. Used onsite EPCs to calculate future risks as TTURF.	Low impact: overestimates risk from the unit if COPCs since actual modeling was not performed for the COPCs from Zone 11.
Uncertainty in Exposure Assessment		
Current Offsite EPCs		
For determining statistical EPCs for current offsite perched groundwater risks, either the 95% UCL (normal or lognormal as appropriate) or the maximum detected concentration becomes the EPC if no data trend exists as determined using Mann-Kendall.	The 95% UCL or maximum detected concentration used as the EPC is assumed over the duration of exposure.	High impact: offsite residential risks are overestimated.
Perched COPCs from Zone 11 not modeled for future impact to the Ogallala.	Applied a dilution factor of 10 to the maximum EPCs in onsite perched groundwater wells to determine potential future Ogallala concentrations and risk.	Low impact: Only 3 COPCs in the perched groundwater were not evaluated through modeling. Use of the conservative factor of 10 only adds one of the COPCs as a potential COC in the Ogallala groundwater at TTURF.
The effects of dispersion, retardation, and degradation were not modeled.	An uncertainty analysis was performed for the effects on the future Ogallala groundwater predictions when reactive transport is considered.	Low to moderate impact: the inclusion of reactive transport generally decreases the maximum predicted concentration in the Ogallala Aquifer. This is not important for those COPCs that enter the Ogallala in concentrations below the RBSV. It would remove 2,4-dinitrotoluene as a COC because concentrations would decrease below the RBSV. RDX concentrations would continue to drive a risk, even with reactive transport, and would continue to be considered a COC.

Table G-15. Sources of Uncertainty Specific to TTURF Groundwater HHRA (continued)

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Exposure Assumptions		
Default exposure assumptions.	Upper percentile exposure parameters are not realistic.	Low to moderate impact: overestimates risk.
Uncertainty in Toxicity Information		
For the current offsite perched groundwater scenario, most organic COPCs (2,4-dinitrotoluene, 2,6-dinitrotoluene, RDX, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, TNT, HMX, and 1,3-dinitrobenzene) are not evaluated for the inhalation pathway for the cancer and/or noncancer endpoint because inhalation slope factors and reference concentrations/doses are not available.	Direct ingestion of perched groundwater as drinking water represents the primary exposure pathway for offsite resident farmer receptors; therefore, the lack of inhalation toxicity values for some these COPCs is not a major source of uncertainty.	Low impact: underestimates risk.
Uncertainty in Risk Characterization		
In the absence of information on the toxicity of specific chemical mixtures, it is assumed that ILCRs and HQs are additive (i.e., cumulative).	Target organs/critical effects and the effects of chemical synergism/antagonism not considered for mixtures.	Negligible impact. Estimated individual ILCRs and HIs exceed acceptable target criteria, with RDX being the predominant risk driver.

G.5 CONCLUSIONS AND COCS FOR GROUNDWATER

This section integrates the risk characterization results and uncertainty analysis to identify receptor and groundwater combinations that may represent an unacceptable risk at TTURF. COCs are documented for onsite and offsite groundwater under current and future exposure scenarios, where potential unacceptable risks are identified.

COCs are defined as COPCs having an individual ILCR greater than 1.0E-06 and/or an HQ greater than 1, or substantially contributing to a cumulative ILCR greater than 1.0E-06 and/or an HI greater than 1, unless weight of evidence factors indicate a COPC does not represent an unacceptable risk as noted below.

G.5.1 Perched Groundwater

All public and most private wells are completed in the Ogallala Aquifer; however, some private wells are known to be completed in localized perched groundwater. No wells are currently present in perched groundwater that has been impacted by Pantex releases.

COPCs are present in the perched groundwater beneath TTURF. No private wells currently exist in this area; therefore, offsite exposure to COPCs in perched groundwater is not currently a complete pathway. However, this pathway could become complete if a well is placed in this area in the future. Risk characterization results are summarized below for two timeframes: current and future. Current risks represent risk from current measured concentrations but from a well constructed in the future, since no wells are currently known to exist in this area.

TTURF groundwater was assessed as a baseline condition, i.e., in the absence of remediation or measures to control or mitigate risk, in accordance with 30 TAC §335.553(b)(2). This baseline condition is used to evaluate the need for and magnitude of remedial measures to be evaluated in the CMS. Additionally, subsurface transport modeling did not consider reactive transport of the COPCs.

G.5.1.1 Current Perched Groundwater COCs

Individual and cumulative ILCRs and HQs/HIs were calculated for 14 COPCs at the TTURF well location with the maximum EPC and evaluated by comparison to the TCEQ and EPA acceptable target risk criteria (i.e., a cumulative cancer risk of 1.0E-06 or a noncancer HI of 1.0). COPCs with risks or hazards exceeding the TCEQ and EPA acceptable target risk criteria were identified for 13 COPCs. Although risks were not elevated for total chromium, total chromium exceeds the EPA MCL.

All 14 current COPCs in perched groundwater are identified as COCs at TTURF. The current COCs include 7 HEs (HMX, RDX, TNT, 2,4-dintrotoluene, 2,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and 2-amino-4,6-dinitrotoluene), 3 metals (total chromium, hexavalent chromium, and boron), 1 inorganic (perchlorate), and 3 VOCs (1,2-dichloroethane, trichloroethene, and 1,3-dinitrobenzene).

G.5.1.2 Future Perched Groundwater COCs

The future COCs are based on a combination of current COCs in the southeastern portion of TTURF, future modeled concentrations in perched groundwater southeast of Pantex, as well as COCs from onsite wells south of Zone 11.

ILCRs and HQs were calculated using EPCs estimated from 5 existing wells on Pantex Plant south of Zones 11 and 12, as well as the modeled concentration for 1,3,5-trinitrobenzene. For each COPC and well, an EPC was quantified to represent a concentration in perched groundwater at onsite wells that may impact TTURF in the future. Individual ILCRs exceed the lower limit of the TCEQ and EPA acceptable target risk range for 2-6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, RDX, TNT, 1,2-dichloroethane, chloroform, trichloroethene (TCE), 1,4-dioxane, and tetrachloroethene (PCE). HQs exceed 1.0 for 4-amino-2,6-dinitrotoluene, 1,3,5-trintrobenzene, perchlorate, and chloroform.

Based on the combined risk results, there are 18 future COCs in the perched groundwater at TTURF. The original 14 COCs from the current risk results are expected to persist in the future and are retained as COCs. In addition, chloroform, 1,4-dioxane, tetrachloroethene, and 1,3,5-trinitrobenzene will move to TTURF in the future and are added as COCs. Only 2 COCs (1,2-dichloroethane and trichloroethene) from the wells south of Zones 11 and 12 may cause higher future concentrations and risk than current. All other current COCs and risks listed above are at the maximum and are not anticipated to increase in the future.

G.5.2 Future Ogallala Groundwater

Perched groundwater underlying portions of Pantex Plant is currently impacted, and COPCs in perched groundwater may migrate to the Ogallala Aquifer by moving downward through the fine-grained zone aquitard. Thus, a hypothetical future groundwater scenario is evaluated for offsite receptors at TTURF using the Ogallala Aquifer. However, for this exposure pathway to be complete, COPCs in Pantex Plant media must migrate to the Ogallala Aquifer and then to an offsite well location used for potable or agricultural supply. There are currently no drinking water or agricultural supply wells completed in the Ogallala Aquifer at TTURF.

TTURF groundwater was assessed as a baseline condition, i.e., in the absence of remediation or measures to control or mitigate risk, in accordance with 30 TAC §335.553(b)(2). This baseline condition is used to evaluate the need for and magnitude of remedial measures to be evaluated in the CMS. Additionally, subsurface transport modeling did not consider reactive transport of the COPCs.

The future Ogallala COCs at TTURF are based on a combination of modeling completed for the southeastern perched groundwater plume and a review of current perched groundwater EPCs south of Zones 11 and 12 that may impact TTURF in the future. The maximum EPCs for perched groundwater constituents that were different from those in the southeast plume, with a dilution factor of 10, was applied as the future concentrations for the Ogallala groundwater beneath TTURF. The use of a dilution factor of 10 to calculate future risk from perchlorate is uncertain because no site-specific fate and transport modeling was applied to determine whether perchlorate might impact the Ogallala in concentrations above the RBSV.

Based on the combined risk results, there are 3 potential future COCs (RDX, 2,4-dinitrotoluene, and perchlorate) in groundwater directly beneath TTURF. Only RDX and 2,4-dinitrotoluene are expected to reach an actual point of exposure to the east in concentrations that may drive a risk.

Table G-16. Summary of Constituents of Concern for Groundwater

Location	Risk Drivers[a]		COCs[b]		Potential Source	Rationale
Current Perched Groundwater[c]						
Offsite TTURF	Boron (HQ = 1.5) Total Chromium (>MCL) Hex Chromium (HQ=55..3) DNT2A (1.7E-05) (HQ = 33.6) DNT4A (1.2E-05) (HQ = 24.6) DCA12 (6.9E-05) DNB13 (HQ = 1.1)	DNT24 (1.7E-03) (HQ = 4.1) DNT26 (1.9E-05) RDX (1.8.E-02) (HQ = 181) TNT (1.6E-04)(HQ=36) HMX (HQ=2.1) TCE (4.3E-05) Perchlorate (HQ=1.8)	Boron CR CR-6 DNT2A DNT4A DCA12 DNB13	DNT24 DNT26 RDX TNT HMX TCE Perchlorate	The primary source areas for these COCs are Zone 12 (SWMU 5-12a (North and South), SWMU 5-13c, and WMG 6/7 west of SWMU 5-12a) and Zone 11. 1,3,5-TNB has not been found on TTURF, but has been detected in wells along the southeastern boundary of Pantex and may be present currently at TTURF.	All risk drivers are site-related COPCs from known source areas with cumulative and three individual ILCRs (for RDX, TNT, and DNT24) exceeding the upper limit of the TCEQ and EPA acceptable target risk range (1.0E-04) and HI/HQ greater than 1.0, or the concentration > MCL.
Future Perched Groundwater[d]						
Offsite TTURF	Boron (HQ = 1.5) Total Chromium (>MCL) Hex Chromium (HQ=378) DNT2A (1.7E-05) (HQ = 33.6) DNT4A (1.2E-05) (HQ = 24.6) DCA12 (1.7E-04) DNB13 (HQ = 1.1) Chloroform (5.2E-04) (HQ=1.1) 1,4-Dioxane[e] (1.43E-03)	DNT24 (1.7E-03) (HQ = 4.1) DNT26 (1.9E-05) RDX (1.8.E-02) (HQ = 181) TNT (1.6E-04)(HQ=36) HMX (HQ=2.1) 1,3,5-Trinitrobenzene (HQ=1450) TCE (4.5E-05) Tetrachloroethene (2.2E-05) Perchlorate (HQ=38.6)	Boron CR CR-6 DNT2A DNT4A DCA12 DNB13 Chloroform p-dioxane	DNT24 DNT26 RDX TNT HMX TNB135 TCE PCE Perchlorate	Impacts to perched groundwater will persist in the future as pore water containing COPCs drains from the overlying partially saturated formation. Potential future impacts are expected to continue in the future, but at lower levels than those currently observed in Zone 12 downgradient areas. Zone 11 will contribute 3 new COCs (chloroform, 1,4-dioxance, and PCE) and risk is slightly higher for 2 future COCs (DCA12 and TCE) from Zone 11. Modeling indicates that 1,3,5-TNB concentrations in the perched will increase in the future (modeled values used for risk analysis).	All risk drivers are site-related COPCs from known source areas. Cumulative and individual ILCRs exceeding the upper and lower limit of the TCEQ and EPA acceptable target risk range (1.0E-06 to 1.0E-04) and HI/HQ greater than 1.0 are expected to persist more than 100 years in the future. Total chromium exceeds the MCL.
Future Ogallala Groundwater[d]						
Offsite TTURF	DNT24 (3.0E-06) RDX (3.7.E-04) (HQ = 3.7)	Perchlorate (HQ=3.9)	DNT24 RDX	Perchlorate	COPCs in perched groundwater that may migrate to the Ogallala Aquifer in concentrations exceeding the RBSV.	All risk drivers are site-related COPCs from known source areas. Individual ILCRs exceeding the lower limit of the TCEQ and EPA acceptable target risk range (1.0E-06) and HI/HQ greater than 1.0 are expected to persist more than 100 years in the future.

[a] Risk drivers are defined as COPCs having individual ILCR > 1E-06 or HQ > 1.0 or substantially contributing to cumulative ILCR > 1.0E-06 or HI > 1.0, or concentration exceeds the MCL. Maximum individual ILCRs for all monitoring wells evaluated are provided in (parentheses), HQs are provided in (HQ = parentheses). Reported cumulative ILCR and HI are maximum for all monitoring wells evaluated (for example, future perched groundwater risk values are based on the higher of the current or future risk calculations).

[b] Risk drivers are retained as COCs unless eliminated by uncertainty analysis.

[c] No wells are currently completed in the COPC impacted area of perched groundwater. Current risks are calculated for a hypothetical future well completed in perched groundwater using current measured concentrations in the perched groundwater.

[d] Future risks are calculated for hypothetical future well completed in perched groundwater or Ogallala Aquifer at the predicted location of maximum future concentration using subsurface modeling., with the exception of perchlorate. Perchlorate was not modeled so a simple dilution factor of 10 was applied to the maximum perched groundwater perchlorate EPC (see Section R.6.2.2.4 for further explanation).

[e] 1,4-Dioxane not considered as a COPC in the Groundwater RFIR, but has been confirmed in Zone 11 since the finalization of the Groundwater RFIR. This compound is discussed in Section R.6.1.1.

Abbreviation Key:
DNT2A - 2-Amino-4,6-dinitrotoluene
DNT4A - 4-Amino-2,6-dinitrotoluene
DCA12 - 1,2-Dichloroethane
DNB13 - 1,3-Dinitrobenzene
DNT24 - 2,4-Dinitrotoluene
DNT26 - 2,6-Dinitrotoluene
PCE- Tetrachloroethene
TCE - Trichloroethene
TNB135 - 1,3,5-Trinitrobenzene
TNT – 2,4,6-Trinitrotoluene

Appendix H

Firing Site 5

Contains modified excerpts from the
FS-5 HHRA (BWXT Pantex, May 2007)

RELEASE OF INFORMATION TO THE PUBLIC DOCUMENTED REVIEW PROCESS

(Ref. WI 02.02.04.06.01)

Index Number PX-2209
Page Number 1 of 1
Issue Number 8

Document Title Firing Site 5 Human Health Risk Assessment Report

Date June 6, 2007

Document Author Michelle Bolwahnn

Type of Doc Risk Assessment Report

Document Due Date **June 12, 2007**

Blanket Release Expires N/A

This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☑ No ☐	Laura Fox for DEH	6/6/07
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐	Don Decker	6-7-07
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐	Don Decker	6-7-07
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐	George C. Weathers	06-08-07
Legal 12-72 Legal	Legal	Yes ☑ No ☐	[illegible]	06/12/07
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐	A. J. Kelly	6-12-2007

After all signatures are obtained, forward copy via email or plant mail to the Classification Officer and OSTI Transmittal Officer

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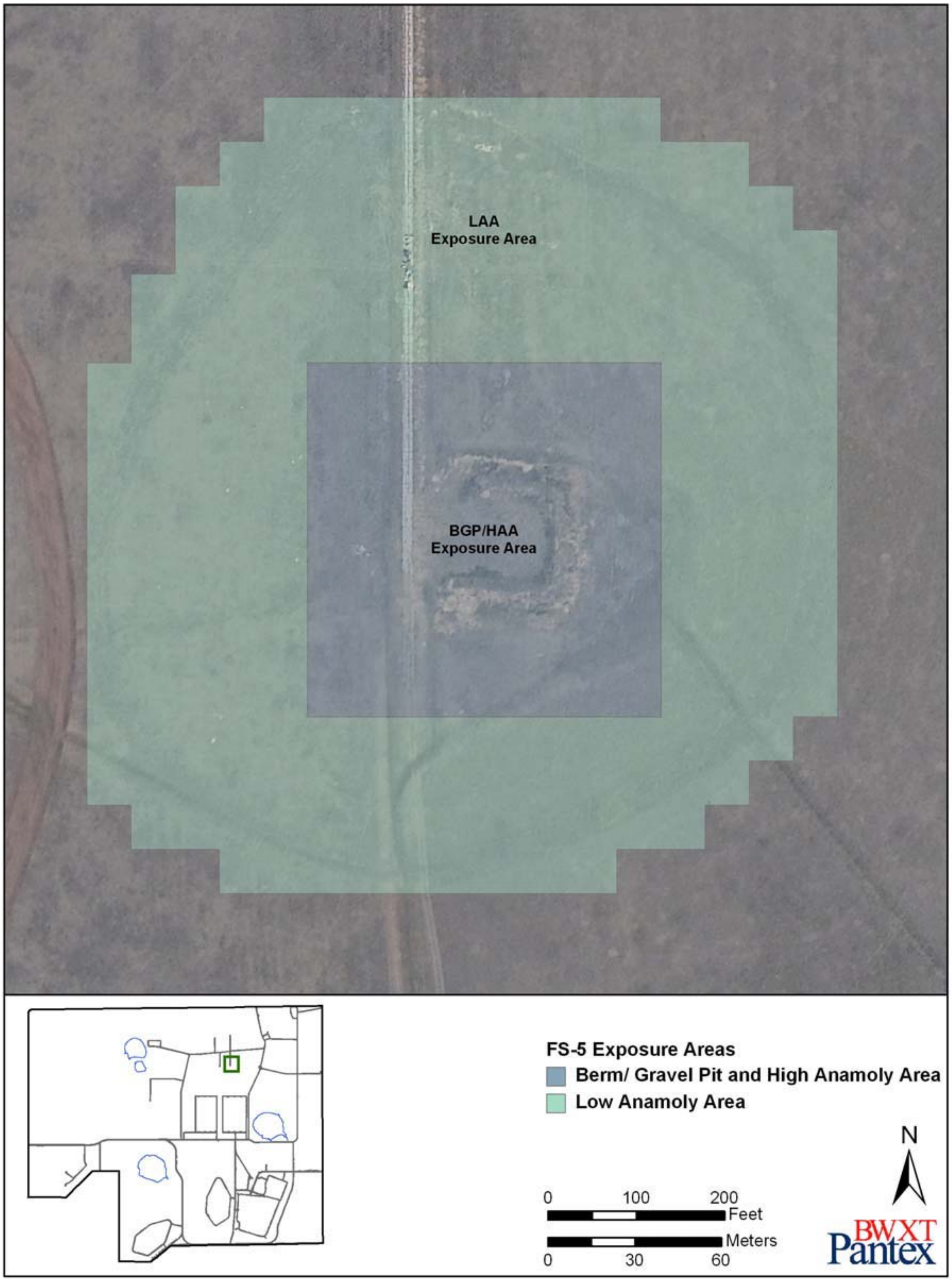

Figure H-1. FS-5 Release Unit and Exposure Area Grid

Table H-1. Initial List of Soil COPCs for FS-5

Type	COPCs	
Metals	Antimony[a]	Lead
	Arsenic[a]	Mercury[a]
	Barium	Nickel[a]
	Beryllium[a]	Selenium[a]
	Cadmium[a]	Silver[a]
	Chromium, total[a]	Thallium[a]
	Chromium, hexavalent[a]	Zinc
	Copper	Total uranium
HEs	HMX	RDX
Radionuclides[b]	^{232}Th	^{235}U
	^{234}U	^{238}U

[a]These metals were added to the list of COPCs, based on the full analyte list from the RFIR.
[b]Although tritium and ^{239}Pu are SRCs for Pantex, they were not analyzed at FS-5 because they were never used at FS-5 as part of the test shots. Although ^{232}Th was not known to be used in the test shots either, it was analyzed as a precaution.

Table H-2. Soil COPCs to be Quantitatively Evaluated in the FS-5 HHRA

Receptor and/or Pathway	COPCs Retained for Quantitative Evaluation	
Industrial Worker	Copper ^{234}U ^{238}U	^{235}U Total Uranium
Construction/Excavation Worker	Copper ^{234}U ^{238}U	^{235}U Total Uranium
Soil-to-Groundwater Pathway	Barium Copper Lead Zinc RDX	^{234}U ^{238}U ^{235}U Total Uranium

Table H-3. Exposure Point Concentrations for Onsite Industrial Worker (0-2 ft)

Exposure Unit	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
Metals									
LAA	Uranium	7440-61-1	14	14	2.4	150	X	43.3	43.3
Radionuclides									
LAA	^{234}U	13966-29-5	12	12	0.18	9.3	X	3.1	3.1
LAA	^{235}U	15117-96-1	12	12	0.013	0.65	X	0.22	0.22
LAA	^{238}U	7440-61-1	12	12	0.96	49.8	X	16.6	16.6
Metals									
HAA/BGP	Copper	7440-50-8	24	24	15.3	2120	L	1013.1	1013.1
HAA/BGP	Uranium, Total	7440-61-1	86	86	3.6	964.15	L	158.8	158.8
Radionuclides									
HAA/BGP	^{234}U	13966-29-5	85	85	0.22	44	L	9.6	9.6
HAA/BGP	^{235}U	15117-96-1	85	85	0.02	4.8	L	0.71	0.71
HAA/BGP	^{238}U	7440-61-1	85	85	1.2	320	N	53.5	53.5

COPC – Contaminant of potential concern

CAS - Chemical Abstract Service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

L - Distribution is lognormal. 95% UCL calculated using Land method.

N - Distribution is normal. 95% UCL calculated using Student's *t*-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table H-4. Exposure Point Concentrations for the Onsite Construction Worker (0-15 ft)

Exposure Unit	COPC	CAS No.	Total Number of Samples	Total Number of Detections	Minimum Detected Concentration (mg/kg or pCi/g)	Maximum Detected Concentration (mg/kg or pCi/g)	Distribution	95% UCL (mg/kg or pCi/g)	EPC (mg/kg or pCi/g)
Metals									
LAA	Uranium	7440-61-1	14	14	2.4	150	X	43.3	43.3
Radionuclides									
LAA	^{234}U	13966-29-5	12	12	0.18	9.3	X	3.1	3.1
LAA	^{235}U	15117-96-1	12	12	0.013	0.65	X	0.22	0.22
LAA	^{238}U	7440-61-1	12	12	0.96	49.8	X	16.6	16.6
Metals									
HAA/BGP	Copper	7440-50-8	36	36	10.6	6670	X	1060.2	1060.2
HAA/BGP	Uranium	7440-61-1	96	96	0.94	964.2	L	183.7	183.7
Radionuclides									
HAA/BGP	^{234}U	13966-29-5	95	95	0.06	44	L	11.2	11.2
HAA/BGP	^{235}U	15117-96-1	95	93	0.02	4.8	L	0.82	0.82
HAA/BGP	^{238}U	7440-61-1	95	95	0.31	320	L	61.9	61.9

COPC – Contaminant of potential concern

CAS - Chemical Abstract Service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

L - Distribution is lognormal. 95% UCL calculated using Land method.

N - Distribution is normal. 95% UCL calculated using Student's *t*-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

Table H-5. Industrial Worker (0-2 ft) Cancer Risk Results by Pathway

Exposure Area	COPC	CAS No.	EPC (mg/kg or pCi/g)	Cancer Ingestion URVc	Cancer Inhalation URVc	Cancer External URVc	Cancer Total URVc	ILCR Ingestion	ILCR Inhalation	ILCR External	ILCR Total	Percent of Total
LAA	Uranium	7440-61-1	43.3	--	--	NAP	--	--	--	--	--	--
LAA	^{234}U	13966-29-5	3.1	4.90E-08	3.10E-09	1.40E-09	5.40E-08	1.52E-07	9.61E-09	4.34E-09	1.66E-07	1.30%
LAA	^{235}U+D	15117-96-1	0.22	5.10E-08	2.80E-09	3.10E-06	3.20E-06	1.12E-08	6.16E-10	**6.82E-07**	**6.94E-07**	5.43%
LAA	^{238}U+D	7440-61-1	16.6	6.60E-08	2.50E-09	6.50E-07	7.20E-07	**1.10E-06**	4.15E-08	**1.08E-05**	**1.19E-05**	93.28%
							Cum ILCR	**1.26E-06**	5.17E-08	**1.15E-05**	**1.28E-05**	100.00%
HAA/BGP	Copper	7440-50-8	1013.1	--	--	NAP	--	--	--	--	--	--
HAA/BGP	Uranium, Total	7440-61-1	158.8	--	--	NAP	--	--	--	--	--	--
HAA/BGP	^{234}U	13966-29-5	9.6	4.90E-08	3.10E-09	1.40E-09	5.40E-08	4.70E-07	2.98E-08	1.34E-08	5.14E-07	1.25%
HAA/BGP	^{235}U+D	15117-96-1	0.71	5.10E-08	2.80E-09	3.10E-06	3.20E-06	3.62E-08	1.99E-09	**2.20E-06**	**2.24E-06**	5.44%
HAA/BGP	^{238}U+D	7440-61-1	53.5	6.60E-08	2.50E-09	6.50E-07	7.20E-07	**3.53E-06**	1.34E-07	**3.48E-05**	**3.84E-05**	93.32%
							Cum ILCR	**4.04E-06**	1.65E-07	**3.70E-05**	**4.12E-05**	100.00%

COPC – Contaminant of potential concern

CAS -chemical abstract service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

ILCR - incremental lifetime cancer risk

URV_c - cancer unit risk value

Bolded values exceed ILCR of 1E-6

-- no data available

Table H-6. Industrial Worker (0-2 ft) Noncancer Risk Results by Pathway

Exposure Area	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_{nc}	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent of Total
LAA	Uranium	7440-61-1	43.3	1.6E-04	1.9E-05	1.5E-05	2.0E-04	0.007	0.001	0.001	0.008	100.00%
LAA	^{234}U	13966-29-5	3.1	--	--	--	--	--	--	--	--	--
LAA	^{235}U+D	15117-96-1	0.22	--	--	--	--	--	--	--	--	--
LAA	^{238}U+D	7440-61-1	16.6	--	--	--	--	--	--	--	--	--
							HI	0.007	0.001	0.001	0.008	100.00%
HAA/BGP	Copper	7440-50-8	1013.1	1.20E-05	2.10E-06	4.50E-06	1.90E-05	0.012	0.002	0.005	0.019	37.95%
HAA/BGP	Uranium, Total	7440-61-1	158.8	1.60E-04	1.90E-05	1.50E-05	2.00E-04	0.025	0.003	0.002	0.031	62.05%
HAA/BGP	^{234}U	13966-29-5	9.6	--	--	--	--	--	--	--	--	--
HAA/BGP	^{235}U+D	15117-96-1	0.71	--	--	--	--	--	--	--	--	--
HAA/BGP	^{238}U+D	7440-61-1	53.5	--	--	--	--	--	--	--	--	--
							HI	0.038	0.005	0.007	0.050	100.00%

COPC – Contaminant of potential concern

CAS -chemical abstract service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

HI - hazard index

HQ - hazard quotient

URV_{nc} - noncancer unit risk value

Bolded values exceed HQ or HI of 1

-- no data available

Table H-7. Construction Worker (0-15 ft) Cancer Risk Results by Pathway

Exposure Area	COPC	CAS No.	EPC (mg/kg or pCi/g)	Cancer Ingestion URV_c	Cancer Inhalation URV_c	Cancer External URV_c	Cancer Total URV_c	ILCR Ingestion	ILCR Inhalation	ILCR External	ILCR Total	Percent of Total
LAA	Uranium	7440-61-1	43.3	--	--	NAP	--	--	--	--	--	--
LAA	^{234}U	13966-29-5	3.1	4.50E-09	3.00E-11	1.40E-11	4.60E-09	1.40E-08	9.30E-11	4.34E-11	1.43E-08	6.45%
LAA	^{235}U+D	15117-96-1	0.22	4.70E-09	2.60E-11	3.00E-08	3.40E-08	1.03E-09	5.72E-12	6.60E-09	7.48E-09	3.39%
LAA	^{238}U+D	7440-61-1	16.6	6.00E-09	2.40E-11	6.20E-09	1.20E-08	9.96E-08	3.98E-10	1.03E-07	1.99E-07	90.16%
							Cum ILCR	1.15E-07	4.97E-10	1.10E-07	2.21E-07	100.00%
HAA/BGP	Copper	7440-50-8	1060.2	--	--	NAP	--	--	--	--	--	--
HAA/BGP	Uranium	7440-61-1	183.7	--	--	NAP	--	--	--	--	--	--
HAA/BGP	^{234}U	13966-29-5	11.2	4.50E-09	3.00E-11	1.40E-11	4.60E-09	5.04E-08	3.36E-10	1.57E-10	5.15E-08	6.27%
HAA/BGP	^{235}U+D	15117-96-1	0.82	4.70E-09	2.60E-11	3.00E-08	3.40E-08	3.85E-09	2.13E-11	2.46E-08	2.79E-08	3.39%
HAA/BGP	^{238}U+D	7440-61-1	61.9	6.00E-09	2.40E-11	6.20E-09	1.20E-08	3.71E-07	1.49E-09	3.84E-07	7.43E-07	90.34%
							Cum ILCR	4.2565E-07	1.8429E-09	4.0854E-07	8.222E-07	100.00%

COPC – Contaminant of potential concern

CAS -chemical abstract service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

ILCR - incremental lifetime cancer risk

URV_c - cancer unit risk value

Bolded values exceed ILCR of 1E-6

-- no data available

Table H-8. Construction Worker (0-15 ft) Noncancer Risk Results by Pathway

Exposure Area	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_{nc}	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent of Total
LAA	Uranium	7440-61-1	43.3	1.60E-03	2.00E-05	1.60E-05	1.70E-03	0.069	0.001	0.001	0.074	100.00%
LAA	^{234}U	13966-29-5	3.1	--	--	--	--	--	--	--	--	--
LAA	^{235}U+D	15117-96-1	0.22	--	--	--	--	--	--	--	--	--
LAA	^{238}U+D	7440-61-1	16.6	--	--	--	--	--	--	--	--	--
							HI	0.069	0.001	0.001	0.074	100.00%
HAA/BGP	Copper	7440-50-8	1060.2	1.20E-04	2.20E-06	4.70E-06	1.30E-04	0.127	0.002	0.005	0.138	30.62%
HAA/BGP	Uranium	7440-61-1	183.7	1.60E-03	2.00E-05	1.60E-05	1.70E-03	0.294	0.004	0.003	0.312	69.38%
HAA/BGP	^{234}U	13966-29-5	11.2	--	--	--	--	--	--	--	--	--
HAA/BGP	^{235}U+D	15117-96-1	0.82	--	--	--	--	--	--	--	--	--
HAA/BGP	^{238}U+D	7440-61-1	61.9	--	--	--	--	--	--	--	--	--
							HI	0.42	0.01	0.01	0.45	100.00%

COPC – Contaminant of potential concern

CAS -chemical abstract service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

HI - hazard index

HQ - hazard quotient

URV_{nc} - noncancer unit risk value

Bolded values exceed HQ or HI of 1

-- no data available

H.1 SUMMARY OF FS-5

SWMU 70 FS-5 is currently an inactive facility that has previously undergone a RCRA facility investigation, radiological investigation, ICM to cleanup depleted uranium fragments and oxidized uranium in soils, post-cleanup human health risk assessment (Battelle, 1999), ecological risk assessment, D&D of facilities, and a final survey and release. FS-5 has been RCRA closed and deed recorded to RRS 2, with approval and release of post-closure care responsibilities provided in a letter dated August 4, 1999 from the TCEQ (formerly TNRCC). This HHRA was conducted to update the FS-5 HHRA to the current work plan (BWXT Pantex/SAIC, 2003) and to update toxicity values used in the toxicity assessment and risk characterization.

FS-5 was used to test the behavior of simulated weapons components, containing depleted uranium, under compression by high explosives. Depleted uranium was used as the heavy metal to simulate the shock properties of the plutonium components used in actual weapons components. Some test shots also used limited quantities of beryllium. Testing performed on the firing pad, and within the gravel pit, resulted in area-wide scattering of depleted uranium and other materials, such as high explosives and metals, until the practice was terminated in 1984.

FS-5 was constructed in 1953 and included an underground bunker building, a surface firing pad at the center of a flat circular area about 900 ft in diameter, and a gravel-filled pit, used for major tests, immediately north of the bunker building. The facilities were surrounded on three sides by an earthen berm approximately 10 ft high, 162 ft long, and 132 ft across. A 50-ft wide fire break (also referred to as the “fire scar”) rings the site. All structures were removed as part of the ICM and the D&D activities. The earthen berm that surrounded the facilities is still present at FS-5.

H.2 SUMMARY OF FS-5 RISK ASSESSMENT

For FS-5, the following potential receptors and pathways were identified for analysis:

- Onsite Industrial Worker
  - Incidental ingestion, dermal contact, inhalation of airborne particulates and volatiles emanating from onsite surface soil, and external radiation (0-2 ft).
  - Potential for future ingestion, inhalation (during showering), dermal contact, and external radiation from Ogallala groundwater that could be affected by contaminants of potential concern (COPCs) in the FS-5 unit soils.
- Onsite Construction Excavation Worker
  - Incidental ingestion, dermal contact, inhalation of airborne particulates and volatiles emanating from onsite surface soil, and external radiation (0-15 ft).
  - Potential for future ingestion, inhalation (during showering), dermal contact, and external radiation from Ogallala groundwater that could be affected by contaminants of potential concern (COPCs) in the FS-5 unit soils.
- Offsite Resident Farmer
  - Potential for future ingestion, inhalation (during showering), dermal contact, and external radiation from Ogallala groundwater that could be affected by COPCs in the FS-5 unit soils.

- o Potential future exposure to COPCs in Ogallala groundwater via ingestion of crops irrigated with groundwater, and ingestion of animal products from animals fed contaminated crops and groundwater.

- o The following exposure pathways were semi-quantitatively evaluated for offsite receptors in this HHRA for FS-5:

- Future resident farmers (adult and child) exposed to COPCs transported offsite in air, via inhalation.

- Future resident farmers (adult and child) exposed to COPCs transported offsite in air and deposited onto crops, via ingestion of crops and animal products from animals fed those crops.

- Future resident farmers (adult and child) exposed to COPCs transported offsite in air and deposited onto soil, via ingestion, dermal contact, and inhalation (re-suspended soil and vapors).

The onsite receptors were evaluated using two exposure areas at FS-5. The exposure areas correspond to the previous grid system and areas used during the ICM. The two exposure areas are the LAA (12 acres) and the combined HAA and berm/gravel pit (3.7 acres). These two areas were chosen because the concentrations and risk were more uniform across the LAA and the highest concentrations occurred in the HAA/BGP. Therefore, the highest concentrations were evaluated using a smaller exposure area.

The COPCs evaluated for FS-5 include metals and radionuclides, present above background levels in soils. Results of the COPC screening indicated that all pathways and affected receptors required further evaluation for a limited number of COPCs.

Subsequent fate and transport modeling of radionuclides at FS-5 indicated that under the interplaya recharge conditions at FS-5, the radionuclides and metals will not impact the perched for thousands of years, so are not expected to impact the Ogallala Aquifer in the future. Even under higher recharge conditions, radionuclides or metals will not impact the perched groundwater within 1,000 years. Therefore, groundwater pathways were not assessed for onsite workers or for an offsite resident farmer.

Based on information from a nearby well, perched groundwater is present beneath FS-5 and has been impacted by HEs and boron that are likely the result of the historical discharges to Playa 1. FS-5 is near Playa 1, and is impacted by the radial perched groundwater flow from Playa 1. The HE and boron concentrations in perched groundwater near FS-5 are consistent with the radial plumes around Playa 1. Because of the radial movement of groundwater from Playa 1, the perched groundwater flow in that area is to the northwest. The extent of saturation of the perched ends near FS-5. For this reason, no offsite receptors will be exposed to perched groundwater from the FS-5 area. Additionally, based on the current monitoring network, the Groundwater RFIR did not identify COPCs in the Ogallala Aquifer. However, non-trending sporadic detections of constituents at non-actionable levels in the Ogallala required the evaluation of the data for uncertainty. Groundwater associated with Playa 1 is assessed in the Baseline HHRA (BWXT Pantex and SAIC, December 2006) for multiple areas. Therefore, perched groundwater is assessed for onsite and offsite receptors for future risk only in this report, based on the potential for migration of soil COPCs to groundwater.

There is limited surface water at FS-5 due to ditches that drain water back into a low area to the east of the berm. During large rainfall events, some water would be collected in the low area, with some surface water draining to Playa 1. Playa 1 surface water was evaluated in the Baseline HHRA Report (December 2006).

That report indicated that surface water at Playa 1 meets all drinking water criteria, and did not require further evaluation in the risk assessment.

Because groundwater modeling indicates there are no future concerns for groundwater and perched groundwater at FS-5 does not extend offsite, no risk calculations were performed for the resident farmer or onsite workers due to exposure to perched or Ogallala groundwater.

Results of the semi-quantitive analysis of offsite air to the resident farmer indicate that risk values are far below a level of concern (ILCR = 3.2E-10 and HI = 8.5E-4). Therefore, only the onsite workers were assessed for current and future risks due to exposure to soils at FS-5.

Risk characterization integrates the exposure and toxicity assessments by comparing estimates of intake with appropriate toxicity values. This, in turn, provides an indication of the potential for adverse effects to exposed receptors. The objective of the FS-5 HHRA was to determine if exposure to COPCs poses risks that exceed EPA or TCEQ target levels for human health effects.

Noncarcinogenic and carcinogenic health risks were quantified and presented as ILCRs and HQs. Only current risk, based on measured concentrations, was evaluated, since the groundwater pathway is incomplete. These risks are then compared to TCEQ and EPA target risk levels to determine if there are unacceptable risks that would require further remediation of soils to protect workers at FS-5. Based on the risk results presented in table below, uranium isotopes exceeded acceptable risk criteria.

Table H-9. Risk Characterization Results for Workers

Worker	COPC	ILCR		HQ	
		LAA	HAA/BGP	LAA	BGP
Industrial Worker	Copper	NA	--	NA	0.019
	Uranium, Total	--	--	0.009	0.032
	^{234}U	1.67E-07	5.18E-07	--	--
	^{235}U	7.04E-07	**2.27E-06**	--	--
	^{238}U	**1.20E-05**	**3.85E-05**	--	--
	Cumulative ILCR/HI	**1.28E-05**	**4.13E-05**	0.009	0.051
Construction/Excavation Worker	Copper	NA	--	NA	0.138
	Uranium, Total	--	--	0.074	0.312
	^{234}U	1.43E-08	5.15E-08	--	--
	^{235}U	7.48E-09	2.79E-08	--	--
	^{238}U	1.99E-07	7.43E-07	--	--
	Cumulative ILCR/HI	2.21E-07	8.22E-07	0.074	0.45

ILCR – incremental lifetime cancer risk.
HQ – hazard quotient.
-- No toxicity values available to calculate risk.
NA – Copper not required to be evaluated in the LAA because all values were below risk-based screening criteria.

The FS-5 HHRA utilized current levels of contaminant concentrations to represent worst-case future risk. Because of the long-lived nature of the COPCs, the concentrations are not expected to decrease significantly. Note that the uranium isotopes (235 and 238) were assessed for impacts from daughter products.

Risk results indicate that individual and cumulative carcinogenic risks exceed acceptable TCEQ criteria and the lower end of the EPA risk range (1.0E-06) for the industrial worker. Carcinogenic risks are below acceptable levels for the construction/excavation worker. Carcinogenic risks predicted for the industrial worker are driven by two isotopes of depleted uranium (235U and 238U). All HQs are below a level of 1.0, so the risks from total uranium are within an acceptable level. Detailed risk tables are provided below.

Conservative assumptions are used when possible, to compensate for uncertainties in the risk assessment. The uncertainty analysis performed for FS-5 indicates that risks are likely to be overestimated, rather than underestimated. This is particularly true for actual workers that may be present at FS-5. TCEQ requires the evaluation of a standard industrial worker as provided in 30 TAC 335, Subchapter S. Because FS-5 is an inactive facility, the only worker present in FS-5 is the Pantex maintenance worker that mows the entire firing site area. Based on analysis of the actual time that worker may be present at FS-5, the risk is below a 1.0E-06 risk level.

It should be noted that there are no data available to assess risk to a potential worker outside the fire scar for FS-5. Based on information in the RFIR (MKC and ETAS, 1999), a survey was conducted outside the fire scar to determine the extent of anomalies (see Section 2.3.1 for detail). That survey indicated that anomalies are present to the north, west, and south of the fire scar. The RFI and ICM grid did not encompass any of those areas, so investigation and cleanup did not include those areas. Based on the information collected during the ICM, fewer anomalies would be expected in the area outside the fire scar; however, risks would be similar to, or slightly lower than, risks to a worker in the LAA, based on evaluation of uncleared anomalies near the fire scar.

Table H-10. Industrial Worker (0-2 ft) Cancer Risk Results by Pathway

Exposure Area	COPC	CAS No.	EPC (mg/kg or pCi/g)	Cancer Ingestion URVc	Cancer Inhalation URVc	Cancer External URVc	Cancer Total URVc	ILCR Ingestion	ILCR Inhalation	ILCR External	ILCR Total	Percent of Total
LAA	Uranium	7440-61-1	43.3	--	--	NAP	--	--	--	--	--	--
LAA	^{234}U	13966-29-5	3.1	4.90E-08	3.10E-09	1.40E-09	5.40E-08	1.52E-07	9.61E-09	4.34E-09	1.66E-07	1.30%
LAA	^{235}U+D	15117-96-1	0.22	5.10E-08	2.80E-09	3.10E-06	3.20E-06	1.12E-08	6.16E-10	**6.82E-07**	**6.94E-07**	5.43%
LAA	^{238}U+D	7440-61-1	16.6	6.60E-08	2.50E-09	6.50E-07	7.20E-07	**1.10E-06**	4.15E-08	**1.08E-05**	**1.19E-05**	93.28%
							Cum ILCR	**1.26E-06**	5.17E-08	**1.15E-05**	**1.28E-05**	100.00%
HAA/BGP	Copper	7440-50-8	1013.1	--	--	NAP	--	--	--	--	--	--
HAA/BGP	Uranium, Total	7440-61-1	158.8	--	--	NAP	--	--	--	--	--	--
HAA/BGP	^{234}U	13966-29-5	9.6	4.90E-08	3.10E-09	1.40E-09	5.40E-08	4.70E-07	2.98E-08	1.34E-08	5.14E-07	1.25%
HAA/BGP	^{235}U+D	15117-96-1	0.71	5.10E-08	2.80E-09	3.10E-06	3.20E-06	3.62E-08	1.99E-09	**2.20E-06**	**2.24E-06**	5.44%
HAA/BGP	^{238}U+D	7440-61-1	53.5	6.60E-08	2.50E-09	6.50E-07	7.20E-07	**3.53E-06**	1.34E-07	**3.48E-05**	**3.84E-05**	93.32%
							Cum ILCR	**4.04E-06**	1.65E-07	**3.70E-05**	**4.12E-05**	100.00%

COPC – Contaminant of potential concern

CAS -chemical abstract service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

ILCR - incremental lifetime cancer risk

URV_c - cancer unit risk value

Bolded values exceed ILCR of 1E-6

-- no data available

Table H-11. Industrial Worker (0-2 ft) Noncancer Risk Results by Pathway

Exposure Area	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_{nc}	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent of Total
LAA	Uranium	7440-61-1	43.3	1.6E-04	1.9E-05	1.5E-05	2.0E-04	0.007	0.001	0.001	0.008	100.00%
LAA	^{234}U	13966-29-5	3.1	--	--	--	--	--	--	--	--	--
LAA	^{235}U+D	15117-96-1	0.22	--	--	--	--	--	--	--	--	--
LAA	^{238}U+D	7440-61-1	16.6	--	--	--	--	--	--	--	--	--
							HI	0.007	0.001	0.001	0.008	100.00%
HAA/BGP	Copper	7440-50-8	1013.1	1.20E-05	2.10E-06	4.50E-06	1.90E-05	0.012	0.002	0.005	0.019	37.95%
HAA/BGP	Uranium, Total	7440-61-1	158.8	1.60E-04	1.90E-05	1.50E-05	2.00E-04	0.025	0.003	0.002	0.031	62.05%
HAA/BGP	^{234}U	13966-29-5	9.6	--	--	--	--	--	--	--	--	--
HAA/BGP	^{235}U+D	15117-96-1	0.71	--	--	--	--	--	--	--	--	--
HAA/BGP	^{238}U+D	7440-61-1	53.5	--	--	--	--	--	--	--	--	--
							HI	0.038	0.005	0.007	0.050	100.00%

COPC – Contaminant of potential concern

CAS -chemical abstract service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

HI - hazard index

HQ - hazard quotient

URV_{nc} - noncancer unit risk value

Bolded values exceed HQ or HI of 1

-- no data available

Table H-12. Construction Worker (0-15 ft) Cancer Risk Results by Pathway

Exposure Area	COPC	CAS No.	EPC (mg/kg or pCi/g)	Cancer Ingestion URV_c	Cancer Inhalation URV_c	Cancer External URV_c	Cancer Total URV_c	ILCR Ingestion	ILCR Inhalation	ILCR External	ILCR Total	Percent of Total
LAA	Uranium	7440-61-1	43.3	--	--	NAP	--	--	--	--	--	--
LAA	^{234}U	13966-29-5	3.1	4.50E-09	3.00E-11	1.40E-11	4.60E-09	1.40E-08	9.30E-11	4.34E-11	1.43E-08	6.45%
LAA	^{235}U+D	15117-96-1	0.22	4.70E-09	2.60E-11	3.00E-08	3.40E-08	1.03E-09	5.72E-12	6.60E-09	7.48E-09	3.39%
LAA	^{238}U+D	7440-61-1	16.6	6.00E-09	2.40E-11	6.20E-09	1.20E-08	9.96E-08	3.98E-10	1.03E-07	1.99E-07	90.16%
							Cum ILCR	1.15E-07	4.97E-10	1.10E-07	2.21E-07	100.00%
HAA/BGP	Copper	7440-50-8	1060.2	--	--	NAP	--	--	--	--	--	--
HAA/BGP	Uranium	7440-61-1	183.7	--	--	NAP	--	--	--	--	--	--
HAA/BGP	^{234}U	13966-29-5	11.2	4.50E-09	3.00E-11	1.40E-11	4.60E-09	5.04E-08	3.36E-10	1.57E-10	5.15E-08	6.27%
HAA/BGP	^{235}U+D	15117-96-1	0.82	4.70E-09	2.60E-11	3.00E-08	3.40E-08	3.85E-09	2.13E-11	2.46E-08	2.79E-08	3.39%
HAA/BGP	^{238}U+D	7440-61-1	61.9	6.00E-09	2.40E-11	6.20E-09	1.20E-08	3.71E-07	1.49E-09	3.84E-07	7.43E-07	90.34%
							Cum ILCR	4.2565E-07	1.8429E-09	4.0854E-07	8.222E-07	100.00%

COPC – Contaminant of potential concern

CAS -chemical abstract service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

ILCR - incremental lifetime cancer risk

URV_c - cancer unit risk value

Bolded values exceed ILCR of 1E-6

-- no data available

Table H-13. Construction Worker (0-15 ft) Noncancer Risk Results by Pathway

Exposure Area	COPC	CAS No.	EPC (mg/kg or pCi/g)	Ingestion URV_{nc}	Dermal URV_{nc}	Inhalation URV_{nc}	Total URV_{nc}	HQ Ingestion	HQ Dermal	HQ Inhalation	HQ Total	Percent of Total
LAA	Uranium	7440-61-1	43.3	1.60E-03	2.00E-05	1.60E-05	1.70E-03	0.069	0.001	0.001	0.074	100.00%
LAA	^{234}U	13966-29-5	3.1	--	--	--	--	--	--	--	--	--
LAA	^{235}U+D	15117-96-1	0.22	--	--	--	--	--	--	--	--	--
LAA	^{238}U+D	7440-61-1	16.6	--	--	--	--	--	--	--	--	--
							HI	0.069	0.001	0.001	0.074	100.00%
HAA/BGP	Copper	7440-50-8	1060.2	1.20E-04	2.20E-06	4.70E-06	1.30E-04	0.127	0.002	0.005	0.138	30.62%
HAA/BGP	Uranium	7440-61-1	183.7	1.60E-03	2.00E-05	1.60E-05	1.70E-03	0.294	0.004	0.003	0.312	69.38%
HAA/BGP	^{234}U	13966-29-5	11.2	--	--	--	--	--	--	--	--	--
HAA/BGP	^{235}U+D	15117-96-1	0.82	--	--	--	--	--	--	--	--	--
HAA/BGP	^{238}U+D	7440-61-1	61.9	--	--	--	--	--	--	--	--	--
							HI	0.42	0.01	0.01	0.45	100.00%

COPC – Contaminant of potential concern

CAS -chemical abstract service

EPC - exposure point concentration is lesser of 95% UCL (upper confidence limit) and maximum detection.

HI - hazard index

HQ - hazard quotient

URV_{nc} - noncancer unit risk value

Bolded values exceed HQ or HI of 1

-- no data available

Table H-14. Sources of Uncertainty in the FS-5 HHRA

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Uncertainty in Data Collection and Analysis		
Sampling Locations		
Soil sample locations are a mixture of random and biased.	Metals soil sample locations are often biased toward areas of highest COPC concentration.	Low impact: overestimates risks for copper.
Copper soil samples collected outside of the exposure areas.	Copper samples collected outside the exposure areas were evaluated through the same process as the exposure area data.	No impact: copper screened out against RBSVs so no elevated risks from copper were missed.
No uranium soil sampling locations north of the FS-5 fire scar.	Evaluation of anomalies and concentrations from the center of FS-5 outward indicate a decreasing trend in the number of anomalies. Potential anomalies outside the fire scar are expected to be less than 5 anomalies per grid because the dispersal pattern indicates the highest number of anomalies occur toward the center of FS-5. Evaluation of concentrations left in place from uncleared anomalies near the fire scar indicate that activities of ^{238}U are above the 1.0E-06 PRG, with many closer to the 1.0E-05 PRG.	Moderate impact: underestimates risk for the area north, west, and south of the fire scar that is not included in the HHRA and the area of impact may need to be expanded for protection of workers. However, those risks are expected to be similar to, or slightly lower than, risks in the outer portions of the LAA. The firing site area is controlled due to the active use of surrounding Firing Sites. FS-5 is no longer used and the only worker present in the area has limited exposure.
Few samples were collected in the subsurface soil.	Subsurface samples were collected in areas where uranium was most likely to be present at depth, and a few random areas were chosen to evaluate uranium at depth.	Low impact: samples were collected in areas most likely impacted by depleted uranium at depth. Random areas were chosen during the investigation to evaluate depleted uranium across FS-5.
Only composite samples were used in the FS-5 HHRA, although some discrete samples were also collected during the final confirmation sampling.	UCLs calculated for the ICM Implementation Report, 1999 HHRA, and the current HHRA were compared. The previous UCLs were calculated using both discrete and composite samples, so current concentrations could be affected by the differences in the concentrations.	Negligible impact: UCLs from previous reports indicate that the UCLs from use of composite data are very similar. UCLs in the HHRAs are slightly higher than those calculated for the ICM, which could be a result of differences in methods for calculation of the UCL.
Use of older alpha spectrometry data along with random ICM/MS composite data.	Some of the alpha spectrometry data were collected in areas that were not resampled after the ICM. Some of the areas have newer discrete data that indicate much lower depleted uranium activities and one area had some remediation.	Low to moderate impact: The area (investigation grid cell 134) where some hand removal of anomalies occurred would be biased high because no confirmation data were collected after the ICM. The sample collected in investigation grid cell 247 is high relative to the discrete data collected after the ICM. This may bias the UCL high and risk may be overestimated.

Table H-14. Sources of Uncertainty in the FS-5 HHRA, continued

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Use of older chemical data from the RFIR may not reflect actual final concentrations at FS-5.	All available data were used to estimate risk for metals and high explosives.	Low to moderate impact: the ICM focused on removal of depleted uranium; however, due to the extensive removal actions that took place, some of the metals concentrations were likely removed as well. Risks estimated from older data likely overestimate the actual risks for metals at FS-5.
Analytical Methods		
Sample collection and analysis may not accurately reflect the amount of depleted uranium that a receptor may actually be exposed to at the site.	Oxidized uranium is the primary concern for the ingestion and inhalation pathways. However, depleted uranium fragments present at the site and collected as part of the samples will not actually contribute to the soil inhalation and ingestion pathways.	Low to moderate impact: acid digestion of the fragments in samples may cause overestimation of the concentrations and risks to workers of offsite residents that may be exposed to wind blown particles from FS-5.
Uncertainty in Exposure Assessment		
Exposure Point Concentrations		
FS-5 exposure areas.	Exposure areas chosen based on concentration and risk patterns for the site. The individual locations were compared to the PRGs to provide a risk ratio that helped determine the risk patterns. The concentrations and risk patterns are centered on the test facilities at the center of FS-5, so exposure areas were set according to those patterns.	Moderate to high impact: Exposure areas were set according to areas of highest concentration and risk, so the calculated risks are likely to be overestimated for FS-5, considering that FS-5 is a closed site that is no longer used.
Groundwater pathway risk not quantified because fate and transport modeling indicated that COPCs in soil would not migrate to the perched groundwater within 1,000 years.	Travel time analysis indicates uranium travel time exceeds 1,000 years over the reported range of upland and playa recharge rates.	Moderate to high impact: tends to overestimate COPC transport and potential exposure because higher recharge rates from the playas are not applicable at FS-5. Interplaya recharge rates may underestimate the impact, because some ponding occurs to the east of the berm. However, the highest recharge rates from the playas at Pantex would not be expected at FS-5.
Groundwater modeling used interplaya recharge rates to assess the groundwater pathway.	SSL development demonstrates, that even under the highest recharge conditions at Pantex, uranium will not reach perched groundwater for over 1,000 years. Movement to the Ogallala would take longer and because of uncertainty with declining water levels in the Ogallala, this pathway is incomplete.	No impact: use of maximum recharge conditions demonstrates groundwater is an incomplete pathway at FS-5.
Exposure Assumptions		
Standard default exposure parameters are used; however, FS-5 facilities have been removed and FS-5 is no longer used, so only mowers are present in FS-5.	Actual exposures are expected to be much less than estimated by standard default exposure parameters.	High impact: overestimates risk, site-specific calculation of risk indicates that a risk to a site-specific worker is below 1.0E-06.
Hotspot Evaluation		
Future workers could be exposed to higher concentrations of COPCs that are left in place in small areas.	Identified individual locations that exceed a 1.0E-05 PRG for future scenarios.	Low impact: current worker patterns are documented workers will not be exposed to small portions of FS-5. Locations with COPC concentrations above the EPA 1.0E-05 PRG were identified for future consideration.
Uncertainty in Toxicity Information		

Table H-14. Sources of Uncertainty in the FS-5 HHRA, continued

Source of Uncertainty	Evaluation	Magnitude and Impact of Uncertainty
Toxicity values.	All toxicity values have inherent uncertainty due to extrapolation from laboratory studies (usually on animals) at relatively high concentrations to environmental exposure to humans at much lower concentrations.	High impact: may over or underestimate risk, but safety factors are used with the intention of overestimating risk.
Uncertainty in Risk Characterization		
In the absence of information on the toxicity of specific chemical mixtures, it is assumed that ILCRs and HQs are additive (i.e., cumulative).	Modes of action of COPCs contributing to total risk were evaluated to determine appropriateness of calculating cumulative risk when cumulative risk is important for risk management decisions (i.e., individual COPCs have acceptable risks, but potentially unacceptable cumulative risk).	Low impact: cumulative risks do not exceed target risk criteria unless individual chemical risks also exceed.
Qualitative evaluation of airborne transport of offsite receptors.	Results of quantitative atmospheric transport at the Burning Ground is used to evaluate the potential for unacceptable offsite risks due to atmospheric transport from other areas.	Negligible impact: Uncertainty in the qualitative method does not impact conclusions because of the extremely low risks predicted for FS-5.

H.3 CONCLUSIONS

Based on the evaluation of risk to a standard industrial worker from residual contamination at FS-5, depleted uranium was identified as a COC for evaluation in the CMS/FS. Cancer risks exceeded 1.0E-06, both individually and cumulatively for the industrial worker. Cancer risks were below 1.0E-06 for the construction/excavation worker. Non-cancer risks (HIs) were well below 1.0, both individually and cumulatively for both onsite workers. Although TCEQ requires the evaluation of a standard industrial worker, risk evaluation of a worker that is actually present at FS-5 demonstrates that the ILCR and the HI for a site-specific worker is below acceptable levels.

It should be noted that there are no data available to assess risk to a potential worker outside the fire scar for FS-5, although anomalies were identified outside the fire scar to the north, west, and south. The endpoints for the surveys and final risks are provided in figures below. No ICMs or investigations were performed in those areas. Based on the information collected during the ICM, fewer anomalies would be expected in the area outside the fire scar; however, risks would be similar to, or slightly lower than, risk predicted in the LAA, based on evaluation of activities at uncleared anomalies near the fire scar.

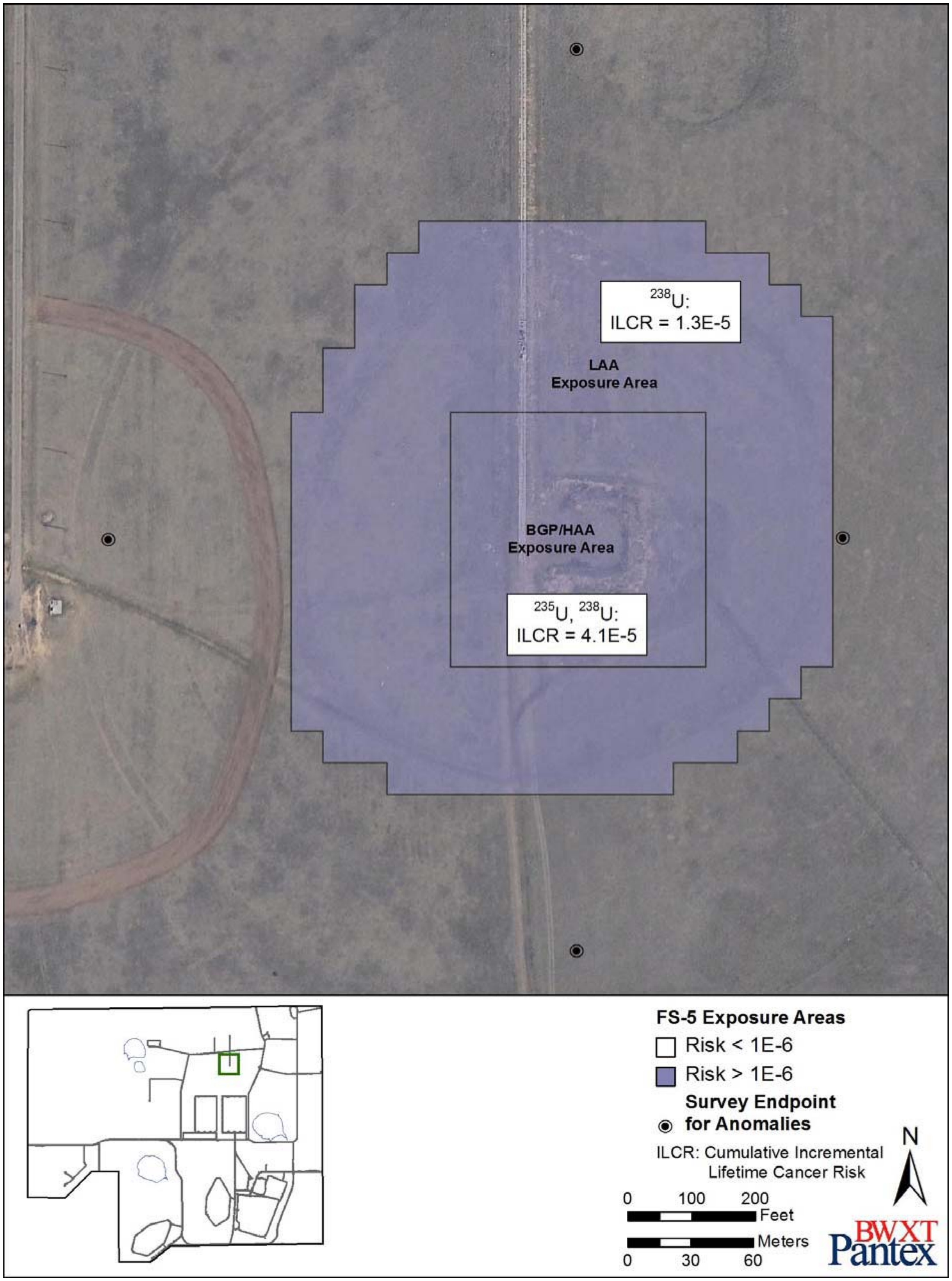

Figure H-2. FS-5 Summary of COCs and Risk Results for Industrial Worker

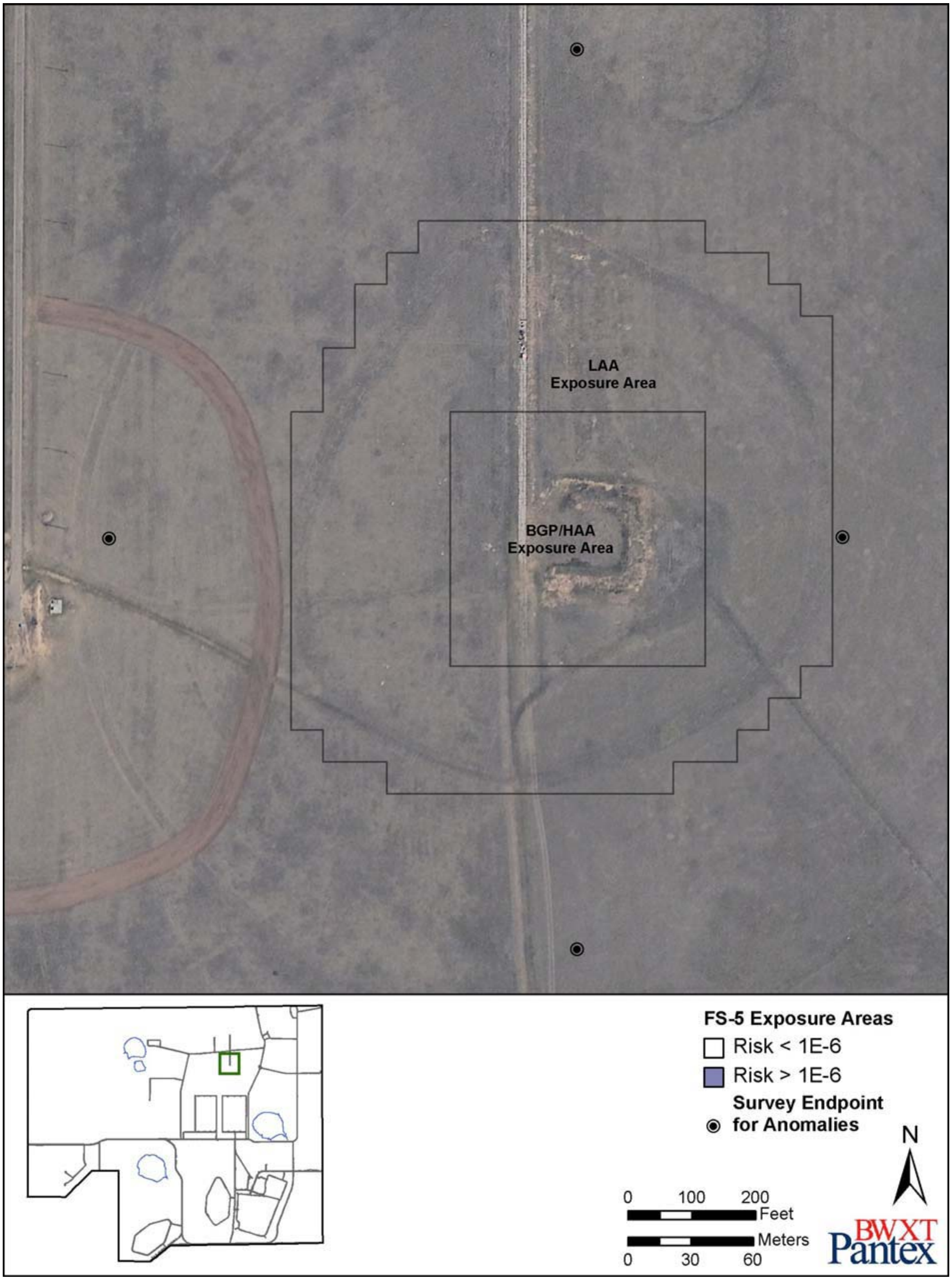

Figure H-3. FS-5 Summary of COCs and Risk Results for Construction/Excavation Worker

Appendix I

Toxicity Criteria and Risk Calculation Methods for Human Health Risk Assessments At Pantex Plant

RELEASE OF INFORMATION TO THE PUBLIC
DOCUMENTED REVIEW PROCESS
(Ref. WI 02.04.02.02.03)

Document Title Baseline Human Health Risk Assessment Report for Zones 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groudnwater – Volumes I and II Date 12/9/2005
Document Author Michelle Bolwahnn Type of Doc Report

Document Due Date 12-22-2005 Blanket Release Expires

This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☒ No ☐	for M.G. Knight	DEC 0 9 2005
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐		12/13/05
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐		12/13/05
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐		12/12/05
Legal 12-72 Legal	Legal	Yes ☑ No ☐		01/09/05
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐		01/10/2005

After all signatures are obtained, forward copy via email or plant mail
to the Classification Officer and OSTI Transmittal Officer

Comments: **Please call Marlon Smith (x4058) or Michelle Bolwahnn (6326) for pickup after signature**

Please see attached comments JX6616
* with revised Exec. Summary and various changes already made

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LIST OF EQUATIONS

I.0 RISK CALCULATIONS

I.1 INTRODUCTION AND PURPOSE

The methods used to define potential health effects from COPCs at units evaluated in the Baseline HHRA are consistent with the *Revised Final BRA Work Plan* (BWXT Pantex/SAIC, 2003). URVs were calculated to quantify incremental lifetime cancer risks (ILCRs) and noncancer HQs. Because of the large number of areas to be evaluated at Pantex Plant, the URV methodology helps facilitate the completion of the risk characterization. The URV represents a factor that, when combined with the media-specific EPC for a COPC, allows immediate estimation of health effects. The URV is derived by multiplying the intake term (without the EPC) by the SF for carcinogens, and dividing the intake term (without the EPC) by the RfD for non-carcinogens. For the inhalation pathway, inhalation unit risk factors (URF_i) and reference concentrations (RfCs) are used in place of SFs and RfDs, respectively, in the derivation of URVs. URVs were quantified for every combination of receptor, exposure pathway, COPC, and health effect type (i.e., cancer, noncancer). Cancer risk and noncancer HQs for each exposure area are then calculated by multiplying the EPC of a COPC in an exposure area and the respective URV using the following general equation:

Equation I-1. Calculation of Risk Using Unit Risk Values

$$\text{ILCR or HQ} = (\text{EPC})(\text{URV})$$

where:

ILCR = individual incremental lifetime cancer risk (dimensionless)
HQ = hazard quotient (dimensionless)
EPC = exposure point concentration
URV = unit risk value for a specific receptor, exposure pathway, chemical, and effect type (risk/unit concentration)

Three types of EPCs are used in the risk evaluation:

- For onsite receptors (industrial worker and construction/excavation worker), soil EPCs calculated from site data are used to calculate risks from all pathways.

- For offsite resident farmer, the calculated air concentration is used to evaluate risks from inhalation of and direct exposure to COPCs transported offsite in air as well as ingestion of produce, meat, and milk exposed to COPCs transported offsite in air.

- For offsite resident farmer, the calculated deposition rate from air to soil is used to evaluate risks from ingestion of soil, inhalation of COPCs released from soil (as VOCs and fugitive dust), external exposure to radionuclides in soil, and ingestion of produce, meat, and milk exposed to COPCs in soil.

The calculated soil EPCs, modeled air concentrations, and modeled air deposition rates are used as the EPC in Equation I-1 to quantify the ILCR or HQ for each receptor. Tables I-2 through I-8 present the URVs for each receptor by pathway and also include the EPC input term used for each receptor and pathway. Table I-1 below provides a crosswalk of each pathway, input term, and EPC used.

Table I-1. Cross-Walk of EPCs used with URVs presented in Table I-2 through I-8

Onsite Receptors	
Soil, Ingestion	Soil EPC from measured concentrations (mg/kg or pCi/g)
Soil, Dermal	Soil EPC from measured concentrations (mg/kg or pCi/g)
Soil, Inhalation	Soil EPC from measured concentrations (mg/kg or pCi/g)
Soil, External	Soil EPC from measured concentrations (mg/kg or pCi/g)
Soil, Total	Soil EPC from measured concentrations (mg/kg or pCi/g)
Groundwater, Drinking Water Ingestion	Measured perched groundwater concentration (mg/L or pCi/L)
Groundwater, Ingestion from Showering	Measured perched groundwater concentration (mg/L or pCi/L)
Groundwater, Dermal from Showering	Measured perched groundwater concentration (mg/L or pCi/L)
Groundwater, Inhalation of VOCs from Showering	Measured perched groundwater concentration (mg/L or pCi/L)
Future Groundwater, Drinking Water Ingestion	Modeled perched groundwater and Ogallala Aquifer concentration (mg/L or pCi/L)
Future Groundwater, Ingestion from Showering	Modeled perched groundwater and Ogallala Aquifer concentration (mg/L or pCi/L)
Future Groundwater, Dermal from Showering	Modeled perched groundwater and Ogallala Aquifer concentration (mg/L or pCi/L)
Future Groundwater, Inhalation of VOCs from Showering	Modeled perched groundwater and Ogallala Aquifer concentration (mg/L or pCi/L)
Groundwater, Root Vegetable Ingestion	For current scenario, measured perched groundwater concentrations (mg/L) for future scenarios, modeled perched and Ogallala groundwater concentrations (mg/L)
Groundwater, Other Vegetable Ingestion	For current scenario, measured perched groundwater concentrations (mg/L) for future scenarios, modeled perched and Ogallala groundwater concentrations (mg/L)
Groundwater, Beef Ingestion	For current scenario, measured perched groundwater concentrations (mg/L) for future scenarios, modeled perched and Ogallala groundwater concentrations (mg/L)
Groundwater, Milk Ingestion	For current scenario, measured perched groundwater concentrations (mg/L) for future scenarios, modeled perched and Ogallala groundwater concentrations (mg/L)
Groundwater, Total	For current scenario, measured perched groundwater concentrations (mg/L) for future scenarios, modeled perched and Ogallala groundwater concentrations (mg/L)

I.2 BASIS FOR URVS

URVs were derived for both chemical and radiological constituents. URVs represent the risk or hazard from one unit of concentration (i.e., mg/kg, mg/L, mg/m^3, pCi/g, pCi/L, and pCi/m^3) of a contaminant. Tables of URVs for the industrial worker (Tables I-2 and I-3), construction/excavation worker (Tables I-4 and I-5), and offsite resident farmer (Tables I-6, I-7 and I-8) are presented in this appendix. Note the tables do not contain URVs for the groundwater pathway, as this pathway was incomplete for the Burning Ground.

The URV is derived by multiplying the intake term (without the EPC) by the SF for carcinogens, and dividing the intake term (without the EPC) by the RfD for non-carcinogens. Intakes are developed for each receptor and pathway using chemical specific properties for COPCs and exposure parameters provided in the Revised Final BRA Work Plan (BWXT/SAIC, 2003) Appendix C. As stated previously in Section 5, equations used to calculate intakes are presented in the Revised Final BRA Work Plan (BWXT Pantex/SAIC, 2003) Appendix C and are not reproduced here unless revisions were required.

Chemical-specific physical/chemical parameters for calculation of intakes for COPCs were obtained from TCEQ's website last updated March 30, 2004. Toxicological values used to calculate the URVs for chemicals were selected using the information hierarchy described in Section 5.2 of this report. Toxicity criteria provided by TCEQ on March 30, 2004 were used for calculation of URVs for chemicals. For radiological contaminants, toxicological values were from the most recent version of the HEAST Radionuclides and Federal Guidance Report No. 13 (EPA, 1999) for external air exposures. The HEAST contains radionuclide SFs specific for estimating cancer risks for soil, water and food ingestion, inhalation, and external exposure to radionuclides in units of risk per picoCurie (risk/pCi). The FGR contains radionuclide SFs for estimating cancer risks for external exposure to air in units of m^3/Bq-s, which are converted to m^3/pCi-hr to calculate the respective URV.
Tables I-11, I-13, and I-14 of this appendix provide exposure parameters, absorption factors (dermal and gastrointestinal), and chemical/physical parameters used to calculate intakes/exposures to the industrial worker, construction/excavation worker, and resident farmer. Toxicity criteria used in the calculation of the URVs are included in Table I-12.

The general form of the equations used to calculate URVs for cancer and non-cancer risk are:

Equation I-2. Calculation of Carcinogenic URVs for Ingestion, Dermal, and External Exposures

$$URV = (Intake)(SF)$$

where:

URV	=	unit risk value for a specific receptor, exposure pathway, chemical and effect type (risk/unit soil concentration, risk/air concentration, or risk/unit deposition rate)
Intake	=	intake per unit soil concentration or intake per unit deposition rate
SF	=	slope factor for a specific chemical (risk/intake rate)

Equation I-3. Calculation of Carcinogenic URVs for Inhalation Exposures

$$URV = (Intake)(URF)$$

where:

URV	=	unit risk value for a specific receptor, exposure pathway, chemical and effect type (risk/unit soil concentration, risk/air concentration, or risk/unit deposition rate)
Intake	=	exposure to air concentration
URF	=	cancer unit risk factor for a specific chemical (risk/intake)

Equation I-4. Calculation of Non-carcinogenic URVs for Ingestion, Dermal, and External Exposures

$$URV = \frac{Intake}{RfD}$$

where:

URV	=	unit risk value for a specific receptor, exposure pathway, chemical and effect type (risk/unit soil concentration, risk/air concentration, or risk/unit deposition rate)
Intake	=	intake per unit soil concentration or intake per unit deposition rate
RfD	=	reference dose for a specific chemical (intake rate)

Equation I-5. Calculation of Non-carcinogenic URVs for Inhalation Exposures

$$URV = \frac{Intake}{RfC}$$

where:

URV	=	unit risk value for a specific receptor, exposure pathway, chemical and effect type (risk/unit soil concentration. risk/unit air concentration, or risk/unit deposition rate)
Intake	=	exposure air concentration
RfC	=	reference concentration for a specific chemical (intake)

Equations used to calculate intakes are presented in Appendix C of the *Revised Final BRA Work Plan* (BWXT Pantex/SAIC, 2003), which is included in the reference disk at the back of this report. Those equations have not been reproduced within this appendix, unless a correction to the equation was required. The Work Plan equations provide for the calculation of dose from radionuclides; therefore, updated radionuclide intake equations, to calculate the risk due to exposure to radionuclides, are presented in Section H.3.1. Additionally, some intake equations require correction of the conversion factors used to provide the desired units. Those equations have not been reproduced in this appendix; however, Section H.3.1.2 presents a listing of the changes made to all affected equations. Additionally, URV tables in this appendix have been footnoted where changes in conversion factors have been applied.

URVs were not calculated for dioxins and lead. The specific risk assessment methodology for these COPCs is discussed in Section 5.3.4 and 5.3.5 of this report.

All radionuclides are identified as carcinogens. However some radionuclides, like uranium, are also known to have noncarcinogenic hazardous properties when ingested or inhaled (e.g., uranium is a kidney toxin independent of radiological characteristics). Potential risks due to uranium exposure were assessed for both carcinogenic risk due to radiological exposure and for noncarcinogenic risk due to systemic affects on the kidneys. Additionally, carcinogenic and noncarcinogenic URVs are also developed for chemical COPCs that exhibit both types of health effects.

I.3 BRA WORK PLAN REVISIONS

This section provides changes to Appendix C equations that were required to evaluate risk. The BRA Work Plan provides all intake equations to calculate dose because of the previous use of MEPAS. MEPAS calculates the dose, then converts the dose to risk. Equations contained in Section 6.3.5 of the Work Plan provide the conversion from dose to risk for risk characterization. To clearly state how the risk would be calculated within this risk assessment, the intake equations were modified and previously submitted to EPA. Those revised equations are included below for ease of review. Additionally, during completion of this HHRA, other changes were required to assess risk. Those changes are also documented below.

I.3.1 Revised Equations for Chronic Intake of Radionuclides

The methods used to calculate chronic intake, and subsequent risk from radionuclides, are consistent with EPA methodology presented on the EPA Radiological PRG calculator website. The difference in the EPA equations and those presented below are:

1. The equation terms were modified to be consistent with those presented in the *Revised Final BRA Work Plan* (BWXT Pantex/SAIC, 2003)

2. The decay factors (decay constant [λ] and years of exposure [t]) in the EPA equations were not included in the following equations (note, the resultant intakes were the same with and without the decay factors).

Age adjusting was applied in estimating chronic intakes for the composite offsite resident farmer (adult and child).

Chronic intakes were used to evaluate incremental lifetime risk due to potential exposure from complete pathways. The corresponding equations for estimating chronic intake are discussed in further detail below. As noted previously, the URVs were developed using these intake equations with the EPC (designated as the SMF in the Work Plan equations).

The following equation presents the method for calculating chronic intake for this HHRA. This equation corrects the BRA Work Plan corresponding Equation C4a and is as follows:

Equation I-6. Chronic Intake for Ingestion of Radionuclides

$$CI_{ing} = (SMF)(U_{ds})(ED)(F_{ds})(CF1) \qquad \boxed{\text{Work Plan Equation C4a}}$$

where:

CI_{ing}	=	Chronic intake for a radionuclide from ingestion exposure to measured soil levels, pCi
SMF	=	Soil concentration of radionuclide, pCi/g dry soil
U_{ds}	=	Ingestion rate of soil, g/day
ED	=	Exposure duration, years
F_{ds}	=	Fraction of year that soil ingestion occurs, dimensionless
CF1	=	Conversion Factor, 365 days/year

The following equation presents the method for calculating chronic intake for external exposure to radionuclides. This equations corrects the BRA Work Plan corresponding Equation C7a and is as follows:

Equation I-7. Chronic Intake for External Exposure to Radionuclides

$$CI_e = (SMF)(ED)(ACF)(U_{de})(F_{de}) \qquad \text{Work Plan Equation C7a}$$

where:

CI_e	=	Chronic intake from external exposure to radionuclides measured in soil, pCi-yr/g
ACF	=	Area Correction Factor, dimensionless, (for 6 acres=1). Replaces t_{ms} and p_{ms} in old equation (C7).
SMF	=	Soil concentration of radionuclide, pCi/g dry soil
U_{de}	=	Exposure time to radionuclide-contaminated ground: Onsite workers - 8 hours/24 hours = 0.333 unitless Offsite resident farmer - 24 hours/24 hours = 1.0 unitless
F_{de}	=	Fraction of days per year that exposure to radionuclides on a ground plane occurs, dimensionless
ED	=	Exposure duration for the pathway, yr

The chronic intake from external exposure to radionuclides in soil following atmospheric deposition is as follows (this equation revises Work Plan Equation C65a):

Equation I-8. Chronic Intake for External Exposure to Radionuclides (following atmospheric deposition)

$$CI_{de} = \frac{DP_s}{(t_{ms})(\rho_{ms})}(SAF)(U_{de})(F_{de})(ED)(CF) \qquad \text{Work Plan Equation C65a}$$

where:

CI_{de}	=	Chronic intake from external exposure to radionuclides measured in soil following atmospheric deposition, pCi-yr/g
DPs	=	Deposition rate, pCi/m^2-d
t_{ms}	=	Thickness of soil layer, m
p_{ms}	=	Density of soil layer, g/cm^3
SAF	=	Soil Accumulation Factor, d
U_{de}	=	Exposure time to radionuclide-contaminated ground: Offsite resident farmer - 24 hours/24 hours = 1.0 dimensionless
F_{de}	=	Fraction of days per year that exposure to radionuclides on a ground plane occurs, dimensionless
ED	=	Exposure duration for the pathway, yr
CF	=	Conversion factor, 1E-06 m^3/cm^3

Additionally, the *Revised Final BRA Work Plan* (BWXT Pantex/SAIC, 2003) lacks equations for the inhalation pathway for radionuclides. The chronic intake from the inhalation pathway is documented as Equation C12b in the June 2004 letter (USDOE, 2004) and is as follows:

Equation I-9. Chronic Intake for Inhalation of Radionuclides

$$CI_{inh} = (SMF)(ED)(U_{ae})(F_{ds})(U_a)(CF1)(CF2)(1/PEF) \qquad \text{Work Plan Equation C12b}$$

where:

CI_{inh}	=	Chronic intake for a radionuclide from inhalation pathway to measured soil levels, pCi
SMF	=	Soil concentration of radionuclide, pCi/g dry soil
U_{ae}	=	Exposure time to radionuclide-contaminated ground: Onsite workers - 8 hours/24 hours= 0.333 unitless; Offsite resident farmer - 24 hours/24 hours = 1.0 unitless
U_a	=	Inhalation Rate of air, 20 m^3/day
F_{ds}	=	Fraction of days per year that exposure to radionuclides on a ground plane occurs, dimensionless
PEF	=	Particulate Emission Factor, 1.53E+08 m^3/kg, BRA Work Plan
CF1	=	Conversion factor, 365 days/yr
CF2	=	Conversion factor, 1000 g/kg
ED	=	Exposure duration for the pathway, yr

In addition to the above changes submitted by letter to EPA (USDOE, 2004), the equations for the resident farmer were also developed to calculate dose, rather than risk. Air modeling was conducted to assess the impact at the fenceline for a resident farmer; therefore, all radionuclide equations applied for the air pathways were updated to calculate risk. To evaluate risk from radionuclides, the following BRA Work Plan equations were modified by removing the dose conversion factor and replacing it with the slope factor.

- Equation C56
- Equation C57
- Equation C60
- Equation C62
- Equation C65

- Equation C72
- Equation C77

I.3.2 Other Revisions to the BRA Work Plan Intake Equations

This section provides corrections and clarifications to the intake equations presented in Appendix C of the *Revised Final BRA Work Plan*. Most of these corrections/clarifications involve units and conversion factors.

Equation C42 – Soil to Plant Transfer Factor for Aboveground Crop: The equation presented in the work plan contains typographical errors and is correctly documented as follows:

Equation I-10. Soil-to-Plant Transfer Factor for Aboveground Crop

$$B_v = (10^{1.58})(K_{ow}^{-0578}) \,/\, f_w$$ Work Plan Equation C65

where:

B_v = Soil-to-plant transfer factor for the contaminant, kg dry soil/kg wet weight plant
K_{ow} = Octanol/water partition coefficient for contaminant, dimensionless
f_w = Plant wet to dry weight ration, kg wet plant/kg dry plant

Equation C71 – Intake from ingestion of contaminated plant material: Consumption rates for plant material are provided in Table C-1 (provided in this appendix as Table I-11) on both a wet weight and dry weight basis. Wet weight plant consumption rates are used in equation C71.

Equation C6 – Total lifetime dose from dermal contact with measure soil: dermal exposure to radionuclides is not an applicable pathway because there is little absorption of the radionuclides through the skin. However, radiation does penetrate through the skin, and this is accounted for through the external exposure pathway, rather than use of the equation for dermal contact. Equations I-7 and I-8 above present the method for calculation of external exposure to radiation.

Table I-2. Carcinogenic URV for the Industrial Worker Exposure to Soil

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	External URV	Total URVc
High Explosives						
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	5.2E-09	1.0E-08	--	NAP	1.6E-08
1,3,5-Trinitrobenzene	99-35-4	--	--	--	NAP	--
1,3-Dinitrobenzene	99-65-0	--	--	--	NAP	--
2,4,6-Trinitrotoluene	118-96-7	5.2E-09	8.7E-09	--	NAP	1.4E-08
2,4-Dinitrotoluene	121-14-2	1.2E-07	1.4E-07	--	NAP	2.6E-07
2,6-Dinitrotoluene	606-20-2	1.2E-07	1.4E-07	--	NAP	2.6E-07
2-Amino-4,6-dinitrotoluene	35572-78-2	1.7E-09	3.5E-09	--	NAP	5.2E-09
2-Nitrotoluene	88-72-2	--	--	--	NAP	--
3-Nitrotoluene	99-08-1	--	--	--	NAP	--
4-Amino-2,6-dinitrotoluene	19406-51-0	1.7E-09	3.5E-09	--	NAP	5.2E-09
4-Nitrotoluene	99-99-0	--	--	--	NAP	--
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	--	--	--	NAP	--
Cyclotrimethylene-trinitramine (RDX)	121-82-4	1.9E-08	1.9E-08	--	NAP	3.8E-08
Nitrobenzene	98-95-3	--	--	--	NAP	--
Tetryl	479-45-8	--	--	--	NAP	--
Metals						
Antimony	7440-36-0	--	--	--	NAP	--
Arsenic	7440-38-2	--	--	--	NAP	--
Barium	7440-39-3	--	--	--	NAP	--
Beryllium	7440-41-7	--	--	3.8E-09	NAP	3.8E-09
Boron	7440-42-8	--	--	--	NAP	--
Cadmium	7440-43-9	--	--	2.9E-09	NAP	2.9E-09
Calcium	7440-70-2	--	--	--	NAP	--
Chromium (total)	7440-47-3	--	--	--	NAP	--
Chromium (hexavalent)	18540-29-9	--	--	1.9E-08	NAP	1.9E-08
Cobalt	7440-48-4	--	--	--	NAP	--
Copper	7440-50-8	--	--	--	NAP	--
Fluoride	7782-41-4	--	--	--	NAP	--
Iron	7439-89-6	--	--	--	NAP	--
Lead	7439-92-1	--	--	--	NAP	--
Magnesium	7439-95-4	--	--	--	NAP	--
Manganese	7439-96-5	--	--	--	NAP	--
Mercury	7439-97-6	--	--	--	NAP	--
Nickel	7440-02-0	--	--	7.7E-10	NAP	7.7E-10
Potassium	7440-09-7	--	--	--	NAP	--
Silver	7440-22-4	--	--	--	NAP	--
Sodium	7440-23-5	--	--	--	NAP	--
Strontium	7440-24-6	--	--	--	NAP	--
Thallium[a]	7791-12-0	--	--	--	NAP	--
Uranium, Total	7440-61-1	--	--	--	NAP	--
Vanadium	7440-62-2	--	--	--	NAP	--
Zinc	7440-66-6	--	--	--	NAP	--
Miscellaneous						
Nitrate	14797-55-8					
Perchlorate	14797-73-0	--	--	--	NAP	--
Pesticides						
4,4'-DDE	72-55-9	5.9E-08	2.5E-08	--	NAP	8.5E-08
4,4'-DDT	50-29-3	5.9E-08	2.5E-08	--	NAP	8.5E-08
Aldrin	309-00-2	3.0E-06	5.9E-06	7.8E-09	NAP	8.9E-06
Alpha Endosulfan	959-98-8	--	--	--	NAP	--
Alpha-BHC	319-84-6	1.1E-06	4.5E-07	2.9E-09	NAP	1.6E-06

Table I-2. Carcinogenic URV for the Industrial Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	External URV	Total URVc
Alpha-Chlordane	5103-71-9	6.1E-08	1.2E-07	1.6E-10	NAP	1.8E-07
Beta Endosulfan	33213-65-9	--	--	--	NAP	--
Beta-BHC	319-85-7	3.1E-07	1.4E-07	8.5E-10	NAP	4.5E-07
Chlordane (technical)	57-74-9	6.1E-08	1.2E-07	1.6E-10	NAP	1.8E-07
Delta-BHC	319-86-8	3.1E-07	2.5E-07	8.2E-10	NAP	5.7E-07
Dieldrin	60-57-1	2.8E-06	5.6E-06	7.4E-09	NAP	8.4E-06
Endosulfan sulfate	1031-07-8	--	--	--	NAP	--
Endrin	72-20-8	--	--	--	NAP	--
Endrin aldehyde	7421-93-4	--	--	--	NAP	--
Gamma-BHC (Lindane)	58-89-9	2.3E-07	9.4E-08	--	NAP	3.2E-07
Heptachlor	76-44-8	7.9E-07	1.1E-06	2.1E-09	NAP	1.9E-06
Heptachlor epoxide	1024-57-3	1.6E-06	2.2E-06	4.2E-09	NAP	3.8E-06
Polychlorinated Biphenyls						
PCB-1248	1336-36-3	3.5E-07	6.0E-07	9.1E-10	NAP	9.5E-07
PCB-1254	1336-36-3	3.5E-07	6.0E-07	9.1E-10	NAP	9.5E-07
PCB-1260	1336-36-3	3.5E-07	6.0E-07	9.1E-10	NAP	9.5E-07
Radionuclides						
^{3}H	10028-17-8	2.9E-11	NAP	1.5E-14	--	2.9E-11
^{234}U	13966-29-5	4.9E-08	NAP	3.1E-09	1.4E-09	5.4E-08
^{235}U	15117-96-1(+D)	5.1E-08	NAP	2.8E-09	3.1E-06	3.2E-06
^{238}U	7440-61-1(+D)	6.6E-08	NAP	2.5E-09	6.5E-07	7.2E-07
Semi-Volatile Organic Compounds						
2-Methylnaphthalene	91-57-6	--	--	--	NAP	--
4,6-Dinitro-2-methylphenol	534-52-1	--	--	--	NAP	--
4-Chlorophenyl phenyl ether	7005-72-3	2.6E-06	5.2E-06	5.3E-09	NAP	7.9E-06
4-Methylphenol	106-44-5	--	--	--	NAP	--
Acenaphthene	83-32-9	--	--	--	NAP	--
Anthracene	120-12-7	--	--	--	NAP	--
Benzo(a)anthracene	56-55-3	1.3E-07	1.9E-07	1.4E-10	NAP	3.1E-07
Benzo(a)pyrene	50-32-8	1.3E-06	1.9E-06	1.4E-09	NAP	3.1E-06
Benzo(b)fluoranthene	205-99-2	1.3E-07	1.9E-07	1.4E-10	NAP	3.1E-07
Benzo(g,h,i)perylene	191-24-2	--	--	--	NAP	--
Benzo(k)fluoranthene	207-08-9	1.3E-08	1.9E-08	1.4E-11	NAP	3.1E-08
Benzyl alcohol	100-51-6	--	--	--	NAP	--
bis(2-Ethylhexyl)phthalate	117-81-7	2.4E-09	1.3E-08	--	NAP	1.5E-08
Carbazole	86-74-8	3.5E-09	5.0E-09	--	NAP	8.5E-09
Chlorocyclohexanol	1561-86-0	--	--	--	NAP	--
Chrysene	218-01-9	1.3E-09	1.9E-09	1.4E-12	NAP	3.1E-09
Cyclohexanone	108-94-1	--	--	--	NAP	--
Cyclohexene	110-83-8	--	--	--	NAP	--
Dibenz(a,h)anthracene	53-70-3	1.3E-06	1.9E-06	1.4E-09	NAP	3.1E-06
Dibenzofuran	132-64-9	--	--	--	NAP	--
Di-n-butyl phthalate	84-74-2	--	--	--	NAP	--
Di-n-octylphthalate	117-84-0	--	--	--	NAP	--
Fluoranthene	206-44-0	--	--	--	NAP	--
Fluorene	86-73-7	--	--	--	NAP	--
Indeno(1,2,3-c,d)pyrene	193-39-5	1.3E-07	1.9E-07	1.4E-10	NAP	3.1E-07
Isophorone	78-59-1	1.7E-10	3.3E-10	--	NAP	5.0E-10
Naphthalene	91-20-3	--	--	--	NAP	--
n-Nitrosodiphenylamine	86-30-6	8.6E-10	3.4E-09	--	NAP	4.3E-09
Pentachlorophenol	87-86-5	2.1E-08	6.9E-08	--	NAP	9.0E-08
Phenanthrene	85-01-8	--	--	--	NAP	--
Phenol (total)	108-95-2	--	--	--	NAP	--
Pyrene	129-00-0	--	--	--	NAP	--

Table I-2. Carcinogenic URV for the Industrial Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	External URV	Total URVc
		Volatile Organic Compounds				
1,1,2,2-Tetrachloroethane	79-34-5	3.5E-08	--	9.7E-07	NAP	1.0E-06
1,2,3-Trichloropropane	96-18-4	1.2E-06	--	--	NAP	1.2E-06
1,2-Dichloroethane	107-06-2	1.6E-08	--	1.7E-06	NAP	1.7E-06
2-Hexanone	591-78-6	--	--	--	NAP	--
Acetone	67-64-1	--	--	--	NAP	--
Bromomethane	74-83-9	--	--	--	NAP	--
Chloroform	67-66-3	--	--	1.8E-06	NAP	1.8E-06
Chloromethane	74-87-3	2.3E-09	--	--	NAP	2.3E-09
Dibromomethane	74-95-3	1.3E-09	--	--	NAP	1.3E-09
Dichlorodifluoromethane	75-71-8	--	--	--	NAP	--
Methylene Chloride	75-09-2	1.3E-09	--	4.2E-08	NAP	4.4E-08
Nonanal	124-19-6	--	--	--	NAP	--
Tetrachloroethylene	127-18-4	9.1E-09	--	4.8E-08	NAP	5.7E-08
Tetrahydrofuran	109-99-9	1.3E-09	--	5.2E-08	NAP	5.4E-08
Toluene	108-88-3	--	--	--	NAP	--
Trichloroethene	79-01-6	1.9E-09	--	1.4E-07	NAP	1.4E-07
Vinyl Chloride	75-01-4	2.6E-07	--	--	NAP	2.6E-07
Xylenes (total)	1330-20-7	--	--	--	NAP	--

URV_c - Cancer Unit Risk Value
URV_c in units of risk per mg/kg or risk per pCi/g and are multiplied by soil concentration in units of mg/kg or pCi/g to calculate risk.
NAP - Not applicable pathway (i.e., external pathway assessed for radionuclides; dermal pathway assessed for chemicals).
-- no value available.
[a]Thallium CAS in Pantex Plant datasets is 7440-28-0 and not TCEQ 7791-61-1 CAS for thallium chloride. For risk calculation thallium chloride values are used.

Table I-3. Noncarcinogenic URV for the Industrial Worker Exposure to Soil

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	Total URV_{nc}
		High Explosives			
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	1.6E-04	3.3E-04	2.2E-06	4.9E-04
1,3,5-Trinitrobenzene	99-35-4	1.6E-05	2.5E-05	--	4.1E-05
1,3-Dinitrobenzene	99-65-0	4.9E-03	7.5E-03	4.5E-06	1.2E-02
2,4,6-Trinitrotoluene	118-96-7	9.8E-04	1.6E-03	4.5E-05	2.7E-03
2,4-Dinitrotoluene	121-14-2	2.4E-04	2.9E-04	3.0E-05	5.6E-04
2,6-Dinitrotoluene	606-20-2	4.9E-04	5.8E-04	3.0E-05	1.1E-03
2-Amino-4,6-dinitrotoluene	35572-78-2	2.9E-03	5.9E-03	4.5E-05	8.9E-03
2-Nitrotoluene	88-72-2	4.9E-05	9.8E-05	4.1E-07	1.5E-04
3-Nitrotoluene	99-08-1	4.9E-05	9.8E-05	4.1E-07	1.5E-04
4-Amino-2,6-dinitrotoluene	19406-51-0	2.9E-03	5.9E-03	4.5E-05	8.9E-03
4-Nitrotoluene	99-99-0	4.9E-05	9.8E-05	4.1E-07	1.5E-04
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	9.8E-06	6.5E-05	1.7E-06	7.7E-05
Cyclotrimethylene-trinitramine (RDX)	121-82-4	1.6E-04	1.6E-04	9.0E-06	3.4E-04
Nitrobenzene	98-95-3	9.8E-04	1.0E-03	9.0E-07	2.0E-03
Tetryl	479-45-8	4.9E-05	9.8E-05	4.5E-05	1.9E-04
		Metals			
Antimony	7440-36-0	1.2E-03	8.2E-04	9.0E-06	2.0E-03
Arsenic	7440-38-2	--	--	--	--
Barium	7440-39-3	7.0E-06	1.0E-05	9.0E-06	2.6E-05
Beryllium	7440-41-7	2.4E-04	3.5E-03	2.2E-04	4.0E-03
Boron	7440-42-8	5.4E-06	6.0E-07	2.2E-07	6.3E-06

Table I-3. Noncarcinogenic URV for the Industrial Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	Total URV_{nc}
Cadmium	7440-43-9	4.9E-04	2.0E-04	--	6.8E-04
Calcium	7440-70-2	--	--	--	--
Chromium (hexavalent)	18540-29-9	1.6E-04	6.5E-04	4.5E-05	8.6E-04
Chromium (total)	7440-47-3	3.3E-07	2.5E-06	4.5E-05	4.8E-05
Cobalt	7440-48-4	8.2E-06	1.0E-06	2.2E-04	2.3E-04
Copper	7440-50-8	1.2E-05	2.1E-06	4.5E-06	1.9E-05
Fluoride	7782-41-4	8.2E-06	8.4E-07	2.2E-05	3.1E-05
Iron	7439-89-6	--	--	--	--
Lead	7439-92-1	--	--	--	--
Magnesium	7439-95-4	--	--	--	--
Manganese	7439-96-5	3.5E-06	5.8E-06	9.0E-05	9.9E-05
Mercury	7439-97-6	1.6E-03	2.3E-03	1.5E-05	4.0E-03
Nickel	7440-02-0	2.4E-05	6.1E-05	5.0E-05	1.4E-04
Potassium	7440-09-7	--	--	--	--
Silver	7440-22-4	9.8E-05	2.4E-04	4.5E-04	7.9E-04
Sodium	7440-23-5	--	--	--	--
Strontium	7440-24-6	8.2E-07	--	--	8.2E-07
Thallium[a]	7791-12-0	6.1E-03	6.1E-04	4.5E-05	6.8E-03
Uranium, Total	7440-61-1	1.6E-04	1.9E-05	1.5E-05	2.0E-04
Vanadium	7440-62-2	7.0E-05	2.7E-04	9.0E-05	4.3E-04
Zinc	7440-66-6	1.6E-06	8.2E-07	--	2.4E-06
Miscellaneous					
Perchlorate	14797-73-0	4.9E-03	2.4E-03	--	7.3E-03
Pesticides					
4,4'-DDE	72-55-9	--	--	--	--
4,4’-DDT	50-29-3	9.8E-04	4.2E-04	--	1.4E-03
Aldrin	309-00-2	1.6E-02	3.3E-02	--	4.9E-02
Alpha Endosulfan	959-98-8	2.4E-04	4.9E-04	1.3E-04	8.7E-04
Alpha-BHC	319-84-6	6.1E-05	2.5E-05	--	8.6E-05
Alpha-Chlordane	5103-71-9	9.8E-04	2.0E-03	6.4E-06	2.9E-03
Beta Endosulfan	33213-65-9	8.2E-05	1.6E-04	--	2.4E-04
Beta-BHC	319-85-7	--	--	--	--
Chlordane (technical)	57-74-9	9.8E-04	2.0E-03	6.4E-06	2.9E-03
Delta-BHC	319-86-8	1.6E-03	1.3E-03	--	2.9E-03
Dieldrin	60-57-1	9.8E-03	2.0E-02	--	2.9E-02
Endosulfan sulfate	1031-07-8	8.2E-05	1.6E-04	--	2.4E-04
Endrin	72-20-8	1.6E-03	3.3E-03	4.5E-05	4.9E-03
Endrin aldehyde	7421-93-4	1.6E-03	3.3E-03	--	4.9E-03
Gamma-BHC (Lindane)	58-89-9	1.6E-03	6.7E-04	9.0E-06	2.3E-03
Heptachlor	76-44-8	9.8E-04	1.4E-03	--	2.3E-03
Heptachlor epoxide	1024-57-3	3.8E-02	5.2E-02	--	9.0E-02
Polychlorinated Biphenyls					
PCB-1248	1336-36-3	2.4E-02	4.2E-02	--	6.7E-02
PCB-1254	1336-36-3	2.4E-02	4.2E-02	--	6.7E-02
PCB-1260	1336-36-3	2.4E-02	4.2E-02	--	6.7E-02
Radionuclides					
Uranium-234	13966-29-5	--	--	--	--
Uranium-235	15117-96-1(+D)	--	--	--	--
Uranium-238	7440-61-1(+D)	--	--	--	--
SVOCs					
2-Methylnaphthalene	91-57-6	1.2E-04	1.8E-04	--	3.0E-04
4,6-Dinitro-2-methylphenol	534-52-1	2.4E-04	2.4E-04	1.5E-05	5.0E-04
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	--

Table I-3. Noncarcinogenic URV for the Industrial Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	Total URV_{nc}
4-Methylphenol	106-44-5	9.8E-05	1.5E-04	4.5E-07	2.5E-04
Acenaphthene	83-32-9	8.2E-06	1.2E-05	--	2.0E-05
Anthracene	120-12-7	1.6E-06	2.4E-06	--	4.0E-06
Benzo(a)anthracene	56-55-3	--	--	--	--
Benzo(a)pyrene	50-32-8	--	--	--	--
Benzo(b)fluoranthene	205-99-2	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	1.6E-05	2.4E-05	--	4.0E-05
Benzo(k)fluoranthene	207-08-9	--	--	--	--
Benzyl alcohol	100-51-6	1.6E-06	2.5E-06	9.0E-08	4.2E-06
bis(2-Ethylhexyl)phthalate	117-81-7	2.4E-05	1.3E-04	--	1.5E-04
Carbazole	86-74-8	--	--	--	--
Chlorocyclohexanol	1561-86-0	--	--	--	--
Chrysene	218-01-9	--	--	--	--
Cyclohexanone	108-94-1	9.8E-08	0.0E+00	2.0E-04	2.0E-04
Cyclohexene	110-83-8	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	--	--	--	--
Dibenzofuran	132-64-9	1.2E-04	2.4E-04	--	3.7E-04
Di-n-butyl phthalate	84-74-2	4.9E-06	4.9E-06	9.0E-07	1.1E-05
Di-n-octylphthalate	117-84-0	2.4E-05	2.7E-05	--	5.2E-05
Fluoranthene	206-44-0	1.2E-05	1.8E-05	--	3.0E-05
Fluorene	86-73-7	1.2E-05	1.8E-05	--	3.0E-05
Indeno(1,2,3-c,d)pyrene	193-39-5	--	--	--	--
Isophorone	78-59-1	2.4E-06	4.9E-06	1.9E-07	7.5E-06
Naphthalene	91-20-3	2.4E-05	3.6E-05	1.5E-06	6.2E-05
n-Nitrosodiphenylamine	86-30-6	--	--	--	--
Pentachlorophenol	87-86-5	1.6E-05	5.4E-05	9.0E-06	7.9E-05
Phenanthrene	85-01-8	1.6E-05	2.4E-05	--	4.0E-05
Phenol (total)	108-95-2	1.6E-06	1.8E-06	2.4E-07	3.7E-06
Pyrene	129-00-0	1.6E-05	2.4E-05	--	4.0E-05
VOCs					
1,1,2,2-Tetrachloroethane	79-34-5	1.2E-05	0.0E+00	--	1.2E-05
1,2,3-Trichloropropane	96-18-4	8.2E-05	0.0E+00	3.7E-04	4.5E-04
1,2-Dichloroethane	107-06-2	--	--	7.4E-05	7.4E-05
2-Hexanone	591-78-6	8.2E-06	0.0E+00	9.4E-03	9.4E-03
Acetone	67-64-1	5.4E-07	0.0E+00	9.0E-05	9.0E-05
Bromomethane	74-83-9	3.5E-04	0.0E+00	9.5E-02	9.5E-02
Chloroform	67-66-3	4.9E-05	0.0E+00	2.2E-03	2.2E-03
Chloromethane	74-87-3	--	--	9.3E-03	9.3E-03
Dibromomethane	74-95-3	8.2E-06	0.0E+00	3.8E-03	3.8E-03
Dichlorodifluoromethane	75-71-8	2.4E-06	0.0E+00	1.2E-04	1.2E-04
Methylene Chloride	75-09-2	8.2E-06	0.0E+00	8.4E-05	9.2E-05
Nonanal	124-19-6	2.4E-06	0.0E+00	--	2.4E-06
Tetrachloroethylene	127-18-4	4.9E-05	0.0E+00	8.6E-04	9.1E-04
Tetrahydrofuran	109-99-9	2.4E-06	0.0E+00	2.6E-04	2.6E-04
Toluene	108-88-3	2.4E-06	0.0E+00	4.1E-04	4.2E-04
Trichloroethene	79-01-6	8.2E-05	0.0E+00	--	8.2E-05
Vinyl Chloride	75-01-4	1.6E-04	0.0E+00	8.5E-03	8.7E-03
Xylenes (total)	1330-20-7	2.4E-06	0.0E+00	1.2E-03	1.2E-03

URV_{nc} - Noncancer Unit Risk Value
URV_{nc} in units of risk per mg/kg and are multiplied by soil concentration in units of mg/kg to calculate risk.
-- no value available.
[a]Thallium CAS in Pantex Plant datasets is 7440-28-0 and not TCEQ 7791-61-1 CAS for thallium chloride. For risk calculation thallium chloride values are used.

Table I-4. Carcinogenic URV for the Construction/Excavation Worker Exposure to Soil

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	External URV	Total URV_c
High Explosives						
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	4.8E-10	1.0E-10	--	NAP	5.8E-10
1,3,5-Trinitrobenzene	99-35-4	--	--	--	NAP	--
1,3-Dinitrobenzene	99-65-0	--	--	--	NAP	--
2,4,6-Trinitrotoluene	118-96-7	4.8E-10	8.4E-11	--	NAP	5.7E-10
2,4-Dinitrotoluene	121-14-2	1.1E-08	1.3E-09	--	NAP	1.2E-08
2,6-Dinitrotoluene	606-20-2	1.1E-08	1.3E-09	--	NAP	1.2E-08
2-Amino-4,6-dinitrotoluene	35572-78-2	1.6E-10	3.4E-11	--	NAP	1.9E-10
2-Nitrotoluene	88-72-2	--	--	--	NAP	--
3-Nitrotoluene	99-08-1	--	--	--	NAP	--
4-Amino-2,6-dinitrotoluene	19406-51-0	1.6E-10	3.4E-11	--	NAP	1.9E-10
4-Nitrotoluene	99-99-0	--	--	--	NAP	--
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	--	--	--	NAP	--
Cyclotrimethylene-trinitramine (RDX)	121-82-4	1.8E-09	1.8E-10	--	NAP	2.0E-09
Nitrobenzene	98-95-3	--	--	--	NAP	--
Tetryl	479-45-8	--	--	--	NAP	--
Metals						
Aluminum	7429-90-5	--	--	--	NAP	--
Antimony	7440-36-0	--	--	--	NAP	--
Arsenic	7440-38-2	--	--	--	NAP	--
Barium	7440-39-3	--	--	--	NAP	--
Beryllium	7440-41-7	--	--	3.7E-14	NAP	3.7E-14
Boron	7440-42-8	--	--	--	NAP	--
Cadmium	7440-43-9	--	--	2.8E-11	NAP	2.8E-11
Calcium	7440-70-2	--	--	--	NAP	--
Chromium (total)	7440-47-3	--	--	--	NAP	--
Chromium (hexavalent)	18540-29-9	--	--	1.8E-10	NAP	1.8E-10
Cobalt	7440-48-4	--	--	--	NAP	--
Copper	7440-50-8	--	--	--	NAP	--

Table I-4. Carcinogenic URV for the Construction/Excavation Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	External URV	Total URV_c
Fluoride	7782-41-4	--	--	--	NAP	--
Iron	7439-89-6	--	--	--	NAP	--
Lead	7439-92-1	--	--	--	NAP	--
Magnesium	7439-95-4	--	--	--	NAP	--
Manganese	7439-96-5	--	--	--	NAP	--
Mercury	7439-97-6	--	--	--	NAP	--
Nickel	7440-02-0	--	--	7.4E-12	NAP	7.4E-12
Potassium	7440-09-7	--	--	--	NAP	--
Silver	7440-22-4	--	--	--	NAP	--
Sodium	7440-23-5	--	--	--	NAP	--
Strontium	7440-24-6	--	--	--	NAP	--
Thallium[a]	7791-12-0	--	--	--	NAP	--
Uranium, total	7440-61-1	--	--	--	NAP	--
Vanadium	7440-62-2	--	--	--	NAP	--
Zinc	7440-66-6	--	--	--	NAP	--
Miscellaneous						
Perchlorate	14797-73-0	--	--	--	NAP	--
Pesticides						
4,4'-DDE	72-55-9	5.5E-09	2.4E-10	--	NAP	5.7E-09
4,4’-DDT	50-29-3	5.5E-09	2.4E-10	1.5E-15	NAP	5.7E-09
Aldrin	309-00-2	2.7E-07	5.7E-08	7.5E-11	NAP	3.3E-07
Alpha Endosulfan	959-98-8	--	--	--	NAP	--
Alpha-BHC	319-84-6	1.0E-07	4.4E-09	2.8E-11	NAP	1.1E-07
Alpha-Chlordane	5103-71-9	5.6E-09	1.2E-09	1.5E-12	NAP	6.8E-09
Beta Endosulfan	33213-65-9	--	--	--	NAP	--
Beta-BHC	319-85-7	2.9E-08	1.3E-09	8.1E-12	NAP	3.0E-08
Chlordane (technical)	57-74-9	5.6E-09	1.2E-09	1.5E-12	NAP	6.8E-09
Delta-BHC	319-86-8	2.9E-08	2.4E-09	7.8E-12	NAP	3.1E-08
Dieldrin	60-57-1	2.6E-07	5.4E-08	7.1E-11	NAP	3.1E-07

Table I-4. Carcinogenic URV for the Construction/Excavation Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	External URV	Total URV_c
Endosulfan sulfate	1031-07-8	--	--	--	NAP	--
Endrin	72-20-8	--	--	--	NAP	--
Endrin aldehyde	7421-93-4	--	--	--	NAP	--
Gamma-BHC (Lindane)	58-89-9	2.1E-08	9.0E-10	--	NAP	2.2E-08
Heptachlor	76-44-8	7.2E-08	1.0E-08	2.0E-11	NAP	8.3E-08
Heptachlor epoxide	1024-57-3	1.5E-07	2.1E-08	4.0E-11	NAP	1.7E-07
Polychlorinated Biphenyls						
PCB-1248	1336-36-3	3.2E-08	5.8E-09	8.7E-12	NAP	3.8E-08
PCB-1254	1336-36-3	3.2E-08	5.8E-09	8.7E-12	NAP	3.8E-08
PCB-1260	1336-36-3	3.2E-08	5.8E-09	8.7E-12	NAP	3.8E-08
Radionuclides						
^{234}U	13966-29-5	4.5E-09	NAP	3.0E-11	1.4E-11	4.6E-09
^{235}U	15117-96-1(+D)	4.7E-09	NAP	2.6E-11	3.0E-08	3.4E-08
^{238}U	7440-61-1(+D)	6.0E-09	NAP	2.4E-11	6.2E-09	1.2E-08
Semi-Volatile Organic Compounds						
2-Methylnaphthalene	91-57-6	--	--	--	NAP	--
4,6-Dinitro-2-methylphenol	534-52-1	--	--	--	NAP	--
4-Chlorophenyl phenyl ether	7005-72-3	2.4E-07	5.0E-08	5.1E-11	NAP	2.9E-07
4-Methylphenol	106-44-5	--	--	--	NAP	--
Acenaphthene	83-32-9	--	--	--	NAP	--
Anthracene	120-12-7	--	--	--	NAP	--
Benzo(a)anthracene	56-55-3	1.2E-08	1.8E-09	1.3E-12	NAP	1.4E-08
Benzo(a)pyrene	50-32-8	1.2E-07	1.8E-08	1.3E-11	NAP	1.4E-07
Benzo(b)fluoranthene	205-99-2	1.2E-08	1.8E-09	1.3E-12	NAP	1.4E-08
Benzo(g,h,i)perylene	191-24-2	--	--	--	NAP	--
Benzo(k)fluoranthene	207-08-9	1.2E-09	1.8E-10	1.3E-13	NAP	1.4E-09
Benzyl alcohol	100-51-6	--	--	--	NAP	--
bis(2-Ethylhexyl)phthalate	117-81-7	2.3E-10	1.2E-10	--	NAP	3.5E-10
Carbazole	86-74-8	3.2E-10	4.8E-11	--	NAP	3.7E-10

Table I-4. Carcinogenic URV for the Construction/Excavation Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	External URV	Total URV_c
Chlorocyclohexanol	1561-86-0	--	--	--	NAP	--
Chrysene	218-01-9	1.2E-10	1.8E-11	1.3E-14	NAP	1.4E-10
Cyclohexanone	108-94-1	--	--	--	NAP	--
Cyclohexene	110-83-8	--	--	--	NAP	--
Dibenz(a,h)anthracene	53-70-3	1.2E-07	1.8E-08	1.3E-11	NAP	1.4E-07
Dibenzofuran	132-64-9	--	--	--	NAP	--
Di-n-butyl phthalate	84-74-2	--	--	--	NAP	--
Di-n-octylphthalate	117-84-0	--	--	--	NAP	--
Fluoranthene	206-44-0	--	--	--	NAP	--
Fluorene	86-73-7	--	--	--	NAP	--
Indeno(1,2,3-c,d)pyrene	193-39-5	1.2E-08	1.8E-09	1.3E-12	NAP	1.4E-08
Isophorone	78-59-1	1.5E-11	3.2E-12	--	NAP	1.8E-11
Naphthalene	91-20-3	--	--	--	NAP	--
n-Nitrosodiphenylamine	86-30-6	7.9E-11	3.3E-11	--	NAP	1.1E-10
Pentachlorophenol	87-86-5	1.9E-09	6.6E-10	--	NAP	2.6E-09
Phenanthrene	85-01-8	--	--	--	NAP	--
Phenol (total)	108-95-2	--	--	--	NAP	--
Pyrene	129-00-0	--	--	--	NAP	--
Volatile Organic Compounds						
1,1,2,2-Tetrachloroethane	79-34-5	3.2E-09	--	9.7E-08	NAP	1.0E-07
1,2,3-Trichloropropane	96-18-4	1.1E-07	--	--	NAP	1.1E-07
1,2-Dichloroethane	107-06-2	1.5E-09	--	1.7E-07	NAP	1.7E-07
2-Hexanone	591-78-6	--	--	--	NAP	--
Acetone	67-64-1	--	--	--	NAP	--
Bromomethane	74-83-9	--	--	--	NAP	--
Chloroform	67-66-3	--	--	1.8E-07	NAP	1.8E-07
Chloromethane	74-87-3	2.1E-10	--	5.4E-11	NAP	2.6E-10
Dibromomethane	74-95-3	1.2E-10	--	--	NAP	1.2E-10
Dichlorodifluoromethane	75-71-8	--	--	--	NAP	--

Table I-4. Carcinogenic URV for the Construction/Excavation Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	External URV	Total URV_c
Methylene Chloride	75-09-2	1.2E-10	--	4.2E-09	NAP	4.4E-09
Nonanal	124-19-6	--	--	--	NAP	--
Tetrachloroethylene	127-18-4	8.4E-10	--	4.8E-09	NAP	5.7E-09
Tetrahydrofuran	109-99-9	1.2E-10	--	5.2E-09	NAP	5.4E-09
Toluene	108-88-3	--	--	--	NAP	--
Trichloroethene	79-01-6	1.8E-10	--	1.4E-08	NAP	1.4E-08
Vinyl Chloride	75-01-4	2.4E-08	--	2.7E-10	NAP	2.4E-08
Xylenes (total)	1330-20-7	--	--	--	NAP	--

URV_c - Cancer Unit Risk Value
URV_c in units of risk per mg/kg or risk per pCi/g and are multiplied by soil concentration in units of mg/kg or pCi/g to calculate risk.
NAP - Not applicable pathway (i.e., external pathway assessed for radionuclides; dermal pathway assessed for chemicals).
-- no value available.
[a]Thallium CAS in Pantex Plant datasets is 7440-28-0 and not TCEQ 7791-61-1 CAS for thallium chloride. For risk calculation thallium chloride values are used.

Table I-5. Noncarcinogenic URV for the Construction/Excavation Worker Exposure to Soil

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	Total URV_{nc}
High Explosives					
1,3-Dinitrobenzene	99-65-0	4.9E-02	7.8E-03	4.7E-06	5.7E-02
2,4-Dinitrotoluene	121-14-2	2.4E-03	3.0E-04	3.1E-05	2.8E-03
2,6-Dinitrotoluene	606-20-2	4.9E-03	6.0E-04	3.1E-05	5.5E-03
2-Amino-4,6-dinitrotoluene	35572-78-2	2.9E-02	6.1E-03	4.7E-05	3.6E-02
4-Amino-2,6-dinitrotoluene	19406-51-0	2.9E-02	6.1E-03	4.7E-05	3.6E-02
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	9.8E-05	6.8E-05	1.7E-06	1.7E-04
Nitrobenzene	98-95-3	9.8E-03	1.1E-03	9.3E-07	1.1E-02
2-Nitrotoluene	88-72-2	4.9E-04	1.0E-04	4.2E-07	5.9E-04
3-Nitrotoluene	99-08-1	4.9E-04	1.0E-04	4.2E-07	5.9E-04

Table I-5. Noncarcinogenic URV for the Construction/Excavation Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	Total URV_{nc}
4-Nitrotoluene	99-99-0	4.9E-04	1.0E-04	4.2E-07	5.9E-04
Cyclotrimethylene-trinitramine (RDX)	121-82-4	1.6E-03	1.7E-04	9.3E-06	1.8E-03
Tetryl	479-45-8	4.9E-04	1.0E-04	4.7E-05	6.4E-04
1,3,5-Trinitrobenzene	99-35-4	1.6E-04	2.6E-05	--	1.9E-04
2,4,6-Trinitrotoluene	118-96-7	9.8E-03	1.7E-03	4.7E-05	1.2E-02
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	1.6E-03	3.4E-04	2.3E-06	2.0E-03
Metals					
Aluminum	7429-90-5	4.9E-06	5.1E-07	9.3E-07	6.3E-06
Antimony	7440-36-0	1.2E-02	8.5E-04	9.3E-06	1.3E-02
Arsenic	7440-38-2	--	--	--	--
Barium	7440-39-3	7.0E-05	1.0E-05	9.3E-06	9.0E-05
Beryllium	7440-41-7	2.4E-03	3.6E-03	2.3E-04	6.3E-03
Boron	7440-42-8	5.4E-05	6.3E-07	2.3E-07	5.5E-05
Cadmium	7440-43-9	4.9E-03	2.0E-04	--	5.1E-03
Calcium	7440-70-2	--	--	--	--
Chromium (total)	7440-47-3	3.3E-06	2.6E-06	4.7E-05	5.3E-05
Chromium (hexavalent)	18540-29-9	1.6E-03	6.8E-04	4.7E-05	2.4E-03
Cobalt	7440-48-4	8.2E-05	1.1E-06	2.3E-04	3.2E-04
Copper	7440-50-8	1.2E-04	2.2E-06	4.7E-06	1.3E-04
Fluoride	7782-41-4	8.2E-05	8.8E-07	2.3E-05	1.1E-04
Iron	7439-89-6	--	--	--	--
Lead	7439-92-1	--	--	--	--
Magnesium	7439-95-4	--	--	--	--
Manganese	7439-96-5	3.5E-05	6.1E-06	9.3E-05	1.3E-04
Mercury	7439-97-6	1.6E-02	2.4E-03	1.6E-05	1.9E-02
Nickel	7440-02-0	2.4E-04	6.4E-05	5.2E-05	3.6E-04
Potassium	7440-09-7	--	--	--	--
Silver	7440-22-4	9.8E-04	2.6E-04	4.7E-04	1.7E-03
Sodium	7440-23-5	--	--	--	--
Strontium	7440-24-6	8.2E-06	--	--	8.2E-06

Table I-5. Noncarcinogenic URV for the Construction/Excavation Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	Total URV_{nc}
Thallium[a]	7791-12-0	6.1E-02	6.4E-04	4.7E-05	6.2E-02
Uranium, total	7440-61-1	1.6E-03	2.0E-05	1.6E-05	1.7E-03
Vanadium	7440-62-2	7.0E-04	2.8E-04	9.3E-05	1.1E-03
Zinc	7440-66-6	1.6E-05	8.5E-07	--	1.7E-05
Miscellaneous					
Perchlorate	14797-73-0	4.9E-02	2.6E-03	--	5.2E-02
Pesticides					
4,4'-DDE	72-55-9	--	--	--	--
4,4'-DDT	50-29-3	9.8E-03	4.4E-04	--	1.0E-02
Aldrin	309-00-2	1.6E-01	3.4E-02	--	2.0E-01
Alpha Endosulfan	959-98-8	2.4E-03	5.1E-04	1.4E-04	3.1E-03
Alpha-BHC	319-84-6	6.1E-04	2.6E-05	--	6.4E-04
Alpha-Chlordane	5103-71-9	9.8E-03	2.0E-03	6.7E-06	1.2E-02
Beta Endosulfan	33213-65-9	8.2E-04	1.7E-04	--	9.9E-04
Beta-BHC	319-85-7	--	--	--	--
Chlordane (technical)	57-74-9	9.8E-03	2.0E-03	6.7E-06	1.2E-02
Delta-BHC	319-86-8	1.6E-02	1.4E-03	--	1.8E-02
Dieldrin	60-57-1	9.8E-02	2.0E-02	--	1.2E-01
Endosulfan sulfate	1031-07-8	8.2E-04	1.7E-04	--	9.9E-04
Endrin	72-20-8	1.6E-02	3.4E-03	4.7E-05	2.0E-02
Endrin aldehyde	7421-93-4	1.6E-02	3.4E-03	--	2.0E-02
Gamma-BHC (Lindane)	58-89-9	1.6E-02	7.0E-04	9.3E-06	1.7E-02
Heptachlor	76-44-8	9.8E-03	1.4E-03	--	1.1E-02
Heptachlor epoxide	1024-57-3	3.8E-01	5.5E-02	--	4.3E-01
Polychlorinated Biphenyls					
PCB-1248	1336-36-3	2.4E-01	4.4E-02	--	2.9E-01
PCB-1254	1336-36-3	2.4E-01	4.4E-02	--	2.9E-01
PCB-1260	1336-36-3	2.4E-01	4.4E-02	--	2.9E-01
Radionuclides					
^{234}U	13966-29-5	--	--	--	--

Table I-5. Noncarcinogenic URV for the Construction/Excavation Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	Total URV_{nc}
^{235}U	15117-96-1(+D)	--	--	--	--
^{238}U	7440-61-1(+D)	--	--	--	--
Semi-Volatile Organic Compounds					
2-Methylnaphthalene	91-57-6	1.2E-03	1.9E-04	--	1.4E-03
4,6-Dinitro-2-methylphenol	534-52-1	2.4E-03	2.6E-04	1.6E-05	2.7E-03
4-chlorophenyl phenyl ether	7005-72-3	--	--	--	--
4-Methylphenol	106-44-5	9.8E-04	1.6E-04	4.7E-07	1.1E-03
Acenaphthene	83-32-9	8.2E-05	1.2E-05	--	9.4E-05
Anthracene	120-12-7	1.6E-05	2.5E-06	--	1.9E-05
Benzo(a)anthracene	56-55-3	--	--	--	--
Benzo(a)pyrene	50-32-8	--	--	--	--
Benzo(b)fluoranthene	205-99-2	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	1.6E-04	2.5E-05	--	1.9E-04
Benzo(k)fluoranthene	207-08-9	--	--	--	--
Benzyl alcohol	100-51-6	1.6E-05	2.6E-06	9.3E-08	1.9E-05
bis(2-Ethylhexyl)phthalate	117-81-7	2.4E-04	1.3E-04	--	3.8E-04
Carbazole	86-74-8	--	--	--	--
Chlorocyclohexanol	1561-86-0	--	--	--	--
Chrysene	218-01-9	--	--	--	--
Cyclohexanone	108-94-1	9.8E-07	0.0E+00	2.2E-03	2.2E-03
Cyclohexene	110-83-8	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	--	--	--	--
Dibenzofuran	132-64-9	1.2E-03	2.6E-04	--	1.5E-03
Di-n-butyl phthalate	84-74-2	4.9E-05	5.1E-06	9.3E-07	5.5E-05
Di-n-octylphthalate	117-84-0	2.4E-04	2.8E-05	--	2.7E-04
Fluoranthene	206-44-0	1.2E-04	1.9E-05	--	1.4E-04
Fluorene	86-73-7	1.2E-04	1.9E-05	--	1.4E-04
Indeno(1,2,3-c,d)pyrene	193-39-5	--	--	--	--
Isophorone	78-59-1	2.4E-05	5.1E-06	2.0E-07	3.0E-05
Naphthalene	91-20-3	2.4E-04	3.7E-05	1.6E-06	2.8E-04

Table I-5. Noncarcinogenic URV for the Construction/Excavation Worker Exposure to Soil (continued)

COPC	CAS No.	Ingestion URV	Dermal URV	Inhalation URV	Total URV_{nc}
n-Nitrosodiphenylamine	86-30-6	--	--	--	--
Pentachlorophenol	87-86-5	1.6E-04	5.6E-05	9.3E-06	2.3E-04
Phenanthrene	85-01-8	1.6E-04	2.5E-05	--	1.9E-04
Phenol (total)	108-95-2	1.6E-05	1.9E-06	2.5E-07	1.8E-05
Pyrene	129-00-0	1.6E-04	2.5E-05	--	1.9E-04
Volatile Organic Compounds					
1,2,3-Trichloropropane	96-18-4	8.2E-04	--	4.1E-03	4.9E-03
1,1,2,2-Tetrachloroethane	79-34-5	1.2E-04	--	--	1.2E-04
tetrachloroethylene	127-18-4	4.9E-04	--	9.3E-03	9.8E-03
1,2-Dichloroethane	107-06-2	--	--	8.0E-04	8.0E-04
2-Hexanone	591-78-6	8.2E-05	--	1.0E-01	1.0E-01
Acetone	67-64-1	5.4E-06	--	9.7E-04	9.8E-04
Chloroform	67-66-3	4.9E-04	--	2.4E-02	2.4E-02
dibromomethane	74-95-3	8.2E-05	--	4.2E-02	4.2E-02
Dichlorodifluoromethane	75-71-8	2.4E-05	--	1.3E-03	1.3E-03
Methylene Chloride	75-09-2	8.2E-05	--	9.1E-04	1.0E-03
Nonanal	124-19-6	2.4E-05	--	--	2.4E-05
Tetrahydrofuran	109-99-9	2.4E-05	--	2.8E-03	2.8E-03
Toluene	108-88-3	2.4E-05	--	4.5E-03	4.5E-03
Trichloroethene	79-01-6	8.2E-04	--	--	8.2E-04
Xylenes (total)	1330-20-7	2.4E-05	--	1.3E-02	1.3E-02
Bromomethane	74-83-9	3.5E-03	--	1.0E+00	1.0E+00
Chloromethane	74-87-3	--	--	1.0E-01	1.0E-01
Vinyl Chloride	75-01-4	1.6E-03	--	9.3E-02	9.4E-02

URV_{nc} - Noncancer Unit Risk Value

-- no value available.

Table I-6. Carcinogenic URV for the Resident Farmer Exposure to Groundwater

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_c
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
High Explosives												
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	5.6E-04	4.9E-06	4.2E-06	--	5.7E-04	2.5E-05	6.4E-05	1.5E-10	9.0E-10	8.9E-05	6.6E-04
1,3,5-Trinitrobenzene	99-35-4	--	--	--	--	--	--	--	--	---	--	--
1,3-Dinitrobenzene	99-65-0	--	--	--	--	--	--	--	--	---	--	--
2,4,6-Trinitrotoluene	118-96-7	5.6E-04	4.9E-06	3.1E-05	--	6.0E-04	2.1E-05	6.3E-05	2.9E-09	1.8E-08	8.4E-05	6.8E-04
2,4-Dinitrotoluene	121-14-2	1.3E-02	1.1E-04	8.8E-04	--	1.4E-02	4.9E-04	1.4E-03	1.0E-07	6.1E-07	1.9E-03	1.6E-02
2,6-Dinitrotoluene	606-20-2	1.3E-02	1.1E-04	8.8E-04	--	1.4E-02	5.0E-04	1.4E-03	1.0E-07	6.1E-07	1.9E-03	1.6E-02
2-Amino-4,6-dinitrotoluene	35572-78-2	1.9E-04	1.6E-06	5.1E-05	--	2.4E-04	7.0E-06	2.1E-05	6.2E-09	3.8E-08	2.8E-05	2.7E-04
2-Nitrotoluene	88-72-2	--	--	--	--	--	--	--	--	---	--	--
3-Nitrotoluene	99-08-1	--	--	--	--	--	--	--	--	---	--	--
4-Amino-2,6-dinitrotoluene	19406-51-0	1.9E-04	1.6E-06	3.9E-05	--	2.3E-04	7.0E-06	2.1E-05	4.1E-09	2.5E-08	2.8E-05	2.6E-04
4-Nitrotoluene	99-99-0	--	--	--	--	--	--	--	--	---	--	--
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	--	--	--	--	--	--	--	--	---	--	--
Cyclotrimethylene-trinitramine (RDX)	121-82-4	2.1E-03	1.8E-05	1.3E-05	--	2.1E-03	7.7E-05	2.3E-04	8.1E-10	4.9E-09	3.1E-04	2.4E-03
Nitrobenzene	98-95-3	--	--	--	--	--	--	--	--	---	--	--
Tetryl	479-45-8	--	--	--	--	--	--	--	--	---	--	--
Metals												
Arsenic	7440-38-2	--	--	--	--	--	--	--	--	--	--	--
Barium	7440-39-3	--	--	--	--	--	--	--	--	--	--	--
Boron	7440-42-8	--	--	--	--	--	--	--	--	--	--	--
Cadmium	7440-43-9	--	--	--	--	--	--	--	--	--	--	--
Calcium	7440-70-2	--	--	--	--	--	--	--	--	--	--	--
Chromium (hexavalent)	18540-29-9	--	--	--	--	--	--	--	--	--	--	--
Chromium (total)	7440-47-3	--	--	--	--	--	--	--	--	--	--	--
Cobalt	7440-48-4	--	--	--	--	--	--	--	--	--	--	--
Copper	7440-50-8	--	--	--	--	--	--	--	--	--	--	--
Fluoride	16984-48-8	--	--	--	--	--	--	--	--	--	--	--
Iron	7439-89-6	--	--	--	--	--	--	--	--	--	--	--
Lead	7439-92-1	--	--	--	--	--	--	--	--	--	--	--
Magnesium	7439-95-4	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	--	--	--	--	--	--	--	--	--	--	--

Table I-6. Carcinogenic URV for the Resident Farmer Exposure to Groundwater (continued)

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_c
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
Mercury	7439-97-6	--	--	--	--	--	--	--	--	--	--	--
Nickel	7440-02-0	--	--	--	--	--	--	--	--	--	--	--
Potassium	7440-09-7	--	--	--	--	--	--	--	--	--	--	--
Selenium	7782-49-2	--	--	--	--	--	--	--	--	--	--	--
Silver	7440-22-4	--	--	--	--	--	--	--	--	--	--	--
Sodium	7440-23-5	--	--	--	--	--	--	--	--	--	--	--
Strontium	7440-24-6	--	--	--	--	--	--	--	--	--	--	--
Thallium	7440-28-0	--	--	--	--	--	--	--	--	--	--	--
Uranium, total	7440-61-1	--	--	--	--	--	--	--	--	--	--	--
Zinc	7440-66-6	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous												
Nitrate	14797-55-8	--	--	--	--	--	--	--	--	--	--	--
Perchlorate	14797-73-0	--	--	--	--	--	--	--	--	--	--	--
Pesticides												
4,4'-DDE	72-55-9	6.4E-03	5.6E-05	3.2E-02	--	3.8E-02	2.4E-04	7.2E-04	3.3E-04	2.0E-03	3.3E-03	4.2E-02
Aldrin	309-00-2	3.2E-01	2.8E-03	4.4E+00	--	4.7E+00	1.3E-02	3.6E-02	9.3E-02	5.7E-01	7.1E-01	5.4E+00
Alpha Endosulfan	959-98-8	--	--	--	--	--	--	--	--	---	--	--
alpha-BHC	319-84-6	1.2E-01	1.0E-03	8.0E-02	--	2.0E-01	4.6E-03	1.3E-02	1.1E-04	6.8E-04	1.9E-02	2.2E-01
alpha-Chlordane	5103-71-9	6.6E-03	5.7E-05	1.1E-01	--	1.2E-01	2.4E-04	7.4E-04	3.2E-03	2.0E-02	2.4E-02	1.4E-01
Beta Endosulfan	33213-65-9	--	--	--	--	--	--	--	--	---	--	--
beta-BHC	319-85-7	3.4E-02	2.9E-04	2.5E-02	--	5.9E-02	1.3E-03	3.8E-03	3.2E-05	2.0E-04	5.3E-03	6.4E-02
Chlordane (technical)	57-74-9	6.6E-03	5.7E-05	1.1E-01	--	1.2E-01	2.5E-04	7.4E-04	3.2E-03	1.9E-02	2.4E-02	1.4E-01
delta-BHC	319-86-8	3.4E-02	2.9E-04	3.1E-02	--	6.5E-02	1.3E-03	3.8E-03	1.8E-05	1.1E-04	5.2E-03	7.0E-02
Dieldrin	60-57-1	3.0E-01	2.6E-03	1.3E+00	--	1.6E+00	1.1E-02	3.4E-02	4.4E-03	2.7E-02	7.6E-02	1.6E+00
Endosulfan sulfate	1031-07-8	--	--	--	--	--	--	--	--	--	--	--
Endrin	72-20-8	--	--	--	--	--	--	--	--	--	--	--
Endrin aldehyde	7421-93-4	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC (Lindane)	58-89-9	2.4E-02	2.1E-04	1.7E-02	--	4.1E-02	9.5E-04	2.7E-03	2.3E-05	1.4E-04	3.9E-03	4.5E-02
Heptachlor	76-44-8	8.5E-02	7.4E-04	5.6E-01	--	6.5E-01	3.6E-03	9.5E-03	7.1E-03	4.3E-02	6.3E-02	7.1E-01
Heptachlor epoxide	1024-57-3	1.7E-01	1.5E-03	2.3E-01	--	4.0E-01	6.5E-03	1.9E-02	7.2E-04	4.4E-03	3.1E-02	4.3E-01

Table I-6. Carcinogenic URV for the Resident Farmer Exposure to Groundwater (continued)

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_c
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
Semi-Volatile Organic Compounds												
4,6-Dinitro-2-methylphenol	534-52-1	--	--	--	--	--	--	--	--	---	--	--
4-Chlorophenyl phenyl ether	7005-72-3	2.8E-01	2.5E-03	1.1E+00	--	1.4E+00	1.1E-02	3.2E-02	1.6E-03	9.8E-03	5.4E-02	1.4E+00
Anthracene	120-12-7	--	--	--	--	--	--	--	--	---	--	--
Benzo(a)anthracene	56-55-3	1.4E-02	1.2E-04	4.2E-02	--	5.6E-02	5.1E-04	1.5E-03	2.4E-04	1.4E-03	3.7E-03	6.0E-02
Benzo(a)pyrene	50-32-8	1.4E-01	1.2E-03	5.8E-01	--	7.2E-01	5.1E-03	1.5E-02	9.2E-03	5.6E-02	8.6E-02	8.1E-01
Benzo(b)fluoranthene	205-99-2	1.4E-02	1.2E-04	5.8E-02	--	7.2E-02	5.1E-04	1.5E-03	9.2E-04	5.6E-03	8.6E-03	8.1E-02
Benzo(g,h,i)perylene	191-24-2	--	--	--	--	--	--	--	--	---	--	--
Benzo(k)fluoranthene	207-08-9	1.4E-03	1.2E-05	5.8E-03	--	7.2E-03	5.1E-05	1.5E-04	9.2E-05	5.6E-04	8.6E-04	8.1E-03
Benzyl alcohol	100-51-6	--	--	--	--	--	--	--	--	---	--	--
bis(2-Ethylhexyl)phthalate	117-81-7	2.6E-04	2.3E-06	1.6E-02	--	1.6E-02	1.1E-05	2.9E-05	3.4E-03	2.1E-02	2.4E-02	4.0E-02
Carbazole	86-74-8	3.8E-04	3.3E-06	1.6E-04	--	5.4E-04	1.4E-05	4.2E-05	3.3E-08	2.0E-07	5.6E-05	6.0E-04
Chrysene	218-01-9	1.4E-04	1.2E-06	4.2E-04	--	5.6E-04	5.1E-06	1.5E-05	2.4E-06	1.4E-05	3.7E-05	6.0E-04
Cyclohexanone	108-94-1	--	--	--	--	--	--	--	--	---	--	--
Cyclohexene	110-83-8	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	1.4E-01	1.2E-03	7.6E-01	--	9.0E-01	5.1E-03	1.5E-02	3.6E-02	2.2E-01	2.7E-01	1.2E+00
Di-n-butyl phthalate	84-74-2	--	--	--	--	--	--	--	--	---	--	--
Di-n-octylphthalate	117-84-0	--	--	--	--	--	--	--	--	---	--	--
Fluoranthene	206-44-0	--	--	--	--	--	--	--	--	---	--	--
Fluorene	86-73-7	--	--	--	--	--	--	--	--	---	--	--
Indeno(1,2,3-c,d)pyrene	193-39-5	1.4E-02	1.2E-04	7.6E-02	--	9.0E-02	5.1E-04	1.5E-03	3.6E-03	2.2E-02	2.7E-02	1.2E-01
Isophorone	78-59-1	1.8E-05	1.6E-07	5.2E-06	--	2.3E-05	7.5E-07	2.0E-06	3.9E-10	2.4E-09	2.8E-06	2.6E-05
n-Nitrosodiphenylamine	86-30-6	9.2E-05	8.0E-07	8.5E-05	--	1.8E-04	3.5E-06	1.0E-05	7.0E-09	4.2E-08	1.4E-05	1.9E-04
Phenanthrene	85-01-8	--	--	--	--	--	--	--	--	---	--	--
Phenol	108-95-2	--	--	--	--	--	--	--	--	---	--	--
Pyrene	129-00-0	--	--	--	--	--	--	--	--	---	--	--
Volatile Organic Compounds												
1,1,2,2-Tetrachloroethane	79-34-5	3.8E-03	3.3E-05	3.5E-04	1.6E-02	2.0E-02	1.4E-04	4.2E-04	3.1E-08	1.9E-07	5.6E-04	2.1E-02
1,2,3-Trichloropropane	96-18-4	1.3E-01	1.1E-03	1.9E-02	--	1.5E-01	4.9E-03	1.5E-02	2.2E-06	1.3E-05	2.0E-02	1.7E-01
1,2-Dichloroethane	107-06-2	1.7E-03	1.5E-05	9.9E-05	7.1E-03	8.9E-03	6.9E-05	1.9E-04	6.1E-09	3.7E-08	2.6E-04	9.2E-03
1,4-Dioxane	123-91-1	2.1E-04	1.16E-03	1.95E-02	--	2.1E-02	1.99E-05	2.4E-05	5.42E-12	3.17E-11	4.4E-05	2.1E-02
2-Hexanone	591-78-6	--	--	--	--	--	--	--	--	---	--	--
Acetone	67-64-1	--	--	--	--	--	--	--	--	---	--	--
Chloroform	67-66-3	--	--	--	6.3E-03	6.3E-03	--	--	--	---	--	6.3E-03

Table I-6. Carcinogenic URV for the Resident Farmer Exposure to Groundwater (continued)

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_c
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
Dibromomethane	74-95-3	1.4E-04	1.2E-06	4.0E-06	--	1.5E-04	5.2E-06	1.6E-05	2.4E-10	1.5E-09	2.1E-05	1.7E-04
Dichlorodifluoromethane	75-71-8	--	--	--	--	--	--	--	--	---	--	--
Methylene Chloride	75-09-2	1.4E-04	1.2E-06	4.5E-06	1.3E-04	2.8E-04	5.7E-06	1.6E-05	1.6E-10	9.8E-10	2.2E-05	3.0E-04
Nonanal	124-19-6	--	--	--	--	--	--	--	--	---	--	--
Tetrachloroethylene	127-18-4	9.8E-04	8.5E-06	2.0E-04	1.6E-04	1.3E-03	3.8E-05	1.1E-04	4.7E-08	2.9E-07	1.5E-04	1.5E-03
Tetrahydrofuran	109-99-9	1.4E-04	1.2E-06	2.0E-06	5.2E-04	6.7E-04	6.6E-06	1.6E-05	3.2E-11	1.9E-10	2.3E-05	6.9E-04
Toluene	108-88-3	--	--	--	--	--	--	--	--	---	--	--
Trichloroethene	79-01-6	2.1E-04	1.8E-06	2.6E-05	4.7E-04	7.0E-04	7.9E-06	2.3E-05	3.2E-09	2.0E-08	3.1E-05	7.3E-04
Xylenes (total)	1310-20-7	--	--	--	--	--	--	--	--	--	--	--

URV_c - Cancer Unit Risk Value

URVs are in units of risk per mg/L or risk per pCi/L and are multiplied by groundwater concentration in units of mg/L or pCi/L to calculate risk.

-- No data available

Table I-7. Noncarcinogenic URV for the Resident Farmer (Adult) Exposure to Groundwater

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_{nc}
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
High Explosives												
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	9.1E+00	6.2E-02	6.9E-02	NA	9.3E+00	4.3E-01	1.1E+00	2.62E-06	7.93E-06	1.5E+00	1.1E+01
1,3,5-Trinitrobenzene	99-35-4	9.1E-01	6.2E-03	2.2E-02	NA	9.4E-01	3.9E-02	1.1E-01	1.45E-06	4.41E-06	1.5E-01	1.1E+00
1,3-Dinitrobenzene	99-65-0	2.7E+02	1.8E+00	1.2E+01	NA	2.9E+02	1.1E+01	3.3E+01	6.60E-04	2.01E-03	4.4E+01	3.3E+02
2,4,6-Trinitrotoluene	118-96-7	5.5E+01	3.7E-01	3.1E+00	NA	5.8E+01	2.2E+00	6.6E+00	3.06E-04	9.34E-04	8.7E+00	6.7E+01
2,4-Dinitrotoluene	121-14-2	1.4E+01	9.2E-02	9.4E-01	NA	1.5E+01	5.6E-01	1.6E+00	1.16E-04	3.55E-04	2.2E+00	1.7E+01
2,6-Dinitrotoluene	606-20-2	2.7E+01	1.8E-01	1.9E+00	NA	2.9E+01	1.1E+00	3.3E+00	2.32E-04	7.10E-04	4.4E+00	3.4E+01
2-Amino-4,6-dinitrotoluene	35572-78-2	1.6E+02	1.1E+00	4.5E+01	NA	2.1E+02	6.5E+00	2.0E+01	5.86E-03	1.79E-02	2.6E+01	2.4E+02
2-Nitrotoluene	88-72-2	2.7E+00	1.8E-02	5.5E-01	NA	3.3E+00	1.1E-01	3.3E-01	3.53E-05	1.08E-04	4.4E-01	3.8E+00
3-Nitrotoluene	99-08-1	2.7E+00	1.8E-02	5.5E-01	NA	3.3E+00	1.1E-01	3.3E-01	3.53E-05	1.08E-04	4.4E-01	3.8E+00
4-Amino-2,6-dinitrotoluene	19406-51-0	1.6E+02	1.1E+00	3.4E+01	NA	2.0E+02	6.5E+00	2.0E+01	3.88E-03	1.19E-02	2.6E+01	2.3E+02
4-Nitrotoluene	99-99-0	2.7E+00	1.8E-02	5.5E-01	NA	3.3E+00	1.1E-01	3.3E-01	3.53E-05	1.08E-04	4.4E-01	3.8E+00
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	5.5E-01	3.7E-03	4.9E-04	NA	5.5E-01	4.8E-01	7.4E-02	1.84E-09	4.84E-09	5.6E-01	1.1E+00
Cyclotrimethylene-trinitramine (RDX)	121-82-4	9.1E+00	6.2E-02	5.6E-02	NA	9.3E+00	3.6E-01	1.1E+00	3.87E-06	1.17E-05	1.5E+00	1.1E+01
Nitrobenzene	98-95-3	5.5E+01	3.7E-01	2.7E+00	NA	5.8E+01	2.2E+00	6.6E+00	2.01E-04	6.13E-04	8.7E+00	6.7E+01
Tetryl	479-45-8	2.7E+00	1.8E-02	1.3E-01	NA	2.9E+00	1.1E-01	3.3E-01	1.70E-05	5.20E-05	4.4E-01	3.3E+00
Miscellaneous												
Perchlorate[b]	14797-73-0	3.91E+01	2.64E-01	8.44E-01	NA	4.03E+01	--	0.0E+00	2.29E-06	6.79E-06	9.08E-06	4.03E+01
Nitrate	14797-55-8	1.7E-02	1.2E-04	4.6E-05	NA	1.7E-02	--	--				
Metals												
Arsenic	7440-38-2	--	--	--	NA	--	--	--	--	--	--	--
Barium	7440-39-3	3.9E-01	2.6E-03	1.3E-02	NA	4.1E-01	1.5E-02	4.7E-02	1.76E-04	4.09E-03	6.6E-02	4.7E-01
Boron	7440-42-8	3.0E-01	2.1E-03	7.6E-04	NA	3.1E-01	1.2E-02	3.7E-02	5.48E-04	9.95E-03	5.9E-02	3.7E-01
Cadmium	7440-43-9	5.5E+01	3.7E-01	4.9E+00	NA	6.0E+01	1.1E+00	3.3E+00	2.47E-02	5.97E-01	5.0E+00	6.5E+01
Calcium	7440-70-2	--	--	--	NA	--	--	--	--	--	--	--
Chromium (III)	7440-47-3	1.8E-02	1.2E-04	3.2E-03	NA	2.2E-02	--	--	3.70E-04	3.98E-06	3.7E-04	2.2E-02
Chromium (VI)	18540-29-9	9.1E+00	6.2E-02	8.2E-01	NA	1.0E+01	3.6E-01	1.1E+00	1.85E-01	1.99E-03	1.6E+00	1.2E+01
Cobalt	7440-48-4	4.6E-01	3.1E-03	1.3E-03	NA	4.6E-01	1.8E-02	5.5E-02	1.03E-04	6.96E-04	7.3E-02	5.3E-01
Copper	7440-50-8	6.8E-01	4.6E-03	2.7E-03	NA	6.9E-01	2.7E-02	8.2E-02	1.39E-02	2.24E-02	1.5E-01	8.4E-01

Table I-7. Noncarcinogenic URV for the Resident Farmer (Adult) Exposure to Groundwater (continued)

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_{nc}
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
Fluoride	16984-48-8	--	--	--	NA	--	--	--	--	--	--	--
Iron	7439-89-6	--	--	--	NA	--	--	--	--	--	--	--
Lead	7439-92-1	--	--	--	NA	--	--	--	--	--	--	--
Magnesium	7439-95-4	--	--	--	NA	--	--	--	--	--	--	--
Manganese	7439-96-5	5.8E-01	3.9E-03	2.2E-02	NA	6.1E-01	2.3E-02	7.0E-02	2.20E-04	1.28E-04	9.3E-02	7.0E-01
Mercury	7439-97-6	9.1E+01	6.2E-01	2.9E-01	NA	9.2E+01	3.6E+00	1.1E+01	2.05E+00	9.35E-01	1.8E+01	1.1E+02
Nickel	7440-02-0	1.4E+00	9.2E-03	7.7E-02	NA	1.5E+00	5.4E-02	1.6E-01	1.54E-02	4.77E-01	7.1E-01	2.2E+00
Potassium	7440-09-7	--	--	--	NA	--	--	--	--	--	--	--
Selenium	7782-49-2	5.5E+00	3.7E-02	1.5E-02	NA	5.5E+00	3.2E+01	9.7E+01	1.23E+00	1.19E+00	1.3E+02	1.4E+02
Silver	7440-22-4	5.5E+00	3.7E-02	3.1E-01	NA	5.8E+00	2.1E-01	6.6E-01	3.70E-02	5.97E-03	9.1E-01	6.7E+00
Sodium	7440-23-5	--	--	--	NA	--	--	--	--	--	--	--
Strontium	7440-24-6	4.6E-02	3.1E-04	--	NA	4.6E-02	1.8E-03	5.5E-03	8.22E-04	2.78E-03	1.1E-02	5.7E-02
Thallium[a]	7440-28-0	3.4E+02	2.3E+00	1.5E+00	NA	3.5E+02	1.3E+01	4.1E+01	3.08E+01	1.49E+01	1.0E+02	4.5E+02
Uranium	7440-61-1	9.1E+00	6.2E-02	2.4E-02	NA	9.2E+00	--	--	6.16E-03	7.95E-02	8.6E-02	9.3E+00
Zinc	7440-66-6	9.1E-02	6.2E-04	6.2E-04	NA	9.3E-02	3.6E-03	1.1E-02	2.05E-02	1.99E-02	5.5E-02	1.5E-01
Pesticides												
4,4'-DDE	72-55-9	--	--	--	NA	--	--	--	--	--	--	--
Aldrin	309-00-2	9.1E+02	6.2E+00	1.3E+04	NA	1.3E+04	3.9E+01	1.1E+02	2.89E+02	8.86E+02	1.3E+03	1.5E+04
Alpha Endosulfan	959-98-8	1.4E+01	9.2E-02	3.7E+01	NA	5.0E+01	5.5E-01	1.6E+00	1.23E-01	3.76E-01	2.7E+00	5.3E+01
alpha-BHC	319-84-6	3.4E+00	2.3E-02	2.3E+00	NA	5.8E+00	1.4E-01	4.1E-01	3.51E-03	1.07E-02	5.6E-01	6.3E+00
alpha-Chlordane	5103-71-9	5.5E+01	3.7E-01	9.3E+02	NA	9.8E+02	2.1E+00	6.6E+00	2.89E+01	8.85E+01	1.3E+02	1.1E+03
Beta Endosulfan	33213-65-9	4.6E+00	3.1E-02	1.2E+01	NA	1.7E+01	1.8E-01	5.5E-01	4.09E-02	1.25E-01	8.9E-01	1.8E+01
beta-BHC	319-85-7	--	--	--	NA	--	--	--	--	--	--	--
Chlordane (technical)	57-74-9	5.5E+01	3.7E-01	9.2E+02	NA	9.8E+02	2.2E+00	6.6E+00	2.86E+01	8.77E+01	1.3E+02	1.1E+03
delta-BHC	319-86-8	9.1E+01	6.2E-01	8.4E+01	NA	1.8E+02	3.6E+00	1.1E+01	5.16E-02	1.58E-01	1.5E+01	1.9E+02
Dieldrin	60-57-1	5.5E+02	3.7E+00	2.3E+03	NA	2.9E+03	2.2E+01	6.6E+01	8.68E+00	2.66E+01	1.2E+02	3.0E+03
Endosulfan sulfate	1031-07-8	4.6E+00	3.1E-02	3.2E+01	NA	3.7E+01	1.8E-01	5.5E-01	2.64E-01	8.08E-01	1.8E+00	3.9E+01
Endrin	72-20-8	9.1E+01	6.2E-01	3.8E+02	NA	4.8E+02	3.8E+00	1.1E+01	1.45E+00	4.43E+00	2.1E+01	5.0E+02
Endrin aldehyde	7421-93-4	9.1E+01	6.2E-01	1.1E+03	NA	1.1E+03	3.6E+00	1.1E+01	1.42E+01	4.35E+01	7.2E+01	1.2E+03
gamma-BHC (Lindane)	58-89-9	9.1E+01	6.2E-01	6.2E+01	NA	1.5E+02	3.8E+00	1.1E+01	9.36E-02	2.87E-01	1.5E+01	1.7E+02
Heptachlor	76-44-8	5.5E+01	3.7E-01	3.7E+02	NA	4.2E+02	2.5E+00	6.6E+00	4.98E+00	1.52E+01	2.9E+01	4.5E+02
Heptachlor epoxide	1024-57-3	2.1E+03	1.4E+01	2.8E+03	NA	5.0E+03	8.5E+01	2.5E+02	9.58E+00	2.93E+01	3.8E+02	5.3E+03

Table I-7. Noncarcinogenic URV for the Resident Farmer (Adult) Exposure to Groundwater (continued)

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_{nc}
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
Semi-Volatile Organic Compounds												
4,6-Dinitro-2-methylphenol	534-52-1	1.4E+01	9.2E-02	6.2E-01	NA	1.4E+01	3.6E+01	1.6E+00	9.07E-05	2.77E-04	3.8E+01	5.2E+01
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	NA	--	--	--	--	--	--	--
Anthracene	120-12-7	9.1E-02	6.2E-04	1.1E-01	NA	2.1E-01	3.6E-03	1.1E-02	1.14E-04	3.50E-04	1.5E-02	2.2E-01
Benzo(a)anthracene	56-55-3	--	--	--	NA	--	--	--	--	--	--	--
Benzo(a)pyrene	50-32-8	--	--	--	NA	--	--	--	--	--	--	--
Benzo(b)fluoranthene	205-99-2	--	--	--	NA	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	9.1E-01	6.2E-03	5.0E+00	NA	6.0E+00	3.6E-02	1.1E-01	2.57E-01	7.86E-01	1.2E+00	7.2E+00
Benzo(k)fluoranthene	207-08-9	--	--	--	NA	--	--	--	--	--	--	--
Benzyl alcohol	100-51-6	9.1E-02	6.2E-04	2.4E-03	NA	9.4E-02	3.9E-03	1.1E-02	6.19E-08	1.88E-07	1.5E-02	1.1E-01
bis(2-Ethylhexyl)phthalate	117-81-7	1.4E+00	9.2E-03	8.2E+01	NA	8.3E+01	6.1E-02	1.6E-01	1.91E+01	5.84E+01	7.8E+01	1.6E+02
Carbazole	86-74-8	--	--	--	NA	--	--	--	--	--	--	--
Chrysene	218-01-9	--	--	--	NA	--	--	--	--	--	--	--
Cyclohexanone	108-94-1	5.5E-03	3.7E-05	1.4E-04	4.8E+00	4.8E+00	2.6E-04	6.6E-04	4.17E-09	1.27E-08	9.2E-04	4.8E+00
Cyclohexene	110-83-8	--	--	--	NA	--	--	--	#N/A	#N/A	#N/A	#N/A
Dibenz(a,h)anthracene	53-70-3	--	--	--	NA	--	--	--	--	--	--	--
Di-n-butyl phthalate	84-74-2	2.7E-01	1.8E-03	3.0E-01	NA	5.8E-01	1.1E-02	3.3E-02	6.31E-04	1.93E-03	4.6E-02	6.3E-01
Di-n-octylphthalate	117-84-0	1.4E+00	9.2E-03	1.7E+01	NA	1.9E+01	5.4E-02	1.6E-01	2.68E+01	8.19E+01	1.1E+02	1.3E+02
Fluoranthene	206-44-0	6.8E-01	4.6E-03	1.4E+00	NA	2.1E+00	2.7E-02	8.2E-02	3.32E-03	1.02E-02	1.2E-01	2.2E+00
Fluorene	86-73-7	6.8E-01	4.6E-03	6.2E-01	NA	1.3E+00	2.7E-02	8.2E-02	4.01E-04	1.23E-03	1.1E-01	1.4E+00
Indeno(1,2,3-c,d)pyrene	193-39-5	--	--	--	NA	--	--	--	--	--	--	--
Isophorone	78-59-1	1.4E-01	9.2E-04	4.0E-02	NA	1.8E-01	6.1E-03	1.6E-02	3.21E-06	9.83E-06	2.3E-02	2.0E-01
n-Nitrosodiphenylamine	86-30-6	--	--	--	NA	--	--	--	--	--	--	--
Phenanthrene	85-01-8	9.1E-01	6.2E-03	1.1E+00	NA	2.1E+00	3.6E-02	1.1E-01	1.14E-03	3.50E-03	1.5E-01	2.2E+00
Phenol	108-95-2	9.1E-02	6.2E-04	3.8E-03	NA	9.6E-02	3.8E-03	1.1E-02	1.69E-07	5.15E-07	1.5E-02	1.1E-01
Pyrene	129-00-0	9.1E-01	6.2E-03	1.9E+00	NA	2.8E+00	3.6E-02	1.1E-01	4.42E-03	1.35E-02	1.6E-01	2.9E+00
Volatile Organic Compounds												
1,1,2,2-Tetrachloroethane	79-34-5	6.8E-01	4.6E-03	6.4E-02	--	7.5E-01	2.8E-02	8.2E-02	6.04E-06	1.85E-05	1.1E-01	8.6E-01
1,2,3-Trichloropropane	96-18-4	4.6E+00	3.1E-02	6.7E-01	8.0E+00	1.3E+01	1.8E-01	5.5E-01	8.23E-05	2.52E-04	7.3E-01	1.4E+01
1,2-Dichloroethane	107-06-2	--	--	--	2.0E-01	2.0E-01	--	--	--	--	--	2.0E-01
2-Hexanone	591-78-6	4.6E-01	3.1E-03	2.4E-02	1.2E+02	1.2E+02	1.9E-02	5.5E-02	7.88E-07	2.40E-06	7.4E-02	1.2E+02
Acetone	67-64-1	2.7E-01	1.8E-03	1.1E-03	8.1E-01	1.1E+00	2.7E-02	3.4E-02	1.05E-09	3.08E-09	6.1E-02	1.2E+00

Table I-7. Noncarcinogenic URV for the Resident Farmer (Adult) Exposure to Groundwater (continued)

		Direct Exposure Pathway					Indirect Exposure Pathway					
COPC	CAS No.	Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	Total Groundwater URV_{nc}
Chloroform	67-66-3	2.7E+00	1.8E-02	4.4E-01	4.9E+00	8.1E+00	1.1E-01	3.3E-01	5.16E-06	1.57E-05	4.4E-01	8.6E+00
dibromomethane	74-95-3	4.6E-01	3.1E-03	1.3E-02	3.6E+01	3.7E+01	1.8E-02	5.5E-02	8.58E-07	2.62E-06	7.3E-02	3.7E+01
Dichlorodifluoromethane	75-71-8	1.4E-01	9.2E-04	3.0E-02	9.7E-02	2.6E-01	5.4E-03	1.6E-02	5.08E-07	1.55E-06	2.2E-02	2.9E-01
Methylene Chloride	75-09-2	4.6E-01	3.1E-03	1.5E-02	1.6E-01	6.3E-01	2.0E-02	5.5E-02	5.68E-07	1.73E-06	7.5E-02	7.1E-01
Nonanal	124-19-6	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	127-18-4	2.7E+00	1.8E-02	5.7E-01	1.8E+00	5.1E+00	1.1E-01	3.3E-01	1.43E-04	4.38E-04	4.4E-01	5.5E+00
Tetrahydrofuran	109-99-9	1.4E-01	9.2E-04	1.9E-03	1.6E+00	1.7E+00	6.7E-03	1.7E-02	3.31E-08	1.00E-07	2.3E-02	1.8E+00
Toluene	108-88-3	1.4E-01	9.2E-04	2.9E-02	1.2E+00	1.4E+00	5.5E-03	1.6E-02	2.69E-06	8.22E-06	2.2E-02	1.4E+00
Trichloroethylene	79-01-6	4.6E+00	3.1E-02	5.7E-01	--	5.2E+00	1.9E-01	5.5E-01	7.68E-05	2.35E-04	7.3E-01	5.9E+00
Xylenes (total)	1310-20-7	1.4E-01	9.2E-04	4.9E-02	4.8E+00	5.0E+00	5.5E-03	1.6E-02	9.47E-06	2.90E-05	2.2E-02	5.0E+00

URV_{nc} - Noncancer Unit Risk Value
URVs in units of risk per mg/L or risk per pCi/L and are multiplied by groundwater concentration in units of mg/L or pCi/L to calculate risk.
NA - Not Applicable
-- No data available
[a]Thallium CAS in Pantex Plant datasets is 7440-28-0 and not TCEQ 7791-61-1 CAS for thallium chloride. For risk calculation thallium chloride values are used.
[b]Perchlorate URV updated according to March 2005 TCEQ updated Tox/chem./phys table for the Risk Reduction Rule.

Table I-8. Noncarcinogenic URV for the Resident Farmer (Child) Exposure to Groundwater

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_{nc}
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
Pesticides												
4,4'-DDE	72-55-9	--	--	--	NA	--	--	--	--	--	--	--
Aldrin	309-00-2	2.1E+03	2.9E+01	2.9E+04	NA	3.1E+04	7.4E+01	2.0E+02	4.9E+02	8.0E+03	8.8E+03	4.0E+04
Alpha Endosulfan	959-98-8	3.2E+01	4.3E-01	8.6E+01	NA	1.2E+02	1.0E+00	3.0E+00	2.1E-01	3.4E+00	7.6E+00	1.3E+02
Alpha-BHC	319-84-6	8.0E+00	1.1E-01	5.4E+00	NA	1.4E+01	2.6E-01	7.5E-01	6.0E-03	9.7E-02	1.1E+00	1.5E+01
Alpha-Chlordane	5103-71-9	1.3E+02	1.7E+00	2.2E+03	NA	2.3E+03	4.0E+00	1.2E+01	4.9E+01	8.0E+02	8.7E+02	3.2E+03
Beta Endosulfan	33213-65-9	1.1E+01	1.4E-01	2.9E+01	NA	3.9E+01	3.4E-01	1.0E+00	7.0E-02	1.1E+00	2.5E+00	4.2E+01
Beta-BHC	319-85-7	--	--	--	NA	--	--	--	--	--	--	--
Chlordane (technical)	57-74-9	1.3E+02	1.7E+00	2.2E+03	NA	2.3E+03	4.1E+00	1.2E+01	4.9E+01	7.9E+02	8.6E+02	3.1E+03
Delta-BHC	319-86-8	2.1E+02	2.9E+00	2.0E+02	NA	4.1E+02	6.7E+00	2.0E+01	8.8E-02	1.4E+00	2.8E+01	4.4E+02
Dieldrin	60-57-1	1.3E+03	1.7E+01	5.4E+03	NA	6.7E+03	4.1E+01	1.2E+02	1.5E+01	2.4E+02	4.2E+02	7.1E+03
Endosulfan sulfate	1031-07-8	1.1E+01	1.4E-01	7.6E+01	NA	8.7E+01	3.3E-01	1.0E+00	4.5E-01	7.3E+00	9.1E+00	9.6E+01
Endrin	72-20-8	2.1E+02	2.9E+00	8.9E+02	NA	1.1E+03	7.0E+00	2.0E+01	2.5E+00	4.0E+01	7.0E+01	1.2E+03
Endrin aldehyde	7421-93-4	2.1E+02	2.9E+00	2.5E+03	NA	2.7E+03	6.7E+00	2.0E+01	2.4E+01	3.9E+02	4.4E+02	3.1E+03
Gamma-BHC (Lindane)	58-89-9	2.1E+02	2.9E+00	1.4E+02	NA	3.6E+02	7.0E+00	2.0E+01	1.6E-01	2.6E+00	3.0E+01	3.9E+02
Heptachlor	76-44-8	1.3E+02	1.7E+00	8.5E+02	NA	9.8E+02	4.6E+00	1.2E+01	8.5E+00	1.4E+02	1.6E+02	1.1E+03
Heptachlor epoxide	1024-57-3	4.9E+03	6.6E+01	6.6E+03	NA	1.2E+04	1.6E+02	4.6E+02	1.6E+01	2.7E+02	9.0E+02	1.3E+04
High Explosives												
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	2.1E+01	2.9E-01	1.6E-01	NA	2.2E+01	8.0E-01	2.0E+00	4.5E-06	7.2E-05	2.8E+00	2.5E+01
1,3,5-Trinitrobenzene	99-35-4	2.1E+00	2.9E-02	5.2E-02	NA	2.2E+00	7.3E-02	2.0E-01	2.5E-06	4.0E-05	2.7E-01	2.5E+00
1,3-Dinitrobenzene	99-65-0	6.4E+02	8.6E+00	2.7E+01	NA	6.8E+02	2.1E+01	6.0E+01	1.1E-03	1.8E-02	8.1E+01	7.6E+02
2,4,6-Trinitrotoluene	118-96-7	1.3E+02	1.7E+00	7.1E+00	NA	1.4E+02	4.0E+00	1.2E+01	5.2E-04	8.5E-03	1.6E+01	1.5E+02
2,4-Dinitrotoluene	121-14-2	3.2E+01	4.3E-01	2.2E+00	NA	3.5E+01	1.0E+00	3.0E+00	2.0E-04	3.2E-03	4.0E+00	3.9E+01
2,6-Dinitrotoluene	606-20-2	6.4E+01	8.6E-01	4.4E+00	NA	6.9E+01	2.1E+00	6.0E+00	4.0E-04	6.4E-03	8.1E+00	7.7E+01
2-Amino-4,6-dinitrotoluene	35572-78-2	3.8E+02	5.2E+00	1.0E+02	NA	4.9E+02	1.2E+01	3.6E+01	1.0E-02	1.6E-01	4.8E+01	5.4E+02
2-Nitrotoluene	88-72-2	6.4E+00	8.6E-02	1.3E+00	NA	7.8E+00	2.0E-01	6.0E-01	6.0E-05	9.8E-04	8.0E-01	8.6E+00
3-Nitrotoluene	99-08-1	6.4E+00	8.6E-02	1.3E+00	NA	7.8E+00	2.0E-01	6.0E-01	6.0E-05	9.8E-04	8.0E-01	8.6E+00
4-Amino-2,6-dinitrotoluene	19406-51-0	3.8E+02	5.2E+00	8.0E+01	NA	4.7E+02	1.2E+01	3.6E+01	6.6E-03	1.1E-01	4.8E+01	5.2E+02
4-Nitrotoluene	99-99-0	6.4E+00	8.6E-02	1.3E+00	NA	7.8E+00	2.0E-01	6.0E-01	6.0E-05	9.8E-04	8.0E-01	8.6E+00
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	1.3E+00	1.7E-02	1.1E-03	NA	1.3E+00	9.0E-01	1.4E-01	3.1E-09	4.4E-08	1.0E+00	2.3E+00

Table I-8. Noncarcinogenic URV for the Resident Farmer (Child) Exposure to Groundwater (continued)

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_{nc}
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
Cyclotrimethylene-trinitramine (RDX)	121-82-4	2.1E+01	2.9E-01	1.3E-01	NA	2.2E+01	6.8E-01	2.0E+00	6.6E-06	1.1E-04	2.7E+00	2.4E+01
Nitrobenzene	98-95-3	1.3E+02	1.7E+00	6.4E+00	NA	1.4E+02	4.1E+00	1.2E+01	3.4E-04	5.5E-03	1.6E+01	1.5E+02
Tetryl	479-45-8	6.4E+00	8.6E-02	3.1E-01	NA	6.8E+00	2.0E-01	6.0E-01	2.9E-05	4.7E-04	8.0E-01	7.6E+00
Semi-Volatile Organic Compounds												
4,6-Dinitro-2-methylphenol	534-52-1	3.2E+01	4.3E-01	1.4E+00	NA	3.4E+01	6.7E+01	3.0E+00	1.5E-04	2.5E-03	7.0E+01	1.0E+02
4-chlorophenyl phenyl ether	7005-72-3	--	--	--	NA	--	--	--	--	--	--	--
Anthracene	120-12-7	2.1E-01	2.9E-03	2.7E-01	NA	4.8E-01	6.7E-03	2.0E-02	1.9E-04	3.2E-03	3.0E-02	5.1E-01
Benzo(a)anthracene	56-55-3	--	--	--	NA	--	--	--	--	--	--	--
Benzo(a)pyrene	50-32-8	--	--	--	NA	--	--	--	--	--	--	--
Benzo(b)fluoranthene	205-99-2	--	--	--	NA	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	2.1E+00	2.9E-02	1.2E+01	NA	1.4E+01	6.7E-02	2.0E-01	4.4E-01	7.1E+00	7.8E+00	2.2E+01
Benzo(k)fluoranthene	207-08-9	--	--	--	NA	--	--	--	--	--	--	--
Benzyl alcohol	100-51-6	2.1E-01	2.9E-03	5.6E-03	NA	2.2E-01	7.3E-03	2.0E-02	1.1E-07	1.7E-06	2.7E-02	2.5E-01
bis(2-Ethylhexyl)phthalate	117-81-7	3.2E+00	4.3E-02	1.9E+02	NA	1.9E+02	1.1E-01	3.0E-01	3.3E+01	5.3E+02	5.6E+02	7.6E+02
Carbazole	86-74-8	--	--	--	NA	--	--	--	--	--	--	--
Chrysene	218-01-9	--	--	--	NA	--	--	--	--	--	--	--
Cyclohexanone	108-94-1	1.3E-02	1.7E-04	3.2E-04	4.8E+00	4.8E+00	4.8E-04	1.2E-03	7.1E-09	1.1E-07	1.7E-03	4.8E+00
Cyclohexene	110-83-8	--	--	--	NA	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	--	--	--	NA	--	--	--	--	--	--	--
Di-n-butyl phthalate	84-74-2	6.4E-01	8.6E-03	7.1E-01	NA	1.4E+00	2.0E-02	6.0E-02	1.1E-03	1.7E-02	9.9E-02	1.5E+00
Di-n-octylphthalate	117-84-0	3.2E+00	4.3E-02	4.1E+01	NA	4.4E+01	1.0E-01	3.0E-01	4.6E+01	7.4E+02	7.9E+02	8.3E+02
Fluoranthene	206-44-0	1.6E+00	2.2E-02	3.3E+00	NA	4.9E+00	5.0E-02	1.5E-01	5.7E-03	9.2E-02	3.0E-01	5.2E+00
Fluorene	86-73-7	1.6E+00	2.2E-02	1.4E+00	NA	3.1E+00	5.0E-02	1.5E-01	6.8E-04	1.1E-02	2.1E-01	3.3E+00
Indeno(1,2,3-c,d)pyrene	193-39-5	--	--	--	NA	--	--	--	--	--	--	--
Isophorone	78-59-1	3.2E-01	4.3E-03	9.4E-02	NA	4.2E-01	1.1E-02	3.0E-02	5.5E-06	8.9E-05	4.1E-02	4.6E-01
n-Nitrosodiphenylamine	86-30-6	--	--	--	NA	--	--	--	--	--	--	--
Phenanthrene	85-01-8	2.1E+00	2.9E-02	2.7E+00	NA	4.8E+00	6.7E-02	2.0E-01	1.9E-03	3.2E-02	3.0E-01	5.1E+00
Phenol	108-95-2	2.1E-01	2.9E-03	8.8E-03	NA	2.2E-01	7.2E-03	2.0E-02	2.9E-07	4.7E-06	2.7E-02	2.5E-01
Pyrene	129-00-0	2.1E+00	2.9E-02	4.3E+00	NA	6.5E+00	6.7E-02	2.0E-01	7.5E-03	1.2E-01	4.0E-01	6.9E+00
Volatile Organic Compounds												
1,1,2,2-Tetrachloroethane	79-34-5	1.6E+00	2.2E-02	1.5E-01	--	1.8E+00	5.2E-02	1.5E-01	1.0E-05	1.7E-04	2.0E-01	2.0E+00
1,2,3-Trichloropropane	96-18-4	1.1E+01	1.4E-01	1.6E+00	8.0E+00	2.0E+01	3.4E-01	1.0E+00	1.4E-04	2.3E-03	1.3E+00	2.2E+01

Table I-8. Noncarcinogenic URV for the Resident Farmer (Child) Exposure to Groundwater (continued)

COPC	CAS No.	Direct Exposure Pathway					Indirect Exposure Pathway					Total Groundwater URV_{nc}
		Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	
1,2-Dichloroethane	107-06-2	--	--	--	2.0E-01	2.0E-01	--	--	--	--	--	2.0E-01
2-Hexanone	591-78-6	1.1E+00	1.4E-02	5.5E-02	1.2E+02	1.2E+02	3.6E-02	1.0E-01	1.3E-06	2.2E-05	1.4E-01	1.2E+02
Acetone	67-64-1	6.4E-01	8.6E-03	2.5E-03	8.1E-01	1.5E+00	5.1E-02	6.2E-02	1.8E-09	2.8E-08	1.1E-01	1.6E+00
Chloroform	67-66-3	6.4E+00	8.6E-02	1.0E+00	4.9E+00	1.2E+01	2.1E-01	6.0E-01	8.8E-06	1.4E-04	8.1E-01	1.3E+01
Dibromomethane	74-95-3	1.1E+00	1.4E-02	3.0E-02	3.6E+01	3.7E+01	3.4E-02	1.0E-01	1.5E-06	2.4E-05	1.3E-01	3.8E+01
Dichlorodifluoromethane	75-71-8	3.2E-01	4.3E-03	6.9E-02	9.7E-02	4.9E-01	1.0E-02	3.0E-02	8.7E-07	1.4E-05	4.0E-02	5.3E-01
Methylene Chloride	75-09-2	1.1E+00	1.4E-02	3.4E-02	1.6E-01	1.3E+00	3.7E-02	1.0E-01	9.7E-07	1.6E-05	1.4E-01	1.4E+00
Nonanal	124-19-6	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	127-18-4	6.4E+00	8.6E-02	1.3E+00	1.8E+00	9.6E+00	2.1E-01	6.0E-01	2.4E-04	4.0E-03	8.1E-01	1.0E+01
Tetrahydrofuran	109-99-9	3.2E-01	4.3E-03	4.4E-03	1.6E+00	1.9E+00	1.3E-02	3.0E-02	5.6E-08	9.0E-07	4.3E-02	2.0E+00
Toluene	108-88-3	3.2E-01	4.3E-03	6.8E-02	1.2E+00	1.6E+00	1.0E-02	3.0E-02	4.6E-06	7.4E-05	4.0E-02	1.6E+00
Trichloroethylene	79-01-6	1.1E+01	1.4E-01	1.3E+00	--	1.2E+01	3.5E-01	1.0E+00	1.3E-04	2.1E-03	1.3E+00	1.3E+01
Xylenes (total)	1310-20-7	3.2E-01	4.3E-03	1.1E-01	4.8E+00	5.2E+00	1.0E-02	3.0E-02	1.6E-05	2.6E-04	4.1E-02	5.3E+00
Miscellaneous												
Perchlorate[b]	14797-73-0	9.13E+01	1.23E+00	1.97E+00	NA	9.45E+01	--	0.0E+00	3.86E-06	6.14E-05	6.5E-05	9.45E+01
Nitrate	14797-55-8	4.0E-02	5.4E-04	0.0E+00	NA	4.0E-02	--	--			--	4.0E-02
Metals												
Arsenic	7440-38-2	--	--	--	NA	--	--	--	--	--	--	--
Barium	7440-39-3	9.1E-01	1.2E-02	2.9E-02	NA	9.5E-01	2.9E-02	8.6E-02	3.0E-04	3.7E-02	1.5E-01	1.1E+00
Boron	7440-42-8	7.1E-01	9.6E-03	1.8E-03	NA	7.2E-01	2.2E-02	6.7E-02	9.3E-04	9.0E-02	1.8E-01	9.0E-01
Cadmium	7440-43-9	1.3E+02	1.7E+00	1.2E+01	NA	1.4E+02	2.0E+00	6.0E+00	4.2E-02	5.4E+00	1.3E+01	1.5E+02
Calcium	7440-70-2	--	--	--	NA	--	--	--	--	--	--	--
Chromium (total)	7440-47-3	4.3E-02	5.8E-04	7.4E-03	NA	5.1E-02	--	--	6.3E-04	3.6E-05	6.7E-04	5.1E-02
Chromium (hexavalent)	18540-29-9	2.1E+01	2.9E-01	1.9E+00	NA	2.4E+01	6.7E-01	2.0E+00	3.2E-01	1.8E-02	3.0E+00	2.7E+01
Cobalt	7440-48-4	1.1E+00	1.4E-02	3.0E-03	NA	1.1E+00	3.3E-02	1.0E-01	1.8E-04	6.3E-03	1.4E-01	1.2E+00
Copper	7440-50-8	1.6E+00	2.2E-02	6.3E-03	NA	1.6E+00	5.0E-02	1.5E-01	2.4E-02	2.0E-01	4.3E-01	2.1E+00
Fluoride	16984-48-8	--	--	--	NA	--	--	--	--	--	--	--
Iron	7439-89-6	--	--	--	NA	--	--	--	--	--	--	--
Lead	7439-92-1	--	--	--	NA	--	--	--	--	--	--	--
Magnesium	7439-95-4	--	--	--	NA	--	--	--	--	--	--	--
Manganese	7439-96-5	4.6E-01	6.2E-03	1.7E-02	NA	4.8E-01	4.3E-02	1.3E-01	3.8E-04	1.2E-03	1.7E-01	6.5E-01
Mercury	7439-97-6	2.1E+02	2.9E+00	6.8E-01	NA	2.2E+02	6.7E+00	2.0E+01	3.5E+00	8.5E+00	3.9E+01	2.6E+02

Table I-8. Noncarcinogenic URV for the Resident Farmer (Child) Exposure to Groundwater (continued)

COPC	CAS No.	Direct Exposure Pathway: Drinking Water URV	Ingestion from Showering URV	Dermal from Showering URV	Inhalation of VOCs from Showering URV	Total Direct URV	Indirect Exposure Pathway: Root Vegetable Ingestion URV	Other Vegetable Ingestion URV	Beef Ingestion URV	Milk Ingestion URV	Total Indirect URV	Total Groundwater URV_{nc}
Nickel	7440-02-0	3.2E+00	4.3E-02	1.8E-01	NA	3.4E+00	1.0E-01	3.0E-01	2.6E-02	4.3E+00	4.7E+00	8.2E+00
Potassium	7440-09-7	--	--	--	NA	--	--	--	--	--	--	--
Selenium	7782-49-2	1.3E+01	1.7E-01	0.0E+00	NA	1.3E+01	4.0E-01	4.2E+02	2.1E+00	1.1E+01	4.3E+02	4.4E+02
Silver	7440-22-4	1.3E+01	1.7E-01	7.2E-01	NA	1.4E+01	4.0E-01	1.2E+00	6.3E-02	5.4E-02	1.7E+00	1.5E+01
Sodium	7440-23-5	--	--	--	NA	--	--	--	--	--	--	--
Strontium	7440-24-6	1.1E-01	1.4E-03	--	NA	1.1E-01	3.3E-03	1.0E-02	1.4E-03	2.5E-02	4.0E-02	1.5E-01
Thallium[a]	7440-28-0	8.0E+02	1.1E+01	3.6E+00	NA	8.1E+02	2.5E+01	7.5E+01	5.3E+01	1.4E+02	2.9E+02	1.1E+03
Uranium	7440-61-1	2.1E+01	2.9E-01	5.6E-02	NA	2.2E+01	--	--	1.1E-02	7.2E-01	7.3E-01	2.2E+01
Zinc	7440-66-6	2.1E-01	2.9E-03	1.4E-03	NA	2.2E-01	6.7E-03	2.0E-02	3.5E-02	1.8E-01	2.4E-01	4.6E-01

URV_{nc} - Noncancer Unit Risk Value

URVs in units of risk per mg/L or risk per pCi/L and are multiplied by groundwater concentration in units of mg/L or pCi/L to calculate risk.

NA - Not Applicable

-- No data available

[a]Thallium CAS in Pantex Plant datasets is 7440-28-0 and not TCEQ 7791-61-1 CAS for thallium chloride. For risk calculation thallium chloride values are used.

[b]Perchlorate URV updated according to March 2005 TCEQ updated Tox/chem./phys table for the Risk Reduction Rule.

Table I-9. Exposure Parameters for URV Calculations

Part 1. Onsite construction/utility excavation receptor	
Exposure duration	0.23 years (12 wks, TCEQ TARA)
Body weight	70 kilograms (EPA 1996b)
Averaging time (AT)	0.23 years (noncarcinogens) 70 years (carcinogens)
Soil ingestion (from measured soil concentrations)	
Exposure frequency (see F_{ds})	5 d/wk (TCEQ review comments 1999)
Fraction of year soil ingestion occurs (F_{ds})	0.7143 (= 5/7)
Ingestion rate (U_{ds})	0.480 g/d (TCEQ review comments 1999)
Dose conversion factor (radionuclides) (DF_g)	(mrem/pCi ingested) chemical specific value
Soil dermal (from measured soil concentrations)	
Exposure frequency (see F_{dd})	5 d/wk (TCEQ review comments 1999)
Fraction of year soil dermal contact occurs (F_{dd})	0.7143 (= 5/7)
Soil contact frequency (FE_{dd})	1 events/d (EPA 1992)
Skin area (A_{dd})	2500 cm^2 (TCEQ review comments 1999)
Skin adherence factor for soil contact (AD)	0.2 mg/cm^2 (TCEQ review comments 1999)
Dermal absorption factor (AB_d)	(Fraction/event) chemical specific value
Gastrointestinal tract absorption factor (f_1)	(mg/mg) chemical specific value
Dose conversion factor (radionuclides) (DF_d)	(mrem/pCi absorbed) chemical specific value
Soil external (radionuclides only) (from measured soil concentrations)	
Exposure frequency (see F_{de})	5 d/wk (TCEQ review comments 1999)
Fraction of year soil dermal contact occurs (F_{de})	0.7143 (= 5/7)
Exposure time to contaminated ground (U_{de})	8 hr/day (daily work period)
Soil thickness contaminant is distributed within (τ_{ms})	0.04 m (see text)
Density of soil contaminant is distributed within (ρ_{ms})	1.56 g/cm^3 (site value for Pullman soil)
Dose conversion factor (DE_g)	(rem/h per pCi/m^2) chemical specific value
Inhalation of volatile and particulate contaminants (from measured soil concentrations)	
Exposure frequency (see F_{di})	5 d/wk (TCEQ review comments 1999)
Fraction of year inhalation exposure occurs (F_{di})	0.7143 (= 5/7)
Volatilization factor (VF)	Chemical specific evaluated using EPA (1996)
Exposure duration (T)	7.2584×10^6 seconds (equal to 0.23 years; for the soil inhalation pathways, volatile pollutants)
Pollutant diffusivity in air (D_i)	(cm^2/sec) chemical specific value
Pollutant diffusivity in water (D_w)	(cm^2/sec) chemical specific value
Air-filled soil porosity (θ_a)	0.2545 (site value, Pullman soil, see section on soil properties)
Water-filled soil porosity (θ_w)	0.162 (site value, Pullman soil)
Area release rate factor (Q/C)	68.81 (EPA 1996b, recommended default value)
Soil bulk density (ρ_b)	1.56 g/cm^3 (site value, Pullman soil, see section on soil properties)
Soil absorption coefficient (K_d)	Chemical specific value ($K_d = K_{oc}\ f_{oc}$)
Carbon matter partition coefficient (K_{oc})	Chemical specific value
Organic carbon content of soil (f_{oc})	0.0084 (site value, Pullman soil, see section on soil properties)
Dose conversion factor for radionuclides (DF_h)	(mrem/pCi ingested) chemical specific value
Equivalent threshold value of wind speed at 7 m (U_T)	11.32 (m/s) (EPA 1996b, recommended value based on a surface roughness length of 0.5 cm)
Function dependent on $U_m/\ U_T$ (F(x))	0.756 (derived from Cowherd et al. (1985) where x = 0.886 $U_m/\ U_T$
Dose conversion factor for radionuclides (DF_h)	(mrem/pCi) chemical specific value
Drinking water ingestion	
Exposure frequency (see F_{dw})	250 days per year (EPA 1991)
Fraction of year contaminated water is consumed (F_{dw})	0.685 (250/365)
Intake rate (U_{dw})	1 L/d (EPA 1991)
Dose conversion factor (radionuclides) (DF_g)	(mrem/pCi ingested) chemical specific value

Table I-9. Exposure Parameters for URV Calculations (continued)

Shower ingestion	
Exposure frequency (see F_{sw})	250 days per year, assuming a typical occupational scenario (EPA 1991)
Fraction of d/y contaminated showers/baths occur (F_{sw})	0.685 (= 250/365)
Intake rate (U_{sw})	0.06 L/hr (assumed default value)
Shower duration (TE_s)	0.225 hr (13.5 min/shower; Burmaster 1988)
Shower frequency (FE_{sh})	1/day (assumes worker showers once per work day)
Dose conversion factor (radionuclides) (DF_g)	(mrem/pCi ingested) chemical specific value
Shower dermal	
Exposure frequency (see F_{sd})	250 days per year, assuming a typical occupational scenario (EPA 1991)
Fraction of d/y contaminated showers/baths occur (F_{sd})	0.685 (= 250/365)
Shower duration (TE_s)	0.225 hr (13.5 min/shower; Burmaster 1988)
Shower frequency (FE_{sh})	1/day (assumes worker showers once per work day)
Area of skin (A_{sd})	20,000 cm^2 (EPA 1996b)
Skin permeability constant (K_p)	(cm/h) this is a calculated, chemical specific value for organics (see chemical parameter table for equation). 10^{-3} cm/h for inorganics and radionuclides (EPA 1992a, default value)
Gastrointestinal tract absorption factor (f_1)	(mg/mg) chemical specific value
Dose conversion factor (radionuclides) (DF_d)	(mrem/pCi absorbed) chemical specific value
Shower (indoor) inhalation	
Exposure frequency (see F_{ia})	250 days per year, assuming a typical occupational scenario (EPA 1991)
Fraction of d/y contaminated showers/baths occur (F_{ia})	0.685 (= 250/365)
Inhalation rate (U_{ia})	20 m^3/d (EPA 1991b, used only for radionuclides, equal to average daily inhalation rate)
Andelman volatilization factor (K)	0.5 L/m^3 for chemicals (EPA 1991b); 0.1 L/m3 for volatile radionuclides (Andelman 1990)
Dose conversion factor (radionuclides) (DF_h)	(mrem/pCi inhaled) chemical specific value
Part 2. Onsite industrial receptor	
Exposure duration (ED)	25 years (EPA 1991b, TCEQ 30 TAC §335)
Body weight (BW)	70 kilograms (EPA 1996b)
Averaging time (AT)	25 years (noncarcinogens) 70 years (carcinogens)
Air inhalation	
Exposure frequency (see F_a)	250 days per year (TCEQ 30 TAC §335)
Fraction of year inhalation exposure occurs (F_a)	0.685 (= 250/365)
Inhalation rate (Ua)	20 m^3/d (EPA 1991b; used only for radionuclides, equal to average daily Inhalation rate)
Dose conversion factor (radionuclides) (DFa)	(mrem/pCi inhaled) chemical specific value
Air internal exposure frequency (see Fae)	250 days per year (TCEQ 30 TAC §335)
Fraction of days per year external exposure occurs (Fae)	0.685 (= 250/365)
Exposure time (Uae)	8 hour/day (daily work period)
Dose conversion factor (DEa)	(rem/h per pCi/m2) chemical specific value
Soil ingestion (following atmospheric deposition)	
Exposure frequency (see F_{ds})	250 days per year (30 TAC §335)
Fraction of year soil ingestion occurs (F_{ds})	0.685 (= 250/365)
Ingestion rate (U_{ds})	0.050 g/d (TCEQ 30 TAC §335)
Soil thickness in which contaminant is distributed (t_{dd})	0.04 m (see section on soil properties)
Density of soil in which contaminant is distributed (ρ_{dd})	1.56 g/cm^3 (site value for Pullman soil, see section on soil properties)
Dose conversion factor (radionuclides) (DF_g)	(mrem/pCi ingested) chemical specific value

Table I-9. Exposure Parameters for URV Calculations (continued)

Soil dermal (following atmospheric deposition)	
Exposure frequency (see F_{dd})	250 days per year (TCEQ 30 TAC §335)
Fraction of year soil dermal contact occurs (F_{dd})	0.685 (= 250/365)
Soil contact frequency (FE_{dd})	1 events/d (assume 1 event/d for 250 d; EPA 1992)
Skin area contacted (A_{dd})	2500 cm^2 (TCEQ review comments 1999)
Adherence factor(AD)	0.2 mg/cm^2 (EPA 1992; TCEQ review comments 1999)
Dermal absorption factor (AB_d)	(fraction/event) chemical specific value (see chemical parameter table)
Gastrointestinal tract absorption factor (f_1)	(mg/mg) chemical specific
Soil thickness in which contaminant is distributed (t_{dd})	0.04 m (see section on soil properties)
Density of soil in which contaminant is distributed (ρ_{dd})	1.56 g/cm^3 (site value for Pullman soil, see section on soil properties)
Dose conversion factor (radionuclides) (DF_d)	(mrem/pCi absorbed) chemical specific value
Soil external (following atmospheric deposition)	
Exposure frequency (see F_{de})	250 days per year (TCEQ 30 TAC §335)
Fraction of year soil external exposure occurs (F_{de})	0.685 (= 250/365)
Exposure time to contaminated ground (U_{de})	8 hr/day (daily work period)
Shielding factor outside home (SH_o)	1.0 (default for dose reduction due to shielding)
Dose conversion factor (DE_g)	(rem/h per pCi/m^2) chemical specific value
Inhalation of volatile and particulate contaminants from soil (following atmospheric deposition)	
Exposure frequency (see F_{di})	250 days per year (TCEQ 30 TAC §335)
Fraction of year inhalation exposure occurs (F_{di})	0.685 (= 250/365)
Volatilization factor (VF)	Chemical specific values calculated using EPA 1996b
Exposure duration (I)	7.884×10^8 seconds (equal to 25 years; soil inhalation pathway, volatile pollutants)
Pollutant diffusivity in air (D_A)	(cm^2/sec) chemical specific
Pollutant diffusivity in water (D_w)	(cm^2/sec) chemical specific value
Air-filled soil porosity (θ_a)	0.2545 (site value for Pullman soil, see section on soil properties)
Water-filled soil porosity (θ_w)	0.162 (site value for Pullman soil, see section on soil properties)
Area release rate factor (Q/C)	68.81 (EPA 1996b; recommended default value)
Soil bulk density (ρ_b)	1.56 g/cm^3 (site value for Pullman soil, see section on soil properties)
Soil absorption coefficient (K_d)	chemical specific value ($K_d = K_{oc}\ f_{oc}$)
Carbon matter partition coefficient (K_{oc})	chemical specific value
Organic carbon content of soil (f_{oc})	0.0084 (site value for Pullman soil, see section on soil properties)
Dose conversion factor for radionuclides (DF_h)	(mrem/pCi) chemical specific value
Soil Inhalation, particles, following atmospheric deposition	
Exposure frequency (see F_{di})	250 days per year (TCEQ 30 TAC §335)
Fraction of year inhalation exposure occurs (F_{di})	0.685 (=250/365)
PEF	1.534×10^8 ($m^{3/}kg$) value base on site soil properties (calculated using EPA 1996 and Cowherd 1984 recommendations)
Particulate area emission factor (Q/C)	90.8 g/m^2s per kilograms/m^3 (EPA 1996b; recommended default value)
Fraction of vegetative cover (V)	0.5 (EPA 1996b; recommended default value)
Mean annual wind speed (U_m)	6.1 m/s (site value from Cowherd (1985))
Equivalent threshold value of wind speed at 7 m (U_T)	11.32 (m/s) (EPA 1996b; recommended value based on a surface roughness length of 0.5 cm
Function dependent on U_m/ U_T (F(x))	0.756 (derived from Cowherd et al. (1985) where x = 0.886 U_m/ U_T
Dose conversion factor for radionuclides (DF_h)	(mrem/pCi) chemical specific value
Drinking water ingestion	
Exposure frequency (see Fd_w)	250 days per year (TCEQ 30 TAC §335)
Fraction of year contaminated water is consumed (F_{dw})	0.685 (= 250/365)
Intake rate (U_{dw})	1 L/d (TCEQ 30 TAC §335)
Dose conversion factor (radionuclides) (DF_g)	(mrem/pCi ingested) chemical specific value

Table I-9. Exposure Parameters for URV Calculations (continued)

Shower ingestion	
Exposure frequency (see F_{sw})	250 days per year (TCEQ 30 TAC §335)
Fraction of d/y contaminated showers/baths occur (F_{sw})	0.685 (= 250/365)
Intake rate (U_{sw})	0.06 L/hr (assumed default value)
Shower duration (TE_s)	0.225 hr (13.5 min/shower; Burmaster 1988)
Shower frequency (FE_{sh})	1/day (assumes worker showers once per work day)
Dose conversion factor (radionuclides) (DF_g)	(mrem/pCi ingested) chemical specific value
Shower dermal	
Exposure frequency (see F_{sd})	250 days per year (TCEQ 30 TAC §335)
Fraction of d/y contaminated showers/baths occur (F_{sd})	0.685 (= 250/365)
Shower duration (TE_s)	0.225 hr (13.5 min/shower; Burmaster 1988)
Shower frequency (FE_{sh})	1/day (assumes worker showers once per work day)
Area of skin (A_{sd})	20,000 cm^2 (EPA 1996b)
Skin permeability constant (K_p)	(cm/h) this is a calculated, chemical specific value for organics (see chemical parameter table for equation). 10^{-3} cm/h for inorganics and radionuclides (EPA 1992a; default value)
Gastrointestinal tract absorption factor (f_1)	(mg/mg) chemical specific value
Dose conversion factor (radionuclides) (DF_d)	(mrem/pCi absorbed) chemical specific value
Shower (indoor) inhalation	
Exposure frequency (see F_{ia})	250 days per year (TCEQ 30 TAC §335)
Fraction of d/y contaminated showers/baths occur (F_{ia})	0.685 (= 250/365)
Inhalation rate (U_{ia})	20 m^3/d (EPA 1991b; used only for radionuclides, equal to average daily inhalation rate)
Andelman volatilization factor (K)	0.5 L/m^3 for chemicals (EPA 1991b); 0.1 L/m^3 for volatile radionuclides (Andelman 1990)
Dose conversion factor (radionuclides) (DF_h)	(mrem/pCi inhaled) chemical specific value
Part 3. Offsite resident farmer receptor	
Exposure duration	34 years (adult) (TCEQ review comments) 6 years (child) (TCEQ 30 TAC §335)
Body weight	70 kilograms (adult) (EPA 1996b; TCEQ 30 TAC §335) 15 kilograms (child) (TCEQ 30 TAC §335)
Averaging time	Noncarcinogen (34 years (adult); 6 years (child) Carcinogens (70 years)
Air inhalation	
Exposure frequency (see F_a)	350 days per year (TCEQ 30 TAC §335)
Fraction of year inhalation exposure occurs (F_a)	0.9583 (= 350/365)
Inhalation rate (U_a)	20 m^3/d (EPA 1991b; used only for radionuclides, equal to average daily Inhalation rate)
Dose conversion factor (radionuclides) (DF_a)	(mrem/pCi inhaled) chemical specific value
Air external	
Exposure frequency (see F_{ae})	350 days per year (TCEQ 30 TAC §335)
Fraction of days per year external exposure occurs (F_{ae})	0.9583 (= 350/365)
Exposure time (U_{ae})	24 hr/d (full-time occupancy)
Dose conversion factor (DE_a)	(rem/h per pCi/m^2) chemical specific value
Soil ingestion (following atmospheric deposition)	
Exposure frequency (see F_{ds})	350 days per year (TCEQ 30 TAC §335)
Fraction of year soil ingestion occurs (F_{ds})	0.9583 (= 350/365)
Ingestion rate (U_{ds})	0.2 g/d (child) (TCEQ 30 TAC §335)
Ingestion rate (U_{ds})	0.100 g/d (adult) (EPA 1991b; TCEQ 30 TAC §335)
Soil thickness contaminant is distributed in (t_{dd})	0.04 m (see section on soil properties)
Density of soil contaminant is distributed in (ρ_{dd})	1.56 g/cm^3 (site value for Pullman soil, see section on soil properties)
Dose conversion factor (radionuclides) (DF_g)	(mrem/pCi ingested) chemical specific value

Table I-9. Exposure Parameters for URV Calculations (continued)

Soil dermal (following atmospheric deposition)	
Exposure frequency (see F_{dd})	350 days per year (TCEQ 30 TAC §335)
Fraction of year soil dermal contact occurs (F_{dd})	0.9583 (= 350/365)
Soil Contact Frequency (FE_{dd})	1 events/d (assume 1 event/day for 250 d; EPA 1992)
Skin area (child) (A_{dd})	2,900 cm^2 (EPA 1996b)
Skin area (adult) (A_{dd})	5,700 cm^2 (EPA 1996b)
Soil adherence factor (AD)	0.2 mg/cm^2 (EPA 1996b)
Dermal Absorption Factor (AB_d)	(fraction/event) chemical specific value
Gastrointestinal tract absorption factor (f_1)	(mg/mg) chemical specific value
Soil thickness contaminant is distributed within (t_{dd})	0.04 m (see section on soil properties)
Density of soil contaminant is distributed within (ρ_{dd})	1.56 g/cm^3 (site value for Pullman soil, see section on soil properties)
Dose conversion factor (radionuclides) (DF_d)	(mrem/pCi absorbed) chemical specific value
Soil external (following atmospheric deposition)	
Exposure frequency (see F_{de})	350 days per year (TCEQ 30 TAC §335)
Fraction of year soil external exposure occurs (F_{de})	0.9583 (= 350/365)
Exposure time to contaminated ground (U_{de})	24 hr/d (Full occupancy)
Dose conversion factor (DE_g)	(rem/h per pCi/m^2) chemical specific value
Soil inhalation, volatiles, following atmospheric deposition	
Exposure frequency (see F_{di})	350 days per year (TCEQ 30 TAC §335)
Fraction of year inhalation exposure occurs (F_{di})	0.9583 (= 350/365)
Volatilization factor (VF)	chemical specific
Exposure duration	1.2623×10^9 seconds (40 years; inhalation of volatile pollutants from soil)
Pollutant diffusivity in air (D_A)	(cm^2/sec) chemical specific value
Pollutant diffusivity in water (D_w)	(cm^2/sec) chemical specific value
Air-filled soil porosity (θ_a)	0.2545 (site value for Pullman soil, see section on soil properties)
Water-filled soil porosity (θ_w)	0.162 (site value for Pullman soil, see section on soil properties)
Area release rate factor (Q/C)	68.81 (EPA 1996b; recommended default value)
Soil bulk density (ρ_b)	1.56 g/cm^3 (site value for Pullman soil, see section on soil properties)
Soil absorption coefficient (K_d)	chemical specific value ($K_d = K_{oc}\ f_{oc}$)
Carbon matter partition coefficient (K_{oc})	chemical specific value, see chemical parameter table)
Organic carbon content of soil (f_{oc})	0.0084 (site value for Pullman soil, see section on soil properties)
Environmental degradation/decay constant (λ_d)	1.87×10^{-10} d^{-1} (λ_d = ln2/contaminant half-life in surface soil, see section on environmental loss)
Contaminant half-life in surface soil	3.7×10^9 d (default value for no decay, see section on environmental loss)
Dose conversion factor for radionuclides (DF_h)	(mrem/pCi ingested) chemical specific value
Soil inhalation, particles, following atmospheric deposition	
Exposure frequency (see F_{di})	350 days per year (TCEQ 30 TAC §335)
Fraction of year inhalation exposure occurs (F_{di})	0.9583 (=350/365)
PEF	1.534×10^8 (m^3/kg) value base on site soil properties (calculated using EPA 1996 and Cowherd 1984 recommendations)
Area emission factor for particulates (Q/C)	90.8 g/m^2s per kilograms/m^3 (EPA 1996b; recommended default value)
Fraction of vegetative cover (V)	0.5 (EPA 1996b; recommended default value)
Mean annual wind speed U_m	6.1 m/s (site value from Cowherd (1985)
Equivalent threshold value of wind speed at 7 m (U_T)	11.32 (m/s) (EPA 1996b; recommended value based on a surface roughness length of 0.5 cm)
Function dependent on $U_m/\ U_T$ (F(x))	0.756 (derived from Cowherd et al. (1985) where x = 0.886 $U_m/\ U_T$
Dose conversion factor for radionuclides (DF_h)	(mrem/pCi) chemical specific value
Drinking water ingestion	
Exposure frequency (see F_{dw})	350 days per year (TCEQ 30 TAC §335)
Fraction of year contaminated water is consumed (F_{dw})	0.9583 (= 350/365)
Ingestion rate (U_{dw})	1.0 L/d child (EPA 1996b)
Ingestion rate (U_{dw})	2.0 L/d adult (TCEQ 30 TAC §335)
Dose conversion factor for radionuclides (DF_g)	(mrem/pCi ingested) chemical specific value

Table I-9. Exposure Parameters for URV Calculations (continued)

Shower water ingestion	
Exposure frequency (see F_{sw})	350 days per year (TCEQ 30 TAC §335)
Fraction of d/y contaminated showers/baths occur (F_{sw})	0.9583 (= 350/365)
Shower frequency (FE_{sh})	1/day (assumes worker showers once per work day)
Ingestion rate (U_{sw})	0.06 L/h (assumed default value for child and adult)
Shower duration (TE_s)	0.225 hr (13.5 min/shower; Burmaster 1988, used for child and adult)
Dose conversion factor for radionuclides (DF_g)	(mrem/pCi ingested) chemical specific value
Shower dermal	
Exposure frequency (see F_{sd})	350 days per year (TCEQ 30 TAC §335)
Fraction of d/y contaminated showers/baths occur (F_{sd})	0.9583 (= 350/365)
Shower frequency (FE_{sh})	1/day (assumes worker showers once per work day)
Skin area (A_{sd})	10,000 cm^2 (child) EPA 1992a; dermal report, nominal value for 95% of 6-year-old child. Area would be less if average for 1st 6 years is used.
Skin area (A_{sd})	20,000 cm^2 (adult) EPA 1996b
Shower duration (TE_s)	0.225 hr (13.5 min/shower; Burmaster 1988, used for child and adult)
Skin permeability constant (K_p)	(cm/h) this is a calculated, chemical specific value for organics. 10^{-3} cm/h for inorganics and radionuclide EPA 1992a, default value)
Gastrointestinal tract absorption factor (f_1)	(mg/mg) chemical specific value
Dose conversion factor for radionuclide) (DF_d)	(mrem/pCi absorbed) chemical specific value
Shower (indoor) inhalation	
Exposure frequency (see F_{ia})	350 days per year (TCEQ 30 TAC §335)
Fraction of d/y contaminated showers/baths occur (F_{ia})	0.9583 (= 350/365)
Inhalation rate (U_{ia})	20 m^3/d (EPA 1991b; used only for radionuclides, equal to average daily Inhalation rate)
Andelman volatilization factor (K)	0.5 L/m^3 for chemicals (EPA 1991b); 0.1 L/m^3 for radionuclides (Andelman 1990)
Dose conversion factor for radionuclides (DF_h)	(mrem/pCi inhaled) chemical specific value
Crop (root vegetable) ingestion (following atmospheric and irrigation water deposition)	
Exposure frequency (see F_p)	350 days per year (TCEQ 30 TAC §335)
Fraction of d/y ingestion occurs (F_p)	0.9583 (= 350/365)
Intake contaminated plant (U_p)	0.0084 kilograms/d (dry wt.) child (TCEQ review comments for the 1997 Draft BRA Work Plan)
Intake contaminated plant (U_p)	0.021 kilograms/d (dry wt.) adult (TCEQ review comments for the 1997 Draft BRA Work Plan)
Intake contaminated plant (U_p)	0.042 kilograms/d (wet wt.) child value from above
Intake contaminated plant (U_p)	0.105 kilograms/d (wet wt.) adult value from above
Plant wet wt. to dry wt. ratio (f_w)	5.0 (Schreckhise et al., 1993)
Contaminated fraction	1.0 (Assumed value, for subsistence farming)
Translocation factor, surface to edible parts (TV_p)	0.1 (Schreckhise et al., 1993)
Crop growing period (TC_p)	90 days nominal (high) value for garden root crops (Schreckhise et al., 1993)
Crop yield (Y_p)	2.5 kg/m^2 (see section on crop parameter values)
Irrigation water application rate (IR)	112 L/m^2/month (site value, see section on crop parameter values)
Interception fraction, irrigation water (r_p)	0.25 (Schreckhise et al., 1993; NRC, 1977; and Kennedy and Strenge, 1992)
Interception fraction, atmospheric dep. (r_p)	0.76 (calculated, see section on crop parameter values)
Effective weathering and decay constant (λ_e)	($\lambda_e = \lambda_d + \lambda_w$) (NRC 1977)
Environmental degradation/decay constant (λ_w)	0.0495 (λ_w = ln2/contaminant half-life on plant surface)
Environmental degradation/decay constant (λ_d)	1.87×10^{-10} d^{-1} (λ_d = ln2/contaminant half-life in surface soil, see section on environmental loss)
Contaminant half-life on plant surfaces	14 d (Schreckhise et al., 1993; NRC, 1977; and Kennedy and Strenge, 1992)
Contaminant half-life in surface soil	3.7×10^9 d (default value for no decay, see section on environmental loss)
Fraction of year irrigation occurs (FI_p)	0.41 (150 days irrigation occurs/365 d, see section on crop parameter values)
Farmland areal soil density (P)	234 kilograms/m^2 (based on 15 cm plow depth and soil density of 1.56 g/cm^3, see section on crop parameter values, see section on soil properties values)

Table I-9. Exposure Parameters for URV Calculations (continued)

Soil-to-plant (root uptake) transfer factor(B_v)	(Kilograms dry soil/kilograms wet wt. plant) chemical specific value, see chemical parameter table (for organic chemicals B_v (root) = ($K_{ow}^{0.77}$ 0.0302 + 0.82)/(K_{oc} f_{oc})) (Briggs et al., 1982)
Octanol/water partition coefficient (K_{ow})	Chemical specific value
Holdup time between harvest and consumption (TH_p)	14 d (NRC, 1977, Schreckhise et al., 1993)
Loss rate constant for water system (λ_g)	1.87×10^{-10} d^{-1} (λ_d = ln2/contaminant half-life in water system, see section on environmental loss) (this describes losses between harvest and consumption)
Contaminant half-life in water system	3.7×10^9 d (default value for no decay, see section on environmental loss)
Dose conversion factor for radionuclides (DF_g)	(mrem/pCi ingested) chemical specific value
Crop (other vegetables) ingestion (following atmospheric and irrigation water deposition)	
Exposure frequency (see F_p)	350 days per year (TCEQ 30 TAC §335)
Fraction of d/y ingestion occurs (F_p)	0.9583 (= 350/365)
Intake contaminated plant (U_p)	0.009 kilograms/d (dry wt.) child (TCEQ review comments for the 1997 Draft BRA Work Plan)
Intake contaminated plant (U_p)	0.023 kilograms/d (dry wt.) adult (TCEQ review comments for the 1997 Draft BRA Work Plan)
Intake contaminated plant (U_p)	0.045 kilograms/d (wet wt.) child value from above
Intake contaminated plant (U_p)	0.115 kilograms/d (wet wt.) adult value from above
Plant wet wt. to dry wt. ratio (f_w)	5.0 (Schreckhise et al., 1993)
Contaminated fraction	1.0 (assumed value for subsistence farming)
Translocation Factor, surface to edible parts (TV_p)	0.19 (1.0 for leafy veg 0.1 for other, intake weighted average is 0.19, Schreckhise et al., 1993)
Crop growing period (TC_p)	90 days nominal (high) value for garden crops (Schreckhise et al., 1993)
Crop yield (Y_p)	1.7 kilograms/m^2 (Schreckhise et al., 1993)
Irrigation water application rate (IR)	112 L/m^2/month (site value, see section on crop parameter values)
Interception fraction, irrigation water (r_p)	0.25 (Schreckhise et al., 1993; NRC, 1977; and Kennedy and Strenge 1992)
Interception fraction, atmospheric dep. (r_p)	0.74 (calculated, see section on crop parameter values)
Effective weathering and decay constant (λ_e)	($\lambda_e = \lambda_d + \lambda_w$) (NRC 1977)
Environmental degradation/decay constant (λ_w)	0.0495 (λ_w = ln2/contaminant half-life on plant surface)
Environmental degradation/decay constant (λ_d)	1.87×10^{-10} d^{-1} (λ_d = ln2/contaminant half-life in surface soil, see section on environmental loss)
Contaminant half-life on plant surfaces	14 d (Schreckhise et al. 1993; NRC 1977; and Kennedy and Strenge 1992)
Contaminant half-life in surface soil	3.7×10^9 d (default value for no decay, see section on environmental loss)
Fraction of year irrigation occurs (FI_p)	0.41 (150 days irrigation occurs/365 d, see section on crop parameter values)
Farmland areal soil density (P)	234 kilograms/m^2 (based on 15 cm plow depth and soil density of 1.56 g/cm^3, see section on crop parameter values)
Soil-to-plant (root uptake) transfer factor (B_v)	(kilograms dry soil/kilograms dry wt. plant) chemical specific value (for organic chemicals log Bv=1.588-0.578log(K_{ow}) (Travis and Arms 1988)
Octanol/water partition coefficient (K_{ow})	chemical specific value
Holdup time between harvest and consumption (TH_p)	14 d (Schreckhise et al. 1993)
Loss rate constant for water system (λ_g)	1.87×10^{-10} d^{-1} (λ_d = ln2/contaminant half-life in water system, see section on environmental loss) (this describes losses between harvest and consumption)
Contaminant half-life in water system	3.7×10^9 d (default value for no decay, see section on environmental loss)
Dose conversion factor (radionuclides) (DF_g)	(mrem/pCi ingested) chemical specific value
Animal (meat) product ingestion (following atmospheric and irrigation water deposition)	
Exposure frequency (see F_{ap})	350 days per year (TCEQ 30 TAC §335)
Fraction of d/y ingestion occurs (F_{ap})	0.9583 (= 350/365)
Intake (U_{ap})	0.021 kilograms/d child (TCEQ review comments for the 1997 Draft BRA Work Plan)
Intake (U_{ap})	0.0575 kilograms/d adult (TCEQ review comments for the 1997 Draft BRA Work Plan)
Contaminated fraction	1.0 (assumed value for subsistence farming)
Translocation factor, surface to edible parts (TV_f)	0.1 (for grain crops, Schreckhise et al. 1993)
Feed crop growing period (TC_f)	270 d (site value for grain production)

Table I-9. Exposure Parameters for URV Calculations (continued)

Plant wet wt. to dry wt. ratio (f_w)	1.14 (grain value from Napier et al. 1988; Schreckhise et al. 1993)
Feed crop yield (Y_f)	0.8 kilograms/m^2 (Napier et al. 1988; Schreckhise et al. 1993)
Irrigation water application rate (IR)	112 L/m^2/month (site value, see section on crop parameter values)
Interception fraction, irrigation water (r_f)	0.25 (Schreckhise et al. 1993; NRC 1977; and Kennedy and Strenge 1992)
Exposure frequency (see F_{ap})	350 days per year (TCEQ 30 TAC §335)
Fraction of d/y ingestion occurs (F_{ap})	0.9583 (= 350/365)
Intake (U_{ap})	0.021 kilograms/d child (TCEQ review comments for the 1997 Draft BRA Work Plan)
Intake (U_{ap})	0.0575 kilograms/d adult (TCEQ review comments for the 1997 Draft BRA Work Plan)
Contaminated fraction	1.0 (assumed value for subsistence farming)
Translocation factor, surface to edible parts (TV_f)	0.1 (for grain crops, Schreckhise et al. 1993)
Feed crop growing period (TC_f)	270 d (site value for grain production)
Plant wet wt. to dry wt. ratio (f_w)	1.14 (grain value from Napier et al. 1988; Schreckhise et al. 1993)
Feed crop yield (Y_f)	0.8 kilograms/m^2 (Napier et al. 1988; Schreckhise et al. 1993)
Irrigation water application rate (IR)	112 L/m^2/month (site value, see section on crop parameter values)
Interception fraction, irrigation water (r_f)	0.25 (Schreckhise et al. 1993; NRC 1977; and Kennedy and Strenge 1992)
Animal (milk) product ingestion (following atmospheric and irrigation water deposition)	
Exposure frequency (see F_{ap})	350 days per year (TCEQ 30 TAC §335)
Fraction of d/y ingestion occurs (F_{ap})	0.9583 (= 350/365)
Intake (U_{ap})	0.353 kg/d child (TCEQ review comments for the 1997 Draft BRA Work Plan)
Intake (U_{ap})	0.182 kg/d adult (TCEQ review comments for the 1997 Draft BRA Work Plan)
Contaminated fraction	1.0 (assumed value for subsistence farming)
Translocation Factor, surface to edible parts (TV_f)	1.0 (value for forage and hay, Schreckhise et al., 1993)
Feed crop growing period (TC_f)	45 d (value, forage/hay crops, Schreckhise et al., 1993)
Plant wet wt. to dry wt. ratio (f_w)	5.0 (hay/forage value from Napier et al., 1988; Schreckhise et al., 1993)
Feed crop yield, milk animal (Y_f)	1.5 kg/m^2 Napier et al., 1988; Schreckhise et al., 1993
Irrigation water application rate (IR)	112 L/m^2/month (site value, see section of crop parameter values)
Interception fraction, irrigation water (r_f)	0.25 (default for irrigation deposition; Schreckhise et al., 1993; NRC 1977; and Kennedy and Strenge 1992)
Interception fraction, atmospheric dep. (r_f)	0.32 (calculated, see section on crop parameter values)
Effective weathering and decay constant (λ_e)	($\lambda_e = \lambda_d + \lambda_w$) (NRC 1977)
Environmental degradation/decay constant (λ_w)	0.0495 (λ_w = ln2/contaminant half-life on plant surface)
Environmental degradation/decay constant (λ_d)	1.87×10^{-10} d^{-1} (λ_d = ln2/contaminant half-life in surface soil, see section on environmental loss)
Contaminant half-life on plant surfaces	14 d (Schreckhise et al., 1993; NRC 1977; and Kennedy and Strenge 1992)
Contaminant half-life in surface soil	3.7×10^9 d (default value for no decay, see section on environmental loss)
Fraction of year irrigation occurs (FI_f)	0.41 (150 days irrigation occurs/365 d, site value, see section on crop parameter values)
Farmland areal soil density (P)	234 kilograms/m^2 (based on 15 cm plow depth and 1.56 g/cm^3 soil density, see crop parameter values)
Soil-to-plant (root uptake) transfer factor (B_v)	(kilograms dry soil/kilograms dry wt. plant) chemical specific value, see chemical parameter table (for organic chemicals log B_v=1.588-0.578log(K_{ow}) (Travis and Arms 1988)
Transfer factor, feed to animal (FM_{ap})	(d/kilograms) chemical specific value, see chemical parameter table (for organic chemicals log FM_{ap}=-8.1 + log(K_{ow}) (Travis and Arms 1988)
Octanol/water partition coefficient (K_{ow})	chemical specific value, see chemical parameter table
Fraction of animal feed contaminated (FC_f)	1.0 (maximum)
Milk animal feed intake rate (Q_f)	16 kilograms/d (dry weight) (IAEA 1982)
Milk animal soil intake rate (Q_s)	0.8 kg/d (5% of dry intake of 16 kg/d)
Milk animal water ingestion rate (Q_w)	60 L/d (Napier et al., 1988, Schreckhise et al., 1993)
Fraction of animal drinking water contaminated (FC_w)	1.0 (maximum)
Holdup time between harvest and consumption (TH_{ap})	1 d (Napier et al., 1988, Schreckhise et al., 1993)

Table I-9. Exposure Parameters for URV Calculations (continued)

Loss rate constant for water system (λ_g)	1.87×10^{-10} d^{-1} (λ_d = ln2/contaminant half-life in water system, see section on environmental loss) (this describes losses between harvest and consumption)
Contaminant half-life in water system	3.7×10^{9} d (default value for no decay, see section on environmental loss)
Dose conversion factor for radionuclides (DF_g)	(mrem/pCi ingested) chemical specific value

Table I-10. Absorption Factors for URV Calculations

COPC	CAS No.	Dermal Absorption Factor (ABd) (unitless)[a]	GI (unitless)[a]
High Explosives			
1,3,5-Trinitrobenzene	99-35-4	0.1	0.65
1,3-Dinitrobenzene	99-65-0	0.1	0.65
2,4,6-Trinitrotoluene	118-96-7	0.1	0.6
2,4-Dinitrotoluene	121-14-2	0.1	0.85
2,6-Dinitrotoluene	606-20-2	0.1	0.85
2-Amino-4,6-dinitrotoluene	35572-78-2	0.1	0.5
2-Nitrotoluene	88-72-2	0.1	0.5
3-Nitrotoluene	99-08-1	0.1	0.5
4-Amino-2,6-dinitrotoluene	19406-51-0	0.1	0.5
4-Nitrotoluene	99-99-0	0.1	0.5
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	0.1	0.15
Cyclotrimethylene-trinitramine (RDX)	121-82-4	0.1	1
Nitrobenzene	98-95-3	0.1	0.97
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	0.1	0.5
Tetryl	479-45-8	0.1	0.5
Pesticides			
4,4’-DDE	72-55-9	0.03	0.7
4,4’-DDT	50-29-3	0.03	0.7
Aldrin	309-00-2	0.1	0.5
Alpha Endosulfan	959-98-8	0.1	0.5
alpha-BHC	319-84-6	0.04	0.97
alpha-Chlordane	5103-71-9	0.1	0.5
Beta Endosulfan	33213-65-9	0.1	0.5
beta-BHC	319-85-7	0.04	0.91
Chlordane (technical)	57-74-9	0.1	0.5
delta-BHC	319-86-8	0.04	0.5
Dieldrin	60-57-1	0.1	0.5
Endosulfan I	959-98-8	0.1	0.5
Endosulfan sulfate	1031-07-8	0.1	0.5
Endrin	72-20-8	0.1	0.5
Endrin aldehyde	7421-93-4	0.1	0.5
gamma-BHC (Lindane)	58-89-9	0.04	0.97
Heptachlor	76-44-8	0.1	0.72
Heptachlor epoxide	1024-57-3	0.1	0.72

Table I-10. Absorption Factors for URV Calculations (continued)

COPC	CAS No.	Dermal Absorption Factor (ABd) (unitless)[a]	GI (unitless)[a]
Polychlorinated Biphenyls			
PCB-1248[b]	1336-36-3	0.14	0.81
PCB-1254[b]	1336-36-3	0.14	0.81
PCB-1260[b]	1336-36-3	0.14	0.81
Semi-Volatile Organic Compounds			
2-Methylnaphthalene	91-57-6	0.13	0.89
4,6-Dinitro-2-methylphenol	534-52-1	0.1	1
4-Chlorophenyl phenyl ether	7005-72-3	0.1	0.5
4-Methylphenol	106-44-5	0.1	0.65
Acenaphthene	83-32-9	0.13	0.89
Anthracene	120-12-7	0.13	0.89
Benzo(a)anthracene	56-55-3	0.13	0.89
Benzo(a)pyrene	50-32-8	0.13	0.89
Benzo(b)fluoranthene	205-99-2	0.13	0.89
Benzo(g,h,i)perylene	191-24-2	0.13	0.89
Benzo(k)fluoranthene	207-08-9	0.13	0.89
Benzyl alcohol	100-51-6	0.1	0.66
bis(2-Ethylhexyl)phthalate	117-81-7	0.1	0.19
Carbazole	86-74-8	0.1	0.7
Chlorocyclohexanol	1561-86-0	--	--
Chrysene	218-01-9	0.13	0.89
Cyclohexanone	108-94-1	0	0.8
Cyclohexene	110-83-8	--	--
Dibenz(a,h)anthracene	53-70-3	0.13	0.89
Di-n-butyl phthalate	84-74-2	0.1	1
Di-n-octyl phthalate	117-84-0	0.1	0.9
Fluoranthene	206-44-0	0.13	0.89
Fluorene	86-73-7	0.13	0.89
Indeno(1,2,3-c,d)pyrene	193-39-5	0.13	0.89
Isophorone	78-59-1	0.1	0.5
n-Nitrosodiphenylamine	86-30-6	0.1	0.25
Pentachlorophenol	87-86-5	0.25	0.76
Phenanthrene	85-01-8	0.13	0.89
Phenol (total)	108-95-2	0.1	0.9
Pyrene	129-00-0	0.13	0.89
Volatile Organic Compounds			
1,1,2,2-Tetrachloroethane	79-34-5	0	0.7
1,2,3-Trichloropropane	96-18-4	0	0.8
1,2-Dichloroethane	107-06-2	0	1
2-Hexanone	591-78-6	0	0.66
Acetone	67-64-1	0	0.83
Chloroform	67-66-3	0	0.2
Dibromomethane	74-95-3	0	0.8
Dichlorodifluoromethane	75-71-8	0	0.23
Methylene Chloride	75-09-2	0	0.95
Nonanal	124-19-6	0	--
Tetrachloroethylene	127-18-4	0	1
Tetrahydrofuran	109-99-9	0	0.8
Toluene	108-88-3	0	0.8
Trichloroethene	79-01-6	0	1

Table I-10. Absorption Factors for URV Calculations (continued)

COPC	CAS No.	Dermal Absorption Factor (ABd) (unitless)[a]	GI (unitless)[a]
Vinyl chloride	75-01-4	0	1
Xylenes (total)	1330-20-7	0	0.92
Miscellaneous			
Nitrate	14797-55-8	0.01	0.5
Perchlorate	14797-73-0	0.01	0.2
Metals			
Antimony	7440-36-0	0.01	0.15
Arsenic	7440-38-2	0.03	0.95
Barium	7440-39-3	0.01	0.07
Beryllium	7440-41-7	0.01	0.007
Boron	7440-42-8	0.01	0.9
Cadmium	7440-43-9	0.001	0.025
Calcium	7440-70-2	--	--
Chromium (total)	7440-47-3	0.01	0.013
Chromium (VI)	18540-29-9	0.01	0.025
Cobalt	7440-48-4	0.01	0.8
Copper	7440-50-8	0.01	0.57
Fluoride	16984-48-8	--	--
Iron	7439-89-6	--	--
Lead	7439-92-1	0.01	0.15
Magnesium	7439-95-4	--	--
Manganese	7439-96-5	0.01	0.06
Mercury	7439-97-6	0.01	0.07
Nickel	7440-02-0	0.01	0.04
Potassium	7440-09-7	--	--
Selenium	7782-49-2	0.01	0.5
Silver	7440-22-4	0.01	0.04
Sodium	7440-23-5	--	--
Strontium	7440-24-6	0.01	0.2
Thallium	7440-28-0	0.01	1
Uranium	7440-61-1	0.01	0.85
Vanadium	7440-62-2	0.01	0.026
Zinc	7440-66-6	0.01	0.2
Radionuclides			
^{234}U	13966-29-5	--	--
^{235}U+D	15117-96-1(+D)	--	--
^{238}U	7440-61-1(+D)	--	--

For metals and radionuclides 0.01 is used as the default ABd.
ABd - dermal absorption factor
-- no data available
[a]Values obtained from Texas Commission on Environmental Quality (TCEQ) Risk Reduction Standards (RRS) website updated March 30, 2004.
[b]Value for total PCBs.

Table I-11. Chemical/Physical Properties for URV Calculations

COPC	CAS No.	Diffusivity in Air (Di) (cm^2/sec)[a]	Diffusivity in Water (Dw) (cm^2/sec)[a]	Soil-Water Partition Coefficient (Kd) (cm^3/g)[b]	Dimensionless Henry's law Constant (H') (unitless)[a]	Organic Carbon Partition Coefficient (Koc) (cm^3/g)[a,c]	Vapor Pressure (mm Hg)[a]	Octanol/Water Partition Coefficient $LogK_{ow}$ (unitless)[a]
High Explosives								
1,3,5-Trinitrobenzene	99-35-4	8.00E-02	8.00E-06	1.19E-01	2.87E-06	1.41E+01	9.90E-05	1.45E+00
1,3-Dinitrobenzene	99-65-0	2.80E-01	7.60E-06	2.52E-01	4.57E-06	3.00E+01	2.49E-04	1.63E+00
2,4,6-Trinitrotoluene	118-96-7	5.41E-02	6.57E-06	2.54E+00	1.90E-05	3.02E+02	1.24E-04	1.99E+00
2,4-Dinitrotoluene	121-14-2	2.03E-01	7.06E-06	4.31E-01	3.60E-05	5.13E+01	1.74E-04	2.18E+00
2,6-Dinitrotoluene	606-20-2	3.27E-02	7.26E-06	3.50E-01	3.11E-05	4.17E+01	5.70E-04	2.18E+00
2-Amino-4,6-dinitrotoluene	35572-78-2	5.60E-02	7.30E-06	4.72E+00	1.19E-07	5.62E+02	1.91E-07	2.80E+00
2-Nitrotoluene	88-72-2	6.47E-02	7.73E-06	1.18E+00	1.87E-03	1.41E+02	1.50E-01	2.36E+00
3-Nitrotoluene	99-08-1	6.42E-02	7.69E-06	1.18E+00	2.24E-03	1.41E+02	1.50E-01	2.36E+00
4-Amino-2,6-dinitrotoluene	19406-51-0	5.60E-02	7.31E-06	3.05E+00	1.74E-07	3.63E+02	5.86E-07	2.62E+00
4-Nitrotoluene	99-99-0	6.40E-02	7.70E-06	1.18E+00	2.29E-03	1.41E+02	1.20E-01	2.36E+00
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	3.74E-02	6.34E-06	3.34E-04	2.50E-14	3.98E-02	4.75E-15	-1.30E+00
Cyclotrimethylene-trinitramine (RDX)	121-82-4	6.65E-02	6.39E-06	5.30E-01	4.99E-04	6.31E+01	1.00E-09	8.70E-01
Nitrobenzene	98-95-3	7.60E-02	8.60E-06	1.11E+00	8.56E-04	1.32E+02	2.44E-01	1.81E+00
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	5.02E-02	6.84E-06	4.10E-02	5.80E-12	4.88E+00	1.34E-11	7.00E-01
Tetryl	479-45-8	5.69E-02	6.40E-06	1.97E+00	8.31E-11	2.34E+02	4.00E-10	2.04E+00
Pesticides								
4,4'-DDE	72-55-9	1.44E-02	5.87E-06	9.21E+02	8.73E-04	1.10E+05	5.66E-06	6.00E+00
4,4'-DDT	50-29-3	1.37E-02	4.95E-06	1.15E+03	2.23E-03	1.38E+05	3.93E-07	6.79E+00
Aldrin	309-00-2	1.32E-02	4.86E-06	4.02E+02	7.07E-03	4.79E+04	1.67E-05	6.75E+00
Alpha Endosulfan	959-98-8	3.22E-02	4.67E-06	1.32E+02	3.55E-05	1.57E+04	2.75E-06	5.20E+00
alpha-BHC	319-84-6	1.42E-02	7.34E-06	1.11E+01	2.82E-04	1.32E+03	4.26E-05	4.26E+00
alpha-Chlordane	5103-71-9	3.32E-02	4.66E-06	5.95E+04	4.11E-03	7.08E+06	8.51E-06	6.97E+00
Beta Endosulfan	33213-65-9	3.22E-02	4.67E-06	1.32E+02	3.55E-05	1.57E+04	1.84E-06	5.20E+00
beta-BHC	319-85-7	1.42E-02	7.34E-06	1.16E+01	1.44E-05	1.38E+03	4.90E-07	4.26E+00
Chlordane (technical)	57-74-9	3.32E-02	4.65E-06	3.30E+03	4.11E-03	3.93E+05	4.17E-06	6.97E+00
delta-BHC	319-86-8	4.50E-02	6.20E-06	7.15E+01	1.77E-04	8.51E+03	2.87E-05	4.00E+00
Dieldrin	60-57-1	1.25E-02	4.74E-06	1.80E+02	1.11E-04	2.14E+04	9.96E-07	5.45E+00
Endosulfan I	959-98-8	3.22E-02	4.67E-06	1.32E+02	3.55E-05	1.57E+04	2.75E-06	5.20E+00

Table I-11. Chemical/Physical Properties for URV Calculations (continued)

COPC	CAS No.	Diffusivity in Air (Di) (cm^2/sec)[a]	Diffusivity in Water (Dw) (cm^2/sec)[a]	Soil-Water Partition Coefficient (Kd) (cm^3/g)[b]	Dimensionless Henry's law Constant (H') (unitless)[a]	Organic Carbon Partition Coefficient (Koc) (cm^3/g)[a,c]	Vapor Pressure (mm Hg)[a]	Octanol/Water Partition Coefficient LogKow (unitless)[a]
Endosulfan sulfate	1031-07-8	3.00E-02	4.63E-06	6.67E+03	3.65E-05	7.94E+05	1.62E-07	6.01E+00
Endrin	72-20-8	1.25E-02	4.74E-06	7.84E+01	4.95E-05	9.33E+03	5.84E-07	5.45E+00
Endrin aldehyde	7421-93-4	2.97E-02	3.83E-06	1.80E+04	1.80E-02	2.14E+06	1.46E-05	6.44E+00
gamma-BHC (Lindane)	58-89-9	1.42E-02	7.34E-06	9.21E+00	1.41E-04	1.10E+03	3.72E-05	4.26E+00
Heptachlor	76-44-8	1.12E-02	5.69E-06	9.87E+01	2.44E-02	1.17E+04	3.26E-04	6.21E+00
Heptachlor epoxide	1024-57-3	1.32E-02	4.23E-06	6.08E+01	3.45E-04	7.24E+03	4.34E-06	4.91E+00
Polychlorinated Biphenyls								
PCB-1248[d]	1336-36-3	1.04E-01	1.00E-05	4.41E+03	1.72E-02	5.25E+05	7.60E-05	6.30E+00
PCB-1254[d]	1336-36-3	1.04E-01	1.00E-05	4.41E+03	1.72E-02	5.25E+05	7.60E-05	6.30E+00
PCB-1260[d]	1336-36-3	1.04E-01	1.00E-05	4.41E+03	1.72E-02	5.25E+05	7.60E-05	6.30E+00
Semi-Volatile Organic Compounds								
2-Methylnaphthalene	91-57-6	6.29E-02	7.20E-06	3.67E+01	1.85E-02	4.37E+03	6.75E-02	3.72E+00
4,6-Dinitro-2-methylphenol	534-52-1	5.31E-02	7.27E-06	2.66E-04	1.07E-07	3.16E-02	2.87E-05	2.07E+00
4-chlorophenyl phenyl ether	7005-72-3	4.89E-02	6.19E-06	1.10E+02	1.30E-02	1.31E+04	1.66E-03	5.04E+00
4-Methylphenol	106-44-5	7.40E-02	1.00E-05	6.83E-01	3.99E-05	8.13E+01	1.30E-01	2.06E+00
Acenaphthene	83-32-9	4.21E-02	7.69E-06	3.34E+01	6.44E-03	3.98E+03	3.75E-03	4.15E+00
Anthracene	120-12-7	3.24E-02	7.74E-06	1.97E+02	4.61E-03	2.34E+04	2.55E-05	4.35E+00
Benzo(a)anthracene	56-55-3	5.10E-02	9.00E-06	2.98E+03	1.39E-04	3.55E+05	1.54E-07	5.52E+00
Benzo(a)pyrene	50-32-8	4.30E-02	9.00E-06	8.02E+03	4.70E-05	9.55E+05	4.89E-09	6.11E+00
Benzo(b)fluoranthene	205-99-2	2.26E-02	5.56E-06	1.01E+04	4.99E-04	1.20E+06	8.06E-08	6.11E+00
Benzo(g,h,i)perylene	191-24-2	4.90E-02	5.65E-05	1.33E+04	5.82E-06	1.58E+06	1.00E-10	6.70E+00
Benzo(k)fluoranthene	207-08-9	2.26E-02	5.56E-06	1.03E+04	4.45E-07	1.23E+06	9.59E-11	6.11E+00
Benzyl alcohol	100-51-6	8.00E-02	8.00E-06	1.01E-01	1.62E-05	1.20E+01	1.06E-01	1.08E+00
bis(2-Ethylhexyl)phthalate	117-81-7	3.51E-02	3.66E-06	5.72E+03	4.57E-04	6.81E+05	6.45E-06	8.39E+00
Carbazole	86-74-8	3.90E-02	7.03E-06	2.06E+01	3.38E-03	2.45E+03	2.66E-04	3.23E+00
Chlorocyclohexanol	1561-86-0	--	--	--	--	--	--	--
Chrysene	218-01-9	2.48E-02	6.21E-06	2.60E+03	5.03E-05	3.09E+05	7.80E-09	5.52E+00
Cyclohexanone	108-94-1	7.72E-02	8.73E-06	4.60E-02	4.99E-04	5.48E+00	4.00E+00	1.13E+00
Cyclohexene	110-83-8	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	2.00E-02	5.18E-06	1.60E+04	4.66E-07	1.91E+06	2.10E-11	6.70E+00
Di-n-butyl phthalate	84-74-2	4.38E-02	7.86E-06	2.85E+02	5.94E-05	3.39E+04	4.25E-05	4.61E+00
Di-n-octyl phthalate	117-84-0	1.51E-02	3.90E-06	6.99E+05	2.78E-03	8.32E+07	4.47E-06	8.54E+00
Fluoranthene	206-44-0	3.02E-02	6.35E-06	4.11E+02	3.88E-04	4.90E+04	8.13E-06	4.93E+00

Table I-11. Chemical/Physical Properties for URV Calculations (continued)

COPC	CAS No.	Diffusivity in Air (Di) (cm^2/sec)[a]	Diffusivity in Water (Dw) (cm^2/sec)[a]	Soil-Water Partition Coefficient (Kd) (cm^3/g)[b]	Dimensionless Henry's law Constant (H') (unitless)[a]	Organic Carbon Partition Coefficient (Koc) (cm^3/g)[a,c]	Vapor Pressure (mm Hg)[a]	Octanol/Water Partition Coefficient LogKow (unitless)[a]
Fluorene	86-73-7	3.63E-02	7.88E-06	6.37E+01	2.64E-03	7.59E+03	3.24E-03	4.02E+00
Indeno(1,2,3-c,d)pyrene	193-39-5	1.90E-02	5.66E-06	2.91E+04	2.85E-06	3.47E+06	1.40E-10	6.70E+00
Isophorone	78-59-1	6.23E-02	6.76E-06	2.54E-01	2.57E-04	3.02E+01	4.10E-01	2.62E+00
n-Nitrosodiphenylamine	86-30-6	3.12E-02	6.35E-06	2.78E+00	2.08E-04	3.31E+02	9.88E-02	3.16E+00
Pentachlorophenol	87-86-5	5.60E-02	6.10E-06	3.42E+00	1.16E-05	4.07E+02	1.70E-05	4.74E+00
Phenanthrene	85-01-8	3.33E-02	7.47E-06	1.19E+02	5.40E-03	1.41E+04	6.80E-04	4.35E+00
Phenol (total)	108-95-2	8.20E-02	9.10E-06	1.46E-01	2.47E-05	1.74E+01	4.63E-01	1.51E+00
Pyrene	129-00-0	2.72E-02	7.24E-06	3.19E+02	4.57E-04	3.80E+04	4.25E-06	4.93E+00
Volatile Organic Compounds								
1,1,2,2-Tetrachloroethane	79-34-5	7.10E-02	7.90E-06	6.52E-01	1.55E-02	7.76E+01	5.17E+00	2.19E+00
1,2,3-Trichloropropane	96-18-4	7.10E-02	7.90E-06	3.27E+00	1.58E-02	3.89E+02	3.70E+00	2.50E+00
1,2-Dichloroethane	107-06-2	1.04E-01	9.90E-06	1.46E-01	5.32E-02	1.74E+01	8.13E+01	1.83E+00
2-Hexanone	591-78-6	6.96E-02	7.75E-06	1.50E-01	3.38E-03	1.79E+01	1.11E+01	1.48E+00
Acetone	67-64-1	1.24E-01	1.14E-05	4.79E-03	1.61E-03	5.70E-01	2.27E+02	-2.35E-01
Chloroform	67-66-3	1.04E-01	1.00E-05	3.93E-01	1.53E-01	4.68E+01	1.98E+02	1.52E+00
Dibromomethane	74-95-3	8.00E-02	8.00E-06	1.53E+00	3.49E-02	1.82E+02	4.56E+01	1.52E+00
Dichlorodifluoromethane	75-71-8	5.20E-02	1.05E-05	1.08E+00	1.67E+01	1.29E+02	4.80E+03	1.82E+00
Methylene Chloride	75-09-2	1.01E-01	1.17E-05	9.87E-02	9.10E-02	1.17E+01	4.55E+02	1.34E+00
Nonanal	124-19-6	--	--	--	2.34E-02	--	3.71E-01	3.50E+00
Tetrachloroethylene	127-18-4	7.20E-02	8.20E-06	1.30E+00	7.65E-01	1.55E+02	1.84E+01	2.97E+00
Tetrahydrofuran	109-99-9	9.36E-02	9.88E-06	3.14E-02	5.75E-03	3.74E+00	1.59E+02	6.25E-01
Toluene	108-88-3	8.70E-02	8.60E-06	1.18E+00	2.76E-01	1.40E+02	2.82E+01	2.54E+00
Trichloroethene	79-01-6	7.90E-02	9.10E-06	7.84E-01	4.28E-01	9.33E+01	7.20E+01	2.47E+00
Vinyl chloride	75-01-4	1.06E-01	1.23E-05	9.21E-02	3.49E+00	1.10E+01	2.83E+03	1.62E+00
Xylenes (total)	1330-20-7	7.40E-02	8.50E-06	2.02E+00	2.93E-01	2.40E+02	8.06E+00	3.09E+00
Miscellaneous								
Nitrate	14797-55-8	--	--	--	--	1.00E-02	--	2.09E-01
Perchlorate	14797-73-0	--	--	--	--	--	--	--
Metals								
Antimony	7440-36-0	--	--	--	--	--	--	--
Arsenic	7440-38-2	--	--	--	--	--	--	6.79E-01
Barium	7440-39-3	--	--	--	--	--	--	--
Beryllium	7440-41-7	--	--	--	--	--	--	5.71E-01
Boron	7440-42-8	--	--	--	--	--	--	--

Table I-11. Chemical/Physical Properties for URV Calculations (continued)

COPC	CAS No.	Diffusivity in Air (Di) (cm^2/sec)[a]	Diffusivity in Water (Dw) (cm^2/sec)[a]	Soil-Water Partition Coefficient (Kd) (cm^3/g)[b]	Dimensionless Henry's law Constant (H') (unitless)[a]	Organic Carbon Partition Coefficient (Koc) (cm^3/g)[a,c]	Vapor Pressure (mm Hg)[a]	Octanol/Water Partition Coefficient LogKow (unitless)[a]
Cadmium	7440-43-9	--	--	--	--	--	--	-7.10E-02
Calcium	7440-70-2	--	--	--	--	--	--	--
Chromium (total)	7440-47-3	--	--	--	--	--	--	--
Chromium (VI)	18540-29-9	--	--	--	--	--	--	--
Cobalt	7440-48-4	--	--	--	--	--	--	--
Copper	7440-50-8	--	--	--	--	--	--	-5.71E-01
Fluoride	16984-48-8	--	--	--	--	--	--	--
Iron	7439-89-6	--	--	--	--	--	--	--
Lead	7439-92-1	--	--	--	--	--	--	7.29E-01
Magnesium	7439-95-4	--	--	--	--	--	--	--
Manganese	7439-96-5	--	--	--	--	--	--	--
Mercury	7439-97-6	--	--	--	--	--	--	--
Nickel	7440-02-0	--	--	--	--	--	--	-5.71E-01
Potassium	7440-09-7	--	--	--	--	--	--	--
Selenium	7782-49-2	--	--	--	--	--	--	2.39E-01
Silver	7440-22-4	--	--	--	--	--	--	--
Sodium	7440-23-5	--	--	--	--	--	--	--
Strontium	7440-24-6	--	--	--	--	--	--	--
Thallium	7440-28-0	--	--	--	--	--	--	--
Uranium	7440-61-1	--	--	--	--	--	--	--
Vanadium	7440-62-2	--	--	--	--	--	--	--
Zinc	7440-66-6	--	--	--	--	--	--	-4.71E-01
Radionuclides								
^{3}H	10028-17-8	--	--	--	--	--	--	--
^{234}U	13966-29-5	--	--	--	--	--	--	--
^{235}U+D	15117-96-1(+D)	--	--	--	--	--	--	--
^{238}U	7440-61-1(+D)	--	--	--	--	--	--	--

[a]Values obtained from TCEQ Risk Reduction Standards website updated March 30, 2004.
[b]Value derived from Work Plan Equation C10.
[c]The inverse log of value obtained from TCEQ Risk Reduction Standards website updated March 30, 2004.
[d]Value for total PCBs.
-- no data available

Table I-12. Toxicity Criteria for URV Calculations

COPC	CAS No.	RfD_o (mg/kg/day or pCi/g/day)	Ref[a]	RfC (mg/m^3)	Ref[a]	SF_o (kg-day/mg or g-day/pCi)	Ref[a]	URF_i $(mg/m^3)^{-1}$	Ref[a]	SF_{ex}	EPA Class	Ref[a]
Pesticides												
4,4'-DDE	72-55-9	--	--	--	--	3.40E-01	I	--	--	--	B2	I
4,4'-DDT	50-29-3	5.00E-4	I	--	--	3.40E-01	I	9.70E-05	I	--	B2	I
Aldrin	309-00-2	3.00E-05	I	--	--	1.70E+01	I	4.90E+00	I	--	B2	I
Alpha Endosulfan	959-98-8	2.00E-03	T	3.33E-05	ESL	--	--	--	--	--	NA	--
alpha-BHC	319-84-6	8.00E-03	A	--	--	6.30E+00	I	1.80E+00	I	--	B2	I
alpha-Chlordane	5103-71-9	5.00E-04	T	7.00E-04	RfC	3.50E-01	T	1.00E-01	T	--	B2	T
Beta Endosulfan	33213-65-9	6.00E-03	T	--	--	--	--	--	--	--	NA	--
beta-BHC	319-85-7	--	--	--	--	1.80E+00	I	5.30E-01	I	--	C	I
Chlordane (technical)	57-74-9	5.00E-04	T	7.00E-04	RfC	3.50E-01	T	1.00E-01	T	--	B2	T
delta-BHC	319-86-8	3.00E-04	T	--	--	1.80E+00	T	5.10E-01	T	--	B2	T
Dieldrin	60-57-1	5.00E-05	I	--	--	1.60E+01	I	4.60E+00	I	--	B2	I
Endosulfan sulfate	1031-07-8	6.00E-03	T	--	--	--	--	--	--	--	NA	--
Endrin	72-20-8	3.00E-04	I	1.00E-04	ESL	--	--	--	--	--	D	I
Endrin aldehyde	7421-93-4	3.00E-04	T	--	--	--	--	--	--	--	D	T
gamma-BHC (Lindane)	58-89-9	3.00E-04	I	5.00E-04	ESL	1.30E+00	H	--	--	--	B2	H
Heptachlor	76-44-8	5.00E-04	I	--	--	4.50E+00	I	1.30E+00	I	--	B2	I
Heptachlor epoxide	1024-57-3	1.30E-05	I	---	--	9.10E+00	I	2.60E+00	I	--	B2	I
Polychlorinated Biphenyls												
PCB-1248[b]	1336-36-3	2.00E-05	I			2.00E+00	I	5.70E-01	I	--	B2	I
PCB-1254[b]	1336-36-3	2.00E-05	I			2.00E+00	I	5.70E-01	I	--	B2	I
PCB-1260[b]	1336-36-3	2.00E-05	I			2.00E+00	I	5.70E-01	I	--	B2	I
High Explosives												
1,3,5-Trinitrobenzene	99-35-4	3.00E-02	I	--	--	--	--	--	--	--	NA	--
1,3-Dinitrobenzene	99-65-0	1.00E-04	I	1.00E-03	ESL	--	--	--	--	--	D	I
2,4,6-Trinitrotoluene	118-96-7	5.00E-04	I	1.00E-04	ESL	3.00E-02	I	--	--	--	C	I
2,4-Dinitrotoluene	121-14-2	2.00E-03	I	1.50E-04	ESL	6.80E-01	I (for mixed isomers)	--	--	--	B2	I

Table I-12. Toxicity Criteria for URV Calculations (continued)

COPC	CAS No.	RfD_o (mg/kg/day or pCi/g/day)	Ref[a]	RfC (mg/m^3)	Ref[a]	SF_o (kg-day/mg or g-day/pCi)	Ref[a]	URF_i $(mg/m^3)^{-1}$	Ref[a]	SF_{ex}	EPA Class	Ref[a]
2,6-Dinitrotoluene	606-20-2	1.00E-03	H	1.50E-04	ESL	6.80E-01	I (for mixed isomers)	--	--	--	B2	I
2-Amino-4,6-dinitrotoluene	35572-78-2	1.67E-04	T	1.00E-04	ESL	1.00E-02	T	--	--	--	NA	--
2-Nitrotoluene	88-72-2	1.00E-02	H	1.10E-02	ESL	--	--	--	--	--	NA	--
3-Nitrotoluene	99-08-1	1.00E-02	H	1.10E-02	ESL	--	--	--	--	--	NA	--
4-Amino-2,6-dinitrotoluene	19406-51-0	1.67E-04	T	1.00E-04	ESL	1.00E-02	T	--	--	--	NA	--
4-Nitrotoluene	99-99-0	1.00E-02	H	1.10E-02	ESL	--	--	--	--	--	NA	--
Cyclotetramethylene-tetranitramine (HMX)	2691-41-0	5.00E-02	I	2.70E-03	ESL	--	--	--	--	--	D	I
Cyclotrimethylene-trinitramine (RDX)	121-82-4	3.00E-03	I	5.00E-04	ESL	1.10E-01	I	--	--	--	C	I
Nitrobenzene	98-95-3	5.00E-04	I	5.00E-03	ESL	--	--	--	--	--	D	I
1,3,5-Triamino-2,4,6-trinitrobenzene	3058-38-6	3.00E-03	T	2.00E-03	ESL	3.00E-02	T	--	--	--	NA	--
Tetryl	479-45-8	1.00E-02	H	1.00E-04	ESL	--	--	--	--	--	NA	--
Semi-Volatile Organic Compounds												
2-Methylnaphthalene	91-57-6	4.00E-3	T	--	--	--	--	--	--	--	NA	--
4,6-Dinitro-2-methylphenol	534-52-1	2.00E-03	T	3.00E-04	ESL	--	--	--	--	--	NA	--
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	--	1.50E+01	T	3.30E+00	T	--	NA	--
4-Methylphenol	106-44-5	0.005	H	0.01	ESL	--	--	--	--	--	C	I
Acenaphthene	83-32-9	0.06	I	--	--	--	--	--	--	--	NA	--
Anthracene	120-12-7	3.00E-01	I	--	--	--	--	--	--	--	D	I
Benzo(a)anthracene	56-55-3	--	--	--	--	7.30E-01	EPA-93	8.80E-02	EPA-93	--	B2	I
Benzo(a)pyrene	50-32-8	--	--	--	--	7.30E+00	I	8.80E-01	N	--	B2	I
Benzo(b)fluoranthene	205-99-2	--	--	--	--	7.30E-01	EPA-93	8.80E-02	EPA-93	--	B2	I
Benzo(g,h,i)perylene	191-24-2	3.00E-02	T	--	--	--	--	--	--	--	D	I
Benzo(k)fluoranthene	207-08-9	--	--	--	--	7.30E-02	EPA-93	8.80E-03	EPA-93	--	B2	I
Benzyl alcohol	100-51-6	3.00E-01	H	5.00E-02	ESL	--	--	--	--	--	NA	--
bis(2-Ethylhexyl)phthalate	117-81-7	2.00E-02	I	--	--	1.40E-02	I	--	--	--	B2	I
Carbazole	86-74-8	--	--	--	--	2.00E-02	H	--	--	--	B2	H
Chlorocyclohexanol	1561-86-0	--	--	--	--	--	--	--	--	--	--	--

Chrysene	218-01-9	--	--	--	--	7.30E-03	EPA-93	8.80E-04	EPA-93	---	B2	I

Table I-12. Toxicity Criteria for URV Calculations (continued)

COPC	CAS No.	RfD_o (mg/kg/day or pCi/g/day)	Ref[a]	RfC (mg/m^3)	Ref[a]	SF_o (kg-day/mg or g-day/pCi)	Ref[a]	URF_i $(mg/m^3)^{-1}$	Ref[a]	SF_{ex}	EPA Class	Ref[a]
Cyclohexanone	108-94-1	5.00E+00	I	1.00E-01	ESL	--	--	--	--	--	NA	--
Cyclohexene	110-83-8	--	--	--	--	--	--	--	--	--	B2	--
Dibenz(a,h)anthracene	53-70-3	-	--	--	--	7.30E+00	EPA-93	8.80E-01	EPA-93	--	B2	I
Di-n-butyl phthalate	84-74-2	1.00E-01	I	5.00E-03	ESL	--	--	--	--	--	D	I
Di-n-octylphthalate	117-84-0	2.00E-02	H	--	--	--	--	--	--	--	NA	--
Fluoranthene	206-44-0	4.00E-02	I	--	--	--	--	--	--	--	D	I
Fluorene	86-73-7	4.00E-02	I	--	--	--	--	--	--	--	D	I
Indeno(1,2,3-c,d)pyrene	193-39-5	--	--	--	--	7.30E-01	EPA-93	8.80E-02	EPA-93	--	B2	I
Isophorone	78-59-1	2.00E-01	I	2.30E-02	ESL	9.50E-04	I	--	--	--	C	I
n-Nitrosodiphenylamine	86-30-6	--	--	--	--	4.90E-03	I	--	--	--	B2	I
Pentachlorophenol	87-86-5	0.03	I	0.0005	ESL	1.20E-01	I	--	--	--	B2	I
Phenanthrene	85-01-8	3.00E-02	T	--	--	--	--	--	--	--	D	I
Phenol (total)	108-95-2	3.00E-01	I	1.90E-02	ESL	--	--	--	--	--	D	I
Pyrene	129-00-0	3.00E-02	I	--	--	--	--	--	--	--	D	I
Volatile Organic Compounds												
1,1,2,2-Tetrachloroethane	79-34-5	4.00E-02	A	--	--	2.00E-01	I	5.80E-02	I	--	C	I
1,2,3-Trichloropropane	96-18-4	6.00E-03	I	6.00E-02	ESL	7.00E+00	H	--	--	--	B2	H
1,2-Dichloroethane	107-06-2	--	--	2.42E+00	A, RfC	9.10E-02	I	2.60E-02	I	--	B2	I
2-Hexanone	591-78-6	6.00E-02	T	4.00E-03	ESL	--	--	--	--	--	NA	--
Acetone	67-64-1	9.00E-01	I	5.90E-01	ESL	--	--	--	--	--	D	I
Chloroform	67-66-3	1.00E-02	I	9.75E-02	A, RfC	--	--	2.30E-02	I	--	B2	I
Dibromomethane	74-95-3	6.00E-02	T	1.32E-02	ESL	7.50E-03	T	--	--	--	NA	--
Dichlorodifluoromethane	75-71-8	2.00E-01	I	4.95E+00	ESL	--	--	--	--	--	NA	--
Methylene Chloride	75-09-2	6.00E-02	I	3.00E+00	H, RfC	7.50E-03	I	4.70E-04	I	--	B2	I
Nonanal	124-19-6	2.00E-01	T	--	---	--	--	--	--	--	NA	--
Tetrachloroethylene	127-18-4	1.00E-02	I	2.71E-01	A, RfC	5.20E-02	N	5.80E-04	N	--	B2	N
Tetrahydrofuran	109-99-9	2.00E-01	N	3.00E-01	N, RfC	7.60E-03	N	1.90E-03	N	--	C	N
Toluene	108-88-3	2.00E-01	I	4.00E-01	I, RfC	--	--	--	--	--	D	I

Trichloroethene	79-01-6	6.00E-03	N	--	---	1.10E-02	N	1.70E-03	N	--	B2	N

Table I-12. Toxicity Criteria for URV Calculations (continued)

COPC	CAS No.	RfD_o (mg/kg/day or pCi/g/day)	Ref[a]	RfC (mg/m^3)	Ref[a]	SF_o (kg-day/mg or g-day/pCi)	Ref[a]	URF_i $(mg/m^3)^{-1}$	Ref[a]	SF_{ex}	EPA Class	Ref[a]
Vinyl Chloride	75-01-4	3.00E-03	I	0.1	I, RfC	1.50E+00	I	8.80E-03	I		A	I
Xylenes (total)	1330-20-7	2.00E-01	I	1.00E-01	I, RfC	--	--	--	--	--	D	I
Miscellaneous												
Nitrate	14797-55-8	1.60E+00	I	--	--	--	--	--	--	--	NA	--
Perchlorate[d]	14797-73-0	7.00E-04	N	--	--	--	--	--	--	--	NA	--
Metals												
Antimony	7440-36-0	0.0004	I	0.0005	ESL	--	--	--	--	--	NA	--
Arsenic	7440-38-2	--	--	--	--	--	--	--	--	--	--	--
Barium	7440-39-3	7.00E-02	I	5.00E-04	ESL	--	--	--	--	--	D	I
Beryllium	7440-41-7	2.00E-03	I	2.00E-05	I, RfC	--	--	2.4	I	--	B1	I
Boron	7440-42-8	9.00E-02	I	2.00E-02	RfC	--	--	--	--	--	NA	--
Cadmium	7440-43-9	1.00E-03	I	--	--	--	--	1.80E+00	I	--	B1	I
Calcium	7440-70-2	--	--	--	--	--	--	--	--	--	--	--
Chromium (total)	7440-47-3	1.50E+00	I	1.00E-04	ESL	--	--	--	--	--	NA	--
Chromium (VI)	18540-29-9	3.00E-03	I	1.00E-04	RfC	--	--	1.20E+01	I	--	A	I
Cobalt	7440-48-4	6.00E-02	N	2.00E-05	ESL	--	--	--	--	--	NA	--
Copper	7440-50-8	4.00E-02	N	1.00E-03	ESL	--	--	--	--	--	D	I
Fluoride	7782-41-4	6.00E-02	I	2.00E-04	ESL	--	--	--	--	--	NA	--
Iron	7439-89-6	--	--	--	--	--	--	--	--	--	--	--
Lead	7439-92-1	--	--	--	--	--	--	--	--	--	--	--
Magnesium	7439-95-4	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	1.40E-01	I	5.00E-05	RfC	--	--	--	--	--	D	I
Mercury	7439-97-6	3.00E-04	I (for HgCl2)	3.00E-04	RfC	--	--	--	--	--	D	I
Nickel	7440-02-0	2.00E-02	I	9.00E-05	RfC	--	--	4.80E-01	I	--	A	I
Potassium	7440-09-7	--	--	--	--	--	--	--	--	--	--	--
Selenium	7782-49-2	0.005	I	2.00E-04	ESL	--	--	--	--	--	D	I
Silver	7440-22-4	5.00E-03	I	1.00E-05	ESL	--	--	--	--	--	D	I

Table I-12. Toxicity Criteria for URV Calculations (continued)

COPC	CAS No.	RfD_o (mg/kg/day or pCi/g/day)	Ref[a]	RfC (mg/m^3)	Ref[a]	SF_o (kg-day/mg or g-day/pCi)	Ref[a]	URF_i $(mg/m^3)^{-1}$	Ref[a]	SF_{ex}	EPA Class	Ref[a]
Sodium	7440-23-5	--	--	--	--	--	--	--	--	--	--	--
Strontium	7440-24-6	6.00E-01	I	--	--	--	--	--	--	--	NA	--
Thallium[c]	7791-12-0	8.00E-05	I	1.00E-04	ESL	--	--	--	--	--	D	I
Uranium, total	7440-61-1	3.00E-03	I	3.00E-04	RfC	--	--	--	--	--	NA	--
Vanadium	7440-62-2	7.00E-03	H	5.00E-05	ESL	--	--	--	--	--	NA	--
Zinc	7440-66-6	3.00E-01	I	--	--	--	--	--	--	--	D	I
Radionuclides												
^{3}H	10028-17-8	NAP	H	NAP	H	9.25E-14	H	5.62E-14	H	--	B2	I
^{234}U	13966-29-5	NAP	H	NAP	H	1.58E-10(soil) 7.07E-11(water)	H	1.14E-08	H	2.52E-10	B2	I
^{235}U	15117-96-1(+D)	NAP	H	NAP	H	1.63E-10(soil) 7.18E-11(water)	H	1.08E-08	H	5.43E-07	B2	I
^{238}U+D	7440-61-1(+D)	NAP	H	NAP	H	2.10E-10	H	9.35E-09	H	1.14E-07	B2	I

[a]Reference (Ref): A = ATSDR MRL, January, 2003; CU = Cornell University Pesticide Management Education Program; EPA-OP = EPA Office of Pesticide Programs; H = HEAST, July, 1997; I = IRIS, as of March 27, 2003; N = NCEA; OEHHA = Cal/EPA Office of Environmental Health; ESL = Effects Screening Level; T = Derived by TCEQ.

[b]Total PCBs were assumed.

[c]Thallium CAS in Pantex Plant datasets is 7440-28-0 and not TCEQ 7791-61-1 CAS for thallium chloride. For risk calculation thallium chloride values are used.

[d]Perchlorate wvalue from March 2005 TCEQ tox/chem./phys tables.

RfD_o - Oral Reference Dose

RfC - Inhalation Reference Concentration

SF_o - Oral Cancer Slope Factor

URF_i - Inhalation Unit Risk Factor used for chemicals; for radionuclides SFi (inhalation slope factors) are used.

SF_{ex} – External Cancer Slope Factor

-- no data available

Appendix J

Selected Remedy Cost Tables

Existing Perched Groundwater Pump & Treat System
Playa 1 Pump & Treat System
Southeast In Situ Bioremediation System
Zone 11 In Situ Bioremediation System
Long-Term Groundwater Monitoring Network & Institutional Controls

RELEASE OF INFORMATION TO THE PUBLIC DOCUMENTED REVIEW PROCESS

(Ref. WI 02.02.04.06.01)

Document Title CMS / FS September 2007 Date 10/9/07

Document Author M. Amos (w/ SAIC, et al) Type of Doc Report

Document Due Date 10/9/07 Blanket Release Expires

This review must be completed prior to release of information, in any form, to public domain.

Activity (Review) Mail Drop	Responsible Officer/Reviewer	Release Decision	Reviewer Signature	Date
Division Concurrence	Division Manager or Designee	Release Approved Yes ☑ No ☐	Martin Amos for DE Huddleston	10/9/07
Classification Review 12-5 CLS Office	Classification Office	Yes ☑ No ☐	Don Bender	10-9-07
UCNI Review 12-5 CLS Office		Yes ☑ No ☐		
ECI Review 12-5 ECC Office	Export Control Compliance Office	Yes ☑ No ☐	Don Bender	10-9-07
Critical Tech. Review 12-5 ECC Office		Yes ☑ No ☐		
OPSEC/OUO Review 12-5 OPSEC	OPSEC	Yes ☑ No ☐	George C Withers	10-10-07
Legal 12-72 Legal	Legal	Yes ☑ No ☐	[illegible]	10/10/07
Work is within Scope of M&O Contract		Yes ☑ No ☐		
Final Approval for Release 12-36 NNSA S&S	NNSA/PXSO	Yes ☑ No ☐	Brenda Swindell	10/10/07

After all signatures are obtained, forward copy via email or plant mail to the Classification Office.

Comments: Document text revised to reflect remedial action objectives and add Zone 11 Corrective measure analysis to section 9. No major content changes from May 2007 version. (See attached PX-2209).

#6458

Call Marlon Smith (x4058) or Martin Amos after signature

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J.0 SELECTED REMEDY COST TABLES

Table J-1. Summarized Cost for Selected Remedy Components

	Capital Cost		Periodic and O&M Cost
	Completed	**Remaining**	**(Discounted)**
Existing Perched Groundwater Pump & Treat System Expansion	$1,850,000	$0	$25,200,599
Playa 1 Perched Groundwater Pump & Treat System	$4,420,000	$4,990,920	$22,177,352
Southeast *In-Situ* Bioremediation System	$6,672,500	$0	$36,272,861
Zone 11 *In-Situ* Bioremediation System	$0	$3,610,800	$26,154,781
Long-Term Groundwater Monitoring Network and Institutional Controls	$0	$2,139,000	$14,745,303
Total	**$12,942,500**	**$10,740,720**	**$124,550,897**

Present Value =	**$148,234,117**

Table J-2. Existing Pump & Treat System

Description		Quantity	Unit	Unit Cost	Cost
Capital Cost					
Completed					
Extraction Wells		15	each	$70,000	$1,050,000
Conveyance Piping		5000	ft	$60	$300,000
Pumps and Wellhead Controls		15	each	$15,000	$225,000
Communication Lines		5000	ft	$30	$150,000
Electric Lines		5000	ft	$25	$125,000
Subtotal for Completed Work					$1,850,000
Remaining					$0
Total Capital Cost					$1,850,000
Periodic Cost					
5-Year Review		320	hr	$100	$32,000
Contingency (10%)					$3,200
Total Periodic Cost					$35,200
O&M Cost					
	Labor	7040	hr	$100	$704,000
	Replacement Parts Allowance	1	LS	$100,000	$100,000
	GAC regeneration	2	ea	$30,000	$60,000
	Ion Exchange Resin Regeneration (Cr-6)	2	ea	$50,000	$100,000
	Ion Exchange Resin Regeneration (B)	2	ea	$50,000	$100,000
Total O&M Cost					$1,064,000
Present Value Cost					
Year	**Capital Cost Remaining**	**Periodic Cost**	**Annual O&M Cost**	**Discount Factor**	**Present Value**
0	$0	$0	$1,064,000	1	$1,064,000
1	$0	$0	$1,064,000	0.9897	$1,053,090
2	$0	$0	$1,064,000	0.9796	$1,042,347
3	$0	$0	$1,064,000	0.9697	$1,031,769

Table J-2. Existing Pump & Treat System, continued

Description		Quantity	Unit	Unit Cost	Cost
4	$0	$35,200	$1,064,000	0.9599	$1,055,141
5	$0	$0	$934,000	0.9503	$887,557
6	$0	$0	$934,000	0.9408	$878,688
7	$0	$0	$934,000	0.9314	$869,952
8	$0	$0	$934,000	0.9222	$861,348
9	$0	$35,200	$934,000	0.9131	$885,016
10	$0	$0	$934,000	0.9042	$844,526
11	$0	$0	$934,000	0.8954	$836,302
12	$0	$0	$934,000	0.8867	$828,201
13	$0	$0	$934,000	0.8782	$820,219
14	$0	$35,200	$934,000	0.8698	$842,971
15	$0	$0	$934,000	0.8615	$804,608
16	$0	$0	$934,000	0.8533	$796,974
17	$0	$0	$934,000	0.8452	$789,452
18	$0	$0	$934,000	0.8373	$782,039
19	$0	$35,200	$934,000	0.8295	$803,931
20	$0	$0	$934,000	0.8218	$767,534
21	$0	$0	$934,000	0.8142	$760,439
22	$0	$0	$934,000	0.8067	$753,446
23	$0	$0	$934,000	0.7993	$746,553
24	$0	$35,200	$934,000	0.7920	$767,638
25	$0	$0	$934,000	0.7849	$733,061
26	$0	$0	$934,000	0.7778	$726,458
27	$0	$0	$934,000	0.7708	$719,949
28	$0	$0	$934,000	0.7640	$713,532
29	$0	$35,200	$934,000	0.7572	$733,858
Total	**$0**	**$211,200**	**$28,670,000**		**$25,200,599**

Table J-3. Playa 1 Pump & Treat System

Description	Quantity	Unit	Unit Cost	Cost
Capital Cost				
Completed				
Work Plans and Authorizations	1	LS	$180,000	$180,000
Contractor Equipment and Field Office Mobilization	1	LS	$300,000	$300,000
Extraction Wells (installation & development)	10	each	$190,000	$1,900,000
Field Testing	10	each	$30,000	$300,000
Access Road	1	LS	$190,000	$190,000
Site Preparation/Grading	10,000	sq ft	$30	$300,000
Foundation	5000	sq ft	$110	$550,000
Fence	1000	ft	$50	$50,000
Phone Line	5000	ft	$30	$150,000
Pre-Fabricated Building	2500	sq ft	$200	$500,000
Subtotal of Capital Cost for Completed Work				$4,420,000
Remaining				
Pre-Fabricated Building (including fire protections system)	2500	sq ft	$200	$500,000
Ancillary Equipment (pumps, valves, etc) w/ Installation	1	LS	$500,000	$500,000
Electrical Equipment and Lines	1	LS	$560,000	$560,000
Treatment Units (GAC & Ion Exchange)	6	units	$175,000	$1,050,000
Process Controls and Sensors	1	LS	$300,000	$300,000
Conveyance Line from Extraction Wells to Building	5000	ft	$175	$875,000
Water Supply Line	6000	ft	$100	$600,000
System Startup	1	LS	$102,000	$102,000
Site Restoration/Project Closeout	1	LS	$50,000	$50,000
Reporting/O&M Plan	1	LS	$200	$200
Subtotal of Capital Cost for Remaining Work				$4,537,200
Contingency (10%)				$453,720
Total Capital Cost				$9,410,920

Table J-3. Playa 1 Pump & Treat System, continued

Description	Quantity	Unit	Unit Cost	Cost
Periodic Cost				
5-Year Review	320	hr	$100	$32,000
Contingency (10%)				$3,200
Total Periodic Cost				$35,200
O&M Cost				
Labor	5280	hr	$100	$528,000
Replacement Parts Allowance	1	LS	$100,000	$100,000
GAC regeneration	2	ea	$30,000	$60,000
Ion Exchange Resin Regeneration (Cr-6)	2	ea	$50,000	$100,000
Ion Exchange Resin Regeneration (B)	2	ea	$50,000	$100,000
Total O&M Cost				$888,000

Present Value Cost

Year	Capital Cost Remaining	Periodic Cost	Annual O&M Cost	Discount Factor at 3.1%	Present Value
0	$4,873,720	$0	$0	1	$4,873,720
1	$0	$0	$888,000	0.9897	$878,895
2	$0	$0	$888,000	0.9796	$869,929
3	$0	$0	$888,000	0.9697	$861,100
4	$0	$35,200	$888,000	0.9599	$852,406
5	$0	$0	$888,000	0.9503	$843,844
6	$0	$0	$888,000	0.9408	$835,412
7	$0	$0	$888,000	0.9314	$827,107
8	$0	$0	$888,000	0.9222	$818,927
9	$0	$35,200	$888,000	0.9131	$810,869
10	$0	$0	$888,000	0.9042	$802,932
11	$0	$0	$888,000	0.8954	$795,114
12	$0	$0	$888,000	0.8867	$787,411
13	$0	$0	$888,000	0.8782	$779,823

Table J-3. Playa 1 Pump & Treat System, continued

Description		Quantity	Unit	Unit Cost	Cost
14	$0	$35,200	$888,000	0.8698	$772,347
15	$0	$0	$888,000	0.8615	$764,981
16	$0	$0	$888,000	0.8533	$757,723
17	$0	$0	$888,000	0.8452	$750,571
18	$0	$0	$888,000	0.8373	$743,523
19	$0	$35,200	$888,000	0.8295	$736,578
20	$0	$0	$888,000	0.8218	$729,733
21	$0	$0	$888,000	0.8142	$722,987
22	$0	$0	$888,000	0.8067	$716,338
23	$0	$0	$888,000	0.7993	$709,785
24	$0	$35,200	$888,000	0.7920	$703,325
25	$0	$0	$888,000	0.7849	$696,957
26	$0	$0	$888,000	0.7778	$690,680
27	$0	$0	$888,000	0.7708	$684,491
28	$0	$0	$888,000	0.7640	$678,390
29	$0	$35,200	$888,000	0.7572	$672,375
Total	**$4,873,720**	**$211,200**	**$25,752,000**		**$27,168,272**

Table J-4. Southeast *In-Situ* Bioremediation

Description	Quantity	Unit	Unit Cost	Cost
Completed				
Work Plans and Authorizations	1	LS	$69,000	$69,000
Contractor Equipment and Field Office Mobilization	1	LS	$118,000	$118,000
Exploratory Wells (installation by air rotary & development)	10	each	$56,000	$560,000
Injection Wells (installation by mud rotary, development, baseline) sampling)	42	each	$53,000	$2,226,000
Access Road	1	LS	$108,000	$108,000
Electrical Lines	1	LS	$101,000	$101,000
Water Supply Line	1500	ft	$95	$142,500
Portable Storage Tanks and Injection Trailer	1	LS	$1,140,000	$1,140,000
Amendment	42	wells	$29,000	$1,218,000
Amendment Injection	42	wells	$21,000	$882,000
Site Restoration/Project Closeout	1	LS	$68,000	$68,000
Reporting/O&M Plan	1	LS	$40,000	$40,000
Subtotal of Capital Cost for Completed Work				$6,672,500
Remaining				$0
Total Capital Cost				$6,672,500
Periodic Cost				
5-Year Review	160	hr	100	$16,000
Contingency (10%)				$1,600
Total Periodic Cost				$17,600
O&M Costs				
Labor	5120	hr	$100	$512,000
Amendment	42	wells	$29,000	$1,218,000
Amendment Injection	42	wells	$21,000	$882,000
Total O&M Cost				$2,612,000

Table J-4. Southeast *In-Situ* Bioremediation, continued

Description		Quantity	Unit	Unit Cost	Cost
Present Value Cost					
Year	**Capital Cost Remaining**	**Periodic Cost**	**Annual O&M Cost**	**Discount Factor at 3.1%**	**Present Value**
0	$0	$0	$0	1	$0
1	$0	$0	$2,612,000	0.9897	$2,585,217
2	$0	$0	$2,612,000	0.9796	$2,558,845
3	$0	$0	$2,612,000	0.9697	$2,532,876
4	$0	$17,600	$2,612,000	0.9599	$2,524,197
5	$0	$0	$2,612,000	0.9503	$2,482,118
6	$0	$0	$1,306,000	0.9408	$1,228,657
7	$0	$0	$1,306,000	0.9314	$1,216,443
8	$0	$0	$1,306,000	0.9222	$1,204,412
9	$0	$17,600	$1,306,000	0.9131	$1,208,633
10	$0	$0	$1,306,000	0.9042	$1,180,889
11	$0	$0	$1,306,000	0.8954	$1,169,390
12	$0	$0	$1,306,000	0.8867	$1,158,062
13	$0	$0	$1,306,000	0.8782	$1,146,902
14	$0	$17,600	$1,306,000	0.8698	$1,151,214
15	$0	$0	$1,306,000	0.8615	$1,125,073
16	$0	$0	$1,044,800	0.8533	$891,519
17	$0	$0	$1,044,800	0.8452	$883,104
18	$0	$0	$1,044,800	0.8373	$874,812
19	$0	$17,600	$1,044,800	0.8295	$881,239
20	$0	$0	$1,044,800	0.8218	$858,587
21	$0	$0	$1,044,800	0.8142	$850,650
22	$0	$0	$1,044,800	0.8067	$842,827
23	$0	$0	$1,044,800	0.7993	$835,116

Table J-4. Southeast *In-Situ* Bioremediation, continued

Description		Quantity	Unit	Unit Cost	Cost
24	$0	$17,600	$1,044,800	0.7920	$841,455
25	$0	$0	$1,044,800	0.7849	$820,024
26	$0	$0	$1,044,800	0.7778	$812,638
27	$0	$0	$1,044,800	0.7708	$805,357
28	$0	$0	$1,044,800	0.7640	$798,178
29	$0	$17,600	$1,044,800	0.7572	$804,427
Total	**$0**	**$105,600**	**$40,747,200**		**$36,272,861**

Table J-5. Zone 11 *In-Situ* Bioremediation

Description	Quantity	Unit	Unit Cost	Cost
Completed				$0
Remaining				
Work Plans and Authorizations	1	LS	$125,000	$125,000
Field Testing	1	LS	$186,000	$186,000
Contractor Equipment and Field Office Mobilization	1	LS	$118,000	$118,000
Injection Wells (installation by air rotary & development)	10	each	$56,000	$560,000
Access Road	1	LS	$72,000	$72,000
Electrical Lines	1	LS	$198,000	$198,000
Conveyance Line and Vaults	1000	ft	$400	$400,000
Water Supply Line	800	ft	$95	$76,000
Portable Storage Tanks and Injection Trailer	1	LS	$0	$0
Amendment	10	wells	$80,000	$800,000
Amendment Injection	10	wells	$30,000	$300,000
Site Restoration/Project Closeout	1	LS	$68,000	$68,000
Reporting/O&M Plan	1	LS	$106,000	$106,000
Subtotal Capital Cost				$3,009,000
Contingency (20%)				$601,800
Total Capital Cost				$3,610,800
Periodic Cost				
5-Year Review	240	hr	$100	$24,000
Contingency (20%)				$4,800
Total Period Cost				$28,800
O&M Cost				
Labor	3840	hr	$100	$384,000
Amendment	10	wells	$80,000	$800,000
Injection Equipment/Supplies	1	LS	$50,000	$50,000
Total O&M Cost				$1,234,000

Table J-5. Zone 11 *In-Situ* Bioremediation, continued					
Description		Quantity	Unit	Unit Cost	Cost
Present Value Cost					
Year	**Capital Cost Remaining**	**Periodic Cost**	**Annual O&M Cost**	**Discount Factor at 3.1%**	**Present Value**
0	$3,610,800	$0	$0	1	$3,610,800
1	$0	$0	$1,234,000	0.9897	$1,221,347
2	$0	$0	$1,234,000	0.9796	$1,208,888
3	$0	$0	$1,234,000	0.9697	$1,196,619
4	$0	$28,800	$1,234,000	0.9599	$1,184,537
5	$0	$0	$1,234,000	0.9503	$1,172,639
6	$0	$0	$1,234,000	0.9408	$1,160,921
7	$0	$0	$1,234,000	0.9314	$1,149,380
8	$0	$0	$1,234,000	0.9222	$1,138,013
9	$0	$28,800	$1,234,000	0.9131	$1,126,816
10	$0	$0	$1,234,000	0.9042	$1,115,787
11	$0	$0	$925,500	0.8954	$828,691
12	$0	$0	$925,500	0.8867	$820,664
13	$0	$0	$925,500	0.8782	$812,755
14	$0	$28,800	$925,500	0.8698	$804,963
15	$0	$0	$925,500	0.8615	$797,286
16	$0	$0	$925,500	0.8533	$789,721
17	$0	$0	$925,500	0.8452	$782,267
18	$0	$0	$925,500	0.8373	$774,922
19	$0	$28,800	$925,500	0.8295	$767,683
20	$0	$0	$925,500	0.8218	$760,549
21	$0	$0	$925,500	0.8142	$753,519
22	$0	$0	$925,500	0.8067	$746,589
23	$0	$0	$925,500	0.7993	$739,759
24	$0	$28,800	$925,500	0.7920	$733,026

Table J-5. Zone 11 *In-Situ* Bioremediation, continued					
Description		**Quantity**	**Unit**	**Unit Cost**	**Cost**
25	$0	$0	$925,500	0.7849	$726,390
26	$0	$0	$925,500	0.7778	$719,847
27	$0	$0	$925,500	0.7708	$713,397
28	$0	$0	$925,500	0.7640	$707,039
29	$0	$28,800	$925,500	0.7572	$700,769
Total	**$3,610,800**	**$172,800**	**$29,924,500**		**$29,765,581**

Table J-6. Long-Term Groundwater Monitoring Network & Institutional Controls

Description	Quantity	Unit	Unit Cost	Cost
Completed				$0
Remaining				
Work Plans and Authorizations	1	LS	$80,000	$80,000
Contractor Equipment Mobilization	1	LS	$100,000	$100,000
Perched Monitoring Wells	7	each	$45,000	$315,000
Ogallala Monitoring Wells	9	wells	$135,000	$1,215,000
Project Closeout	1	LS	$50,000	$50,000
Surveying	1	LS	$25,000	$25,000
Preparing and Recording Deed Restrictions	1	LS	$15,000	$15,000
Reporting	1	LS	$60,000	$60,000
Subtotal Capital Cost				$1,860,000
Contingency (15%)				$279,000
Total Capital Cost				$2,139,000
Periodic Cost				
5-Year Review	320	hr	$100	$32,000
Contingency (15%)				$4,800
Totatl Periodic Cost				$36,800
O&M Cost				
Labor	3840	hr	$75	$288,000

Table J-6. Long-Term Groundwater Monitoring Network & Institutional Controls, continued

Description	Quantity	Unit	Unit Cost	Cost
Sampling Supplies/Equipment	1	LS	$35,000	$35,000
Sampling and Analysis	288	samples	$600	$172,800
Data Management	1728	hr	$100	$172,800
Reporting	640	hr	$100	$64,000
Total O&M Cost				$732,600

Present Value Cost

Year	Capital Cost Remaining	Periodic Cost	Annual O&M Cost	Discount Factor at 3.1%	Present Value
0	$2,139,000	$0	$0	1	$2,139,000
1	$0	$0	$732,600	0.9897	$725,088
2	$0	$0	$732,600	0.9796	$717,691
3	$0	$0	$732,600	0.9697	$710,408
4	$0	$36,800	$732,600	0.9599	$738,560
5	$0	$0	$732,600	0.9503	$696,171
6	$0	$0	$732,600	0.9408	$689,215
7	$0	$0	$732,600	0.9314	$682,363
8	$0	$0	$732,600	0.9222	$675,614
9	$0	$36,800	$732,600	0.9131	$702,571
10	$0	$0	$732,600	0.9042	$662,419
11	$0	$0	$549,450	0.8954	$491,977
12	$0	$0	$549,450	0.8867	$487,211
13	$0	$0	$549,450	0.8782	$482,516
14	$0	$36,800	$549,450	0.8698	$509,897
15	$0	$0	$549,450	0.8615	$473,332
16	$0	$0	$549,450	0.8533	$468,841
17	$0	$0	$549,450	0.8452	$464,416
18	$0	$0	$549,450	0.8373	$460,055
19	$0	$36,800	$549,450	0.8295	$486,282

Table J-6. Long-Term Groundwater Monitoring Network & Institutional Controls, continued					
Description		**Quantity**	**Unit**	**Unit Cost**	**Cost**
20	$0	$0	$549,450	0.8218	$451,522
21	$0	$0	$412,088	0.8142	$335,511
22	$0	$0	$412,088	0.8067	$332,426
23	$0	$0	$412,088	0.7993	$329,384
24	$0	$36,800	$412,088	0.7920	$355,534
25	$0	$0	$412,088	0.7849	$323,432
26	$0	$0	$412,088	0.7778	$320,519
27	$0	$0	$412,088	0.7708	$317,647
28	$0	$0	$412,088	0.7640	$314,816
29	$0	$36,800	$412,088	0.7572	$339,888
Total	**$2,139,000**	**$220,800**	**$16,529,288**		**$16,884,303**