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This exposure period lasts for 5 years. At the recommendation of the USEPA, we are using a value of 5800 cm^2 for the dermal exposure. This approximates the 95th percentile for the exposure of 25 percent of the body surface area.

(5) Adult Resident. These receptors spend each day at the site (7 days/week for 50 weeks, RME). This exposure period lasts for 30 years. At the recommendation of the USEPA, we are using a value of 5800 cm^2 for the dermal exposure. This approximates the 95th percentile for the exposure of 25 percent of the body surface area.

Table C-22. Exposure Parameters

Exposure Scenario	Industrial Worker	Utility/ Grounds Maintenance Worker	Construction Worker	Training Soldier	Adult Resident
Dermal Contact Rate*	**5800 squared centimeters (cm^2)	**5800 cm^2	**5800 cm^2	**5800 cm^2	**5800 cm^2
Dermal Exposure Frequency*	250 days per year (days/year)	250 days/year	250 days/year	14 days/year	350 days/year
Ingestion Rate***	50 mg/day	480 mg/day	480 mg/day	480 mg/day	50 mg/day
Inhalation Rate*	20 cubic meters per day (m^3/day)	20 m^3/day	20 m^3/day	20 m^3/day	20 m^3/day
Exposure*	250 days	125 days	190 days	350 days	350 days
Duration*	25 years	25 years	1 year	5 years	30 years
Body Weight*	70 kilograms (kg)	70 kg	70 kg	70 kg	70 kg
Lifetime*	25550 days	25550 days	25550 days	25550 days	25550 days
Adherence factor*	0.043 milligrams per squared centimeters (mg/cm^2) based on greenhouse workers hands	0.27 mg/cm^2 based on utility workers hands	0.24 mg/cm^2 based on construction workers hands	0.24 mg/cm^2 based on construction workers hands	0.20 mg/cm^2 based on gardener hands

Notes:
*USEPA Exposure Factors Handbook (USEPA, 1997).
** This represents 25 percent of the total body skin surface area.
*** Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 1996) (see http://www.epa.gov/superfund/health/conmedia/soil/index.htm)

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g. Incidental Ingestion of Soil.

(1) The equation for intake is as follows:

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Where:

CS	=	Chemical Concentration in Soil (mg/kg soil)
IR	=	Ingestion Rate (mg soil/day)
CF	=	Conversion Factor (1 kg/10^6 mg)
FI	=	Fraction Ingested from Contaminated Source (unitless)(1)
EF	=	Exposure Frequency (days/years)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

(2) Table C-23 shows the results of these calculations for the ingestion intake for the Phase I sampling. Table C-24 shows the results of these calculations for the ingestion intake for the Phase II sampling. Table C-25 shows the results of these calculations for the ingestion intake for the Phase IIB sampling.

h. Dermal Contact With Soils.

(1) The same receptors considered to have the potential to ingest soil may also dermally contact the same soils. The equation for the absorbed dose from dermal exposure is as follows based on USEPA guidance (USEPA, 2004a).

$$\text{Intake (mg/kg/day)} = \frac{CS \times EF \times ED \times SA \times AF \times ABS}{BW \times AT}$$

Where:

CS	=	Chemical concentration in soil (mg/kg)
SA	=	Exposed skin surface area (cm^2)
AF	=	Adherence Factor (mg/cm^2)
ABS	=	Skin Absorption coefficient (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Bodyweight (kg)
AT	=	Averaging Time (days)

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(2) Table C-26 shows the results of the calculations for dermal absorbed dose for Phase I data. Table C-27 shows the results of the calculations for dermal absorbed dose for Phase II data. Table C-28 shows the results of the calculations for dermal absorbed dose for Phase IIB data.

(3) Dermal exposure involves several unique exposure factors briefly discussed here. Specifically, the dermal exposure calculation considers the amount of exposed skin, the amount of soil which adheres to the skin, and the degree to which a chemical may be absorbed through the skin. The surface area of exposed skin depends on the size of an individual, clothing worn, and the specific parts of the body which may directly contact the medium of concern (for example, soil).

Table C-23. Chemical Intakes for Ingestion Route by Receptor for Phase I Data (all values are in mg/kg-day)

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Subsurface Soil											
Ingestion		NA	NA							NA	NA
	EPC(mg/kg)										
Naphthalene	0.54222			5.1E-07	7.3E-09	5.1E-07	5.1E-09	7.1E-08	1.8E-07		
Tetrachloroethene	1.30199			1.2E-06	1.8E-08	1.2E-06	1.2E-08	1.7E-07	4.4E-07		
4,4'-DDD	0.77282			7.3E-07	1.0E-08	7.3E-07	7.3E-09	1.0E-07	2.6E-07		
4,4'-DDT	0.26209			2.5E-07	3.5E-09	2.5E-07	2.5E-09	3.5E-08	8.8E-08		
alpha-BHC	0.44587			4.2E-07	6.0E-09	4.2E-07	4.2E-09	5.9E-08	1.5E-07		
delta-BHC	0.5155			4.8E-07	6.9E-09	4.8E-07	4.8E-09	6.8E-08	1.7E-07		
gamma-BHC (lindane)	12.97604			1.2E-05	1.7E-07	1.2E-05	1.2E-07	1.7E-06	4.4E-06		

Table C-24. Chemical Intakes for Ingestion Route by Receptor for Phase II Data (all values are in mg/kg-day)

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Ingestion											
	EPC(mg/kg)										
4,4 DDD	0.588	2.9E-07	1.0E-07	1.4E-06	4.9E-07	2.1E-06	3.0E-08	1.9E-06	1.4E-07	4.0E-07	1.7E-07
4,4 DDE	0.588	2.9E-07	1.0E-07	1.4E-06	4.9E-07	2.1E-06	3.0E-08	1.9E-06	1.4E-07	4.0E-07	1.7E-07
4,4 DDT	10.3	5.0E-06	1.8E-06	2.4E-05	8.6E-05	3.7E-05	5.2E-07	3.4E-05	2.4E-06	7.0E-06	3.0E-06
alpha-BHC	0.0486	2.4E-08	8.5E-09	1.1E-07	4.1E-08	1.7E-07	2.5E-09	1.6E-07	1.1E-08	3.3E-08	1.4E-08
delta-BHC	0.0506	2.5E-08	8.9E-09	1.2E-07	4.3E-08	1.8E-07	2.6E-09	1.7E-07	1.2E-08	3.5E-08	1.5E-08
Dieldrin	0.0583	2.9E-08	1.0E-08	1.4E-07	4.9E-08	2.1E-07	3.0E-09	1.9E-07	1.4E-08	4.0E-08	1.7E-08
gamma-BHC (lindane)	1.57	7.7E-07	2.7E-07	3.7E-06	1.3E-06	5.6E-06	8.0E-08	5.2E-06	3.7E-07	1.1E-06	4.6E-07
Tetrachloroethene	3.51	1.7E-06	6.1E-07	8.2E-05	2.9E-06	1.3E-05	1.8E-07	1.2E-05	8.2E-07	2.4E-06	1.0E-06
Benzo(a)pyrene	0.0144	7.0E-09	2.5E-09	3.4E-08	1.2E-08	5.1E-08	7.3E-10	4.7E-08	3.4E-09	9.8E-09	4.2E-09

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Subsurface Soil											
Ingestion		NA	NA							NA	NA
	EPC(mg/kg)										
I-TEQ(ND=0)	7.13E-07			6.7E-13	2.4E-13	6.7E-13	9.6E-15	9.4E-14	6.7E-15		
4,4'-DDT	2.77			2.6E-06	9.3E-07	2.6E-06	3.7E-08	3.6E-07	2.6E-08		
alpha-BHC	0.0254			2.4E-08	8.6E-09	2.4E-08	3.4E-10	3.4E-09	2.4E-10		
delta-BHC	0.0367			3.5E-08	1.2E-08	3.5E-08	4.9E-10	4.8E-09	3.5E-10		
Dieldrin	0.0193			1.8E-08	6.5E-09	1.8E-08	2.6E-10	2.5E-09	1.8E-10		
gamma-BHC (lindane)	0.487			4.6E-07	1.6E-07	4.6E-07	6.5E-09	6.4E-08	4.6E-09		

Table C-25. Chemical Intakes for Ingestion Route by Receptor for the Phase IIB Data (all values are in mg/kg-day)

Table C-25 Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Ingestion											
	EPC(mg/kg)										
Arsenic	55.42	2.7E-05	9.7E-06	1.3E-04	4.7E-05	2.0E-04	2.8E-06	1.8E-04	1.3E-05	3.8E-05	1.6E-05
Subsurface Soil											
Ingestion		NA	NA							NA	NA
	EPC(mg/kg)										
4,4 DDD	0.740			7.0E-07	2.5E-07	7.0E-07	9.9E-09	9.7E-08	7.0E-09		
4,4'-DDT	3.08			2.9E-06	1.0E-06	2.9E-06	4.1E-08	4.1E-07	2.9E-08		
Arsenic	10.76			1.0E-05	3.6E-06	1.0E-05	1.4E-07	1.4E-06	1.0E-06		

Table C-26. Chemical Intake Results for the Dermal Route by Receptor for Phase I Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Subsurface Soil											
	EPC(mg/kg)										
Dermal		NA	NA							NA	NA

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Naphthalene	0.54222			2.2E-07	2.7E-09	1.9E-07	3.8E-09	5.4E-08	7.7E-08		
Tetrachloroethene	1.30199			1.9E-07	2.4E-09	1.7E-07	3.4E-09	4.8E-08	6.8E-08		
4,4'-DDD	0.77282			2.4E-07	3.0E-09	2.1E-07	4.2E-09	5.9E-08	8.5E-08		
4,4'-DDT	0.26209			2.4E-08	3.1E-10	2.1E-08	4.3E-10	6.0E-09	8.6E-09		
alpha-BHC	0.44587			1.4E-07	1.7E-09	1.2E-07	2.4E-09	3.4E-08	4.9E-08		
delta-BHC	0.5155			1.6E-07	2.0E-09	1.4E-07	2.8E-09	3.9E-08	5.6E-08		
gamma-BHC (lindane)	12.97604			1.6E-06	2.0E-08	1.4E-06	2.8E-08	4.0E-07	5.7E-07		

Table C-27. Chemical Intake Results for the Dermal Route by Receptor for Phase II Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Dermal											
	EPC(mg/kg)										
4,4 DDD	0.588	1.4E-07	5.1E-08	4.5E-07	1.6E-07	6.1E-07	8.7E-09	1.1E-06	8.0E-08	9.3E-07	4.0E-07
4,4 DDE	0.588	1.4E-07	5.1E-08	4.5E-07	1.6E-07	6.1E-07	8.7E-09	1.1E-06	8.0E-08	9.3E-07	4.0E-07
4,4 DDT	10.3	7.5E-07	2.7E-07	2.4E-06	8.4E-06	3.2E-06	4.6E-08	5.9E-06	4.2E-07	1.6E-05	7.0E-06
alpha-BHC	0.0486	1.2E-08	4.2E-08	3.7E-08	1.3E-08	5.0E-08	7.2E-10	9.3E-08	6.6E-09	7.7E-08	3.3E-08
delta-BHC	0.0506	1.2E-08	4.4E-09	3.9E-08	1.4E-08	5.2E-08	7.5E-10	9.7E-08	6.9E-09	8.0E-08	3.5E-08
Dieldrin	0.0583	1.4E-08	5.1E-09	4.5E-08	1.6E-08	6.0E-08	8.6E-10	1.1E-07	7.9E-09	9.3E-08	4.0E-08
gamma-BHC (lindane)	1.57	1.5E-07	5.5E-08	4.8E-07	1.7E-07	6.5E-07	9.3E-09	1.2E-06	8.6E-08	2.5E-06	1.1E-06
Tetrachloroethene	3.51	3.4E-06	1.2E-06	1.1E-05	3.8E-06	1.5E-05	2.1E-07	2.7E-05	1.9E-06	5.6E-06	2.4E-06
Benzo(a)pyrene	0.0144	4.6E-09	1.6E-09	1.4E-08	5.1E-09	1.9E-08	2.8E-10	3.6E-08	2.5E-09	2.3E-08	9.8E-09
Subsurface Soil											
Dermal		NA	NA							NA	NA
	EPC(mg/kg)										
I-TEQ(ND=0)	7.13E-07			6.6E-14	2.3E-14	5.8E-14	8.3E-16	1.6E-14	1.2E-15		
4,4'-DDT	2.77			2.6E-07	9.1E-08	2.3E-07	3.2E-09	6.3E-08	4.5E-09		
alpha-BHC	0.0254			7.8E-09	2.8E-09	6.9E-09	9.9E-11	1.9E-09	1.4E-10		
delta-BHC	0.0367			3.4E-09	1.2E-09	3.0E-09	4.3E-11	8.4E-10	6.0E-11		
Dieldrin	0.0193			5.9E-09	2.1E-09	5.3E-09	7.5E-11	1.5E-09	1.1E-10		
gamma-BHC (lindane)	0.487			6.0E-08	2.1E-08	5.3E-08	7.6E-10	1.5E-08	1.1E-09		

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Table C-28. Chemical Intake Results for the Dermal Route by Receptor for Phase IIB Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Dermal											
	EPC(mg/kg)										
Arsenic	55.42	4.1E-06	1.5E-06	1.3E-05	4.6E-06	1.7E-05	2.5E-07	3.2E-05	2.3E-06	2.6E-05	1.1E-05
Subsurface Soil											
Dermal		NA	NA							NA	NA
	EPC(mg/kg)										
4,4 DDD	0.740			2.3E-07	8.1E-08	2.0E-07	2.9E-09	5.6E-08	4.0E-09		
4,4'-DDT	3.08			2.8E-07	1.0E-07	2.5E-07	3.6E-09	7.0E-08	5.0E-09		
Arsenic	10.76			3.3E-06	1.2E-06	8.8E-07	1.3E-08	2.5E-07	1.8E-08		

(4) Certain chemicals may be readily absorbed through the skin while others penetrate much more slowly or not at all. In the case of soil, some chemicals may be strongly bound to the matrix which reduces their ability to absorb through the skin. Chemical-specific absorption factors from the USEPA were used in this assessment.

(5) The reader should note that in the USEPA guidance document Dermal Exposure Assessment: Principles and Applications, the USEPA cautions that "dermal exposure is the least well understood of the major exposure routes (USEPA, 2004a). Very little chemical-specific data are available, especially for soils, and the predictive techniques have not been well validated." The USEPA further states that dermal exposure/risk estimates have considerable uncertainty, and in some cases they may be overly conservative.

i. Inhalation of Soil Particles.

(1) The same receptors considered having the potential to ingest soil and touch soil may also breathe the soil particles that are suspended in the air. The equation for the exposure from the inhalation of fugitive dust is as follows based on USEPA guidance (USEPA, 1989).

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$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times EF \times ED}{PEF \times BW \times AT}$$

Where:

CS = Chemical Concentration in Soil (mg/kg soil)
IR = Inhalation Rate (m^3)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
PEF = Particulate Emission Factor (1.316E9 m^3/kg (USEPA default))
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days)

(2) Tables C-29, C-30, and C-31 show the results of the calculations for intake from inhalation of soil particles for Phase I, II, and IIB data, respectively.

Table C-29. Chemical Intake Results for the Inhalation of Soil Particles by Receptor for Phase I Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Subsurface Soil											
	EPC(mg/kg)										
Inhalation		NA	NA							NA	NA
Naphthalene	0.54222			1.0E-07	1.5E-09	1.0E-07	2.1E-09	2.9E-08	3.7E-08		
Tetrachloroethene	1.30199			5.2E-06	7.5E-08	5.2E-06	1.1E-07	1.5E-06	1.9E-06		
4,4'-DDD	0.77282			7.6E-12	1.1E-13	7.6E-12	1.5E-13	2.1E-12	2.7E-12		
4,4'-DDT	0.26209			2.6E-12	3.7E-14	2.6E-12	5.1E-14	7.2E-13	9.2E-13		
alpha-BHC	0.44587			4.4E-12	6.3E-14	4.4E-12	8.8E-14	1.2E-12	1.6E-12		
delta-BHC	0.5155			5.1E-12	7.2E-14	5.1E-12	1.0E-13	1.4E-12	1.8E-12		
gamma-BHC (lindane)	12.97604			1.3E-10	1.8E-12	1.3E-10	2.6E-12	3.6E-11	4.6E-11		

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Table C-30. Chemical Intake Results for the Inhalation of Soil Particles by Receptor for Phase II Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Inhalation											
	EPC(mg/kg)										
4,4 DDD	0.588	2.9E-11	1.0E-11	1.4E-11	5.2E-12	1.2E-11	3.1E-13	4.0E-11	2.9E-12	1.2E-10	5.2E-11
4,4 DDE	0.588	2.8E-11	1.0E-11	1.4E-11	5.2E-12	2.2E-11	3.1E-13	4.0E-11	2.9E-12	1.2E-10	5.2E-11
4,4 DDT	10.3	5.0E-10	1.8E-10	2.5E-10	9.0E-11	3.8E-10	5.5E-12	7.1E-10	5.0E-11	2.1E-09	9.2E-10
alpha-BHC	0.0486	2.4E-12	8.5E-13	1.2E-12	4.3E-13	1.8E-12	2.6E-14	3.3E-12	2.4E-13	1.0E-11	4.3E-12
delta-BHC	0.0506	2.5E-12	8.9E-13	1.2E-12	4.4E-13	1.9E-12	2.7E-14	3.5E-12	2.5E-13	1.1E-11	4.5E-12
Dieldrin	0.0583	2.9E-12	1.0E-12	1.4E-12	5.1E-13	2.2E-12	3.1E-14	4.0E-12	2.9E-13	1.2E-11	5.2E-12
gamma-BHC (lindane)	1.57	7.7E-11	2.8E-11	3.9E-11	1.4E-11	5.9E-11	8.4E-13	1.1E-10	7.7E-12	3.3E-10	1.4E-10
Tetrachloroethene	3.51	7.1E-05	2.6E-05	3.5E-05	1.3E-05	5.4E-05	7.7E-07	9.9E-05	7.1E-06	3.0E-04	1.3E-04
Benzo(a)pyrene	0.0144	7.0E-13	2.5E-13	3.5E-13	1.3E-13	5.4E-13	7.7E-15	9.9E-13	7.0E-14	3.0E-12	1.3E-12
Subsurface Soil											
Inhalation		NA	NA							NA	NA
	EPC(mg/kg)										
I-TEQ(ND=0)	7.13E-07			7.0E-18	2.5E-18	7.0E-18	1.0E-19	2.0E-18	1.4E-19		
4,4'-DDT	2.77			2.7E-11	9.7E-12	2.7E-11	3.9E-13	7.6E-12	5.4E-13		
alpha-BHC	0.0254			2.5E-13	8.9E-14	2.5E-13	3.6E-15	7.0E-14	5.0E-15		
delta-BHC	0.0367			3.6E-13	1.3E-13	3.6E-13	5.2E-15	1.0E-13	7.2E-15		
Dieldrin	0.0193			1.9E-13	6.8E-14	1.9E-13	2.7E-15	5.3E-14	3.8E-15		
gamma-BHC (lindane)	0.487			4.8E-12	1.7E-12	4.8E-12	6.8E-14	1.3E-12	9.6E-14		

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Table C-31. Chemical Intake Results for the Inhalation of Soil Particles by Receptor for Phase IIB Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Inhalation											
	EPC(mg/kg)										
Arsenic	55.42	2.7E-09	9.7E-10	1.4E-09	4.9E-10	2.1E-09	3.0E-11	3.8E-09	2.7E-10	1.2E-08	4.9E-09
Subsurface Soil											
Inhalation		NA	NA							NA	NA
	EPC(mg/kg)										
4,4 DDD	0.740			7.3E-12	2.6E-12	7.3E-12	1.0E-13	2.0E-12	1.5E-13		
4,4'-DDT	3.08			3.0E-11	1.1E-11	3.0E-11	4.3E-13	8.5E-12	6.0E-13		
Arsenic	10.76			1.1E-10	3.8E-11	1.1E-10	1.5E-12	3.0E-11	2.1E-12		

j. Incidental Ingestion of Groundwater.

(1) While drinking water is supplied through a municipal source, some receptors (i.e., construction workers or utility workers) can be directly exposed to groundwater as a result of their work. Therefore, incidental ingestion of groundwater should be considered.

(2) The equation for the intake from this exposure is as follows (USEPA, 1989).

$$\text{Intake (mg/kg-day)} = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

Where:

CW = Chemical Concentration in Water (mg/liter)
IR = Ingestion Rate (liters/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Bodyweight (kg)
AT = Averaging time (days)

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(3) Table C-32 shows the results of the calculations for intake from incidental ingestion of groundwater for Phase I data. Table C-33 shows the results of the calculations for intake from incidental ingestion of groundwater for Phase II data. Table C-34 shows the results of the calculations for intake from incidental ingestion of groundwater for Phase IIB data.

Table C-32. Chemical Intake Results for the Incidental Ingestion of Groundwater by Receptor for Phase I Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Ingestion		NA	NA							NA	NA
	EPC(mg/l)										
alpha-BHC	0.0000698			1.4E-08	2.0E-10	1.4E-08	2.7E-10	3.8E-09	4.9E-09		
gamma-BHC (lindane)	0.002726			5.3E-07	7.6E-09	5.3E-07	1.1E-08	1.5E-07	1.9E-07		
delta-BHC	0.00029			5.7E-08	8.1E-10	5.7E-08	1.1E-09	1.6E-08	2.0E-08		
Tetrachloroethene	0.057295711			1.1E-05	1.6E-07	1.1E-05	2.2E-07	3.1E-06	4.0E-06		
Naphthalene	0.000174949			3.4E-08	4.9E-10	3.4E-08	6.9E-10	9.6E-09	1.2E-08		

Table C-33. Chemical Intake Results for the Incidental Ingestion of Groundwater By Receptor for Phase II Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Ingestion		NA	NA							NA	NA
	EPC (mg/l)										
Benzene	1.60E-03			3.1E-07	1.1E-07	3.1E-07	4.5E-09	8.8E-08	6.3E-09		
1,1-Dichloroethane	2.91E-03			5.7E-07	2.0E-07	5.7E-07	8.1E-09	1.6E-07	1.1E-08		
cis-1,2-Dichloroethene	8.35E-02			1.6E-05	5.8E-06	1.6E-05	2.3E-07	4.6E-06	3.3E-07		

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Naphthalene	7.00E-03			1.4E-06	4.9E-07	1.4E-06	2.0E-08	3.8E-07	2.7E-08		
Tetrachloroethene	1.61E-01			3.2E-05	1.1E-05	3.2E-05	4.5E-07	8.8E-06	6.3E-07		
1,2,4-Trichlorobenzene	3.37E-02			6.6E-06	2.4E-06	6.6E-06	9.4E-08	1.9E-06	1.3E-07		
Trichloroethene	1.59E-01			3.1E-05	1.1E-05	3.1E-05	4.4E-07	8.7E-06	6.2E-07		
Vinyl chloride	1.68E-03			3.3E-07	1.2E-07	3.3E-07	4.7E-09	9.2E-08	6.6E-09		
alpha-BHC	1.01E-04			2.0E-08	7.1E-09	2.0E-08	2.8E-10	5.5E-09	4.0E-10		
gamma-BHC (lindane)	8.35E-04			1.6E-07	5.8E-08	1.6E-07	2.3E-09	4.6E-08	3.3E-09		
beta-BHC	2.91E-04			5.7E-08	2.0E-08	5.7E-08	8.2E-10	1.6E-08	1.1E-09		
delta-BHC	2.96E-04			5.8E-08	2.1E-08	5.8E-08	8.3E-10	1.6E-08	1.2E-09		
Dieldrin	1.11E-04			7.7E-09	2.2E-08	2.2E-08	3.1E-10	6.1E-09	4.3E-10		
Manganese	1.91E+00			1.3E-04	3.7E-04	3.7E-04	5.3E-06	1.0E-04	7.5E-06		

Table C-34. Chemical Intake Results for the Incidental Ingestion of Groundwater by Receptor for Phase IIB Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Ingestion		NA	NA							NA	NA
	EPC (mg/l)										
Benzene	2.94E-03			5.8E-07	2.1E-07	5.8E-07	8.2E-09	1.6E-07	1.2E-08		
1,1-Dichloroethane	3.43E-03			6.7E-07	2.4E-07	6.7E-07	9.6E-09	1.9E-07	1.3E-08		
cis-1,2-Dichloroethene	3.00E-01			5.9E-05	2.1E-05	5.9E-05	8.4E-07	1.7E-05	1.2E-06		
Naphthalene	7.00E-03			1.4E-06	4.9E-07	1.4E-06	2.0E-08	3.8E-07	2.7E-08		
Tetrachloroethene	5.46E-02			1.1E-05	3.8E-06	1.1E-05	1.5E-07	3.0E-06	2.1E-07		
Trichloroethene	4.14E-02			8.1E-06	2.9E-06	8.1E-06	1.2E-07	2.3E-06	1.6E-07		
Vinyl chloride	1.10E-02			2.2E-06	7.7E-07	2.2E-06	3.1E-08	6.1E-07	4.3E-08		
alpha-BHC	3.75E-05			7.3E-09	2.6E-09	7.3E-09	1.1E-10	2.1E-09	1.5E-10		
beta-BHC	1.36E-04			2.7E-08	9.5E-09	2.7E-08	3.8E-10	7.5E-09	5.3E-10		
Dieldrin	2.04E-05			4.0E-09	1.4E-09	4.0E-09	5.7E-11	1.1E-09	8.0E-11		

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k. Dermal Contact With Groundwater.

(1) The same receptors considered to have the potential to ingest groundwater may also dermally contact the same groundwater. The equation for the absorbed dose from dermal exposure is as follows based on USEPA guidance (USEPA, 2004a).

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times CF \times PC \times SA \times EF \times ED \times ET}{BW \times AT}$$

Where:

CW = Chemical Concentration in Groundwater (mg/L)
CF = Conversion Factor (10^{-6} kg/mg)
PC = Chemical Specific Dermal Permeability Constant (cm/hr)
SA = Skin Surface Area Available for Contact (cm^2)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (year)
ET = Exposure Time (hr/day)
BW = Body Weight (kg)
AT = Averaging Time (days)

(2) Table C-35 shows the results of the calculations for dermal absorbed dose for the Phase I data. Table C-36 shows the results of the calculations for dermal absorbed dose for the Phase II data. Table C-37 shows the results of the calculations for dermal absorbed dose for the Phase IIB data.

Table C-35. Chemical Intake Results for the Dermal Route by Receptor for the Phase I Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
	EPC (mg/l)										
Dermal		NA	NA							NA	NA
alpha-BHC	0.0000698			4.4E-08	6.3E-10	4.4E-08	8.9E-10	1.2E-08	1.6E-08		
gamma-BHC (lindane)	0.002726			1.7E-06	2.5E-08	1.7E-06	3.5E-08	4.9E-07	6.2E-07		
delta-BHC	0.00029			1.8E-07	2.6E-09	1.8E-07	3.7E-09	5.2E-08	6.6E-08		
Tetrachloroethene	0.057295711			1.3E-04	1.8E-06	1.3E-04	2.5E-06	3.5E-05	4.5E-05		
Naphthalene	0.000174949			5.5E-07	7.8E-09	5.5E-07	1.1E-08	1.5E-07	2.0E-07		

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Table C-36. Chemical Intake Results for the Dermal Route by Receptor for the Phase II Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Dermal		NA	NA							NA	NA
	EPC (mg/l)										
Benzene	1.60E-03			1.5E-06	5.5E-07	1.5E-06	2.2E-08	4.3E-07	3.1E-08		
1,1-Dichloroethane	2.91E-03			7.0E-07	2.5E-07	7.0E-07	1.0E-08	2.0E-07	1.4E-08		
cis-1,2-Dichloroethene	8.35E-02			3.8E-05	1.4E-05	3.8E-05	5.4E-07	1.1E-05	7.6E-07		
Naphthalene	7.00E-03			2.2E-05	7.8E-06	2.2E-05	3.1E-07	6.1E-06	4.4E-07		
Tetrachloroethene	1.61E-01			3.5E-04	1.3E-04	3.5E-04	5.0E-06	9.8E-05	7.0E-06		
1,2,4-Trichlorobenzene	3.37E-02			1.5E-04	5.5E-05	1.5E-04	2.2E-06	4.3E-05	3.1E-06		
Trichloroethene	1.59E-01			1.2E-04	4.1E-05	1.2E-04	1.7E-06	3.2E-05	2.3E-06		
Vinyl chloride	1.68E-03			5.6E-07	2.0E-07	5.6E-07	7.9E-09	1.6E-07	1.1E-08		
alpha-BHC	1.01E-04			6.4E-08	2.3E-08	6.4E-08	9.2E-10	1.8E-08	1.3E-09		
gamma-BHC (lindane)	8.35E-04			5.3E-07	1.9E-07	5.3E-07	7.6E-09	1.5E-07	1.1E-08		
beta-BHC	2.91E-04			1.9E-07	6.6E-08	1.9E-07	2.7E-09	5.2E-08	3.7E-09		
delta-BHC	2.96E-04			1.9E-07	6.7E-08	1.9E-07	2.7E-09	5.3E-08	3.8E-09		
Dieldrin	1.11E-04			8.0E-08	2.9E-08	8.0E-08	1.2E-09	2.3E-08	1.6E-09		
Manganese	1.91E+00			8.7E-05	3.1E-05	8.7E-05	1.2E-06	2.4E-05	1.7E-06		

Table C-37. Chemical Intake Results for the Dermal Route by Receptor for the Phase IIB Data

Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day		mg/kg/day	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Dermal		NA	NA							NA	NA
	EPC (mg/l)										
Benzene	2.94E-03			1.9E-06	6.7E-07	1.9E-06	2.7E-08	5.2E-07	3.7E-08		
1,1-Dichloroethane	3.43E-03			2.2E-06	7.8E-07	2.2E-06	3.1E-08	6.1E-07	4.4E-08		

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cis-1,2-Dichloroethene	3.00E-01			1.9E-04	6.8E-05	1.9E-04	2.7E-06	5.4E-05	3.8E-06		
Naphthalene	7.00E-03			4.5E-06	1.6E-06	4.5E-06	6.4E-08	1.3E-06	8.9E-08		
Tetrachloroethene	5.46E-02			3.5E-05	1.2E-05	3.5E-05	5.0E-07	9.7E-06	6.9E-07		
Trichloroethene	4.14E-02			2.6E-05	9.4E-06	2.6E-05	3.8E-07	7.4E-06	5.3E-07		
Vinyl chloride	1.10E-02			7.0E-06	2.5E-06	7.0E-06	1.0E-07	2.0E-06	1.4E-07		
alpha-BHC	3.75E-05			2.4E-08	8.5E-09	2.4E-08	3.4E-10	6.7E-09	4.8E-10		
beta-BHC	1.36E-04			3.0E-07	1.1E-07	3.0E-07	4.2E-09	8.3E-08	5.9E-09		
Dieldrin	2.04E-05			6.4E-08	2.3E-08	6.4E-08	9.1E-10	1.8E-08	1.3E-09		

I. Inhalation of Volatiles from Groundwater.

(1) Modeling of the potential migration of volatile chemicals from groundwater through the soil and into the indoor air was accomplished using the USEPA's web version of the Johnson and Ettinger (J&E) Model. The J&E Model provides a one-dimensional analytical solution to convective and diffusive vapor transport from groundwater, soil, or soil gas sources. This is a screening level implementation and was used for the assessment of each individual receptor since site-specific input parameters could be used. All buildings are considered as slab-on-grade with no basements as this seems to be the building preference around airfields.

(2) In modeling the groundwater pathway, the volatile chemicals dissolved in the groundwater are assumed to reach equilibrium with the air-filled pore space in the soil that is in contact with the groundwater. At this point, the released volatiles must diffuse through a capillary zone above the water table and then through the subsequent unsaturated soil. Each chemical diffuses upward through the soil until it reaches the "zone of influence" of the building. Here convective air movement within the soil near the building is assumed to transport the diffused vapors through cracks between the foundation and floor slab. The J&E Model relates the indoor vapor concentration to the soil gas concentration at the groundwater interface for each modeled constituent; the ratio of which is called the "attenuation coefficient." The attenuation coefficient combines the soil and transport characteristics to predict the concentration of the chemical that were volatilized from the groundwater into the air. This indoor air concentration was then reported out and used to estimate the resulting risk.

(3) The infinite source solution form of the J&E Model was used for the groundwater pathway evaluation. This assumption implies that the groundwater concentrations of the various contaminants would remain constant with time for the purpose of estimating risk. The building properties for the model were based on conservative default values. The actual equations used to calculate the indoor air concentrations and risk from groundwater contamination are documented in Section 2

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of the User's Guide for the Johnson and Ettinger Model for Subsurface Vapor Intrusion into Buildings (USEPA, 2004b). While it is contained in the J&E Model, the following is a discussion of the equations used to determine intake from air concentrations.

(4) The equation for estimating the average daily intake from inhalation is as shown below. The inhaled dose is often assumed to be 100 percent absorbed by the lungs, which is the point-of-entry for inhaled substances.

$$ADI_{Inh} = \frac{C_{air} \cdot IR_{inh} \cdot ET \cdot EF \cdot ED \cdot 10^{-3}}{BW \cdot AT}$$

Where:

ADI_{inh}	=	Average daily intake from inhalation (mg/kg/day)
C_{air}	=	Resuspended air concentration (µg/m^3)
IR_{inh}	=	Inhalation rate (m^3/hr)
ET	=	Exposure time (hours/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (year)
10^{-3}	=	Units conversion factor (µg to mg)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

m. Ingestion of Drinking Water. All current and future receptors drink groundwater. However, the samples from the drinking water distribution system showed that all chemicals met drinking water standards. Thus, no chemicals were retained for further evaluation and there are no COPCs for this media.

C-5. TOXICITY ASSESSMENT. The objective of the toxicity assessment is to weigh available evidence regarding the potential of the chemicals to cause adverse effects in exposed individuals, and to provide, where possible, an estimate of the relationship between the extent of exposure to a chemical and the increased likelihood and/or severity of adverse effects. The types of toxicity information considered in this assessment include the oral reference dose (RfD_{oral}) and reference air concentration (RfC) used to evaluate noncarcinogenic effects and the ingestion slope factor and air unit risk to evaluate carcinogenic potential. Inhalation reference doses and inhalation slope factors were calculated from the RfCs and air unit risks as explained in USEPA, 1989. Oral reference doses and slope factors were used for calculating risk from dermal absorption assuming that there was no difference between the administered dose and the absorbed dose. Table C-38 summarizes the toxicity factors used in this evaluation for noncarcinogenic and carcinogenic effects. Where possible, the value recommended by the USEPA's IRIS was used for the risk assessment.

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Table C-38. Carcinogenic Slope Factors and Reference Doses for Chemicals of Potential Concern

Parameter	CAS No.	Reference Dose(RfD) oral (mg/kg-day)	Cancer Slope Factor (CSF) oral (mg/kg-day)$^{-1}$	RfD inhalation* (mg/kg-day)	CSF inhalation* (mg/kg-day)$^{-1}$	Source
Arsenic	7440-38-2	3.0E-04	1.5E+00	4.29E-06	1.51E+01	IRIS
Manganese	7439-96-5	2.4E-02		1.43E-05		IRIS
Benzene	71-43-2	4.0E-03	5.5E-02	8.57E-03	2.73E-02	IRIS
1,1-Dichloroethane	75-34-3	2.0E-01	5.7E-03		5.60E-03	IRIS
Cis-1,2-Dichloroethene	156-59-2	2.0E-03				IRIS
1,2,4-Trichlorobenzene	120-82-1	1.0E-02	2.9E-02	5.71E-04		IRIS
I-TEQ	1746-01-6	1.0E-09	1.5E+05	1.14E-08	1.33E+05	IRIS
Trichloroethene	79-01-6	5.0E-04	4.6E-02	5.7E-04	1.4E-02	IRIS
Vinyl chloride	75-01-4	3.0E-03	7.2E-01	2.86E-02	1.54E-02	IRIS
Naphthalene	91203	2.0E-02		8.57E-04	1.19E-01	IRIS
Tetrachloroethene	127184	1.0E-02	5.4E-01	7.71E-02	2.07E-02	IRIS
Benzo(a)pyrene	50-32-8		7.3E+00		3.85E+00	IRIS
Dieldrin	60-57-1	5.0E-05	1.6E+01		1.61E+01	IRIS
4,4'-DDD	72548		2.4E-01		2.42E-01	IRIS
4,4'-DDE	72-55-9		3.4E-01		3.4E-01	IRIS
4,4'-DDT	50293	5.0E-04	3.4E-01		3.4E-01	IRIS
alpha-BHC	319846	8.0E-03	6.3E+00		6.3E+00	IRIS
beta-BHC	319-85-7		1.8E+00		1.86E+00	IRIS
delta-BHC	608731		1.8E+00		1.86E+00	IRIS
gamma-BHC (lindane)	58899	3.0E-04	1.1E+00		1.09E+00	IRIS

Notes:
Integrated Risk Information System (IRIS) – (USEPA, 2007)
* Calculated from the reference exposure level or through route extrapolation

a. Noncarcinogenic Effects.

(1) For chemicals that exhibit noncarcinogenic (such as, systemic) effects, authorities consider organisms to have repair and detoxification capabilities that must be exceeded by some critical concentration (threshold) before the health effect is manifested. For example, an organ can have a large number of cells performing the

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same or similar functions that must be significantly depleted before the effect on the organ is seen. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without an appreciable risk of adverse effects.

(2) Health criteria for chemicals exhibiting noncarcinogenic effects for use in risk assessment are generally developed using USEPA RfDs developed by the RfD/RfC Work Group and included in the IRIS. In general, the RfD is an estimate of an average daily exposure to an individual (including sensitive individuals) below which there will not be an appreciable risk of adverse health effects. The RfD is derived using uncertainty factors (for example, to adjust from animals to humans and to protect sensitive subpopulations) to ensure that it is unlikely to underestimate the potential for adverse noncarcinogenic effects to occur. The purpose of the RfD is to provide a benchmark against which an intake (or an absorbed dose in the case of dermal contact) from human exposure to various environmental conditions might be compared. Intakes of doses, which are significantly higher than the RfD, may indicate that an inadequate margin of safety could exist for exposure to that substance and that an adverse health effect could occur.

(3) The types of toxicity values used to evaluate the noncarcinogenic effects of chemicals include RfDs which represent thresholds for toxicity. They are derived such that human lifetime exposure to a given chemical via a given route at levels at or below the RfD, as appropriate, should not result in adverse health effects even for the most sensitive members of the population. The chronic RfD for a chemical is ideally based on studies where either animal or human populations were exposed to a given chemical by a given route of exposure for the major portion of the life span (referred to as a chronic study). Various effect levels may be determined in a study; however, the preferred effect level for calculating noncarcinogenic toxicity values is the no-observed-adverse-effect level (NOAEL). Second to the NOAEL is the lowest-observed-adverse-effect level (LOAEL).

(4) The oral RfD is derived by determining dose-specific effect levels from all the available quantitative studies and applying uncertainty factors and/or a modifying factor to the most appropriate effect level. Uncertainty factors are intended to account for: the variation in sensitivity among members of the human population; the uncertainty in extrapolating animal data to humans; the uncertainty in extrapolating from data obtained in a study that is less than lifetime exposure; the uncertainty in using LOAEL data rather than NOAEL data; and the uncertainty resulting from inadequacies in the database. The modifying factor may be used to account for other uncertainties such as inadequacy of the number of animals in the critical study. Usually, each of these uncertainty factors is set equal to 10, while the modifying factor varies between 1 and 10. The RfDs are reported as doses in milligrams of chemical per kilogram body weight per day (mg/kg-day).

(5) As mentioned earlier, chronic RfDs are intended to be set at levels such that human lifetime exposure at or below these levels should not result in adverse health effects, even for the most sensitive members of the population. These values are ideally based on chronic exposure studies in humans or animals. Chronic exposure for humans is considered to be exposure of roughly 7 years or more, based on exposure of rodents for 1 year or more in animal toxicity studies.

b. Carcinogenic Effects.

(1) For chemicals that exhibit carcinogenic effects, most authorities recognize that one or more molecular events can evoke changes in a single cell or a small number of cells that can lead to tumor formation. This is the nonthreshold theory of carcinogenesis, which purports that any level of exposure to a carcinogen can result in some finite possibility of generating the disease. Generally, regulatory agencies assume the nonthreshold hypothesis for carcinogens in the absence of information concerning the mechanisms of action for the COPC.

(2) The USEPA's Carcinogen Risk Assessment Verification Endeavor has developed slope factors and unit risks (such as, dose-response values) for estimating excess lifetime cancer risks associated with various levels of lifetime exposure to potential human carcinogens. The carcinogenic slope factors can be used to estimate the lifetime excess cancer risk associated with exposure to a potential carcinogen. Risks estimated using slope factors are considered unlikely to underestimate actual risks, but they may overestimate actual risks. Excess lifetime cancer risks are generally expressed in scientific notation. An excess lifetime cancer risk of 1×10^{-6} (one in a million), for example, represents the probability of an individual developing cancer over a lifetime as a result of exposure to the specific carcinogenic chemical. The USEPA considers total excess lifetime cancer risks within the range of 1×10^{-4} (one in ten thousand) to 1×10^{-6} (59 Federal Register (FR) 47473, 1994) to be acceptable when developing remedial alternatives for remediation. In practice, slope factors are derived from the results of human epidemiology studies or chronic animal bioassays. The data from animals studies are fitted to the linearized, multistage model and a dose-response curve is obtained. The dose-response curve is subjected to various adjustments, and an interspecies scaling factor is applied to conservatively derive the slope factor for humans. This linearized multistage procedure leads to a plausible upper limit of the risk that is consistent with some proposed mechanisms of carcinogenesis. Thus, the actual risks associated with exposure to a potential carcinogen are not likely to exceed the risks estimated using these slope factors, but they may be much lower. Dose-response data derived from human epidemiological studies are fitted to dose time-response curves on an ad-hoc basis. These models provide rough but plausible estimates of the upper limits on lifetime risk. Slope factors based on human epidemiological data are also derived using very conservative assumptions and, as such, are considered unlikely

to underestimate risks. In summary, while the actual risks associated with exposures to potential carcinogens are unlikely to be higher than the risks calculated using a slope factor, they could be considerably lower.

(3) Slope factors and unit risks are developed by the USEPA based on epidemiological or animal bioassay data for a specific route of exposure, either oral or inhalation. For some chemicals, sufficient data are available to develop route-specific slope factors for inhalation and ingestion. For chemicals with only one route-specific slope factor but for which carcinogenic effects may also occur via another route, the available slope factor may be used by the USEPA to evaluate risks associated with several potential routes of exposure (USACE, 2008).

c. Toxicity Value Conversions.

(1) Toxicity values are provided for the three main routes of exposure: ingestion, inhalation, and dermal exposure. Toxicity values for the ingestion pathway are usually provided as the oral slope factors (SF_o) for carcinogens or as the oral reference dose (RfD_o) for noncarcinogens. The SF_o may be derived from drinking water unit risks, if needed. This conversion is shown as:

$$SF_o\ (mg/kg\text{-}day)^{-1} = \frac{\text{Water Unit Risk } (ug/L)^{-1} \text{X } 70\ kg \text{ X } 10^3\ ug/mg}{2\ L/day}$$

(2) As of January 1991, the IRIS and National Center for Environmental Assessment databases no longer present RfDs or SFs for the inhalation route. These criteria have been replaced with an RfC for noncarcinogenic effects and a unit risk factor (URF) for carcinogenic effects. However, for the purpose of estimating risk, the inhalation reference doses (RfD_i) and inhalation slope factors (SF_i) may still be used. The RfD_i and SF_i are easily converted from the RfC and URF, respectively. The following equations show these conversions.

$$SF_i\ (mg/kg\text{-}day)^{-1} = \frac{URF\ (ug/m^3)^{-1} \text{X } 70\ kg \text{ X } 10^3\ ug/mg}{20\ m^3/day}$$

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$$RfD_i(mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

(3) The USEPA has not developed SFs or RfDs for dermal exposure to all chemicals, but has provided a method for extrapolating dermal toxicity values from oral toxicity values. This route-to-route extrapolation has a scientific basis because once a chemical is absorbed its distribution, metabolism, and elimination patterns are usually similar, regardless of exposure route. However, dermal toxicity values typically are based on absorbed dose, whereas oral exposures are usually expressed in terms of administered dose.

(4) Consequently, if adequate data regarding the gastrointestinal absorption of a COPC are available, then the dermal toxicity values may be derived by applying a gastrointestinal absorbance factor (ABS), the percentage of contaminant absorbed in the gastrointestinal tract, to the oral toxicity value. For chemicals lacking a gastrointestinal absorbance value, the ABS is assumed to be 100 percent and the RfD_o or SF_o will be used to estimate toxicity via dermal absorption. The equations used to calculate the dermal slope factor and dermal reference dose from the ingestion toxicity values are:

$$SF_d\ (mg/kg\text{-}day) = \frac{SF_o\ (mg/kg\text{-}day)^{-1}}{ABS}$$

Where:
SF_d = Dermal Slope Factor

$$Rfd_d\ (mg/kg\text{-}day) = \frac{Rfd_o\ (mg/kg\text{-}day)^{-1}}{ABS}$$

Where:
Rfd_d = Dermal Reference Dose

d. Chemicals Eliminated Due to Toxicity Assessment. Several COPCs were eliminated from further consideration in this assessment due to the toxicity assessment. Toxicological criteria could not be found for the following chemicals: methyl iodide; phenanthrene; benzo(ghi)perylene; 4-chlorophenyl phenyl ether; and 4-bromophenyl phenyl ether.

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C-6. RISK CHARACTERIZATION.

a. Introduction. To characterize risk, toxicity and exposure assessments were summarized and integrated into quantitative and qualitative expressions of risk. To characterize potential noncarcinogenic effects, comparisons were made between projected intakes of substances and toxicity values. To characterize potential carcinogenic effects, probabilities that a hypothetical individual will develop cancer over a lifetime from the modeled exposure are estimated from projected intakes and chemical-specific dose-response information. Major assumptions, scientific judgments, and, to the extent possible, estimates of the uncertainties embodied in the assessment are also presented.

b. Noncarcinogenic Effects.

(1) The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period with an RfD derived for a similar exposure period. This ratio of exposure to toxicity is called a hazard quotient (HQ) according to the following equation:

$$\text{Noncarcinogenic Hazard Quotient} = E/RfD$$

Where:
E = Exposure level or intake (mg/kg-day)
RfD = Reference Dose (mg/kg-day)

(2) The noncarcinogenic HQ assumes that there is a level of exposure (such as, an RfD) below which it is unlikely for even sensitive populations to experience adverse health effects. If the exposure level (E) does not exceed the threshold (such as, if E/RfD does not exceed unity), there is no concern for potential noncarcinogenic effects.

(3) To assess the overall potential for noncarcinogenic effects posed by more than one exposure pathway, an HI approach has been developed by the USEPA. This approach assumes that simultaneous subthreshold exposures to several exposure pathways could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to respective acceptable exposures. This is expressed as:

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$$HI = E_1/RfD_1 + E_2/RfD_2 + ... + Ei/RfDi$$

Where:
Ei = Exposure level or intake of the I pathway
RfDi = Reference dose for the i^{th} pathway

(4) While any single chemical with an exposure level greater than the toxicity value will cause the HI to exceed unity, for multiple exposures, the HI can also exceed unity even if no single exposure exceeds its RfD.

c. Carcinogenic Effects.

(1) For carcinogens, risks are estimated as the incremental probability of a hypothetical individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (such as, excess individual lifetime cancer risk). The slope factor converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of a hypothetical individual developing cancer. It can generally be assumed that the dose-response relationship will be linear in the low-dose portion of the multistage model dose-response curve. Under this assumption, the slope factor is a constant, and risk will be directly related to intake. Thus, the following linear low-dose equation was used in this assessment:

$$Risk = CDI \times CSF$$

Where:
Risk = A unitless probability of a hypothetical individual developing cancer
CDI = Chronic Daily Intake over 70 years (mg/kg-day)
CSF = Carcinogenic Slope Factor $(mg/kg\text{-}day)^{-1}$

(2) Since the slope factor is often a 95^{th} UCL of the probability of a response and is based on animal data used in the multistage model, the carcinogenic risk will generally be an upper-bound estimate. This means that the "true risk" is not likely to exceed the risk estimate derived through this model and is likely to be less than predicted.

(3) For simultaneous exposure by more than one pathway, the USEPA assumes that the risks are additive. That is expressed as:

$$Risk_T = Risk_1 + Risk_2 + \ldots + Risk_i$$

Where:
$Risk_T$ = Total cancer risk, expressed as a unitless probability
$Risk_i$ = Risk estimate for the i^{th} pathway

(4) Addition of the carcinogenic risks is valid when the following assumptions are met:

(a) Doses are low.

(b) No synergistic or antagonistic interactions occur.

(c) Similar endpoints are evaluated.

(5) According to guidance in the National Oil and Hazardous Substances Pollution Contingency Plan, the target overall lifetime carcinogenic risks from exposures for determining cleanup levels should range from 1×10^{-4} to 1×10^{-6} (59 FR 47473, 1994).

d. Risk Summary.

(1) Phase I. Carcinogenic and noncarcinogenic risks were calculated for all applicable exposure routes. Table C-39 shows the results of the risk calculations for the incidental ingestion, dermal contact, and inhalation from exposure to the surface and subsurface soil in the Phase I site. Table C-40 shows the results of the risk calculations for exposure to the groundwater and drinking water in the Phase I site. Table C-41 summarizes the calculated carcinogenic and noncarcinogenic risks for all receptors and exposure routes considered in the Phase I site of the risk assessment. The total carcinogenic risks for all receptors are within or below the USEPA acceptable range for determining risk to human health. Likewise, the total noncarcinogenic HI for all receptors is less than the threshold of unity. This indicates that exposure to the Phase I site does not pose a significant adverse health risk to human health.

Table C-39. Carcinogenic and Noncarcinogenic Risks from Exposure to the Soil in the Phase I Site

Media/ Pathway/ Chemical	Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Subsurface Soil										
Ingestion	NA	NA							NA	NA
Naphthalene			2.6E-05		2.6E-05		3.6E-06			
Tetrachloroethene			1.2E-04	2.4E-07	1.2E-04	9.4E-09	1.7E-05	6.6E-09		
4,4'-DDD				6.2E-08		2.5E-09		1.7E-09		
4,4'-DDT			4.9E-04	3.0E-08	4.9E-04	1.2E-09	6.9E-05	8.4E-10		
alpha-BHC			5.2E-05	9.4E-07	5.2E-05	3.8E-08	7.3E-06	2.6E-08		
delta-BHC				3.1E-07		1.3E-08		8.7E-09		
gamma-BHC (lindane)			4.1E-02	4.8E-06	4.1E-02	1.9E-07	5.7E-03	1.3E-07		
Dermal	NA	NA							NA	NA
Naphthalene			1.1E-05	---	9.6E-06		2.7E-06			
Tetrachloroethene			1.9E-05	3.7E-08	1.7E-05	1.3E-09	4.8E-06	1.8E-09		
4,4'-DDD			---	2.0E-08		7.2E-10		1.0E-09		
4,4'-DDT			4.8E-05	2.9E-09	4.3E-05	1.0E-10	1.2E-05	1.5E-10		
alpha-BHC			1.7E-05	3.1E-07	1.5E-05	1.1E-08	4.3E-06	1.5E-08		
delta-BHC			---	1.0E-07		3.6E-09		5.1E-09		
gamma-BHC (lindane)			5.3E-03	6.3E-07	4.7E-03	2.2E-08	1.3E-03	3.1E-08		
Inhalation	NA	NA							NA	NA
Naphthalene			1.2E-04	4.4E-09	1.2E-04	1.8E-10	3.4E-05	2.5E-10		
Tetrachloroethene			6.8E-05	3.9E-08	6.8E-05	1.6E-09	1.9E-05	2.2E-09		
4,4'-DDD				9.2E-13		3.7E-14		5.2E-14		
4,4'-DDT				3.1E-13		1.3E-14		1.8E-14		
alpha-BHC				9.9E-12		3.9E-13		5.5E-13		
delta-BHC				3.4E-12		1.3E-13		1.9E-13		
gamma-BHC (lindane)				4.9E-11		2.0E-12		2.8E-12		
Surface Soil Total Risk	0	0	0	0	0	0	0	0	0	0
Subsurface Soil Total Risk	0	0	4.7E-02	7.5E-06	4.6E-02	2.9E-07	7.2E-03	2.3E-07	0	0

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Table C-40. Carcinogenic and Noncarcinogenic Risk from Exposure to the Groundwater and Drinking Water in the Phase I Site

Media/ Pathway/ Chemical	Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water										
Ingestion	NA	NA							NA	NA
alpha-BHC			1.7E-06	3.1E-08	1.7E-06	1.2E-09	4.8E-07	1.7E-09		
gamma-BHC (lindane)			1.8E-03	2.1E-07	1.8E-03	8.9E-09	5.0E-04	1.2E-08		
delta-BHC				3.7E-08		1.5E-09		2.0E-09		
Tetrachloroethene			1.1E-03	2.2E-06	5.6E-04	---	1.6E-04	---		
Naphthalene			1.7E-06		3.4E-06	2.6E-10	9.6E-07	3.7E-10		
Dermal	NA	NA							NA	NA
alpha-BHC			5.6E-06	1.0E-07	5.6E-06	4.0E-09	1.6E-06	5.6E-09		
gamma-BHC (lindane)			5.8E-03	6.8E-07	5.8E-03	2.7E-08	1.6E-03	3.8E-08		
delta-BHC				1.2E-07		4.7E-09		6.6E-09		
Tetrachloroethene			1.3E-02	2.4E-05	6.2E-03	---	1.8E-03	---		
Naphthalene			2.7E-05		5.5E-05	4.2E-09	1.5E-05	5.9E-09		
Vapor Intrusion/ Inhalation from Groundwater			NA	NA	NA	NA	NA	NA		
alpha-BHC	---	4.7E-10							---	7.9E-10
gamma-BHC (lindane)	3.2E-054	4.4E-09							4.6E-05	7.4E-09
delta-BHC	---	2.0E-09							---	3.3E-09
Tetrachloroethene	---	1.3E-06							---	2.2E-06
Naphthalene	5.3E-05	---							7.7E-05	---
Drinking Water Total Risk	0	0	0	0	0	0	0	0	0	0
Groundwater Water Total Risk	0	0	2.1E-02	2.7E-05	1.4E-02	5.2E-08	4.0E-03	7.2E-08	0	0
Vapor Intrusion Pathway Total Risk	8.4E-05	1.3E-06	0	0	0	0	0	0	1.2E-04	2.2E-06

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Table C-41. Total Risk Results for All Receptors for the Phase I Site

Media/ Pathway/ Chemical	Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil Total Risk	0	0	0	0	0	0	0	0	0	0
Subsurface Soil Total Risk	0	0	4.7E-02	7.5E-06	4.6E-02	2.9E-07	7.2E-03	2.3E-07	0	0
Drinking Water Total Risk	0	0	0	0	0	0	0	0	0	0
Groundwater Water Total Risk	0	0	2.1E-02	2.7E-05	1.4E-02	5.2E-08	4.0E-03	7.2E-08	0	0
Vapor Intrusion Pathway Total Risk	8.4E-05	1.3E-06	0	0	0	0	0	0	1.2E-04	2.2E-06
Receptor Total Risks	8.4E-05	1.3E-06	6.8E-02	3.5E-05	6.1E-02	3.5E-07	1.1E-02	3.1E-07	1.2E-04	2.2E-06

(2) Phase II. Carcinogenic and noncarcinogenic risks were calculated for all applicable exposure routes. Table C-42 shows the results of the risk calculations for the incidental ingestion, dermal contact, and inhalation from exposure to the surface and subsurface soil in the Phase II site. (Note: This table is presented as Tables C-42a, b, and c.) Table C-43 shows the results of the risk calculations for exposure to the groundwater and drinking water in the Phase II site. (Note: This table is presented as Tables C-43a, b, and c.) Table C-44 summarizes the calculated carcinogenic and noncarcinogenic risks for all receptors and exposure routes considered in this phase of the risk assessment. The total carcinogenic risks for all receptors are within or below the USEPA acceptable range for determining risk to human health. With the exception of the hypothetical future adult resident and the industrial worker, the total noncarcinogenic risk (HI) is less than the threshold of unity. The noncarcinogenic risk to these hypothetical future receptors slightly exceeds the threshold. The exceedance of the USEPA criteria for both receptors is due to vapor intrusion of trichloroethene in the groundwater. The vapor intrusion model used assumptions of the construction of the building and the parameters of the underlying soil which most likely over estimates the transport of chemicals into the building; thus, the small exceedance of the threshold should not be taken to indicate a health concern. It is important to note here that the adult resident receptor was included in this assessment for informational purposes only since this area is not being considered for future residential development. Exposure to the Phase II site by other modeled receptors does not pose a significant adverse health risk to human health.

Table C-42a, b, and c. Carcinogenic and Noncarcinogenic Risk from Exposure to the Soil for the Phase II Site

Table C-42a Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Ingestion											
	EPC (mg/kg)										
4,4 DDD	0.588	NA	2.46E-08	NA	1.2E-07	NA	7.2E-09	NA	3.3E-08	NA	4.1E-08
4,4 DDE	0.588	NA	3.49E-08	NA	1.7E-07	NA	1.0E-08	NA	4.7E-08	NA	5.9E-08
4,4 DDT	10.3	1.0E-02	6.09E-07	4.8E-02	2.9E-06	7.7E-02	1.8E-07	6.7E-02	8.2E-07	1.4E-02	1.0E-06
alpha-BHC	0.0486	3.0E-06	5.35E-08	1.4E-05	2.6E-07	2.3E-05	1.6E-08	2.0E-05	7.2E-08	4.2E-06	9.0E-08
delta-BHC	0.0506	NA	1.59E-08	NA	7.6E-08	NA	4.7E-09	NA	2.1E-08	NA	2.7E-08
Dieldrin	0.0583	5.7E-04	1.63E-07	2.7E-03	7.8E-07	4.4E-03	4.8E-08	3.8E-03	2.2E-07	8.0E-04	2.7E-07
gamma-BHC (lindane)	1.57	2.6E-03	3.02E-07	1.2E-02	1.5E-06	2.0E-02	8.8E-08	1.7E-02	4.1E-07	3.6E-03	5.1E-07
Tetrachloroethene	3.51	1.7E-04	3.31E-07	8.2E-04	1.6E-06	1.3E-03	9.7E-08	1.2E-03	4.5E-07	2.4E-04	5.6E-07
Benzo(a)pyrene	0.0144	NA	1.83E-08	NA	8.8E-08	NA	5.3E-09	NA	2.5E-08	NA	3.1E-08
Subsurface Soil											
Ingestion		NA	NA							NA	NA
	EPC (mg/kg)										
I-TEQ(ND=0)	7.13E-07			6.7E-04	3.1E-08	6.7E-04	1.2E-09	9.4E-05	8.7E-10		
4,4'-DDT	2.77			5.2E-03	3.2E-07	5.2E-03	1.3E-08	7.3E-04	8.8E-09		
alpha-BHC	0.0254			3.0E-06	5.4E-08	3.0E-06	2.2E-09	4.2E-07	1.5E-09		
delta-BHC	0.0367			NA	2.2E-08	NA	8.9E-10	NA	6.2E-10		
Dieldrin	0.0193			3.6E-04	1.0E-07	3.6E-04	4.1E-09	5.1E-05	2.9E-09		
gamma-BHC (lindane)	0.487			1.5E-03	1.8E-07	1.5E-03	7.2E-09	2.1E-04	5.0E-09		

Table C-42b Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Dermal											
	EPC (mg/kg)										
4,4 DDD	0.588	NA	1.2E-08	NA	3.9E-08	NA	2.1E-09	NA	1.9E-08	NA	9.6E-08
4,4 DDE	0.588	NA	1.7E-08	NA	5.5E-08	NA	3.0E-09	NA	2.7E-08	NA	1.4E-07
4,4 DDT	10.3	1.5E-03	9.1E-08	4.7E-03	2.9E-07	6.4E-03	1.6E-08	1.2E-02	1.4E-07	3.3E-02	2.4E-06
alpha-BHC	0.0486	1.5E-06	2.7E-08	4.7E-06	8.4E-08	6.3E-06	4.5E-09	1.2E-05	4.2E-08	9.7E-06	2.1E-07
delta-BHC	0.0506	NA	7.9E-09	NA	2.5E-08	NA	1.4E-09	NA	1.2E-08	NA	6.2E-08
Dieldrin	0.0583	2.8E-04	8.1E-08	8.9E-04	2.6E-07	1.2E-03	1.4E-08	2.2E-03	1.3E-07	1.9E-03	6.4E-07

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gamma-BHC (lindane)	1.57	5.1E-04	6.0E-08	1.6E-03	1.9E-07	2.2E-03	1.0E-08	4.0E-03	9.4E-08	8.3E-03	1.2E-06
Tetrachloroethene	3.51	3.4E-04	6.6E-07	1.1E-03	2.1E-06	1.5E-03	1.1E-07	2.7E-03	1.0E-06	5.6E-04	1.3E-06
Benzo(a)pyrene	0.0144	NA	1.2E-08	NA	3.7E-08	NA	2.0E-09	NA	1.9E-08	NA	7.1E-08
Subsurface Soil											
Dermal		NA	NA							NA	NA
	EPC (mg/kg)										
I-TEQ(ND=0)	7.13E-07			6.6E-05	3.0E-09	5.8E-05	1.1E-10	1.6E-05	1.2E-24		
4,4'-DDT	2.77			5.1E-04	3.1E-08	4.5E-04	1.1E-09	1.3E-04	1.5E-09		
alpha-BHC	0.0254			9.8E-07	1.8E-08	8.7E-07	6.2E-10	2.4E-07	8.7E-10		
delta-BHC	0.0367			NA	2.2E-09	NA	7.7E-11	NA	1.1E-10		
Dieldrin	0.0193			1.2E-04	3.4E-08	1.1E-04	1.2E-09	2.9E-05	1.7E-09		
gamma-BHC (lindane)	0.487			2.0E-04	2.4E-08	1.8E-04	8.3E-10	5.0E-05	1.2E-09		

Table C-42c Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Inhalation											
	EPC (mg/kg)										
4,4 DDD	0.588	NA	2.5E-12	NA	1.2E-12	NA	7.6E-14	NA	7.0E-13	NA	1.3E-11
4,4 DDE	0.588	NA	3.5E-12	NA	1.8E-12	NA	1.1E-13	NA	9.8E-13	NA	1.8E-11
4,4 DDT	10.3	NA	6.1E-11	NA	3.1E-11	NA	1.9E-12	NA	1.7E-11	NA	3.1E-10
alpha-BHC	0.0486	NA	5.4E-12	NA	2.7E-12	NA	1.6E-13	NA	1.5E-12	NA	2.7E-11
delta-BHC	0.0506	NA	1.6E-12	NA	7.9E-13	NA	4.8E-14	NA	4.4E-13	NA	8.1E-12
Dieldrin	0.0583	NA	1.6E-11	NA	8.2E-12	NA	5.0E-13	NA	4.6E-12	NA	8.4E-11
gamma-BHC (lindane)	1.57	NA	3.0E-11	NA	1.5E-11	NA	9.1E-13	NA	8.4E-12	NA	1.5E-10
Tetrachloroethene	3.51	9.2E-04	5.2E-07	4.6E-04	2.6E-07	7.0E-04	1.6E-08	1.3E-03	1.5E-07	3.9E-03	2.7E-06
Benzo(a)pyrene	0.0144	NA	9.7E-13	NA	4.8E-13	NA	2.9E-14	NA	2.7E-13	NA	4.9E-12
Subsurface Soil											
Inhalation		NA	NA							NA	NA
	EPC (mg/kg)										
I-TEQ(ND=0)	7.13E-07			6.1E-10	3.3E-13	6.1E-10	1.3E-14	1.7E-10	1.9E-14		
4,4'-DDT	2.77			NA	3.3E-12	NA	1.3E-13	NA	1.8E-13		
alpha-BHC	0.0254			NA	5.6E-13	NA	2.3E-14	NA	3.2E-14		
delta-BHC	0.0367			NA	2.3E-13	NA	9.2E-15	NA	1.3E-14		
Dieldrin	0.0193			NA	1.1E-12	NA	4.4E-14	NA	6.1E-14		
gamma-BHC (lindane)	0.487			NA	1.9E-12	NA	7.4E-14	NA	1.0E-13		

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Table C-43a, b, and c. Carcinogenic and Noncarcinogenic Risk from Exposure to the Groundwater and Drinking Water in the Phase II Site

Table C-43a Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Ingestion		NA	NA							NA	NA
	EPC (mg/l)										
Benzene	1.60E-03			7.8E-05	6.2E-09	7.8E-05	2.5E-10	2.2E-05	3.5E-10		
1,1-Dichloroethane	2.91E-03			2.8E-06	1.2E-09	2.8E-06	4.6E-11	8.0E-07	6.5E-11		
cis-1,2-Dichloroethene	8.35E-02			8.2E-03	NA	8.2E-03	NA	2.3E-03	NA		
Naphthalene	7.00E-03			6.9E-05	NA	6.9E-05	NA	1.9E-05	NA		
Tetrachloroethene	1.61E-01			3.2E-03	6.1E-06	3.2E-03	2.4E-07	8.8E-04	3.4E-07		
1,2,4-Trichlorobenzene	3.37E-02			6.6E-04	6.8E-08	6.6E-04	2.7E-09	1.9E-04	3.8E-09		
Trichloroethene	1.59E-01			6.2E-02	5.1E-07	6.2E-02	2.0E-08	1.7E-02	2.9E-08		
Vinyl chloride	1.68E-03			1.1E-04	8.4E-08	1.1E-04	3.4E-09	3.1E-05	4.7E-09		
alpha-BHC	1.01E-04			2.5E-06	4.5E-08	2.5E-06	1.8E-09	6.9E-07	2.5E-09		
gamma-BHC (lindane)	8.35E-04			5.5E-04	6.4E-08	5.5E-04	2.6E-09	1.5E-04	3.6E-09		
beta-BHC	2.91E-04				3.7E-08		1.5E-09		2.1E-09		
delta-BHC	2.96E-04				3.7E-08		1.5E-09		2.1E-09		
Dieldrin	1.11E-04			4.3E-04	1.2E-07	4.3E-04	5.0E-09	1.2E-04	6.9E-09		
Manganese	1.91E+00			2.7E-03	NA	2.7E-03	NA	7.5E-04	NA		

Table C-43b Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
Drinking Water		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Ground water											
Dermal		NA	NA							NA	NA
	EPC (mg/l)										
Benzene	1.60E-03			3.8E-04	3.0E-08	3.8E-04	1.2E-09	1.1E-04	1.7E-09		
1,1-Dichloroethane	2.91E-03			3.5E-06	1.4E-09	3.5E-06	5.7E-11	9.8E-07	8.0E-11		
cis-1,2-Dichloroethene	8.35E-02			1.9E-02	NA	1.9E-02	NA	5.3E-03	NA		
Naphthalene	7.00E-03			1.1E-03	NA	1.1E-03	NA	3.1E-04	NA		
Tetrachloroethene	1.61E-01			3.5E-02	6.8E-05	3.5E-02	2.7E-06	9.8E-03	3.8E-06		
1,2,4-Trichlorobenzene	3.37E-02			1.5E-02	1.6E-06	1.5E-02	6.3E-08	4.3E-03	8.9E-08		
Trichloroethene	1.59E-01			2.3E-01	1.9E-06	2.3E-01	7.6E-08	6.5E-02	1.1E-07		
Vinyl chloride	1.68E-03			1.9E-04	1.4E-07	1.9E-04	5.7E-09	5.2E-05	8.0E-09		

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alpha-BHC	1.01E-04			8.0E-06	1.5E-07	8.0E-06	5.8E-09	2.3E-06	8.1E-09		
gamma-BHC(Lindane)	8.35E-04			1.8E-03	2.1E-07	1.8E-03	8.3E-09	5.0E-04	1.2E-08		
beta-BHC	2.91E-04				1.2E-07		4.8E-09		6.7E-09		
delta-BHC	2.96E-04				1.2E-07		4.8E-09		6.8E-09		
Dieldrin	1.11E-04			1.6E-03	4.6E-07	1.6E-03	1.8E-08	4.5E-04	2.6E-08		
Manganese	1.91E+00			6.2E-04	NA	6.2E-04	NA	1.7E-04	NA		

Table C-43c.Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Ground water											
Vapor intrusion				NA	NA	NA	NA	NA	NA		
	EPC (mg/l)										
Benzene	1.60E-03	NA	4.2E-08							NA	7.0E-08
1,1-Dichloroethane	2.91E-03	5.0E-05	NA							7.3E-05	NA
cis-1,2-Dichloroethene	8.35E-02	1.6E-02	NA							2.3E-02	NA
Naphthalene	7.00E-03	2.1E-03	NA							3.1E-03	NA
Tetrachloroethene	1.61E-01	NA	3.7E-06							NA	6.2E-06
1,2,4-Trichlorobenzene	3.37E-02	2.0E-04	NA							3.0E-04	NA
Trichloroethene	1.59E-01	1.2E-00	3.4E-06							1.7E-00	5.6E-06
Vinyl chloride	1.68E-03	1.0E-03	3.3E-07							1.5E-03	5.5E-07
alpha-BHC	1.01E-04	NA	6.8E-10							NA	1.1E-09
gamma-BHC (lindane)	8.35E-04	9.7E-06	1.4E-09							1.4E-05	2.3E-09
beta-BHC	2.91E-04	NA	2.0E-09							NA	3.3E-09
delta-BHC	2.96E-04	NA	2.0E-09							NA	3.3E-09
Dieldrin	1.11E-04	5.5E-06	1.6E-09							8.0E-06	2.6E-09
Manganese	1.91E+00	NA	NA							NA	NA

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Table C-44. Total Risk Results for All Receptors for the Phase II Site

Media/ Pathway/ Chemical	Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil Total Risk	1.7E-02	3.0E-06	7.7E-02	1.1E-05	1.1E-01	6.2E-07	1.1E-01	3.8E-06	6.6E-02	1.1E-05
Subsurface Soil Total Risk	0	0	8.6E-03	8.2E-07	8.6E-03	3.2E-08	1.3E-03	2.5E-08	0	0
Drinking Water Total Risk	0	0	0	0	0	0	0	0	0	0
Groundwater Water Total Risk	0	0	3.8E-01	7.9E-05	3.8E-01	3.2E-06	1.1E-01	4.5E-06	0	0
Vapor Intrusion Pathway Total Risk	1.2E-00	7.4E-06	0	0	0	0	0	0	1.7E-00	1.2E-05
Receptor Total Risks	1.2E-00	1.0E-05	4.7E-01	9.1E-05	5.0E-01	3.8E-06	2.2E-01	8.2E-06	1.8E-00	2.4E-05

(3) Phase IIB. Carcinogenic and noncarcinogenic risks were calculated for all applicable exposure routes. Table C-45 shows the results of the risk calculations for the incidental ingestion, dermal contact and inhalation from exposure to the surface and subsurface soil in the Phase IIB site. (Note: This table is presented as Tables C-45a, b, and c.) Table C-46 shows the results of the risk calculations for exposure to the groundwater and drinking water in the Phase IIB site. (Note: This table is presented as Tables C-46a and b.) Table C-47 summarizes the calculated carcinogenic and noncarcinogenic risks for all receptors and exposure routes considered in this phase of the risk assessment. The risk evaluation performed for the Phase IIB site determined that exposure to this site by any modeled receptor would not result in a significant adverse health threat. The total noncarcinogenic HI for all receptors is less than the threshold of unity used by the USEPA to determine if further action is warranted. Exposure to the Phase IIB site by the modeled receptors does not pose a significant adverse health risk to human health.

Table C-45a, b, and c. Carcinogenic and Noncarcinogenic Risk from Exposure to the Soil for the Phase IIB Site

Table C-45a Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Ingestion											
	EPC (mg/kg)										
Arsenic	55.42	9.0E-02	1.5E-05	4.3E-01	7.0E-05	6.6E-01	4.2E-06	6.1E-01	2.0E-05	1.3E-01	2.4E-05
Subsurface Soil											
Ingestion		NA	NA							NA	NA
	EPC(mg/kg)										
4,4 DDD	0.740			NA	6.0E-08	NA	2.4E-09	NA	1.7E-09		
4,4'-DDT	3.08			5.8E-03	3.5E-07	5.8E-03	1.4E-08	8.1E-04	9.8E-09		
Arsenic	10.76			3.4E-02	5.4E-06	3.4E-02	2.2E-07	4.7E-03	1.5E-07		

Table C-45b Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Dermal											
	EPC (mg/kg)										
Arsenic	55.42	1.4E-02	2.2E-06	4.3E-02	6.8E-06	5.7E-02	3.7E-07	1.1E-01	3.4E-06	8.8E-02	1.7E-05
Subsurface Soil											
Dermal		NA	NA							NA	NA
	EPC(mg/kg)										
4,4 DDD	0.740			NA	1.9E-08	NA	6.9E-10	NA	9.7E-10		
4,4'-DDT	3.08			5.7E-04	3.4E-08	5.0E-04	1.2E-09	1.4E-04	1.7E-09		
Arsenic	10.76			1.1E-02	1.8E-06	2.9E-03	1.9E-08	8.2E-04	2.6E-08		

Table C-45c Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil											
Inhalation											
	EPC (mg/kg)										
Arsenic	55.42	6.4E-04	1.5E-08	3.2E-04	7.3E-09	4.8E-04	4.4E-10	8.9E-04	4.1E-09	2.7E-03	7.4E-08
Subsurface Soil											
Inhalation		NA	NA							NA	NA
	EPC (mg/kg)										
4,4 DDD	0.740			NA	2.8E-12	NA	1.1E-13	NA	1.6E-13		
4,4'-DDT	3.08			NA	1.9E-11	NA	7.7E-13	NA	1.1E-12		
Arsenic	10.76			2.5E-05	5.7E-10	2.7E-05	2.3E-11	6.9E-06	3.2E-11		

Tables C-46a, b, and c. Carcinogenic and Noncarcinogenic Risk from Exposure to the Groundwater and Drinking Water in the Phase IIB Site

Table C-46a Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Ingestion		NA	NA							NA	NA
	EPC (mg/l)										
Benzene	2.94E-03			1.4E-04	1.1E-08	1.4E-04	4.5E-10	4.0E-05	6.3E-10		
1,1-Dichloroethane	3.43E-03			3.4E-06	1.4E-09	3.4E-06	5.5E-11	9.4E-07	7.7E-11		
cis-1,2-Dichloroethene	3.00E-01			2.9E-02	NA	2.9E-02	NA	8.2E-03	NA		
Naphthalene	7.00E-03			6.9E-05	NA	6.9E-05	NA	1.9E-05	NA		
Tetrachloroethene	5.46E-02			1.1E-03	2.1E-06	1.1E-03	8.2E-08	3.0E-04	1.2E-07		
Trichloroethene	4.14E-02			1.6E-02	1,3E-07	1.6E-02	5.3E-09	4.5E-03	7.5E-09		
Vinyl chloride	1.10E-02			7.2E-04	5.6E-07	7.2E-04	2.2E-08	2.0E-04	3.1E-08		
alpha-BHC	3.75E-05			9.2E-07	1.7E-08	9.2E-07	6.6E-10	2.6E-07	9.3E-10		
beta-BHC	1.36E-04			NA	1.7E-08	NA	6.8E-10	NA	9.6E-10		
Dieldrin	2.04E-05			8.0E-05	2.3E-08	8.0E-05	9.1E-10	2.2E-05	1.3E-09		

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Table C-46b Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Dermal		NA	NA							NA	NA
	EPC (mg/l)										
Benzene	2.94E-03			4.7E-04	3.7E-08	4.7E-04	1.5E-09	1.3E-04	2.1E-09		
1,1-Dichloroethane	3.43E-03			1.1E-05	4.4E-09	1.1E-05	1.8E-10	3.1E-06	2.5E-10		
cis-1,2-Dichloroethene	3.00E-01			9.5E-02	NA	9.5E-02	NA	2.7E-02	NA		
Naphthalene	7.00E-03			2.2E-04	NA	2.2E-04	NA	6.2E-05	NA		
Tetrachloroethene	5.46E-02			3.5E-03	6.7E-06	3.5E-03	2.7E-07	9.7E-04	3.8E-07		
Trichloroethene	4.14E-02			5.3E-02	4.3E-07	5.3E-02	1.7E-08	1.5E-02	2.4E-08		
Vinyl chloride	1.10E-02			2.3E-03	1.8E-06	2.3E-03	7.2E-08	6.6E-04	1.0E-07		
alpha-BHC	3.75E-05			3.0E-06	5.4E-08	3.0E-06	2.2E-09	9.5E-11	3.0E-09		
beta-BHC	1.36E-04			NA	1.9E-07	NA	7.6E-09	NA	1.1E-08		
Dieldrin	2.04E-05			1.3E-03	3.7E-07	1.3E-03	1.5E-08	3.6E-04	2.1E-08		

Table C-46c Media/ Pathway/ Chemical		Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
		Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Drinking Water		No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs	No COPCs
Ground water											
Vapor Intrusion				NA	NA	NA	NA	NA	NA		
	EPC (mg/l)										
Benzene	2.94E-03	NA	7.7E-08							NA	1.3E-07
1,1-Dichloroethane	3.43E-03	8.6E-05	NA							8.6E-05	NA
cis-1,2-Dichloroethene	3.00E-01	8.2E-02	NA							8.2E-02	NA
Naphthalene	7.00E-03	2.1E-03	NA							3.1E-03	NA
Tetrachloroethene	5.46E-02	NA	1.6E-07							NA	2.1E-06
Trichloroethene	4.14E-02	3.0E-01	8.8E-07							4.4E-01	1.5E-06
Vinyl chloride	1.10E-02	6.8E-03	2.1E-06							9.9E-03	3.6E-06
alpha-BHC	3.75E-05	NA	2.5E-10							NA	4.2E-10
beta-BHC	1.36E-04	NA	9.1E-10							NA	1.5E-09
Dieldrin	2.04E-05	1.0E-06	2.9E-10							1.5E-06	4.9E-10

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Table C-47. Total Risk Results for All Receptors for the Phase IIB Site

Media/ Pathway/ Chemical	Industrial Worker		Utility Worker		Construction Worker		Soldier Training		Adult Resident	
	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc	Non-carc	Carc
Surface Soil Total Risk	1.0E-01	1.7E-05	4.8E-01	7.7E-05	7.2E-01	4.6E-06	7.1E-01	1.3E-05	2.2E-01	4.1E-05
Subsurface Soil Total Risk	0	0	5.1E-02	7.6E-06	4.3E-02	2.5E-07	6.5E-03	1.9E-07	0	0
Drinking Water Total Risk	0	0	0	0	0	0	0	0	0	0
Groundwater Water Total Risk	0	0	1.0E-01	5.7E-06	2.0E-01	5.0E-07	5.7E-02	6.9E-07	0	0
Vapor Intrusion Pathway Total Risk	3.1E-01	3.0E-06	0	0	0	0	0	0	4.5E-01	5.1E-06
Receptor Total Risks	4.1E-01	2.0E-05	6.3E-01	9.0E-05	9.6E-01	5.4E-06	7.8E-01	2.4E-05	6.6E-01	4.7E-05

C-7. UNCERTAINTY ASSESSMENT. All risk assessments involve the use of assumptions, judgments, and imperfect data to varying degrees. This results in uncertainty in the final estimates of risk. There are uncertainties associated with each component of the risk assessment from data collection through risk characterization. For example, there is uncertainty in the initial selection of substances used to characterize exposures and risk on the basis of the sampling data and available toxicity information. Other sources of uncertainty are inherent in the toxicity values for each substance and the exposure assessments used to characterize risk. Finally, additional uncertainties are incorporated into the risk assessment when exposures across multiple pathways are summed. Areas of uncertainty in each risk assessment step are discussed below.

a. Uncertainty in Data Collection and Evaluation.

(1) It is an uncertainty of the determination of what, if anything, was buried on the site. The compounds that constituted Herbicide Orange were generally 2,4,5-T and 2,4-D with a manufacturing contaminant of dioxin (mainly 2,3,7,8-TCDD). However, the mixture also contained several chlorinated phenols as remnants and intermediates of the parent materials that made each ingredient. This is common in chemical manufacturing that is not being developed for research purposes. Each of these compounds have a variable level of persistence in the natural environment but only the dioxin compounds are considered to have an environmental persistence that can last decades. For instance, the compound 2,4,5-T is reported to be able to exist in the soil environment for as long as 48 months if the conditions are optimal for its persistence. Generally, it is reported to last for less than a growing season (usually defined as 3-4 months). This assessment assumes that the presently measured concentrations persist

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over the entire exposure period and only addresses the risk from chemicals in the present timeframe. As is the nature of chemicals released into the natural environment, they would most likely be at higher concentrations at the time of release and lower as the time from release increases. This assessment does not attempt to predict the risk existing during other timeframes.

(2) Uncertainties in the data collection/evaluation step of the risk assessment limit determining whether enough samples were collected to adequately characterize the risk, and if sample analyses were conducted in a qualified manner to maximize the confidence in the results. Sample analyses results were used to develop a database, which includes a complete list of the chemicals in the environmental media and their representative concentrations used in the risk assessment. The sampling and analysis addressed various objectives in addition to the risk assessment. Therefore, the samples were not collected randomly but were collected from areas of the site with the greatest likelihood to contain the COPCs. This type of nonrandom sampling biases the data collected toward overestimating chemical concentrations from the site.

(3) All chemicals detected that were potentially site-related were retained in this assessment. Chemicals that were never detected were eliminated from the assessment. This practice may slightly underestimate risks due to low levels (such as, below the sample quantitation limit) of eliminated chemicals; however, it is unlikely that the addition of these chemicals would lead to a significant health risk.

(4) The laboratory data packages were reviewed for preservation, holding times, blanks, surrogate spikes, matrix spike/matrix spike duplicates and laboratory control samples (blank spikes). Evaluation for these parameters is considered to be a "Level 2b" Data Validation. Data validation for the Phase I data indicated that some parameters did not meet quality standards and should be rejected or considered as estimates. While the specifics of the data validation are contained in Appendix E and will not be reproduced here, the chemical that was recommended for rejection was a chemical that was not detected above the analytical detection limit. Thus, it is unlikely that this would lead to a significant impact on the calculated health risk.

b. Uncertainty in Exposure Assessment.

(1) A large part of the risk assessment is the estimation of risks for a broad set of exposure scenarios and pathways. If exposure does not occur, no risks are present. This assessment does not factor in the probability of the exposure occurring. For certain pathways, exposure may be extremely unlikely. This assumption yields an overestimate of risk.

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(2) Once pathways are identified, EPCs must be estimated. There is always some doubt as to how well an exposure model approximates the actual conditions receptors will be exposed to at a given site. Key assumptions in estimating EPCs and exposure assumptions and their potential impact on the assessment are described in the following paragraphs.

(a) Many factors determine the level of exposure for each exposure pathway. These factors include ingestion rates, exposure frequencies, exposure durations, and body weight. The values for these exposure factors must be selected by the risk assessor to represent each receptor. For the scenarios in this risk assessment, upper-bound values were selected for each exposure factor. In the calculations of exposure, these multiple upper-bound exposure factors estimates compound to yield intakes which overestimate likely exposure levels.

(b) The EPCs derived from the measured chemical concentrations are assumed to persist without change for the entire duration of each exposure scenario. It is likely that chemical concentrations will change over time. Unfortunately, it is not known whether the quality will improve or degrade. Therefore, this steady state assumption could tend to under or overestimate exposure levels.

c. Uncertainty in the Toxicity Assessment. There is considerable uncertainty inherent in the toxicity values for both carcinogens and noncarcinogens. Many of the studies are based on animals and extrapolated to humans, and in some cases, subchronic studies must be used to assess chronic effects. There is also uncertainty associated with the route to route extrapolation of oral RfDs for calculation of dermal risk. Most cancer slope factors are calculated using a model which extrapolates low-dose effects from high-dose animal studies. Since toxicity constants are generally based on the 95th UCL interval or incorporate safety factors to compensate for uncertainty, chemical-specific risks may be overestimated.

d. Uncertainty in Risk Characterization. Uncertainties in the toxicity assessment are compounded under the assumption of dose additivity for multiple substance/pathway exposure. That assumption ignores possible synergism and antagonisms among chemicals and assumes similarity in mechanisms of action and metabolism. Overall, these assumptions could tend to under or overestimate risk. Similarly, risks summed for chemicals having different target organs may also tend to overestimate risk.

APPENDIX D

TEST RESULTS OF GROUNDWATER RESAMPLING FOR HERBICIDES CAMP CARROLL, KOREA

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FAR EAST DISTRICT
Unit #15546
APO AP 96205-5546

REPLY TO
ATTENTION OF:

CEPOF-ED-G

AUG 0 2 2011

MEMORANDUM FOR USFK Assistant Chief of Staff, Engineers, ATTN: Colonel Joseph F. Birchmeier, UNIT #15237, APO AP 96205-5237

SUBJECT: Test Results of Groundwater Samples for Herbicide, Cp Carroll, Korea (G&E 11-032E/E2011-44)

1. Enclosed is the summary of test results for groundwater samples collected from water supply and monitoring wells at Cp Carroll. The samples were collected by Geotechnical and Environmental Engineering Branch, US Army Corps of Engineers, Far East District (FED) and tested for 2,4,5-T (chlorinated herbicides) according to US EPA Method 8151A.

2. Laboratory Findings for Original Sampling

a. Original sampling was conducted from 3 Jun to 15 Jun 2011 and the samples were tested by SGS North America. Based on test results in FED memorandum E2011-38, dated 11 July 2011, 2,4,5-T was found in 3 samples at concentrations of 1.02 ~ 2.83 µg/L and detected in other 2 samples at levels between the detection limit and the reporting limit.

b. Five (5) sample extracts obtained from original samples which had detected concentrations of 2,4,5-T were re-analyzed by gas chromatography (GC) equipped with electron capture detector (ECD) and verified with mass spectrometry to confirm presence of 2,4,5-T. Subsequent reanalysis showed that there was no 2,4,5-T detected in any of the water samples. The results of re-test are provided in Table 1.

c. The 5 samples had false positives for 2,4,5-T in the first test due to the reasons below.

(1) The laboratory failed to perform sufficient sample preparation which resulted in interferences of 2,4,5-T analysis by Lindane which is one of the chlorinated pesticide compound.

(2) The laboratory failed to follow their protocols for flagging data that exceeded analytical tolerances. The data should have been flagged because of the high relative percent difference (RPD) between the results from the two columns/detectors.

(3) The laboratory has been implementing the corrective actions to ensure a similar mistake does not happen again. Summary of corrective actions is attached at Appendix A.

3. Laboratory Findings for Re-Sampling Event

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CEPOF-ED-G
SUBJECT: Test Results of Groundwater Samples for Herbicide, Cp Carroll, Korea (G&E 11-032E/E2011-44)

a. Groundwater samples were re-collected on 22 Jul from 5 locations where 2,4,5-T was detected in the 1st test of original samples. The water samples from monitoring well were collected in both methods of filtered and unfiltered. Filtered samples were obtained by using in-line filter with 0.45 μm pore size.

b. Samples were tested by ECCS Laboratory according to US EPA Method 8151A. As provided in Table 1, **there was no 2,4,5-T detected in any of the water samples.**

4. The POC for this matter is [redacted] b6 s at 721-7715.

Encl

[redacted] b6

Chief, Geotechnical and Environmental
Engineering Branch

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Table 1. Results of 2,4,5-T in Groundwater at Cp Carroll

Unit: µg/L

Location	Sample filtering	Original sampling (3 Jun to 15 Jun 2011)		Re-sampling (22 Jul 2011)
		1st test*	Re-test	
15-286	Unfiltered	0.0579 J	< 0.568	< 0.41
B09-178MW	Unfiltered	2.13	< 0.573	< 0.41
	Filtered	-	-	< 0.41
B03-463MW	Unfiltered	2.93	< 0.584	< 0.41
	Filtered	-	-	< 0.40
B03-466MW	Unfiltered	1.02	< 0.582	< 0.39
	Filtered	-	-	< 0.39
B03-467MW	Unfiltered	0.308 J	< 0.593	< 0.40
	Filtered	-	-	< 0.81**

NOTES:

1. J: Estimated amount detected between method detection limit and reporting limit
2. The non-detects are reported as "less than (<) sample reporting limit".
3. * Result of 1st test was issued by FED memorandum E2011-38, dated 11 Jul 2011.
4. ** Increase of sample reporting limit is caused by less sample volume taken. An accidental spill of sample occurred during extraction procedure in the lab.

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APPENDIX A

SGS

SGS Environmental Services

From: [redacted] b6

Office: Wilmington NC

Date: 7/29/2011

Copy: NA

Re: CAR G11-3

To: [redacted] b6

The following concerns were placed into our corrective action process:

1. Herbicide dual column results with RPD > 40% were not flagged with P qualifier as stated in SGS SOP SV_7.13.
2. Results were reported from the column with the higher result when the RPD was > 40%.

The root cause for the concerns was determined as follows:

1. The Acode testing for the dual column method was not thorough enough to catch this error.
2. The analyst did not suspect interference at the time; therefore the higher result was reported on the original data set. The interpretation of section 10.5 of the SOP lead SGS to report the results from the column with the higher number.

Actions taken are as follows:

1. Performed various analytical testing to demonstrate that interference was present including GCMS confirmations. (see attachments)
2. Provided revised reports to client.
3. Writing code to trigger calculation in LIMS on the upload that will automatically calculate the RPD. If the RPD is > 40% it will set the qualifier to "P". The program will report the lower value of the two columns if the RPD is >40%. If the RPD is ≤40% the higher value will be reported. (this will be completed on 7/29/2011)
4. Revise SOP SV_7.13 and SV_5.14 to reflect P flag procedure.

TEL 304.346.0725 FAX 304.346.0761
SGS Member of the SGS Group (Société Générale de Surveillance)

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APPENDIX E

PHASE I DATA VALIDATION REPORT

Validation Report SGS_SDG1872_9-6-11
Validation Report SGS_SDG1879_9-6-11
Validation Report SGS_SDG1889_9-6-11
Validation Report SGS_SDG_1915
Validation Report SGS_OC_Herbicides2
Validation Report SGS_OC_Dioxin

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Chemical Data Validation Report for Camp Carroll Agent Orange Investigation

Far East District Project Number 11-032E

Phase: Phase 1 Soil Sampling

Laboratory: SGS North America Inc.

Method: SW 846 Method 8290a, Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans

Date: 19 August 2011

Validator: [redacted] b6

US Army Engineer District, Honolulu

SUMMARY: Samples for all four sample delivery groups were evaluated in accordance with guidance provided in the *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans*, OSWER 9240.1-51, September 2005. Laboratory data packages were reviewed for preservation, holding times, blanks, surrogate spikes, matrix spike/matrix spike duplicates and laboratory control samples (Blank spikes).

While one cooler of samples was received slightly below the recommended preservation temperature, no qualifications to the data are required. All samples were prepared and analyzed within the recommended holding times. Some batches had slight contamination in blanks for one to three analytes but there was no evidence of systemic blank contamination. Some sample results need to be qualified as estimated at low levels due to a possible positive bias.

Matrix spike and Matrix Spike Duplicate (MS/MSD) analyses were generally acceptable with only one batch being qualified for one compound (1,2,3,4,6,7,8-HpCDF). Radiolabeled compounds are used as surrogates for this method and almost all samples had acceptable recoveries of the surrogates.

No performance evaluation or reference samples were reported with any batches.

TABLE 1 SAMPLE DELIVERY GROUP INFORMATION

Sample Delivery Group	Chain of Custody Number	Number of Samples	Sample Dates	Receipt Date	Report Date
31101871	2483	28	7/12/11-7/13/11	7/15/11	7/26/11
31101877	None	44	7/14/11-7/15/11	7/19/11	7/27/11
31101890	None	35	7/16/11-7/17/11	7/19/11	7/28/11
31101913	None	22	7/18/11	7/21/11	8/1/11

TABLE 2 SAMPLE RECEIPT INFORMATION

Sample Delivery Group	Temperature	Sample Dates	Preparation Dates	Sample to Preparation	Analysis Dates
31101871	1.2, 2.7C	7/12/11-7/13/11	7/15/11-7/17/11	2-7 days	7/18/11-7/21/11
31101877	5.2, 5.5, 5.8, 5.9C	7/14/11-7/15/11	7/19/11-7/21/11	5-6 days	7/21/11-7/23/11
31101890	4.2, 5.2, 5.2C	7/16/11-7/17/11	7/21/11-7/24/11	6-8 days	7/24/11-7/26/11
31101913	3.8, 3.9C	7/18/11	7/24/11-7/25/11	6-7 days	7/27/11-7/29/11

Sample Preservation. All samples must be protected from light and refrigerated at 4 ± 2°C from the time of receipt (time of collection when possible) until the time of extraction. All samples were received by the laboratory at temperatures between 1° and 6°C. The temperature discrepancies are slight and should not affect the validity of the data. No data qualification is required for any sample.

Holding Times. According to the Method, the maximum allowable holding time between sample collection and sample preparation is 30 days. All samples were prepared within the allowable holding time. The maximum allowable holding time between sample preparation and sample analysis is 45 days. All samples were analyzed within the allowable holding time. There are no holding time discrepancies. No data qualification is required for any sample.

Blanks. Method blanks were prepared and analyzed with every batch. Target analytes were detected in several batches and the reported results for these analytes should be considered as estimated. Samples with reported levels similar to that found in the associated blanks may be false positives.

For SDG 31101871, Three batches were prepared with three different results. Batch HXX/1180 had three contaminants detected: 1,2,3,4,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,4,6,7,8-HpCDF. Samples from batch HXX/1180 with reported levels of these compounds should be considered as "Estimated". Batch HXX/1181 had one contaminant detected (2,3,7,8-TCDF). Samples from batch HXX/1181 with reported levels of this compound should be considered as "Estimated". Batch HXX1187 had no contaminants detected and samples from this batch need no qualification. All radiolabled compound additions were within acceptable limits for all batches.

For SDG 31101877, three batches were prepared with three different results. Batch HXX1187 was shared with some samples from SDG 31101871 and had no contaminants detected. Batch HXX/1185 was contaminated with 2,3,7,8 TCDF. Samples from Batch HXX1185 with reported levels of this compound should be considered as "Estimated". Batch HXX/1190 reported a blank result for Total TCDF but all individual isomer results were below the Detection Limit. The functional guidelines only address reporting for individual isomers so blank values for "Totals" were not evaluated. No qualification of results for Batch HXX/1190 is required. All radiolabled compound additions were within acceptable limits for all batches.

For SDG 31101890, three batches were prepared with three different results. Batch HXX/1190 was shared with some samples from SDG 31101877. As discussed above, Batch HXX/1190 reported a blank result for Total TCDF but all individual isomer results were below the Detection Limit. No qualification of results for Batch HXX/1190 is required. Batch HXX/1191 had detectable levels of 2,3,7,8-TCDF and 2,3,4,7,8-PeCDF. Samples from Batch HXX1191 with reported levels of these compounds should be considered as "Estimated". Batch HXX/1192 reported blank results for Total TCDF and Total PeCDF but all individual isomer results were below the Detection Limit but the signal to noise ratio for the quantitation ions was above 2.5:1. No qualification of results for Batch HXX/1192 is required. All radiolabled compound additions were within acceptable limits for all batches.

For SDG 31101913, two batches were prepared with two different results. Batch HXX/1192 reported blank results for Total TCDF and Total PeCDF but all individual isomer results were below the Detection Limit but the signal to noise ratio for the quantitation ions was above 2.5:1. No qualification of results for Batch HXX/1192 is required. Batch HXX/1993 reported a blank result for 2,3,7,8-TCDF. Samples from Batch HXX/1993 with reported levels of this compound should be considered as "Estimated". All radiolabled compound additions were within acceptable limits for all batches.

Radiolabled Compound Recoveries. Radiolabeled chlorinated dioxins and dibenzofurans serve as the isotopic dilution quantitative mechanism in this method. The recovery of these compounds along with the recovery of the cleanup standard is a critical measure of the effectiveness of the laboratory and method to extract the compounds of interest. ^{37}Cl is a measure losses during cleanup.

For SDG 31101871, Batch HXX/1881 had low recoveries for the radiolabeled ^{13}C compounds in the Matrix Spike/ Matrix Spike Duplicates but acceptable ^{37}Cl recovery. This indicates problems with the preparation and handling of these quality control samples. While four of the radiolabled compounds were below the acceptance limit in the Matrix Spike sample, only one radiolabled compound in one of the associated field samples was outside the limits. No qualification of the results is required.

For SDG 31101877, samples E11-117-S1 and E11-131-S1 had low recoveries for most radiolabled compounds and failures for one or more. While the reported amounts for these compounds were below the estimated detection limit, the overall low recoveries indicate a slightly low bias for the reported result. However, no qualification of the results is required.

For SDG 31101890, sample E11-141-S2 had low recovery for ^{13}C OCDD. This sample had detectable levels of OCDD (48.5 pg/g) and therefore the results should be flagged as estimated with a probable low bias.

For SDG 31101913, sample E11-153-S3 (MSD) had low recoveries for several radiolabled compounds. However, the MS/MSD recoveries for the native compounds were well within acceptable limits so no qualification is required for the associated samples in preparation batch HXX1193.

Matrix Spike/Matrix Spike Duplicate (MS/MSD). A matrix spike and matrix spike duplicate pair are used to document the bias of a method in a given sample matrix. An aliquot of sample is fortified (spiked) with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

For these analyses, laboratory control blanks or field samples were fortified at levels approximately **forty** times the lower limit of quantitation (Method Reporting Limit). The acceptance limits are set between 70% and 135% of the amount added.

For SDG 31101871, one field sample (E11-115-S4) and one lab control sample for batch HXX/1881 were reported. There were no exceedances in the MS/MSD results for the field sample. The lab control MS and MSD samples had several low recoveries each for radiolabled compounds, as discussed above. No qualification of samples is required.

For SDG 31101877, three field MS/MSD samples and three lab control samples were analyzed. All resulted in acceptable recoveries and no sample qualification is required.

For SDG 31101890, two field MS/MSD and three laboratory control samples were analyzed. For batch HXX/1190, all analytes were within acceptable limits and no sample qualification is required for associated field samples. For batch HXX1191, Laboratory Control Sample 8934 had slightly high recovery for 1,2,3,4,6,7,8-HpCDF in the MSD only. The field MS/MSD sample for batch HXX1191 had low recoveries for OCDD with acceptable ^{13}C OCDD. No sample qualification is required for associated samples. For batch HXX1192, both the Lab Control Sample (Blank Spike/Blank Spike Duplicate) and the field sample (E11-148-S2) had high recovery exceedances for 1,2,3,4,6,7,8-HpCDF. This indicates a high

bias and associated samples with detectable results should be considered as "Estimated". Sample E11-148-S2 MS recoveries for all radiolabled compounds were low with four ^{13}C compounds below acceptable limits. MSD recoveries were well within the limits for this sample.

For SDG 31101913, two field and two lab control MS/MSD samples were analyzed. As reported above, for batch HXX1192, both the Lab Control Sample (Blank Spike/Blank Spike Duplicate) and the field sample (E11-148-S2) had high recovery exceedances for 1,2,3,4,6,7,8-HpCDF. For batch HXX1193, 1,2,3,4,6,7,8-HpCDF was also high for the Blank Spike MS sample. This indicates a high bias for both batches and associated samples with detectable results should be considered as "Estimated". Field Sample ES11-153-S3 had high recovery for the MS sample for OCDD and poor relative percent difference between the MS/MSD samples. The MSD sample had low recovery for both ^{13}C and ^{37}Cl radiolabeled surrogates. While this indicates probably sample processing difficulties with this MS/MSD pair, no sample qualification is required. MS/MSD recoveries for sample ES11-149-S2 were all within acceptable limits.

Overall, MS/MSD recoveries of field samples were within acceptable limits. With the exception of 1,2,3,4,6,7,8-HpCDF in batch HXX1192, no sample qualification is required.

Chemical Data Validation Report for Camp Carroll Agent Orange Investigation

Far East District Project Number 11-032E

Phase: Phase 1 Soil Sampling

Laboratory: SGS North America Inc.

Method: SW 846 Method 8290a, Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans

Date: 19 August 2011

Validator: [redacted] b6

US Army Engineer District, Honolulu

SUMMARY: Samples for all four sample delivery groups were evaluated in accordance with guidance provided in the *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans*, OSWER 9240.1-51, September 2005. Laboratory data packages were reviewed for preservation, holding times, blanks, surrogate spikes, matrix spike/matrix spike duplicates and laboratory control samples (Blank spikes).

While one cooler of samples was received slightly below the recommended preservation temperature, no qualifications to the data are required. All samples were prepared and analyzed within the recommended holding times. Some batches had slight contamination in blanks for one to three analytes but there was no evidence of systemic blank contamination. Some sample results need to be qualified as estimated at low levels due to a possible positive bias.

Matrix spike and Matrix Spike Duplicate (MS/MSD) analyses were generally acceptable with only one batch being qualified for one compound (1,2,3,4,6,7,8-HpCDF). Radiolabeled compounds are used as surrogates for this method and almost all samples had acceptable recoveries of the surrogates.

No performance evaluation or reference samples were reported with any batches.

TABLE 1 SAMPLE DELIVERY GROUP INFORMATION

Sample Delivery Group	Chain of Custody Number	Number of Samples	Sample Dates	Receipt Date	Report Date
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31101890	None	35	7/16/11-7/17/11	7/19/11	7/28/11
31101913	None	22	7/18/11	7/21/11	8/1/11

TABLE 2 SAMPLE RECEIPT INFORMATION

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31101890	4.2, 5.2, 5.2C	7/16/11-7/17/11	7/21/11-7/24/11	6-8 days	7/24/11-7/26/11
31101913	3.8, 3.9C	7/18/11	7/24/11-7/25/11	6-7 days	7/27/11-7/29/11

Sample Preservation. All samples must be protected from light and refrigerated at 4 ± 2°C from the time of receipt (time of collection when possible) until the time of extraction. All samples were received by the laboratory at temperatures between 1° and 6°C. The temperature discrepancies are slight and should not affect the validity of the data. No data qualification is required for any sample.

Holding Times. According to the Method, the maximum allowable holding time between sample collection and sample preparation is 30 days. All samples were prepared within the allowable holding time. The maximum allowable holding time between sample preparation and sample analysis is 45 days. All samples were analyzed within the allowable holding time. There are no holding time discrepancies. No data qualification is required for any sample.

Blanks. Method blanks were prepared and analyzed with every batch. Target analytes were detected in several batches and the reported results for these analytes should be considered as estimated. Samples with reported levels similar to that found in the associated blanks may be false positives.

For SDG 31101871, Three batches were prepared with three different results. Batch HXX/1180 had three contaminants detected: 1,2,3,4,7,8-HxCDF, 2,3,4,6,7,8-HxCDF, and 1,2,3,4,6,7,8-HpCDF. Samples from batch HXX/1180 with reported levels of these compounds should be considered as "Estimated". Batch HXX/1181 had one contaminant detected (2,3,7,8-TCDF). Samples from batch HXX/1181 with reported levels of this compound should be considered as "Estimated". Batch HXX1187 had no contaminants detected and samples from this batch need no qualification. All radiolabled compound additions were within acceptable limits for all batches.

For SDG 31101877, three batches were prepared with three different results. Batch HXX1187 was shared with some samples from SDG 31101871 and had no contaminants detected. Batch HXX/1185 was contaminated with 2,3,7,8 TCDF. Samples from Batch HXX1185 with reported levels of this compound should be considered as "Estimated". Batch HXX/1190 reported a blank result for Total TCDF but all individual isomer results were below the Detection Limit. The functional guidelines only address reporting for individual isomers so blank values for "Totals" were not evaluated. No qualification of results for Batch HXX/1190 is required. All radiolabled compound additions were within acceptable limits for all batches.

For SDG 31101890, three batches were prepared with three different results. Batch HXX/1190 was shared with some samples from SDG 31101877. As discussed above, Batch HXX/1190 reported a blank result for Total TCDF but all individual isomer results were below the Detection Limit. No qualification of results for Batch HXX/1190 is required. Batch HXX/1191 had detectable levels of 2,3,7,8-TCDF and 2,3,4,7,8-PeCDF. Samples from Batch HXX1191 with reported levels of these compounds should be considered as "Estimated". Batch HXX/1192 reported blank results for Total TCDF and Total PeCDF but all individual isomer results were below the Detection Limit but the signal to noise ratio for the quantitation ions was above 2.5:1. No qualification of results for Batch HXX/1192 is required. All radiolabled compound additions were within acceptable limits for all batches.

For SDG 31101913, two batches were prepared with two different results. Batch HXX/1192 reported blank results for Total TCDF and Total PeCDF but all individual isomer results were below the Detection Limit but the signal to noise ratio for the quantitation ions was above 2.5:1. No qualification of results for Batch HXX/1192 is required. Batch HXX/1993 reported a blank result for 2,3,7,8-TCDF. Samples from Batch HXX/1993 with reported levels of this compound should be considered as "Estimated". All radiolabled compound additions were within acceptable limits for all batches.

Radiolabled Compound Recoveries. Radiolabeled chlorinated dioxins and dibenzofurans serve as the isotopic dilution quantitative mechanism in this method. The recovery of these compounds along with the recovery of the cleanup standard is a critical measure of the effectiveness of the laboratory and method to extract the compounds of interest. ^{37}Cl is a measure losses during cleanup.

For SDG 31101871, Batch HXX/1881 had low recoveries for the radiolabeled ^{13}C compounds in the Matrix Spike/ Matrix Spike Duplicates but acceptable ^{37}Cl recovery. This indicates problems with the preparation and handling of these quality control samples. While four of the radiolabled compounds were below the acceptance limit in the Matrix Spike sample, only one radiolabled compound in one of the associated field samples was outside the limits. No qualification of the results is required.

For SDG 31101877, samples E11-117-S1 and E11-131-S1 had low recoveries for most radiolabled compounds and failures for one or more. While the reported amounts for these compounds were below the estimated detection limit, the overall low recoveries indicate a slightly low bias for the reported result. However, no qualification of the results is required.

For SDG 31101890, sample E11-141-S2 had low recovery for ^{13}C OCDD. This sample had detectable levels of OCDD (48.5 pg/g) and therefore the results should be flagged as estimated with a probable low bias.

For SDG 31101913, sample E11-153-S3 (MSD) had low recoveries for several radiolabled compounds. However, the MS/MSD recoveries for the native compounds were well within acceptable limits so no qualification is required for the associated samples in preparation batch HXX1193.

Matrix Spike/Matrix Spike Duplicate (MS/MSD). A matrix spike and matrix spike duplicate pair are used to document the bias of a method in a given sample matrix. An aliquot of sample is fortified (spiked) with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

For these analyses, laboratory control blanks or field samples were fortified at levels approximately **forty** times the lower limit of quantitation (Method Reporting Limit). The acceptance limits are set between 70% and 135% of the amount added.

For SDG 31101871, one field sample (E11-115-S4) and one lab control sample for batch HXX/1881 were reported. There were no exceedances in the MS/MSD results for the field sample. The lab control MS and MSD samples had several low recoveries each for radiolabled compounds, as discussed above. No qualification of samples is required.

For SDG 31101877, three field MS/MSD samples and three lab control samples were analyzed. All resulted in acceptable recoveries and no sample qualification is required.

For SDG 31101890, two field MS/MSD and three laboratory control samples were analyzed. For batch HXX/1190, all analytes were within acceptable limits and no sample qualification is required for associated field samples. For batch HXX1191, Laboratory Control Sample 8934 had slightly high recovery for 1,2,3,4,6,7,8-HpCDF in the MSD only. The field MS/MSD sample for batch HXX1191 had low recoveries for OCDD with acceptable ^{13}C OCDD. No sample qualification is required for associated samples. For batch HXX1192, both the Lab Control Sample (Blank Spike/Blank Spike Duplicate) and the field sample (E11-148-S2) had high recovery exceedances for 1,2,3,4,6,7,8-HpCDF. This indicates a high

bias and associated samples with detectable results should be considered as "Estimated". Sample E11-148-S2 MS recoveries for all radiolabled compounds were low with four ^{13}C compounds below acceptable limits. MSD recoveries were well within the limits for this sample.

For SDG 31101913, two field and two lab control MS/MSD samples were analyzed. As reported above, for batch HXX1192, both the Lab Control Sample (Blank Spike/Blank Spike Duplicate) and the field sample (E11-148-S2) had high recovery exceedances for 1,2,3,4,6,7,8-HpCDF. For batch HXX1193, 1,2,3,4,6,7,8-HpCDF was also high for the Blank Spike MS sample. This indicates a high bias for both batches and associated samples with detectable results should be considered as "Estimated". Field Sample ES11-153-S3 had high recovery for the MS sample for OCDD and poor relative percent difference between the MS/MSD samples. The MSD sample had low recovery for both ^{13}C and ^{37}Cl radiolabeled surrogates. While this indicates probably sample processing difficulties with this MS/MSD pair, no sample qualification is required. MS/MSD recoveries for sample ES11-149-S2 were all within acceptable limits.

Overall, MS/MSD recoveries of field samples were within acceptable limits. With the exception of 1,2,3,4,6,7,8-HpCDF in batch HXX1192, no sample qualification is required.

Chemical Data Validation Report for Camp Carroll Agent Orange Investigation

Far East District Project Number 11-032E

Phase: Phase 1 Soil Sampling

Laboratory: SGS North America Inc.

Method: SW 846 Method 8151a, Organochlorine Herbicides

Date: 19 August 2011

Validator: [redacted] b6

US Army Engineer District, Honolulu

Samples for all four sample delivery groups were evaluated in accordance with guidance provided in the *National Functional Guidelines for Superfund Organic Methods Data Review*, OSWER 9240.1-48, June 2008. Pesticide Organic Analysis criteria were utilized. Laboratory data packages were reviewed for preservation, holding times, blanks, surrogate spikes, matrix spike/matrix spike duplicates and laboratory control samples.

TABLE 1 SAMPLE DELIVERY GROUP INFORMATION

Sample Delivery Group	Chain of Custody Number	Number of Samples	Sample Dates	Receipt Date	Report Date
31101872	2483	28	7/12/11-7/13/11	7/15/11	7/26/11
31101879	None	44	7/14/11-7/15/11	7/19/11	7/27/11
31101889	None	35	7/16/11-7/17/11	7/19/11	7/28/11
31101915	None	22	7/18/11	7/21/11	8/1/11

TABLE 2 SAMPLE RECEIPT INFORMATION

Sample Delivery Group	Temperature	Sample Dates	Preparation Dates	Sample to Preparation	Analysis Dates
31101872	1.2, 2.7C	7/12/11-7/13/11	7/15/11	3-4 days	7/21/11-7/22/11
31101879	5.2, 5.5, 5.8, 5.9C	7/14/11-7/15/11	7/19/11 – 7/21/11	6-7 days	7/22/11-7/28/11
31101889	4.2, 5.2, 5.2C	7/16/11-7/17/11	7/21/11	3 days	7/26/11-7/28/11
31101915	3.8, 3.9C	7/18/11	7/24/11 – 8/1/11	7-14 days	7/28/11-8/3/11

Sample Preservation. All samples must be protected from light and refrigerated at 4 ± 2°C from the time of receipt (time of collection when possible) until the time of extraction. All samples were received by the laboratory at temperatures between 1° and 6°C. The temperature discrepancies are slight and should not affect the validity of the data. No data qualification is required for any sample.

Holding Times. The maximum allowable holding time between sample collection and sample preparation is 14 days. All samples were prepared within the allowable holding time. The maximum allowable holding time between sample preparation and sample analysis is 40 days. All samples were analyzed within the allowable holding time. There are no holding time discrepancies. No data qualification is required for any sample.

Blanks. Blanks were analyzed with every preparation and analytical batch. No analytes were detected in any of the blanks. No data qualification is required for any sample.

Surrogate Spike Recoveries. A surrogate is a pure compound different from, but similar enough to, the analyte that, when added at a known concentration to the sample prior to processing, provides a measure of the overall efficiency of the method (recovery). Surrogates have chemical characteristics that are similar to that of the analyte and must provide an analytical response that is distinct from that of the analyte. Surrogates must be unlikely to be found in environmental samples and are added to them for quality control purposes.

The US EPA recommended surrogate is 2,4-Dichlorophenylacetic Acid (DCAA) is specified in the laboratories Standard Operating Procedure and was utilized for these analyses. DCAA is added to samples at the beginning of the preparation process and carried through to the final analysis. The recovery of the surrogate is expressed as a percentage of the amount originally added. The acceptance limits are set at 35% and 135% of the amount added.

For SDG 31101872, all sample, blank, and blank spike results were within the acceptance limits. Matrix Spike and Matrix Spike Duplicate (MS/MSD) surrogates were above the upper control limit. The recoveries of 186% and 193% (extraction lots xxx1537 and xxx1538 respectively) for these laboratory blank samples may indicate improper addition of the surrogate for these samples, but do not affect the sample results.

For SDG 31101879, all sample, blank, and blank spike results were within acceptable limits. Surrogates were not added to MS/MSD samples for field samples (E11-122-S4, E11-123-S3, and E11-140-S2) and they could not be evaluated.

For SDG 31101889, all sample, blank, and blank spike results were within acceptable limits. Surrogates were not added to MS/MSD samples for field samples (E11-135-S2 E11-148-S2) and they could not be evaluated.

For SDG 31101915, all sample, blank, and blank spike results were within acceptable limits. Surrogates were added to MS/MSD samples for field samples E11-149-S2 and E11-150-S3. Surrogate recovery for E11-150-S3 was within the acceptance limits but recoveries for E11-149-S2 were above the upper control limit. Surrogate recovery for the unfortified sample was 63.7%, well within the acceptance range and it is unlikely that sample matrix interference can be attributed to the exceedances. The anomalous surrogate recovery may be due to contaminated glassware or improper addition of surrogate for this sample and does not affect the other sample results.

Matrix Spike/Matrix Spike Duplicate (MS/MSD). A matrix spike and matrix spike duplicate pair are used to document the bias of a method in a given sample matrix. An aliquot of sample is fortified (spiked) with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

For these analyses, laboratory control blanks or field samples were fortified at levels approximately five times the lower limit of quantitation (Method Reporting Limit). The acceptance limits are set between 60% and 140% of the amount added.

For SDG 31101872, one MS/MSD sample, a lab control sample for batch xxx1538 was reported. There were no exceedances. Two field samples were listed as MS/MSD (E11-115-S4 and E11-124-S4) however according to the MS/MSD reports these were not spiked (spike amount listed as "0"). Both of the MS/MSD analyses had detectable levels of target analytes and recoveries which are within acceptable limits are provided. The report narrative states that "The client MS/MSD associated with this sample does not meet the QC criteria. The samples were re-analyzed and confirmed the MS/MSD recoveries. These recoveries may be attributed to matrix interferences." It is not clear whether the spike amount was omitted from the sample or simply from the lab report. The laboratory has been contacted for clarification. If the spike amount was a typographical error, then the batch was within acceptable limits and does not need to be flagged.

Sample E11-115-S4 was prepared in batch XXX1538, sample E11-124-S4 was prepared in batch XXX1537 and three out of the four surrogate recoveries significantly exceed the acceptance criteria and as

discussed above, were the only results in the batches to do so. It is likely that the field MS/MSD samples were incorrectly handled during the preparation process, thus invalidating their usefulness for determining bias.

For SDG 31101879, three field MS/MSD samples were analyzed. Low recoveries (<60%) were found for eight analytes from four of the six analyses. The relative percent difference between replicate spiked samples was generally fair to good which indicates a slightly low bias. Field samples from these lots (xxx1549 and xxx1551) have been flagged "MS/MSD does not meet QC criteria due to matrix interference.". None of the samples had detectable levels of any of the target compounds.

For SDG 31101889, two field MS/MSD samples were analyzed. Low recoveries (<60%) were found for five analytes from three of the four analyses. The relative percent difference between replicate spiked samples was generally fair which indicates a slightly low bias. Clean laboratory spikes generally demonstrated higher recoveries than the field sample spikes. Field samples from these lots (xxx1566 and xxx1567) have been flagged "MS/MSD does not meet QC criteria due to martrix interference.". None of the samples had detectable levels of any of the target compounds. None of the samples had detectable levels of any of the target compounds.

For SDG 31101915, two field and two lab control MS/MSD samples were analyzed. Low recoveries (<60%) were found for seven analytes from three of the four field samples analyses. Low recoveries (<60%) were found for four analytes from two of the four lab control samples analyses. The relative percent difference between replicate spiked samples was generally fair which indicates a slightly low bias with no difference between the field and the lab control samples. Field samples from these lots (xxx1575, xxx1576, xxx1605 and xxx1613) are affected. None of the samples had detectable levels of any of the target compounds.

Overall, MS/MSD recoveries of field samples were variable and sometimes below the lower acceptance limit, and never above the upper limit. This indicates a low bias. None of the samples in any of the SDG's had detectable levels of any target analyte so therefore a "J" flag (estimated) should be attached to the "U".

Laboratory Control Samples. Laboratory control samples were prepared and analyzed for each batch. The recoveries of all target compounds were within the laboratory acceptance range of 60% through 135%. No data qualification is required for any sample.

Chemical Data Validation Report for Camp Carroll Agent Orange Investigation

Far East District Project Number 11-032E

Phase: Phase 1 Soil Sampling

Laboratory: SGS North America Inc.

Method: SW 846 Methods 6010c, 7471b, 8081, 8151a, 8260b, and 8270d.

Sample Group: 31101879

Date: 6 September 2011

Validator: [redacted]

US Army Engineer District, Honolulu

SUMMARY: Results for organic analyses were evaluated in accordance with *National Functional Guidelines for Superfund Organic Methods Data Review*, OSWER 9240.1-48, June 2008. Laboratory data packages were reviewed for preservation, holding times, blanks, surrogate spikes, matrix spike/matrix spike duplicates and laboratory control samples (Blank spikes). Evaluation for these parameters is considered to be a "Level 2b" Data Validation.

This report includes a discussion of the evaluation, identification of reported results which need to be qualified (flagged) due to quality control issues or deficiencies, and the reasons for the flags. The evaluation showed that the data is generally of acceptable quality with some results for specific analytes being rejected or qualified as estimated.

No performance evaluation or reference samples were reported with any batches.

APPENDIX 1

Automated Data Review Results

Summary Report by Analysis Method

EDD Summary Report by Analysis Method

Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
6010C									
	E11-109-S1	31101879044	RES	3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-110-S1	31101879052		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
				3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/21/2011
	E11-111-S1	31101879038		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-112-S1	31101879008		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-112-S2	31101879009		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-117-S1	31101879018		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-117-S2	31101879019		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-117-S3	31101879020		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-117-S4	31101879021		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-120-S1	31101879039		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-120-S2	31101879040		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-120-S3	31101879041		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-121-S1	31101879042		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-121-S2	31101879043		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-122-S1	31101879022		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-122-S2	31101879023		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-122-S3	31101879024		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-122-S4	31101879025		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-123-S1	31101879032		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-123-S2	31101879033		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-123-S3	31101879034		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/21/2011
				3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-123-S4	31101879037		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-125-S1	31101879006		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-125-S2	31101879007		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-126-S1	31101879004		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-126-S2	31101879005		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-127-S1	31101879010		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011

EDD Summary Report by Analysis Method

Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-127-S2	31101879011	RES	3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-129-S1	31101879046		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-130-S1	31101879047		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/20/2011
	E11-131-S1	31101879002		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-131-S2	31101879003		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-132-S1	31101879048		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
				3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/21/2011
	E11-132-S2	31101879049		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
				3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/21/2011
	E11-133-S1	31101879050		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
				3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/21/2011
	E11-133-S2	31101879051		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/21/2011
				3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-136-S1	31101879053		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
				3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/21/2011
	E11-136-S2	31101879054		3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/21/2011
				3050B	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-140-S1	31101879012		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-140-S2	31101879013		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-140-S3	31101879016		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-146-S1	31101879028		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-146-S2	31101879029		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
	E11-146-S3	31101879030		3050B	SO	07/14/2011	07/19/2011	07/20/2011	07/20/2011
7471B									
	E11-109-S1	31101879044	RES	7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-110-S1	31101879052		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-111-S1	31101879038		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-112-S1	31101879008		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-112-S2	31101879009		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-117-S1	31101879018		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011

EDD Summary Report by Analysis Method

Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-117-S2	31101879019	RES	7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-117-S3	31101879020		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-117-S4	31101879021		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-120-S1	31101879039		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-120-S2	31101879040		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-120-S3	31101879041		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-121-S1	31101879042		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-121-S2	31101879043		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-122-S1	31101879022		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-122-S2	31101879023		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-122-S3	31101879024		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-122-S4	31101879025		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-123-S1	31101879032		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-123-S2	31101879033		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-123-S3	31101879034		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-123-S4	31101879037		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-125-S1	31101879006		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-125-S2	31101879007		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-126-S1	31101879004		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-126-S2	31101879005		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-127-S1	31101879010		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-127-S2	31101879011		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-129-S1	31101879046		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-130-S1	31101879047		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-131-S1	31101879002		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-131-S2	31101879003		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-132-S1	31101879048		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-132-S2	31101879049		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-133-S1	31101879050		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-133-S2	31101879051		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011

EDD Summary Report by Analysis Method

Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-136-S1	31101879053	RES	7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-136-S2	31101879054		7471B	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-140-S1	31101879012		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-140-S2	31101879013		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-140-S3	31101879016		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-146-S1	31101879028		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-146-S2	31101879029		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-146-S3	31101879030		7471B	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
8081									
	E11-109-S1	31101879044	RES	3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
	E11-110-S1	31101879052		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
	E11-111-S1	31101879038		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
	E11-112-S1	31101879008		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-112-S2	31101879009		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-117-S1	31101879018		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-117-S2	31101879019		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-117-S3	31101879020		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-117-S4	31101879021		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-120-S1	31101879039		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
	E11-120-S2	31101879040		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
	E11-120-S3	31101879041		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011

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Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-121-S1	31101879042	DL	3541	SO	07/15/2011	07/19/2011	07/20/2011	07/27/2011
				3541	SO	07/15/2011	07/19/2011	07/20/2011	07/27/2011
	E11-121-S2	31101879043	RES	3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
	E11-122-S1	31101879022		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-122-S2	31101879023		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-122-S3	31101879024		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-122-S4	31101879025		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-123-S1	31101879032		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
	E11-123-S2	31101879033		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
	E11-123-S3	31101879034		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
	E11-123-S4	31101879037		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/20/2011	07/25/2011
	E11-125-S1	31101879006		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-125-S2	31101879007		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-126-S1	31101879004		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-126-S2	31101879005		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-127-S1	31101879010		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-127-S2	31101879011		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-129-S1	31101879046		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
	E11-130-S1	31101879047		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
	E11-131-S1	31101879002	DL	3541	SO	07/14/2011	07/19/2011	07/20/2011	07/26/2011

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Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-131-S1	31101879002	DL	3541	SO	07/14/2011	07/19/2011	07/20/2011	07/26/2011
	E11-131-S2	31101879003	RES	3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-132-S1	31101879048		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/27/2011
				3541	SO	07/15/2011	07/19/2011	07/21/2011	07/27/2011
	E11-132-S2	31101879049	DL	3541	SO	07/15/2011	07/19/2011	07/21/2011	07/29/2011
				3541	SO	07/15/2011	07/19/2011	07/21/2011	07/29/2011
	E11-133-S1	31101879050	RES	3541	SO	07/15/2011	07/19/2011	07/21/2011	07/27/2011
				3541	SO	07/15/2011	07/19/2011	07/21/2011	07/27/2011
	E11-133-S2	31101879051		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
	E11-136-S1	31101879053		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
	E11-136-S2	31101879054		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
				3541	SO	07/15/2011	07/19/2011	07/21/2011	07/25/2011
	E11-140-S1	31101879012		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-140-S2	31101879013		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/23/2011
	E11-140-S3	31101879016		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-146-S1	31101879028	DL	3541	SO	07/14/2011	07/19/2011	07/20/2011	07/26/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/26/2011
	E11-146-S2	31101879029	RES	3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
				3541	SO	07/14/2011	07/19/2011	07/20/2011	07/24/2011
	E11-146-S3	31101879030		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/25/2011
8151									
	E11-109-S1	31101879044	RES	3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-110-S1	31101879052		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-111-S1	31101879038		3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
	E11-112-S1	31101879008		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
				3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-112-S2	31101879009		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011

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Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-117-S1	31101879018	RES	3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-117-S2	31101879019		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-117-S3	31101879020		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-117-S4	31101879021		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/28/2011
	E11-120-S1	31101879039		3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
	E11-120-S2	31101879040		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-120-S3	31101879041		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-121-S1	31101879042		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-121-S2	31101879043		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-122-S1	31101879022		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/28/2011
	E11-122-S2	31101879023		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/21/2011
	E11-122-S3	31101879024		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/21/2011
	E11-122-S4	31101879025		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/21/2011
	E11-123-S1	31101879032		3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
	E11-123-S2	31101879033		3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
	E11-123-S3	31101879034		3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
	E11-123-S4	31101879037		3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/15/2011	07/19/2011	07/19/2011	07/22/2011
	E11-125-S1	31101879006		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
	E11-125-S2	31101879007		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-126-S1	31101879004		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
	E11-126-S2	31101879005		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
	E11-127-S1	31101879010		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-127-S2	31101879011		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011

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EDD Summary Report by Analysis Method

Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-129-S1	31101879046	RES	3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-130-S1	31101879047		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-131-S1	31101879002		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
	E11-131-S2	31101879003		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
				3541	SO	07/14/2011	07/19/2011	07/19/2011	07/22/2011
	E11-132-S1	31101879048		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-132-S2	31101879049		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-133-S1	31101879050		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-133-S2	31101879051		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-136-S1	31101879053		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-136-S2	31101879054		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/26/2011
	E11-140-S1	31101879012		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-140-S2	31101879013		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-140-S3	31101879016		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/23/2011
	E11-146-S1	31101879028		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/21/2011
	E11-146-S2	31101879029		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/21/2011
	E11-146-S3	31101879030		3541	SO	07/14/2011	07/19/2011	07/19/2011	07/21/2011
8260B									
	E11-109-S1	31101879044	RES	5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-110-S1	31101879052		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-111-S1	31101879038		5035	SO	07/15/2011	07/19/2011	07/25/2011	07/25/2011
	E11-112-S1	31101879008		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-112-S2	31101879009		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-117-S1	31101879018		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-117-S2	31101879019		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-117-S3	31101879020		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-117-S4	31101879021		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-120-S1	31101879039		5035	SO	07/15/2011	07/19/2011	07/25/2011	07/25/2011
	E11-120-S2	31101879040		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011

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EDD Summary Report by Analysis Method

Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-120-S3	31101879041	RES	5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-121-S1	31101879042		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-121-S2	31101879043		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-122-S1	31101879022		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-122-S2	31101879023		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-122-S3	31101879024		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-122-S4	31101879025		5035	SO	07/14/2011	07/19/2011	07/22/2011	07/22/2011
	E11-123-S1	31101879032		5035	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-123-S2	31101879033		5035	SO	07/15/2011	07/19/2011	07/21/2011	07/21/2011
	E11-123-S3	31101879034		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-123-S4	31101879037		5035	SO	07/15/2011	07/19/2011	07/25/2011	07/25/2011
	E11-125-S1	31101879006		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-125-S2	31101879007		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-126-S1	31101879004		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-126-S2	31101879005		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-127-S1	31101879010		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-127-S2	31101879011		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-129-S1	31101879046		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-130-S1	31101879047		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-131-S1	31101879002		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-131-S2	31101879003		5035	SO	07/14/2011	07/19/2011	05/20/2011	07/20/2011
	E11-132-S1	31101879048		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-132-S2	31101879049		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-133-S1	31101879050		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-133-S2	31101879051		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-136-S1	31101879053		5035	SO	07/15/2011	07/19/2011	07/25/2011	07/25/2011
	E11-136-S2	31101879054		5035	SO	07/15/2011	07/19/2011	07/22/2011	07/22/2011
	E11-140-S1	31101879012		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-140-S2	31101879013		5035	SO	07/14/2011	07/19/2011	07/25/2011	07/25/2011
	E11-140-S3	31101879016		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011

EDD Summary Report by Analysis Method

Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-146-S1	31101879028	RES	5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-146-S2	31101879029		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	E11-146-S3	31101879030		5035	SO	07/14/2011	07/19/2011	07/21/2011	07/21/2011
	Trip Blank (0800)	31101879001	DL	5035	SO	07/14/2011	07/19/2011	07/25/2011	07/26/2011
	Trip Blank (0810)	31101879031		5035	SO	07/15/2011	07/19/2011	07/25/2011	07/26/2011
	Trip Blank (0813)	31101879017		5035	SO	07/14/2011	07/19/2011	07/25/2011	07/26/2011
	Trip Blank (7/15/11 0800	31101879045		5035	SO	07/15/2011	07/19/2011	07/25/2011	07/25/2011
8270D									
	E11-109-S1	31101879044	RES	3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-110-S1	31101879052		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-111-S1	31101879038		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-112-S1	31101879008		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-112-S2	31101879009		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-117-S1	31101879018		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-117-S2	31101879019		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-117-S3	31101879020		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-117-S4	31101879021		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-120-S1	31101879039		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-120-S2	31101879040		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-120-S3	31101879041		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-121-S1	31101879042		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-121-S2	31101879043		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-122-S1	31101879022		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-122-S2	31101879023		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-122-S3	31101879024		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-122-S4	31101879025		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-123-S1	31101879032		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-123-S2	31101879033		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-123-S3	31101879034		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011
	E11-123-S4	31101879037		3541	SO	07/15/2011	07/19/2011	07/20/2011	07/22/2011

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EDD Summary Report by Analysis Method

Laboratory Reporting Batch : 31101879 **Laboratory :** SGSW **Lab Report Date :** 08/22/2011

Analysis Method	Client Sample ID	Lab Sample ID	Analysis Type	Preparation Method	Matrix	Collection Date	Receipt Date	Preparation Date	Analysis Date
	E11-125-S1	31101879006	RES	3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-125-S2	31101879007		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-126-S1	31101879004		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-126-S2	31101879005		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-127-S1	31101879010		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-127-S2	31101879011		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-129-S1	31101879046		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-130-S1	31101879047		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-131-S1	31101879002		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-131-S2	31101879003		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-132-S1	31101879048		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-132-S2	31101879049		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-133-S1	31101879050		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-133-S2	31101879051		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-136-S1	31101879053		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-136-S2	31101879054		3541	SO	07/15/2011	07/19/2011	07/21/2011	07/22/2011
	E11-140-S1	31101879012		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-140-S2	31101879013		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-140-S3	31101879016		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/21/2011
	E11-146-S1	31101879028		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/22/2011
	E11-146-S2	31101879029		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/22/2011
	E11-146-S3	31101879030		3541	SO	07/14/2011	07/19/2011	07/20/2011	07/22/2011

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Laboratory Control Sample/Laboratory Control Sample Duplicate Outlier Report

Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : VXX1802 **Analysis Method :** 8260B **Analysis Date :** 07/20/2011

Preparation Batch : VXX1802 **Preparation Type :** 5035 **Preparation Date :** 07/20/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
31693	SO	1,1-Dichloroethane	106	22	10.00	75.00	125.00	20.00
		trans-1,2-Dichloroethene	98	23	10.00	75.00	125.00	20.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-112-S1	31101879008
E11-112-S1	31101879008
E11-112-S2	31101879009
E11-112-S2	31101879009
E11-125-S1	31101879006
E11-125-S1	31101879006
E11-125-S2	31101879007
E11-125-S2	31101879007
E11-126-S1	31101879004
E11-126-S1	31101879004
E11-126-S2	31101879005
E11-126-S2	31101879005
E11-127-S1	31101879010
E11-127-S1	31101879010
E11-127-S2	31101879011
E11-127-S2	31101879011
E11-131-S1	31101879002
E11-131-S1	31101879002
E11-131-S2	31101879003
E11-131-S2	31101879003

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : VXX1811 **Analysis Method :** 8260B **Analysis Date :** 07/21/2011

Preparation Batch : VXX1811 **Preparation Type :** 5035 **Preparation Date :** 07/21/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
31968	SO	Carbon tetrachloride	131		10.00	75.00	125.00	20.00
31969		Carbon tetrachloride	133	1.5	10.00	75.00	125.00	20.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-117-S1	31101879018
E11-117-S1	31101879018
E11-117-S2	31101879019
E11-117-S2	31101879019
E11-117-S3	31101879020
E11-117-S3	31101879020
E11-117-S4	31101879021
E11-117-S4	31101879021
E11-122-S1	31101879022
E11-122-S1	31101879022
E11-122-S2	31101879023
E11-122-S2	31101879023
E11-122-S3	31101879024
E11-122-S3	31101879024
E11-123-S1	31101879032
E11-123-S1	31101879032
E11-123-S2	31101879033
E11-123-S2	31101879033
E11-140-S1	31101879012
E11-140-S1	31101879012
E11-140-S3	31101879016
E11-140-S3	31101879016
E11-146-S1	31101879028
E11-146-S1	31101879028
E11-146-S2	31101879029
E11-146-S2	31101879029
E11-146-S3	31101879030
E11-146-S3	31101879030

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : VXX1817 **Analysis Method :** 8260B **Analysis Date :** 07/22/2011

Preparation Batch : VXX1817 **Preparation Type :** 5035 **Preparation Date :** 07/22/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
32140	SO	2-Butanone	133		10.00	75.00	125.00	20.00
		2-Hexanone	127		10.00	75.00	125.00	20.00
		Acetone	132		10.00	75.00	125.00	20.00
32141		1,1-Dichloroethane	80	25	10.00	75.00	125.00	20.00
		1,1-Dichloroethene	82	23	10.00	75.00	125.00	20.00
		Acetone	105	23	10.00	75.00	125.00	20.00
		Carbon disulfide	82	21	10.00	75.00	125.00	20.00
		Methylene chloride	78	30	10.00	75.00	125.00	20.00
		tert-Butyl methyl ether (MTBE)	84	29	10.00	75.00	125.00	20.00
		trans-1,2-Dichloroethene	76	29	10.00	75.00	125.00	20.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-123-S3	31101879034
E11-123-S3	31101879034
E11-136-S2	31101879054
E11-136-S2	31101879054

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : VXX1819 **Analysis Method :** 8260B **Analysis Date :** 07/22/2011

Preparation Batch : VXX1819 **Preparation Type :** 5035 **Preparation Date :** 07/22/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

LCS Lab Sample ID	Matrix	Analyte Name	Reported Values		Project Limits (Percent)			
			Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
32174	SO	1,1,1-Trichloroethane	126		10.00	75.00	125.00	20.00
		Carbon tetrachloride	141		10.00	75.00	125.00	20.00
		tert-Butyl methyl ether (MTBE)	133		10.00	75.00	125.00	20.00
32176		Carbon tetrachloride	135	4.1	10.00	75.00	125.00	20.00
		tert-Butyl methyl ether (MTBE)	130	2.3	10.00	75.00	125.00	20.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-109-S1	31101879044
E11-109-S1	31101879044
E11-110-S1	31101879052
E11-110-S1	31101879052
E11-120-S2	31101879040
E11-120-S2	31101879040
E11-120-S3	31101879041
E11-120-S3	31101879041
E11-121-S1	31101879042
E11-121-S1	31101879042
E11-121-S2	31101879043
E11-121-S2	31101879043
E11-122-S4	31101879025
E11-122-S4	31101879025
E11-129-S1	31101879046
E11-129-S1	31101879046
E11-130-S1	31101879047
E11-130-S1	31101879047
E11-132-S1	31101879048
E11-132-S1	31101879048
E11-132-S2	31101879049
E11-132-S2	31101879049
E11-133-S1	31101879050
E11-133-S1	31101879050
E11-133-S2	31101879051
E11-133-S2	31101879051

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : XXX1554 **Analysis Method :** 8270D **Analysis Date :** 07/21/2011

Preparation Batch : XXX1554 **Preparation Type :** 3541 **Preparation Date :** 07/20/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
31862	SO	Hexachlorocyclopentadiene	2181		10.00	55.00	250.00	60.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-112-S1	31101879008
E11-112-S1	31101879008
E11-112-S2	31101879009
E11-112-S2	31101879009
E11-117-S1	31101879018
E11-117-S1	31101879018
E11-117-S2	31101879019
E11-117-S2	31101879019
E11-117-S3	31101879020
E11-117-S3	31101879020
E11-117-S4	31101879021
E11-117-S4	31101879021
E11-122-S1	31101879022
E11-122-S1	31101879022
E11-125-S1	31101879006
E11-125-S1	31101879006
E11-125-S2	31101879007
E11-125-S2	31101879007
E11-126-S1	31101879004
E11-126-S1	31101879004
E11-126-S2	31101879005
E11-126-S2	31101879005
E11-127-S1	31101879010
E11-127-S1	31101879010
E11-127-S2	31101879011
E11-127-S2	31101879011
E11-131-S1	31101879002
E11-131-S1	31101879002
E11-131-S2	31101879003
E11-131-S2	31101879003
E11-140-S1	31101879012
E11-140-S1	31101879012
E11-140-S2	31101879013
E11-140-S2	31101879013
E11-140-S3	31101879016
E11-140-S3	31101879016

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : XXX1555 **Analysis Method :** 8270D **Analysis Date :** 07/21/2011

Preparation Batch : XXX1555 **Preparation Type :** 3541 **Preparation Date :** 07/20/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
31864	SO	Hexachlorocyclopentadiene	2268		10.00	55.00	250.00	60.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-111-S1	31101879038
E11-111-S1	31101879038
E11-120-S1	31101879039
E11-120-S1	31101879039
E11-120-S2	31101879040
E11-120-S2	31101879040
E11-120-S3	31101879041
E11-120-S3	31101879041
E11-121-S1	31101879042
E11-121-S1	31101879042
E11-121-S2	31101879043
E11-121-S2	31101879043
E11-122-S2	31101879023
E11-122-S2	31101879023
E11-122-S3	31101879024
E11-122-S3	31101879024
E11-122-S4	31101879025
E11-122-S4	31101879025
E11-123-S1	31101879032
E11-123-S1	31101879032
E11-123-S2	31101879033
E11-123-S2	31101879033
E11-123-S3	31101879034
E11-123-S3	31101879034
E11-123-S4	31101879037
E11-123-S4	31101879037
E11-146-S1	31101879028
E11-146-S1	31101879028
E11-146-S2	31101879029
E11-146-S2	31101879029
E11-146-S3	31101879030
E11-146-S3	31101879030

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : XXX1560 **Analysis Method :** 8270D **Analysis Date :** 07/22/2011

Preparation Batch : XXX1560 **Preparation Type :** 3541 **Preparation Date :** 07/21/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
32031	SO	Hexachlorocyclopentadiene	2259		10.00	55.00	250.00	60.00
		Pentachlorophenol	67		10.00	75.00	120.00	60.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-109-S1	31101879044
E11-109-S1	31101879044
E11-110-S1	31101879052
E11-110-S1	31101879052
E11-129-S1	31101879046
E11-129-S1	31101879046
E11-130-S1	31101879047
E11-130-S1	31101879047
E11-132-S1	31101879048
E11-132-S1	31101879048
E11-132-S2	31101879049
E11-132-S2	31101879049
E11-133-S1	31101879050
E11-133-S1	31101879050
E11-133-S2	31101879051
E11-133-S2	31101879051
E11-136-S1	31101879053
E11-136-S1	31101879053
E11-136-S2	31101879054
E11-136-S2	31101879054

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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Matrix Spike / Matrix Spike Duplicate Recovery and RPD

Outlier Report

4681

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

Method Batch : VXX1817 **Analysis Method :** 8260B **Analysis Date :** 07/22/2011

Preparation Batch : VXX1817 **Preparation Type :** 5035 **Preparation Date :** 07/22/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Matrix	Analyte Name	Reported *		Project Limits (Percent)			
				Percent Recovery	RPD	Rejection Point**	Lower Limit	Upper Limit	RPD
31101879034MS	31101879035	SO	1,1,2,2-Tetrachloroethane	138		10.00	70.00	130.00	20.00
			1,2,3-Trichloropropane	140		10.00	70.00	130.00	20.00
			1,2,4-Trichlorobenzene	65		10.00	70.00	130.00	20.00
			1,2-Dibromo-3-chloropropane	191		10.00	70.00	130.00	20.00
			2-Butanone	153		10.00	70.00	130.00	20.00
			2-Hexanone	165		10.00	70.00	130.00	20.00
			4-Methyl-2-pentanone	172		10.00	70.00	130.00	20.00
			Bromoform	134		10.00	70.00	130.00	20.00
			Naphthalene	45		10.00	70.00	130.00	20.00
			Styrene	46		10.00	70.00	130.00	20.00
31101879034MSD	31101879036		1,1,2,2-Tetrachloroethane	140		10.00	70.00	130.00	20.00
			1,2,3-Trichloropropane	144		10.00	70.00	130.00	20.00
			1,2,4-Trimethylbenzene	65		10.00	70.00	130.00	20.00
			1,2-Dibromo-3-chloropropane	199		10.00	70.00	130.00	20.00
			2-Butanone	156		10.00	70.00	130.00	20.00
			2-Hexanone	169		10.00	70.00	130.00	20.00
			4-Methyl-2-pentanone	177		10.00	70.00	130.00	20.00
			Bromoform	141		10.00	70.00	130.00	20.00
			Naphthalene	29	44	10.00	70.00	130.00	20.00
			Styrene	40		10.00	70.00	130.00	20.00

Associated Samples: All samples in Method Batch

Client Sample ID	Lab Sample ID
E11-123-S3	31101879034
E11-123-S3	31101879034
E11-136-S2	31101879054
E11-136-S2	31101879054

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.

** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

46 82

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

Method Batch : VXX1819 **Analysis Method :** 8260B **Analysis Date :** 07/22/2011

Preparation Batch : VXX1819 **Preparation Type :** 5035 **Preparation Date :** 07/22/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Matrix	Analyte Name	Reported *		Project Limits (Percent)			
				Percent Recovery	RPD	Rejection Point**	Lower Limit	Upper Limit	RPD
31101879025MS	31101879026	SO	1,1,2,2-Tetrachloroethane	133		10.00	70.00	130.00	20.00
			1,2,3-Trichloropropane	148		10.00	70.00	130.00	20.00
			1,2,4-Trichlorobenzene	69		10.00	70.00	130.00	20.00
			1,2,4-Trimethylbenzene	67		10.00	70.00	130.00	20.00
			1,2-Dibromo-3-chloropropane	174		10.00	70.00	130.00	20.00
			2-Butanone	152		10.00	70.00	130.00	20.00
			2-Hexanone	147		10.00	70.00	130.00	20.00
			4-Methyl-2-pentanone	176		10.00	70.00	130.00	20.00
			Naphthalene	68		10.00	70.00	130.00	20.00
			Styrene	51		10.00	70.00	130.00	20.00
			tert-Butyl methyl ether (MTBE)	153		10.00	70.00	130.00	20.00
31101879025MSD	31101879027		1,1,2,2-Tetrachloroethane	133		10.00	70.00	130.00	20.00
			1,2,3-Trichloropropane	151		10.00	70.00	130.00	20.00
			1,2,4-Trichlorobenzene	67		10.00	70.00	130.00	20.00
			1,2,4-Trimethylbenzene	64		10.00	70.00	130.00	20.00
			1,2-Dibromo-3-chloropropane	180		10.00	70.00	130.00	20.00
			2-Butanone	164		10.00	70.00	130.00	20.00
			2-Hexanone	154		10.00	70.00	130.00	20.00
			4-Methyl-2-pentanone	179		10.00	70.00	130.00	20.00
			Acetone	155		10.00	70.00	130.00	20.00
			Naphthalene	38	63	10.00	70.00	130.00	20.00
			Styrene	42	28	10.00	70.00	130.00	20.00
			tert-Butyl methyl ether (MTBE)	158		10.00	70.00	130.00	20.00
			Trichlorofluoromethane		22	10.00	70.00	130.00	20.00

Associated Samples: All samples in Method Batch

Client Sample ID	Lab Sample ID
E11-109-S1	31101879044
E11-109-S1	31101879044
E11-110-S1	31101879052
E11-110-S1	31101879052
E11-120-S2	31101879040
E11-120-S2	31101879040
E11-120-S3	31101879041
E11-120-S3	31101879041
E11-121-S1	31101879042
E11-121-S1	31101879042
E11-121-S2	31101879043
E11-121-S2	31101879043
E11-122-S4	31101879025

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.

** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

9683

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

E11-122-S4	31101879025
E11-129-S1	31101879046
E11-129-S1	31101879046
E11-130-S1	31101879047
E11-130-S1	31101879047
E11-132-S1	31101879048
E11-132-S1	31101879048
E11-132-S2	31101879049
E11-132-S2	31101879049
E11-133-S1	31101879050
E11-133-S1	31101879050
E11-133-S2	31101879051
E11-133-S2	31101879051

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.
** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: ***11-032E - 11-032E Carroll Agent Orange***

4684

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

Method Batch : VXX1823 **Analysis Method :** 8260B **Analysis Date :** 07/25/2011

Preparation Batch : VXX1823 **Preparation Type :** 5035 **Preparation Date :** 07/25/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Matrix	Analyte Name	Reported *		Project Limits (Percent)			
				Percent Recovery	RPD	Rejection Point**	Lower Limit	Upper Limit	RPD
31101879013MS	31101879014	SO	1,1,2,2-Tetrachloroethane	146		10.00	70.00	130.00	20.00
			1,2,3-Trichloropropane	159		10.00	70.00	130.00	20.00
			1,2-Dibromo-3-chloropropane	205		10.00	70.00	130.00	20.00
			2-Butanone	172		10.00	70.00	130.00	20.00
			2-Hexanone	178		10.00	70.00	130.00	20.00
			4-Methyl-2-pentanone	188		10.00	70.00	130.00	20.00
			Bromoform	136		10.00	70.00	130.00	20.00
31101879013MSD	31101879015		1,1,2,2-Tetrachloroethane	138		10.00	70.00	130.00	20.00
			1,2,3-Trichloropropane	149		10.00	70.00	130.00	20.00
			1,2-Dibromo-3-chloropropane	192		10.00	70.00	130.00	20.00
			2-Butanone	160		10.00	70.00	130.00	20.00
			2-Hexanone	170		10.00	70.00	130.00	20.00
			4-Methyl-2-pentanone	177		10.00	70.00	130.00	20.00
			Bromoform	131		10.00	70.00	130.00	20.00

Associated Samples: All samples in Method Batch

Client Sample ID	Lab Sample ID
E11-111-S1	31101879038
E11-111-S1	31101879038
E11-120-S1	31101879039
E11-120-S1	31101879039
E11-123-S4	31101879037
E11-123-S4	31101879037
E11-136-S1	31101879053
E11-136-S1	31101879053
E11-140-S2	31101879013
E11-140-S2	31101879013

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.
** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

46 85

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

Method Batch : XXX1549 **Analysis Method :** 8151 **Analysis Date :** 07/23/2011

Preparation Batch : XXX1549 **Preparation Type :** 3541 **Preparation Date :** 07/19/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Matrix	Analyte Name	Reported *		Project Limits (Percent)			
				Percent Recovery	RPD	Rejection Point**	Lower Limit	Upper Limit	RPD
31101879013MSD	31101879015	SO	2,4,5-TP (Silvex)		33	5.00	25.00	115.00	25.00
			2,4,5-TP (Silvex)		33	5.00	25.00	115.00	25.00
			2,4'-D		34	5.00	25.00	115.00	25.00
			2,4'-D		34	5.00	25.00	115.00	25.00

Associated Samples: All samples in Method Batch

Client Sample ID	Lab Sample ID
E11-112-S1	31101879008
E11-112-S1	31101879008
E11-112-S2	31101879009
E11-112-S2	31101879009
E11-117-S1	31101879018
E11-117-S1	31101879018
E11-117-S2	31101879019
E11-117-S2	31101879019
E11-117-S3	31101879020
E11-117-S3	31101879020
E11-117-S4	31101879021
E11-117-S4	31101879021
E11-122-S1	31101879022
E11-122-S1	31101879022
E11-125-S1	31101879006
E11-125-S1	31101879006
E11-125-S2	31101879007
E11-125-S2	31101879007
E11-126-S1	31101879004
E11-126-S1	31101879004
E11-126-S2	31101879005
E11-126-S2	31101879005
E11-127-S1	31101879010
E11-127-S1	31101879010
E11-127-S2	31101879011
E11-127-S2	31101879011
E11-131-S1	31101879002
E11-131-S1	31101879002
E11-131-S2	31101879003
E11-131-S2	31101879003
E11-140-S1	31101879012
E11-140-S1	31101879012
E11-140-S2	31101879013
E11-140-S2	31101879013
E11-140-S3	31101879016

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.

** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

4656

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

E11-140-S3	31101879016

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.
** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

4689

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

Method Batch : XXX1554 **Analysis Method :** 8270D **Analysis Date :** 07/21/2011

Preparation Batch : XXX1554 **Preparation Type :** 3541 **Preparation Date :** 07/20/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Matrix	Analyte Name	Reported *		Project Limits (Percent)			
				Percent Recovery	RPD	Rejection Point**	Lower Limit	Upper Limit	RPD
31101879013MS	31101879014	SO	Hexachlorocyclopentadiene	1257		10.00	45.00	135.00	60.00
31101879013MSD	31101879015		Hexachlorocyclopentadiene	1358		10.00	45.00	135.00	60.00

Associated Samples: All samples in Method Batch

Client Sample ID	Lab Sample ID
E11-112-S1	31101879008
E11-112-S1	31101879008
E11-112-S2	31101879009
E11-112-S2	31101879009
E11-117-S1	31101879018
E11-117-S1	31101879018
E11-117-S2	31101879019
E11-117-S2	31101879019
E11-117-S3	31101879020
E11-117-S3	31101879020
E11-117-S4	31101879021
E11-117-S4	31101879021
E11-122-S1	31101879022
E11-122-S1	31101879022
E11-125-S1	31101879006
E11-125-S1	31101879006
E11-125-S2	31101879007
E11-125-S2	31101879007
E11-126-S1	31101879004
E11-126-S1	31101879004
E11-126-S2	31101879005
E11-126-S2	31101879005
E11-127-S1	31101879010
E11-127-S1	31101879010
E11-127-S2	31101879011
E11-127-S2	31101879011
E11-131-S1	31101879002
E11-131-S1	31101879002
E11-131-S2	31101879003
E11-131-S2	31101879003
E11-140-S1	31101879012
E11-140-S1	31101879012
E11-140-S2	31101879013
E11-140-S2	31101879013
E11-140-S3	31101879016
E11-140-S3	31101879016

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.
** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

Method Batch : XXX1555 **Analysis Method :** 8270D **Analysis Date :** 07/21/2011

Preparation Batch : XXX1555 **Preparation Type :** 3541 **Preparation Date :** 07/20/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Matrix	Analyte Name	Reported *		Project Limits (Percent)			
				Percent Recovery	RPD	Rejection Point**	Lower Limit	Upper Limit	RPD
31101879025MS	31101879026	SO	Hexachlorocyclopentadiene	1095		10.00	45.00	135.00	60.00
31101879025MSD	31101879027		Hexachlorocyclopentadiene	1198		10.00	45.00	135.00	60.00
31101879034MS	31101879035		Hexachlorocyclopentadiene	2309		10.00	45.00	135.00	60.00
31101879034MSD	31101879036		Hexachlorocyclopentadiene	2331		10.00	45.00	135.00	60.00

Associated Samples: All samples in Method Batch

Client Sample ID	Lab Sample ID
E11-111-S1	31101879038
E11-111-S1	31101879038
E11-120-S1	31101879039
E11-120-S1	31101879039
E11-120-S2	31101879040
E11-120-S2	31101879040
E11-120-S3	31101879041
E11-120-S3	31101879041
E11-121-S1	31101879042
E11-121-S1	31101879042
E11-121-S2	31101879043
E11-121-S2	31101879043
E11-122-S2	31101879023
E11-122-S2	31101879023
E11-122-S3	31101879024
E11-122-S3	31101879024
E11-122-S4	31101879025
E11-122-S4	31101879025
E11-123-S1	31101879032
E11-123-S1	31101879032
E11-123-S2	31101879033
E11-123-S2	31101879033
E11-123-S3	31101879034
E11-123-S3	31101879034
E11-123-S4	31101879037
E11-123-S4	31101879037
E11-146-S1	31101879028
E11-146-S1	31101879028
E11-146-S2	31101879029
E11-146-S2	31101879029
E11-146-S3	31101879030
E11-146-S3	31101879030

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.
** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

4689

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

Method Batch : XXX1556 **Analysis Method :** 8081 **Analysis Date :** 07/24/2011

Preparation Batch : XXX1556 **Preparation Type :** 3541 **Preparation Date :** 07/20/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Matrix	Analyte Name	Reported *		Project Limits (Percent)			
				Percent Recovery	RPD	Rejection Point**	Lower Limit	Upper Limit	RPD
31101879013MS	31101879014	SO	Endrin	148		10.00	40.00	140.00	50.00
			Endrin	148		10.00	40.00	140.00	50.00
31101879013MSD	31101879015		Endrin	143		10.00	40.00	140.00	50.00
			Endrin	143		10.00	40.00	140.00	50.00

Associated Samples: All samples in Method Batch

Client Sample ID	Lab Sample ID
E11-112-S1	31101879008
E11-112-S1	31101879008
E11-112-S2	31101879009
E11-112-S2	31101879009
E11-117-S1	31101879018
E11-117-S1	31101879018
E11-117-S2	31101879019
E11-117-S2	31101879019
E11-117-S3	31101879020
E11-117-S3	31101879020
E11-117-S4	31101879021
E11-117-S4	31101879021
E11-122-S1	31101879022
E11-122-S1	31101879022
E11-125-S1	31101879006
E11-125-S1	31101879006
E11-125-S2	31101879007
E11-125-S2	31101879007
E11-126-S1	31101879004
E11-126-S1	31101879004
E11-126-S2	31101879005
E11-126-S2	31101879005
E11-127-S1	31101879010
E11-127-S1	31101879010
E11-127-S2	31101879011
E11-127-S2	31101879011
E11-131-S1	31101879002
E11-131-S1	31101879002
E11-131-S2	31101879003
E11-131-S2	31101879003
E11-140-S1	31101879012
E11-140-S1	31101879012
E11-140-S2	31101879013
E11-140-S2	31101879013
E11-140-S3	31101879016

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.
** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

4690

Matrix Spike / Matrix Spike Duplicate Recovery and RPD Outlier Report

E11-140-S3	31101879016

* Only those Percent Recovery and/or RPD values outside project limits are listed in this report.
** Metal are also assessed against an upper rejection point of 150 percent for waters and 200 percent for soils and sediments

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

Surrogate Recovery Outlier Report*

*Excludes samples diluted more than 20x

Surrogate Recovery Outlier Report

Lab Report Batch: 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Analysis Method	Dilution	Matrix	Surrogate	Percent Recovery	Criteria (percent) Lower Limit	Upper Limit	Reject Point	Associated Target Analytes
31101879013MS	31101879014	8151	1	SO	DCAA	339	35.0	135.0	10.0	All Target
31101879013MSD	31101879015	8151	1	SO	DCAA	372	35.0	135.0	10.0	All Target
31101879025MS	31101879026	8151	1	SO	DCAA	174	35.0	135.0	10.0	All Target
		8260B			1,2-Dichloroethane-d4	122	80.0	120.0	10.0	All Target
31101879025MSD	31101879027	8260B	1	SO	1,2-Dichloroethane-d4	122	80.0	120.0	10.0	All Target
E11-109-S1	31101879044	8260B	1	SO	1,2-Dichloroethane-d4	126	80.0	120.0	10.0	All Target
E11-110-S1	31101879052	8260B	1	SO	1,2-Dichloroethane-d4	126	80.0	120.0	10.0	All Target
E11-117-S1	31101879018	8260B	1	SO	1,2-Dichloroethane-d4	124	80.0	120.0	10.0	All Target
E11-117-S2	31101879019	8260B	1	SO	1,2-Dichloroethane-d4	125	80.0	120.0	10.0	All Target
E11-117-S3	31101879020	8260B	1	SO	1,2-Dichloroethane-d4	125	80.0	120.0	10.0	All Target
E11-117-S4	31101879021	8260B	1	SO	1,2-Dichloroethane-d4	121	80.0	120.0	10.0	All Target
E11-120-S2	31101879040	8260B	1	SO	1,2-Dichloroethane-d4	126	80.0	120.0	10.0	All Target
E11-120-S3	31101879041	8081	1	SO	Dibutylchlorendate	203	30.0	139.0	10.0	All Target

Surrogate Recovery Outlier Report

Lab Report Batch: 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Analysis Method	Dilution	Matrix	Surrogate	Percent Recovery	Criteria (percent) Lower Limit	Upper Limit	Reject Point	Associated Target Analytes
E11-120-S3	31101879041	8260B	1	SO	1,2-Dichloroethane-d4	124	80.0	120.0	10.0	All Target
E11-121-S1	31101879042	8081	20	SO	Tetrachloro-m-xylene	146	70.0	130.0	10.0	All Target
		8260B	1		1,2-Dichloroethane-d4	128	80.0	120.0	10.0	All Target
E11-121-S2	31101879043	8260B	1	SO	1,2-Dichloroethane-d4	126	80.0	120.0	10.0	All Target
E11-122-S1	31101879022	8260B	1	SO	1,2-Dichloroethane-d4	130	80.0	120.0	10.0	All Target
E11-122-S2	31101879023	8260B	1	SO	1,2-Dichloroethane-d4	123	80.0	120.0	10.0	All Target
E11-122-S3	31101879024	8260B	1	SO	1,2-Dichloroethane-d4	129	80.0	120.0	10.0	All Target
E11-122-S4	31101879025	8260B	1	SO	1,2-Dichloroethane-d4	134	80.0	120.0	10.0	All Target
E11-123-S1	31101879032	8260B	1	SO	1,2-Dichloroethane-d4	123	80.0	120.0	10.0	All Target
E11-123-S2	31101879033	8260B	1	SO	1,2-Dichloroethane-d4	124	80.0	120.0	10.0	All Target
E11-129-S1	31101879046	8260B	1	SO	1,2-Dichloroethane-d4	125	80.0	120.0	10.0	All Target
E11-130-S1	31101879047	8260B	1	SO	1,2-Dichloroethane-d4	126	80.0	120.0	10.0	All Target
E11-132-S1	31101879048	8260B	1	SO	1,2-Dichloroethane-d4	127	80.0	120.0	10.0	All Target

Surrogate Recovery Outlier Report

Lab Report Batch: 31101879 **Lab ID:** SGSW

Client Sample ID	Lab Sample ID	Analysis Method	Dilution	Matrix	Surrogate	Percent Recovery	Criteria (percent) Lower Limit	Upper Limit	Reject Point	Associated Target Analytes
E11-132-S2	31101879049	8260B	1	SO	1,2-Dichloroethane-d4	127	80.0	120.0	10.0	All Target
E11-133-S1	31101879050	8260B	1	SO	1,2-Dichloroethane-d4	125	80.0	120.0	10.0	All Target
E11-133-S2	31101879051	8260B	1	SO	1,2-Dichloroethane-d4	124	80.0	120.0	10.0	All Target
E11-140-S1	31101879012	8260B	1	SO	1,2-Dichloroethane-d4	122	80.0	120.0	10.0	All Target
E11-140-S3	31101879016	8260B	1	SO	1,2-Dichloroethane-d4	121	80.0	120.0	10.0	All Target
E11-146-S1	31101879028	8081	10	SO	Tetrachloro-m-xylene	62	70.0	130.0	10.0	All Target
		8260B	1		1,2-Dichloroethane-d4	130	80.0	120.0	10.0	All Target
E11-146-S2	31101879029	8260B	1	SO	1,2-Dichloroethane-d4	129	80.0	120.0	10.0	All Target
E11-146-S3	31101879030	8260B	1	SO	1,2-Dichloroethane-d4	124	80.0	120.0	10.0	All Target

Laboratory Duplicate RPD Outlier Report

4696

Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : VXX1802 **Analysis Method :** 8260B **Analysis Date :** 07/20/2011

Preparation Batch : VXX1802 **Preparation Type :** 5035 **Preparation Date :** 07/20/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
31693	SO	1,1-Dichloroethane	106	22	10.00	75.00	125.00	20.00
		trans-1,2-Dichloroethene	98	23	10.00	75.00	125.00	20.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-112-S1	31101879008
E11-112-S1	31101879008
E11-112-S2	31101879009
E11-112-S2	31101879009
E11-125-S1	31101879006
E11-125-S1	31101879006
E11-125-S2	31101879007
E11-125-S2	31101879007
E11-126-S1	31101879004
E11-126-S1	31101879004
E11-126-S2	31101879005
E11-126-S2	31101879005
E11-127-S1	31101879010
E11-127-S1	31101879010
E11-127-S2	31101879011
E11-127-S2	31101879011
E11-131-S1	31101879002
E11-131-S1	31101879002
E11-131-S2	31101879003
E11-131-S2	31101879003

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : VXX1811 **Analysis Method :** 8260B **Analysis Date :** 07/21/2011

Preparation Batch : VXX1811 **Preparation Type :** 5035 **Preparation Date :** 07/21/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
31968	SO	Carbon tetrachloride	131		10.00	75.00	125.00	20.00
31969		Carbon tetrachloride	133	1.5	10.00	75.00	125.00	20.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-117-S1	31101879018
E11-117-S1	31101879018
E11-117-S2	31101879019
E11-117-S2	31101879019
E11-117-S3	31101879020
E11-117-S3	31101879020
E11-117-S4	31101879021
E11-117-S4	31101879021
E11-122-S1	31101879022
E11-122-S1	31101879022
E11-122-S2	31101879023
E11-122-S2	31101879023
E11-122-S3	31101879024
E11-122-S3	31101879024
E11-123-S1	31101879032
E11-123-S1	31101879032
E11-123-S2	31101879033
E11-123-S2	31101879033
E11-140-S1	31101879012
E11-140-S1	31101879012
E11-140-S3	31101879016
E11-140-S3	31101879016
E11-146-S1	31101879028
E11-146-S1	31101879028
E11-146-S2	31101879029
E11-146-S2	31101879029
E11-146-S3	31101879030
E11-146-S3	31101879030

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : VXX1817 **Analysis Method :** 8260B **Analysis Date :** 07/22/2011

Preparation Batch : VXX1817 **Preparation Type :** 5035 **Preparation Date :** 07/22/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

LCS Lab Sample ID	Matrix	Analyte Name	Reported Values		Project Limits (Percent)			
			Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
32140	SO	2-Butanone	133		10.00	75.00	125.00	20.00
		2-Hexanone	127		10.00	75.00	125.00	20.00
		Acetone	132		10.00	75.00	125.00	20.00
32141		1,1-Dichloroethane	80	25	10.00	75.00	125.00	20.00
		1,1-Dichloroethene	82	23	10.00	75.00	125.00	20.00
		Acetone	105	23	10.00	75.00	125.00	20.00
		Carbon disulfide	82	21	10.00	75.00	125.00	20.00
		Methylene chloride	78	30	10.00	75.00	125.00	20.00
		tert-Butyl methyl ether (MTBE)	84	29	10.00	75.00	125.00	20.00
		trans-1,2-Dichloroethene	76	29	10.00	75.00	125.00	20.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-123-S3	31101879034
E11-123-S3	31101879034
E11-136-S2	31101879054
E11-136-S2	31101879054

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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Laboratory Control Sample / Laboratory Control Sample Duplicate Outlier Report

Method Batch : VXX1819 **Analysis Method :** 8260B **Analysis Date :** 07/22/2011

Preparation Batch : VXX1819 **Preparation Type :** 5035 **Preparation Date :** 07/22/2011

Lab Reporting Batch : 31101879 **Lab ID:** SGSW

			Reported Values		Project Limits (Percent)			
LCS Lab Sample ID	Matrix	Analyte Name	Percent Recovery	RPD	Rejection Point	Lower Limit	Upper Limit	RPD
32174	SO	1,1,1-Trichloroethane	126		10.00	75.00	125.00	20.00
		Carbon tetrachloride	141		10.00	75.00	125.00	20.00
		tert-Butyl methyl ether (MTBE)	133		10.00	75.00	125.00	20.00
32176		Carbon tetrachloride	135	4.1	10.00	75.00	125.00	20.00
		tert-Butyl methyl ether (MTBE)	130	2.3	10.00	75.00	125.00	20.00

Associated Samples

Client Sample ID	Lab Sample ID
E11-109-S1	31101879044
E11-109-S1	31101879044
E11-110-S1	31101879052
E11-110-S1	31101879052
E11-120-S2	31101879040
E11-120-S2	31101879040
E11-120-S3	31101879041
E11-120-S3	31101879041
E11-121-S1	31101879042
E11-121-S1	31101879042
E11-121-S2	31101879043
E11-121-S2	31101879043
E11-122-S4	31101879025
E11-122-S4	31101879025
E11-129-S1	31101879046
E11-129-S1	31101879046
E11-130-S1	31101879047
E11-130-S1	31101879047
E11-132-S1	31101879048
E11-132-S1	31101879048
E11-132-S2	31101879049
E11-132-S2	31101879049
E11-133-S1	31101879050
E11-133-S1	31101879050
E11-133-S2	31101879051
E11-133-S2	31101879051

Scope of Data Qualification: The outlier in the LCS qualifies that analyte in all samples with the same Preparation Batch ID as the LCS

Project Number and Name: 11-032E - 11-032E Carroll Agent Orange

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