241884

SUPERFUND CONTRACT SUPPORT TEAM

SAMPLING REPORT

for the

TURNPIKE DUMP SITE #5

JERSEY CITY, HUDSON COUNTY, NEW JERSEY

February 12-22, April 23, 2007

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1.0 BACKGROUND

The New Jersey Turnpike Dump #5 site is located between Gilchrist and Aetna Avenues in Jersey City, Hudson County, New Jersey. The former landfill, CERCLIS ID# NJD980532899, occupies approximately 16 acres of land bordering the Bergen-Hudson Light Rail System and the New Jersey Turnpike, and is comprised of three lots (19H, 19Q, and 19R) owned by the Municipality of Jersey City. The landfill has been used historically for municipal solid waste, as well as the unsystematic depository of liquid and drummed industrial wastes. These operations have led to an accumulation of such waste as ash, slag, tires, construction debris, drums and cylinders, and various contaminated oils throughout the site.

A discovery for the site was performed on June 1, 1981 and a preliminary assessment completed on August 25, 1987. The assessment indicated the presence of low levels of Poly Chlorinated Biphenyls in surface soil throughout the northeastern portion of the site where a previous fire had occurred. A site inspection and subsequent 'No Further Remedial Action Planned' was issued on March 31, 1988.

On April 10, 1991, a fire erupted at the site. Responders at the incident (consisting of the Jersey City Fire Department, emergency medical technicians, nurses, and doctors) experienced cases of hypertension, soar throats, nausea, headaches, and acute hypertension. A post fire site walk-through conducted by an EPA On-Scene Coordinator revealed the presence of several drums of unknown origin.

Between 1991 and 1993, the U.S. EPA conducted several removal actions in order to address the concern for contamination at the site. On June 8, 1992 an EPA Fund Financed Removal Action was performed, followed by a PRP removal between August 12, 1992 and February 19, 1993. A removal assessment was conducted between March 8, 1993 and November 26, 1993. The site was archived by the EPA on May 05, 2000.

On May 8, 2006, at the request of the U.S. EPA Brownsfields Program, the U.S. EPA conducted another site inspection in order to determine if present conditions warranted a CERCLA removal action. The inspection revealed the existence of numerous 55-gallon drums, pails, and small bottles on the surface as well as within mounded debris areas throughout the site.

Currently, conditions at the site include the presence of partially buried collapsed and rusted 55-gallon drums, transformer insulator materials, debris and stressed vegetation, especially in the northeastern portion of the site.

The Division of Environmental Science and Assessment (DESA), Hazardous Waste Support Branch (HWSB), Superfund Support Team (SST) was requested by the EPA Emergency

Remedial and Response Division (ERRD) Removal Action Branch to conduct soil sampling at the site.

The purpose of this assessment was to collect valid data in order to identify the levels of contaminants in the subsurface and surface soil. The sampling event was performed to assist in the future removal of contaminated soil, assess the levels of pesticides/PCBs, Target Analyte List (TAL) total metals and volatile organic compounds (VOCs) in the soil, and to further define the potential source area(s).

2.0 SAMPLING PROCEDURES

The sampling procedures were in accordance with the guidelines set forth in the Quality Assurance Project Plan (QAPP) which is located in Appendix D.

3.0 DESCRIPTION OF EVENTS

The U.S. EPA Emergency and Remedial Response Division (ERRD) on-scene coordinator (OSC) requested the SST to sample surface and sub-surface soils at 62 locations within the boundaries of the Turnpike Dump #5 site. The samples were submitted to the two separate Contract Laboratory Program (CLP) laboratories for the analysis of target analyte list (TAL) total metals and mercury, pesticides/PCBs, and Volatile Organic Compounds (VOCs).

3.1 Sampling

A team from the U.S. EPA DESA Hazardous Waste Support Branch Superfund Support Team conducted sampling at the subject site during February 12 - 23 and April 23, 2007. Surface and sub-surface soil samples were collected from the predetermined 62 sampling locations within the subject site. The implemented sampling plan and notations are given in Table 1 on pg. 3. Samples collected from lower depths were collected and analyzed for the determination of Target Compound List (TCL) PCBs, pesticides/PCBs and/or volatile organics. The required analytical parameters mandated for each sampling location and depth is displayed in Figure 1 on pg. 4 and Table 2 on pg. 10. The samples were shipped daily to the CLP laboratories listed on page one of the Trip Reports located in Appendix H of this document.

Table 1: : General Sampling Notation

Sampling Type	#Locations/sampling type (out of 62)	Depth*	Identification
Surface Soil Sample	62	0 - 6.0"	NJTP5-(Location I.D.)-01
Subsurface Soil Sample	46	1.5' – 2.0'	NJTP5-(Location I.D.)-02
Subsurface Soil Sample	47	2.0' – 6.0'	NJTP5-(Location I.D.)-03

***: " denotes inches, ' denotes feet; depths of sample I.D. '03' taken from 'Primary Debris Area' (fig.1) are 0.5ft above groundwater).**

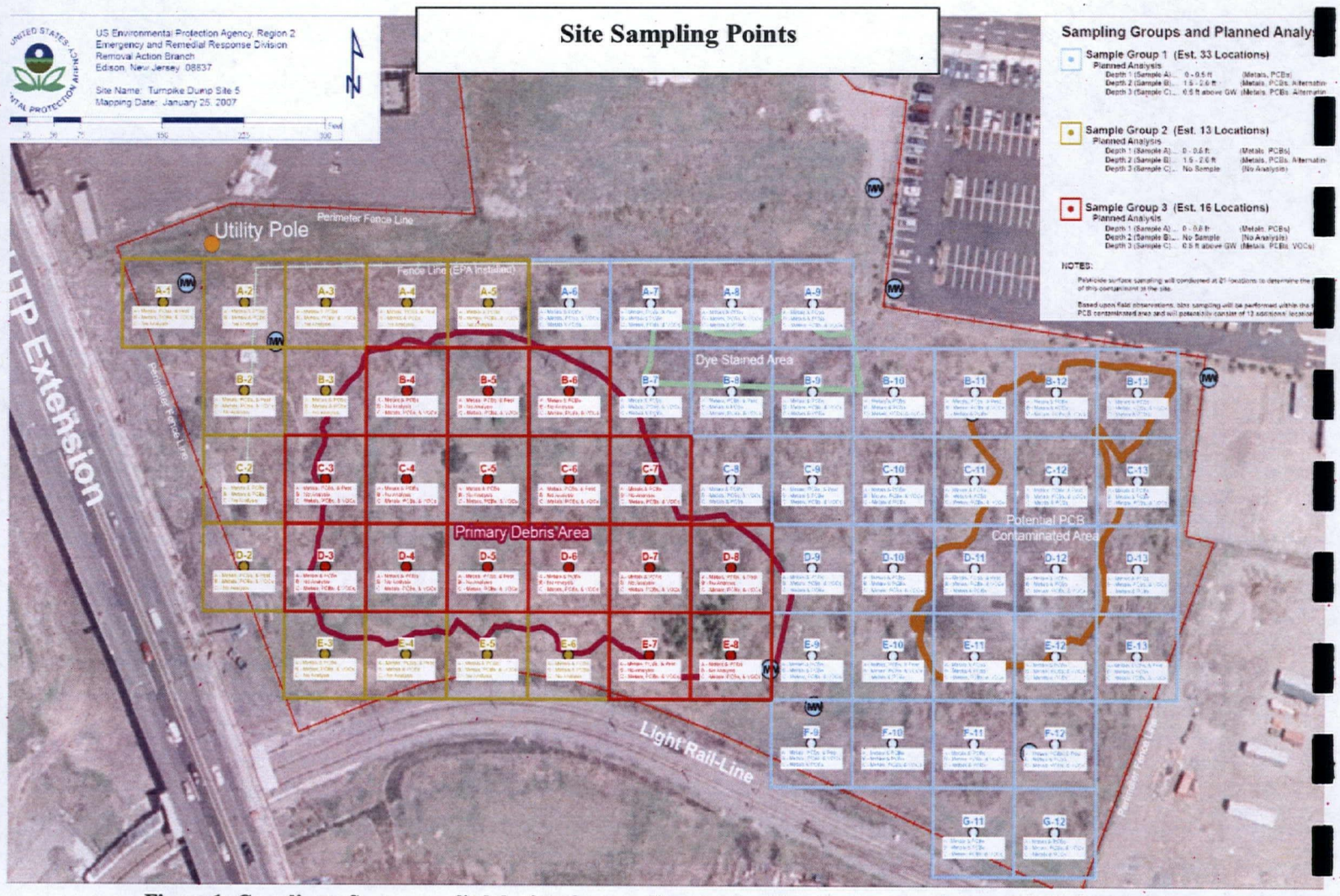

Figure 1: Coordinate System applied during the sampling events. Blue denotes sample group 1; Yellow denotes sample group 2; Red denotes sample group 3.

Soil samples were collected for the purpose of determining potential surface and sub-surface contamination at the site. The sample nomenclature consists of three sets of character strings connected with a hyphen. All sample numbers begin with NJTP5 indicating the site name (New Jersey Turnpike Dump 5). The second character set includes a two digit sample location indicator and the third set being either '01', '02', or '03' indicating the depth of the sample below ground surface. A '01' indicates the sample is a surface sample from 0-6 inches, '02' is 1.5-3 feet, and '03' is 3.5 to 6 feet. The sample results were compared to the New Jersey Department of Environmental Protection (NJDEP) *New Jersey Administrative Code. N.J.A.C. 7:26D-3, Table 3-2: Soil Cleanup Standards.& N.J.A.C. 7:26D-7, Table 7-1: Non-Residential Surface Soil Cleanup Standards, February 3, 1993. Office of Administrative Law, Division of Rules and Publications, Trenton, NJ* which can be found as Appendix E. The results can be found in Appendices A and B of this report.

3.1.1 Timeline

On February 12, 2007, a total of 10 soil samples were collected from 4 separate locations. The samples were collected from depths varying from 6.0 inches to 3.0 feet below ground surface. All samples were collected for the analysis of TAL metals, nine samples were collected for the analysis of TCL PCBs only, one sample was collected for both TCL pesticides and PCBs analysis, and three samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs. The samples were held in the DESA Laboratory Branch walk-in cooler overnight, and shipped overnight to the CLP laboratory the following day.

On February 13, 2007, a total of 8 soil samples were collected from 4 separate locations. The samples were collected from depths varying from 6.0 inches to 2.0 feet below ground surface. All samples were collected for the analysis of TAL metals. Seven samples were collected for the analysis of TCL PCBs only, one sample was collected for both TCL pesticides and PCBs analysis and two samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs as well as one trip blank for the analysis of TCL VOCs only.

On February 15, 2007, a total of 21 soil samples were collected from 12 separate locations. The samples were collected from depths varying from 6.0 inches to 5.5 feet below ground surface. All samples were collected for the analysis of TAL metals. Sixteen samples were collected for the analysis of TCL PCBs only, six samples were collected for both TCL pesticides and PCBs analysis and eight samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs as well as one trip blank for the analysis of TCL VOCs only.

On February 20, 2007, a total of 19 soil samples were collected from 10 separate locations. The samples were collected from depths varying from 6.0 inches to 6.0 feet below ground surface. All samples were collected for the analysis of TAL metals. Fifteen samples were collected for the analysis of TCL PCBs only, five samples were collected for both TCL pesticides and PCBs analysis and seven samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs. Two field duplicate samples and one MS/MSD sample were collected.

On February 21, 2007, a total of 36 soil samples were collected from 19 separate locations. The samples were collected from depths varying from 6.0 inches to 6.0 feet below ground surface. All samples were collected for the analysis of TAL metals. Thirty samples were collected for the analysis of TCL PCBs only, six samples were collected for both TCL pesticides and PCBs analysis and 14 samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs. Two field duplicate samples and one MS/MSD sample were collected.

On February 22, 2007, a total of 37 soil samples were collected from 20 separate locations. The samples were collected from depths varying from 6.0 inches to 6.0 feet below ground surface. All samples were collected for the analysis of TAL metals. Thirty two samples were collected for the analysis of TCL PCBs only, five samples were collected for both TCL pesticides and PCB analysis and 14 samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs. Three field duplicate pair samples and four MS/MSD samples were collected on this sampling day. Samples collected from a depth indicated as exactly 6 feet were revisited after previous rejection with a hand auger and collected with the use of a back hoe.

On February 23, 2007, a total of 23 soil samples were collected from 15 separate locations. The samples were collected from depths varying from 6.0 inches to 6.0 feet below ground surface. All samples were collected for the analysis of TAL metals. Twenty two samples were collected for the analysis of TCL PCBs only; one sample was collected for both TCL pesticides and PCBs analysis and 14 samples for TCL VOC analysis. Two field duplicates were collected on this sampling day.

On April 23, 2007, a total of 10 soil samples were collected from 5 separate locations. The samples were collected from depths varying from 6.0 inches to 6.0 feet below ground surface. All samples were collected for the analysis of TAL metals and PCBs, while eight samples were collected for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL PCBs and VOCs. One field duplicate pair sample was collected on this sampling day. Samples collected from a depth indicated at exactly 6 feet were revisited after previous rejection with a hand auger and collected with the use of a back hoe.

4.0 RESULTS

A daily rinsate blank sample was collected for Quality Control purposes and to ensure that none of the contamination found in the soil samples had originated from the sampling equipment. There were no organic contaminants found in the rinsate blank samples. A number of inorganic analytes were detected above the detection limits in the blank samples. The analytes are not contaminants of concern at this site and did not, according to the U.S. EPA Region 2 criteria, adversely affect the associated environmental sample data.

4.1.1 Inorganic (Metals)

Inorganic analyses were conducted on all samples taken at the subject site, and individual sample results can be found in Appendix B. Arsenic, antimony, cadmium, copper, lead, thallium and zinc were the only elements found to be above the state non-residential clean-up levels. Concentrations exceeded the New Jersey non-residential clean-up level for at least one element in

124 of the 155 samples collected and analyzed. The highest concentration of arsenic was 461 ppm found in sample NJTP5-A6-01. The highest concentration of Antimony was 3660 ppm found in sample NJTP5-D11-02. The highest concentration of cadmium was 132 ppm found in sample NJTP5-C8-03. The highest concentration of copper was 54,900 ppm found in sample NJTP5-C13-01. The highest concentration of lead was 45,200 ppm found in sample NJTP5-G12-01. The highest concentration of thallium was 20.5 ppm found in sample NJTP5-E9-03. The highest concentration of zinc was 217,000 ppm found in sample NJTP5-B11-02.

4.1.2 Volatile Organics

There were no volatile organic compounds found above the state criteria as can be seen from the individual sample results located in Table 2 of Appendix A. The highest concentrations for the Volatile Organic Compounds were observed within the 'Primary Debris Area' of figure 1, markedly all at the depth of 0.5ft above groundwater. This could be due in part because of the sampling strategy; locations sampled within the primary debris area always included a sample for volatile organic analysis approximately 0.5ft above groundwater whereas other areas underwent alternating VOC sampling at inconsistent depths.

4.1.3 PCBs

For aroclors 1016, 1221, 1232, 1242, or 1268, there were no PCB results found above the state criteria as can be seen from the sample data in Table 1 of Appendix A. Aroclors 1248, 1254, and 1260 were found to be above the state clean-up levels. The highest concentration of aroclor-1248 was 100 ppm found in sample NJTP5-E11-01. The highest concentration of aroclor-1254 was 170 ppm found in sample NJTP5-C11-02. The highest concentration of aroclor-1260 was 7100 ppm found in sample NJTP5-C11-01. The highest concentration of aroclor-1262 was 1.2 ppm found in sample NJTP5-E5-01.

4.1.4 Pesticides

Detailed sample data for pesticide analysis can be found in Table 3 of Appendix A. The highest concentration of alpha-BHC was 0.027 ppm found in sample NJTP5-D11-01. The highest concentration of beta-BHC was 0.099 ppm found in sample NJTP5-C6-01. The highest concentration of delta-BHC was 0.015 ppm found in field duplicate sample of NJTP5-E7-01 (NJTP5-E7-11). The highest concentration of gamma-BHC (lindane) was 0.007 ppm found in sample NJTP5-D8-01. The highest concentration of heptachlor was 0.017 ppm found in sample NJTP5-E7-01. The highest concentration of aldrin was 0.076 ppm found in sample NJTP5-C6-01. The highest concentration of heptachlor epoxide was 0.410 ppm found in sample NJTP5-C12-01. The highest concentration of endosulfan I was 0.011 ppm found in sample NJTP5-B11-01. The highest concentration of dieldrin was 0.830 ppm found in sample NJTP5-E4-01. The

highest concentration of 4,4–DDE was 0.074 ppm found in sample NJTP5-C3-01. The highest concentration of endrin was 0.2 ppm found in sample NJTP5-D5-01. The highest concentration of endosulfan II was 0.022 ppm found in sample NJTP5-C6-01. The highest concentration of 4, 4'–DDD was 0.034 ppm found in sample NJTP5-B11-01. The highest concentration of endosulfan sulfate was 0.029 ppm found in sample NJTP5-B8-01. The highest concentration of 4, 4'–DDT was 0.84 ppm found in sample NJTP5-E7-01. The highest concentration of methoxychlor was 0.71 ppm found in sample NJTP5-D11-01. The highest concentration of endrin ketone was 0.03 ppm found in sample NJTP5-B8-01. The highest concentration of endrin aldehyde was 0.41 ppm found in sample NJTP5-C12-01. The highest concentration of alpha-chlordane was 0.54 ppm found in sample NJTP5-E7-01. The highest concentration of gamma-chlordane was 0.42 ppm found in sample NJTP5-D11-01. The highest concentration of toxaphene was 51.0 ppm found in sample NJTP5-E7-01.

4.2 Data Usability

Two different Contract Laboratory Program (CLP) laboratories were utilized for the analysis of the samples collected at the subject site, as well as the U.S. EPA DESA Laboratory for several samples. The data usability qualifiers are as follows:

4.2.1 Inorganics (Metals)

- **U** - Undetected value reported at or below the Instrument Detection Limit (IDL).
- **B** - Detected value between the Instrument Detection Limit (IDL) and the Contract Required Detection Limit (CRDL).
- **UJ** – The analyte was not detected above the CRDL. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

4.2.2 Organics

- **U** – The analyte was analyzed for, but was not detected above the reported sample Blank concentration limit.
- **UJ** – The analyte was not detected above the quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- **B** – Blank Contamination
- **N** – Presumptive evidence for the presence of the material at an estimated value.
- **L** – Identification of the compound is acceptable; reported value may be considered biased low. Actual value is expected to be less than the reported value.

4.2.3 Data Usability Qualifier Definitions:

- **J** - Estimated value due to analytical quality control criteria outside EPA requirements.
- **R** - Rejected value due to analytical quality control criteria outside EPA requirements.

All data are valid and acceptable except those analytes flagged rejected "R" (unusable). Data are rejected on the basis of unacceptable QC analysis and should be excluded from further review or consideration. Data are rejected when associated QC analysis results exceed expanded control limits of the QC criteria. The rejected data are known to contain significant errors based on documented information. The data user must not use the rejected data to make environmental decisions.

It can be seen in the Appendix A, tables 1 and 2, that all of the raw data are usable (not rejected) for volatile organic analyses and all the PCB analyses. The pesticide data contain more than fifty rejected data points. Rejections in these data are due to analytes falling outside the calculated retention time windows for two chromatographic columns and having a percent difference between column results exceeding the primary criteria of 50%. The inorganic data contain several rejected values as is seen in Appendix B; most rejected values occur for chromium, nickel, arsenic, and manganese. Rejections in the inorganic data are due to an associated matrix spike recovery falling outside the control limits of 75-125% when the sample concentrations were less than 4x the spike concentration added, and when the absolute difference between sample and laboratory duplicates was less than 5x the Contract Required Quantitation Limits (CRQL) but greater than or equal to the method detection limit (MDL). The remaining organic and inorganic result rejections were due to sample moisture content in excess of 50%.

5.0 CONCLUSION:

A total of 155 environmental soil samples were collected. All samples were submitted for the analysis of TAL – total metals analysis, 56 for the analysis of VOCs, 134 for the analysis of PCBs, and 21 for the analysis of PCBs and Pesticides.

The highest contaminant level results were observed in the primary debris area. The detailed raw data can be found in Appendices A and B. A list of the Quality Control samples is found in table 2, and the Relative Percent Differences (RPDs) of the Field Duplicates relative to their respective samples found in tables 3-7. Note that the values reported in the table are only numeric values for those analytes that were above the detection limits. If results from both the duplicate and the original sample were reported as non-detects they are not included in tables 3-7. These RPDs represent sample collection precision as per section 9.1.1.2 on page 17 of the QAPP in Appendix D. There are no generic criteria for comparability of field duplicate analyses. Soil duplicate samples will usually have a greater variance than water duplicate samples. In general, the U.S. EPA does not qualify soil field duplicate data with RPDs less than 100 %.

Table 2: Laboratory Quality Control (QC) Samples

Matrix Spike/ Matrix Spike Duplicate (MS/MSD)/Analysis	Field Duplicate
NJTP5-B8-03: TAL, PCBs, VOCs	NJTP5-B7-22 is a duplicate of NJTP5-B7-02
NJTP5-G11-02: TAL, PCBs	NJTP5-B8-04 is a duplicate of NJTP5-B8-03
NJTP5A6-03: TAL, PCBs	NJTP5-C5-33 is a duplicate of NJTP5-C5-03
NJTP5-RB-022207: TAL, Pest/PCBs, VOCs	NJTP5-E5-22 is a duplicate of NJTP5-E5-02
NJTP5-E5-02: TAL, PCBS, VOCs	NJTP5-E7-11 is a duplicate of NJTP5-E7-01
NJTP5-D10-03: TAL, PCBs, VOCs	NJTP5-E3-22 is a duplicate of NJTP5-E3-02
	NJTP5-E8-33 is a duplicate of NJTP5-E8-03
	NJTP5-F9-33 is a duplicate of NJTP5-F9-03

Table 3: Inorganic Field Duplicate RPDs

Analyte/Sample-Duplicate/RPD	NJTP5B7-02	NJTP5-B7-22	RPD	NJTP5-B9-03	NJTP5-B9-33	RPD	NJTP5-C5-03	NJTP5-C5-33	RPD
Aluminum	6080	8030	27.6	7690	7440	3.30	17200	11100	43.1
Antimony	74.9	73.3	2.16	14.3	16.6	14.9	11.5	ND	-
Arsenic	27.6	32.7	16.9	66.8	109	48.0	5.8	4.9	16.8
Barium	5050	5350	5.77	5660	10400	59.0	85.6	82	4.17
Beryllium	0.31	0.45	36.8	0.51	0.34	40.0	ND	ND	-
Cadmium	54.1	61.8	13.3	3.2	4.6	35.9	0.057	0.029	65.1
Calcium	3020	3420	12.4	17000	11100	42.0	1470	1380	6.32
Chromium	169	489	97.3	414	682	48.9	28.6	19.1	39.8
Cobalt	12.2	16.2	28.2	ND	ND	-	ND	ND	-
Copper	1420	1570	10.0	1650	2550	42.9	28.1	15.4	58.4
Iron	75800	89600	16.7	18200	35300	63.9	3920	2420	47.3
Lead	5100	8440	49.3	5820	10500	57.4	32.2	19.5	49.1
Magnesium	1890	2010	6.2	8100	2620	102	414	368	11.8
Manganese	528	547	3.53	371	430	14.7	14.2	9	43.8
Mercury	13.6	21.6	45.4	86.0	91.1	5.76	0.19	0.10	62.1
Nickel	95	142	40.1	33.5	67	66.8	37.1	17.5	71.8
Potassium	ND	ND	-	1390	1220	13.0	216	203	6.21
Selenium	5.7	6.8	17.6	3.9	3.9	0.0	0.95	0.83	13.5
Silver	5.5	6.3	13.6	1.7	3.30	64.0	0.43	0.44	2.30
Sodium	127	174	31.2	1270	1740	31.2	1890	2010.0	6.15
Thallium	3.1	3.7	17.6	ND	ND	-	ND	ND	-
Vanadium	30.1	30.7	1.97	15.1	19.8	26.9	10.3	6.5	45.2
Zinc	29900	42900	35.7	8290	18000	73.9	49.8	24.5	68.1

ND = Not Detected

Table 4: Inorganic Field Duplicate RPDs (cont'd)

Analyte/Sample/ Duplicate/RPD	Sample # NJTP5-C13-03	Duplicate # NJTP5-C13-33	RPD	Sample # NJTP5-E3-02	Duplicate # NJTP5-E3-22	RPD	Sample # NJTP5-E7-01	Duplicate # NJTP5-E7-11	RPD
Aluminum	5300	4000	28.0	6740	6820	1.18	5450	5070	7.22
Antimony	13.0	11.0	16.7	0.46	0.6	26.4	2.0	6.6	107
Arsenic	37.0	43.0	15.0	14.5	10.8	29.2	6.5	7.0	7.41
Barium	310	260	17.5	128	114	11.6	291	356	20.1
Beryllium	ND	ND	-	1.30	1.4	7.41	0.73	1.6	74.7
Cadmium	4.1	3.4	18.7	1.1	0.90	20.0	0.76	4.5	142
Calcium	2700	1900	34.8	19500	21500	9.76	6630	10600	46.1
Chromium	22.0	19.0	14.6	26.7	20.4	26.8	9.8	45.2	129
Cobalt	3.4	4.1	18.7	ND	ND	-	3.40	7.6	76.4
Copper	630	580	8.26	853	680	22.6	40.4	292.0	151
Iron	44000	39000	12.0	17200	14400	17.7	13700	30300	75.4
Lead	880	1400	45.6	142	122	15.2	517	505	2.35
Magnesium	490	340	36.1	6580	6700	1.81	531	1020	63.1
Manganese	160	110	37.0	102	95.0	7.11	91.4	254	94.2
Mercury	0.73	0.96	27.2	1.6	2.2	31.6	0.77	0.7	12.4
Nickel	30.0	30.0	0.00	18.1	15.5	15.5	9.1	52.3	141
Potassium	410	300	31.0	942	964	2.31	370	397	7.04
Selenium	ND	ND	-	ND	ND	-	0.54	2.8	135
Silver	ND	ND	-	1.1	0.83	28.0	0.61	2.1	110
Sodium	150	140.0	6.90	ND	ND	-	2340	ND	200
Thallium	ND	ND	-	1.0	0.8	13.5	0.94	1.8	62.8
Vanadium	14.0	13.0	7.41	24.3	22.7	6.81	14.6	32.1	75.0
Zinc	970	960	1.04	144	119	19.0	229	3910	178

ND = Not Detected

Table 5: Pesticide Duplicate RPDs

Analyte/Sample	Sample #	Duplicate #	RPD
	NJTP5-E7-01	NJTP5-E7-11	
beta-BHC	0.047	0.038	21.2
delta-BHC	ND	0.015	200
Heptachlor	0.017	0.014	19.4
Aldrin	0.034	0.031	9.23
Heptachlor epoxide	0.160	0.150	6.45
4,4' - DDT	0.840	0.760	10.0
alpha-Chlordane	0.540	0.460	16.0
gamma-Chlordane	0.400	0.320	22.2
Toxaphene	51.0	42.0	19.4

Table 6: Volatile Organic Compound Duplicate RPDs

Analyte/Sample	Sample #	Duplicate #	RPD	Sample #	Duplicate #	RPD	Sample #	Duplicate #	RPD
	NJTP5-C5-03	NJTP5-C5-33		NJTP5-E3-02	NJTP5-E3-22		NJTP5-E8-03	NJTP5-E8-33	
Acetone	0.82	1	45.3	0.017	0.02	16.2	0.015	0.023	42.1
2-Butanone	1.3	1.9	37.5	-	-	-	-	-	-
Benzene	0.028	ND	200	-	-	-	-	-	-
4-Methyl-2-	0.017	ND	200	-	-	-	-	-	-
2-Hexanone	1.3	0.72	57.4	-	-	-	-	-	-

Table 7: Polychlorinated biphenyl Duplicate RPDs

Analyte/Sample	Sample #	Duplicate #	RPD	Sample #	Duplicate #	RPD	Sample #	Duplicate #	RPD	Sample #	Duplicate #	RPI
	NJTP5-C13-03	NJTP5-C13-33		NJTP5-E3-02	NJTP5-E3-22		NJTP5-E5-02	NJTP5-E5-22		NJTP5-F9-03	NJTP5-F9-33	
Aroclor-1254	3.6	3.1	14.9	-	-	-	0.31	0.31	0.00	0.40	ND	20(
Aroclor-1260	4.3	2.9	38.9	0.45	ND	200	0.22	0.17	25.6	0.52	0.76	37.:

ND = Not Detected

Table 8: New Jersey Turnpike Dump#5; Sample Numbers/Depths/Analysis

Sample	Depth	Analysis
NJTP5-A1-01	0-0.5ft	Metals & PCBs
NJTP5-A1-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-A2-01	0-0.5ft	Metals & PCBs
NJTP5-A2-02	1.5-2ft	Metals & PCBs
NJTP5-A3-01	0-0.5ft	Metals & PCBs
NJTP5-A3-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-A4-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-A4-02	1.5-2ft	Metals & PCBs
NJTP5-A5-01	0-0.5ft	Metals & PCBs
NJTP5-A5-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-A6-01	0-0.5ft	Metals & PCBs
NJTP5-A6-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-A6-03	0.5ft above GW	Metals & PCBs
NJTP5-A7-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-A7-02	1.5-2ft	Metals & PCBs
NJTP5-A7-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-A8-01	0-0.5ft	Metals & PCBs
NJTP5-A8-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-A8-03	0.5ft above GW	Metals & PCBs
NJTP5-A9-01	0-0.5ft	Metals & PCBs
NJTP5-A9-02	1.5-2ft	Metals & PCBs
NJTP5-A9-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-B2-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-B2-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-B3-01	0-0.5ft	Metals & PCBs
NJTP5-B3-02	1.5-2ft	Metals & PCBs
NJTP5-B4-01	0-0.5ft	Metals & PCBs
NJTP5-B4-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-B5-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-B5-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-B6-01	0-0.5ft	Metals & PCBs
NJTP5-B6-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-B7-01	0-0.5ft	Metals & PCBs
NJTP5B7-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-B7-03	0.5ft above GW	Metals & PCBs
NJTP5-B8-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-B8-02	1.5-2ft	Metals & PCBs
NJTP5-B8-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-B9-01	0-0.5ft	Metals & PCBs
NJTP5-B9-02	1.5-2ft	Metals, PCBs, & VOCs

Table 8 (cont'd): New Jersey Turnpike Dump#5; Sample Numbers/Depths/Analysis

Sample	Depth	Analysis
NJTP5-B9-03	0.5ft above GW	Metals & PCBs
NJTP5-B10-01	0-0.5ft	Metals & PCBs
NJTP5-B10-02	1.5-2ft	Metals & PCBs
NJTP5-B10-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-B11-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-B11-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-B11-03	0.5ft above GW	Metals & PCBs
NJTP5-B12-01	0-0.5ft	Metals & PCBs
NJTP5-B12-02	1.5-2ft	Metals & PCBs
NJTP5-B12-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-B13-01	0-0.5ft	Metals, PCBs, & VOCs
NJTP5-B13-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-B13-03	0.5ft above GW	Metals & PCBs
NJTP5-C2-01	0-0.5ft	Metals & PCBs
NJTP5-C2-02	1.5-2ft	Metals & PCBs
NJTP5-C3-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-C3-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP-C4-01	0-0.5ft	Metals & PCBs
NJTP-C4-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-C5-01	0-0.5ft	Metals & PCBs
NJTP5-C5-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-C6-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-C6-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-C7-01	0-0.5ft	Metals & PCBs
NJTP5-C7-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-C8-01	0-0.5ft	Metals & PCBs
NJTP5-C8-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-C8-03	0.5ft above GW	Metals & PCBs
NJTP5-C9-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-C9-02	1.5-2ft	Metals & PCBs
NJTP5-C9-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-C10-01	0-0.5ft	Metals & PCBs
NJTP5-C10-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-C10-03	0.5ft above GW	Metals & PCBs
NJTP5-C11-01	0-0.5ft	Metals & PCBs
NJTP5-C11-02	1.5-2ft	Metals & PCBs
NJTP5-C11-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-C12-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-C12-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-C12-03	0.5ft above GW	Metals & PCBs

Table 8 (cont'd): New Jersey Turnpike Dump#5; Sample Numbers/Depths/Analysis

Sample	Depth	Analysis
NJTP5-C13-01	0-0.5ft	Metals & PCBs
NJTP5-C13-02	1.5-2ft	Metals & PCBs
NJTP5-C13-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D2-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-D2-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-D3-01	0-0.5ft	Metals & PCBs
NJTP5-D3-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D4-01	0-0.5ft	Metals & PCBs
NJTP5-D4-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D5-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-D5-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D6-01	0-0.5ft	Metals & PCBs
NJTP5-D6-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D7-01	0-0.5ft	Metals & PCBs
NJTP5-D7-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D8-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-D8-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D9-01	0-0.5ft	Metals & PCBs
NJTP5-D9-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-D9-03	0.5ft above GW	Metals & PCBs
NJTP5-D10-01	0-0.5ft	Metals & PCBs
NJTP5-D10-02	1.5-2ft	Metals & PCBs
NJTP5-D10-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D11-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-D11-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-D11-03	0.5ft above GW	Metals & PCBs
NJTP5-D12-01	0-0.5ft	Metals & PCBs
NJTP5-D12-02	1.5-2ft	Metals & PCBs
NJTP5-D12-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-D13-01	0-0.5ft	Metals & PCBs
NJTP5-D13-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-D13-03	0.5ft above GW	Metals & PCBs
NJTP5-E3-01	0-0.5ft	Metals & PCBs
NJTP5-E3-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-E4-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-E4-02	1.5-2ft	Metals & PCBs
NJTP5-E5-01	0-0.5ft	Metals & PCBs
NJTP5-E5-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-E6-01	0-0.5ft	Metals & PCBs
NJTP5-E6-02	1.5-2ft	Metals & PCBs

Table 8 (cont'd): New Jersey Turnpike Dump#5; Sample Numbers/Depths/Analysis

Sample	Depth	Analysis
NJTP5-E7-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-E7-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-E8-01	0-0.5ft	Metals & PCBs.
NJTP5-E8-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-E9-01	0-0.5ft	Metals & PCBs
NJTP5-E9-02	1.5-2ft	Metals & PCBs
NJTP5-E9-03	0.5ft above GW	Metals, PCBs, & VOCs.
NJTP5-E10-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-E10-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-E10-03	0.5ft above GW	Metals & PCBs
NJTP5-E11-01	0-0.5ft	Metals & PCBs
NJTP5-E11-02	1.5-2ft	Metals & PCBs
NJTP5-E11-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-E12-01	0-0.5ft	Metals & PCBs
NJTP5-E12-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-E12-03	0.5ft above GW	Metals & PCBs
NJTP5-E13-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-E13-02	1.5-2ft	Metals & PCBs
NJTP5-E13-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-F9-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-F9-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-F9-03	0.5ft above GW	Metals & PCBs
NJTP5-F10-01	0-0.5ft	Metals & PCBs
NJTP5-F10-02	1.5-2ft	Metals & PCBs
NJTP5-F10-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-F11-01	0-0.5ft	Metals & PCBs
NJTP5-F11-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-F11-03	0.5ft above GW	Metals & PCBs
NJTP5-F12-01	0-0.5ft	Metals, PCBs, & Pest.
NJTP5-F12-02	1.5-2ft	Metals & PCBs
NJTP5-F12-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-G11-01	0-0.5ft	Metals & PCBs
NJTP5-G11-02	1.5-2ft	Metals & PCBs
NJTP5-G11-03	0.5ft above GW	Metals, PCBs, & VOCs
NJTP5-G12-01	0-0.5ft	Metals & PCBs
NJTP5-G12-02	1.5-2ft	Metals, PCBs, & VOCs
NJTP5-G12-03	0.5ft above GW	Metals & PCBs

Appendices

APPENDIX A

Organic Laboratory Data

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-A1-02	Q	NJTP5-A2-01	Q	NJTP5-A2-02	Q	NJTP5-A3-01	Q	NJTP5-A3-02	Q	Clean-up Level
Aroclor-1016	ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		48.0		4.9		33.0		8.3		2.0
Aroclor-1254	ND		ND		ND		ND		ND		2.0
Aroclor-1260	ND		ND		ND		ND		ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-A4-01	Q	NJTP5-A4-02	Q	NJTP5-A5-01	Q	NJTP5-A5-02	Q	NJTP5-A6-01	Q	NJTP5-A6-02	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	0.72		1.1		ND		ND		6.4		ND		2.0
Aroclor-1254	ND		ND		0.17	J	0.07		3.0		ND		2.0
Aroclor-1260	ND		ND		0.12	JN	0.04	JN	1.8	J	ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

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Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-A6-03	Q	NJTP5-A7-01	Q	NJTP5-A7-02	Q	NJTP5-A7-03	Q	NJTP5-A8-01	Q	NJTP5-A8-02	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		0.22	J	0.08		0.07	JN	1.10	JN	0.11	JN	2.0
Aroclor-1254	ND		0.42	J	0.16	JN	0.13	JN	0.99	JN	ND		2.0
Aroclor-1260	ND		0.27	J	0.12	J	0.09	J	0.51	J	ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

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ND - Not Detected
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Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-A8-03	Q	NJTP5-A9-01	Q	NJTP5-A9-02	Q	NJTP5-A9-03	Q	NJTP5-B2-01	Q	NJTP5-B2-02	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	0.10	JN	2.0	J	0.41	JN	ND		1.3		ND		2.0
Aroclor-1254	ND		2.8		0.66		ND		ND		0.16	J	2.0
Aroclor-1260	ND		2.1	J	0.31	J	ND		0.14	J	ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

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ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-B3-01	Q	NJTP5-B3-02	Q	NJTP5-B4-01	Q	NJTP5-B4-03	Q	NJTP5-B5-01	Q	NJTP5-B5-03	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	43.0		54.0		0.98		ND		0.096		ND		2.0
Aroclor-1254	ND		ND		ND		ND		0.16		ND		2.0
Aroclor-1260	1.9		2.1		0.18		ND		0.13		ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

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ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-B6-01	Q	NJTP5-B6-03	Q	NJTP5-B7-01	Q	NJTP5-B7-02	Q	NJTP5-B7-22	Q	NJTP5-B7-03	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1254	11.0		ND		0.21	J	0.21		0.38		ND		2.0
Aroclor-1260	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-B8-01	Q	NJTP5-B8-02	Q	NJTP5-B8-03	Q	NJTP5-B8-04	Q	NJTP5-B9-01	Q	NJTP5-B9-02	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	1.5	JN	ND		ND		ND		ND		ND		2.0
Aroclor-1254	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1260	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-B9-03	Q	NJTP5-B9-33	Q	NJTP5-B10-01	Q	NJTP5-B10-02	Q	NJTP5-B10-03	Q	NJTP5-B11-01	Q	Clean-up Level
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1254	ND		ND		12.0		ND		ND		ND		2.0
Aroclor-1260	ND		ND		6.1		ND		ND		13.0		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-B11-02	Q	NJTP5-B11-03	Q	NJTP5-B12-01	Q	NJTP5-B12-02	Q	NJTP5-B12-03	Q	NJTP5-B13-01	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		8.0		2.0
Aroclor-1254	ND		ND		27.0		5.2		ND		17.0		2.0
Aroclor-1260	1.1		0.053	J	15.0		3.4		ND		5.0	J	2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-B13-02	Q	NJTP5-B13-03	Q	NJTP5-C2-01	Q	NJTP5-C2-02	Q	NJTP5-C3-01	Q	NJTP5-C3-03	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		1.0		0.22		ND		ND		2.0
Aroclor-1254	3.5		5.5		0.81		0.12	J	0.19	J	ND		2.0
Aroclor-1260	0.79		1.3		0.31	J	ND		0.19		ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-C4-01	Q	NJTP5-C4-03	Q	NJTP5-C5-01	Q	NJTP5-C5-03	Q	NJTP5-C5-33	Q	NJTP5-C6-01	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND	R	0.052	R	ND		2.0
Aroclor-1221	ND		ND		ND		ND	R	0.052	R	ND		2.0
Aroclor-1232	ND		ND		ND		ND	R	0.052	R	ND		2.0
Aroclor-1242	ND		ND		ND		ND	R	0.052	R	ND		2.0
Aroclor-1248	ND		ND		ND		ND	R	0.052	R	1.5		2.0
Aroclor-1254	0.73		0.27		ND		ND	R	0.052	R	0.80	JN	2.0
Aroclor-1260	0.56		0.30		0.72		ND	R	0.052	R	ND		2.0
Aroclor-1262	ND		ND		ND		ND	R	0.052	R	ND		2.0
Aroclor-1268	ND		ND		ND		ND	R	0.052	R	ND		2.0

NA – Not Applicable
ND - Not Detected
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Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-C6-03	Q	NJTP5-C7-01	Q	NJTP5-C7-03	Q	NJTP5-C8-01	Q	NJTP5-C8-02	Q	NJTP5-C8-03	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		4.0		ND		ND		ND		ND		2.0
Aroclor-1254	0.10	J	ND		ND		ND		0.23	J	ND		2.0
Aroclor-1260	ND		0.42	J	ND		3.5		0.08		ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-C9-01	Q	NJTP5-C9-02	Q	NJTP5-C9-03	Q	NJTP5-C10-01	Q	NJTP5-C10-02	Q	NJTP5-C10-03	Q	Clean-up Level
Aroclor-1016	ND		ND		ND		ND		ND	J	ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND	J	ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND	J	ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND	J	ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND	J	ND		2.0
Aroclor-1254	0.70	J	0.56	J	ND		ND		ND	J	ND		2.0
Aroclor-1260	0.76	J	0.63	J	ND		2.8		ND	J	ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND	J	ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND	J	ND		2.0

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R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-C11-01	Q	NJTP5-C11-02	Q	NJTP5-C11-03	Q	NJTP5-C12-01	Q	NJTP5-C12-02	Q	NJTP5-C12-03	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1254	ND		170		ND		150		23.0		ND		2.0
Aroclor-1260	7100		20.0	J	95.0	J	92.0		10.0		3.6		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

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ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
L - Identification of the analyte is acceptable; reported value may be biased high. Actual Value is expected to be less than the reported value.

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-C13-01	Q	NJTP5-C13-02A*	Q	NJTP5-C13-02B*	Q	NJTP5-C13-03	Q	NJTP5-C13-33**	Q	NJTP5-D2-01	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1254	10.0		2.6		ND		3.6		3.1	L	ND		2.0
Aroclor-1260	12.0		1.9		ND		4.3		2.9	L	ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
L - Identification of the analyte is acceptable; reported value may be biased high. Actual Value is expected to be less than the reported value.
* - Sampled for on 2 dates; A denotes the sample taken 4/23/2007 and analyzed by EPA DESA laboratory; B denotes the sample taken 2/22/2007 analyzed by CLP
** - Denotes the duplicate sample of C13-03

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-D2-02	Q	NJTP5-D3-01	Q	NJTP5-D3-03	Q	NJTP5-D4-01	Q	NJTP5-D4-03	Q	NJTP5-D5-01	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1248	ND		0.095	J	ND		1.0	J	ND		2.0		2.0
Aroclor-1254	ND		0.21	J	ND		0.62		ND		ND		2.0
Aroclor-1260	ND		0.19	J	0.04	J	0.22		ND		3.0		2.0
Aroclor-1262	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND	R	ND		ND		ND		ND		2.0

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Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-D5-03	Q	NJTP5-D6-01	Q	NJTP5-D6-03	Q	NJTP5-D7-01	Q	NJTP5-D7-03	Q	NJTP5-D8-01	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND	J	ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND	J	ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND	J	ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND	J	ND		ND		ND		2.0
Aroclor-1248	0.35		ND		ND	J	ND		ND		ND		2.0
Aroclor-1254	ND		0.78		0.23	J	ND		ND		ND		2.0
Aroclor-1260	0.27		0.32		0.15	J	ND		ND		0.39	J	2.0
Aroclor-1262	ND		ND		ND	J	ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND	J	ND		ND		ND		2.0

NA – Not Applicable
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R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-D8-03	Q	NJTP5-D9-01	Q	NJTP5-D9-02	Q	NJTP5-D9-03	Q	NJTP5-D10-01	Q	NJTP5-D10-02	Q	Clean-up Level
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1254	0.39	J	ND		ND		0.08	J	ND		4.4	J	2.0
Aroclor-1260	2.1		ND		0.24	J	0.17		ND		7.4		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-D10-03	Q	NJTP5-D11-01	Q	NJTP5-D11-02	Q	NJTP5-D11-03	Q	NJTP5-D12-01	Q	NJTP5-D12-02	Q	Clean-up Level
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1254	ND		83.0		47.0	J	ND		24.0		ND		2.0
Aroclor-1260	37.0		150		90.0	J	ND		55.0		22.0	L	2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

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ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
L - Identification of the analyte is acceptable; reported value may be biased high. Actual Value is expected to be less than the reported value.

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-D12-03	Q	NJTP5-D13-01	Q	NJTP5-D13-02	Q	NJTP5-D13-03	Q	NJTP5-E3-01	Q	NJTP5-E3-02	Q	Clean-up Level
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1254	ND		ND		ND		ND		0.81	J	ND		2.0
Aroclor-1260	3.6	L	0.44	J	ND		ND		1.3		0.45	J	2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
L - Identification of the analyte is acceptable; reported value may be biased high. Actual Value is expected to be less than the reported value.

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-E3-22*	Q	NJTP5-E4-01	Q	NJTP5-E4-02	Q	NJTP5-E5-01	Q	NJTP5-E5-02	Q	Clean-up Level
Aroclor-1016	ND		ND		ND	J	ND		ND		2.0
Aroclor-1221	ND		ND		ND	J	ND		ND		2.0
Aroclor-1232	ND		ND		ND	J	ND		ND		2.0
Aroclor-1242	ND		ND		ND	J	ND		ND		2.0
Aroclor-1248	ND		ND		ND	J	ND		ND		2.0
Aroclor-1254	ND		0.59	J	ND	J	ND		0.31		2.0
Aroclor-1260	ND		0.93	J	ND	J	1.8		0.22	J	2.0
Aroclor-1262	ND		ND		ND	J	1.2		ND		2.0
Aroclor-1268	ND		ND		ND	J	ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
* - Denotes the duplicate sample of E3-02

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-E5-22**	Q	NJTP5-E6-01	Q	NJTP5-E6-02	Q	NJTP5-E7-01	Q	NJTP5-E7-11*	Q	NJTP5-E7-03	Q	Clean-up Level
Aroclor-1016	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		0.45		ND		ND		ND		ND		2.0
Aroclor-1254	0.31		0.54		0.081	J	ND		ND		ND		2.0
Aroclor-1260	0.17		0.46		0.096		ND		ND		ND		2.0
Aroclor-1262	ND		ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
* - Denotes the duplicate sample of E7-01
** - Denotes the duplicate sample of E5-02

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-E8-01	Q	NJTP5-E8-03	Q	NJTP5-E8-03**	Q	NJTP5-E9-01	Q	NJTP5-E9-02	Q	NJTP5-E9-03	Q	Clean-up Level
Aroclor-1016	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND	R	ND		2.9		ND		ND		2.0
Aroclor-1254	ND		ND	R	ND		2.1	J	ND		ND		2.0
Aroclor-1260	0.39	J	ND	R	ND		0.67		ND		20.0		2.0
Aroclor-1262	ND		ND	R	ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND	R	ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
** - Denotes the duplicate sample of E8-03

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-E10-01	Q	NJTP5-E10-02	Q	NJTP5-E10-03	Q	NJTP5-E11-01	Q	NJTP5-E11-02	Q	NJTP5-E11-03A	Q	NJTP5-E11-03B	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND	J	ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND	J	ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND	J	ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND	J	ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND	J	ND		100	J	ND		ND		0.83		2.0
Aroclor-1254	6.5		ND	J	ND		67.0		0.65	J	26.0		ND		2.0
Aroclor-1260	23.0		ND	J	33.0		47.0		2.7	J	5.1	J	0.49		2.0
Aroclor-1262	ND		ND	J	ND		ND		ND	N	ND		ND		2.0
Aroclor-1268	ND		ND	J	ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
* - Sampled for on 2 dates; A denotes the sample taken 4/23/2007 and analyzed by EPA DESA laboratory; B denotes the sample taken 2/22/2007 analyzed by CLP

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-E12-01	Q	NJTP5-E12-02	Q	NJTP5-E12-03	Q	NJTP5-F9-01	Q	NJTP5-F9-02	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		2.0
Aroclor-1254	6.1		6.8	J	ND		ND		1.2		2.0
Aroclor-1260	23.0		27.0	J	ND		0.67	J	1.5		2.0
Aroclor-1262	ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-F9-03	Q	NJTP5-F9-33*	Q	NJTP5-F10-01	Q	NJTP5-F10-02	Q	NJTP5-F10-03	Q	NJTP5-F11-01	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND	R	ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND	R	ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND	R	ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND	R	ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND	R	ND		ND		2.0
Aroclor-1254	0.40		ND		ND		ND	R	ND		12.0		2.0
Aroclor-1260	0.52		0.76		ND		ND	R	ND		15.0		2.0
Aroclor-1262	ND		ND		ND		ND	R	ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND	R	ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
* - Denotes the duplicate sample of F9-03

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-F11-02	Q	NJTP5-F11-03	Q	NJTP5-F12-01	Q	NJTP5-F12-03	Q	NJTP5-G11-01	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		0.86		2.0
Aroclor-1254	3.3		ND		0.39	J	1.1	J	1.5		2.0
Aroclor-1260	5.0		ND		0.69		4.1		1.5		2.0
Aroclor-1262	ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
* - CLP unable to analyze sample
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 1:
Turnpike Dump #5
PCB Results
(mg/kg)

Analyte/Sample	NJTP5-G11-02	Q	NJTP5-G11-03	Q	NJTP5-G12-01	Q	NJTP5-G12-02	Q	NJTP5-G12-03	Q	Clean-up Level (mg/kg)
Aroclor-1016	ND		ND		ND		ND		ND		2.0
Aroclor-1221	ND		ND		ND		ND		ND		2.0
Aroclor-1232	ND		ND		ND		ND		ND		2.0
Aroclor-1242	ND		ND		ND		ND		ND		2.0
Aroclor-1248	ND		ND		ND		ND		ND		2.0
Aroclor-1254	0.35	J	ND		0.92	J	3.2	J	0.21	J	2.0
Aroclor-1260	0.49		ND		0.85		7.7	J	0.37		2.0
Aroclor-1262	ND		ND		ND		ND		ND		2.0
Aroclor-1268	ND		ND		ND		ND		ND		2.0

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 2:
Turnpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP5-A1-02	Q	NJTP5-A5-02	Q	NJTP5-A6-02	Q	NJTP5-A7-03	Q	NJTP5-A8-02	Q	NJTP5-A9-03	Q	NJTP5-B2-02	Q	Clean up Levels
Dichlorodifluoromethane	ND		ND		8.6		ND		ND		ND		ND		NA
Chloromethane	ND		ND		8.6		ND		ND		ND		ND		1000
Vinyl Chloride	ND	J	ND	J	8.6	J	ND	J	ND	J	ND		ND	J	7.0
Bromomethane	ND		ND		ND		ND		ND		ND		ND		1000
Chloroethane	ND		ND		ND		ND		ND		ND		ND		NA
Trichlorofluoromethane	ND		ND		0.0078	J	ND		ND		ND	J	ND		NA
1,1-Dichloroethene	ND		ND		ND		ND		ND		ND	J	ND		150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		ND		ND		ND		ND		ND	J	ND		NA
Acetone	ND		ND	J	0.034		0.027		0.043		0.012	J	ND		1000
Carbon Disulfide	ND		ND		ND		ND		ND		ND		ND		NA
Methyl acetate	ND		ND		ND		ND		ND		ND	J	ND		NA
Methylene chloride	ND		ND		ND		ND		ND		ND	J	ND		210.0
trans-1,2-Dichloroethene	ND		ND		ND		ND		ND		ND		ND		1000
Methyl tert-butytl ether	ND		ND		ND		ND		ND		ND	J	ND		NA
1,1-Dichloroethane	ND		ND		ND		ND		ND		ND		ND		1000
cis-1,2-Dichloroethene	ND		ND		ND		ND		ND		ND		ND		1000
2-Butanone	ND		ND		0.017		ND		ND		ND		ND		1000
Bromochloromethane	ND		ND		ND		ND		ND		ND		ND		NA
Chloroform	ND		ND		ND		ND		ND		ND		ND		28
1,1,1-Trichloromethane	ND		ND		ND		ND		ND		ND	J	ND		NA
Cyclohexane	ND	J	ND	J	ND	J	ND		ND		ND		ND		NA
Carbon tetrachloride	ND		ND		ND	J	ND		ND		ND	J	ND		4.0
Benzene	ND		ND	J	ND		ND		ND		ND		ND		13.0
1, 2 -Dichloroethane	ND		ND		ND	R	ND		ND		ND	J	ND		24.0
1, 4-Dioxane	ND	R	ND	R	ND		ND	R	ND	R	ND	R	ND	R	NA
Trichloroethene	ND		ND	J	ND	J	ND		ND		ND		ND		54.0
Methylcyclohexane	ND	J	ND	J	ND	J	ND		ND		ND		ND		NA
1,2-Dichloropropane	ND	J	ND	J	ND		ND		ND		ND		ND		43
Bromodichloromethane	ND	J	ND	J	ND		ND		ND		ND		ND		46
cis-1,3-Dichloropropene	ND		ND	J	ND		ND		ND		ND	J	ND		5.0
4-Methyl-2-pentanone	ND		ND		ND		ND		ND		ND		ND		1000
Toluene	ND		ND	J	ND		ND		ND		0.0009	J	ND		1000
trans-1, 3-Dichloropropene	ND		ND	J	ND		ND		ND		7.6	J	ND		5.0
1,1,2-Trichloroethane	ND		ND	J	ND		ND		ND		ND		ND		420.0
Tetrachloroethene	ND		ND	J	ND		ND		ND		ND		ND		6.0
2-Hexanone	ND		ND		ND		ND		ND		ND		ND		NA
Dibromochloromethane	ND		ND		ND		ND		ND		ND		ND		1000
1,2-Dibromoethane	ND		ND		ND		ND		ND		ND	J	ND		NA
Chlorobenzene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	680
Etylbenzene	ND		ND	J	ND		ND		ND		ND	J	ND		1000
o-Xylene	ND		ND	J	0.0016	J	ND		ND		ND		ND		1000
m,p-Xylene	ND		ND	J	0.0024	J	ND		ND		ND		ND		1000
Styrene	ND		ND	J	ND		ND		ND		ND		ND		97
Bromoform	ND		ND		ND		ND		ND		ND		ND		370
Iopropylbenzene	ND		ND	J	ND		ND		ND		0.00054	J	ND		NA
1,1,2,2-Tetrachoroethane	ND		ND		ND		ND		ND		ND		ND		70.0
1,3-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	10000
1,4-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	10000
1,2-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	10000
1,2-Dibromo-3-chloropropane	ND		ND		ND		ND		ND		ND		ND		NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	1200
1,2,3-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

Table 2:
Turnpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP5-B4-03	Q	NJTP5-B5-03	Q	NJTP5-B6-03	Q	NJTP5-B7-02	Q	NJTP5-B7-22	Q	NJTP-B8-03	Q	NJTP5-B8-04	Q	Clean up Levels
Dichlorodifluoromethane	ND		ND		ND	J	ND		ND		ND		ND		NA
Chloromethane	ND		ND		ND	J	ND		ND		ND		ND		1000
Vinyl Chloride	ND	J	ND	J	ND		ND		ND		ND		ND		7.0
Bromomethane	ND		ND		ND	J	ND		ND		ND		ND		1000
Chloroethane	ND		ND		ND		ND		ND		ND		ND		NA
Trichlorofluoromethane	ND	J	ND	J	ND		ND		ND		ND		ND		NA
1,1-Dichloroethene	ND	J	ND	J	ND	J	ND		ND		ND		ND		150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	J	ND	J	ND	J	ND		ND		ND		ND		NA
Acetone	0.063		0.014		0.0078	J	ND		ND		0.025		0.025		1000
Carbon Disulfide	ND		ND		ND		ND		ND		ND		ND		NA
Methyl acetate	ND	J	ND	J	ND	J	ND		ND		ND		ND		NA
Methylene chloride	ND	J	ND	J	ND	J	ND		ND		ND		ND		210.0
trans-1,2-Dichloroethene	ND		ND		ND		ND		ND		ND		ND		1000
Methyl tert-butytl ether	ND	J	ND	J	ND	J	ND		ND		ND		ND		NA
1,1-Dichloroethane	ND		ND		ND		ND		ND		ND		ND		1000
cis-1,2-Dichloroethene	ND		ND		ND		ND		ND		ND		ND		1000
2-Butanone	ND		ND		ND		ND		ND		ND		ND		1000
Bromochloromethane	ND		ND		ND		ND		ND		ND		ND		NA
Chloroform	ND		ND		ND		ND		ND		ND		ND		28
1,1,1-Trichloromethane	ND	J	ND	J	ND	J	ND		ND		ND		ND		NA
Cyclohexane	ND	J	ND	J	ND		ND		ND		ND		ND		NA
Carbon tetrachloride	ND	J	ND	J	ND	J	ND		ND		ND		ND		4.0
Benzene	ND	J	ND	J	ND		ND		ND		0.0023		0.0013		13.0
1, 2 -Dichloroethane	ND	J	ND	J	ND	J	ND		ND		ND		ND		24.0
1, 4-Dioxane	ND	R	ND	R	ND	R	ND	R	ND	R	ND	R	ND	R	NA
Trichloroethene	ND	J	ND	J	ND		ND		ND		ND		ND		54.0
Methylcyclohexane	ND	J	ND	J	ND		ND		ND		ND		ND		NA
1,2-Dichloropropane	ND	J	ND	J	ND		ND		ND		ND		ND		43
Bromodichloromethane	ND	J	ND	J	ND		ND		ND		ND		ND		46
cis-1,3-Dichloropropene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND		5.0
4-Methyl-2-pentanone	ND		ND		ND		ND		ND		ND		ND		1000
Toluene	ND	J	ND	J	ND		ND		ND		ND		ND		1000
trans-1, 3-Dichloropropene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND		5.0
1,1,2-Trichloroethane	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND		420.0
Tetrachloroethene	ND	J	ND	J	ND		ND		ND		ND		ND		6.0
2-Hexanone	ND		ND		ND		ND		ND		ND		ND		NA
Dibromochloromethane	ND		ND		ND		ND		ND		ND		ND		1000
1,2-Dibromoethane	ND	J	ND	J	ND	J	ND		ND		ND		ND		NA
Chlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND		ND		680
Etylbenzene	ND	J	ND	J	ND		ND		ND		0.0048	J	ND		1000
o-Xylene	ND	J	ND	J	ND		ND		ND		0.0036	J	0.0037	J	1000
m,p-Xylene	ND	J	ND	J	ND		ND		ND		0.00052	J	0.00049	J	1000
Styrene	ND	J	ND	J	ND		ND		ND		ND		ND		97
Bromoform	ND		ND		ND		ND		ND		ND		ND		370
Iopropylbenzene	ND	J	ND	J	ND		ND		ND		0.0065	J	0.0059	J	NA
1,1,2,2-Tetrachoroethane	ND	J	ND	J	ND	J	ND		ND		ND		ND		70.0
1,3-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND		ND		10000
1,4-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND		ND		10000
1,2-Dichlorobenzene	ND	J	ND	J	ND		ND	J	ND	J	ND		ND		10000
1,2-Dibromo-3-chloropropane	ND	J	ND	J	ND		ND		ND		ND		ND		NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND		ND		1200
1,2,3-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND		ND		NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

Table 2:
Turnpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP5-B9-02	Q	NJTP5-B10-03	Q	NJTP-B11-02	Q	NJTP5-B12-03	Q	NJTP5- B13-02	Q	NJTP5-C3-03	Q	Clean up Levels
Dichlorodifluoromethane	ND		ND		ND		ND		ND		ND		NA
Chloromethane	ND		ND		ND		ND		ND		ND		1000
Vinyl Chloride	ND		ND	J	ND	J	ND	J	ND	J	ND	J	7.0
Bromomethane	ND		ND		ND		ND		ND	J	ND		1000
Chloroethane	ND		ND		ND		ND		ND		ND		NA
Trichlorofluoromethane	ND		ND		ND	J	ND	J	ND		ND	J	NA
1,1-Dichloroethene	ND		ND		ND	J	ND		ND		ND	J	150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		ND		ND	J	ND		ND		ND	J	NA
Acetone	0.023		0.014	J	ND		0.028		0.2		0.53		1000
Carbon Disulfide	ND		ND		ND		ND		0.0083		ND		NA
Methyl acetate	ND		ND		ND	J	ND		ND		ND	J	NA
Methylene chloride	ND		ND		ND	J	ND		ND		ND	J	210.0
trans-1,2-Dichloroethene	ND		ND		ND		ND		ND		ND		1000
Methyl tert-butytl ether	ND		ND		ND	J	ND		ND		ND	J	NA
1,1-Dichloroethane	ND		ND		ND		ND		ND		ND	J	1000
cis-1,2-Dichloroethene	ND		ND		ND		ND		ND		ND		1000
2-Butanone	ND		ND		ND		ND		0.048	L	ND		1000
Bromochloromethane	ND		ND		ND		ND		ND		ND	J	NA
Chloroform	ND		ND		ND		ND		ND		ND	J	28
1,1,1-Trichloromethane	ND		ND		ND	J	ND		ND		ND	J	NA
Cyclohexane	ND		ND		ND	J	ND	J	0.012		ND	J	NA
Carbon tetrachloride	ND		ND	J	ND	J	ND		ND		ND	J	4.0
Benzene	0.0012	J	ND		ND	J	0.0023	J	ND		ND	J	13.0
1, 2 -Dichloroethane	ND		ND		ND	J	ND		ND		ND	J	24.0
1, 4-Dioxane	ND	R	ND	R	ND	R	ND	R	ND		ND	R	NA
Trichloroethene	ND		ND		ND	J	ND		ND		ND	J	54.0
Methylcyclohexane	ND		ND		ND	J	ND	J	0.033		ND	J	NA
1,2-Dichloropropane	ND		ND		ND	J	ND	J	ND		ND	J	43
Bromodichloromethane	ND		ND		ND	J	ND	J	ND		ND	J	46
cis-1,3-Dichloropropene	ND	J	ND	J	ND	J	ND		ND		ND	J	5.0
4-Methyl-2-pentanone	ND		ND		ND		ND		ND	J	ND		1000
Toluene	ND		0.0009	J	ND	J	0.0088		ND	J	ND	J	1000
trans-1, 3-Dichloropropene	ND	J	ND	J	ND	J	ND		ND	J	ND	J	5.0
1,1,2-Trichloroethane	ND	J	ND	J	ND	J	ND		ND	J	ND	J	420.0
Tetrachloroethene	ND		ND		ND	J	ND		ND	J	ND	J	6.0
2-Hexanone	ND		ND		ND		ND		ND	J	ND		NA
Dibromochloromethane	ND		ND		ND		ND		ND	J	ND	J	1000
1,2-Dibromoethane	ND		ND		ND	J	ND		ND	J	ND	J	NA
Chlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	680
Etylbenzene	ND		ND		ND	J	0.041		ND	J	ND	J	1000
o-Xylene	ND		ND		ND	J	0.025		0.0085	J	ND	J	1000
m,p-Xylene	ND		ND		ND	J	0.058		0.010	J	ND	J	1000
Styrene	ND		ND		ND	J	ND		ND	J	ND	J	97
Bromoform	ND		ND		ND		ND		ND	J	ND	J	370
Iopropylbenzene	ND		ND		ND	J	ND		ND	J	ND	J	NA
1,1,2,2-Tetrachoroethane	ND		ND		ND		ND		ND	J	ND	J	70.0
1,3-Dichlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	10000
1,4-Dichlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	10000
1,2-Dichlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	10000
1,2-Dibromo-3-chloropropane	ND		ND		ND		ND		ND	J	ND	J	NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	1200
1,2,3-Trichlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
L - Identification of the analyte is acceptable; reported value may be biased high. Actual Value is expected to be less than the reported value.

Table 2:
Tumpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP-C4-03	Q	NJTP5-C5-03	Q	NJTP5-C5-33**	Q	NJTP5-C6-03	Q	NJTP5-C8-02	Q	NJTP5-C9-03	Q	NJTP-C10-02	Q	Clean up Levels
Dichlorodifluoromethane	ND		ND		ND	R	ND	J	ND	J	ND	J	ND		NA
Chloromethane	ND		ND		ND	R	ND	J	ND	J	ND	J	ND		1000
Vinyl Chloride	ND	J	ND		ND	R	ND	J	ND	J	ND	J	ND	J	7.0
Bromomethane	ND	J	ND		ND	R	ND	J	ND	J	ND	J	ND	J	1000
Chloroethane	ND		ND		ND	R	ND	J	ND	J	ND	J	ND		NA
Trichlorofluoromethane	ND		ND	J	ND	R	ND	J	ND	J	ND	J	ND		NA
1,1-Dichloroethene	ND		ND	J	ND	R	ND	J	ND	J	ND	J	ND		150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND		ND	J	ND	R	ND	J	ND	J	ND	J	ND		NA
Acetone	0.78	J	0.82		1	J	0.038		0.034		ND		ND		1000
Carbon Disulfide	0.01		ND		ND	R	ND	J	ND	J	ND	J	ND		NA
Methyl acetate	0.034		ND	J	ND	R	ND	J	ND	J	ND	J	ND		NA
Methylene chloride	0.019		ND	J	ND	R	ND	J	ND	J	ND	J	ND		210.0
trans-1,2-Dichloroethene	ND		ND		ND	R	ND	J	ND	J	ND	J	ND		1000
Methyl tert-butytl ether	ND		ND	J	ND	R	ND	J	ND	J	ND	J	ND		NA
1,1-Dichloroethane	ND		ND	J	ND	R	ND	J	ND	J	ND		ND		1000
cis-1,2-Dichloroethene	0.015		ND		ND	R	ND	J	ND	J	ND	J	ND		1000
2-Butanone	0.340	J	1.3		1.9	J	ND		ND		ND		ND		1000
Bromochloromethane	ND		ND	J	ND	R	ND	J	ND	J	ND		ND		NA
Chloroform	0.095		ND	J	ND	R	ND	J	ND	J	ND		ND		28
1,1,1-Trichloromethane	ND		ND	J	ND	R	ND	J	ND	J	ND	J	ND		NA
Cyclohexane	ND		ND		ND	R	ND		ND	J	ND		ND		NA
Carbon tetrachloride	ND		ND	J	ND	R	ND	J	ND	J	ND	J	ND		4.0
Benzene	0.014		0.028	J	ND	R	ND		ND	J	ND		ND		13.0
1, 2 -Dichloroethane	ND		ND	J	ND	R	ND	J	ND	J	ND	J	ND		24.0
1, 4-Dioxane	NA		ND	R	ND	R	ND	R	ND	R	ND	R	NA		NA
Trichloroethene	ND		ND	J	ND	R	ND		ND	J	ND		ND		54.0
Methylcyclohexane	ND		ND		ND	R	ND		ND	J	ND		ND		NA
1,2-Dichloropropane	ND		ND		ND	R	ND		ND	J	ND		ND		43
Bromodichloromethane	ND		ND		ND	R	ND		ND	J	ND		ND		46
cis-1,3-Dichloropropene	ND		ND	J	ND	R	ND		ND	J	ND	J	ND		5.0
4-Methyl-2-pentanone	ND	J	0.017	J	ND	R	ND		ND		ND		ND		1000
Toluene	0.07	J	ND	J	ND	R	0.002	J	ND	J	ND		ND		1000
trans-1, 3-Dichloropropene	ND	J	ND	J	ND	R	ND		ND	J	ND	J	ND		5.0
1,1,2-Trichloroethane	ND	J	ND	J	ND	R	ND		ND	J	ND	J	ND		420.0
Tetrachloroethene	ND	J	ND		ND	R	ND		ND	J	ND		ND		6.0
2-Hexanone	0.093	J	1.3		0.72	J	ND		0.0034	J	ND		ND		NA
Dibromochloromethane	ND	J	ND	J	ND	R	ND	J	ND	J	ND	J	ND		1000
1,2-Dibromoethane	ND	J	ND	J	ND	R	ND	J	ND	J	ND	J	ND		NA
Chlorobenzene	0.02	J	ND	J	ND	R	ND	J	ND	J	ND		ND		680
Etylbenzene	0.21	J	ND	J	ND	J	ND		ND	J	ND		ND		1000
o-Xylene	0.12	J	ND	J	ND	J	ND		0.00059	J	ND		ND		1000
m,p-Xylene	0.49	J	ND	J	ND	R	0.0015	J	ND	J	ND		ND		1000
Styrene	ND	J	ND	J	ND	R	ND		ND	J	ND		ND		97
Bromoform	ND	J	ND	J	ND	R	ND	J	ND	J	ND		ND		370
Iopropylbenzene	0.025	J	ND	J	ND	R	ND		ND	J	ND		ND		NA
1,1,2,2-Tetrachoroethane	ND	J	ND	J	ND	R	ND		ND		ND		ND		70.0
1,3-Dichlorobenzene	ND	J	ND	J	ND	R	ND	J	ND	J	ND	J	ND		10000
1,4-Dichlorobenzene	ND	J	ND	J	ND	R	ND	J	ND	J	ND	J	ND		10000
1,2-Dichlorobenzene	ND	J	ND	J	ND	R	ND	J	ND	J	ND	J	ND		10000
1,2-Dibromo-3-chloropropane	ND	J	ND	J	ND	R	ND		ND		ND		ND		NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	R	ND	J	ND	J	ND	J	ND		1200
1,2,3-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND		NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
** - Denotes the duplicate sample of C5-03

Table 2:
Turnpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP-C11-03	Q	NJTP5-C12-02	Q	NJTP5-C13-03	Q	NJTP5-C13-33*	Q	NJTP5-D2-02	Q	NJTP5-D3-03	Q	NJTP-D4-03	Q	Clean up Levels
Dichlorodifluoromethane	ND		ND		ND		ND		ND	J	ND		ND		NA
Chloromethane	ND		ND		ND		ND		ND	J	ND		ND		1000
Vinyl Chloride	ND	J	ND		ND	J	ND	J	ND	J	ND		ND		7.0
Bromomethane	ND		ND		ND	J	ND	J	ND	J	ND		ND		1000
Chloroethane	ND		ND		ND		ND		ND	J	ND		ND		NA
Trichlorofluoromethane	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	NA
1,1-Dichloroethene	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	NA
Acetone	0.039		0.06		ND		ND		0.046		0.15		0.1		1000
Carbon Disulfide	ND		ND		ND		ND		ND	J	ND		ND		NA
Methyl acetate	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	NA
Methylene chloride	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	210.0
trans-1,2-Dichloroethene	ND		ND		ND		ND		ND	J	ND		ND		1000
Methyl tert-butytl ether	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	NA
1,1-Dichloroethane	ND		ND		ND		ND		ND	J	ND		ND	J	1000
cis-1,2-Dichloroethene	ND		ND		ND		ND		ND	J	ND		ND		1000
2-Butanone	ND		ND		ND		ND		0.015		0.052		ND		1000
Bromochloromethane	ND		ND		ND		ND		ND	J	ND		ND	J	NA
Chloroform	ND		ND		ND		ND		ND	J	ND		ND	J	28
1,1,1-Trichloromethane	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	NA
Cyclohexane	ND		ND		ND		ND		ND		ND		ND		NA
Carbon tetrachloride	ND	J	ND		ND		ND		ND		ND	J	ND	J	4.0
Benzene	ND		ND		ND		ND		ND	J	ND		ND	J	13.0
1, 2 -Dichloroethane	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	24.0
1, 4-Dioxane	ND	R	ND	R	ND		ND		0.11	R	ND	R	ND	R	NA
Trichloroethene	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	54.0
Methylcyclohexane	ND		ND		ND		ND		ND		ND		ND		NA
1,2-Dichloropropane	ND		ND		ND		ND		ND		ND		ND		43
Bromodichloromethane	ND		ND		ND		ND		ND		ND		ND		46
cis-1,3-Dichloropropene	ND	J	ND	J	ND		ND		ND	J	ND	J	ND	J	5.0
4-Methyl-2-pentanone	ND		ND		ND	J	ND	J	ND		ND		ND		1000
Toluene	0.0013	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	1000
trans-1, 3-Dichloropropene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	5.0
1,1,2-Trichloroethane	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	420.0
Tetrachloroethene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	6.0
2-Hexanone	ND		ND		ND	J	ND	J	ND		ND		ND		NA
Dibromochloromethane	ND		ND		ND	J	ND	J	ND	J	ND		ND	J	1000
1,2-Dibromoethane	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	NA
Chlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	680
Etylbenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	1000
o-Xylene	0.0014	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	1000
m,p-Xylene	0.0020	J	ND		ND	J	ND	J	0.00048	J	ND	J	ND	J	1000
Styrene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	97
Bromoform	ND		ND		ND	J	ND	J	ND	J	ND		ND	J	370
Iopropylbenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	NA
1,1,2,2-Tetrachoroethane	ND		ND		ND	J	ND	J	ND		ND		ND		70.0
1,3-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,4-Dichlorobenzene	0.0036	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,2-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,2-Dibromo-3-chloropropane	ND		ND		ND	J	ND	J	ND		ND		ND		NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	1200
1,2,3-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
* - Denotes the duplicate sample of C13-03

Table 2:
Turnpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP5-D5-03	Q	NJTP5-D6-03	Q	NJTP5-D7-03	Q	NJTP5-D8-03	Q	NJTP5-C13-03	Q	NJTP5-D9-02	Q	NJTP5-D10-03	Q	Clean up Levels
Dichlorodifluoromethane	ND		ND		ND		ND		ND		ND	J	ND	J	NA
Chloromethane	ND		ND		ND		ND		ND		ND	J	ND	J	1000
Vinyl Chloride	ND	J	ND	J	ND	J	ND		ND	J	ND	J	ND	J	7.0
Bromomethane	ND		ND		ND		ND		ND	J	ND	J	ND	J	1000
Chloroethane	ND		ND		ND		ND		ND		ND	J	ND	J	NA
Trichlorofluoromethane	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	NA
1,1-Dichloroethene	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	NA
Acetone	0.061		0.038		ND		1.2	J	ND		0.021		0.07		1000
Carbon Disulfide	ND		ND		ND		ND		ND		ND	J	ND	J	NA
Methyl acetate	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	NA
Methylene chloride	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	210.0
trans-1,2-Dichloroethene	ND	J	ND		ND		ND		ND		ND	J	ND	J	1000
Methyl tert-butytl ether	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	NA
1,1-Dichloroethane	ND		ND		ND		ND		ND		ND	J	ND	J	1000
cis-1,2-Dichloroethene	ND	J	ND		ND		ND		ND		ND	J	ND	J	1000
2-Butanone	0.016		ND		ND		0.02		ND		ND		ND		1000
Bromochloromethane	ND		ND		ND		ND		ND		ND	J	ND	J	NA
Chloroform	ND		ND		ND		ND		ND		ND	J	ND	J	28
1,1,1-Trichloromethane	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	NA
Cyclohexane	0.0031	J	ND		ND		ND		ND		ND	J	ND	J	NA
Carbon tetrachloride	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	4.0
Benzene	ND		ND		ND		ND		ND		ND	J	ND	J	13.0
1, 2 -Dichloroethane	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	24.0
1, 4-Dioxane	ND	R	ND	R	ND	R	ND	R	NA		ND	R	ND	R	NA
Trichloroethene	ND	J	ND		ND		ND		ND		ND	J	ND	J	54.0
Methylcyclohexane	ND		ND		ND		ND		ND		ND	J	ND	J	NA
1,2-Dichloropropane	ND		ND		ND		ND		ND		ND	J	ND	J	43
Bromodichloromethane	ND		ND		ND		ND		ND		ND	J	ND	J	46
cis-1,3-Dichloropropene	ND	J	ND	J	ND	J	ND		ND		ND	J	ND	J	5.0
4-Methyl-2-pentanone	ND		ND		ND		ND		ND	J	ND		ND		1000
Toluene	ND	J	ND		ND		0.00095	J	ND	J	ND	J	ND	J	1000
trans-1, 3-Dichloropropene	ND	J	ND	J	ND	J	ND		ND	J	ND	J	ND	J	5.0
1,1,2-Trichloroethane	ND	J	ND	J	ND	J	ND		ND	J	ND	J	ND	J	420.0
Tetrachloroethene	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	6.0
2-Hexanone	ND		ND		ND		ND		ND	J	ND		ND		NA
Dibromochloromethane	ND		ND	J	ND		ND		ND	J	ND	J	ND	J	1000
1,2-Dibromoethane	ND	J	ND	J	ND	J	ND		ND	J	ND	J	ND	J	NA
Chlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	680
Etylbenzene	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	1000
o-Xylene	0.00073	J	0.001	J	ND		ND		ND	J	ND	J	ND	J	1000
m,p-Xylene	0.0015	J	0.0017	J	ND		ND		ND	J	ND	J	ND	J	1000
Styrene	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	97
Bromoform	ND		ND	J	ND		ND		ND	J	ND	J	ND	J	370
Iopropylbenzene	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	NA
1,1,2,2-Tetrachoroethane	ND		ND		ND		ND		ND	J	ND	J	ND	J	70.0
1,3-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,4-Dichlorobenzene	ND	J	ND	J	0.00064	J	ND	J	ND	J	ND	J	ND	J	10000
1,2-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,2-Dibromo-3-chloropropane	ND		ND		ND		ND		ND	J	ND		ND	J	NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	1200
1,2,3-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

Table 2:
Turnpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP5-D11-02	Q	NJTP5-D12-03	Q	NJTP5-D13-02	Q	NJTP5-E3-02	Q	NJTP5-E3-22*	Q	NJTP5-E5-02	Q	NJTP5-E5-22**	Q	Clean up Levels
Dichlorodifluoromethane	ND		ND		ND	J	ND	J	ND		ND	J	ND	J	NA
Chloromethane	ND		ND		ND	J	ND	J	ND		ND	J	ND	J	1000
Vinyl Chloride	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	7.0
Bromomethane	ND		ND	J	ND	J	ND	J	ND		ND	J	ND	J	1000
Chloroethane	ND		ND		ND	J	ND	J	ND		ND	J	ND	J	NA
Trichlorofluoromethane	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	NA
1,1-Dichloroethene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	NA
Acetone	0.13		0.091		0.011	J	0.017		0.02		0.0074	J	0.013		1000
Carbon Disulfide	0.0014	J	ND		ND	J	ND	J	ND		ND		ND	J	NA
Methyl acetate	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	NA
Methylene chloride	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	210.0
trans-1,2-Dichloroethene	ND	J	ND		ND	J	ND	J	ND		ND	J	ND	J	1000
Methyl tert-butytl ether	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	NA
1,1-Dichloroethane	ND	J	ND		ND	J	ND	J	ND		ND	J	ND	J	1000
cis-1,2-Dichloroethene	ND	J	ND		ND	J	ND	J	ND		ND	J	ND	J	1000
2-Butanone	0.038		0.018		ND		ND		ND		ND		ND		1000
Bromochloromethane	ND	J	ND		ND	J	ND	J	ND		ND	J	ND	J	NA
Chloroform	ND	J	ND		ND	J	ND	J	ND		ND	J	ND	J	28
1,1,1-Trichloromethane	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	NA
Cyclohexane	0.03		ND		ND	U	ND	J	ND		ND	U	ND		NA
Carbon tetrachloride	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	4.0
Benzene	0.00066	J	ND		ND	J	ND	J	ND		ND	J	ND	J	13.0
1, 2 -Dichloroethane	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	24.0
1, 4-Dioxane	ND	R	NA		ND	R	ND	R	ND	R	ND	R	ND	R	NA
Trichloroethene	ND	J	ND		ND	J	ND	J	ND		ND	J	ND	J	54.0
Methylcyclohexane	0.03		0.0082		ND		ND	J	ND		ND		ND		NA
1,2-Dichloropropane	ND		ND		ND		ND	J	ND		ND		ND		43
Bromodichloromethane	ND		ND		ND		ND	J	ND		ND		ND		46
cis-1,3-Dichloropropene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	5.0
4-Methyl-2-pentanone	ND		ND	J	ND	U	ND		ND		ND		ND		1000
Toluene	0.0007	J	ND	J	ND	J	ND	J	ND		0.001	J	ND	J	1000
trans-1, 3-Dichloropropene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	5.0
1,1,2-Trichloroethane	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	420.0
Tetrachloroethene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	6.0
2-Hexanone	ND	J	ND	J	ND		ND		ND		ND		ND		NA
Dibromochloromethane	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	1000
1,2-Dibromoethane	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	NA
Chlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	680
Etylbenzene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	1000
o-Xylene	0.0021	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	1000
m,p-Xylene	0.0016	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	1000
Styrene	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	97
Bromoform	ND	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	370
Iopropylbenzene	0.0016	J	ND	J	ND	J	ND	J	ND		ND	J	ND	J	NA
1,1,2,2-Tetrachoroethane	ND		ND	J	ND		ND	J	ND		ND	J	ND		70.0
1,3-Dichlorobenzene	0.0034	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,4-Dichlorobenzene	0.0068	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,2-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,2-Dibromo-3-chloropropane	ND		ND	J	ND		ND	J	ND		ND	J	ND		NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	1200
1,2,3-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
* - Denotes the duplicate sample of E3-02
** - Denotes the duplicate sample of E5-02

Table 2:
Turnpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP5-E7-03	Q	NJTP5-E8-03	Q	NJTP5-E8-33*	Q	NJTP5-E9-03	Q	NJTP5-E10-02	Q	NJTP5-E11-03A	Q	NJTP5-E11-03B	Q	Clean up Levels
Dichlorodifluoromethane	ND	R	ND		ND		ND		ND	J	ND		ND		NA
Chloromethane	ND	R	ND		ND		ND		ND	J	ND		ND		1000
Vinyl Chloride	ND	R	ND		ND		ND		ND	J	ND		ND	J	7.0
Bromomethane	ND	R	ND		ND		ND		ND	J	ND		ND		1000
Chloroethane	ND	R	ND		ND		ND		ND	J	ND		ND		NA
Trichlorofluoromethane	ND	R	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	NA
1,1-Dichloroethene	ND	R	ND		ND		ND		ND	J	ND	J	ND	J	150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	R	ND		ND		ND		ND	J	ND	J	ND	J	NA
Acetone	ND	R	0.015		0.023		0.03		0.022		0.0051		0.016		1000
Carbon Disulfide	ND	J	ND		ND		ND		ND	J	ND		ND		NA
Methyl acetate	ND	R	ND		ND		ND		ND	J	ND	J	ND	J	NA
Methylene chloride	ND	R	ND		ND		ND		ND	J	ND	J	ND	J	210.0
trans-1,2-Dichloroethene	ND	R	ND		ND		ND		ND	J	ND		ND	J	1000
Methyl tert-butytl ether	ND	R	ND		ND		ND		ND	J	ND	J	ND	J	NA
1,1-Dichloroethane	ND	J	ND		ND		ND		ND	J	ND		ND		1000
cis-1,2-Dichloroethene	ND	R	ND		ND		ND		ND	J	ND		ND	J	1000
2-Butanone	ND	J	ND		ND		ND		ND		ND		ND		1000
Bromochloromethane	ND	J	ND		ND		ND		ND	J	ND		ND		NA
Chloroform	ND	J	ND		ND		ND		ND	J	ND		ND		28
1,1,1-Trichloromethane	ND	R	ND		ND		ND		ND	J	ND	J	ND	J	NA
Cyclohexane	ND	J	ND		ND		ND		ND		ND		ND		NA
Carbon tetrachloride	ND	R	ND		ND		ND	J	ND	J	ND	J	ND	J	4.0
Benzene	ND	R	ND		ND		ND		0.305	J	ND	J	ND		13.0
1, 2 -Dichloroethane	ND	R	ND		ND		ND		ND	J	ND	J	ND	J	24.0
1, 4-Dioxane	ND	R	ND	R	ND	R	ND	R	ND	R	ND	R	ND	R	NA
Trichloroethene	ND	J	ND		ND		ND		ND	J	ND	J	ND		54.0
Methylcyclohexane	ND	J	ND		ND		ND		0.0052	J	0.0064		ND		NA
1,2-Dichloropropane	ND	J	ND		ND		ND		ND		ND		ND		43
Bromodichloromethane	ND	J	ND		ND		ND		ND		ND		ND		46
cis-1,3-Dichloropropene	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	5.0
4-Methyl-2-pentanone	ND	J	ND		ND		ND		ND		0.0012		ND		1000
Toluene	ND	J	ND		ND		ND		0.017	J	ND	J	ND		1000
trans-1, 3-Dichloropropene	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	5.0
1,1,2-Trichloroethane	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	420.0
Tetrachloroethene	ND	J	ND		ND		ND		ND	J	ND	J	ND		6.0
2-Hexanone	ND	J	ND		ND		ND		ND		ND		ND		NA
Dibromochloromethane	ND	J	ND		ND		ND		ND	J	ND		ND		1000
1,2-Dibromoethane	ND	R	ND		ND		ND		ND	J	ND	J	ND	J	NA
Chlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	680
Etylbenzene	ND	J	ND		ND		ND		0.008	J	ND	J	ND		1000
o-Xylene	ND	J	ND		ND		ND		0.016	J	ND	J	ND		1000
m,p-Xylene	ND	J	ND		ND		ND		0.025	J	ND	J	ND	J	1000
Styrene	ND	J	ND		ND		ND		ND	J	ND	J	ND		97
Bromoform	ND	J	ND		ND		ND		ND	J	ND		ND		370
Iopropylbenzene	ND	J	ND		ND		ND		0.0013	J	ND	J	ND		NA
1,1,2,2-Tetrachoroethane	ND	J	ND		ND		ND		ND	J	ND		ND		70.0
1,3-Dichlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,4-Dichlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,2-Dichlorobenzene	ND	J	ND		ND	J	ND	J	ND	J	ND	J	ND	J	10000
1,2-Dibromo-3-chloropropane	ND	J	ND		ND		ND		ND	J	ND	J	ND		NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	1200
1,2,3-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
* - Denotes the duplicate sample of E8-03
** - Sampled for on 2 dates; A denotes the sample taken 4/23/2007 and analyzed by EPA DESA laboratory; B denotes the sample taken 2/22/2007 analyzed by CLP

Table 2:
Turnpike Dump #5
VOC Results
(mg/kg)

Analyte/Sample	NJTP5-E12-02	Q	NJTP5-F9-02	Q	NJTP5-F10-03	Q	NJTP5-F11-02	Q	NJTP5-F12-03	Q	NJTP5-G11-03	Q	NJTP5-G12-02	Q	Clean up Levels
Dichlorodifluoromethane	ND	J	ND		ND		ND		ND		ND		ND	J	NA
Chloromethane	ND	J	ND		ND		ND		ND		ND		ND	J	1000
Vinyl Chloride	ND	J	ND		ND		ND	J	ND	J	ND		ND	J	7.0
Bromomethane	ND	J	ND		ND		ND		ND		ND		ND	J	1000
Chloroethane	ND	J	ND		ND		ND		ND		ND		ND	J	NA
Trichlorofluoromethane	ND	J	ND		ND		ND	J	ND	J	ND	J	ND	J	NA
1,1-Dichloroethene	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	150.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	NA
Acetone	0.0071	J	ND		0.13		0.0071	J	0.013		0.069		ND		1000
Carbon Disulfide	ND	J	ND		ND		ND		ND		ND		ND	J	NA
Methyl acetate	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	NA
Methylene chloride	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	210.0
trans-1,2-Dichloroethene	ND	J	ND		ND		ND		ND		ND		ND	J	1000
Methyl tert-butytl ether	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	NA
1,1-Dichloroethane	ND	J	ND		ND		ND		ND	J	ND		ND	J	1000
cis-1,2-Dichloroethene	ND	J	ND		ND		ND		ND		ND		ND	J	1000
2-Butanone	ND		ND		ND		ND		ND		0.023		ND		1000
Bromochloromethane	ND	J	ND		ND		ND		ND	J	ND		ND	J	NA
Chloroform	ND	J	ND		ND		ND		ND	J	ND		ND	J	28
1,1,1-Trichloromethane	ND	J	ND		ND		ND		ND	J	ND		ND	J	NA
Cyclohexane	ND		ND		ND	J	ND	J	ND	J	ND		ND	U	NA
Carbon tetrachloride	ND	J	ND		ND		ND		ND	J	ND	J	ND	J	4.0
Benzene	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	13.0
1, 2 -Dichloroethane	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	24.0
1, 4-Dioxane	ND	R	ND	R	ND	R	ND	R	ND	R	ND	R	ND	R	NA
Trichloroethene	ND	J	ND		ND		ND	J	ND	J	ND		ND	J	54.0
Methylcyclohexane	ND		ND		ND		ND		ND	J	ND		ND		NA
1,2-Dichloropropane	ND		ND		ND		ND		ND	J	ND		ND		43
Bromodichloromethane	ND		ND		ND		ND		ND	J	ND		ND		46
cis-1,3-Dichloropropene	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	5.0
4-Methyl-2-pentanone	ND		ND		ND		ND		ND		ND		ND		1000
Toluene	ND	J	ND		ND		ND	J	ND	J	0.0012	J	ND	J	1000
trans-1, 3-Dichloropropene	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	5.0
1,1,2-Trichloroethane	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	420.0
Tetrachloroethene	ND	J	ND		ND		ND	J	ND	J	ND		ND	J	6.0
2-Hexanone	ND		ND		ND		ND		ND		ND		ND		NA
Dibromochloromethane	ND	J	ND		ND		ND		ND	J	ND		ND	J	1000
1,2-Dibromoethane	ND	J	ND		ND	J	ND	J	ND	J	ND		ND	J	NA
Chlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	R	680
Etylbenzene	ND	J	ND		ND		ND	J	ND	J	ND		ND	J	1000
o-Xylene	ND	J	ND		ND		ND	J	ND	J	ND		ND	J	1000
m,p-Xylene	ND	J	ND		ND		ND	J	ND	J	ND		ND	J	1000
Styrene	ND	J	ND		ND		ND	J	ND	J	ND		ND	J	97
Bromoform	ND	J	ND		ND		ND		ND	J	ND		ND	J	370
Iopropylbenzene	ND	J	ND		ND		ND	J	ND	J	ND		ND	J	NA
1,1,2,2-Tetrachoroethane	ND		ND		ND		ND		ND		ND		ND		70.0
1,3-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	R	10000
1,4-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	R	10000
1,2-Dichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	R	10000
1,2-Dibromo-3-chloropropane	ND		ND		ND		ND		ND		ND		ND		NA
1,2,4-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	R	1200
1,2,3-Trichlorobenzene	ND	J	ND	J	ND	J	ND	J	ND	J	ND	J	ND	R	NA

NA – Clean-up levels:None Applicable; Under Sample I.D.: No Analysis
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

Table 3:
Turnpike Dump #5
Pesticide Results
(mg/kg)

Analyte/Sample	NJTP5-A1-01	Q	NJTP5-A4-01	Q	NJTP5-A7-01	Q	NJTP5-B2-01	Q	NJTP5-B5-01	Q	Clean-up Level (mg/kg)
alpha-BHC	ND		ND		ND		ND		ND		NA
beta-BHC	ND		ND	R	0.003	R	0.005	R	0.003	R	NA
delta-BHC	ND		ND		ND		ND		0.00067	J	NA
gamma-BHC (Lindane)	ND		ND		ND		ND		ND		NA
Heptachlor	ND		0.005	J	0.004	J	ND		ND		0.65
Aldrin	ND		ND		ND		ND		ND		0.17
Heptachlor epoxide	0.006	R	ND		0.004	JN	0.003	R	0.003	J	NA
Endosulfan I	ND		ND		ND		ND		ND		6200
Dieldrin	0.017		ND		0.017		0.006	R	0.007	J	0.18
4,4' - DDE	0.009	R	0.011		0.054		ND		ND		9.0
Endrin	ND		ND		0.006	J	0.002	J	ND		310
Endosulfan II	ND		ND		ND		ND		ND		NA
4,4' - DDD	0.004	J	0.007	J	ND		0.003	J	0.004	J	12.0
Endosulfan sulfate	0.016	JN	ND		ND		ND		ND		NA
4,4' - DDT	0.053		0.008	J	0.056	J	0.015		0.009		9.0
Methoxychlor	ND		ND		ND		ND		ND		5200
Endrin ketone	0.013		ND		ND		ND		ND		NA
Endrin aldehyde	0.036		ND		ND		ND		0.006		NA
alpha-Chlordane	0.004		0.005	JN	0.008	J	0.004		ND		NA
gamma-Chlordane	ND		0.007	J	0.012	JN	0.003	R	0.002	J	NA
Toxaphene	ND		ND		ND		ND		ND		0.20

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 3:
Turnpike Dump #5
Pesticide Results
(mg/kg)

Analyte/Sample	NJTP5-B6-01	Q	NJTP5-B8-01	Q	NJTP5-B11-01	Q	NJTP5-C3-01	Q	NJTP5-C6-01	Q	Clean-up Level (mg/kg)
alpha-BHC	ND		ND		0.005	JN	ND	J	0.010		NA
beta-BHC	0.009	JN	0.004	R	0.012	R	0.007	R	0.099	J	NA
delta-BHC	ND		ND		ND		ND		ND		NA
gamma-BHC (Lindane)	ND		ND		ND		ND		ND		NA
Heptachlor	0.002	J	ND		ND		ND		0.002	R	0.65
Aldrin	ND		ND		ND		0.015	J	0.076	JN	0.17
Heptachlor epoxide	0.019	JN	0.008	R	0.020	JN	0.015	J	0.086		NA
Endosulfan I	0.006	R	ND		0.011	J	0.005	J	0.007	R	6200
Dieldrin	0.019	R	0.100	JN	0.230	JN	0.082	J	0.047	R	0.18
4,4' - DDE	0.061		0.015	R	0.019	R	0.074	J	0.031	R	9.0
Endrin	0.033	R	ND		0.190		0.008	J	0.017		310
Endosulfan II	0.020	R	0.011	R	0.012	R	0.010	JN	0.022	JN	NA
4,4' - DDD	ND		0.077	R	0.034	JN	0.006	JN	0.027	JN	12.0
Endosulfan sulfate	ND		0.029		0.006	JN	ND		ND		NA
4,4' - DDT	ND		0.022	R	0.350	JN	0.049	J	0.210		9.0
Methoxychlor	ND		0.035	JN	0.076	JN	0.018	J	0.035	J	5200
Endrin ketone	ND		0.030	J	ND		0.009	JN	ND		NA
Endrin aldehyde	0.020	J	0.013	R	0.063	R	0.026	J	0.020	R	NA
alpha-Chlordane	0.029		0.008		0.004	R	0.019	J	0.130	J	NA
gamma-Chlordane	0.027	R	0.010	JN	0.021	R	0.026	J	0.160		NA
Toxaphene	ND		ND		ND		ND		ND		0.20

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 3:
Turnpike Dump #5
Pesticide Results
(mg/kg)

Analyte/Sample	NJTP5-C9-01	Q	NJTP5-C12-01	Q	NJTP5-D2-01	Q	NJTP5-D5-01	Q	NJTP5-D8-01	Q	Clean-up Level (mg/kg)
alpha-BHC	ND	J	ND		ND		0.016	JN	ND		NA
beta-BHC	ND	J	ND		ND		0.052	J	0.014	JN	NA
delta-BHC	ND	J	ND		ND		0.008	R	0.003	R	NA
gamma-BHC (Lindane)	ND	J	ND		ND		ND		0.007	J	NA
Heptachlor	ND	J	ND		ND		ND		0.002	R	0.65
Aldrin	ND	J	ND		0.002	J	ND		ND		0.17
Heptachlor epoxide	0.004	J	0.410	JN	0.003		0.041	JN	0.005	R	NA
Endosulfan I	0.002	J	0.089	R	ND		0.006	R	ND		6200
Dieldrin	0.020	JN	ND		0.013	J	0.082	JN	0.021	J	0.18
4,4' - DDE	0.034	J	ND		ND		0.055	J	0.005	R	9.0
Endrin	ND	J	ND		ND		0.200	JN	ND		310
Endosulfan II	ND	J	0.360	R	0.004	R	0.010	R	0.006		NA
4,4' - DDD	0.013	J	ND		0.017	J	0.007	R	0.006		12.0
Endosulfan sulfate	ND	J	ND		0.017	J	ND		ND		NA
4,4' - DDT	0.007	J	ND		0.023		0.140		0.027	J	9.0
Methoxychlor	ND	J	0.200	J	0.028	R	0.039		ND		5200
Endrin ketone	ND	J	ND		ND		ND		ND		NA
Endrin aldehyde	ND		0.410	JN	0.014	R	0.120	JN	0.015	JN	NA
alpha-Chlordane	0.006	J	0.041	R	0.004	J	0.021		ND		NA
gamma-Chlordane	0.013	J	ND		0.007	J	0.030	R	0.007	J	NA
Toxaphene	ND	J	ND		ND		ND		ND		0.20

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 3:
Turnpike Dump #5
Pesticide Results
(mg/kg)

Analyte/Sample	NJTP5-D11-01	Q	NJTP5-E4-01	Q	NJTP5-E7-01	Q	NJTP5-E7-11*	Q	NJTP5-E10-01	Q	Clean-up Level (mg/kg)
alpha-BHC	0.027	JN	ND	J	ND		ND		0.009	J	NA
beta-BHC	0.058	R	ND	J	0.047	J	0.038		0.011	R	NA
delta-BHC	ND		ND	J	ND	J	0.015		ND	J	NA
gamma-BHC (Lindane)	ND	J	ND	J	ND	J	ND		ND	J	NA
Heptachlor	ND		ND	J	0.017	J	0.014	J	ND	J	0.65
Aldrin	ND		ND	J	0.034	J	0.031	J	ND	J	0.17
Heptachlor epoxide	0.310	R	ND	J	0.160	J	0.150	J	0.019	JN	NA
Endosulfan I	ND	J	ND	J	ND		ND		ND		6200
Dieldrin	ND		0.830		ND		ND		0.078	R	0.18
4,4' - DDE	ND	J	ND	J	ND		ND		ND	J	9.0
Endrin	ND		0.007	J	ND		ND		0.083	J	310
Endosulfan II	0.180	R	ND	J	ND		ND		ND	J	NA
4,4' - DDD	ND		0.003	J	ND		ND		ND	J	12.0
Endosulfan sulfate	0.670	R	ND	J	ND		ND		ND	J	NA
4,4' - DDT	ND		0.013	J	0.840	J	0.760	JN	0.270	JN	9.0
Methoxychlor	0.710	J	ND	J	ND		ND		0.110	J	5200
Endrin ketone	ND		0.011	JN	ND		ND		ND	J	NA
Endrin aldehyde	0.530	R	ND	J	ND		ND		0.120	J	NA
alpha-Chlordane	0.046	J	ND	J	0.540	JN	0.460	JN	ND	J	NA
gamma-Chlordane	0.420	J	ND	J	0.400		0.320	JN	0.041	J	NA
Toxaphene	ND		ND	J	51.0		42.0		ND	J	0.20

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value
* - Denotes the duplicate sample of C7-01

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Table 3:
Turnpike Dump #5
Pesticide Results
(mg/kg)

Analyte/Sample	NJTP5-F9-01	Q	NJTP5-F12-01	Q	Clean-up Level
alpha-BHC	0.001	J	ND		NA
beta-BHC	0.008	R	0.008	JN	NA
delta-BHC	ND		ND		NA
gamma-BHC (Lindane)	ND		ND		NA
Heptachlor	ND		ND		0.65
Aldrin	0.003		ND		0.17
Heptachlor epoxide	0.008		0.007		NA
Endosulfan I	ND		ND		6200
Dieldrin	0.008	R	0.014	R	0.18
4,4' - DDE	0.032		0.034		9.0
Endrin	0.010	R	0.013	R	310
Endosulfan II	0.018		ND		NA
4,4' - DDD	0.014	J	0.012	JN	12.0
Endosulfan sulfate	0.027	J	0.008	R	NA
4,4' - DDT	0.130		0.160		9.0
Methoxychlor	0.051	J	0.020	J	5200
Endrin ketone	ND		ND		NA
Endrin aldehyde	0.066		ND		NA
alpha-Chlordane	0.004	J	0.009		NA
gamma-Chlordane	0.011		0.011	J	NA
Toxaphene	ND		ND		0.20

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
N - Presumptive evidence for the presence of the material at an estimated value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

APPENDIX B

Inorganic Laboratory Data

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-A1-01	Q	NJTP5-A1-02	Q	NJTP5-A2-01	Q	NJTP5-A2-02	Q	NJTP5-A3-01	Q	NJTP5-A3-02	Q	Clean-up Level#
Aluminum	9500	J	6950		8610		10100		7730		8930		NA
Antimony	ND	J	ND	J	1.3	J	0.65	J	0.73	J	0.70	J	340
Arsenic	6.4	J	6.5		6.8	J	9.1	J	4.6	J	6.4	J	20.0
Barium	407	J	316		169		238		67.7		90.5		47000
Beryllium	0.44	J	0.18	J	0.37	J	0.36	J	0.16		0.32	J	2.0
Cadmium	11.5	J	1.1		3.6		1.5		1.1		0.87		100
Calcium	21100	J	17000		5710	J	3540	J	3350	J	4710	J	NA
Chromium	64.3	J	27.7		62.8	R	97.8	R	28.9	R	28.1	R	6100
Cobalt	ND	J	7.3		9.3		6.8		6.5		8.0		NA
Copper	357	J	122		265		342		111		220		600
Iron	24600	J	18700		21600		36900		18900		20200		NA
Lead	2450	J	276	J	564	J	521	J	173	J	197	J	600
Magnesium	4650	J	3570		3880		3690		3780		4430		NA
Manganese	515	J	299		317	J	306	J	220	J	297	J	NA
Mercury	0.98	J	0.81		1.7		1.8		0.38		1.3		270
Nickel	54.0	J	19.4		33.1		22.1		22.0		20.6		2400
Potassium	1530	J	1930		1910		2100		1770		1970		NA
Selenium	ND	J	ND	J	1.2	J	0.93	J	0.84	J	0.88	J	3100
Silver	ND	J	ND		0.87	J	0.79	J	0.63		0.72	J	4100
Sodium	ND	J	ND		ND		ND		ND		ND		NA
Thallium	1.4	J	1.3	J	1.6	J	2.0	J	1.3	J	1.4	J	2.0
Vanadium	68.2	J	35.9		51.7		37.0		42.6		30.2		7100
Zinc	1400	J	315		598		459		298		264		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-A4-01	Q	NJTP5-A4-02	Q	NJTP5-A5-01	Q	NJTP5-A5-02	Q	NJTP5-A6-01	Q	NJTP5-A6-02	Q	Clean-up Level#
Aluminum	2010		1190		5340		5080		6360		4260		NA
Antimony	8.2	J	3.1	J	4.2	J	1.9	J	34.5	J	13.8	J	340
Arsenic	10.8	J	3.9	J	89.2	J	35.0	J	461	J	178.0	J	20.0
Barium	118		38.6		2470		139		659		1620		47000
Beryllium	0.16	J	0.065		0.12	J	0.18	J	0.11	J	0.43	J	2.0
Cadmium	2.0		0.6		3.7		0.70	J	21.4		18.7		100
Calcium	332000	J	213000	J	57700	J	70800	J	9080	J	6520	J	NA
Chromium	181	R	25.8	R	72.4	R	16.3	R	354	R	93.5	R	6100
Cobalt	4.1	J	2.0		4.2	J	4.6	J	14.6		26.5		NA
Copper	129		27.3		174		38.5		1420		2860		600
Iron	18400		4030		17300		7360		90900		195000		NA
Lead	218	J	54.9	J	2160	J	166	J	3440	J	10100	J	600
Magnesium	2410		1630		3310		9450		4490		6000		NA
Manganese	511	J	267	J	309	J	583	J	1270	J	1230	J	NA
Mercury	1.9		1.3		0.96		0.47		4.5		4.0		270
Nickel	42.5		7.1		37.6		16.7		180		277		2400
Potassium	347	J	227		510	J	708	J	1240		671		NA
Selenium	1.3	J	0.68	J	0.71	J	2.4	J	ND	J	ND	J	3100
Silver	1.7	J	0.28	J	0.49	J	ND		3.6		0.54		4100
Sodium	3300		2170		ND		ND		ND		ND		NA
Thallium	1.8	J	0.77	J	2.2	J	1.5	J	11.3		9.8		2.0
Vanadium	24.3		8.7		36.2		25.5		58.1		45.8		7100
Zinc	577		242		915		167		4350		7190		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

#Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-A6-03	Q	NJTP5-A7-01	Q	NJTP5-A7-02	Q	NJTP5-A7-03	Q	NJTP5-A8-01	Q	NJTP5-A8-02	Q	Clean-up Level#
Aluminum	3410		4760		8230		7600		7700	J	9210		NA
Antimony	72.6	J	51.2	J	77.6	J	40.3	J	113.0	J	13.2	J	340
Arsenic	25.6	R	1.6	J	19.0	J	10.1	J	37.2	J	9.4	J	20.0
Barium	3370		1900		3280		1410		3070	J	4050		47000
Beryllium	0.13	J	0.27	J	0.49	J	0.17		0.64	J	0.21		2.0
Cadmium	56.0		8.3		22.3	J	23.6		12.6	J	3.6		100
Calcium	22200	J	13200	J	41500	J	31700	J	3300	J	2310	J	NA
Chromium	169	R	58.5	R	128	R	65.0	R	331	R	107	R	6100
Cobalt	53.9		12.7		9.0		9.3		7.9	J	8.2		NA
Copper	1720	J	18400		12200		4260		3220	J	416		600
Iron	345000		112000		25300		76500		120000	J	44300		NA
Lead	7410	J	2070	J	3220	J	2420	J	3570	J	5270	J	600
Magnesium	8390		1950		2940		2960		1260	J	967		NA
Manganese	3620	R	472	J	441	J	450	J	463	J	144	J	NA
Mercury	17.0	J	4.4		6.8		6.2		18.6	J	1.4		270
Nickel	296	R	70.3		50.3		72.4		64.1	J	94.3		2400
Potassium	ND		851		791		551		375	J	280	J	NA
Selenium	9.0	J	ND	J	ND	J	ND	J	ND		ND	J	3100
Silver	15.0	J	2.7		0.63		0.69		1.4	J	0.63		4100
Sodium	1110		ND		ND		ND		ND		ND		NA
Thallium	12.2	J	4.3		2.1		3.6		5.4	J	2.4	J	2.0
Vanadium	24.6		28.7		41.1		26.8		227.0	J	40.0		7100
Zinc	12500		1760		3990		17000		3720	J	3390		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-A8-03	Q	NJTP5-A9-01	Q	NJTP5-A9-02	Q	NJTP5-A9-03	Q	NJTP5-B2-01	Q	NJTP5-B2-02	Q	Clean-up Level#
Aluminum	3020	J	6140		5100		2510		9630		10400		NA
Antimony	51.0	J	81.8	J	54.8	J	11.3	J	ND	J	ND	J	340
Arsenic	10.0	J	16.2	J	21.2	J	13.2	R	6.2		8.7		20.0
Barium	2370	J	2580		2010		3050		139		203		47000
Beryllium	0.25	J	0.31		0.29	J	0.23	J	0.40	J	0.51	J	2.0
Cadmium	9.8	J	11.2		26.7		2.9	J	2.1		1.1		100
Calcium	7160	J	4190	J	5010	J	2760		3720		3070		NA
Chromium	55.7	R	146	R	104	R	748	R	61.5		65.7		6100
Cobalt	10.1	J	17.6		17.6		ND		8.8		8.7		NA
Copper	1000	J	2490		1720		962	J	141		419		600
Iron	27400	J	43000		108000		12000		25000		25700		NA
Lead	3370	J	7760	J	8190	J	4360	J	379	J	472		600
Magnesium	4350	J	2020		2340		710	R	3600		3640		NA
Manganese	127	J	395	J	785	J	138		464		235		NA
Mercury	2.2	J	39.3		33.9		4.9		0.91		1.9		270
Nickel	187	J	79.3		66.0		45.4	R	31.2		31.6		2400
Potassium	197	J	461	J	331	J	ND		1850		1910		NA
Selenium	ND	J	2.9	J	ND	J	ND	J	ND	J	ND	J	3100
Silver	0.77	J	2.0		1.0		0.41	J	ND		ND		4100
Sodium	ND	J	ND		ND		ND		ND		ND		NA
Thallium	1.5	J	ND		5.0		ND	J	1.8	J	1.6	J	2.0
Vanadium	17.4	J	50.3		48.9		68.8		36.2		38.3		7100
Zinc	6930	J	8240		24600		2850		927		576		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-B3-01	Q	NJTP5-B3-02	Q	NJTP5-B4-01	Q	NJTP5-B4-03	Q	NJTP5-B5-01	Q	NJTP5-B5-03	Q	Clean-up Level#
Aluminum	3610		24600	J	12100		13600		21100		7240		NA
Antimony	ND	J	ND	J	ND	J	ND	J	0.95	J	ND		340
Arsenic	2.6		18.5	J	18.9		16.7		10.8	J	5.7	J	20.0
Barium	103		453	J	327		483		189		145		47000
Beryllium	0.13	J	1.1	J	0.57		1.0		0.87	J	ND		2.0
Cadmium	1.2		5.5	J	1.8		ND		1.6	J	ND	J	100
Calcium	5040	J	21000	J	8600		2690		12900		4540		NA
Chromium	45.6	R	297	J	32.9		27.3		62.7		5.7		6100
Cobalt	ND		ND	J	ND		ND		6.0	J	1.6	J	NA
Copper	929		747	J	194		55.1		116		10.4		600
Iron	10000		37600	J	30100		19500		24900		6010		NA
Lead	265		802	J	418	J	109		231		39.1		600
Magnesium	1250		6010	J	2330		437	J	14600		1570		NA
Manganese	71.7		282	J	276		78.4		250	J	46.6	J	NA
Mercury	0.57		4.7	J	0.94		0.67		0.40		0.29		270
Nickel	23.1		116	J	42.4		40.9		33.5	R	3.9	R	2400
Potassium	575	J	1540	J	540	J	279	J	1300		ND	J	NA
Selenium	ND		ND	J	ND	J	ND	J	2.80	J	ND	J	3100
Silver	ND		8.60	J	ND		ND		1.6	J	0.75	J	4100
Sodium	ND		1450	J	865		ND		545	J	2510		NA
Thallium	ND		2.2	J	1.9	J	1.0	J	0.99	J	ND		2.0
Vanadium	20.9		162	J	25.7		27.6		50.0		8.1	J	7100
Zinc	459		1790	J	405		130		218		29.9		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-B6-01	Q	NJTP5-B6-03	Q	NJTP5-B7-01	Q	NJTP5B7-02	Q	NJTP5-B7-22	Q	NJTP5-B7-03	Q	Clean-up Level#
Aluminum	9970	J	2920		6540		6080		8030		3250		NA
Antimony	4.3	J	50.5	J	600.0		74.9		73.3		12.1	J	340
Arsenic	12.0	J	16.5	R	13.2	J	27.6	J	32.7	J	21.5		20.0
Barium	379	J	1780		19300		5050		5350		1040	J	47000
Beryllium	ND	J	0.28	J	0.22	J	0.31	J	0.45	J	ND	J	2.0
Cadmium	5.2	J	16.3		29.3	J	54.1	J	61.8	J	6.7		100
Calcium	12700	J	9930	J	25600		3020		3420		9560		NA
Chromium	27.9	J	174	R	642.0		169	J	489	J	232		6100
Cobalt	4.6	J	12.5		14.2		12.2		16.2		ND		NA
Copper	336	J	3170	J	1600		1420		1570		350	J	600
Iron	18600	J	87200		49500		75800		89600		27900		NA
Lead	965	J	5830	J	3780		5100	J	8440	J	4710		600
Magnesium	3490	J	3610		27500		1890		2010		1580		NA
Manganese	221	J	6390		729	J	528	J	547	J	1170	R	NA
Mercury	3.1	J	55.4		16.90		13.6	J	21.6	J	171	J	270
Nickel	48.6	R	187	R	791	R	95	R	142	R	42.6		2400
Potassium	ND	J	ND		1300		ND	J	ND		ND		NA
Selenium	2.2	J	3.0	J	4.2	J	5.7	J	6.8	J	3.2	J	3100
Silver	2.0	J	7.4	J	3.8		5.5		6.3		2.5		4100
Sodium	688	J	ND	J	327	J	127	J	174	J	ND	J	NA
Thallium	6.4	J	11.4	J	2.4	J	3.1	J	3.7		2.6	J	2.0
Vanadium	22.2	J	28.1		49.0		30.1		30.7		20.7		7100
Zinc	882	J	3650		4950		29900	J	42900	J	4210		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-B8-01	Q	NJTP5-B8-02	Q	NJTP5-B8-03	Q	NJTP5-B8-04	Q	NJTP5-B9-01	Q	NJTP5-B9-02	Q	Clean-up Level#
Aluminum	12400		1590		2540	J	5260	J	2070	J	9310		NA
Antimony	465		203		289		384.0	J	38	J	52.5		340
Arsenic	36.9	J	15.2	J	14.1	J	29.8	J	2.2	J	56.7	J	20.0
Barium	13200		2310		5010	J	9500	J	484	J	4090		47000
Beryllium	0.39	J	0.16	J	0.21	J	0.30	J	0.12	J	0.14	J	2.0
Cadmium	25.0	J	1.5		5.9	J	16.6	J	6.2	J	73.1	J	100
Calcium	4880		948		11400	J	16300	J	36800	J	18000		NA
Chromium	1190		14.8		28.8	J	45.6	J	62.4	J	193		6100
Cobalt	8.9		2.1	J	5.3	J	9.7	J	8.4	J	9.1		NA
Copper	1890		3490		490	R	8380	R	2930	J	2050		600
Iron	34400		3060		20100	J	57700	J	58200	J	73600		NA
Lead	10800		547		1270	R	5520	R	1060	J	16000		600
Magnesium	2990		549	J	1830	J	3780	J	2300	J	4730		NA
Manganese	294	J	12.4	J	137	J	418	J	236	J	588	J	NA
Mercury	135		43.4		12.7	J	26.9	J	8.8	J	98.8		270
Nickel	421	R	11.1	R	96.0	R	142.0	R	584	R	105	R	2400
Potassium	ND		ND		ND		ND	J	ND	J	ND		NA
Selenium	7.5	J	4.6	J	3.3	J	5.0	J	3.3	J	6.4	J	3100
Silver	3.0		0.22	J	1.5		4.9	J	8.4	J	6.2		4100
Sodium	499	J	63.8	J	187	J	466	J	1260	J	207	J	NA
Thallium	1.4	J	ND		1.4	J	2.6	J	0.97	J	3.1	J	2.0
Vanadium	53.9		13.7		20.8	J	36.2	J	21.8	J	23.0		7100
Zinc	5110		376		7490	J	18600	J	96500	J	94900		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-B9-03	Q	NJTP5-B9-33	Q	NJTP5-B10-01	Q	NJTP5-B10-02	Q	NJTP5-B10-03	Q	NJTP5-B11-01	Q	Clean-up Level#
Aluminum	7690		7440		6360	J	5600		5300		1850		NA
Antimony	14.3	J	16.6	J	31.0	J	9.8	J	13.0	J	ND	J	340
Arsenic	66.8	R	109	R	17.3	J	12.9		26.4	R	11.2		20.0
Barium	5660		10400		1440	J	381		473		190		47000
Beryllium	0.51	J	0.34	J	0.47	J	0.43	J	0.53	J	0.81		2.0
Cadmium	3.2		4.6		11.1	J	2.7		3.4		6.9		100
Calcium	17000	J	11100	J	10500	J	8370		9220		5070		NA
Chromium	414	R	682	R	113	J	34.1		69.8	R	46.5		6100
Cobalt	ND		ND		15.0	J	8.9		7.7		8.3		NA
Copper	1650	J	2550	J	2760	J	539		351	J	424		600
Iron	18200		35300		54600	J	21200		24700		30600		NA
Lead	5820	J	10500	J	4600	J	1310	J	683	J	500	J	600
Magnesium	8100		2620	R	7790	J	3130		1780	R	1130		NA
Manganese	371		430		671	J	336		220		262.0		NA
Mercury	86.0		91.1		22.4	J	4.3		4.1		2.40		270
Nickel	33.5	R	67	R	127	J	48.3		27.7	R	39.5		2400
Potassium	1390		1220		1050	J	813		ND		379	J	NA
Selenium	3.9	J	3.9	J	ND	J	ND	J	5.4	J	ND	J	3100
Silver	1.7	J	3.30	J	ND	J	ND		1.6	J	ND		4100
Sodium	1270		1740		275	J	ND		ND		ND		NA
Thallium	ND	J	ND	J	3.0	J	1.6	J	ND	J	1.6	J	2.0
Vanadium	15.1		19.8		89.6	J	72.0		78.5		44.1		7100
Zinc	8290		18000		8410	J	2150		1860		2720		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
** - Field Duplicate Pair

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-B11-02	Q	NJTP5-B11-03	Q	NJTP5-B12-01	Q	NJTP5-B12-02	Q	NJTP5-B12-03	Q	NJTP5-B13-01	Q	Clean-up Level#
Aluminum	9090		4440		9560		7150		8420		4670		NA
Antimony	60.1	J	ND	J	63.7	J	45.9	J	32.2	J	37.2	J	340
Arsenic	76.8		7.6	R	82.0		39.4		34.0		45.6		20.0
Barium	1580		166		4440		3470		7240		2640		47000
Beryllium	0.18	J	0.43	J	0.24	J	0.30	J	0.20	J	0.43	J	2.0
Cadmium	84.6		4.0		102.0		64.8		33.3		10.2		100
Calcium	30800		5610	J	3100		10700		16400		3190		NA
Chromium	39.6		25.0	R	124		264		38.7		366		6100
Cobalt	6.1	J	8.4		18.7		17.1		6.5	J	6.4	J	NA
Copper	229		169	J	1110		799		690		2240		600
Iron	43100		40200		109000		125000		45000		58500		NA
Lead	11900		635	J	24500		11300		8390		4660		600
Magnesium	11100		1170	R	6170		3820		3370		1170		NA
Manganese	346		380		2190		1100		419		254		NA
Mercury	0.61		1.4		1.90		9.6		9.0		222		270
Nickel	112		35.2	R	205		143		33.8		70.9		2400
Potassium	145	J	ND		186	J	193	J	378	J	384	J	NA
Selenium	19.8	J	1.8	J	5.5		ND	J	ND	J	ND	J	3100
Silver	1.2	J	2.9	J	1.1	J	ND		0.68	J	ND		4100
Sodium	ND		ND		ND		ND		ND		ND		NA
Thallium	2.5	J	ND	J	7.9		6.7		2.6	J	2.5	J	2.0
Vanadium	16.2		15.4		69.1		42.0		23.8		104		7100
Zinc	217000		2180		200000		98700		84200		3590		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value
** - Field Duplicate Pair

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-B13-02	Q	NJTP5-B13-03	Q	NJTP5-C2-01	Q	NJTP5-C2-02	Q	NJTP5-C3-01	Q	NJTP5-C3-03	Q	Clean-up Level#
Aluminum	1300		3600		6190		16400		7690		13200		NA
Antimony	5.1		ND		ND	J	ND	J	ND	J	ND	J	340
Arsenic	5.2		21.0		4.4		6.4		12.8		11.7		20.0
Barium	140		99.0		702		112	J	269		281		47000
Beryllium	ND		ND		0.21	J	ND	J	0.87		0.71	J	2.0
Cadmium	4.4		ND		4.0		1.9		2.9		1.7		100
Calcium	860		4300		21300		10700		5980		4890		NA
Chromium	7.3		5.4		80.9		96.9		35.4		29.2		6100
Cobalt	5.1		7.5		8.2	J	8.9		7.2	J	4.4		NA
Copper	330		42		382		330	J	6440		2220		600
Iron	13000		20000		18200		21300		35100		23300		NA
Lead	350		62.0		899		817		2010		441		600
Magnesium	300		360		5990		3330		2310		2460		NA
Manganese	96		120		427		240	R	304		123		NA
Mercury	1.2		ND		2.2		0.55	J	0.36		0.70		270
Nickel	15.0		18.0		39.1		31.4		57.5		53.2		2400
Potassium	180		450		673	J	1310		501	J	857	J	NA
Selenium	ND		ND		ND	J	1.7	J	ND	J	ND	J	3100
Silver	ND		ND		13.0		2.2		0.39	J	0.17	J	4100
Sodium	ND		160.0		ND		ND	J	ND		ND		NA
Thallium	ND		ND		1.1	J	1.3	J	1.7	J	0.66	J	2.0
Vanadium	6.9		11.0		35.0		36.5		39.8		31.37		7100
Zinc	1200		190		1270		428		2060		1200		1500

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Q - Data Qualifier
J - Estimated Value
L - Acceptable; Biased Low

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP-C4-01	Q	NJTP-C4-03	Q	NJTP5-C5-01	Q	NJTP5-C5-03	Q	NJTP5-C5-33	Q	NJTP5-C6-01	Q	Clean-up Level#
Aluminum	12000.0		18000		4740		17200		11100		6220		NA
Antimony	ND		22.0		3.3	J	11.5		ND		26.9	J	340
Arsenic	48		31		8.3	J	5.8	J	4.9	J	ND		20.0
Barium	170		460		397		85.6		82		825		47000
Beryllium	0.94		0.83		0.73		ND		ND		0.36	J	2.0
Cadmium	3.9	L	5.7		3.2		0.057	J	0.029	J	18.9		100
Calcium	12000.0		30000		5590		1470	J	1380	J	5230		NA
Chromium	30		170		26.5		28.6	R	19.1	R	167		6100
Cobalt	4		17		ND		ND		ND		53.6		NA
Copper	550		1200		415	J	28.1	J	15.4	J	1240	J	600
Iron	19000		200000		24800		3920		2420		149000		NA
Lead	390		4700		638		32.2		19.5		1230		600
Magnesium	38000		4600		1180		414	J	368	J	1650		NA
Manganese	100		1000		181.0		14.2		9		796		NA
Mercury	1.9		2.7		0.9		0.19	J	0.10	J	5.3		270
Nickel	130		240		34.9		37.1		17.5	J	166.0		2400
Potassium	1300		1500		541	J	216	J	203	J	541	J	NA
Selenium	ND		ND		1.40	J	0.95	J	0.83	J	3.8	J	3100
Silver	ND		ND		1.8		0.43	J	0.44	J	6.3		4100
Sodium	2000		4100		ND		1890		2010.0		ND		NA
Thallium	ND		ND		1.3	J	ND		ND		5.8	J	2.0
Vanadium	22		59		22.7		10.3		6.5	J	31.3		7100
Zinc	410		1800		662		49.8		24.5		8930		1500

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- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-C6-03	Q	NJTP5-C7-01	Q	NJTP5-C7-03	Q	NJTP5-C8-01	Q	NJTP5-C8-02	Q	NJTP5-C8-03	Q	Clean-up Level#
Aluminum	8300		5050		5180		10700		3220		12700		NA
Antimony	23.9	J	22.2		9.7		51.1		176	J	51.5	J	340
Arsenic	77.4		4.6	J	7.8	J	17.4	J	7.4		70.9		20.0
Barium	257	J	1270		737		2990		1670	J	5150	J	47000
Beryllium	0.62	J	0.42	J	ND		0.41	J	0.55	J	0.30	J	2.0
Cadmium	13.7		8.8	J	5.3		34.5	J	44.4		132		100
Calcium	12400		11200		5180		8310		2020		28100		NA
Chromium	37.3		103		43.8	J	372.0		25.7		86.2		6100
Cobalt	8.3		17.5		7.4		146		6.7		8.9		NA
Copper	345	J	1340		672		24200		1730	J	1570	J	600
Iron	22700		49400		33700		109000		9120		53400		NA
Lead	8020		1890		2780		6760		474		19600		600
Magnesium	1290		2230		3410	J	4150		ND		6420		NA
Manganese	386	R	398	J	2110		5000	J	120	R	765	R	NA
Mercury	0.39	J	3.8		2.5	J	11.2		3.4	J	3.2	J	270
Nickel	47.0		106	R	62.8		4580	R	28.6		71.9		2400
Potassium	2380		ND		1190		ND		ND		ND		NA
Selenium	6.5	J	2.6	J	3.5	J	7.8	J	4.6		5.6	J	3100
Silver	2.1		4.7		5.7		11.0		ND		5.6		4100
Sodium	1380	J	341	J	ND	J	289.0	J	ND	J	ND	J	NA
Thallium	3.1	J	2.0	J	4.1		10.8		0.68	J	3.3	J	2.0
Vanadium	23.8		29.6		15.3		94.3		20.3		39.0		7100
Zinc	4390		4340		1510		12300		1350		157000		1500

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- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-C9-01	Q	NJTP5-C9-02	Q	NJTP5-C9-03	Q	NJTP5-C10-01	Q	NJTP5-C10-02	Q	NJTP5-C10-03	Q	Clean-up Level#
Aluminum	3280	J	8970		2490		7760		5900		7400		NA
Antimony	ND	J	32.5	J	11.9	J	35.0	J	4.6		5.1		340
Arsenic	3.8	R	17.2	R	8.0		ND		3.4		3.3		20.0
Barium	379	J	2790		397	J	1980		52.0		71.0		47000
Beryllium	0.25	J	0.11	J	0.51	J	0.096		ND		ND		2.0
Cadmium	6.0	J	30.4		2.8		77.9		1.0		0.68		100
Calcium	5860	J	12500	J	2900		9730		770		1400		NA
Chromium	67.9	R	197	R	28.9		288		20.0		76.0		6100
Cobalt	ND	J	18.4		ND		36.9		3.3		5.0		NA
Copper	7360	J	5750	J	2040	J	4170	J	44.0		64.0		600
Iron	29200	J	70700		8560		161000		15000		17000		NA
Lead	723	J	6020	J	569		4100		180		210		600
Magnesium	1340	R	3280	R	ND		3380		330		420		NA
Manganese	333	J	1710		106	R	1100		140		490		NA
Mercury	1.7	J	12.8		3.8	J	1.9		0.27		0.19		270
Nickel	43.4	R	155	R	38.2		912		260		960		2400
Potassium	ND	J	812		ND		463	J	310		360		NA
Selenium	1.1	J	5.2	J	2.4	J	5.3		ND		ND		3100
Silver	4.0	J	11.6	J	ND		11.6		ND		ND		4100
Sodium	ND	J	ND		ND	J	ND		ND		ND		NA
Thallium	ND	J	4.9	J	0.76	J	6.5		ND		ND		2.0
Vanadium	28.3	J	56.5		21.0		53.5		16.0		20.0		7100
Zinc	1780	J	12200		1100		11500		450		200		1500

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- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-C11-01	Q	NJTP5-C11-02	Q	NJTP5-C11-03	Q	NJTP5-C12-01	Q	NJTP5-C12-02	Q	NJTP5-C13-01	Q	Clean-up Level#
Aluminum	4700	J	7270		2990		12200		7020		9260		NA
Antimony	82.5	J	26.7	J	9.8	J	15.4	J	4.6	J	164	J	340
Arsenic	ND	J	3.1		19.3	R	2.3		9.7		21.8	R	20.0
Barium	466	J	1100		476		359		325		1860		47000
Beryllium	ND	J	0.20	J	0.51	J	0.23		0.18	J	0.33	J	2.0
Cadmium	20.1	J	28.2		5.4		18.1		2.4		44.1		100
Calcium	36200	J	8100		5370	J	10300		13400		5480	J	NA
Chromium	243	J	129		34.1	R	101		38.3		127	R	6100
Cobalt	28.3	J	15.0		6.7		39.5		7.9		17.5		NA
Copper	39600	J	8950	J	491	J	2250	J	203	J	54900	J	600
Iron	250000	J	76500		51600		103000		25100		127000		NA
Lead	1260	J	1540		1460	J	1560		1450		16200	J	600
Magnesium	2950	J	2730		1090	R	2210		3550		2760	R	NA
Manganese	1400	J	644		296		567		349		873		NA
Mercury	0.46	J	1.7		10.3		1.1		1.7		1.5		270
Nickel	610	J	221		38.9	R	915		33.9		175	R	2400
Potassium	414	J	495	J	ND		268		1390		ND		NA
Selenium	5.5	J	3.7	J	4.0	J	2.8	J	1.5	J	4.4	J	3100
Silver	17.0	J	5.8		4.8	J	5.1	J	1.4	J	18.5	J	4100
Sodium	ND	J	ND		ND		ND		ND		ND		NA
Thallium	9.4	J	3.2		ND	J	4.1	J	1.5	J	5.3	J	2.0
Vanadium	82.6	J	37.3		28.4		59.8		31.5		55.7		7100
Zinc	108000	J	6600		2620		3830		1800		9860		1500

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Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-C13-02A	Q	NJTP5-C13-02B	Q	NJTP5-C13-03	Q	NJTP5-C13-33	Q	NJTP5-D2-01	Q	NJTP5-D2-02	Q	Clean-up Level#
Aluminum	3600		1600		5300		4000		8940		10000		NA
Antimony	ND	J	22.0		13.0	J	11.0		47.5	J	10.8	J	340
Arsenic	31.0	R	4.5		37.0		43.0		16.9		3.8		20.0
Barium	199		190		310		260		227		1030	J	47000
Beryllium	0.66		ND		ND		ND		0.16	J	0.53	J	2.0
Cadmium	3.2		2.6		4.1		3.4		2.0		4.7		100
Calcium	937	J	630		2700		1900		21400		19400		NA
Chromium	17.5	R	6.2		22.0		19.0		54.8		75.8		6100
Cobalt	ND		ND		3.4		4.1		10.8		9.6		NA
Copper	496	J	850		630		580		279	J	259	J	600
Iron	14600		8000		44000		39000		30600		38900		NA
Lead	567	J	790		880		1400		749		2900		600
Magnesium	215	R	490		490		340		4470		3960		NA
Manganese	37.2		62		160		110		397		394	R	NA
Mercury	0.31		0.49		0.73		0.96		1.5		0.80	J	270
Nickel	17.3	R	18.0		30.0		30.0		33.2		41.9		2400
Potassium	ND		300		410		300		1290		730		NA
Selenium	2.8	J	ND		ND		ND		1.5	J	1.8	J	3100
Silver	1.3	J	ND		ND		ND		1.6		3.3		4100
Sodium	ND		170.0		150		140.0		ND		ND	J	NA
Thallium	ND	J	ND		ND		ND		1.8	J	1.9	J	2.0
Vanadium	13.4		11.0		14.0		13.0		48.7		52.2		7100
Zinc	442		820		970		960		540		1310		1500

NA – Not Applicable
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Q - Data Qualifier
J - Estimated Value
A&B - Sample taken during 2 separate events; A is from CLP, sampled 2/22/07; B is from EPA DESA Laboratory, Sampled 4/23/07

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-D3-01	Q	NJTP5-D3-03	Q	NJTP5-D4-01	Q	NJTP5-D4-03	Q	NJTP5-D5-01	Q	NJTP5-D5-03	Q	Clean-up Level#
Aluminum	27100	J	31200	J	12100		10900		13700		11500		NA
Antimony	0.63	J	1.2	J	1.0		1.4	J	1.5	J	5.5	J	340
Arsenic	5.4	J	4.6	J	12.6	J	11.0	J	9.9	J	5.6	J	20.0
Barium	138	J	66.4	J	218		290		327		493		47000
Beryllium	1.7	J	0.76	J	0.74		0.73		0.58	J	0.54	J	2.0
Cadmium	1.4	J	ND	J	1.8		1.5		2.2		5.1		100
Calcium	14500	J	12100	J	4960	J	8510	J	12700	J	9590	J	NA
Chromium	44.7	J	43.2	J	44.9	R	27.2	R	40.3	R	83.7	R	6100
Cobalt	ND	J	ND	J	ND		ND		ND		12.6		NA
Copper	446		320	J	196	J	118	J	497	J	1550	J	600
Iron	21300	J	11800	J	29700		35500		30800		63400		NA
Lead	208	J	80.7	J	226		140		329		1310		600
Magnesium	6310	J	4660	J	1190		1590		2840		4470		NA
Manganese	148	J	89.9	J	134		142		197		450		NA
Mercury	3.6	J	2.5	J	3.2	J	0.73	J	1.8	J	1.3	J	270
Nickel	271	J	184	J	90.6	J	32.7	J	109	J	255	J	2400
Potassium	894	J	30300	J	352	J	609	J	764	J	784	J	NA
Selenium	2.9	J	2.2	J	1.1	J	0.84	J	1.6	J	1.4	J	3100
Silver	1.0	J	0.56	J	1.2	J	3.1		1.4	J	3.1		4100
Sodium	ND	J	8080	J	ND		2130		2960		ND		NA
Thallium	1.0	J	ND	J	1.5	J	1.7	J	1.5	J	3.0	J	2.0
Vanadium	39.9	J	21.3	J	28.7		24.7		30.9		31.6		7100
Zinc	155	J	123	J	255		1130		595		884		1500

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- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-D6-01	Q	NJTP5-D6-03	Q	NJTP5-D7-01	Q	NJTP5-D7-03	Q	NJTP5-D8-01	Q	NJTP5-D8-03	Q	Clean-up Level#
Aluminum	10600		5570		6090		7740		13000		7340		NA
Antimony	7.8	J	0.92	J	3.2	J	6.0	J	27.1	J	ND	J	340
Arsenic	14.5	J	12.8	J	12.4		13.7	J	23.7		9.8		20.0
Barium	310		242.0		296		400		794	J	1040	J	47000
Beryllium	0.74	J	0.82		0.94		0.75		1.8	J	1.4	J	2.0
Cadmium	1.7		1.2		1.8		4.2		104		5.5		100
Calcium	9130		4780	J	7270	J	5970	J	130000		61300		NA
Chromium	29.8	R	14.4	R	20.4	R	35.9	R	170	J	60.3		6100
Cobalt	ND		ND		ND		7.1		ND		6.4		NA
Copper	2650	J	789	J	196	J	487	J	4210	J	1340	J	600
Iron	12500		19400		21600		30100		18500		12000		NA
Lead	226		222		352		422		1490		2830		600
Magnesium	2360		1260		509		994		3320	J	3050		NA
Manganese	119		102		144		213		737	R	1130	R	NA
Mercury	1.7	J	0.61	J	0.6	J	0.55	J	1.5	J	1.7	J	270
Nickel	35.4	J	18.6	J	33.1	J	36.4	J	65.5		39.1		2400
Potassium	435	J	401	J	343	J	455	J	ND		745		NA
Selenium	2.8	J	1.2	J	0.76	J	1.4	J	2.5	J	1.2	J	3100
Silver	0.82	J	1.0	J	1.0	J	1.6		5.2		1.6		4100
Sodium	ND		ND		ND		ND		2110	J	950	J	NA
Thallium	1.0	J	1.1	J	1.1	J	1.7	J	1.7		2.1	J	2.0
Vanadium	43.1		24.2		31.0		33.0		75.8		34.2		7100
Zinc	672		475		851		1740		2760		1210		1500

NA – Not Applicable
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J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-D9-01	Q	NJTP5-D9-02	Q	NJTP5-D9-03	Q	NJTP5-D10-01	Q	NJTP5-D10-02	Q	NJTP5-D10-03	Q	Clean-up Level#
Aluminum	11500		8010		6670		4040	J	5950		721		NA
Antimony	9.1	J	7.8	J	17.8	J	14.8	J	8.2	J	7.8	J	340
Arsenic	6.1	J	7.1		15.7		18.7	R	8.2	R	13.2	J	20.0
Barium	577		525	J	507	J	6450	J	878		97.1		47000
Beryllium	0.56	J	0.79	J	0.55	J	0.15	J	0.22		ND		2.0
Cadmium	9.1		5.6		8.1		13.0	J	9.8		0.58	J	100
Calcium	9780		18100		6970		13300	J	17200	J	894		NA
Chromium	52.5	J	78.8		84.9		76.0	R	47.6	R	9.9	J	6100
Cobalt	9.4		9.0		13.1		ND	J	7.0		0.95	J	NA
Copper	390	J	375	J	1210	J	786	J	1450	J	244	J	600
Iron	29300		38100		60200		69200	J	35000		8990		NA
Lead	777		822		1740		8300	J	2290	J	298		600
Magnesium	3440		4240		3010		2370	R	4090		115	J	NA
Manganese	925	J	829	R	486	R	420	J	291		26.9	J	NA
Mercury	3.3	R	3.0	J	1.9	J	2.8	J	1.5		1.8	R	270
Nickel	63.9		42.5		62.8		91.0	R	90.0	R	8.7		2400
Potassium	1240		1120		747		ND	J	ND	ND	103	J	NA
Selenium	1.4	J	2.0	J	2.7	J	ND	J	ND	J	1.4	J	3100
Silver	1.8		3.1		4.4		7.0	J	2.2		0.96	J	4100
Sodium	ND		ND	J	ND	J	ND	J	ND		ND		NA
Thallium	2.4	J	2.3	J	2.8	J	2.5	J	1.6	J	0.47	J	2.0
Vanadium	27.7		32.1		32.7		53.2	J	38.0		8.4		7100
Zinc	1960		1900		3720		7900	J	8200		370		1500

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- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-D11-01	Q	NJTP5-D11-02	Q	NJTP5-D11-03	Q	NJTP5-D12-01	Q	NJTP5-D12-02	Q	NJTP5-D12-03	Q	Clean-up Level#
Aluminum	5360		3010		2500		5650		5900		5700		NA
Antimony	24.8	J	3660	J	1.8	J	83.3	J	110		ND		340
Arsenic	5.8		26.9	R	6.6	R	13.9	R	41.0		33.0		20.0
Barium	825		825		33		1500		1200		650		47000
Beryllium	0.32	J	0.25	J	0.28	R	0.26	J	ND		0.62		2.0
Cadmium	14.7		14.5		0.7	R	19.0		16.0		3.5		100
Calcium	7010		4190	J	4300	J	12500	J	10000		20000		NA
Chromium	83.3		77.5	R	3.7	R	154	R	140		54.0		6100
Cobalt	18.0		20.5		ND	ND	19.6		18.0		16.0		NA
Copper	4610	J	5210	J	1170	J	10500	J	3900		630		600
Iron	38800		185000		14700		90800		180000		180000		NA
Lead	4830		2620	J	269	J	8540	J	7000		1500		600
Magnesium	3960		2100	R	1260	R	2630	R	3200		3700		NA
Manganese	351		738		1060		538		1800		1100		NA
Mercury	2.2		2.4		0.87		3.2		5.0		2.50		270
Nickel	105		153	R	7.2	R	544	R	180		83.0		2400
Potassium	320	J	ND		ND		ND		450		1100		NA
Selenium	2.2	J	4.5	J	ND	J	ND	J	ND		ND		3100
Silver	4.4		4.4	J	1.3	J	5.6	J	ND		ND		4100
Sodium	ND		ND		ND		ND		580		430		NA
Thallium	2.0	J	6.7	J	2.1	J	3.9	J	ND		ND		2.0
Vanadium	86.7		49.6		8.1		52.6		34.0		21.0		7100
Zinc	5800		2690		723		6030		5800		2300		1500

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Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-D13-01	Q	NJTP5-D13-02	Q	NJTP5-D13-03	Q	NJTP5-E3-01	Q	NJTP5-E3-02	Q	NJTP5-E3-22	Q	Clean-up Level#
Aluminum	6040		2320		6140		7490		6740		6820		NA
Antimony	2.8	J	4.3	J	1.4	J	3.6	J	0.46	J	0.6	J	340
Arsenic	12.1	R	9.0	R	10.6	J	2.8		14.5		10.8		20.0
Barium	186		468		149		256		128		114		47000
Beryllium	0.20	J	0.41	J	0.37		0.97		1.30		1.4		2.0
Cadmium	12.9		3.4		1.2		5.9	J	1.1	J	0.90	J	100
Calcium	8380	J	2170	J	11600		11800		19500		21500		NA
Chromium	22.5	R	10.4	R	11.5	J	41.1		26.7		20.4		6100
Cobalt	ND		ND		6.9		ND		ND		ND		NA
Copper	503	J	540	J	148	J	8020	J	853	J	680	J	600
Iron	17800		35600		19000		31900		17200		14400		NA
Lead	1150	J	1710	J	740		645		142		122		600
Magnesium	5820		777	R	2430		3460		6580		6700		NA
Manganese	421		303		180	J	241		102		95.0		NA
Mercury	0.52		1.0		ND	R	4.5	J	1.6		2.2	J	270
Nickel	30.9	R	23.6	R	15.8		50.0		18.1		15.5		2400
Potassium	ND		ND		815		914		942		964		NA
Selenium	ND	J	ND	J	1.8	J	ND	J	ND	J	ND	J	3100
Silver	1.3	J	1.7	J	1.0	J	2.6		1.1		0.83		4100
Sodium	ND		ND		ND		ND		ND		ND		NA
Thallium	1.5	J	1.9	J	1.2	J	1.2		1.0		0.8	J	2.0
Vanadium	32.5		11.2		16.3		27.4		24.3		22.7		7100
Zinc	4810		1640		410		2070		144		119		1500

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Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-E4-01	Q	NJTP5-E4-02	Q	NJTP5-E5-01	Q	NJTP5-E5-02	Q	NJTP5-E5-22	Q	NJTP5-E6-01	Q	Clean-up Level#
Aluminum	5470	J	4780		4400		4710		1580		4290		NA
Antimony	6.2	J	9.5	J	3.9	J	3.3	J	1.7	J	6.6	J	340
Arsenic	9.7	J	16.1		4.6	J	16.2	J	3.1	J	8.2	J	20.0
Barium	184	J	139		192		99.9		ND		314		47000
Beryllium	ND	J	ND		0.55	J	0.49	J	0.14	J	0.80	J	2.0
Cadmium	6.3	J	1.6	J	5.2		1.6		0.40	J	4.7		100
Calcium	8520	J	2420		10700		15900		3750		5470		NA
Chromium	61.9	J	21.3		66.2	J	23.8	J	6.2	J	73.2	J	6100
Cobalt	ND	J	ND		6.0	J	8.5		2.4	J	7.3	J	NA
Copper	324	J	286	J	399	J	205	J	66.0	J	6720	J	600
Iron	73600	J	18400		38000		26400		8190		35800		NA
Lead	679	J	530		525		348		85.2		667		600
Magnesium	2060	J	1360		1780		2710		641.0	J	1360		NA
Manganese	915	J	118		296	J	440	J	136.0		283	J	NA
Mercury	1.0	J	0.18	J	2.2	R	2.3	R	2.0		1.5	R	270
Nickel	60.2	J	22.1		29.6		25.7		6.8	J	116.0		2400
Potassium	ND	J	ND		502	J	651		206.0	J	497	J	NA
Selenium	ND	J	ND	J	2.1	J	1.8	J	0.70	J	2.1	J	3100
Silver	5.9	J	1.5		3.0		1.6		0.49	J	2.6		4100
Sodium	ND	J	ND		ND		ND		ND		ND		NA
Thallium	3.7	J	1.1		2.0	J	1.8	J	0.46	J	1.9	J	2.0
Vanadium	49.2	J	37.9		40.8		30.6		8.5	J	40.4		7100
Zinc	1270	J	374		1270		660		280		3460		1500

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Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-E6-02	Q	NJTP5-E7-01	Q	NJTP5-E7-11	Q	NJTP5-E7-03	Q	NJTP5-E8-01	Q	NJTP5-E8-03	Q	Clean-up Level#
Aluminum	465		5450		5070		4090		5450		4780		NA
Antimony	7.7	J	2.0	J	6.6	J	1.6	J	18.3	J	153	J	340
Arsenic	ND	J	6.5	J	7.0	J	6.8	J	10.9		36.5		20.0
Barium	ND		291		356		256		420		1540		47000
Beryllium	0.039	J	0.73		1.6		ND		1.1		1.7		2.0
Cadmium	0.26	J	0.76	R	4.5	R	0.63		12.4	J	55.2	J	100
Calcium	1350		6630	J	10600		5240		9190		14900		NA
Chromium	6.7	J	9.8	R	45.2	R	8.8	J	316.0		1050		6100
Cobalt	0.44	J	3.40	J	7.6		3.0	J	40.3		29.2		NA
Copper	163	J	40.4	R	292.0	R	31.9	J	9430	J	8280	J	600
Iron	1150		13700	J	30300		13000		63800		201000		NA
Lead	29.6		517		505		82.2		1190		6070		600
Magnesium	321	J	531	J	1020		496	J	1430		3770		NA
Manganese	26.5	J	91.4	J	254	J	87.1	J	812		3690		NA
Mercury	0.47	R	0.77	R	0.7	R	0.04	R	0.69	J	6.9	J	270
Nickel	8.5		9.1	R	52.3	R	8.4		4330		664		2400
Potassium	87.3	J	370	J	397		307	J	ND		ND	J	NA
Selenium	0.28	J	0.54	J	2.8	J	0.71	J	ND	J	ND	J	3100
Silver	0.17	J	0.61	J	2.1		0.62	J	6.1		58.4		4100
Sodium	ND		2340	J	ND		1820		981		ND		NA
Thallium	ND		0.94	J	1.8	J	0.91	J	3.6		11.6		2.0
Vanadium	3.4	J	14.6	J	32.1		13.3		25.7		28.3		7100
Zinc	165		229	R	3910	R	149		2200		11400		1500

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Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-E8-33	Q	NJTP5-E9-01	Q	NJTP5-E9-02	Q	NJTP5-E9-03	Q	NJTP5-E10-01	Q	NJTP5-E10-02	Q	Clean-up Level#
Aluminum	4380		5550		9070		2600		4480	J	9440	J	NA
Antimony	90.8	J	22.1		82.3		7.6	J	25.1	J	17.8	J	340
Arsenic	33.6		7.1	J	8.6	J	ND		27.3	J	13.6	J	20.0
Barium	1430.0		966		1140		979	J	1000	J	270		47000
Beryllium	1.0		0.39	J	ND		ND	J	0.56	J	1.20		2.0
Cadmium	43.7	J	14.4	J	30.0	J	6.8		18.3	J	4.1		100
Calcium	12600.0		10200		27600		13800	J	15600	J	34300		NA
Chromium	1500.0		76.3		602		93.6		73.3	J	17.9	J	6100
Cobalt	30.0		10.0		25.3		20.9		22.1	J	2.4	J	NA
Copper	4700.0	J	1040		5550		2040	J	1500	J	958	J	600
Iron	175000.0		46600		125000		105000		81700	J	7970		NA
Lead	5930.0		1490		5080		831		2540	J	898		600
Magnesium	4740.0		2370		5620		3240		1820	J	13000		NA
Manganese	3120.0		1120	J	2010	J	12900	R	504	J	767	J	NA
Mercury	4.6	J	23.4		4.1		0.85	J	1.4	R		R	270
Nickel	824.0		98.1		809	R	495		93	J	27.8		2400
Potassium	ND		641		ND		ND		946	J	918		NA
Selenium	ND	J	2.3	J	9.9	J	1.1	J	5.9	J	2.0	J	3100
Silver	17.6	J	4.3		12.3		7.5		9.7	J	0.69	J	4100
Sodium	ND		616	J	407	J	ND	J	1670	J	1500		NA
Thallium	9.9		2.9	J	6.0		20.5		3.3	J	1.7	J	2.0
Vanadium	22.2		27.6		27.0		17.5		47.4	J	15.5		7100
Zinc	9340.0		2500		7270		1400		8260	J	22710		1500

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Q - Data Qualifier
J - Estimated Value
A - E11-03; shipped 2/23/07

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-E10-03	Q	NJTP5-E11-01	Q	NJTP5-E11-03A	Q	NJTP5-E11-02	Q	NJTP5-E11-03B	Q	NJTP5-E12-01	Q	Clean-up Level#
Aluminum	1110		7850		3920		5970		6450		23200		NA
Antimony	21.2	J	31.1		7.5	J	3.2	J	1.5		21.3	J	340
Arsenic	4.4	J	11.3	J	18.0		8.8	J	13.3	J	9.0	J	20.0
Barium	1640		1310		333		316		83		1010		47000
Beryllium	0.13	J	0.77	J	ND		0.33	J	0.24		0.74	J	2.0
Cadmium	3.2		21.8		3.70	J	2.2		0.67		11.50		100
Calcium	853		7030	J	6110		6580	J	8380	J	9300		NA
Chromium	238	J	265	R	262		37.2	R	20.6	R	104	J	6100
Cobalt	2.5	J	20.3		9.7		7.1		6.9		17.2		NA
Copper	396	J	7300	J	845	J	732	J	93.1	J	4560	J	600
Iron	11000		76200		31200		21400		12900		58300		NA
Lead	4290		7050		1130		1040		304		3490		600
Magnesium	ND		2860		1100		3230		3490		3310		NA
Manganese	101	J	616		328		246		236		654	J	NA
Mercury	24.1	R	3.7	J	0.59	J	0.92	J	1.2	J	2.3	R	270
Nickel	24.1		140.0	J	38.8		22.0	J	14.9	J	92.0		2400
Potassium	146	J	521	J	ND		1070		1340		781	J	NA
Selenium	0.6	J	3.2	J	ND		1.30	J	2.5		2.9	J	3100
Silver	0.75	J	10.0		2.20		0.98	J	0.65		6.5		4100
Sodium	ND		ND		ND		ND		ND		ND	J	NA
Thallium	0.7	J	4.0		1.90		1.7	J	1.3		3.2	J	2.0
Vanadium	3.2	J	54.3		18.7		22.2		22.4		53.3		7100
Zinc	4690		9010		1290		1080		209		4650		1500

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J - Estimated Value
B - E11-03; shipped 2/21/07

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Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-E12-02	Q	NJTP5-E12-03	Q	NJTP5-F9-01	Q	NJTP5-F9-02	Q	NJTP5-F9-03	Q	NJTP5-F9-33	Q	Clean-up Level#
Aluminum	6960		12500	J	4800		9980		17500		15700		NA
Antimony	8.8	J	2.5	J	4.7	J	14.2		83.8		70.0	J	340
Arsenic	3.1	J	31.3	J	5.9	J	7.4	J	42.6	J	38.7		20.0
Barium	300		197	J	255		1360		5620		6140	J	47000
Beryllium	0.77		1.60	J	0.12	J	0.23	J	ND		ND	J	2.0
Cadmium	8.9		2.10	J	5.5	J	19.6	J	66.3		70.6		100
Calcium	27100		10500	J	10100		23000		31700	J	36100		NA
Chromium	75.6	J	20.4	J	36.3		83.8		70.6	R	58.2		6100
Cobalt	20.1		ND	J	9.2		11.7		ND		8.6		NA
Copper	1050	J	140	J	360		593		3710	J	4110	J	600
Iron	46100		55600	J	29700		57000		40300		46200		NA
Lead	1560		482	J	832		2450		6480		5360		600
Magnesium	3870		3500	J	3130		5320		8510		9120		NA
Manganese	392	J	246	J	439	J	516	J	335		394	R	NA
Mercury	1.1	R	2.9	J	1.6		1.2		13.1	J	17.0	J	270
Nickel	113.0		25.9	J	47.6	R	78	R	64.0	J	65		2400
Potassium	501	J	2370	J	832		801		222	J	ND		NA
Selenium	1.8	J	ND	J	1.7	J	3.0	J	11.2		13.0	J	3100
Silver	2.8		3.60	J	3.1		4.9		2.9		4.70		4100
Sodium	ND		ND	J	186	J	314	J	ND		ND	J	NA
Thallium	2.2	J	3.0	J	1.4	J	2.5	J	2.1	J	2.1	J	2.0
Vanadium	27.5		28.7	J	24.0		43.8		43.7		34.8		7100
Zinc	3780		261	J	1490		11900		138000		117000		1500

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Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-F10-01	Q	NJTP5-F10-02	Q	NJTP5-F10-03	Q	NJTP5-F11-01	Q	NJTP5-F11-02	Q	NJTP5-F11-03	Q	Clean-up Level#
Aluminum	3930		15000		10000	J	6330		4650		2050		NA
Antimony	4.9	J	30.2	J	3.8	J	19.2		13.7		1.2	J	340
Arsenic	7.5	J	39.7		29.1	J	ND	J	8.8	J	5.3		20.0
Barium	262		1040		168	J	702		927		52.0	J	47000
Beryllium	0.26	J	1.80		ND	J	0.28	J	0.33	J	ND	J	2.0
Cadmium	2.6	J	23.6	K	1.9	J	19.4		15.6		0.93		100
Calcium	5610		42300		4720	J	17300	J	28200	J	5980	J	NA
Chromium	28.0		128		23.4	J	187	R	150	R	5.1		6100
Cobalt	5.5	J	17.6		55.4	J	13.5		13.4		ND		NA
Copper	242		821	J	125	J	912	J	7300	J	238	J	600
Iron	13500		97500		48600	J	121000		108000		10900		NA
Lead	634		4370		328	J	8560		4480		241		600
Magnesium	1460		9390		3250	J	2740		3490		ND		NA
Manganese	197	J	1310		157	J	742		1020		107	R	NA
Mercury	2.4		3.6	J	2.0	J	3.2	J	9.6	J	0.23	J	270
Nickel	27.5	R	178		216	J	115	J	104	J	13.7		2400
Potassium	732		760		1710	J	423	J	268	J	ND		NA
Selenium	1.2	J	5.0	J	ND	J	2.5	J	3.2	J	2.2	J	3100
Silver	1.9		5.7		3.0	J	4.3		3.4		0.8	J	4100
Sodium	281	J	ND		ND	J	ND		ND		ND	J	NA
Thallium	0.67	J	5.3		2.2	J	5.2		5.3		0.73		2.0
Vanadium	25.4		35.4		31.8	J	52.6		158		10.2		7100
Zinc	824		6950		3800	J	5630		4110		491		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-F12-01	Q	NJTP5-F12-03	Q	NJTP5-G11-01	Q	NJTP5-G11-02	Q	NJTP5-G11-03	Q	NJTP5-G12-01	Q	Clean-up Level#
Aluminum	2120	J	5530		5360		8260		3340		5560		NA
Antimony	8.5	J	7.6	J	15.3		3.3	J	4.1	J	35.2		340
Arsenic	ND	J	4.4		7.7	J	20.2		5.2	J	7.2	J	20.0
Barium	299	J	434		264		721	J	61.1	J	1880		47000
Beryllium	0.23	J	0.88		0.25	J	4.4	J	ND	J	0.32	J	2.0
Cadmium	17.7	J	5.1	J	5.2		4.6		0.73	J	10.5		100
Calcium	9140	J	2900		10200	J	19700		6340		24600	J	NA
Chromium	98.0	J	31.6		52.7	R	41.7		6.5		64.6	R	6100
Cobalt	20.5	J	8.5		8.1		12.0		ND		11.3		NA
Copper	598	J	386	J	349	J	230	J	93.6	J	507	J	600
Iron	246000	J	49200		27300		20800		14800		70800		NA
Lead	1510	J	1850		2050		701		172		45200		600
Magnesium	1160	J	2320		2800		5110		1590	J	8600		NA
Manganese	1730	J	490		592		225	R	190	R	700		NA
Mercury	1.4	J	1.5	J	1.5	J	2.0	J	0.33	J	1.1	J	270
Nickel	68.2	J	54.0		56.8	J	510		9.9		141	J	2400
Potassium	246	J	ND		861		1020		ND	J	376	J	NA
Selenium	3.8	J	ND		0.53	J	1.6	R	0.90	J	1.3	J	3100
Silver	7.5	J	3.5		1.9		20.9		1.1	J	4.2		4100
Sodium	ND	J	ND		ND		ND	J	ND		ND		NA
Thallium	9.4	J	2.4	J	1.9	J	5.2		0.84	J	4.2		2.0
Vanadium	106	J	26.4		31.0		2080		13.5		255		7100
Zinc	2370	J	1640		1530		1370		256		4540		1500

NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

Turnpike Dump #5
Inorganic Results
(mg/kg)

Analyte/Sample	NJTP5-G12-02	Q	NJTP5-G12-03	Q	Clean-up Level#
Aluminum	5160		1770		NA
Antimony	8.5	J	13.0	J	340
Arsenic	9.0	J	ND	J	20.0
Barium	343		657		47000
Beryllium	1.6		1.3		2.0
Cadmium	4.4		16.7		100
Calcium	9880		3920		NA
Chromium	115	J	55.3	J	6100
Cobalt	7.3		7.4		NA
Copper	282	J	435	J	600
Iron	39000		40000		NA
Lead	541		1860		600
Magnesium	857		824		NA
Manganese	291	J	304	J	NA
Mercury	8.5	R	1.4	R	270
Nickel	56.3		129.0		2400
Potassium	458	J	226	J	NA
Selenium	0.88	J	0.94	J	3100
Silver	2.2		ND		4100
Sodium	ND		ND		NA
Thallium	2.0	J	3.4		2.0
Vanadium	36.9		783.0		7100
Zinc	1050		1920		1500

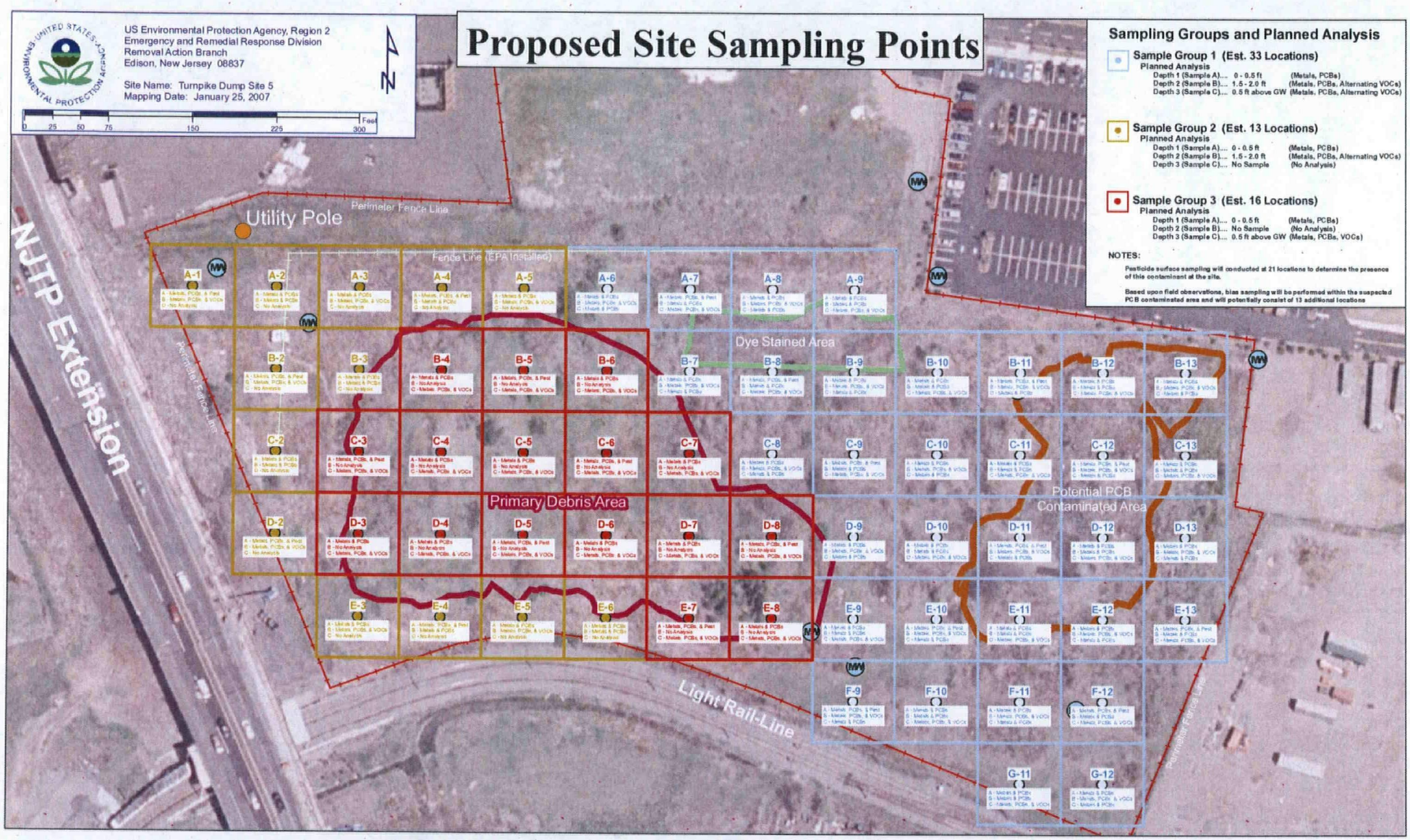
NA – Not Applicable
ND - Not Detected
R – Rejected Value
Q - Data Qualifier
J - Estimated Value

- Shaded area indicates concentration above the New Jersey State Non-Residential Clean-up Level

APPENDIX C

Site Map

Proposed Site Sampling Points



APPENDIX D

QUALITY ASSURANCE PROJECT PLAN
FOR THE
NEW JERSEY TURNPIKE DUMP SITE #5
FEBRUARY, 2007

QUALITY ASSURANCE PROJECT PLAN (QAPP)

FOR THE

REMOVAL ASSESSMENT

AT THE

NEW JERSEY TURNPIKE DUMP #5 SITE

JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Project Officer's Signature: _____ Date: 2/5/07

Project Officer's Name: Robert Finke, Chemist

Project Quality Assurance Officer's Signature: _____ Date: 2/12/07

Project Quality Assurance Officer's Name: Pat Sheridan, QA Officer

Date Prepared: February 5, 2007

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Appendix C - U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment. Part 141: National Primary Drinking Water Regulations. Subpart G: National Revised Primary Drinking Water Regulations: Maximum Contaminant Levels. Section 61: *Maximum Contaminant Levels for Organic Contaminants.* 7-1-97 Edition

Appendix D - U.S. EPA (Environmental Protection Agency).January 1991. Environmental Response Team (ERT) Standard Operating Procedure (SOP) *#2012: Soil Sampling;* from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*. OSWER Directive 9360.4-02. Interim Final. EPA/540/P-91/006. Office of Emergency and Remedial Response (OERR), Washington, DC. *U.S. EPA ERT SOP #2006: Sampling Equipment Decontamination* from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*

Appendix E - U.S.EPA (Environmental Protection Agency). July 2005. *Contract Laboratory Program (CLP) Statement of Work (SOW) for Multi-Media, Multi-Concentration, Organic Analytical Service for Superfund (SOM01.1); Quick Reference Fact Sheet.* Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC.

Appendix F - U.S.EPA (Environmental Protection Agency). March 2004. *Contract Laboratory Program (CLP) Statement of Work (SOW) for Multi-Media, Multi-Concentration Inorganic Analysis (ILM0 5.3).Quick Reference Fact Sheet.* Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC.

Appendix G - Field Data Sheets and Sample Documentation Examples

1.0 Project Description

1.1 Problem Definition/Background

The New Jersey Turnpike Dump #5 is located between Gilchrist and Aetna Avenues in Jersey City, Hudson County, New Jersey. The former landfill, CERCLIS ID# NJD980532899, occupies approximately 16 acres bordering the Bergen-Hudson Light Rail System and the New Jersey Turnpike. The site which is currently owned by the city of Jersey City, NJ contains material documented to contain tires, PCB's surficial and buried drums in addition to various municipal wastes. According to the EPA CERCLIS database, a discovery for the subject site was performed on June 1, 1981 and a preliminary assessment completed on August 25, 1987. The assessment indicated the presence of low levels of PCBs in surface soil throughout the northeastern portion of the site where a previous fire had occurred. A site inspection and subsequent No Further Remedial Action Planned was issued on March 31, 1988. Subsequently, an EPA Fund Financed Removal Action was performed on June 8, 1992 and a PRP Removal performed between August 12, 1992 and February 19, 1993. A removal assessment was performed between March 8, 1993 and November 26, 1993. The site was archived by the EPA on May 05, 2000 and unarchived on August 21, 2006 due to the discovery of partially buried drums present at the site.

Current conditions at the site include the presence of partially buried collapsed and rusted 55 gallon drums, transformer insulator materials, debris and stressed vegetation, especially in the northeaster portion of the site. Due to potential sale and reuse of portions of the subject parcel of property, an additional subsurface investigation has been proposed. This document will outline the additional subsurface investigation strategy.

1.2 Project/Task Description:

The purpose of this removal assessment is to collect valid data which are necessary and efficient to identify the levels of contaminants in the subsurface and surface soil. The sampling event will assist in the future removal of contaminated soil. The scope of the removal assessment is to:

- assess the levels of Pesticides/PCBs and Target Analyte List (TAL) total metals in the soil; and
- Further define the potential source area(s).

The purpose and scope of this QAPP is to specify the details related to the collection, analysis and validation of the soil samples collected by the U.S. EPA Region 2, Division of Environmental Science and Assessment (DESA), Hazardous Waste Support Branch (HWSB), Superfund Support Team (SST) on February 12–16, 2007. A contract laboratory program (CLP) laboratory will be performing the sample analyses. The activity schedule is as follows:

ACTIVITY	DATE
Date of the request which initiates the project.	December 04, 2006
Review and Background information	December 07, 2006
Date by which the project plan will be submitted to all interested parties.	February 05, 2007
Obtain site access	Completed
Date by which comments on the plan are to be received by the project officer.	February 8, 2007
Date(s) of the field reconnaissance.	January 29, 2007
Date(s) of the field sampling activities.	February 12 – 16, 2007
Date(s) the samples will be submitted to the laboratory for analysis.	February 12 – 16, 2007
Date(s) by which all analyses are to be completed and the data submitted to the project officer.	March 16, 2007
Date(s) the data will be entered into STORET or other computerized systems.	Not applicable.
Date of the completion of the draft interim/final project report. (Sampling Trip Report)	Within one week of the end of the sampling event
Date for the issuance of the final project report.	Within two weeks of receipt of validated analytical data.

The primary use of the data collected will be to determine the levels of contaminants in the soil below the site for future use in the removal actions at this site. This information will eventually be used to evaluate potential health risks, future land use and determine environmental impacts.

Soil samples will be compared to the following:

- New Jersey Administrative Code. N.J.A.C.7:26D-3,*Table 3-2:Soil Cleanup Standards.*& N.J.A.C. 7:26D-7, *Table 7-1: Non-Residential Surface Soil Cleanup Standards,* February 3, 1993. Office of Administrative Law, Division of Rules and Publications, Trenton, NJ.

- U.S. EPA (Environmental Protection Agency). May 1996. Soil Screening Guidance: Technical Background Document, Appendix A - *Generic Soil Screening Levels (SSLs). 2nd Edition. EPA/540/R95/128.* Publication 9355.4-17A. Office of Solid Waste and Emergency Response (OSWER), Washington, DC which can be found as Appendix B.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 Project/Task Organization

The following list of key personnel and their corresponding responsibilities. Due to the work breakdown structure of the project, an organization list is provided instead of a concise organization chart.

PROJECT PERSONNEL	RESPONSIBILITY
Andrew Confortini, On-Scene Coordinator (OSC) ERRD/RAB Removal Section	Overall Project Manager
Robert C. Finke, Project Officer DESA/HWSB Superfund Support Team	Project Management/ Sampling Operations
Mark Denno, Environmental Scientist DESA/HWSB Superfund Support Team	Sampling Operations/ Field Support
Christina Leung, Environmental Scientist DESA/HWSB Superfund Support Team	Sampling Operations/ Field Support
Diane Salkie, Environmental Scientist DESA/HWSB Superfund Support Team	Sampling Operations/ Field Support
DESA/HWSB Hazardous Waste Support Section	Data Quality Review
Patricia Sheridan, Project Quality Assurance Officer DESA/HWSB Superfund Support Team	Report QA
CLP Laboratory	Organic and Inorganic Laboratory Analysis Laboratory QC Data Processing Activities
DESA/Hazardous Waste Support Branch	Overall QA

2.2 Documentation and Records

The data collected for the sampling activities will be organized, analyzed, and summarized in a final project report that will be submitted the OSC according to the Project Schedule. The report will be prepared by the project officer and include appropriate data quality assessment. Standard methods and references will be used as guidelines for data reduction and reporting.

3.0 QUALITY ASSURANCE (QA) OBJECTIVES FOR MEASUREMENT DATA (PARCC)

3.1 Quality Objectives and Criteria for Measurement Data

To assess data quality, PARCC (Precision, Accuracy, Representativeness, Completeness, and Comparability) parameters will be utilized. This is an integral part of the overall monitoring network design. Precision and accuracy are expressed in purely quantitative terms. The other parameters are only expressed using a mixture of quantitative and qualitative terms. All of these parameters are interrelated in terms of overall data quality and they may be

difficult to evaluate separately due to these interrelationships. The relative significance of each of the parameters depends on the type and intended use of the data being collected. Therefore, these essential data quality elements are delineated as follows.

3.1.1 Analytical and sample collection precision

To assess error associated with analyte interference with the quantitation of other analytes and error due to laboratory bias and precision, Matrix Spike and Matrix Spike Duplicate samples (MS/MSDs) will be collected. Hence, one sample will have three aliquots. The first aliquot will be analyzed routinely for the parameters of interest, while the other two aliquots will be spiked with known quantities of the parameters of interest prior to analysis. The Relative Percent Difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed. The equation for this calculation is presented below.

$$RPD = \frac{|MSR - MSDR|}{(MSR+MSDR)/2} \times 100$$

where: MSR = Matrix Spike Recovery
MSDR = Matrix Spike Duplicate Recovery
| | indicates absolute value of the difference. Hence, RPD is always expressed as a positive value.

For the CLP laboratory, which will be conducting the analyses, an MS/MSD is not required for any of the organic samples. As an alternative the laboratory uses a Deuterated Monitoring Compound (DMC) solution which they add to the sample at a known concentration. DMC solutions are added to each sample, standard and blank. This is used to assess error associated with analyte interference with the quantitation of other analytes and error due to laboratory bias and precision.

Sample collection precision and data representativeness will be assessed by collecting field replicate samples. The field replicates will be used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. The analytical results from these samples will provide data on the overall measurement precision.

3.1.2 Analytical and sample collection accuracy

Analytical accuracy will be assessed through the analysis of quality control samples specified in the analytical method (i.e., matrix spike, surrogate spike). The quality control samples will be used to reduce the sources of error associated with sample matrix, sample preparation and analysis techniques. Accuracy is defined as a measure of how close an analytically determined concentration is to the true value.

The analytical accuracy will be expressed as the percent recovery (%R) of an analyte which has been added to the environmental sample at a known concentration before analysis and is

calculated according to the following equation.

$$\%R = [(A-B)/C] \times 100$$

where: A = The analyte concentration determined experimentally from the spiked sample.
B = The unspiked sample concentration.
C = The amount of spike added.

To assess sample accuracy, field quality control (QC) samples are usually collected including a rinsate, trip, and/or field blanks. The blanks would be used to evaluate errors arising from potential cross-contamination due to: improper handling of samples by collectors and lab personnel; improper decontamination procedures; improper shipment and storage; and/or on-site atmospheric contaminants.

3.1.3 Data representativeness

As previously discussed, data representativeness will be assessed by collecting field replicate samples. The field replicates are by definition equally representative of a given point and space and time. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. Therefore, data representativeness will be satisfied by ensuring that:

- The sampling program is followed according to:
  - U.S. EPA (Environmental Protection Agency). October 1989. *Region II CERCLA Quality Assurance Manual.* Final Copy, Revision 1. Division of Environmental Services and Assessment, Edison, NJ.; and
  - U.S. EPA (Environmental Protection Agency). December 1995. *Superfund Program Representative Sampling Guidance.* OSWER Directive 9360.4-10. Interim Final. EPA/540/R-95/141. Office of Emergency and Remedial Response (OERR). Washington, D.C.
- Proper sampling techniques are used in accordance with:
  - U.S. EPA (Environmental Protection Agency). January 1991. *Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2012: Soil Sampling;* from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures.* Interim Final. EPA/540/P-91/006. Office of Emergency and Remedial Response (OERR), Washington, DC. The SOP is enclosed as Appendix F; and
- Proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory according to:

For organic analysis, the following SOW applies:

- U.S.EPA (Environmental Protection Agency). July 2005. Contract Laboratory Program (CLP) *Statement of Work (SOW) for Multi-Media, Multi-Concentration Organic Analytical Services for Superfund (SOM 01.1)*. Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC. which can be found as Appendix E.

For metals analysis, the following SOW applies:

- U.S.EPA (Environmental Protection Agency). July 2005. Contract Laboratory Program (CLP) *Statement of Work (SOW) for Multi-Media, Multi-Concentration Inorganic Analytical Services for Superfund (ILM0 5.3)*. Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC. which can be found as Appendix F.

3.1.4 Data completeness

Data completeness will be expressed as the percentage of valid data obtained from measurement system. For data to be considered valid, it must meet all the acceptable criteria including accuracy and precision, as well as any other criteria specified by the analytical method used. Therefore, all data points critical to the sampling program in terms of completeness will be 100% validated by U.S. EPA Region 2 DESA/HWSB/Hazardous Waste Support Section (HWSS) according to the appropriate and current U.S. EPA Region 2 Data Validation SOPs. With 100% validation, the rationale for considering data points non-critical is not required.

3.1.5 Data comparability

To ensure data comparability, sampling and analysis for all samples will be performed using standardized analytical methods and adherence to the quality control procedures outlined in the methods and this QAPP. Therefore, the data will be comparable.

4.0 SAMPLING PROCEDURES

4.1 Sampling Process Design

As part of the removal assessment process, U.S. EPA Region 2 DESA/HWSB/SST personnel

will collect subsurface and surface soil samples along a specified sampling grid (figure1). Samples will be collected with stainless steel scoops, bowls and hand augers. Soil sampling will follow methods as described in *U.S. EPA/ERT SOP #2012: Soil Sampling* which can be found as Appendix D.

There will be a total of 62 sample locations and up to three (3) samples per location from a uniform area of the site (figure 1). Under the discretion of the on-site OSC, a sample will be collected at 0–6 inches, 2 feet and a third interval slightly above the groundwater table if auger rejection is not encountered. All samples collection depths will be documented in a bound field log book and included in figures, drawing and reports.

To assess error associated with analyte interference with the quantitation of other analytes and error due to laboratory bias and precision, Matrix Spike and Matrix Spike Duplicate samples (MS/MSDs) will be collected. Sample collection frequency for this site will be one MS/MSD per twenty (20) soil samples collected per analytical parameter analyzed. Double sample collection volume is required for inorganic MS/MSD analysis.

To assess sample collection precision and data representativeness, a field replicate sample will be collected. The field replicate will be used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. Sample collection frequency will be one field replicate per twenty (20) soil or aqueous samples collected per analytical parameter/ fraction analyzed.

To assess sample accuracy, field quality control samples will be collected including a rinsate blank. The blank will be used to evaluate errors arising from potential cross-contamination due to: improper handling of samples by collectors and lab personnel; improper shipment and storage; and/or on-site atmospheric contaminants. Rinsate blanks will be prepared in the field by pouring deionized water over decontaminated sampling equipment which in this case would entail pouring the water over stainless steel bowls and augers. Sample frequency will be one rinsate blank for each type of equipment used per each day a decontamination event is carried out. Rinsate blanks will be analyzed for TAL - total metals and TCL Volatiles and Pesticides/PCBs.

The number and type of samples and analytical requirements are listed in Table 1.

TABLE 1 - New Jersey Turnpike Dump #5 Site
Removal Investigation - Soil Sampling
Sampling and Analysis Protocols - RAS Parameters

Sample Type	Number of Samples	Matrix	Parameter/Fraction	Sample Container[1]	Sample Preservation	Analytical Method**	Method Detection Limit	Holding Time[2]
Environmental Surface and Subsurface Soil	170*	Soil	Target Analyte List-Total Metals	(1) 4 oz. Wide-mouth glass jar with Teflon lid	Cool to 4°C	ILM0 5.3	Aluminum, Barium: 200 ug/L Antimony: 60 ug/L Arsenic, chromium, silver: 10 ug/L Beryllium, Barium, Selenium: 5 ug/L K, Mg, Na, Mg: 5000 ug/L Cobalt: 50 ug/L Copper: 25 ug/L Iron: 100 ug/L Lead: 3.0 ug/L Mercury: 0.2 ug/L Nickel: 40 ug/L Vanadium: 50 ug/L Zinc: 20 ug/L	6 Months
	25*	Soil	Target Compound List-Pesticides	(1) 4 oz. Wide-mouth glass jar with Teflon lid	Cool to 4°C	SOM01.1	Toxaphene: 170 ug/kg Dieldrin/Endrin: 3.3 ug/kg DDD, DDE, DDT: 3.3 ug/kg Endosulfan (sulfate): 3.3 ug/kg Endrin Ketone/Aldehyde: 3.3 ug/kg	10 Days 10 Days
	175*	Soil	Target Compound List- PCBs	(1) 4 oz. Wide-mouth glass jar with Teflon lid	Cool to 4°C	SOM01.1	Aroclors: 33.0 ug/kg	

Legend:
1 The number in parentheses in the "Sample Container" column denotes the number of containers needed.
All sample bottles will comply with OSWER Directive #9240.0-05A; Specifications and Guidance for obtaining Contaminant-Free Containers, EPA 540/R-93/051.
2 All holding times listed are Contractual Holding Times and are from the date of Verified Time of Sample Receipt (VTSR) if not otherwise specified.
* The number of samples indicated includes field replicate samples and MS/MSDs.
** Sample concentration for metals determination converted to a dry weight basis based upon sample weight and percent solids content.

TABLE 1 – New Jersey Turnpike Dump #5 Site (Continued)
Removal Investigation – Soil Sampling
Sampling and Analysis Protocols - RAS Parameters

Sample Type	Number of Samples	Matrix	Parameter/Fraction	Sample Container[1]	Sample Preservation	Analytical Method**	Method Detection Limit	Holding Time[2]
Environmental Surface and Subsurface Soil	175*	Soil	Target Compound List- VOCs	(2) 40 ml glass with Teflon Septa	Cool to 4°C	SOM01.1	TCL-VOC List: 5-10 ug/kg	10 Days
Rinsate Water	10	Water	Target Analyte List-Total Metals	(1)Liter Amber Glass	Cool to 4°C, pH to <2 w/HNO3	ILM0 5.3	Aluminum, Barium: 200 ug/L Antimony: 60 ug/L Arsenic, chromium, silver: 10 ug/L Beryllium, Barium, Selenium: 5 ug/L K, Mg, Na, Mg: 5000 ug/L Cobalt: 50 ug/L Copper: 25 ug/L Iron: 100 ug/L Lead: 3.0 ug/L Mercury: 0.2 ug/L Nickel: 40 ug/L Vanadium: 50 ug/L Zinc: 20 ug/L	180 Days
	10	Water	Target Compound List-Pesticides	(1)Liter Amber Glass	Cool to 4°C	SOM01.1	0.05-0.10 ug/L, Toxaphene: 5.0 ug/L	5 Days
	10	Water	Target Compound List-PCBs	(1)Liter Amber Glass	Cool to 4°C	SOM01.1	Aroclors 1.0 ug/L	5 Days
	10	Water	Target Compound List-VOCs	(3) 40 mL glass vials with Teflon Septa	Cool to 4°C, pH to <2.0 w/HCl	SOM01.1	TCL-VOC List:5-10ug/L	10 Days

Legend;
1 The number in parentheses in the "Sample Container" column denotes the number of containers needed.
All sample bottles will comply with OSWER Directive #9240.0-05A; Specifications and Guidance for obtaining Contaminant-Free Containers, EPA 540/R-93/051.
2 All holding times listed are Contractual Holding Times and are from the date of Verified Time of Sample Receipt (VTSR) unless otherwise specified.
* The number of samples indicated includes field replicate samples and MS/MSDs.
** Sample concentration converted to a dry weight basis based upon sample weight and percent solids content.

4.2 Sampling Methods Requirements

4.2.1 Standard operating procedures

As previously stated, all sampling will be performed in accordance with the *U.S. EPA Region 2 CERCLA Quality Assurance Manual*; and *U.S. EPA Superfund Program Representative Sampling Guidance* OSWER Directive 9360.4-10, Interim Final, EPA/540/R-95/141, Office of Emergency and Remedial Response (OERR), Washington, D.C. Furthermore, the specific Standard Operating Procedure (SOP) utilized for soil sampling is the *U.S. EPA ERT SOP #2012: Soil Sampling*; from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures* which can found as Appendix D.

4.2.2 Sample collection methodology

All samples including QA/QC samples will be collected by personnel from the U.S. EPA Region 2 DESA/HWSB/SST at approximately 62 locations. Sample locations may be demarcated on-site utilizing survey paint, marks, or flags. A global positioning system will be utilized during or shortly thereafter the actual sampling. The total number of soil samples includes: 170 environmental soil samples for the analysis of TAL metals, 175 environmental soil samples for the analysis of TCL PCBs and VOCs, and 25 environmental soil samples for the analysis of TCL Pesticides. Additionally, one field duplicates (i.e., laboratory quality control sample) and 1 MS/MSD sample will be collected for every 20 environmental samples collected as well as one rinsate blank sample per day for all analytical parameters. As previously stated, the specific SOP utilized will be the *U.S. EPA ERT SOP #2012: Soil Sampling,* from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures* which can be found as Appendix D. The samples will be homoginized in stainless steel bowls and scoops prior to placement in sample jars.

For MS/MSD sample collection, double sample volume is required for inorganic and organic analysis. Sample preservation for all soil samples requires only wet ice with samples cooled to 4°C. Water samples (QC samples) for VOC determinations will be preserved with hydrochloric acid to a pH of 2 or less. Water samples collected for metals determinations will be preserved with nitric acid to a pH of 2 or less. All sample bottles will comply with the *U.S. EPA Specifications and Guidance for Contaminant-Free Sample Containers.* Samples will be maintained in sealed cooler(s) with ice at 4°C. All samples will be sent to CLP laboratories via United Parcel Service within specified holding times.

4.2.3 Sample Containers, Volume, Preservation, and Holding Times

Sample container type, volume, preservation, and holding times are dependent upon analytical parameter and fraction and are matrix specific. The following table outlines the sample container type, volume, preservation, and holding times for samples to be collected on-site.

Analytical Parameter/ Laboratory	Sample Container	Required Sample Volume	Matrix	Sample Preservation	Holding Time*
TAL - Total Metals CLP Laboratory	(1) 4 oz. clear wide-mouth glass with Teflon lined cap	4 oz.	Soil	Wet Ice; Cooled to 4°C	6 months.
TAL - Total Metals CLP Laboratory	(1) 1L clear polyethylene bottle	32 oz.	Water	Wet Ice; Cooled to 4°C, Nitric Acid to pH ≤2	6 months
TCL – VOCs CLP Laboratory	(3) Encore Samplers and (1) 4 oz. jar for percent moisture	40 ml X 3	Soil	Wet Ice; Cooled to 4°C	10 days
TCL – VOCs CLP Laboratory	(3) 40 ml clear narrow-mouth glass with Teflon lined cap	40 ml X 3	Water	Wet Ice; Cooled to 4°C, HCl to pH ≤2	10 Days
TCL-Pesticides CLP Laboratory	(1) 8 oz. glass jar with Teflon lined cap	8 oz.	Soil	Wet Ice; Cooled to 4°C	10 Days
TCL-Pesticides CLP Laboratory	(2) 1L wide mouth amber jars with Teflon lined cap	1L x 2	Water	Wet Ice; Cooled to 4°C	5 Days
TCL-PCBs CLP Laboratory	(1) 8 oz. glass jar with Teflon lined cap	8 oz.	Soil	Wet Ice; Cooled to 4°C	10 Days
TCL-PCBs CLP Laboratory	(2) 1L wide mouth amber jars with Teflon lined cap	1L x 2	Water	Wet Ice; Cooled to 4°C	5 Days
All sample bottles will comply with OSWER Directive #9240.0-05A; U.S.EPA Specifications and Guidance for Obtaining Contaminant-Free Containers, EPA 540/R-93/051. *All holding times listed are Contractual holding times used from the date of Verified Time of Sample Receipt (VTSR).					

4.2.4 Field measurement data collection

Air monitoring will be conducted at this site with a photo-ionization detector (PID). Field data sheets and the field notebook will be completed for each sample collected. The *Soil Field Data Sheet* will record sample location; upper limit of observed PID readings; sample depth; time of sample collection; lowest depth of observed contamination; laboratory sample number; laboratory sample analysis; laboratory sample number; and sample collection notes and/or observations. The *Soil Field Data Sheet* is presented in Appendix G. The field notebook will be completed as provided for in Section 8.4: Data Quality Management of the QAPP.

4.2.5 Sampling Equipment Decontamination

Soil and QC water samples will be collected using stainless steel scoops, bowls and augers. With respect to all non-disposable equipment, these tools to be used on-site will also be decontaminated prior to site activities. Decontamination of equipment will be done at the

Edison facility and in the field if necessary. All soil decontamination procedures will be in accordance with the following:

- *U.S. EPA ERT SOP #2006: Sampling Equipment Decontamination* from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures* (Appendix D.)
- *U.S. EPA Region II CERCLA Quality Assurance Manual.*

4.2.6 Management of Investigative-Derived Wastes (IDW)

The wastes that are anticipated on being generated during this sampling event are soils, decontamination water and personnel protective equipment (i.e. goggles, booties, etc.). The waste soils will be that from the usage of augers, shovels, spatulas, and other soil sampling equipment. These excess soils will be placed back in the hole that was generated through sampling processes. Excess decontamination water will be released to the ground surface on site.

The personnel protective equipment will be double-bagged and properly disposed of in on-site solid waste roll-off or off-site in properly designated containers.

5.0 SAMPLE CUSTODY

5.1 Special Training Requirements/Certification

To perform the operations of this sampling event, SST will be dealing with the sampling activities on-site. This can imminently expose SST personnel to potential occupational environmental hazards. As a result, it is important for SST field personnel to be familiar with:

- Identifying methods and procedures for recognizing, evaluating and controlling hazardous substances.
- Identifying concepts, principles, and guidelines to properly protect SST field personnel.
- Discussing regulations and action levels to ensure the health and safety of SST field oversight personnel.
- Discussing the fundamentals needed to develop organizational structures and standard operating procedures to mitigate potential environmental hazards.
- Demonstrating the selection and use of dermal and respiratory protective equipment.
- Demonstrating the selection and use of direct-reading air monitoring instrumentation

In practice, not all of the potential environmental hazards which may be inherent to a site can be readily anticipated. To mitigate these circumstances, SST field personnel must learn, follow, and enforce the published rules governing occupational health and safety. In addition, they must maintain awareness and exercise common sense and good judgment when confronting possible unsafe situations. Consequently, all divisions and offices at the Edison facility are required to provide their staff with the necessary safety training and equipment to perform their assigned duties.

For SST personnel, all training and certification requirements are to be undertaken in accordance with the protocols set forth in the 1995 "Edison Health and Safety Manual." Specifically, this requires completion of the forty (40) hour "Hazardous Materials Incident Response Operations" training pursuant to Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1910.120 and U.S. EPA Order 1440.2. This is to be supplemented by completing the twenty four (24) hour OSHA sanctioned supervised on-site operations certification training. In conjunction, SST personnel are also to maintain certifications for:

- The supplemental eight (8) hour annual health and safety refresher training.
- Fit testing for atmosphere supplying respirators (Level B) and air purifying respirators (Level C).
- Enrollment in a physician authorized medical monitoring program.

5.2 Sample Handling and Custody Requirements

5.2.1 Sample handling and shipment

Field data sheets and the field notebook will be completed for each sample collected. All field and sample documents will be legibly written in indelible ink. Any corrections or revisions will be made by lining through the original entry and initialing the change. The *Field Data Sheet* will record sample location; sample depth; sample type; equipment used; analysis; sample characteristics; sampling personnel and weather. For reference, the field data sheets are presented in Appendix G. The field logbook is a descriptive notebook detailing site activities and observations so that an accurate, factual account of field procedures may be reconstructed. The sample team or individuals performing a particular sampling activity are required to maintain a field notebook. This field notebook will be a bound weatherproof logbook that shall be filled out at the location of sample collection immediately after sampling. All entries will be signed by the individuals making them. At a minimum, the logbook will contain sample particulars including sample number, collection time, location, descriptions, methods used, daily weather conditions, field measurements, name of sampler(s), sample preservation, names of on-site personnel, and other site-specific observations including any deviations from protocol.

Sample labels will be securely affixed to the sample container and include the sample identification number as per protocol. The sample labels will be sealed with clear tape to maintain sample label integrity. Custody seals will then be affixed around each individual sample container top. Once sealed, samples will be placed in a polyethylene bag inside a waterproof High Density Polyethylene (HDPE) cooler. The coolers will be packed with sufficient wet ice to cool the samples to 4°C along with non-combustible adsorbent cushioning material to minimize the possibility of container breakage and movement during shipment. Custody seals and strapping tape will then be affixed to the coolers. A temperature blank will be included in each cooler as per requirements.

All samples will be the responsibility of the Project Officer to see that the samples are

delivered the CLP laboratory(ies). At the completion of each day, the samples will be sent to a CLP laboratory for analysis via UPS.

5.2.2 Sample custody procedures

Standard U.S. EPA Chain-of-Custody Procedures will be followed for all samples and be in accordance with the U.S.EPA Region 2 *CERCLA Quality Assurance Manual.* The Forms II Lite computer program will be used to generate the Chain of Custodies for the laboratories. An example can be found in Appendix G. The Traffic Report & Chain-of-Custody Records will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for and a copy of the record will be kept for each individual who has signed it. The chain-of-custody records will include, at a minimum, sample identification number, number of samples collected, sample collection date and time, sample type, sample matrix, sample container type, sample analysis requested, sample preservation, and the name(s) and signature(s) of samplers and all individuals who have had custody. Sample labels will only include the sample identification number, time and date to prevent any conflict of interest issues for samples. Custody seals will demonstrate that a sample container or cooler has not been opened or tampered with. The sampler will sign and date the custody seal and affix it to the container and/or cooler in such a manner that it cannot be opened without breaking the seal.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 Instrument Calibration and Frequency

The CLP laboratory analytical equipment will follow procedures as specified under the U.S. EPA CLP *Statement of Work (SOW) for Multi-Media, Multi-Concentration Organic Analytical Services for Superfund (SOM 01.1)* and U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Inorganic Analysis (ILM0 5.3).*

7.0 ANALYTICAL PROCEDURES

7.1 Analytical Methods Requirements

The analytical method, equipment and method performance requirements for TCL Pesticides/PCBs and VOC analyses will be in accordance with U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Organic Analytical Services for Superfund (SOM 01.1)* and U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Inorganic Analysis (ILM0 5.3)* for metals determinations. The documents listed in sections 6.1 and 7.1 can be found in Appendices E and F respectively.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 Data Review, Validation and Verification Requirements:

All CLP SOW data generated by the CLP laboratory will be reported in standard CLP deliverable format. All data validation reports will be summarized according to:

- U.S. EPA Region 2 SOP HW-33, 2006 for Volatile Organics laboratory data review, U.S. EPA Region 2 SOP HW-36, 2006 for Pesticide laboratory data review, U.S. EPA Region 2 SOP HW-37, 2006 for PCB laboratory data review.

- U.S. EPA (Environmental Protection Agency) Region 2. 2005. *Evaluation of Metals Data for Contract Laboratory Program, HW-2,* Revision 13, Division of Environmental Services and Assessment, Hazardous Waste Support Branch, Hazardous Waste Support Section, Edison, NJ

8.2 Validation and Verification Methods

All CLP data will be validated by U.S. EPA Region II DESA/HWSB/HWSS in accordance with *U.S. EPA Region II SOP No. HW-13: Low Concentration Data Validation, (CLP/SOW OLC0 3.2)* and *Evaluation of Metals Data for Contract Laboratory Program, HW-2,* Revision 13.

8.3 Data Acquisition Requirements

Data acquisition from non-direct measurements such as data from databases or literature is not anticipated at this time. Therefore, this is not applicable.

8.4 Data Quality Management

All project data and information must be documented in a format that is usable by project personnel. This section of the QAPP describes how project data and information will be documented, tracked, and managed from their generation in the field to final use and storage in a manner that ensures data integrity and defensibility. All field and sample documents will be legibly written in indelible ink. Any correction or revisions will be made by lining through the original entry and initialing the change.

The following field and sample documentation will be maintained. Examples are presented in Appendix G.

- The field logbook is a descriptive notebook detailing site activities and observations so that an accurate, factual account of field procedures may be reconstructed. The sample

team or individuals performing a particular sampling activity are required to maintain a field notebook. This field notebook will be a bound weatherproof logbook that shall be filled out at the location of sample collection immediately after sampling. All entries will be signed by the individuals making them. At a minimum, the logbook will contain sample particulars including sample number, collection time, location, descriptions, methods used, daily weather conditions, field measurements, name of sampler(s), sample preservation, and other site-specific observations including any deviations from protocol.

- Field data sheets and corresponding sample labels are used to identify samples and document field sampling conditions and activities. The field data sheets will be completed at the time of sample collection and will include the following: sample location; upper limit of observed contamination; sample depth; time of sample collection; lowest depth of observed contamination; laboratory sample number; laboratory sample analysis; private laboratory sample number; private laboratory sample analysis; and sample collection notes and/or observations. An example of the *Soil Field Data Sheet* is presented in Appendix G. Sample labels will be securely affixed to the sample container and include only the sample identification number as per protocol.

- Sample labels will be securely affixed to the sample container and include only the sample identification number as per protocol to prevent any conflict of interest issues. The sample labels will be sealed with clear tape to maintain sample label integrity.

- The Traffic Report & Chain-of-Custody Records will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for and a copy of the record will be kept for each individual who has signed it. The chain-of-custody records will include, at a minimum, sample identification number, number of samples collected, sample collection date and time, sample type, sample matrix, sample container type, sample analysis requested, sample preservation, and the name(s) and signature(s) of samplers and all individuals who have had custody.

- Custody seals will demonstrate that a sample container or cooler has not been opened or tampered with. The sampler will sign and date the custody seal and affix it to the container or cooler in such a manner that it cannot be opened without breaking the seal.

- Procedures are provided for project personnel to make changes, take corrective actions and document the process through Corrective Action Request Forms. Corrective action can occur during field activities, laboratory analysis, data validation, and data assessment. For further information, refer to Section 13.0: Corrective Action.

9.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

9.1 Quality Control Requirements

As previously stated, to assess data quality, PARCC (Precision, Accuracy, Representativeness, Completeness, and Comparability) parameters will be utilized. These essential data quality elements are delineated as follows.

9.1.1 Data precision

Precision is defined as a measure of the reproducibility of individual measurements of the same property under a given set of conditions. The overall precision of measurement data is a mixture of sampling and analytical factors.

9.1.1.1 Analytical precision

To assess error associated with analyte interference with the quantitation of other analytes and error due to laboratory bias and precision, Matrix Spike and Matrix Spike Duplicate samples (MS/MSDs) will be collected. One sample will have three aliquots. The first aliquot will be analyzed routinely for the parameters of interest, while the other two aliquots will be spiked with known quantities of the parameters of interest prior to analysis. The Relative Percent Difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed.

$$RPD = \frac{|MSR - MSDR|}{(MSR+MSDR)/2} \times 100$$

Where: MSR = Matrix Spike Recovery
MSDR = Matrix Spike Duplicate Recovery
| | indicates absolute value of the difference.

Table 2 located on page 24 of this QAPP depicts the analytical precision for the analytical methods chosen in terms of estimated RPD.

9.1.1.2 Sample collection precision

Sample collection precision will be assessed by collecting field replicate samples. The field replicates will be used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. The analytical results from these samples will provide data on the overall measurement precision.

9.1.2 Data accuracy

Accuracy is defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement is. It is difficult to measure accuracy for the entire data collection activity. Sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation and analysis techniques.

9.1.2.1 Analytical accuracy

Analytical accuracy will be assessed through the analysis of quality control samples specified in the analytical method (i.e., matrix spike, surrogate spike). The analytical accuracy will expressed as the percent recovery (%R) of an analyte which has been added to the environmental sample at a known concentration before analysis and is calculated according to the following equation. See previous table for estimated accuracy.

$$\%R = [(A-B)/C] \times 100$$

where: A = The analyte concentration determined experimentally from the spiked sample.
B =The unspiked sample concentration.
C =The amount of spike added.

Table 2 on page 24 located in this QAPP depicts both the analytical precision and accuracy for the analytical methods chosen in terms of estimated percent recovery.

9.1.2.2 Sample collection accuracy

To assess sample accuracy, field quality control samples will be collected and evaluated including rinsate blanks. The blanks will be used to evaluate errors arising from potential cross-contamination due to: improper handling of samples by collectors and lab personnel, improper decontamination procedures, improper shipment and storage, or on-site atmospheric contaminants.

9.1.3 Data Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or and environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program and proper laboratory protocol. The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected. Therefore, data representativeness will be assessed by collecting field replicate samples. The field replicates are by definition equally representative of a given point in space and time.

In addition, as previously stated, data representativeness will be satisfied by ensuring that the sampling program is followed according to the *U.S. EPA Region II CERCLA Quality Assurance Manual*; and the *U.S. EPA Superfund Program Representative Sampling Guidance* for soil, Volume 1. Also, proper sampling techniques will be used in accordance with the *U.S. EPA ERT SOP #2012: Soil Sampling*; from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures* which can be found as Appendix D.

Furthermore, proper analytical procedures will be followed and holding times of the samples will not be exceeded in the laboratory according to U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Organic Analytical Services for Superfund (SOM 01.1)* and U.S. EPA

CLP *SOW for Multi-Media, Multi-Concentration Inorganic Analysis (ILM05.3)*..

9.1.4 Data Comparability

Comparability is defined as the confidence with which one data set can be compared to another. Field and laboratory procedures greatly affect comparability. Therefore, to optimize comparability, sampling and analysis for all samples will be performed using standardized analytical methods and adherence to the quality control procedures outlined in the methods and this QAPP. Therefore, the data will be compared.

9.1.5 Data Completeness

Completeness is defined as the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data completeness will be expressed as the percentage of valid data obtained from measurement system. For data to be considered valid, it must meet all the acceptable criteria including accuracy and precision, as well as any other criteria specified by the analytical method used. Therefore, all data points critical to the sampling program in terms of completeness will be 100% validated by U.S. EPA Region II DESA/HWSB/HWSS in accordance with the U.S. EPA Region 2 SOPs. With 100% validation, the rationale for considering data points non-critical is not required.

10.0 Performance and Systems Audits

10.1 Assessments and Response Actions

No performance audit of field operations is anticipated at this time. If conducted, performance and systems audits will be in accordance with:

- U.S. EPA (Environmental Protection Agency) Region II. October 1994. *SOP No. HW-20: Standard Operation Procedure (SOP) for Conducting CERCLA Field Audits.* Revision 0. Division of Environmental Services and Assessment, Hazardous Waste Support Branch, Hazardous Waste Support Section, Edison, NJ.

11.0 PREVENTIVE MAINTENANCE

11.1 Instrument/Equipment Testing, Procedures & Scheduled Inspection and Maintenance Requirements

As previously stated, calibration and preventative maintenance of analytical laboratory equipment will follow procedures as specified under to U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Organic Analytical Services for Superfund (SOM 01.1)* and U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Inorganic Analysis (ILM0 5.3)*.

11.2 Inspection/Acceptance Requirements for Supplies and Consumables

All blanks (e.g., rinsate blanks) will be prepared using demonstrated analyte free, deionized water as specified in the U.S. EPA Region II *CERCLA Quality Assurance Manual.* The demonstrated analyte free water meets the assigned criteria values for the Contract Laboratory Program (CLP) Contract Required Detection Limits (CRDLs) and Contract Required Quantitation Limits (CRQLs) as outlined in the most recent CLP Statements of Work (SOWs). The criteria is as follows: purgeable organics < 10 ppb; semi-volatile organics < CRQL; pesticides < CRQL; PCBs < CRQL; inorganics < CRDL. However, for common laboratory contaminants (i.e., methylene chloride, acetone, toluene, 2-butanone, and phthalates), the allowable limits are three times the respective CRQLs. All sample bottles comply with OSWER Directive #9240.0-05A; U.S. EPA *Specifications and Guidance for obtaining Contaminant-Free Containers*, EPA 540/R-93/051.

12.0 SPECIFIC ROUTINE PROCEDURES/MEASUREMENT PARAMETERS INVOLVED

12.1 Reconciliation with Data Used to Assess PARCC for Quality Objectives Measurement

Sample collection precision will be evaluated by collecting and analyzing a field duplicate sample. The field duplicate samples will be used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. The analytical results from the field duplicate samples will provide data on the overall measurement precision. Precision will be reported as the relative percent difference (RPD) for two measurements. The acceptance criteria for the field duplicate samples are located in Table 2.

Data will be generated through the collection of soil samples at New Jersey Turnpike Landfill #5 site. This data will be used to determine the location of soil contamination, the extent of contamination, evaluate potential health threats, and determine future use of the property.

TABLE 2: PRECISION AND ACCURACY

Sample Analysis	Sample Matrix	Analytical Method	Method Detection Limit	Quantitation Limit	Estimated Accuracy	Accuracy Protocol	Estimated Precision	Precision Protocol
TAL Total Metals	Soil	ILM05.3	Analyte Specific* (0.2 – 5000 ug/kg)	ppm levels	50% - 150%	CLP-RAS	< 20%^	CLP-RAS
TCL Pesticides/PCBs	Soil	SOM0 1.1	Compound Specific (3.3 - 170 μg/kg)	ppb levels	59% - 172%	CLP-RAS	< 50%	CLP-RAS
TCL VOCs	Soil	SOM0 1.1	Compound Specific (5 - 10 μg/kg)	ppb levels	59% - 172%	CLP RAS	< 50%	CLP-RAS
TAL Total Metals	Water	ILM05.3	1-10 ug/L	ppb levels	50% - 150%	CLP RAS	< 20%	CLP RAS
TCL Pesticides/PCBs	Water	SOM0 1.1	0.05-5.0 ug/L	ppb levels	50% - 150%	CLP RAS	< 50%	CLP RAS
TCL VOCs	Water	SOM0 1.1	5-100 ug/L	ppb levels	50% - 150%	CLP RAS	< 50%	CLP RAS

* Wet weight basis converted to dry weight basis in mg/kg based upon sample weight and solids content.

13.0 CORRECTIVE ACTION

13.1 Assessments and Response Actions

Procedures are provided for project personnel to make changes, take corrective actions and document the process through Corrective Action Request Forms. Corrective action can occur during field activities, laboratory analysis, data validation, and data assessment.

Corrective action in the field may be necessary when the monitoring network design is changed. A change in the field includes: increasing the number or type of samples or analyses; changing sampling locations; and/or modifying sampling protocol. When this occurs, the project officer or project QA officer will identify any suspected technical or QA deficiencies and note them in the field logbook. The project QA officer will be responsible for assessing the suspected deficiency and determining the impact on the quality of the data. Development of the appropriate corrective action will be the responsibility of the OSC.

Laboratory corrective action will be in accordance with U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Organic Analytical Services for Superfund (SOM 01.1)]* and U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Inorganic Analysis (ILM0 5.3)*.

The data generated by the CLP laboratory(ies) will be in accordance with the U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Organic Analytical Services for Superfund (SOM 01.1)* and U.S. EPA CLP *SOW for Multi-Media, Multi-Concentration Inorganic Analysis (ILM0 5.3)*.

14.0 QA REPORTS TO MANAGEMENT

14.1 Distribution List

The following project personnel will receive copies of the approved QAPP and any subsequent revisions.

Project Personnel	Title
Andrew Confortini, On-Scene Coordinator ERRD	Overall Project Coordinator
Robert Finke DESA/HWSB Superfund Contract Support Team (SCST)	Project Officer
Pat Sheridan DESA/HWSB/HWSS Hazardous Waste Support Section (HWSS)	Quality Assurance Officer

14.2 Reports to Management

The data collected as a result of sampling activities; will be organized, analyzed and summarized in a final project report that will be submitted to the all project officers according to the Project Schedule. The report will be prepared by the project officer or project quality assurance officer and include appropriate data quality assessment.

APPENDIX E

New Jersey DEP (Department of Environmental Protection)
non-residential clean-up levels, New Jersey Administrative Code. N.J.A.C. 7:26D-3, *Table 3-2: Soil Cleanup Standards.* & N.J.A.C. 7:26D-7, *Table 7-1: Non-Residential Surface Soil Cleanup Standards.*
February 3, 1993. Office of Administrative Law, Division of Rules and Publications, Trenton, NJ.

THIS IS A COURTESY COPY OF THIS RULE ADOPTION. THE OFFICIAL VERSION WILL BE PUBLISHED IN THE MAY 7, 2007 NEW JERSEY REGISTER. IF THERE ARE ANY DISCREPANCIES BETWEEN THIS TEXT AND THE OFFICIAL VERSION OF THE PROPOSAL, THE OFFICIAL VERSION WILL GOVERN.

ENVIRONMENTAL PROTECTION

SITE REMEDIATION and WASTE MANAGEMENT PROGRAM

Remediation Standards; Technical Requirements for Site Remediation

Proposed New Rules:	N.J.A.C. 7:26D
Proposed Amendments:	N.J.A.C. 7:26E-1.3
Proposed Repeal	N.J.A.C. 7:26E- 1.13
Authorized by:	Lisa P. Jackson, Commissioner Department of Environmental Protection
Authority:	N.J.S.A. 13:1D-1 et seq., 58:10-23.11a et seq., 58:10A-1 et seq., and 58:10B-1 et seq.

Calendar Reference: See Summary below for explanation of exception to calendar requirement.

DEP Docket Number: 07-07-04/46.

Proposal Number: PRN 2007-143.

A public hearing concerning this proposal will be held on

Date: June 7, 2007
Time: 2:00 PM
New Jersey Department of Environmental Protection
Public Hearing Room
401 East State Street
Trenton, NJ 08625

Submit written comments by July 6, 2007 to:

Leslie W. Ledogar, Esq.
Attention: DEP Docket No. 07-07-04/46.

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Office of Legal Affairs

New Jersey Department of Environmental Protection

401 East State Street

P.O. Box 402

Trenton, New Jersey 08625

The Department of Environmental Protection (Department) requests that commenters submit comments on disk or CD as well as on paper. Submittal of a CD or disk is not a requirement. The Department prefers Microsoft Word™ 6.0 or above. Macintosh™ formats should not be used. Each comment should be identified by the applicable N.J.A.C. citation, with the commenter's name and affiliation following the comment.

This rule proposal can be viewed or downloaded from the Department's web site at http://www.state.nj.us/dep/rules.

The agency proposal follows:

Summary

As the Department has provided a 60-day comment period on this notice of proposal, this notice is excepted from the rulemaking calendar requirement pursuant to N.J.A.C. 1:30-3.3(a)5.

Opportunity for public comment on draft soil remediation standards

The Department published a notice of opportunity for public comment on the draft soil remediation standards in the New Jersey Register on July 19, 2004. See 36 N.J.R. 3395(a). A draft of the soil remediation standards and supporting documentation were made available on the Department's web site. The Department then extended the public comment period for an additional 30 days, until October 18, 2004.

The Department received over 300 comments on the draft soil standards from 73 commenters. Commenters included specific industries and industry groups, environmental consultants, law firms, and several environmental groups. The comments submitted covered a

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broad range of topics ranging from technical issues related to the derivation of the numeric standards to concerns about the economic impacts of the rule and the impact of the rule on brownfield redevelopment.

In response to comments, several modifications to the procedures used to develop standards for the Impact to Ground Water Pathway and to the input parameters used to develop the non-residential inhalation remediation standards are appropriate. Formerly, the Department proposed the use of the Soil Water Partition Equation (SPE) for the development of the Impact to Ground Water Pathway standards. The commenters noted that mobility, which plays a key role in the pathway, differed greatly among contaminants, and that some contaminants are only mobilized under certain site-specific conditions. It was their opinion that the Department's use of SPE-generated standards is overly conservative for many contaminants. In response to these comments, the Department decided to modify the framework used to develop the standards by limiting the use of SPE to the development of standards for mobile contaminants; testing on-site leachability of a contaminant is proposed to be used for low mobility and inorganic contaminants.

Commenters questioned the validity of the assumptions that the Department used for truck traffic as part of the development of the non-residential inhalation remediation standard. In response to these comments the Department contracted with Rutgers University to conduct a study to better estimate the number and weight of vehicles that could be expected to drive on non-residential sites in New Jersey (Boile, M. 2006. Estimation of the Average Number of Trucks Visiting Non-Residential Sites in New Jersey). Based on the study, the Department revised the input parameters used to develop the non-residential inhalation remediation standards.

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Background on proposed new soil remediation standards

The Brownfield and Contaminated Site Remediation Act ("Brownfield Act"), at N.J.S.A. 58:10B-12(a), directs the Department to adopt minimum remediation standards for soil, ground water, and surface water necessary for the remediation of contaminated sites. Consistent with this legislative directive, the Department previously established remediation standards for surface water and ground water, which are codified in the Technical Rules for Site Remediation, N.J.A.C. 7:26E (the Technical Rules), at N.J.A.C. 7:26E-1.13. The Technical Rules set forth the minimum requirements for the remediation of every contaminated site in New Jersey, including both the methodology that must be followed and the standards to which ground water and surface water must be remediated.

The Department is now proposing remediation standards for soil at new N.J.A.C. 7:26D-4. In addition, the Department proposes to recodify with amendments the existing remediation standards for surface water and ground water from the Technical Rules at N.J.A.C. 7:26E-1.13 to the proposed new Remediation Standards rules at N.J.A.C. 7:26D-2 and 3, respectively. The Department intends to apply these standards to contaminated sites according to all applicable New Jersey statutes. The Department intends that the new chapter containing the remediation standards for soil, ground water and surface water, in concert with the Technical Rules as amended, will form the minimum standards by which all sites in New Jersey are to be remediated.

The Department has prepared three basis and background documents for these proposed rules that contain additional technical detail regarding the soil remediation standards. The basis and background documents for the ingestion-dermal exposure pathway, the inhalation exposure pathway, and the impact to ground water pathway are available at http://www.nj.gov/dep/srp/regs/srs.

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Background

On February 3, 1992, the Department proposed soil cleanup standards (see 24 N.J.R. 373(a)), but did not adopt the standards because the Department thought it prudent to wait for input from the Legislature, which was considering pertinent legislation at the time.

In 1993, the Hazardous Site Remediation Act, N.J.S.A. 58:10B-1 et seq., was enacted. This act was amended in 1997 and renamed the Brownfield and Contaminated Site Remediation Act (the Brownfield Act). In the Brownfield Act, the Legislature outlined State policies for many aspects of site remediation, and provided broad guidelines for the Department to use in developing minimum remediation standards for soil, ground water, and surface water. The Legislature specifically declared that "strict remediation standards are necessary to protect public health and safety and the environment" and that these standards "should be adopted based upon the risk posed by discharged hazardous substances." See N.J.S.A. 58:10B-1.2.

A multi-part section of the Brownfield Act, codified at N.J.S.A. 58:10B-12(a) through (o), outlines the principles for the Department to use in making site remediation decisions. N.J.S.A. 58:10B-12(a) provides that the Department "shall adopt minimum remediation standards for soil, ground water and surface water quality necessary for the remediation of contamination of real property." N.J.S.A. 58:10B-12(a) further provides that these standards "shall be developed to ensure that the potential for harm to public health and safety and to the environment is minimized to acceptable levels, taking into consideration the location, the surroundings, the intended use of the property, the potential exposure to the discharge and the surrounding ambient conditions, whether naturally occurring or man-made."

The Brownfields Act, at N.J.S.A. 58:10B-12(c), requires the Department to develop two sets of soil remediation standards based on the projected use of the remediated site, both of which must be protective of public health and safety: residential and nonresidential. However, the soil remediation standards at all sites must also be protective of ground water and surface water for contaminants that are mobile and transportable to ground water or surface water.

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Residential soil remediation standards must be set at levels or concentrations of contamination that: (1) are based upon the use of the site for residential or similar uses; (2) will allow the unrestricted use of the site without the need of engineering devices or any institutional controls; and (3) do not exceed a health risk standard for human carcinogens, as categorized by the United States Environmental Protection Agency (EPA), that will result in an additional cancer risk of one in one million, and for noncarcinogens, that will limit the hazard index for any given effect to a value not to exceed one. See N.J.S.A. 58:10B-12c(1) and d.

Nonresidential soil remediation standards must be set at levels or concentrations of contaminants that recognize the lower likelihood of exposure to contamination on property that will not be used for residential or similar uses. These standards are to be designed to allow for the unrestricted use of that property for nonresidential purposes. See N.J.S.A. 58:10B-12c(1).

N.J.S.A. 58:10B-12a and 12c, subsections b and d provide technical and policy guidelines for developing generic numeric standards for soil. The Legislature directed the Department to:

1. Identify the hazards posed by a contaminant to determine whether exposure to that contaminant can cause an increase in the incidence of an adverse health effect and whether the adverse health effect may occur in humans (N.J.S.A. 58:10B-12d);

2. Base the standards on generally accepted and peer reviewed scientific evidence or methodologies (N.J.S.A. 58:10B-12b(1));

3. Base the standards upon reasonable assumptions of exposure scenarios as to amounts of contaminants to which humans or other receptors will be exposed, when and where those exposures will occur, and the amount of that exposure (N.J.S.A. 58:10B-12b(2));

4. Avoid the use of redundant conservative assumptions by the use of parameters that provide an adequate margin of safety, avoid the use of unrealistic conservative exposure parameters, and make use of the guidance and regulations for exposure assessment developed by

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the United States Environmental Protection Agency pursuant to the "Comprehensive Environmental Response, Compensation, and Liability Act of 1980," 42 U.S.C. §§ 9601 et seq. and other statutory authorities as applicable (N.J.S.A. 58:10B-12b(3));

5. Establish, where feasible, the remediation standards as numeric or narrative standards, setting forth acceptable levels or concentrations for particular contaminants (N.J.S.A. 58:10B-12b(4)); and

6. Consider and utilize, in the absence of other standards used or developed by the Department of Environmental Protection and the United States Environmental Protection Agency, the toxicity factors, slope factors for carcinogens and reference doses for non-carcinogens from the United States Environmental Protection Agency's Integrated Risk Information System (IRIS) (N.J.S.A. 58:10B-12b(5)).

Technical Requirements for Site Remediation, N.J.A.C. 7:26E

As mentioned above, the proposed new Remediation Standards are designed to work in concert with the Technical Rules, which establish the minimum technical requirements for remediation of a contaminated site. The new Remediation Standards establish the minimum standards to which contaminated soil, surface water and ground water must be remediated. As a part of this proposal establishing the new remediation standards, the Department proposes to amend the Technical Rules. Specifically, the Department is proposing to add a new subsection (d) at N.J.A.C. 7:26E-1.3, Applicability, to establish a "phase in period" for the new Soil Remediation Standards. As a matter of course, the Department provides a six-month phase-in period for new remediation requirements. See N.J.A.C. 7:26E-1.3(c). Pursuant to proposed new N.J.A.C. 7:26E-1.3(d), a person responsible for conducting the remediation of contaminated sites who submits the required remedial action workplans or remedial action reports to the Department prior to the effective date of these amendments plus six months, will be able to use soil cleanup criteria that were approved for the site prior to the effective date of the new remediation standards. For example, if the effective date of the adopted new rules and amendments is January 1, 2008, any site for which a remedial action workplan or remedial action

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report was submitted prior to June 30, 2008 may be remediated using the soil cleanup criteria that were developed for the site prior to the January 1, 2008 effective date.

An exception exists when a new standard is adopted that is lower than a cleanup criterion that was developed for the site prior to the effective date of the new remediation standards by an order of magnitude or more. When a new remediation standard is lower than a soil cleanup criterion by an order of magnitude or more, the Brownfield Act at N.J.S.A. 58:10B-12j mandates that the new standard must be used. For sites where a remedial action workplan or a remedial action report is not submitted to the Department prior to the effective date plus six months, the remediation must be conducted using the new standards, exclusively.

Remediation options for the remediation of contaminated sites

The options for the remediation of a site that are currently available will not change upon the adoption of N.J.A.C. 7:26D. Remediation options for soil for the direct contact pathways (ingestion-dermal and inhalation) include treatment, removal, control via institutional and/or engineering controls, or in limited situations, the development of site specific alternative remediation standards (ARS). Remediation options for the impact to ground water pathway include the development of an ARS for soil that is protective of the ground water, or treatment or removal of contaminated soil. Containment with engineering controls may be approved as part of a ground water/soil remedial action when removal or treatment is deemed to be technically impractical.

If contaminants in soil do not exceed or are remediated to a level that meets both the most stringent direct contact remediation standards and the impact to ground water standards, no further remediation is required. If contaminants in soil exceed the most stringent direct contact remediation standards, the person responsible for conducting the remediation may elect, with Department approval, to use institutional and/or engineering controls pursuant to the Technical Rules, N.J.A.C. 7:26E-8, instead of removing or treating the contaminated soil to achieve the remediation standard. If contaminants in soil exceed the impact to ground water standards, then the person responsible for conducting the remediation must either remove or treat the contaminated soil, or may request an alternative remediation standard.

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The majority of the most stringent direct contact standards for soil are developed for the residential exposure pathway. For five contaminants, however, the most stringent standard is based on non-residential inhalation exposure. These contaminants are acenaphthylene, benzo(ghi)perylene, cobalt, manganese and phenanthrene. The non-residential inhalation standards for these particulate contaminants incorporate dust generated by vehicular traffic and have resulted in several instances where the non-residential standards are lower than the residential standards for the inhalation exposure pathway.

Risk based remediation standards

The Department is proposing new soil remediation standards for the combined ingestion and dermal exposure pathway and for the inhalation exposure pathway based on residential and non-residential exposure scenarios. These standards are referred to as the direct contact remediation standards.

The Department is also proposing new remediation standards for the impact to ground water pathway. These remediation standards are based on the Ground Water Quality Standards, N.J.A.C. 7:9C. The only ground water classification for which numeric ground water quality standards are developed by the Department in N.J.A.C. 7:9C are for Class II ground water (ground water for potable water supply). As such, impact to ground water remediation standards that are protective of Class IIA ground water are being proposed herein. Ground water remediation standards and impact to ground water remediation standards for Class I (ground water of special ecological significance) and Class III ground water (ground water with uses other than potable water supply) will continue to be developed by the Department on a site-specific basis.

In addition, as discussed more fully below, the Department proposes to relocate with amendments remediation standards for surface water and ground water from the Technical Rules at N.J.A.C. 7:26E-1.13 to the Remediation Standards rules at N.J.A.C. 7:26D-2 and 3, so that all of the Department's remediation standards are located in one chapter.

The Department is proposing to allow a person responsible for conducting a remediation to develop an alternative soil remediation standard for a site using the procedures provided in N.J.A.C. 7:26D Appendices 5, 6 and 7. An alternative remediation standard is a site-specific standard that must be equally protective of human health as the soil remediation standards provided in N.J.A.C. 7:26D Appendix 1, Tables 1A, 1B, 2A, 2B and 2C of this chapter. If a person uses an alternative soil remediation standard at a site prior to receiving the Department's approval, this remedial work is considered to be conducted "at risk" and is subject to the Department's review and approval. The Department will not approve the use of an alternative standard if it is determined that the alternative soil remediation standard is not adequately protective of human health and safety.

Selection of contaminants

The Department is proposing soil remediation standards for 136 contaminants. The Department reviewed and compared the following contaminant or constituent lists to determine a list of contaminants for which it would develop remediation standards:

USEPA Contract Laboratory Program (CLP) Target Analyte List/Target Compound List
USEPA Priority Pollutant List
USEPA Soil Screening Levels
New Jersey Ground Water Quality Standards

In addition the Department reviewed soil cleanup criteria that were developed on a site-by-site basis pursuant to N.J.S.A. 58:10B-12. These criteria are listed in the document "NJDEP SRP – Soil Cleanup Criteria" and are posted on the Department's website at www.state.nj.us/dep/srp/regs/scc.

The Department did not develop a standard for every contaminant on all of the lists that were reviewed. The Department determined, based on its experience in remediating sites, that some of the contaminants on these lists are rarely found at contaminated sites in New Jersey. Therefore, the Department determined that it would not be an efficient use of resources to develop a health-based remediation standard for every chemical on every existing list of

contaminants. Instead, the Department focused on the 136 chemicals that are most often encountered at contaminated sites. If a contaminant is found for which the Department does not have a promulgated standard, the Department may develop an interim remediation standard using the equations and methods contained in N.J.A.C. 7:26D. The Department will make available to the public a listing of all interim remediation standards and the technical information used in their derivation. Technical information includes the human health risk information and toxicity data and the risk assessment methods used. The Department will also replace an interim remediation standard with a codified remediation standard as soon as is reasonably possible by rulemaking.

Toxicity hierarchy

Detailed information regarding the data sources used for the development of the soil remediation standards for each chemical are provided in the exposure pathway basis and background documents, available at http://www.nj.gov/dep/srp/regs/srs/proposed. For each contaminant for which the Department calculated a soil remediation standard, the Department utilized the following hierarchy of toxicity data sources for the carcinogenic slope factor variable for carcinogens or the reference dose variable for non-carcinogens: (1) information which forms the basis for drinking water standards adopted by the Department pursuant to the Safe Drinking Water Act (SDWA); (2) the USEPA's Integrated Risk Information System (IRIS); and (3) other pertinent health-based data.

SDWA toxicity data are first in the Department's hierarchy because the Legislature, in the 1984 amendments to the New Jersey Safe Drinking Water Act, N.J.S.A. 58:12A-13, directed the Department to develop maximum contaminant levels (MCLs) for certain chemicals based on Drinking Water Quality Institute (DWQI) recommendations. The SDWA data were peer reviewed through the DWQI's review process and the resultant MCLs and drinking water standards were subject to public comment during the promulgation of the Safe Drinking Water Act rules, N.J.A.C. 7:10. The Department also used these toxicity values to develop ground water quality standards and surface water quality standards. The Department determined, for consistency, to use these data in the development of the soil remediation standards.

IRIS is an electronic database (available at http://www.epa.gov/iris) that contains information on human health effects that may result from exposure to various chemicals in the environment. IRIS was initially developed by USEPA in response to a growing demand for consistent information on chemical substances for use in risk assessments, decision-making and regulatory activities. The heart of the IRIS system is descriptive and quantitative information on the oral reference doses (RfDs) and inhalation reference concentrations (RfCs) for chronic non-carcinogenic health effects, and hazard identification, oral slope factors, and oral and inhalation unit risks for carcinogenic effects of various chemical substances.

A group of USEPA health scientists reviewed each reference dose/concentration and carcinogenicity assessment in IRIS using consistent chemical hazard identification and dose-response assessment methods to achieve agency consensus. USEPA revises the information in IRIS periodically when additional health effects data become available. This process is explained more fully below in the Summary section entitled "Updating Remediation Standards."

Other toxicity data sources include, but are not limited to, the California Environmental Protection Agency, the USEPA National Center for Environmental Assessment (NCEA), and the USEPA Health Effects Assessment Summary Tables (HEAST, last revised in 1997). The Department uses these sources when data are not available from either the DWQI or IRIS.

Group C carcinogens

Different USEPA programs have employed different approaches to developing standards for Group C carcinogens. The Department evaluated the approaches used by both the USEPA Office of Drinking Water and the USEPA Superfund Program to assess the risk associated with Group C carcinogens. The Office of Drinking Water requires that the risk assessment be based on the reference dose for non-carcinogenic effects, with an additional uncertainty factor of 10 to protect from possible carcinogenic effects. However, if no reference dose is available, the risk assessment is based on the carcinogenic slope factor using a lifetime cancer risk level of 1×10^{-5}. In contrast, the Superfund program bases risk assessments for Group C carcinogens on the carcinogenic slope factor, if available, using a lifetime cancer risk level of 1×10^{-6}. If no

carcinogenic slope factor is available, the Superfund program requires that the reference dose for non-carcinogenic effects be used without the incorporation of an additional uncertainty factor.

To develop health-based soil remediation standards for Group C carcinogens, the Department proposes to use a revised approach that is protective of human health. The Department's proposed approach specifies the use of a carcinogenic slope factor with a lifetime cancer risk level of 1×10^{-6} if a slope factor is applicable. This approach is similar to the approach used by the USEPA Superfund Program and is mandated by the Brownfield Act. If no suitable slope factor is available, the risk assessment will be calculated using the applicable formula in N.J.A.C. 7:26D Appendices 2, 3 or 4, based on non-carcinogenic effects, using the reference dose and an additional uncertainty factor of 10 to protect for possible carcinogenicity (similar to the approach used by the USEPA Office of Water). This approach is also the approach established in the New Jersey Ground Water Quality Standards at N.J.A.C. 7:9C. For more information regarding specific Group C carcinogens, refer to the ingestion-dermal basis and background document.

Regional Natural Background

In developing the proposed soil remediation standards, the Department balanced several legislative mandates. In addition to requiring that soil remediation standards be health-based, the Brownfield Act at N.J.S.A. 58:10B-12(g)(4) precludes the Department from requiring the remediation of a discharge to levels that are lower than regional natural background levels for any particular contaminant. The Department reviewed regional natural background levels of inorganic chemicals in soil in relation to the health-based standards being proposed to ensure that the proposed soil remediation standards are not lower than frequently detected background levels in New Jersey. After an evaluation of a Statewide survey of background soil concentrations, the Department has determined that arsenic is usually present in New Jersey soil at concentrations that are higher than the health-based criterion. Therefore, the Department developed a soil remediation standard for arsenic based on background concentrations specific to New Jersey. The Department selected a state-wide generic soil standard for arsenic of 19 mg/kg because the health-based criterion (0.5 mg/kg) is lower than naturally occurring concentrations.

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The Department based the State-wide background concentration for arsenic on a three-year study conducted by the Department to determine background values of selected metals throughout the State. See Sanders, P., 2002. Characterization of Ambient Levels of Selected Metals and Other Analytes in New Jersey Soils. This report is available at www.state.nj.us/dep/dsr/publications/pub.htm. A total of 248 soil samples were collected in areas of the State that were not directly affected by local discharges. The geographic provinces included in the study were the piedmont, ridge and valley, highlands, and the coastal plain. Samples were collected in urban and rural areas within the sampled regions

The Department ranked the background sample data by concentration and by distribution of the samples throughout the State, including geographical provinces and population density (urban or rural). The Department used the arsenic measured in these samples to represent the background arsenic concentrations in soil from the different geographic provinces throughout the State, although some additional concentration of arsenic may be present from diffuse anthropogenic sources. The Department used these data to develop the following table of the 95th percentile of the arsenic concentrations found in the different provinces of the State. The percentile evaluates a single value within the range of values in any given data set. The 95th percentile represents the concentration at which 95 percent of all the values in the data set are less than or equal to that concentration.

New Jersey Arsenic Concentrations

Geographic Province	Arsenic - 95th Percentile
Piedmont - urban	29 mg/kg
Ridge and Valley - rural	8 mg/kg
Highlands - rural	10 mg/kg
Coastal Plain - rural	15 mg/kg
Coastal Plain - rural	9 mg/kg
All areas	19 mg/kg

Based on these data, the Department proposes to establish a Statewide standard for arsenic. The Department does not believe that there are sufficient data on which to base a standard for the different geographical provinces, or for urban and rural areas of the State. The 95th percentile concentration (19 mg/kg) of all the sampled areas of the State has been selected as representative of background for the State. The Department selected 19 mg/kg as a reasonable background arsenic value that represents New Jersey soil that is not affected by local discharges.

Even though the Department is proposing a Statewide standard for arsenic, there is a wide variation in background concentrations of arsenic that exist across the State. Therefore, in those instances where the person responsible for conducting the remediation believes that naturally occurring levels of arsenic are greater than 19 mg/kg at a site, a site-specific background determination can be conducted as part of the remediation. The procedures to determine background on a site-specific basis are outlined in the Technical Rules at N.J.A.C. 7:26E-3.10.

Other factors affecting the development of soil remediation standards

The soil saturation level, or C_{sat} value, corresponds to the contaminant concentration in soil at which the absorptive limit of the soil particles, the solubility limit of the soil pore water, and saturation of soil pore air are reached. For some contaminants, the soil pore air concentration at C_{sat} is less than the calculated health based inhalation criterion. This means that, regardless of the concentration of the contaminant in soil, the calculated health based criterion can never be exceeded and, therefore, a health based standard is not needed for the inhalation exposure pathway for those contaminants. The Department determined not to establish numeric inhalation remediation standards for contaminants for which the calculated health-based criterion is greater than the contaminant's C_{sat} value.

There are instances when, in the calculation of a health based criterion, the calculated value is greater than one million parts per million. Because this cannot actually occur, the Department determined not to establish a numeric remediation standard in these instances.

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Reporting of numeric standards

The numeric soil remediation standards are expressed as mg/kg. The Department rounded the standards to two significant figures for standards with a value greater than or equal to 10 mg/kg and to one significant figure for standards with a value less than 10 mg/kg, including those with a value less than one. This approach is used by the USEPA Office of Solid Waste and Emergency Response. See USEPA, 2001. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24.

The Department applied the following rounding rules from a standard statistics text, Hurlbert, R. T. (1994). Comprehending Behavioral Statistics. Brooks/Cole Publishers, Pacific Grove, CA. If the first number beyond the last significant figure is less than five, the last significant figure remains the same; and the remaining numbers are dropped. For example, if 4.438 is rounded to one significant figure, the result is four. If 44.38 is rounded to two significant figures, the result is 44.

If the first number beyond the last significant figure is more than five, the last significant figure increases by one and the remaining numbers are dropped. For example, if 4.638 is rounded to one significant figure, the result is five. If 46.68 is rounded to two significant figures, the result is 47.

If the first number beyond the last significant figure is exactly five, then the last significant figure is rounded to the closest even number. For example, if 4.5 is rounded to one significant figure, the result is four. If 45.5 is rounded to two significant figures, the result is 46.

Proposed new soil remediation standards rules

The following is a summary of the proposed new rules at N.J.A.C. 7:26D.

N.J.A.C. 7:26D-1 General Information

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Proposed new Subchapter 1 contains the general information that applies to the remediation standards proposed herein.

Proposed new N.J.A.C. 7:26D-1.1 sets forth the purpose of these new rules and proposed new N.J.A.C. 7:26D-1.2 sets forth the scope. Proposed new N.J.A.C. 7:26D-1.1(a) and 1.2(a) state that the proposed rules establish minimum remediation standards for contaminated ground water, surface water, and soil in order to comply with the provisions of the Brownfield Act. N.J.A.C. 7:26D-1.1(b) explains that these rules supplement the requirements in the Technical Rules. N.J.A.C. 7:26D-1.2(b) provides that remediating ground water, surface water or soil to any applicable standard set forth in this chapter does not relieve a person from complying with more stringent requirements or provisions imposed by any other Federal, State, or local applicable statutes or regulations, or from obtaining any and all permits required by Federal, State, or local statutes or regulations, except as expressly provided herein.

Proposed new N.J.A.C. 7:26D-1.2(c) provides that the Department's authority to require additional remediation based upon site-specific conditions in order to protect human health, safety and the environment is not limited by any provisions of the new rules. Proposed new N.J.A.C. 7:26D-1.2(d) provides that the Department's authority to establish discharge limits for pollutants, or to prescribe penalties for violations of those limits pursuant to any statutory authority, or to require the complete removal of any illegally discharged hazardous substances, hazardous waste, or pollutants pursuant to law is not limited by any provisions of the proposed new rules.

Proposed new N.J.A.C. 7:26D-1.2(e) implements the provision of the Brownfield Act that states that the person responsible for conducting the remediation is not required to remediate soil, ground water or surface water to a level or concentration that is lower than the regional natural background level. This concept, as it pertains to ground water, is currently codified at N.J.A.C. 7:26E-1.13(c); it will be relocated to N.J.A.C. 7:26D-1.2(e).

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Proposed new N.J.A.C. 7:26D-1.3, Construction and severability, states that the rules are to be liberally construed and if any subchapter, section, subsection, provision, clause, or portion of the chapter is rendered invalid, it shall not affect or impair the remainder of the rules.

Proposed new subsection (a) of N.J.A.C. 7:26D-1.4, Applicability, provides that the Remediation Standards apply to those sites that are subject to the listed statutes. Proposed new N.J.A.C. 7:26D-1.4(b) states that all remediation work conducted at any contaminated site in New Jersey must be conducted in compliance with the Technical Requirements for Site Remediation, N.J.A.C. 7:26E, and must achieve the remediation standards proposed herein, whether the remediation is conducted with or without the Department's oversight.

Proposed new N.J.A.C. 7:26D-1.4(c) implements the Brownfield Act provision at N.J.S.A. 58:10B-2.e that provides that remediation of real property located in the Pinelands must be consistent with the Pinelands Protection Act and its implementing rules and with section 502 of the National Parks and Recreation Act of 1978.

Proposed new N.J.A.C. 7:26D-1.5, Definitions, provides definitions for the words and terms used in these proposed new rules. The Department proposes to add a definition of the term "alternative remediation standard" or "ARS." The term was established in the Brownfield Act (see N.J.S.A. 58:10B-12f) and is the standard that a person responsible for conducting the remediation proposes to use to remediate contaminated soil in lieu of using the minimum soil remediation standards established in these proposed new rules. See N.J.S.A. 58:10B-12f. The Department proposes to establish the procedures for the development of alternative remediation standards in N.J.A.C. 7:26D-7, and Appendices 5 through 7 of this chapter.

The Department proposes to define "carcinogen." The Brownfield Act directs the Department to "consider and utilize, in the absence of other standards used or developed by the Department of Environmental Protection and the United States Environmental Protection Agency, the toxicity factors, slope factors for carcinogens and reference doses for non-carcinogens from the United States Environmental Protection Agency's Integrated Risk Information System (IRIS)." N.J.S.A. 58:10B-12b(5). The Department proposes to define

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carcinogen consistent with the USEPA Guidelines for Carcinogen Risk Assessment, 51 Fed. Reg. 33932 (1986), as amended and supplemented.

Several words and terms used in this chapter are defined in the Technical Rules. The Department proposes to define the following terms by reference to the definition section of the Technical Rules at N.J.A.C. 7:26E-1.8: "contaminated site," "contamination" or "contaminant," "discharge," "effective solubility," "method detection limit" or "MDL," "person responsible for conducting the remediation," "practical quantitation level," or "PQL," "remediation" or "remediate," and "soil."

The Department proposes to define "exposure pathways" to describe the methods by which humans can come into contact with contamination, specifically the ingestion-dermal exposure pathway, the inhalation pathway, and the impact to ground water pathway.

The Department proposes to define "ground water" and "ground water quality criteria" by reference to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.4.

The Department proposes to define "impact to ground water remediation standard" as a soil remediation standard that is designed to limit the amount of contaminant that leaches from the soil vadose zone to ground water for the protection of ground water quality.

The proposed definitions of "ingestion-dermal exposure pathway" and "inhalation exposure pathway" describe process by which humans can come into contact with contamination. Ingestion-dermal exposure is the process of exposure through direct ingestion of contamination and the absorption of contamination through the skin. Inhalation exposure is the method of exposure through the direct inhalation of contamination.

The Department proposes to define "leachate criteria" as the remediation standards to use for the impact to ground water pathway for less mobile and inorganic contaminants that are based on the analysis of the leachate from soil using the synthetic precipitation leaching procedure.

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The proposed definitions of "non-residential use" and "residential use" are based on standard exposure durations established by the USEPA Risk Assessment Guidance for Superfund Human Health Evaluation Manual, Part B (RAGS HHEM, Part B; USEPA, 1991).

"Non-residential direct contact soil remediation standard" and "residential direct contact soil remediation standard" are soil remediation standards that are designed to be protective of human health for the ingestion-dermal and inhalation exposure pathways, at non-residential use and residential use sites. The Department has determined that it is appropriate to apply residential soil remediation standards at sites that are used for schools (K-12) and childcare centers. These standards are appropriately protective of children in residential, school and childcare settings.

The Department proposes to define "oversight document" by reference to the Department Oversight of the Remediation of Contaminated Sites rules at N.J.A.C. 7:26C-1.3.

"Pollutant" is defined as any substance defined as such under the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.

The proposed definition of "regional natural background level" is based on the Brownfield Act, which provides that regional natural background level is the concentration of a contaminant that is consistently present in the environment in the region of the site and which has not been influenced by localized human activities. See N.J.S.A. 58:10B-12g(4).

The proposed definition of "remediation standards" is also based on the Brownfield Act. Remediation standards means the combination of numeric standards, adopted pursuant to this chapter, that establish a level or concentration, and narrative standards, to which contaminants must be treated, removed or otherwise cleaned for soil, ground water or surface water, as established by the Department. See N.J.S.A. 58:10B-12.

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The Department proposes to define "surface water" by reference to the Surface Water Quality Standards, N.J.A.C. 7:9B.

N.J.A.C. 7:26D-2 Minimum Ground Water Remediation Standards

At proposed new N.J.A.C. 7:26D-2, the Department proposes to relocate the minimum standards to be used for the remediation of contaminated ground water from N.J.A.C. 7:26E-1.13(b). The Department is not proposing substantive changes to the regulations establishing ground water remediation standards; however, the Department incorporated portions of N.J.A.C. 7:26E-1.13 into different sections of these rules to be consistent with the format used for these rules, as described below.

Proposed new N.J.A.C. 7:26D-2.1, Purpose, states that the purpose of the subchapter is to set forth the minimum remediation standards for ground water.

Proposed new N.J.A.C. 7:26D-2.2(a)1 provides that the ground water remediation standards for Class II ground water are the ground water quality criteria established pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c) and (d). This paragraph conceptually relocates N.J.A.C. 7:26E-1.13(b)1i, ii and iii in these proposed new rules. The Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c) describe all the methods and procedures that the Department uses to develop ground water quality standards for Class II ground water. Appendix Tables 1 and 2 of the Ground Water Quality Standards contain ground water quality criteria for the listed constituents. The Ground Water Quality Standards also describe how the Department updates Tables 1 and 2 and derives an interim specific criterion for a constituent not listed in Appendix 1. When the Department develops a ground water quality criterion pursuant to the Ground Water Quality Standards rules as an Appendix, Table 1 criterion or an interim specific criterion, that criterion will become the ground water remediation standard for that constituent by operation of proposed new N.J.A.C. 7:26D-2.2(a)1.

Proposed new N.J.A.C. 7:26D-2.2(a)2 provides that the ground water remediation standards for Class I-A and Class I-PL ground water are the ground water quality criteria developed pursuant to N.J.A.C. 7:9C-1.7(a) and (b). The ground water quality criteria for Class I

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ground water is a nondegradation classification where natural quality is to be maintained or restored.

Proposed new N.J.A.C. 7:26D-2.2(a)3 provides that the ground water remediation standards for Class III-A and Class III-B ground water are the ground water quality criteria developed pursuant to N.J.A.C. 7:9C-1.7(e) and (f). The ground water quality criteria for Class III ground water are determined on a case-by-case basis to ensure that that there is no significant migration of ground water pollution to adjacent to ground waters that are not Class III. In addition, the criteria for Class III shall ensure that there will be no impairment of the existing uses of ground water, resulting in violation of the Surface Water Quality Standards and release of pollutants to the ground surface, structures or air in concentrations that pose a threat to human health.

The Department proposes to relocate existing N.J.A.C. 7:26E-1.13(b)2 at proposed new N.J.A.C. 7:26D-2.2(a)4 with minor changes to the text. These provisions set forth the minimum narrative ground water remediation standards for all classes of ground water and include general ground water quality policies, N.J.A.C. 7:9C-1.2, narrative ground water quality criteria, N.J.A.C. 7:9C-1.7, the ground water quality antidegradation policy, N.J.A.C. 7:9C-1.8, and the remediation requirements of the Technical Rules, N.J.A.C. 7:26E. Additional narrative ground water remediation standards include the removal, treatment, or containment of free and residual product, N.J.A.C. 7:26E-6.1(d); no migration of contaminants to the ground surface, structures or air in concentrations that pose a threat to human health; and a set of narrative criteria for selecting an appropriate ground water remedial action based on site-specific use and conditions. The Department proposes to replace the word "release" at N.J.A.C. 7:26D-2.2(a)4iv with the word "migration" because the word migration more accurately reflects the transport mechanism for the movement of contamination from one environmental medium to another.

The Department proposes to relocate N.J.A.C. 7:26E-1.13(d) as new N.J.A.C. 7:26D-2.2(b). This provision states that the Department will not approve an alternative ground water remediation standard that is based on a site-specific risk assessment. Although the Legislature offered a procedure to establish an alternative numeric remediation standard for soil based upon

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a site-specific risk assessment at N.J.S.A. 58:10B-12(f), the Legislature did not extend that procedure to ground water or surface water remediation standards. The use of site-specific risk assessments to develop alternative remediation standards for ground water and surface water would be inconsistent with the regulatory water classification systems already in place throughout the State. The Department has determined that allowing the development of alternative ground water or surface water remediation standards would not be consistent with either New Jersey's statutory or regulatory framework for protecting and remediating contaminated waters, or New Jersey's water supply management policies and principles.

N.J.A.C. 7:26D-3 Minimum Surface Water Remediation Standards

Proposed new Subchapter 3 sets forth the minimum standards to be used for surface water remediation at contaminated sites. The Department proposes to recodify the surface water remediation standards from the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.13(e) to proposed new N.J.A.C. 7:26D-3.2 with one significant change. The Department is not including the reference to the Federal Surface Water Criteria currently codified at N.J.A.C. 7:26E-1.13(e)1. The Federal Interim Final Rule, 60 CFR 22229 (May 4, 1995) and the National Toxics rule, 60 CFR 44120 (August 24, 1995) are collectively known as the National Toxics Rule (NTR). The Department adopted numerical criteria for toxics identified in the NTR applicable to New Jersey as the toxics criteria for New Jersey. See 37 N.J.R. 3487(a) (September 18, 2005) for the proposal, and 38 N.J.R. 4449(a) (October 16, 2006) for the adoption. Accordingly, the reference to the Federal Surface Water Criteria is redundant.

Proposed new N.J.A.C. 7:26D-3.1, Purpose, states that the purpose of Subchapter 3 is to establish minimum standards to be used for the remediation of surface water at contaminated sites.

At proposed new N.J.A.C. 7:26D-3.2, Minimum surface water remediation standards, the Department proposes to relocate N.J.A.C. 7:26E-1.13(e)1. This section establishes that the minimum surface water remediation standards are the numeric New Jersey Surface Water Quality Standards, N.J.A.C. 7:9B-1.14(c) and (d) and the narrative surface water remediation standards to be codified at proposed new N.J.A.C. 7:26D-3.2(a)2.

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The Department proposes to relocate existing N.J.A.C. 7:26E-1.13(e)2 at proposed new N.J.A.C. 7:26D-3.2(a)2. This paragraph establishes narrative surface water remediation standards. Narrative surface water remediation standards are the general and narrative surface water quality policies and criteria included in N.J.A.C. 7:9B-1.5 and 1.14. Narrative standards also are the remediation requirements of the Technical Rules, N.J.A.C. 7:26E-1 through 8, and the removal, treatment or containment of free and residual product, N.J.A.C. 7:26E-6.1(d). N.J.A.C. 7:26D-3.2(a)2v provides narrative criteria that may be used for selecting an appropriate surface water remedial action that includes, but is not limited to, the location of the site and the present and projected use of the surface water.

The Department proposes to relocate N.J.A.C. 7:26E-1.13(f) at proposed new N.J.A.C. 7:26D-3.2(b). This provision states that the Department will not allow the use of a site specific risk assessment to develop an alternative surface water remediation standard. This rule provision parallels N.J.A.C. 7:26D-2.2(b) for ground water. See the discussion regarding site specific risk assessment for alternative ground water remediation standards above.

N.J.A.C. 7:26D-4 Minimum Soil Remediation Standards

Proposed new Subchapter 4 sets forth the minimum standards to be used for soil remediation at contaminated sites. As previously mentioned, the Brownfield Act at N.J.S.A. 58:10B-12.c(1) sets forth guidelines for the Department to follow in developing health-based remediation standards for soil, such as distinguishing between residential and non-residential soil remediation standards to reflect the current use of the property.

The Brownfield Act at N.J.S.A. 58:10B-12c(1) requires the Department to "develop residential and nonresidential soil remediation standards that are protective of human health and the environment" and "for contaminants that are mobile and transportable to ground water or surface water, the residential and nonresidential soil remediation standards shall be protective of ground water and surface water." Accordingly, proposed new N.J.A.C. 7:26D-4.1, Purpose, provides that the purpose of the subchapter is to establish residential direct contact soil

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remediation standards, non-residential direct contact soil remediation standards and impact to ground water soil remediation standards.

The Brownfield Act at N.J.S.A. 58:10B-12c(1) further requires that residential soil remediation standards be set at "levels or concentrations of contamination for real property based upon the use of that property for residential or similar uses and which will allow the unrestricted use of that property without the need of engineering devices or any institutional controls" and without exceeding a health risk standard for carcinogens that "will result in an additional cancer risk of one in one million," and for noncarcinogens, that "will limit the Hazard Index for any given effect to a value not exceeding one." Accordingly, proposed new N.J.A.C. 7:26D-4.2, Residential direct contact soil remediation standards, establishes soil remediation standards that are appropriate for residential site use for the direct contact pathways. The residential direct contact soil remediation standards are listed in Appendix 1 Table 1A. As explained in proposed new N.J.A.C. 7:26D-4.2(a), the Department developed the residential direct contact human health-based criteria based on the equations, data sources, and conventions provided in Appendices 2 and 3 of these rules.

Proposed new N.J.A.C. 7:26D-4.2(b) establishes that for the contaminants listed in Table 1A, the residential direct contact remediation standard is the more stringent of either the ingestion dermal human health-based criterion or the inhalation human health-based criterion as applicable, or the PQL for that chemical if the PQL is less stringent than the corresponding ingestion-dermal or the inhalation human health based criterion. The Department defaults to the PQL so that compliance with the numeric standard can be reliably measured using commonly used certified laboratory methods.

The residential direct contact soil remediation standards in Appendix 1, Table 1A are based on the human health criteria for the ingestion-dermal and the inhalation pathways that are protective of human exposure based on residential exposure scenarios. The residential exposure scenario is based on the following USEPA calculations and assumptions: Risk Assessment Guidance for Superfund Human Health Evaluation Manual, Part B (RAGS HHEM, Part B; USEPA, 1991), Soil Screening Guidance: Technical Background Document (USEPA, 1996a),

and Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 2001). For more detailed information on the procedure used for the development of the residential direct contact soil remediation standards, see the ingestion-dermal and the inhalation basis and background documents.

The Brownfield Act at N.J.S.A. 58:10B-12.c(1) also mandates that the Department set non-residential soil remediation standards "at levels or concentrations of contaminants that recognize the lower likelihood of exposure to contamination on the property that will not be used for residential or similar uses, which will allow for the unrestricted use of that property for nonresidential purposes, and that can be met without the need of engineering controls." N.J.S.A. 58:10B-12(d) requires that soil standards established for non-residential use is the same as the health risk standards for residential uses described above. Accordingly, proposed new N.J.A.C. 7:26D-4.3, Non-residential direct contact soil remediation standards, establishes soil remediation standards for non-residential site use for the direct contact pathways. The non-residential exposure scenario is based on the same USEPA calculations and assumptions noted in the USEPA documents referenced above, for the outdoor worker. As provided in proposed new N.J.A.C. 7:26D-4.3(a), the Department developed the non-residential direct contact human health-based criteria based on the equations, data sources, and conventions provided in Appendices 2 and 3 of these new rules.

Proposed new N.J.A.C. 7:26D-4.3(a) explains that non-residential direct contact remediation standards, listed in Appendix 1, Table 1B, were developed by the Department for the ingestion-dermal exposure pathway and the inhalation exposure pathway. The health-based criteria for the ingestion-dermal exposure pathway are based on the equations, data sources and conventions provided in Appendix 2 of these rules. The health-based criteria for the inhalation exposure pathway are based on the equations, data sources and conventions provided in Appendix 3 of these rules.

Proposed new N.J.A.C. 7:26D-4.3(b) establishes that, for the contaminants listed in Appendix 1, Table 1B, the non-residential direct contact remediation standard is the more stringent of either the ingestion dermal human health-based criterion or the inhalation human

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health-based criterion as applicable, or the PQL for that chemical if the PQL is less stringent than either the ingestion-dermal or the inhalation human health based criterion. The Department defaults to the PQL so that compliance with the numeric standard can be reliably measured using commonly used certified laboratory methods.

Proposed new N.J.A.C. 7:26D-4.4, Impact to ground water soil remediation standards, establishes soil remediation standards for the impact to ground water pathway, which are listed in Appendix 1 Tables 2A, 2B and 2C. These soil remediation standards are protective of the ground water remediation standards for Class II ground water as defined in the Ground Water Quality Standards at N.J.A.C. 7:9C. These standards apply to sites that are being remediated for residential and non-residential use.

As explained in proposed new N.J.A.C. 7:26D-4.4(a), soil criteria for the impact to ground water pathway were developed based on the equations, data sources, and conventions provided in Appendix 4. The Department has developed impact to ground water soil remediation standards in two different ways based on whether the contaminant is likely to leach into ground water. Impact to ground water standards developed for mobile contaminants that are likely to be transported from soil to ground water are listed in Appendix 1, Table 2A. The impact to ground water remediation standards for mobile contaminants are directly measured as the concentrations of contaminants in soil and are compared to the impact to ground water soil remediation standards listed in Table 2A. This group of contaminants includes volatile organic chemicals that are very likely to impact ground water.

Impact to ground water standards developed for less mobile contaminants, which are less likely to be transported from soil to ground water, are listed as leachate standards in Appendix 1, Tables 2B and 2C. Compliance with these standards will require the person responsible for conducting the remediation to conduct a synthetic precipitate leaching procedure (SPLP) on contaminated soils from the site. The leachate must be analyzed for the contaminants of concern. The concentrations measured in the leachate are then compared to the impact to ground water leachate remediation standards listed in Table 2A. The SPLP leaching procedure is a

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direct measure of the ability of a contaminant to leach from the soil and migrate to the ground water.

N.J.A.C. 7:26D-4.4(b) establishes that for the contaminants listed in Tables 2A, 2B and 2C, the impact to ground water soil remediation standard is the health-based criterion unless the PQL listed in Tables 2A, 2B and 2C is less stringent. If the PQL is less stringent than the health-based criterion, the impact to ground water soil remediation standard is set at the PQL. The Department defaults to the PQL so that compliance with numeric standards can be reliably measured using commonly used certified laboratory methods.

N.J.A.C. 7:26D-5 Interim Soil Remediation Standards

As described at proposed new N.J.A.C. 7:26D-5.1, Purpose, proposed new Subchapter 5 sets forth the procedures that the Department proposes to use to develop interim remediation standards for soil.

Proposed new N.J.A.C. 7:26D-5.2, Development of an interim soil remediation standard, establishes the methods and circumstances under which the Department may develop an interim standard for soil.

Proposed new N.J.A.C. 7:26D-5.2(a) provides that the Department may establish an interim soil remediation standard for any contaminant that is not listed in Appendix 1, Tables 1A, 1B, 2A, 2B or 2C of this chapter.

Proposed new N.J.A.C. 7:26D-5.2(b) sets forth the Department's procedures for developing interim soil remediation standards. Interim soil remediation standards will be developed using the criteria development procedures set forth in Appendices 2 through 4 of these rules as applicable. Additionally, the person responsible for conducting the remediation may request that the Department develop an interim remediation standard pursuant to N.J.A.C. 7:26D-5.2(c).

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Proposed new N.J.A.C. 7:26D-5.3, Publication of interim soil remediation standards; promulgation, provides that the Department will publish interim remediation standards on the Department's web site, along with the technical basis that is used for their derivation. The technical basis will focus on the human health risk assessment for the contaminant and include information on the toxicity data and the risk assessment approach used. Interim soil remediation standards are to be replaced with duly promulgated remediation standards as soon as reasonably possible.

N.J.A.C. 7:26D-6 Updating Soil Remediation Standards

Proposed new Subchapter 6 sets forth the procedures that the Department proposes to use to update remediation standards for soil under certain circumstances. N.J.A.C. 7:26D-6.1, Purpose, establishes the purpose of this subchapter.

Proposed new N.J.A.C. 7:26D-6.2, Notice of administrative change process, describes the process that the Department will use to update a soil remediation standard. The Department will publish a notice of administrative change in the New Jersey Register to update a soil remediation standard for any contaminant subsequent to the effective date of these rules under the two circumstances described in proposed new N.J.A.C. 7:26D-6.2(a). The first circumstance occurs when the Department updates a soil remediation standard as a result of a change in the carcinogenic slope factor or reference dose data contained in the EPA's Integrated Risk Information System (IRIS) database on which the promulgated soil remediation standard is based. The second circumstance occurs when the Department updates an impact to ground water soil remediation standard as a result of the promulgation of a new Ground Water Quality Standard under N.J.A.C. 7:9C.

USEPA's revisions to IRIS are subject to a comprehensive internal and external peer review process prior to their inclusion in the database. This process consists of: (1) an annual announcement in the Federal Register of USEPA's IRIS agenda and a call for scientific information from the public on the selected chemical substances; (2) a search of the current scientific literature; (3) development of health assessments and draft IRIS summaries; (4) peer review of the health assessments and draft IRIS summaries within USEPA; (5) peer review of

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the health assessments and draft IRIS summaries outside USEPA; (6) USEPA consensus review and management approval; (7) preparation of final IRIS summaries and supporting documents; and (8) entry of summaries and supporting documents into the IRIS database.

The public may obtain information regarding the IRIS database from several sources. First, as previously mentioned, USEPA maintains an IRIS web site at http://www.epa.gov/iris. Second, the National Center for Environmental Assessment, the IRIS Hotline that fields questions regarding the IRIS database. Webmaster and Hotline contact information are provided on the IRIS web site. Third, the central IRIS file and public reading room, located at the IRIS Hotline contractor facility, serves as the repository for the peer review record for the assessment of each chemical in the IRIS database, the summary of the consensus review, the final consensus memorandum, copies of key references (documenting "principal studies" used in the assessment), any difficult-to-find reference material including unpublished studies, USEPA reports, and foreign translations, and any public submissions pertinent to the assessment.

The soil remediation standards for the impact to ground water pathway are to be updated when the Ground Water Quality Standards are revised because the impact to ground water soil remediation standards are developed to be protective of ground water and are back-calculated from the Ground Water Quality Standards. Therefore, when the Department adopts a change in a numeric ground water quality standard the impact to ground water soil remediation standard must also be updated.

The Department is not proposing to include provisions in this rule to update ground water remediation standards via the notice of administrative change process. The Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c)5 permit the Department to update the ground water quality standards via a notice of administrative change. As the ground water remediation standards are the ground water quality standards pursuant to N.J.A.C. 7:26D-2.2(a), there is no need to include a notice of administrative change for ground water remediation standards.

Proposed new N.J.A.C. 7:26D-6.2(b) establishes the content of the notice of administrative change for updated soil remediation standards. the department will identify in the

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notice the contaminant that is being updated, the basis for the change, and the revised criterion that will be listed in Tables 1A, 1B, 2A, 2B or 2C. Proposed new N.J.A.C. 7:26D-6.2(c) states that the Department will make the notice of administrative change available to the public on its web site.

N.J.A.C. 7:26D-7 Alternative Soil Remediation Standards

The Brownfield Act at N.J.S.A. 58:10B-12(f)1 provides that a person responsible for conducting soil remediation may submit an application to the Department for the development of an alternative remediation standard. Alternative remediation standards for soil may be developed for residential use or non-residential use or for the impact to ground water pathway. A person performing a remediation of contaminated real property, in lieu of using the promulgated minimum numeric soil remediation standard for either residential use or non-residential use, may submit a request to use an alternative numeric residential use or non-residential use soil remediation standard. The person responsible for conducting the remediation is required to use appropriate institutional controls when non-residential remediation standards are applied at a site pursuant to N.J.A.C. 7:26E-8.

Additionally, the Department may, of its own initiative, develop an alternative numeric soil remediation standard for a particular contaminant for a specific real property site, in lieu of using the promulgated minimum residential use or non-residential use soil remediation standard. The Brownfield Act at N.J.S.A. 58:10B-12.f.(2) provides that the Department may require the use of an alternative numeric soil remediation standard when it determines, based on the weight of the scientific evidence, that the use of the adopted residential use or non-residential use soil remediation standards would not be protective, or would be unnecessarily overprotective, of public health or safety or of the environment, as appropriate.

Accordingly, the Department proposes new Subchapter 7 to implement N.J.S.A. 58:10B-12(f)1 and 2 concerning the circumstances under which the Department or the person responsible for conducting the remediation may develop an alternative remediation standard. Proposed new N.J.A.C. 7:26D-7.1, Purpose, sets forth the purpose of the subchapter. Proposed new N.J.A.C.

7:26D-7.2, Applicability, states that an alternative numeric soil remediation standard may be used only at the site for which it is approved and is not applicable at any other site.

Proposed new N.J.A.C. 7:26D-7.3, Basis for an alternative soil remediation standard, describes the circumstances under which alternative soil remediation standards may be established as mandated by the Brownfield Act and described above.

Proposed new N.J.A.C. 7:26D-7.3(a) describes the procedures a person responsible for conducting the remediation must follow when applying for an alternative soil remediation standard for each listed exposure pathway.

Proposed new N.J.A.C. 7:26D-7.3(b) describes some of the bases for a request for an alternative soil remediation standard.

Proposed new N.J.A.C. 7:26D-7.3(c) establishes the circumstances under which the Department may require the person responsible for conducting the remediation to develop an alternative soil remediation standard that is more stringent than the minimum standards provided in this chapter when the Department determines that a more stringent standard is necessary to protect human health. The Brownfield Act enables the Department to require the more stringent standard based upon the number or magnitude of the discharges being investigated, the nature of the substance(s) discharged, the distance to and sensitivity of exposed populations and any other site-specific conditions the Department identifies which necessitate the need for an alternative numeric soil remediation standard.

Proposed new N.J.A.C. 7:26D-7.4, Alternative soil remediation standards application and approval process, contains the procedural requirements concerning the application for and Department approval of a request for an alternative soil remediation standard.

Proposed new N.J.A.C. 7:26D-7.4(a) requires the person responsible for conducting the remediation who is seeking Department approval of an alternative soil remediation standard to

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complete an application, which is to be codified at proposed new Appendix 8, and submit it to the Department.

Proposed new N.J.A.C. 7:26D-7.4(b) requires the person responsible for conducting the remediation to submit the application for the alternative soil remediation standard as part of an oversight document as described in the Department Oversight of the Remediation of Contaminated Sites Rule, N.J.A.C. 7:26C. An oversight document is an agreement between the Department and the person responsible for conducting the remediation, wherein the Department agrees to review a submittal, such as an application for an alternative soil remediation standard, and the person agrees to pay the Department's costs to review the submittal. The Department is requiring that applications for an alternative soil remediation standard are submitted under an oversight document to ensure that it receives payment for the cost to review the application.

Proposed new N.J.A.C. 7:26D-7.4(c) states that the person responsible for conducting the remediation shall submit the application for the alternative remediation standard to the Department.

Proposed new N.J.A.C. 7:26D-7.4(d) describes the process for the Department's review and approval or denial of the alternative soil remediation standard application. The process includes the provision that the person responsible for conducting the remediation may not remediate soil to an alternative numeric standard at a site until the Department approves the alternative numeric standard in writing. This provision ensures that an alternative numeric remediation standard will not be used at a site until the Department determines that the standard is protective of human health.

Appendix 8 contains the application that the person responsible for conducting the remediation of a contaminated site shall use to apply for an alternative soil remediation standard. The application requires submittal of information that the Department uses in the determination of whether the proposed alternative soil remediation standard is protective of human health. The required information includes the name and the chemical abstract services registry number of the contaminant for which alternative numeric remediation standard is being sought; the exposure

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pathway for which the alternative numeric remediation standard is being sought; and the proposed numeric alternative numeric remediation standard. The person responsible for conducting the remediation must submit documentation to support the proposed alternative soil remediation standard. Documentation may include, but is not limited to, new chemical toxicity data, new risk assessment methodology or models, alternative land use planned for the site, or site specific conditions that support the modification of input parameters for models used to develop remediation standards pursuant to Appendices 5 through 7.

Technical Rules

In addition to the new rules proposed at N.J.A.C. 7:26D, the Department is proposing to amend the Technical Rules at N.J.A.C. 7:26E-1.3, Applicability, to add a new subsection (d) that requires the person responsible for conducting the remediation of a contaminated site to remediate the site in full compliance with the Remediation Standards in N.J.A.C. 7:26D. The exception to this requirement is proposed at N.J.A.C. 7:26D-1.3(d)2. A person may conduct the remediation of the site pursuant to the Department's cleanup criteria in effect prior to the effective date of N.J.A.C. 7:26D if the person submitted a remedial action workplan to the Department prior to the effective date plus six months, and the submitted remedial action workplan is prepared pursuant to N.J.A.C. 7:26E-6. In this case, the person may apply the numeric cleanup criteria that were applicable prior to the effective date unless the promulgated remediation standard in N.J.A.C. 7:26D is lower, by an order of magnitude or more, than the cleanup criteria applicable prior to the effective date of N.J.A.C. 7:26D plus six months.

The Department is proposing to repeal N.J.A.C. 7:26E-1.13, Minimum ground water and surface water remediation standards and relocate those requirements with amendments as described above, at N.J.A.C. 7:26D-2 and 3, so that the Department's remediation standards are codified in one chapter.

Social Impact

The remediation of contaminated sites and the resulting protection of human health and the environment has wide ranging social benefits. The proposed new rules are the Department's

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standards for remediating contamination at sites throughout the State. These rules provide predictable, consistent and flexible remediation goals to responsible parties, volunteers and developers, and to the Department for the investigation and remediation of contaminated sites. These rules ensure that the remediation of contaminated sites is protective of human health. With the adoption of the soil remediation standards, the Department will improve the process of remediating sites by making remediation requirements as complete, clear and flexible as possible.

Those affected by these rules include anyone who discharged hazardous substances and is responsible for the remediation of the discharge, whether they are doing so under the Department's oversight or they are conducting a self-directed remediation, or any person conducting remediation of a contaminated site.

The only social impact that the recolocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have is to provide a centralized location for all of the remediation standards, thereby making these standards more accessible and easier to understand.

Economic Impact

The proposed remediation standards will have an economic impact primarily on persons responsible for conducting remediation of contaminated sites. The level of impact will vary depending upon the type and complexity of contamination that a person is remediating.

The proposed new soil remediation standards will provide the regulated community with the means to calculate new standards as science changes over time. Currently, the Department uses guidance in the form of the soil cleanup criteria to determine the soil remediation standard at a site, on a case-by-case basis. The promulgation of soil remediation standards will provide the regulated community with uniform standards to which any site must be remediated in order to be protective of human health. These proposed rules will continue to encourage parties to come forward and remediate sites voluntarily using private funds, but the fact that the standards

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are uniform (as opposed to being calculated on a site-by-site basis) should help persons responsible for remediation more accurately anticipate and plan for their costs associated with remediation projects. This will have a positive economic impact on the State as a whole.

It is difficult to assign a specific dollar value to the economic impact of the proposed new soil remediation standards due to the variety in the complexity of contaminated sites throughout the state, including such factors as historical use of the site and the selected remedy. The Department estimates that the cost of a simple site investigation may range from $1,000 to $18,000 as a result of the new standard depending on the number of areas of concern at the site and the nature of the contamination. At a more complex site (one at which there are twenty or more areas of concern) the cost of a site investigation may range from $20,000 to $3,500,000. The costs for a remedial investigation range from $17,000 to $40,000 at a site with one to three areas of concern to $170,000 to $500,000 at more complex sites. However, as a general rule, when the Department adopts a standard that is more stringent than an existing soil cleanup criterion, it may cost the person responsible for conducting the remediation more to investigate and remediate a contaminated site. Conversely, if the Department adopts a standard that is less stringent than an existing soil cleanup criterion, it will likely cost less to complete delineation and remediation.

A comparison of the proposed residential direct contact soil remediation standards to the residential soil cleanup criteria shows that Department is proposing less stringent standards for 44 contaminants, more stringent standards for 51 contaminants and proposes standards for eight contaminants at the same level as the corresponding cleanup criteria. A comparison of the proposed non-residential direct contact soil remediation standards to the non-residential soil cleanup criteria shows that Department is proposing less stringent standards for 45 contaminants. more stringent standards for 55 contaminants and proposes a standard for one contaminant at the same level as the corresponding cleanup criterion.

An example of a more stringent proposed standard is benzo(a)pyrene. Benzo(a)pyrene is a polycyclic aromatic hydrocarbon (PAH) that is very commonly found in the environment since it is formed as a result of incomplete combustion of organic materials. Currently, the residential

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soil cleanup criterion for benzo(a)pyrene is 0.66 mg/kg. The proposed residential soil remediation standard is 0.2 mg/kg. Although the proposed standard is more stringent than the soil cleanup criteria for this contaminant, it is unlikely that the cost to remediate to the more stringent standard will be greater because the difference between the new standard and the current criterion is quite small. However, because the standard is more stringent it is likely that the standard will be exceeded more often, and therefore remediation will be required at more sites.

Another example of a more stringent proposed standard is 4-chloroaniline. This chemical is used as an intermediate in the production of number of products, including agricultural chemicals, azo dyes and pigments. Currently, the residential soil cleanup criterion for 4-chloroaniline is 230 mg/kg. The proposed residential soil remediation standard is nine mg/kg. The proposed standard is significantly more stringent and it is possible that the cost to remediate a contaminated site to the more stringent standard would be considerably greater because of additional delineation and remedial action costs. However, the Department anticipates that the overall impact of the change to the more stringent standard will be small because 4-chloroaniline is not frequently detected at contaminated sites in the State.

In addition, the economic impact of the proposed soil remediation standards will vary depending on whether the person responsible for conducting the remediation elects to apply for an alternative numeric remediation standard pursuant to proposed N.J.A.C. 7:26D-7.

Alternative Numeric Soil Remediation Standards

The costs associated with the development of an alternative soil remediation standard (ARS) generally involve the collection of additional site specific data, the calculation of a standard through the use of formulas or more complex computer modeling, the preparation of reports and the payment of the Department's oversight costs associated with the review of the reports. The Department anticipates that the cost of obtaining an ARS will vary widely depending on the level of complexity of the ARS option. An example of a simple ARS option (such as Option I in Appendix 7) would be the development of an ARS based on site specific soil

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pH, which could cost as little as $100.00. The cost of measuring soil pH as part of the collection of samples and the chemical analysis is minimal and would cost only a few dollars per sample. A site specific distribution coefficient is developed using the site specific pH to generate an ARS using the soil-water partitioning equation. The Department plans to provide on its web site, free of charge, a spread sheet that will enable parties to calculate an ARS in this manner.

Option IV in Appendix 7, Development of an ARS using Vadose Zone and Ground Water Modeling (SESOIL/AT123D), is a more complex and intensive approach to develop a site specific ARS for the impact to ground water pathway, which could cost from $2,000 to $5,000 to complete. However, much of the information required to complete this ARS option is already required by existing Technical Rule provisions, such as the requirements to determine ground water flow velocity and direction, and the complete vertical and horizontal delineation of ground water contamination. These requirements can be costly and time consuming but should not require additional expenditures since they are existing provisions that form some of the most basic remediation requirements. The person responsible for conducting the remediation will need to collect and use additional site specific parameters such as soil texture and soil organic carbon content. Additional costs per sample could range from $25.00 to $100.00 per sample for these additional analyses. The site specific measurements are entered into the SESOIL model to generate the site specific source input data for the AT123D model. In addition to owning a copy of the software, a person trained to run the SESOIL and AT123D models is needed. Additional costs will be incurred in the preparation of a report for submittal to the Department. However, the Department anticipates that the cost of developing an alternative numeric remediation standard could be minimal compared to the cost of a remediation conducted to a lower alternative numeric remediation standard.

Impact to ground water leachate criteria

The Department is proposing new standards for certain contaminants for the impact to ground water pathway. The standards for low mobility and inorganic contaminants will be based on leachate criteria. The person conducting the remediation will be required to use additional testing procedures to determine compliance with impact to ground water standards provided in Appendix 1, Tables 2B and 2C. In addition to directly analyzing the concentration of a

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contaminant in soil to determine compliance with the direct contact standards, the synthetic precipitation leaching procedure (SPLP) is conducted on an additional soil sample. The resulting leachate is then analyzed for low mobility and inorganic contaminants of concern at the site. The concentration measured in the leachate is then compared with the leachate standards provided in Tables 2B and 2C.

The cost of a SPLP test is approximately $100.00, and the analysis for the contaminants of concern will vary from $60.00 to $500.00 per sample, based on the number and types of contaminants present. The Department believes that the additional cost associated with the leaching step and the additional analysis is warranted. The Department is proposing this new approach to determine the impact to ground water from certain contaminates in soil because it is the quickest and most accurate way to ensure the protection of ground water from contaminated sites. This approach provides a direct measure of the ability for a contaminant to leach from soil to the ground water.

The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no economic impact as these are not new remediation standards.

Environmental Impact

The proposed rules will have a positive environmental impact by providing the regulated community with predictable and consistent minimum standards for the remediation of contaminated sites. The latest toxicological information and methodologies are used to develop the proposed remediation standards. The resulting standards meet the human health criteria set by the Legislature at one-in-one-million additional cancer risk for carcinogens and a hazard quotient of 1 for non-carcinogens.

The proposed standards are designed to be protective of human health. Consistent with EPA, the Department is proposing to include consideration of dermal exposure as part of the ingestion exposure pathway. The Department makes the assumption that people can be exposed

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to contamination through the ingestion of contaminated soil and through the absorption of contamination through the skin during any hand to mouth activity. In addition, remediation standards are protective of people who may be exposed through the inhalation of contamination. As such, the remediation standards provide protection of human health via direct contact exposure to contaminants in soil.

The impact to ground water standards are derived from updated contaminant fate and transport modeling and will be protective of Class II ground water. The standards proposed for the impact to ground water pathway are improved over the draft soil cleanup criteria that are currently being used.

The Department is proposing several different methods that may be used for the development of site specific alternative soil remediation standards. These methods will allow for the development of standards that are designed to be protective of human health and safety, and ground water when applied at a specific site. Standards developed using site specific conditions and input parameters will protect ground water at that particular site. With the ability to develop alternative remediation standards, the Department has provided a person conducting remediation with needed flexibility and clear remediation goals for the impact to ground water pathway.

The remediation standards being proposed will have a positive environmental benefit. Applying these standards to the remediation of contaminated sites will ensure that New Jersey's soils and extensive ground water resources are protected from further contamination. Protection of these resources is important to ensure high quality ground water for commercial, domestic, industrial and environmental uses.

The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no environmental impact as these are not new remediation standards.

Federal Standards Analysis

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Executive Order No. 27 (1994) and N.J.S.A. 52:14B-1 et seq. require State agencies which adopt, readopt or amend State regulations that exceed any Federal standards, or requirements to include a Federal Standards Analysis in the rulemaking document.

The Remediation Standards, N.J.A.C. 7:26D, are proposed under the authority of the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq., the Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq., and the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq. These State statutes all refer to or incorporate Federal law, Federal standards or Federal requirements. Thus, in accordance with N.J.S.A. 52:14B-22 through 24 and Executive Order No. 27, the Department compared the proposed rules to the Federal rules and associated guidance documents issued pursuant to the following Federal laws: the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) 42 U.S.C.§§ 9601 et seq., the Resource Conservation and Recovery Act (RCRA) of 1980; 42 U.S.C. § 6901, 42 U.S.C. §§ 6991 et seq. and the Federal Safe Drinking Water regulations 40 U.S.C. § 141, 142 and 143.

The soil remediation standards are not promulgated under the authority of, or in order to implement, comply with, or participate in any program established under Federal law. However, the Department compared the proposed soil remediation standards with the contaminants on EPA's list of Soil Screening Levels (SSL) (Draft Final, March 2001). The USEPA has not promulgated soil standards but has developed Soil Screening Levels under the CERCLA program, which are provided as guidance. The list of contaminants for which the Department is proposing to adopt remediation standards and the Federal list of generic SSLs are not the same. The Department is proposing remediation standards for 136 contaminants as compared with the SSL list which contains 108 contaminants. The Department included additional contaminants on the list because these contaminants are found at sites in New Jersey and thus require remediation standards. Similarly, USEPA has SSLs for contaminants for which the Department is not proposing remediation standards at this time.

Ingestion-Dermal Exposure Pathway

For the residential ingestion-dermal pathway, the Department compared the residential soil remediation standards (Appendix 1, Table 1A) with the EPA's SSLs for the residential exposure scenario. For the non-residential ingestion-dermal pathway, the Department compared the non-residential soil remediation standards (Appendix 1, Table 1B) with the EPA's SSLs for the commercial/industrial scenario, for the outdoor worker receptor. The Department determined that the majority of the proposed residential and non-residential soil remediation standards are the same or are less stringent than the USEPA soil screening levels. The Department is proposing remediation standards for 19 contaminants that are more stringent than EPA's soil screening levels for the ingestion dermal exposure pathway. These contaminants are as follows:

Benzene	1,1-Dichloroethane	Thallium
Beryllium	1,2-Dichloroethane	Toluene
Butyl benzyl phthalate	1,1-Dichloroethene	1,2,4-Trichlorobenzene
Chlordane	1,2-Dichloroethene	2,4,6-Trichlorophenol
Chlorobenzene	Methylene chloride	Vanadium
1,2-Dichlorobenzene	2-Methylphenol	Xylenes

There are two primary reasons that the Department's proposed remediation standards could be more stringent then EPA's SSLs. First, the Department determined by policy to prioritize the toxicity information which forms the basis for drinking water standards adopted by the Department pursuant to the Safe Drinking Water Act (SDWA) which is in some cases different than the toxicity information used to develop the SSLs. Second, some of the proposed standards are more stringent due to the implementation of the Department's Group C carcinogen policy. The use of SDWA toxicity data and the Department's Group C carcinogen policy are discussed in further detail above.

For example, the proposed ingestion-dermal remediation standard for beryllium for the residential exposure scenario is 16 mg/kg as compared with the USEPA SSL of 160 mg/kg. The Department's proposed non-residential standard for beryllium is 230 mg/kg as compared to EPA's SSL of 2,300 mg/kg. The more stringent proposed standard is the result of the application of the Department's Group C carcinogen policy. Because beryllium is a Group C carcinogen, the Department applied a safety factor of 10 which results in a remediation standard that is an order of magnitude more stringent than the USEPA SSL.

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The Department's proposed residential ingestion-dermal soil remediation standard for benzene of three mg/kg for the ingestion-dermal exposure pathway, as compared to EPA's SSL for benzene which is 12 mg/kg. The Department's proposed non-residential standard for benzene is 14 mg/kg as compared to EPA's SSL of 58 mg/kg. The Department's standard for benzene is more stringent than EPA's SSL because the toxicity factor used to develop the remediation standard is based on the toxicity factor that the Department uses to develop drinking water maximum contaminant levels (MCL), which is more stringent than the slope factor provided by IRIS which USEPA used. The cost-benefit analysis provided at the end of the Federal Standards Analysis discusses the costs and benefits for the soil remediation standards in general, including the Ingestion-Dermal Exposure and the Inhalation Exposure Pathways and the Impact to Ground Water Pathway.

Inhalation Exposure Pathway

For the residential exposure scenario, the Department compared the residential inhalation soil remediation standards (Table 1A) to EPA's SSLs for the residential scenario. For the non-residential exposure scenario, the Department compared the non-residential inhalation soil remediation standards for sites that are less than two acres in size (Table 1B) to EPA's SSLs for the commercial/industrial scenario for the outdoor worker receptor. The Department determined that is was appropriate to use the standards developed for sites that are less than two acres in size for comparison because these standards are based solely on wind generation of dust as are the EPA's inhalation exposure pathway SSLs.

EPA's list of SSLs and the Department's list of proposed remediation standards are not identical. EPA's list contains contaminants that Department's list does not and the Department's list contains contaminants that EPA's list does not.

For 50 contaminants, the Department is proposing residential inhalation standards that are more stringent than EPA's SSLs. Of the 50, the Department is proposing standards for 44 contaminants for which EPA has no standards. Six of the Department's proposed standards are more stringent than EPA's SSLs.

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Contaminant	DEP Residential Inhalation Health Based Criterion	EPA Residential Inhalation SSLs
Acetophenone	2	NA
Acrolein	0.5	NA
Acrylonitrile	0.9	NA
Anthracene	380,000	NA
Antimony	36,000	NA
Benzidine	0.004	NA
Benzo(a)anthracene	38,000	NA
Benzo(a)pyrene	3,800	NA
Benzo(b)fluoranthene	38,000	NA
Benzo(ghi)perylene	380,000	NA
Benzo(k)fluoranthene	38,000	NA
Bis(2-chloroisopropyl)ether	23	NA
Bromodichloromethane	1	NA
Bromomethane	25	NA
Cadmium	1,000	1,800
Carbazole	740,000	NA
4-Chloroaniline	26	NA
Chloroform	0.6	NA
Chloromethane	4	NA
2-Chlorophenol	910	NA
Chrysene	380,000	NA
Cobalt	9,100	NA
4,4'-DDD	61,000	NA
4,4'-DDE	670	NA
4,4'-DDT	44,000	NA
Dibenz(a,h)anthracene	3,500	NA
Dibromochloromethane	3	NA
1,2-Dibromo-3-chloropropane	0.08	NA
1,2-Dibromoethane	0.1	NA
1,4-Dichlorobenzene	5	NA
3,3'-Dichlorobenzidine	3	NA
Dichlorodifluoromethane	490	NA
1,1-Dichloroethane	8	1,200
1,2-Dichloroethene	230	NA
1,2-Dichloroethene	300	NA
1,2-Dichloropropane	2	15
4,6-Dinitro-2-methylphenol	730,000	NA
2,4-Dinitrotoluene	6	NA
2,6-Dinitrotoluene	2	NA
1,2-Diphenylhydrazine	5	NA
Methyl tert-butyl ether	110	NA
Naphthalene	6	170

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2-Nitroaniline	39	NA
N-Nitrosodimethylamine	0.02	NA
N-Nitrosodi-n-propylamine	0.2	NA
Polychlorinated biphenyls	20	NA
Styrene	90	1,500
Tertiary butyl alcohol	4,800	NA
Thallium	360,000	NA
Toxaphene	70	87

NA = No Standard Developed

For 74 contaminants, the Department is proposing non-residential inhalation standards that are more stringent than EPA's SSLs. Of the 74, the Department is proposing standards for 65 contaminants for which EPA has no standards. Nine of the Department's proposed standards are more stringent than EPA's SSLs.

Contaminant	DEP Inhalation Health Based Criterion	EPA Inhalation SSLs
Acenaphthene	300,000	NA
Acenaphthylene	300,000	NA
Acetophenone	4	NA
Acrolein	1	NA
Acrylonitrile	2	NA
Anthracene	30,000	NA
Antimony	23,000	NA
Arsenic	76	1,400
Barium	59,000	1,000,000
Benzidine	0.01	NA
Benzo(a)anthracene	3,000	NA
Benzo(a)pyrene	300	NA
Benzo(b)fluoranthene	3,000	NA
Benzo(ghi)perylene	30,000	NA
Benzo(k)fluoranthene	3,000	NA
Beryllium	140	2,600
Bis(2-chloroisopropyl)ether	60	NA
Bis(2-ethylhexyl) phthalate	140,000	NA
Bromodichloromethane	3	NA
Bromomethane	53	NA
Cadmium	78	3,400
Carbazole	58,000	NA

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Contaminant	DEP Inhalation Health Based Criterion	EPA Inhalation SSLs
Chlordane	3,300	NA
4-Chloroaniline	66	NA
Chloroform	2	NA
Chloromethane	11	NA
2-Chlorophenol	2,000	NA
Chrysene	30,000	NA
Cobalt	590	NA
Copper	280,000	NA
4,4'-DDD	4,800	NA
4,4'-DDE	3,400	NA
4,4'-DDT	3,400	NA
Dibenz(a,h)anthracene	270	NA
Dibromochloromethane	7	NA
1,2-Dibromo-3-chloropropane	0.2	NA
1,2-Dibromoethane	0.3	NA
1,4-Dichlorobenzene (p-Dichlorobenzene)	12	NA
3,3'-Dichlorobenzidine	960	NA
1,1-Dichloroethane	21	1,700
1,2-Dichloroethane	2	NA
1,1-Dichloroethene	130	410
1,2-Dichloroethene	500	NA
1,2-Dichloroethene	650	NA
1,2-Dichloropropane	5	21
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	47,000	NA
2,4-Dinitrophenol	820,000	NA
2,4-Dinitrotoluene	15	NA
2,6-Dinitrotoluene	6	NA
1,2-Diphenylhydrazine	12	NA
Endrin	120,000	NA
Fluoranthene	300,000	NA
Fluorene	300,000	NA
beta-HCH (beta-BHC)	620	NA
Indeno(1,2,3-cd)pyrene	3,000	NA

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Contaminant	DEP Inhalation Health Based Criterion	EPA Inhalation SSLs
Lead	12,000	NA
Lindane	9	NA
Manganese	5,900	NA
2-Methylnaphthalene	250,000	NA
Methyl tert-butyl ether	290	NA
Naphthalene	16	240
2-Nitroaniline	83	NA
N-Nitrosodimethylamine	0.04	NA
N-Nitrosodi-n-propylamine	130,000	NA
N-Nitrosodiphenylamine	1,500	NA
Pentachlorophenol	300,000	NA
Phenanthrene	300,000	NA
Polychlorinated biphenyls	52	NA
Pyrene	300,000	NA
Styrene	230	1,500
Tertiary butyl alcohol	10,000	NA
Thallium	23,000	NA
Vanadium	470,000	NA
Zinc	110,000	NA

NA = No standard developed

The differences between the Department's proposed standards and USEPA SSLs are due, in part, to the use of sandy loam soil as the default soil type appropriate for New Jersey as compared with EPA's use of loam soil. The selection of sandy loam results in different soil input parameters including the values for soil texture, organic soil content and soil porosity. The Department also used local weather conditions in the calculations used to develop inhalation standards as opposed to weather conditions measured in the mid-west that were used by EPA.

The toxicity hierarchy used by the Department for the inhalation pathway is similar to the one used for the other exposure pathways except that the Department did have a preference for inhalation-based toxicity data as opposed to oral-based data. In several cases the Department

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chose to use a different toxicity source than EPA. Some of the proposed standards are more stringent due to the implementation of the Department's Group C carcinogen policy. The Department's Group C carcinogen policy is discussed in further detail above.

By way of example, the proposed residential inhalation standard for heptachlor epoxide is four mg/kg as compared with EPA's SSL of five mg/kg. The difference in the standard is due to the different soil parameters and weather conditions. The differences between the proposed residential standard for naphthalene is six mg/kg as compared with EPA's SSL of 170 mg/kg is due to both different soil parameters and the Department's Group C carcinogen policy.

Two of the Department's proposed standards, for 1,1-dichloropropane and styrene, are more stringent because the Department determined, based on a review of pertinent toxicological studies, that it is appropriate to consider these contaminants as carcinogens as compared with EPA's decision to use non-carcinogenic end points.

Impact to Ground Water

The Department compared the impact to ground water soil remediation standards provided in Table 2A for mobile contaminants to the USEPA SSLs developed with a dilution attenuation factor (DAF) of 20. No analysis was conducted for the less mobile and inorganic contaminants provided in Tables 2B and 2C because these standards are applicable for leachate resulting from the SPLP test and thus are not comparable to the USEPA soil numbers.

EPA has standards for 56 of those contaminants. Of the 56 the Department is proposing more stringent standards for 53 contaminants. Of the remaining three contaminants the standard for N-Nitrosodi-n-propylamine is the same and Pentachlorophenol and 1,1,2,-Tetrachloroethane are slightly less stringent. For the remaining 22 contaminants, the Department is proposing standards for which EPA has no standard; thus, for these contaminants, the Department is more stringent. The table below lists the contaminants for which the Department is more stringent than EPA.

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Contaminant	DEP Impact to Ground Water Soil Criterion	EPA Migration to Ground Water SSLs DAF = 20
Acenaphthene	74	570
Acetone	12	16
Acetophenone	2	NA
Acrolein	0.008	NA
Acrylonitrile	0.0001	NA
Atrazine	0.03	NA
Benzene	0.0008	2
Benzidine	0.0000006	NA
1,1'-Biphenyl	90	NA
Bis(2-chloroethyl)ether	0.00007	0.0004
Bis(2-chloroisopropyl)ether	3	NA
Bromodichloromethane	0.002	0.6
Bromoform	0.02	0.8
Bromomethane	0.03	0.2
2-Butanone	0.6	NA
Carbon disulfide	4	32
Carbon tetrachloride	0.003	0.07
4-Chloroaniline	0.1	0.7
Chlorobenzene	0.4	1
Chloroform	0.2	0.6
2-Chlorophenol	0.5	4
Dibromochloromethane	0.001	0.4
1,2-Dibromo-3-chloropropane	0.00008	NA
1,2-Dibromoethane	0.000001	NA
1,2-Dichlorobenzene	11	17
1,3-Dichlorobenzene	12	NA
1,4-Dichlorobenzene	1	2
3,3'-Dichlorobenzidine	0.002	0.007
Dichlorodifluoromethane	25	NA
1,1-Dichloroethane	0.2	23
1,2-Dichloroethane	0.0008	0.02
1,1-Dichloroethene	0.005	0.06
1,2-Dichloroethene	0.2	0.4
1,2-Dichloroethene	0.4	0.7
2,4-Dichlorophenol	0.1	1
1,2-Dichloropropane	0.002	0.03
1,3-Dichloropropene	0.002	0.004
Diethyl phthalate	57	470
2,4-Dimethyl phenol	0.7	9
2,4-Dinitrophenol	0.02	0.2
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	0.0002	0.0007
1,2-Diphenylhydrazine	0.0008	NA
Endosulfan I and Endosulfan II	2	18

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Contaminant	DEP Impact to Ground Water Soil Criterion	EPA Migration to Ground Water SSLs DAF = 20
Endosulfan sulfate	1	NA
Endrin	0.6	1
Ethyl benzene	8	13
Fluorene	110	560
alpha-HCH	0.0002	0.0005
beta-HCH	0.0007	0.003
Hexachloroethane	0.1	0.5
Isophorone	0.1	0.5
Lindane	0.0009	0.009
Methyl acetate	14	NA
2-Methylnaphthalene	5	NA
Methylene chloride	0.007	0.02
2-Methylnaphthalene	5	NA
Methyl tert-butyl ether	0.2	NA
Naphthalene	16	84
Nitrobenzene	0.01	0.1
N-Nitrosodimethylamine	0.000001	NA
N-Nitrosodiphenylamine	0.2	1
Pentachlorophenol	0.04	0.03
Phenol	5	100
Styrene	2	4
Tertiary butyl alcohol	0.2	NA
Tetrachloroethene	0.003	0.06
Toluene	4	12
1,2,4-Trichlorobenzene	0.4	5
1,1,1-Trichloroethane	0.2	2
1,1,2-Trichloroethane	0.01	0.02
Trichloroethene	0.007	0.06
Trichlorofluoromethane	22	NA
2,4,5-Trichlorophenol	44	270
2,4,6-Trichlorophenol	0.03	NA
Vinyl chloride	0.0003	0.01
Xylenes	12	200

NA = Standard not developed

Generally, there are three basic reasons that the Department's remediation standards for the impact to ground water pathway could be more stringent than EPA's SSLs.

To develop impact to ground water standards the Department used a dilution attenuation factor (DAF) of 13 which is appropriate because it is based on New Jersey soils and

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environmental conditions. USEPA generated SSLs based on DAFs of 1 and of 20 for silty and sandy soils respectively. The Department appropriately based the impact to ground water standards on the New Jersey Ground Water Quality Criteria (GWQC). The GWQC are in turn affected by the Department's A-280 and Group C carcinogen toxicity policies that are discussed in more detail above. USEPA based their impact to ground water SSLs on federal drinking water maximum contaminant levels (MCLs). The Federal MCLs take into consideration factors such as analytical PQLs and treatability. Third, the Department used values for soil parameters such as pH and soil texture that are appropriate for New Jersey but are different than the soil parameters used by EPA.

As an example, the Department is proposing an impact to ground water soil remediation standard of 11 mg/kg for 1,2-Dichlorobenzene as compared to EPA's impact to ground water SSL which is 17 mg/kg. The standard proposed by the Department is more stringent due to the application of a DAF of 13 that is appropriate for New Jersey soil and ground water conditions.

Another example is that the Department is proposing an impact to ground water soil remediation standard of 16 mg/kg for naphthalene as compared to EPA's impact to ground water SSL which is 84 mg/kg. The standard for naphthalene is back calculated from the New Jersey Ground Water Quality Criteria that is set at 0.3 mg/l as compared with EPA's target ground water concentration of one mg/l. The standard for naphthalene is also affected by the application of a DAF of 13 that is appropriate for New Jersey ground water conditions.

More stringent remediation standards may increase the cost of remediation to the regulated community. It is difficult to assign a specific dollar value to the economic impact of the proposed rules due to the variability in the complexity of contaminated sites throughout the state, including such factors as historical use of the site and the selected remedy. The Department believes that additional costs associated with the more stringent standards is necessary to satisfy the statutory requirement that the Department develop remediation standards that are protective of human health. The more stringent standards have resulted from the application of current scientific information and models which are appropriate for New Jersey soils, weather conditions, and ground water quality.

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Ground Water Remediation Standards

The Department is proposing to relocate N.J.A.C. 7:26E-1.13(b) from the Technical Requirements for Site Remediation to N.J.A.C. 7:26D-2. The ground water remediation standards are linked directly to New Jersey's Ground Water Quality Standards (GWQS). The GWQS provide the basis for protection of ambient ground water quality in New Jersey by establishing constituent standards for ground water pollutants. These constituent standards are applicable to the development of effluent limitations and discharge requirements pursuant to the New Jersey Pollutant Discharge Elimination System (NJPDES), N.J.A.C. 7:14A; to develop minimum ground water remediation standards pursuant to the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq.; and other requirements and regulatory actions applicable to discharges that cause or may cause pollutants to enter the ground waters of the State. The authority for setting these standards comes solely from New Jersey law and has no Federal counterpart. The GWQS are not promulgated under the authority of, or in order to implement, comply with, or participate in any program established under Federal law or under a State statute that incorporates or refers to Federal law, Federal standards or Federal requirements. The GWQS do not contain any standards or requirements that exceed those required by Federal law. The GWQS provides the associated ground water standards that are relevant to the New Jersey Underground Injection Control program, RCRA D, and RCRA C ground water monitoring programs at 40 CFR 144-146, 258, and 264. These Federal programs are implemented through the NJPDES program.

Surface Water Remediation Standards

The Department is proposing to recodify N.J.A.C. 7:26E-1.13(e) from the Technical Requirements for Site Remediation to N.J.A.C. 7:26D-3. The surface water remediation standards are linked directly to New Jersey's Surface Water Quality Standards (SWQS). Subchapter 3 references the State criteria and establishes the minimum surface water remediation standards for New Jersey. The Department reviewed the Federal regulation and guidance concerning surface water and provides the following analysis.

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The Federal Interim Final Rule, 60 CFR 22229 (May 4, 1995) and the National Toxics rule, 60 CFR 44120 (August 24, 1995) are collectively known as the National Toxics Rule (NTR). The Department adopted numerical criteria for toxics identified in the NTR applicable to New Jersey as the toxics criteria for New Jersey. See 37 N.J.R. 3487(a) (September 18, 2005) for the proposal, and 38 N.J.R. 4449(a) (October 16, 2006) for the adoption. Therefore, no further analysis under Executive Order 27 No. or (1994) N.J.S.A. 52:14B-1 et seq. is required.

The Department's analysis comparing State and Federal standards concluded that while there are differences in numeric criteria, the use of more stringent criteria will not result in significantly increased cost to the regulated community. The benefit of including these more stringent State standards in these rules is to ensure the consistent application of the standards and to further the Department's goal of clean and plentiful water. For a more detailed discussion of this issue see at 30 N.J.R. 1778 (May 18, 1998) and 32 N.J.R. 4397 (December 18, 2000).

Jobs Impact

The Department anticipates that the promulgation of these rules will increase the number of jobs for people who are skilled in engineering, laboratory analysis and environmental technology. Additional jobs in the technical consulting field may be generated when the person responsible for conducting the remediation chooses to develop a site specific alternative remediation standard. Technical personnel will be needed to conduct the work to support the development of alternative remediation standards. While the Department believes that there will be an increase in the number of jobs as the result of these rules, an accurate number of jobs cannot be determined because it is difficult to quantify the number of sites that will pursue remediation where the development of site specific alternative remediation standards will be necessary.

In addition, the proposed new rules will continue to encourage the remediation of abandoned and underutilized properties known as Brownfield sites. The remediation of Brownfield sites will potentially result in the use of these sites for viable businesses, thus creating more jobs associated with the staffing of these businesses.

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The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no impact on jobs as these are not new remediation standards.

Agricultural Impact

In accordance with N.J.S.A. 4:1C-10.3, the Right to Farm Act, the Department has determined that the proposed remediation standards will impact State agriculture only when a discharge occurs and impacts a farm. A discharge at a farm has the ability to harm human health and the environment. The presence of leaking underground storage tanks and storage areas for pesticides and fertilizers are sources of contamination on some farms. As for all other contaminated sites, the remediation standards for discharges at farms will ensure that any remedial action conducted on agricultural land is protective of human health. The rules provide the State's minimum standards for the remediation of all sites without regard to the origin of the discharge or the use of the site.

The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no agricultural impact as these are not new remediation standards.

Regulatory Flexibility Analysis

In accordance with the Regulatory Flexibility Act, N.J.S.A. 52:14B-16 et seq., the Department has determined that the proposed new rules to establish remediation standards for ground water, surface water and soil are not anticipated to have a significant impact on small businesses as defined in the Act. The remediation standards are not implementing rules and, therefore, they do not directly compel any recordkeeping or reporting requirements nor, except as discussed below, do they require the use of professional services for compliance.

N.J.A.C. 7:26D-7, Alternative Soil Remediation Standards, establishes the procedures and compliance requirements if a person responsible for conducting the remediation (including a small business) seeks an alternative soil remediation standard. The rules require the application

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for an alternative standard to comply with N.J.S.A. 58:10B-12(f) and N.J.A.C. 7:26D-7 and to include certain information as part of the application. Should the person responsible for conducting the remediation decide to pursue an optional alternative soil remediation standard, additional professional services would be required to demonstrate that the proposed standard would be protective of human health and the environment. The costs that might be incurred in pursuing an alternative standard would vary widely depending on the specifics of the alternative standard sought and whatever costs would be charged for the professional services employed by the petitioner.

Small businesses will be affected through the administration of the Site Remediation and Waste Management Program to the extent that these businesses are regulated under the Industrial Site Recovery Act, N.J.S.A. 13:1K-6 et seq., the New Jersey Underground Storage of Hazardous Substances Act, N.J.S.A. 58:10A-21 et seq., or the Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq. The Site Remediation and Waste Management Program requires contaminated sites to be remediated to levels that are protective of public health and the environment. However, the extent of remediation of a contaminated site is dependent on the nature and extent of contamination, not the size of the business. In the instances where the ground water quality standard, the surface water standard or the soil remediation standard was increased, compliance and/or remediation costs may decrease. In cases where the standard was reduced, the costs of compliance/remediation may be increased.

Smart Growth

Executive Order No. 4 (2002) requires State agencies that adopt, amend or repeal any rule to describe the impact of the proposed rule on the achievement of smart growth and implementation of the New Jersey State Development and Redevelopment Plan (State Plan). The proposed remediation standards do not involve land use policies or infrastructure development and, therefore, will not have an impact on the achievement of smart growth. The new rules and amendments are intended to ensure the protection of the State's natural resources which is one of the overall goals of the State Plan. Accordingly, the protection and preservation of the soil, surface water and ground water resources is supportive of the goals of the State Plan.

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The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no impact on the achievement of smart growth nor the implementation of the State Plan as these are not new remediation standards.

Full text of the rule proposed for repeal may be found in the New Jersey Administrative Code at N.J.A.C. 7:26E-1.13.

Full text of the proposed new rules and amendment follows (additions indicated in boldface thus; deletions indicated in brackets [thus]):

REMEDIATION STANDARDS CHAPTER 26D

SUBCHAPTER 1 GENERAL INFORMATION

7:26D-1.1 Purpose

(a) This chapter implements the provisions of the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1.1 et seq., and other statutes, by establishing minimum standards for the remediation of contaminated ground water, surface water, and soil.

(b) This chapter supplements the requirements in the Technical Requirements for Site Remediation rules, N.J.A.C. 7:26E.

7:26D-1.2 Scope

(a) Unless otherwise provided by rule or statute, this chapter shall constitute the rules of the Department concerning minimum standards for the remediation of ground water, surface water and soil.

(b) Remediating ground water, surface water, or soil to any applicable standard set forth in this chapter shall not relieve any person from:

1. Complying with more stringent requirements or provisions imposed under any other Federal, State, or local applicable statutes or regulations; and

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2. Obtaining any and all permits required by Federal, State or local statutes or regulations.

(c) No provision of this chapter shall be construed to limit the Department's authority to require additional remediation based upon site-specific conditions in order to protect human health, safety and the environment.

(d) Nothing in this chapter shall be construed to limit the authority of the Department to establish discharge limits for pollutants, or to prescribe penalties for violations of those limits pursuant to any statutory authority, or to require the complete removal of any illegally discharged hazardous substances, hazardous waste, or pollutants pursuant to law.

(e) The person responsible for conducting the remediation shall not be required to remediate to a level or concentration that is lower than the regional natural background level.

7:26D-1.3 Construction and severability

(a) This chapter shall be liberally construed to permit the Department to effectuate the purposes of the statutes listed in N.J.A.C. 7:26D-1.4(a).

(b) If any subchapter, section, subsection, provision, clause, or portion of this chapter, or the application thereof to any person, is adjudged unconstitutional or invalid by a court of competent jurisdiction, such judgment shall be confined in its operation to the subchapter, section, subsection, provision, clause, portion, or application directly involved in the controversy in which such judgment shall have been rendered and it shall not affect or impair the remainder of this chapter or the application thereof to other persons.

7:26D-1.4 Applicability

(a) This chapter establishes the minimum remediation standards for ground water, surface water and soil for any contaminated site in New Jersey including, without limitation, those sites subject to:

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1. The Industrial Site Recovery Act (ISRA), N.J.S.A. 13:1K-6 et seq.;

2. The New Jersey Underground Storage of Hazardous Substances Act (UST), N.J.S.A. 58:10A-21 et seq.;

3. The Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq.;

4. The Solid Waste Management Act, N.J.S.A. 13:E-1 et seq.;

5. The Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.;

6. The Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq.;

7. The Comprehensive Regulated Medical Waste Management Act, N.J.S.A. 13:1E-48.1 et seq.;

8. The Major Hazardous Waste Facilities Siting Act, N.J.S.A. 13:1E-49 et seq;

9. The Sanitary Landfill Facility Closure and Contingency Fund Act, N.J.S.A. 13:1E-100 et seq.; and

10. The Regional Low-Level Radioactive Waste Disposal Facility Siting Act, N.J.S.A. 13:1E-177 et seq.

(b) The requirements of this chapter shall be applied pursuant to N.J.A.C. 7:26E-1.3(c) regardless of whether remediation is conducted with Department oversight pursuant to N.J.A.C. 7:26C.

(c) Notwithstanding any other provision of this chapter, all applicable remediation standards and remedial actions that involve real property located in the Pinelands area shall be consistent with the provisions of the Pinelands Protection Act, N.J.S.A. 13:18A-1 et seq., and any rules

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promulgated pursuant thereto, and with Section 502 of the National Parks and Recreation Act of 1978, 16 U.S.C. §4711.

7:26D-1.5 Definitions

The following words and terms, when used in this chapter, shall have the following meanings unless the context clearly indicates otherwise:

"Alternative remediation standard" or "ARS" means a residential use or non-residential use soil remediation standard that is established using site specific factors following the procedures set forth in N.J.A.C. 7:26D-7 Appendices 5 through 7, pursuant to this chapter.

"Carcinogen" means a contaminant capable of inducing a cancer response, including Group A (Human Carcinogen), Group B (Probable Human Carcinogen) and Group C (Possible Human Carcinogen) categorized in accordance with the USEPA Guidelines for Carcinogen Risk Assessment, 51 Fed. Reg. 33932 (1986), as amended and supplemented.

"Contaminated site" means a contaminated site as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Contamination" or "contaminant" means contamination or a contaminant as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Department" means the New Jersey Department of Environmental Protection.

"Discharge" means a discharge as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Effective solubility" means effective solubility as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

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"EPA" means the United States Environmental Protection Agency.

"Exposure pathways" means the methods by which humans can come into contact with contamination including, but not limited to, the ingestion-dermal exposure pathway, the inhalation exposure pathway, and the impact to ground water pathway.

"Ground water" means ground water as defined pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.6, which includes Class I, Class II and Class III ground water.

"Ground water quality criteria" means any human health-based ground water quality criteria as defined pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.6.

"Impact to ground water pathway" means process by which soil contamination is transported to ground water, which is then ingested by humans.

"Impact to ground water remediation standard" means a vadose zone soil remediation standard established or developed pursuant to this chapter that is designed to limit the amount of contaminant that leaches from the vadose zone to ground water such that the resulting ground water concentration will not exceed the applicable ground water remediation standard.

"Ingestion-dermal exposure pathway" means the process by which humans can come into contact with contamination through the direct ingestion of contamination and the absorption of contamination through the skin.

"Inhalation exposure pathway" means the process by which humans can come into contact with contamination through the inhalation of contamination.

"Leachate criteria" means the human health-based criteria for the impact to ground water pathway that are evaluated from the analysis of the leachate of the less mobile and inorganic contaminants from the synthetic precipitation leaching procedure.

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"Method detection limit" or "MDL" means a method detection limit or MDL as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Non-residential use" means an exposure assumption based on exposure of adult outdoor workers to contaminated media during an eight-hour work day, 225 days a year, for 25 years.

"Non-residential direct contact soil remediation standard" means a soil remediation standard for the ingestion-dermal and inhalation exposure pathways established or developed pursuant to this chapter that is designed to protect human health at non-residential use sites.

"Oversight document" means any document defined as an oversight document pursuant to the Department Oversight of the Remediation of Contaminated Sites rules at N.J.A.C. 7:26C-1.3.

"Person responsible for conducting the remediation" means the person responsible for conducting the remediation as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Pollutant" means any substance defined as such pursuant to the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.

"Practical quantitation level" or "PQL" means a practical quantitation level or PQL as defined pursuant to Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Regional natural background level" means the concentration of a contaminant consistently present in the environment in the region of the site and which has not been influenced by localized human activities.

"Remediation" or "remediate" means remediation or remediate as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Remediation standards" means the combination of numeric standards that establish a level or concentration, and narrative standards, to which contaminants must be treated, removed or otherwise cleaned for soil, ground water or surface water, as established by the Department pursuant to the Brownfield and Contaminated Sites Remediation Act at N.J.S.A. 58:10B-12 and this chapter.

"Residential direct contact soil remediation standard" means a soil remediation standard for the ingestion-dermal and inhalation exposure pathways established or developed pursuant to this chapter that is designed to protect human health at residential use sites, schools (K-12) and childcare centers.

"Residential use" means a land use scenario based on exposure to contaminated media for 24 hours a day, 350 days a year for 30 years by children and adults living on a site.

"Surface water" means "surface water" as defined pursuant to the Surface Water Quality Standards, N.J.A.C. 7:9B.

SUBCHAPTER 2. MINIMUM GROUND WATER REMEDIATION STANDARDS

7:26D-2.1 Purpose

This subchapter establishes the minimum remediation standards for ground water.

7:26D-2.2 Minimum ground water remediation standards

(a) The minimum remediation standards to which ground water shall be remediated are:

1. For Class II ground water, the Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(c) and (d);

2. For Class I-A and Class I-PL, Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(a) and (b);

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3. For Class III-A and Class III-B, Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(e) and (f); and

4. For all ground water, regardless of classification, each of the following narrative ground water remediation standards, as applicable:

i. The general ground water quality policies in N.J.A.C. 7:9C-1.2;

ii. The narrative ground water quality criteria in N.J.A.C. 7:9C-1.7;

iii. The ground water quality antidegradation policy in N.J.A.C. 7:9C-1.8;

iv. The remediation requirements in N.J.A.C. 7:26E-1 through 8 in order to both:

(1) Address the adverse impact of the contamination on the ground water itself; and

(2) Limit additional risks posed by the contamination to the human health and safety and to the environment;

v. The free and residual product removal, treatment, or containment requirements of N.J.A.C. 7:26E-6.1(d);

vi. The contaminants have not migrated to the ground surface, structures, or air in concentrations that pose a threat to human health; and

vii. The following factors, as applicable on a site-specific basis, for selecting an appropriate ground water remedial action:

(1) The location of the contaminated site relative to ground water use;

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(2) The potential human and environmental exposure to the ground water contamination;

(3) The present, projected, and potential ground water use at the site and in the area surrounding the site over the 25 years after the selection of the ground water remedy;

(4) The ambient ground water quality at the site and in the area surrounding the site resulting from both human activities and natural conditions;

(5) The physical and chemical characteristics of the contaminants of concern; and

(6) The criteria in N.J.A.C. 7:26E-6.3(d)1i, used to determine when natural remediation is appropriate as a remedial action for ground water contamination.

(b) The Department shall not approve an alternative ground water remediation standard that is based on a site-specific risk assessment.

SUBCHAPTER 3. MINIMUM SURFACE WATER REMEDIATION STANDARDS

7:26D-3.1 Purpose

This subchapter establishes the minimum remediation standards for surface water.

7:26D-3.2 Minimum surface water remediation standards

(a) The minimum remediation standards for surface water are:

1. The numeric New Jersey Surface Water Quality Standards, N.J.A.C. 7:9B-1.14(c) and (d); and

2. The following narrative surface water remediation standards:

i. The general surface water quality policies in N.J.A.C. 7:9B-1.5;

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ii. The narrative surface water quality criteria in N.J.A.C. 7:9B-1.14;

iii. The remediation requirements in N.J.A.C. 7:26E-1 through 8 in order to both:

(1) Address the adverse impact of the contamination on the surface water itself; and

(2) Limit additional risks posed by the contamination to the public health and safety and to the environment;

iv. The free and residual product removal, treatment, or containment requirements of N.J.A.C. 7:26E-6.1(d); and

v. The following narrative criteria, as applicable on a site-specific basis, for selecting an appropriate surface water remedial action:

(1) The location of the contaminated site relative to surface water use;

(2) The potential human and environmental exposure to the surface water contamination;

(3) The present and projected surface water use at the site and in the area surrounding the site;

(4) The ambient ground water quality at the site and in the area surrounding the site resulting from both human activities and natural conditions; and

(5) The physical and chemical characteristics of the contaminants of concern.

(b) The Department shall not approve an alternative surface water remediation standard that is based on a site-specific risk assessment.

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SUBCHAPTER 4 MINIMUM SOIL REMEDIATION STANDARDS

7:26D-4.1 Purpose

(a) This subchapter establishes minimum soil remediation standards, including:

1. Residential direct contact soil remediation standards;
2. Non-residential direct contact soil remediation standards; and
3. Impact to ground water soil remediation standards.

7:26D-4.2 Residential direct contact soil remediation standards

(a) The Department developed the residential direct contact human health-based criteria in chapter Appendix 1, Table 1A, incorporated herein by reference, as follows:

1. The residential human health-based criteria for the ingestion-dermal exposure pathway, based on the equations, data sources, and conventions provided in chapter Appendix 2 incorporated herein by reference; and

2. The residential human health-based criteria for the inhalation exposure pathway, based on the equations, data sources, and conventions provided in chapter Appendix 3, incorporated herein by reference.

(b) The residential direct contact soil remediation standard for each contaminant listed in Appendix Table 1A is the more stringent of either the ingestion-dermal human health-based criterion or the inhalation human health-based criterion, or the PQL if the PQL is less stringent than the corresponding human health-based criterion.

7:26D-4.3 Non-residential direct contact soil remediation standards

(a) The Department developed the non-residential direct contact human health-based criteria in Appendix 1, Table 1B, incorporated herein by reference, as follows:

1. The non-residential human health-based criteria for the ingestion-dermal exposure pathway, based on the equations, data sources, and conventions provided in Appendix 2; and

2. The non-residential human health-based criteria for the inhalation exposure pathway, based on the equations, data sources, and conventions provided in Appendix 3.

(b) The non-residential direct contact soil remediation standard for each contaminant listed in Table 1B is the more stringent of either the ingestion-dermal human health-based criterion or the inhalation human health-based criterion, or the PQL if the PQL is less stringent than the corresponding human health-based criterion.

7:26D-4.4 Impact to ground water soil remediation standards

(a) The Department developed the impact to ground water human health-based criteria for Class IIA ground water in chapter Appendix 1, Tables 2A, 2B and 2C, incorporated herein by reference, as follows:

1. The human health-based soil criteria for the impact to ground water pathway, based on the equations, data sources, and conventions provided in chapter Appendix 4, incorporated herein by reference; and

2. The human health-based leachate criteria for the impact to ground water pathway, based on the equations, data sources, and conventions provided in Appendix 4.

(b) The impact to ground water soil remediation standard for each contaminant listed in Appendix 1, Tables 2A, 2B or 2C, or the PQL if the PQL is less stringent than the corresponding human health-based criterion.

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SUBCHAPTER 5 INTERIM SOIL REMEDIATION STANDARDS

7:26D-5.1 Purpose

This subchapter sets forth the procedures that the Department will use to establish interim soil remediation standards.

7:26D-5.2 Development of an interim soil remediation standard

(a) The Department may establish an interim remediation standard for soil when a contaminant is not listed in Appendix 1, Tables 1A, 1B, 2A, 2B, or 2C of this chapter.

(b) An interim remediation standard shall be developed for soil as follows:

1. For the ingestion-dermal pathway, using the procedures set forth in Appendix 2;

2. For the inhalation pathway, using the procedures set forth in Appendix 3; and

3. For the impact to ground water pathway, using the procedures set forth in Appendix 4.

(c) The person responsible for conducting a remediation may request that the Department develop an interim soil remediation standard under this section.

7:26D-5.3 Publication of interim soil remediation standards; promulgation

(a) The Department shall publish on its web site a listing of all interim soil remediation standards and the technical basis used in their derivation.

(b) Interim soil remediation standards shall be replaced with duly promulgated soil remediation standards as soon as reasonably possible.

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SUBCHAPTER 6 UPDATING SOIL REMEDIATION STANDARDS

7:26D-6.1 Purpose

This subchapter sets forth the procedures that the Department will use to update remediation standards for soil.

7:26D-6.2 Notice of administrative change to update promulgated soil remediation standards

(a) The Department shall post on its web site and publish in the New Jersey Register a notice of administrative change to modify a soil remediation standard in Appendix 1, Tables 1A, 1B, 2A, 2B or 2C when:

1. The USEPA revises the carcinogenic slope factor or reference dose data contained in the Integrated Risk Information System (IRIS) database on which a remediation standard in Table 1A or 1B is based; or

2. The Department promulgates a new criterion in the Ground Water Quality Standards at N.J.A.C. 7:9C on which an impact to ground water soil remediation standard is based.

(b) The notice of administrative change shall identify the contaminant, the basis for the administrative change, and the revised criterion to be listed in Appendix 1, Table 1A, 1B, 2A, 2B or 2C.

SUBCHAPTER 7 ALTERNATIVE SOIL REMEDIATION STANDARDS

7:26D-7.1 Purpose

This subchapter sets forth the circumstances in which the Department may require the person responsible for conducting the remediation to develop an alternative soil remediation standard, the procedures that the person responsible for conducting the remediation shall use to apply for permission to use an alternative soil remediation standard, and the procedures the Department shall use to evaluate an application for the use of an alternative soil remediation standard that is proposed by the person responsible for conducting the remediation.

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7:26D-7.2 Applicability

An alternative soil remediation standard may only be numeric and may only be used at the site for which it is approved and is not applicable at any other site.

7:26D-7.3 Basis for an alternative soil remediation standard

(a) The person responsible for conducting the remediation may propose, in accordance with N.J.A.C. 7:26D-7.4, an alternative soil remediation standard based on the following:

1. For the ingestion-dermal exposure pathway, the procedures set forth in chapter Appendix 5, incorporated herein by reference;

2. For the inhalation pathway, the procedures set forth in chapter Appendix 6, incorporated herein by reference; and

3. For the impact to ground water pathway, the procedures set forth in chapter Appendix 7, incorporated herein by reference.

(b) The basis for the request for an alternative remediation standard may include, but is not limited to, the following:

1. New chemical toxicity data;

2. New risk assessment methodology or models;

3. Alternative land use planned for the site; or

4. Site-specific conditions that support the modification of input parameters for models used to develop alternative soil remediation standards pursuant to Appendices 5 through 7.

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(c) The Department may require the person responsible for conducting the remediation to develop an alternative soil remediation standard that is more stringent than the minimum standards established by this chapter where necessary to ensure adequate protection of human health, based upon a review of the following:

1. The number or magnitude of the discharge(s) being investigated;

2. The nature of the contaminants;

3. Distance to and sensitivity of people at risk of exposure; and

4. Any other site-specific conditions the Department identifies that necessitate the need for an alternative soil remediation standard in order to protect human health.

7:26D-7.4 Alternative soil remediation standards application and approval process

(a) The person responsible for conducting the remediation may seek Department approval for an alternative soil remediation standard based on the criteria in N.J.A.C. 7:26D-7.2(a) and (b) above by completing the application in chapter Appendix 8, incorporated herein by reference, and submitting the completed application in accordance with (c) below.

(b) The person responsible for conducting the remediation that elects to submit an application for an alternative soil remediation standard agrees to pay the Department's oversight costs pursuant to Industrial Site Recovery Act Rules, N.J.A.C. 7:26B , Underground Storage Tanks rules, N.J.A.C. 7:14B or the Department Oversight of the Remediation of Contaminated Sites rules, N.J.A.C. 7:26C.

(c) The Department will review the application to develop an alternative remediation standard and send the person responsible for conducting the remediation the following, as applicable:

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1. If the Department determines that the application is complete and that the proposed alternative soil remediation standard is protective of human health and safety and the environment, the Department will provide the person responsible for conducting the remediation with a written approval of the alternative soil remediation standard for that site or area of concern;

2. If the Department determines that the application is deficient, the Department will provide written comments to the person responsible for conducting the remediation describing the deficiencies in the application, in which case the person may submit a revised application addressing the deficiencies to the Department; or

3. If the Department determines that the proposed alternative soil remediation is not protective of human health, the Department will provide the person responsible for conducting the remediation with written notification of the denial of the application. The person shall not apply the denied alternative remediation standard to the contaminated site or area of concern.

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APPENDIX 1
SOIL REMEDIATION STANDARDS TABLES

Table 1A – Residential Direct Contact Health Based Criteria and Soil Remediation Standards (mg/kg)

Contaminant	CAS No.	Ingestion-Dermal Heath Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Acenaphthene	83-32-9	3,400	NA	0.2	3,400
Acenaphthylene	208-96-8	NA	NA	0.2	NA
Acetone (2-Propanone)	67-64-1	70,000	NA	0.01	70,000
Acetophenone	98-86-2	6,100	2	0.2	2
Acrolein	107-02-8	39	0.5	0.5	0.5
Acrylonitrile	107-13-1	1	0.9	0.5	0.9
Aldrin	309-00-2	0.04	5	0.002	0.04
Aluminum	7429-90-5	78,000	NA	20	78,000
Anthracene	120-12-7	17,000	380,000	0.2	17,000
Antimony	7440-36-0	31	36,000	6	31
Arsenic	7440-38-2	0.4	980	1	19*
Atrazine	1912-24-9	210	NA	0.2	210
Barium	7440-39-3	16,000	910,000	20	16,000
Benzaldehyde	100-52-7	6,100	NA	0.2	6100
Benzene	71-43-2	3	2	0.005	2
Benzidine	92-87-5	0.002	0.004	0.7	0.7
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.6	38,000	0.2	0.6
Benzo(a)pyrene	50-32-8	0.06	3,800	0.2	0.2
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.6	38,000	0.2	0.6
Benzo(ghi)perylene	191-24-2	NA	380,000	0.2	380,000
Benzo(k)fluoranthene	207-08-9	6	38,000	0.2	6
Beryllium	7440-41-7	16	1,800	0.5	16
1,1'-Biphenyl	92-52-4	3,100	NA	0.2	3,100
Bis(2-chloroethyl)ether	111-44-4	0.4	0.6	0.2	0.4
Bis(2-chloroisopropyl)ether	108-60-1	2,400	23	0.2	23
Bis(2-ethylhexyl) phthalate	117-81-7	35	NA	0.2	35
Bromodichloromethane (Dichlorobromomethane)	75-27-4	10	1	0.005	1
Bromoform	75-25-2	81	98	0.005	81
Bromomethane (Methyl bromide)	74-83-9	110	25	0.005	25
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	3,100	NA	0.01	3,100
Butyl benzyl phthalate	85-68-7	1,200	NA	0.2	1,200
Cadmium	7440-43-9	78	1,000	0.5	78

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Contaminant	CAS No.	Ingestion-Dermal Heath Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Caprolactam	105-60-2	31,000	NA	0.2	31,000
Carbazole	86-74-8	24	740,000	0.2	24
Carbon disulfide	75-15-0	7,800	NA	0.5	7,800
Carbon tetrachloride	56-23-5	7	0.6	0.005	0.6
Chlordane (alpha and gamma)	57-74-9	0.2	42,000	0.002	0.2
4-Chloroaniline (p-Chloroaniline)	106-47-8	9	26	0.2	9
Chlorobenzene	108-90-7	510	NA	0.005	510
Chloroethane (Ethyl chloride)	75-00-3	220	NA	0.005	220
Chloroform	67-66-3	780	0.6	0.005	0.6
Chloromethane (Methyl chloride)	74-87-3	NA	4	0.005	4
2-Chlorophenol (o-Chlorophenol)	95-57-8	310	910	0.2	310
Chrysene	218-01-9	62	380,000	0.2	62
Cobalt	7440-48-4	1,600	9,100	5	1,600
Copper	7440-50-8	3,100	NA	3	3,100
Cyanide	57-12-5	1,600	NA	3	1,600
4,4'-DDD	72-54-8	3	61,000	0.003	3
4,4'-DDE	72-55-9	2	670	0.003	2
4,4'-DDT	50-29-3	2	44,000	0.003	2
Dibenz(a,h)anthracene	53-70-3	0.06	3,500	0.2	0.2
Dibromochloromethane (Chlorodibromomethane)	124-48-1	8	3	0.005	3
1,2-Dibromo-3-chloropropane	96-12-8	0.3	0.08	0.005	0.08
1,2-Dibromoethane	106-93-4	0.008	0.1	0.005	0.008
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	5,300	NA	0.005	5,300
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	5,300	NA	0.005	5,300
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	610	5	0.005	5
3,3'-Dichlorobenzidine	91-94-1	1	3	0.2	1
Dichlorodifluoromethane	75-71-8	16,000	490	0.005	490
1,1-Dichloroethane	75-34-3	510	8	0.005	8
1,2-Dichloroethane	107-06-2	5	0.9	0.005	0.9
1,1-Dichloroethene	75-35-4	11	61	0.005	11
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	780	230	0.005	230
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	1,300	300	0.005	300
2,4-Dichlorophenol	120-83-2	180	NA	0.2	180
1,2-Dichloropropane	78-87-5	9	2	0.005	2
1,3-Dichloropropene (cis and trans)	542-75-6	6	2	0.005	2
Dieldrin	60-57-1	0.04	1	0.003	0.04
Diethyl phthalate	84-66-2	49,000	NA	0.2	49,000
2,4-Dimethyl phenol	105-67-9	1,200	NA	0.2	1,200

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Contaminant	CAS No.	Ingestion-Dermal Heath Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Di-n-butyl phthalate	84-74-2	6,100	NA	0.2	6,100
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	6	730,000	0.3	6
2,4-Dinitrophenol	51-28-5	120	NA	0.3	120
2,4-Dinitrotoluene	121-14-2	0.7	6	0.2	0.7
2,6-Dinitrotoluene	606-20-2	0.7	2	0.2	0.7
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	0.7	NA	0.2	0.7
Di-n-octyl phthalate	117-84-0	2,400	NA	0.2	2,400
1,2-Diphenylhydrazine	122-66-7	0.6	5	0.7	0.7
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	470	NA	0.003	470
Endosulfan sulfate	1031-07-8	470	NA	0.003	470
Endrin	72-20-8	23	NA	0.003	23
Ethyl benzene	100-41-4	7,800	NA	0.005	7,800
Fluoranthene	206-44-0	2,300	NA	0.2	2,300
Fluorene	86-73-7	2,300	NA	0.2	2,300
alpha-HCH (alpha-BHC)	319-84-6	0.1	0.7	0.002	0.1
beta-HCH (beta-BHC)	319-85-7	0.4	8,000	0.002	0.4
Heptachlor	76-44-8	0.1	6	0.002	0.1
Heptachlor epoxide	1024-57-3	0.07	5	0.002	0.07
Hexachlorobenzene	118-74-1	0.3	1	0.2	0.3
Hexachloro-1,3-butadiene	87-68-3	6	12	0.2	6
Hexachlorocyclopentadiene	77-47-4	370	45	0.2	45
Hexachloroethane	67-72-1	35	83	0.2	35
Indeno(1,2,3-cd)pyrene	193-39-5	0.6	38,000	0.2	0.6
Isophorone	78-59-1	510	NA	0.2	510
Lead	7439-92-1	400	44,000	1	400
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	0.4	3	0.002	0.4
Manganese	7439-96-5	11,000	91,000	2	11,000
Mercury	7439-97-6	23	27	0.1	23
Methoxychlor	72-43-5	390	NA	0.02	390
Methyl acetate	79-20-9	78,000	NA	0.005	78,000
Methylene chloride (Dichloromethane)	75-09-2	46	34	0.005	34
2-Methylnaphthalene	91-57-6	230	NA	0.17	230
2-Methylphenol (o-Creosol)	95-48-7	310	NA	0.2	310
4-Methylphenol (p-Creosol)	106-44-5	31	NA	0.2	31
Methyl tert-butyl ether (MTBE)	1634-04-4	780	110	0.005	110
Naphthalene	91-20-3	2,400	6	0.2	6
Nickel (Soluble salts)	7440-02-0	1,600	360,000	4	1,600
2-Nitroaniline	88-74-4	NA	39	0.3	39
Nitrobenzene	98-95-3	31	160	0.2	31

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Contaminant	CAS No.	Ingestion-Dermal Heath Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
N-Nitrosodimethylamine	62-75-9	0.01	0.02	0.7	0.7
N-Nitrosodi-n-propylamine	621-64-7	0.07	0.2	0.2	0.2
N-Nitrosodiphenylamine	86-30-6	99	NA	0.2	99
Pentachlorophenol	87-86-5	3	590	0.3	3
Phenanthrene	85-01-8	NA	NA	0.2	NA
Phenol	108-95-2	18,000	NA	0.2	18,000
Polychlorinated biphenyls (PCBs)	1336-36-3	0.2	20	0.03	0.2
Pyrene	129-00-0	1,700	NA	0.2	1,700
Selenium	7782-49-2	390	NA	4	390
Silver	7440-22-4	390	NA	1	390
Styrene	100-42-5	16,000	90	0.005	90
Tertiary butyl alcohol (TBA)	75-65-0	1,400	4,800	0.1	1,400
1,1,2,2-Tetrachloroethane	79-34-5	10	1	0.005	1
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	8	2	0.005	2
Thallium	7440-28-0	5	360,000	3	5
Toluene	108-88-3	6,300	NA	0.005	6,300
Toxaphene	8001-35-2	0.6	70	0.2	0.6
1,2,4-Trichlorobenzene	120-82-1	73	NA	0.005	73
1,1,1-Trichloroethane	71-55-6	290	NA	0.005	290
1,1,2-Trichloroethane	79-00-5	31	2	0.005	2
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	21	7	0.005	7
Trichlorofluoromethane	75-69-4	23,000	NA	0.005	23,000
2,4,5-Trichlorophenol	95-95-4	6,100	NA	0.2	6,100
2,4,6-Trichlorophenol	88-06-2	19	340	0.2	19
Vanadium	7440-62-2	78	NA	5	78
Vinyl chloride	75-01-4	2	0.7	0.005	0.7
Xylenes	1330-20-7	12,000	NA	0.005	12,000
Zinc	7440-66-6	23,000	NA	6	23,000

NA = Standard not available

* The direct contact standard for arsenic is based on natural background

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Table 1B – Non-Residential Direct Contact Health Based Criteria and Soil Remediation Standards (mg/kg)

Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Acenaphthene	83-32-9	37,000	300,000	0.2	37,000
Acenaphthylene	208-96-8	NA	300,000	0.2	300,000
Acetone (2-Propanone)	67-64-1	NA	NA	0.01	NA
Acetophenone	98-86-2	68,000	4	0.2	4
Acrolein	107-02-8	570	1	0.5	1
Acrylonitrile	107-13-1	6	2	0.5	2
Aldrin	309-00-2	0.2	13	0.002	0.2
Aluminum	7429-90-5	NA	NA	20	NA
Anthracene	120-12-7	180,000	30,000	0.2	30,000
Antimony	7440-36-0	450	23,000	6	450
Arsenic	7440-38-2	2	76	1	19*
Atrazine	1912-24-9	2,400	NA	0.2	2,400
Barium	7440-39-3	230,000	59,000	20	59,000
Benzaldehyde	100-52-7	68,000	NA	0.2	68,000
Benzene	71-43-2	14	4	0.005	4
Benzidine	92-87-5	0.008	0.01	0.7	0.7
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	2	3,000	0.2	2
Benzo(a)pyrene	50-32-8	0.2	300	0.2	0.2
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	2	3,000	0.2	2
Benzo(ghi)perylene	191-24-2	NA	30,000	0.2	30,000
Benzo(k)fluoranthene	207-08-9	23	3,000	0.2	23
Beryllium	7440-41-7	230	140	0.5	140
1,1'-Biphenyl	92-52-4	34,000	NA	0.2	34,000
Bis(2-chloroethyl)ether	111-44-4	2	1	0.2	1
Bis(2-chloroisopropyl)ether	108-60-1	27,000	60	0.2	60
Bis(2-ethylhexyl) phthalate	117-81-7	140	140,000	0.2	140
Bromodichloromethane (Dichlorobromomethane)	75-27-4	51	3	0.005	3

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Bromoform	75-25-2	400	250	0.005	250
Bromomethane (Methyl bromide)	74-83-9	1,600	53	0.005	53
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	44,000	NA	0.01	44,000
Butyl benzyl phthalate	85-68-7	14,000	NA	0.2	14,000
Cadmium	7440-43-9	1,100	78	0.5	78
Caprolactam	105-60-2	340,000	NA	0.2	340,000
Carbazole	86-74-8	96	58,000	0.2	96
Carbon disulfide	75-15-0	110,000	NA	0.5	110,000
Carbon tetrachloride	56-23-5	35	2	0.005	2
Chlordane (alpha and gamma)	57-74-9	1	3,300	0.002	1
4-Chloroaniline (p-Chloroaniline)	106-47-8	2,700	66	0.2	66
Chlorobenzene	108-90-7	7,400	NA	0.005	7,400
Chloroethane (Ethyl chloride)	75-00-3	1,100	NA	0.005	1,100
Chloroform	67-66-3	11,000	2	0.005	2
Chloromethane (Methyl chloride)	74-87-3	NA	11	0.005	11
2-Chlorophenol (o-Chlorophenol)	95-57-8	3,400	2,000	0.2	2,000
Chrysene	218-01-9	230	30,000	0.2	230
Cobalt	7440-48-4	23,000	590	5	590
Copper	7440-50-8	45,000	280,000	3	45,000
Cyanide	57-12-5	23,000	NA	3	23,000
4,4'-DDD	72-54-8	13	4,800	0.003	13
4,4'-DDE	72-55-9	9	3,400	0.003	9
4,4'-DDT	50-29-3	8	3,400	0.003	8
Dibenz(a,h)anthracene	53-70-3	0.2	270	0.2	0.2
Dibromochloromethane (Chlorodibromomethane)	124-48-1	38	7	0.005	7
1,2-Dibromo-3-chloropropane	96-12-8	1	0.2	0.005	0.2

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
1,2-Dibromoethane	106-93-4	0.04	0.3	0.005	0.04
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	59,000	NA	0.005	59,000
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	59,000	NA	0.005	59,000
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	6,800	12	0.005	12
3,3'-Dichlorobenzidine	91-94-1	4	960	0.2	4
Dichlorodifluoromethane	75-71-8	230,000	NA	0.005	230,000
1,1-Dichloroethane	75-34-3	7,400	21	0.005	21
1,2-Dichloroethane	107-06-2	26	2	0.005	2
1,1-Dichloroethene	75-35-4	160	130	0.005	130
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	11,000	500	0.005	500
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	19,000	650	0.005	650
2,4-Dichlorophenol	120-83-2	2,100	NA	0.2	2,100
1,2-Dichloropropane	78-87-5	47	5	0.005	5
1,3-Dichloropropene (cis and trans)	542-75-6	32	6	0.005	6
Dieldrin	60-57-1	0.2	3	0.003	0.2
Diethyl phthalate	84-66-2	550,000	NA	0.2	550,000
2,4-Dimethyl phenol	105-67-9	14,000	NA	0.2	14,000
Di-n-butyl phthalate	84-74-2	68,000	NA	0.2	68,000
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	68	47,000	0.3	68
2,4-Dinitrophenol	51-28-5	1,400	820,000	0.3	1,400
2,4-Dinitrotoluene	121-14-2	3	15	0.2	3
2,6-Dinitrotoluene	606-20-2	3	6	0.2	3
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	3	NA	0.2	3
Di-n-octyl phthalate	117-84-0	27,000	NA	0.2	27,000
1,2-Diphenylhydrazine	122-66-7	2	12	0.7	2
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	6,800	NA	0.003	6,800

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Endosulfan sulfate	1031-07-8	6,800	NA	0.003	6,800
Endrin	72-20-8	340	120,000	0.003	340
Ethyl benzene	100-41-4	110,000	NA	0.005	110,000
Fluoranthene	206-44-0	24,000	300,000	0.2	24,000
Fluorene	86-73-7	24,000	300,000	0.2	24,000
alpha-HCH (alpha-BHC)	319-84-6	0.5	2	0.002	0.5
beta-HCH (beta-BHC)	319-85-7	2	620	0.002	2
Heptachlor	76-44-8	0.7	16	0.002	0.7
Heptachlor epoxide	1024-57-3	0.3	12	0.002	0.3
Hexachlorobenzene	118-74-1	1	4	0.2	1
Hexachloro-1,3-butadiene	87-68-3	25	31	0.2	25
Hexachlorocyclopentadiene	77-47-4	4,100	97	0.2	97
Hexachloroethane	67-72-1	140	82,000	0.2	140
Indeno(1,2,3-cd)pyrene	193-39-5	2	3,000	0.2	2
Isophorone	78-59-1	2,000	NA	0.2	2,000
Lead	7439-92-1	800	12,000	1	800
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	2	9	0.002	2
Manganese	7439-96-5	160,000	5,900	2	5,900
Mercury	7439-97-6	340	65	0.1	65
Methoxychlor	72-43-5	5,700	NA	0.02	5,700
Methyl acetate	79-20-9	NA	NA	0.005	NA
Methylene chloride (Dichloromethane)	75-09-2	230	87	0.005	87
2-Methylnaphthalene	91-57-6	2400	250,000	0.17	2400
2-Methylphenol (o-Creosol)	95-48-7	3,400	NA	0.2	3,400
4-Methylphenol (p-Creosol)	106-44-5	340	NA	0.2	340
Methyl tert-butyl ether (MTBE)	1634-04-4	11,000	290	0.005	290
Naphthalene	91-20-3	25,000	16	0.2	16
Nickel (Soluble salts)	7440-02-0	23,000	23,000	4	23,000
2-Nitroaniline	88-74-4	NA	83	0.3	83

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Nitrobenzene	98-95-3	340	350	0.2	340
N-Nitrosodimethylamine	62-75-9	0.06	0.04	0.7	0.7
N-Nitrosodi-n-propylamine	621-64-7	0.3	130,000	0.2	0.3
N-Nitrosodiphenylamine	86-30-6	390	1,500	0.2	390
Pentachlorophenol	87-86-5	10	300,000	0.3	10
Phenanthrene	85-01-8	NA	300,000	0.2	300,000
Phenol	108-95-2	210,000	NA	0.2	210,000
Polychlorinated biphenyls (PCBs)	1336-36-3	1	52	0.03	1
Pyrene	129-00-0	18,000	300,000	0.2	18,000
Selenium	7782-49-2	5,700	NA	4	5,700
Silver	7440-22-4	5,700	NA	1	5,700
Styrene	100-42-5	230,000	230	0.005	230
Tertiary butyl alcohol (TBA)	75-65-0	20,000	10,000	0.1	10,000
1,1,2,2-Tetrachloroethane	79-34-5	150	3	0.005	3
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	39	5	0.005	5
Thallium	7440-28-0	79	23,000	3	79
Toluene	108-88-3	91,000	NA	0.005	91,000
Toxaphene	8001-35-2	3	180	0.2	3
1,2,4-Trichlorobenzene	120-82-1	820	NA	0.005	820
1,1,1-Trichloroethane	71-55-6	4,200	NA	0.005	4,200
1,1,2-Trichloroethane	79-00-5	440	5	0.005	5
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	100	18	0.005	18
Trichlorofluoromethane	75-69-4	340,000	NA	0.005	340,000
2,4,5-Trichlorophenol	95-95-4	68,000	NA	0.2	68,000
2,4,6-Trichlorophenol	88-06-2	74	870	0.2	74
Vanadium	7440-62-2	1,100	470,000	5	1,100
Vinyl chloride	75-01-4	8	2	0.005	2
Xylenes	1330-20-7	170,000	NA	0.005	170,000
Zinc	7440-66-6	340,000	110,000	6	110,000

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NA = Standard not available
* The direct contact standard for arsenic is based on natural background

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Table 2A – Impact to Ground Water (GW) Health Based Soil Criteria and Soil Remediation Standards for Mobile Organic Chemicals (mg/kg)

Contaminant	CAS Number	Impact to GW Health Based Soil Criterion	Soil PQL	Impact to GW Soil Remediation Standard
Acenaphthene	83-32-9	74	0.2	74
Acenaphthylene	208-96-8	NA	0.2	NA
Acetone (2-propanone)	67-64-1	12	0.01	12
Acetophenone	98-86-2	2	0.2	2
Acrolein	107-02-8	0.008	0.5	0.5
Acrylonitrile	107-13-1	0.0001	0.5	0.5
Atrazine	1912-24-9	0.03	0.2	0.2
Benzaldehyde	100-52-7	NA	0.2	NA
Benzene	71-43-2	0.0008	0.005	0.005
Benzidine	92-87-5	0.0000006	0.7	0.7
1,1'-Biphenyl	92-52-4	90	0.2	90
Bis(2-chloroethyl)ether	111-44-4	0.00007	0.2	0.2
Bis(2-chloroisopropyl)ether	108-60-1	3	0.2	3
Bromodichloromethane (Dichlorobromomethane)	75-27-4	0.002	0.005	0.005
Bromoform	75-25-2	0.02	0.005	0.02
Bromomethane (Methyl bromide)	74-83-9	0.03	0.005	0.03
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	0.6	0.01	0.6
Caprolactam	105-60-2	NA	0.2	NA
Carbazole	86-74-8	NA	0.2	NA
Carbon disulfide	75-15-0	4	0.5	4
Carbon tetrachloride	56-23-5	0.003	0.005	0.005
4-Chloroaniline (p-Chloroaniline)	106-47-8	0.1	0.2	0.2
Chlorobenzene	108-90-7	0.4	0.005	0.4
Chloroethane	75-00-3	NA	0.005	NA
Chloroform	67-66-3	0.2	0.005	0.2
Chloromethane (Methyl chloride)	74-87-3	NA	0.005	NA
2-Chlorophenol (o-Chlorophenol)	95-57-8	0.5	0.2	0.5
Dibromochloromethane (Chlorodibromomethane)	124-48-1	0.001	0.005	0.005
1,2-Dibromo-3-chloropropane	96-12-8	0.00008	0.005	0.005
1,2-Dibromoethane	106-93-4	0.000001	0.005	0.005
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	11	0.005	11
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	12	0.005	12
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	1	0.005	1
3,3'-Dichlorobenzidine	91-94-1	0.002	0.2	0.2
Dichlorodifluoromethane	75-71-8	25	0.005	25
1,1-Dichloroethane	75-34-3	0.2	0.005	0.2
1,2-Dichloroethane	107-06-2	0.0008	0.005	0.005
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	0.005	0.005	0.005
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	0.2	0.005	0.2
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	0.4	0.005	0.4
2,4-Dichlorophenol	120-83-2	0.1	0.2	0.2

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Contaminant	CAS Number	Impact to GW Health Based Soil Criterion	Soil PQL	Impact to GW Soil Remediation Standard
1,2-Dichloropropane	78-87-5	0.002	0.005	0.005
1,3-Dichloropropene (cis and trans) (summed)	542-75-6	0.002	0.005	0.005
Diethyl phthalate	84-66-2	57	0.2	57
2,4-Dimethyl phenol	105-67-9	0.7	0.2	0.7
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	NA	0.3	NA
2,4-Dinitrophenol	51-28-5	0.02	0.3	0.3
2,4-Dinitrotoluene	121-14-2	NA	0.2	NA
2,6-Dinitrotoluene	606-20-2	NA	0.2	NA
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	0.0002	0.2	0.2
1,2-Diphenylhydrazine	122-66-7	0.0008	0.7	0.7
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	2	0.003	2
Endosulfan sulfate	1031-07-8	1	0.003	1
Endrin	72-20-8	0.6	0.003	0.6
Ethyl benzene	100-41-4	8	0.005	8
Fluorene	86-73-7	110	0.2	110
alpha-HCH (alpha-BHC)	319-84-6	0.0002	0.002	0.002
beta-HCH (beta-BHC)	319-85-7	0.0007	0.002	0.002
Hexachloroethane	67-72-1	0.1	0.2	0.2
Isophorone	78-59-1	0.1	0.2	0.2
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	0.0009	0.002	0.002
Methyl acetate	79-20-9	14	0.005	14
2-Methylnaphthalene	91-57-6	5	0.17	5
Methylene chloride (Dichloromethane)	75-09-2	0.007	0.005	0.007
2-Methylnaphthalene	91-57-6	5	0.17	5
2-Methylphenol (o-cresol)	95-48-7	NA	0.2	NA
4-Methylphenol (p-cresol)	106-44-5	NA	0.2	NA
Methyl tert-butyl ether (MTBE)	1634-04-4	0.2	0.005	0.2
Naphthalene	91-20-3	16	0.2	16
2-Nitroaniline	88-74-4	NA	0.3	NA
Nitrobenzene	98-95-3	0.01	0.2	0.2
N-Nitrosodimethylamine	62-75-9	0.000001	0.7	0.7
N-Nitrosodi-n-propylamine	621-64-7	0.00001	0.2	0.2
N-Nitrosodiphenylamine	86-30-6	0.2	0.2	0.2
Pentachlorophenol	87-86-5	0.04	0.3	0.3
Phenol	108-95-2	5	0.2	5
Styrene	100-42-5	2	0.005	2
Tertiary butyl alcohol (TBA)	75-65-0	0.2	0.1	0.2
1,1,2,2-Tetrachloroethane	79-34-5	0.004	0.005	0.005
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	0.003	0.005	0.005
Toluene	108-88-3	4	0.005	4
1,2,4-Trichlorobenzene	120-82-1	0.4	0.005	0.4
1,1,1-Trichloroethane	71-55-6	0.2	0.005	0.2
1,1,2-Trichloroethane	79-00-5	0.01	0.005	0.01
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	0.007	0.005	0.007

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Contaminant	CAS Number	Impact to GW Health Based Soil Criterion	Soil PQL	Impact to GW Soil Remediation Standard
Trichlorofluoromethane	75-69-4	22	0.005	22
2,4,5-Trichlorophenol	95-95-4	44	0.2	44
2,4,6-Trichlorophenol	88-06-2	0.03	0.2	0.2
Vinyl chloride	75-01-4	0.0003	0.005	0.005
Xylenes (total)	1330-20-7	12	0.005	12

NA = Standard not available

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Table 2B - Impact to Ground Water (GW) Health Based Leachate* Criteria and Leachate Standards for Low Mobility Organic Contaminants (ug/L)

Contaminant	CAS Number	Impact to GW Health Based Leachate Criterion	Aqueous PQL	Impact to GW Leachate Standard
Aldrin	309-00-2	0.03	0.04	0.04
Anthracene	120-12-7	26,000	5	26,000
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.6	0.1	0.6
Benzo(a)pyrene	50-32-8	0.06	0.1	0.1
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.6	0.2	0.6
Benzo(ghi)perylene	191-24-2	NA	0.2	NA
Benzo(k)fluoranthene	207-08-9	6	0.3	6
Bis(2-ethylhexyl)phthalate	117-81-7	26	3	26
Butyl benzyl phthalate	85-68-7	1300	1	1,300
Chlordane (alpha and gamma)	57-74-9	0.1	0.05	0.1
Chrysene	218-01-9	65	0.2	65
4,4'-DDD	72-54-8	1	0.02	1
4,4'-DDE	72-55-9	1	0.01	1
4,4'-DDT	50-29-3	1	0.1	1
Dibenz(a,h)anthracene	53-70-3	0.06	0.3	0.3
Dieldrin	60-57-1	0.03	0.02	0.03
Di-n-butyl phthalate	84-74-2	9,100	5	9,100
Di-n-octyl phthalate	117-84-0	1,300	5	20
Fluoranthene	206-44-0	3,900	5	3,900
Heptachlor	76-44-8	0.1	0.05	0.1
Heptachlor epoxide	1024-57-3	0.05	0.02	0.05
Hexachlorobenzene	118-74-1	0.3	0.02	0.3
Hexachloro-1,3-butadiene	87-68-3	5	1	5
Hexachlorocyclopentadiene	77-47-4	520	0.5	520
Indeno(1,2,3-cd)pyrene	193-39-5	0.6	0.2	0.6
Methoxychlor	72-43-5	520	0.1	520
Phenanthrene	85-01-	NA	0.4	NA
Polychlorinated biphenyls (PCBs)	81336-36-3	0.3	0.5	0.5
Pyrene	129-00-0	2,600	0.1	2,600
Toxaphene	8001-35-2	0.4	2.0	2.0

NA = Standard not available

* The leachate standard is based on analysis of leachate resulting from the synthetic leaching procedure conducted on contaminated soil.

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Table 2C - Impact to Ground Water (GW)Health Based Leachate* Criteria and Leachate Standards for Inorganic Contaminants (ug/L)

Contaminant	CAS Number	Impact to GW Health Based Leachate Criteria	Aqueous PQL	Leachate Standard
Aluminum	7429-90-5	2,600	20	2,600
Antimony	7440-36-0	78	3	78
Arsenic	7440-38-2	0.3	0.5	0.5
Barium	7440-39-3	91,000	1	91,000
Beryllium	7440-41-7	13	0.3	13
Cadmium	7440-43-9	52	1	52
Cobalt	7440-48-4	NA	2	NA
Copper	7440-50-8	16,900	3	16,900
Cyanide	57-12-5	1,300	6	1,300
Lead	7439-92-1	65	5	65
Manganese	7439-96-5	650	0.4	650
Mercury	7439-97-6	26	0.2	26
Nickel (Soluble salts)	7440-02-0	1,300	4	1,300
Selenium	7782-49-2	520	4	520
Silver	7440-22-4	520	1	520
Thallium	7440-28-0	6	0.7	6
Vanadium	7440-62-2	NA	3	NA
Zinc	7440-66-6	26,000	2	26,000

* The leachate standard is based on analysis of leachate resulting from the synthetic leaching procedure conducted on contaminated soil.

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APPENDIX 2
Methods for the Development of Ingestion-Dermal Soil Remediation Standards for Residential and Non-residential Exposure (Equations 1 through 4)

Equation 1

Combined Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil Residential Scenario

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard (mg/kg)} = \frac{TR * AT * 365 d/yr}{\left(EF * 10^{-6}\, kg/mg\right)\left[\left(SF_o * IF_{soil/adj}\right) + \left(SF_{ABS} * SFS * ABS_d * EV\right)\right]}$$

Parameter	Definition	Units	Default
TR	Target cancer risk	Unitless	10^{-6}
AT	Averaging time	Years	70
EF	Exposure frequency	Days/year	350
SF_{ABS}	Dermally adjusted cancer slope factor	$(mg/kg\text{-}d)^{-1}$	Chemical-specific
SFS	Age-adjusted dermal factor	mg-yr/kg-event	360
ABS_d	Dermal absorption fraction	Unitless	Chemical-specific
EV	Event frequency	Events/day	1
SF_o	Oral cancer slope factor	$(mg/kg\text{-}d)^{-1}$	Chemical-specific
$IF_{soil/adj}$	Age-adjusted soil ingestion factor	mg-yr/kg-d	114

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Equation 2

Combined Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Contaminants in Soil Residential Sites

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard (mg/kg)} = \frac{THQ * BW * AT * 365 d/yr}{\left(EF * ED * 10^{-6} kg/mg\right)\left[\left(\frac{1}{RfD_o} * IR\right) + \left(\frac{1}{RfD_{ABS}} * AF * ABS_d * EV * SA\right)\right]}$$

Parameter	Definition	Units	Default
THQ	Target hazard quotient	Unitless	1
BW	Body weight	kg	15
AT	Averaging time	Years	6
EF	Exposure frequency	Days/year	350
ED	Exposure duration	Years	6
RfD_o	Oral reference dose	mg/kg-day	Chemical-specific
IR	Soil ingestion rate	mg/day	200
RfD_{ABS}	Dermally adjusted reference dose	mg/kg-day	Chemical-specific
AF	Skin-soil adherence factor	mg/cm^2-event	0.2
ABS_d	Dermal absorption factor	Unitless	Chemical-specific
EV	Event frequency	Events/day	1
SA	Skin surface area exposed-child	cm^2	2,800

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Equation 3

Combined Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil Non-Residential Outdoor Worker Site

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard (mg/kg)} = \frac{TR * BW * AT * 365\,d/yr}{(EF * ED * 10^{-6}\,kg/mg)((SF_o * IR) * (SF_{ABS} * AF * ABS_d * SA * EV))}$$

Parameter	Definition	Units	Default
TR	Target cancer risk	Unitless	10^{-6}
BW	Body weight	kg	70
AT	Averaging time	Years	70
EF	Exposure frequency	Days/year	225
ED	Exposure duration	Years	25
SF_O	Oral cancer slope factor	$(mg/kg\text{-}d)^{-1}$	Chemical-specific
IR	Soil ingestion rate	mg/d	100
SF_{ABS}	Dermally adjusted cancer slope factor	$(mg/kg\text{-}d)^{-1}$	Chemical-specific
AF	Soil-skin adherence factor	mg/cm^2-event	0.2
ABS_d	Dermal absorption factor	Unitless	Chemical-specific
SA	Skin surface exposed	cm^2	3,300
EV	Event frequency	Events/day	1

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Equation 4

Combined Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Contaminants in Soil Non-Residential Outdoor Worker Site

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard (mg/kg)} = \frac{THQ * BW * AT * 365\, d/yr}{\left(EF * ED * 10^{-6}\, kg/mg\right)\left[\left(\frac{1}{RfD_o} * IR\right) + \left(\frac{1}{RfD_{ABS}} * AF * ABS_d * SA * EV\right)\right]}$$

Parameter	Definition	Units	Default
THQ	Target hazard quotient	Unitless	1
BW	Body weight	kg	70
AT	Averaging time	Years	25
EF	Exposure frequency	Days/years	225
ED	Exposure duration	Years	25
RfD_o	Oral reference dose	mg/kg-d	Chemical-specific
IR	Soil ingestion rate	mg/d	100
RfD_{ABS}	Dermally adjusted reference dose	mg/kg-d	Chemical-specific
AF	Skin-soil adherence factor	mg/cm^2-event	0.2
ABS_d	Dermal absorption fraction	Unitless	Chemical-specific
SA	Skin surface exposed	cm^2	3,300
EV	Event frequency	Events/day	1

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APPENDIX 3
Methods for the Development of Inhalation Remediation Standards Residential and Non-residential Use (Equations 1 through 25)

I. Methods for the Development of Inhalation Standards for Volatile Contaminants (Equations 1 through 8)

Equation 1

Inhalation Soil Remediation Standards for Carcinogenic Volatile Organic Contaminants

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 4

$$Inh_v SRS_c = \frac{TR * AT * 365\,{}^{days}/_{year}}{URF * 1000\,{}^{\mu g}/_{mg} * EF * ED * \left(\frac{1}{VF}\right)}$$

Parameter	Definition	Units	Default
$Inh_v SRS_c$	Inhalation soil remediation standard for volatile carcinogens	mg/kg	Chemical-specific
TR	Target cancer risk	unitless	$1x10^{-6}$
AT	Averaging time	years	70
URF	Inhalation unit risk factor	$(\mu g/m^3)^{-1}$	Chemical-specific
EF	Exposure frequency	day/year	350 (Residential) 225 (Non-residential)
ED	Exposure duration	years	30 (Residential) 25 (Non-residential)
VF	Soil-to-air volatilization factor	m^3/kg	Chemical-specific

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Equation 2

Inhalation Soil Remediation Standards for Non-carcinogenic Volatile Organic Contaminants

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 5

$$Inh_vSRS_n = \frac{THQ * AT * 365^{days}/_{year}}{EF * ED * \left(\frac{1}{RfC}\right) * \left(\frac{1}{VF}\right)}$$

Parameter	Definition	Units	Default
Inh_vSRS_n	Inhalation soil remediation standard for volatile noncarcinogens	mg/kg	Chemical-specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	years	30 (Residential) 25 (Non-residential)
EF	Exposure frequency	day/year	350 (Residential) 225 (Non-residential)
ED	Exposure duration	years	30 (Residential) 25 (Non-residential)
RfC	Inhalation reference concentration	mg/m^3	Chemical-specific
VF	Soil-to-air volatilization factor	m^3/kg	Chemical-specific

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Equation 3

Volatilization Factor (VF)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 6

$$VF = \left(Q/C_{vol} \right) * \frac{(3.14 * D_A \cdot T)^{1/2}}{2 * \rho b * D_A} * 10^{-4} \, m^2/cm^2$$

Parameter	Definition	Units	Default
VF	Soil-to-air volatilization factor	m^3/kg	Chemical-specific
Q/C_{vol}	Inverse concentration at center of (specific to volume)	$(g/m^2\text{-}s)/(kg/m^3)$	90.4 (Residential) 138.7 (Non-residential)
D_A	Apparent diffusivity	cm^2/s	Chemical-specific
T	Exposure interval	seconds	9.5×10^8 (Residential) 7.9×10^8 (Non-residential)
ρb	Dry soil bulk density	g/cm^3	1.5

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Equation 4

Apparent Diffusivity (DA)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 57

$$D_A = \frac{\left[\left(\theta_a^{10/3} * D_i * H'\right) + \left(\theta_w^{10/3} * D_w\right)\right] / n^2}{\left(\rho b * K_d\right) + \theta_w + \left(\theta_a * H'\right)}$$

Parameter	Definition	Units	Default
D_A	Apparent diffusivity	cm^2/s	Chemical-specific
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
D_i	Diffusivity in air	cm^2/s	Chemical-specific
H'	Henry's Law Constant	unitless	Chemical-specific
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
D_w	Diffusivity in water	cm^2/s	Chemical-specific
n	Total soil porosity	L_{pore}/L_{soil}	0.41
ρb	Dry soil bulk density	g/cm^3	1.5
K_d	Soil-water partition coefficient	cm^3/g	Chemical-specific

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Equation 5

Soil-Water Partition Coefficient (Kd)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 74

$$K_d = K_{oc} * f_{oc}$$

Parameter	Definition	Units	Default
K_d	Soil-water partition coefficient	cm^3/g	Chemical-specific
K_{oc}	Soil organic carbon-water partition coefficient	cm^3/g	Chemical-specific
f_{oc}	Organic carbon content of soil	g/g	0.002

Equation 6

Air-Filled Soil Porosity (θ_a)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 7

$$\theta_a = n - \theta_w$$

Parameter	Definition	Units	Default
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
n	Total soil porosity	L_{pore}/L_{soil}	0.41

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Equation 7

Soil Moisture Content

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Attachment A - "Conceptual Site Model"

$$\theta_w = n(I / K_s)^{1/(2b+3)}$$

Parameter	Definition	Units	Default
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
n	Total soil porosity	L_{pore}/L_{soil}	0.41
I	Soil moisture infiltration rate	m/yr	0.28
K_s	Saturated hydraulic conductivity of the soil	m/yr	387
1/(2b+3)	Determined by soil type (Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Attachment A - "Conceptual Site Model," Table A-2)	Unitless	0.080

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Equation 8

Soil Saturation Limit (C_{sat})

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 9

$$C_{sat} = \frac{S}{\rho_b}\left[\left(K_d * \rho_b\right) + \theta_w + \left(H' * \theta_a\right)\right]$$

Parameter	Definition	Units	Default
C_{sat}	Soil saturation concentration	mg/kg	Chemical-specific
S	Solubility in water	mg/L_{water}	Chemical-specific
ρ_b	Dry soil bulk density	g/cm^3	1.5
K_d	Soil-Water partition coefficient	cm^3/g	Chemical-specific
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
H'	Henry's Law Constant	Unitless	Chemical-specific
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18

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II. Methods for the Development of Inhalation Standards for Particulate Contaminants for Exposure Scenarios for Residential Sites (Equations 9 through 13)

Equation 9

Inhalation Soil Remediation Standards for Carcinogenic Particulate Contamination for Residential Sites

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 4

$$Inh_pSRS_c = \frac{TR * AT \times 365\ days/year}{URF * 1{,}000\ \mu g/mg * EF * ED * \left(\frac{1}{PEF}\right)}$$

Parameter	Definition	Units	Default
Inh_pSRS_c	Inhalation Soil Remediation Standard for carcinogens	mg/kg	Chemical-specific
TR	Target cancer risk	unitless	1×10^{-6}
AT	Averaging time	years	70
URF	Inhalation unit risk factor	$(\mu g/m^3)^{-1}$	Chemical-specific
EF	Exposure frequency	days/year	350 (Residential)
ED	Exposure duration	years	30 (Residential)
PEF	Particulate emission factor	m^3/kg	1,739,586,603

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Equation 10

Inhalation Soil Remediation Standards for Noncarcinogenic Particulate Contamination for Residential Sites

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 5

$$Inh_pSRS_n = \frac{THQ * AT * 365\ days/year}{EF * ED * \left(\frac{1}{RfC}\right) * 1{,}000\,\mu g/mg * \left(\frac{1}{PEF}\right)}$$

Parameter	Definition	Units	Default
Inh_pSRS_n	Inhalation Soil Standard for noncarcinogens	mg/kg	Chemical-specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	years	30 (Residential)
EF	Exposure frequency	days/year	350 (Residential)
ED	Exposure duration	years	30 (Residential)
RfC	Inhalation reference concentration	$\mu g/m^3$	Chemical-specific
PEF	Particulate emission factor	m^3/kg	1,739,586,603

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Equation 11

Particulate Emission Factor (PEF)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 10

$$PEF = Q/C * \left[\frac{3{,}600 \text{ sec/ } hr}{0.036 * (1 - V) * \left(\frac{U_m}{U_t} \right)^3 * F(x)} \right]$$

Parameter	Definition	Units	Default
PEF	Particulate emission factor	m^3/kg	1,739,586,603 (Residential)
Q/C	Inverse concentration at center of source	$(g/m^2\text{-}s)/(kg/m^3)$	90.4 (Residential)
V	Fraction of vegetative cover	unitless	0.5
U_m	Mean annual wind speed	m/s	4.56
U_t	Equivalent threshold value of wind speed at seven miles per hr	m/s	11.32
F(x)	Function dependent on U_m/U_t derived using Cowherd et al. (1985)	unitless	0.159

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Equation 12

Inverse Concentration Factor for Dispersion (Q/C)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 59

$$Q/C = \frac{J_{s^{ave}}}{C_{air} * 10^{-9} \cdot kg/\mu g}$$

Parameter	Definition	Units	Default
Q/C	Inverse concentration at center of source	$(g/m^2\text{-}s)/(kg/m^3)$	90.4 (Residential)
J_s^{ave}	Average rate of contaminant flux	$g/m^2\text{-}s$	0.000494315 (Residential)
C_{air}	Maximum contaminant concentration	$\mu g/m^3$	5,468 (Residential)

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Equation 13

Average Rate Of Contaminant Flux (J_s^{ave})

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 59

$$J_{s^{ave}} = \frac{ER}{A}$$

Parameter	Definition	Units	Default
J_s^{ave}	Average rate of contaminant flux	g/m^2-s	0.000494315 (Residential)
ER	Emission rate (normalized)	g/s	1
A	Area	m^2	1/2 acre = 2,023 m^2 (Residential)

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III. Methods for the Development of Inhalation Standards for Particulate Contaminants for Exposure Scenarios for Non-Residential Sites (Equations 14 through 21)

Equation 14

Inhalation Soil Remediation Standards for Non-Residential Sites for Carcinogenic Particulate Contaminants

ource: Derived from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4-24 (March 2001), Equation 4-3

$$Inh_p SRS_c = \frac{TR}{CSF * DOSE} * \frac{10^6 mg}{kg}$$

Parameter	Definition	Units	Default
Inh_pSRS_c	Health-based soil cleanup level for carcinogens	mg/kg	Chemical-specific
TR	Target cancer risk	unitless	$1x10^{-6}$
CSF	Cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical-specific
DOSE	Exposure dose calculation	mg/kg-day	0.00105

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Equation 15

Inhalation Soil Remediation Standards for Non-Residential Sites for Non-Carcinogenic Particulate Contaminants

Source: Derived from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4-24 (March 2001), Equation 4-4

$$Inh_pSRS_n = \frac{1}{DOSE / RfD} * \frac{10^6\, mg}{kg}$$

Parameter	Definition	Units	Default
Inh_pSRS_n	Health-based soil cleanup level for noncarcinogens	mg/kg	Chemical-specific
DOSE	Exposure dose calculation	mg/kg-day	0.00294
RfD	Reference dose	mg/kg-day	Chemical-specific

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Equation 16

Converting Unit Risk Factor to Cancer Slope Factor

Source: Derived from footnote equation Table A-1, NJDEP Technical Manual 1003 - Guidance on Preparing a Risk Assessment for Air Contaminant Emissions, December 1994

$$CSF = \frac{URF * BW}{DIR} * \frac{10^3 \mu g}{mg}$$

Parameter	Definition	Units	Default
CSF	Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$	Chemical-specific
URF	Unit Risk Factor	$(\mu g/m^3)^{-1}$	Chemical-specific
BW	Body weight	kg	70
DIR	Daily inhalation rate	m^3/day	20

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Equation 17

Converting Reference Concentration to Reference Dose

Source: Users Guide and Background Technical Document for USEPA Region IX Preliminary Remediation Goals Table, USEPA (2004)

$$RfD = RfC * DIR * \left(\frac{1}{BW}\right) * \left(\frac{mg}{10^3\,\mu g}\right)$$

Parameter	Definition	Units	Default
RfD	Reference dose	(mg/kg-day)	Chemical-specific
RfC	Reference concentration	($\mu g/m^3$)	Chemical-specific
DIR	Daily inhalation rate	m^3/day	20
BW	Body weight	kg	70

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Equation 18

Exposure Dose

Source: Derived from Guidelines for Exposure Assessment, EPA/600/2-92/001 (May 1992); Equation 2-5

$$DOSE = \frac{PEF_s * IR * EF * ED}{BW * AT}$$

Parameter	Definition	Units	Default
DOSE	Exposure dose calculation	mg/kg-day	0.00105 (Carcinogenic) 0.00294 (Non-carcinogenic)
PEF_s	Particulate emission factor from site activity; differs from "PEF" noted in Equations 10 and 11	mg/m^3	0.0167
IR	Inhalation rate	m^3/day	20
EF	Exposure frequency	days at site per year	225
ED	Exposure duration	Years	25
BW	Body weight	kg	70
AT	Averaging time	days	25,550 (Carcinogenic) 9,125 (Non-carcinogenic)

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Equation 19

Particulate Emission Factor From Site Activity (PEF_s)

Source: Derived from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4-24 (March 2001), Equation 5-9

$$PEF_s = CF * \left[(D_{isc} * ER_{wind}) + (D_{isc} * ER_{traffic}) * \left(\frac{A_{traf}}{A_s} \right) \right]$$

Parameter	Definition	Units	Default
PEF_s	Particulate emission factor from site activity	mg/m^3	0.0167
CF	Conversion factor	mg/μg	10^{-3}
D_{isc}	Air dispersion factor for unit emission rate of one g/s	(μg-sec)/(m^3-g)	170
ER_{wind}	Wind generated particulate emission rate per year	g/s	0.0528
$ER_{traffic}$	Particulate emission rate for site traffic	g/s	0.0453
A_{traf}	Area of traffic	m^2	8,093.65
A_s	Site area	m^2	8,093.65

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Equation 20

Particulate Emission Rate ($ER_{traffic}$)

Source: Derived from Equation 21, below - conversion of units in Equation 21 from g/VKT to g/s

$$ER_{traffic} = \frac{E_{10} * TC * D * TF}{(28{,}800 \text{ seconds/8-hr day}) * EF}$$

Parameter	Definition	Units	Default
$ER_{traffic}$	Particulate emission rate for site traffic	g/s	0.0453
E_{10}	Particulate emission factor	g/VKT	579.3
TC	Daily traffic count for the unpaved area	vehicles/day	33
D	Average distance a vehicle travels through the unpaved area	km	0.09
TF	Traffic frequency	days with traffic/year	225
EF	Exposure frequency	days at site/year	225

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Equation 21

Particulate Emission Factor from vehicles per kilometer traveled (from USEPA 2003c)

Source: AP-42, Chapter 13.2.2.2; Equations 1a and 2

$$E_{10} = (281.9\ g/VKT) * \left[k(s/12)^{0.9} * (W/3)^{0.45}\right] * \left[\frac{(365 - p)}{365\ days}\right]$$

Parameter	Definition	Units	Default
E_{10}	Particulate emission factor per kilometer traveled	g/VKT (grams per vehicle-kilometer-traveled)	579.3
k	Particle size multiplier	unitless	1.5 for PM10
s	Silt content of unpaved surface	%	11
W	Mean vehicle weight	tons	3.1
p	days with at least 0.254 mm (0.01 in) precipitation per year	days	121.3

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IV. Equations for Industrial Wind Erosion listed in Section 13.2.5 of U.S. EPA's AP-42, Compilation of Air Pollutant Emission Factors, Volume I: Stationary, Point, and Area Source (listed with several New Jersey-specific values for convenience; Equations 22 through 25)

Equation 22

Particulate Emission Rate from Wind Erosion (ER_{wind})

Source: Derived from AP-42, Chapter 13.2.5.3; Equation 2

$$ER_{wind} = \frac{k*N*P*SA}{31{,}536{,}000 \text{ sec/ } year}$$

Parameter	Definition	Units	Default
ER_{wind}	Wind generated particulate emission rate per year	g/s	0.0528
k	Particle size multiplier	unitless	0.5 for PM10
N	Number of disturbances per year	$(year)^{-1}$	225
P	Erosion Potential	g/m^2	1.83
SA	Surface area of the site	m^2	8,093.65

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Equation 23

Erosion Potential for a Dry Exposed Surface

Source: Derived from AP-42, Chapter 13.2.5.3; Equation 3

$$P = 58*(u^* - u^t)^2 + 25*(u^* - u^t)$$

Parameter	Definition	Units	Default
P	Erosion potential	g/m^2	1.83
u*	Friction velocity	m/s	1.39376
u^t	Threshold Friction Velocity	m/s	1.33

A threshold friction velocity of 1.33 m/s for roadbed material is assumed. This value is taken from Table 13.2.5-2 of AP-42 (USEPA 1998a).

Equation 24

Friction Velocity (u*)

Source: Derived from AP-42, Chapter 13.2.5.3; Equation 4

$$u^* = 0.053*u_{10}^{+}$$

Parameter	Definition	Units	Default
u*	Friction velocity	m/s	1.39376
u^+_{10}	Fastest Mile Wind at 10 meters	m/s	26.297

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Equation 25

Correct the Fastest Wind Mile ($u^{6.1}$) to a Reference Height of 10 meters

Source: Derived from AP-42, Chapter 13.2.5.3; Equation 5

$$u_{10}^{+} = u^{6.1} * \frac{\ln(10m/0.005)}{\ln(z/0.005)}$$

Parameter	Definition	Units	Default
u^{+}_{10}	Fastest Mile Wind at 10 meters	m/s	26.297
$u^{6.1}$	Fastest Mile Wind at standard anemometer height	m/s	24.587
z	Anemometer height	m	6.1

Fastest Mile Wind Speed of 55 miles per hour (24.58 m/s) found in "Local Climatological Data Annual Summary for Newark, New Jersey" (NOAA 2002b). Value is fastest mile wind speed among climatological records for stations at Allentown and Philadelphia, Pennsylvania, Wilmington, Delaware, Atlantic City, New Jersey, and Central Park, New York.

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APPENDIX 4
Methods for the Development
Impact to Ground Water Soil Remediation Standards for Class II A Ground Water

Equation 1

Soil-Water Partition Equation
Generic Impact to Ground Water Soil Remediation Standards for Mobile Organic Chemicals

Source: USEPA. Soil Screening Guidance: Technical Background Document, May 1996. U.S. Environmental Protection Agency, Office of Emergency Response: Washington, D.C., EPA/540/R-95/128 PB96-963502

$$\text{Impact to Ground Water Soil Remediation Standard } (IGWSRS) = GWQC\left\{(K_{oc}f_{oc}) + \frac{\theta_w + \theta_a H'}{\rho_b}\right\}DAF$$

Parameter	Definition	Units	Default
$GWQC$	Health Based Ground Water Quality Criterion (N.J.A.C. 7:9C-1.6 *et seq.*)	mg/L	Chemical-specific
K_{oc}	Soil organic carbon-water partition coefficient	L/kg	Chemical-specific
f_{oc}	Fraction organic carbon	dimensionless	0.002
θ_w	Water filled soil porosity	dimensionless	0.23
θ_a	Air filled soil porosity	dimensionless	0.18
H'	Henry's Law Constant	dimensionless	Chemical specific
ρ_b	Dry soil bulk density	kg/L	1.5
DAF	Dilution attenuation factor	dimensionless	13 (see eq. 2)

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Equation 2
Dilution-Attenuation Factor (DAF):

Source: USEPA. Soil Screening Guidance: Technical Background Document, May 1996. U.S. Environmental Protection Agency, Office of Emergency Response: Washington, D.C., EPA/540/R-95/128 PB96-963502

$$\text{Dilution Attenuation Factor } (DAF) = 1 + \frac{Kid}{IL}$$

Parameter	Definition	Units	Default
Ki product	Aquifer Hydraulic Conductivity (m/yr)* hydraulic gradient (dimensionless)	m/yr	30
d	Mixing zone depth	m	3.5 (See eq. 3)
I	Infiltration rate	m/yr	0.28
L	Length of area of concern parallel to ground water flow direction	m	30.5

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Equation 3
Aquifer mixing zone depth, *d*

Source: USEPA. Soil Screening Guidance: Technical Background Document, May 1996. U.S. Environmental Protection Agency, Office of Emergency Response: Washington, D.C., EPA/540/R-95/128 PB96-963502

$$\text{Mixing zone depth}\,(d) = (0.0112L^2)^{0.5} + d_a\{1 - \exp[(-LI)/(Kid_a)]\}$$

Parameter	Definition	Units	Default
L	Length of area of concern parallel to ground water flow direction	m	30.5
d_a	Aquifer thickness	m	3.5
I	Infiltration rate	m/yr	0.28
Ki Product	Aquifer hydraulic conductivity (m/yr) multiplied by the hydraulic gradient (dimensionless)	m/yr	30

Equation 4
Leachate Standards

Source: NJDEP Derived equation

$$\text{Leachate Standard}\,(LS) = GWQC * DAF$$

Parameter	Definition	Units	Default
$GWQC$	Health Based Ground Water Quality Criterion (N.J.A.C. 7:9C-1.4)	µg/l	Chemical Specific
DAF	Dilution Attenuation Factor (see equation 2)	dimensionless	13 (see eq. 2)

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APPENDIX 5
Methods for the Development of Alternative Ingestion-Dermal Soil Remediation Standards

Pursuant to N.J.A.C. 7:26D-7, the person responsible for conducting the remediation may propose, for the Department's approval, an alternative soil remediation standard (ARS) for the Ingestion-Dermal exposure pathway for a site or an area of concern based on one of the options provided in this Appendix.

A. General Requirements

The ingestion-dermal exposure pathway has limited ARS options. Soil remediation standards developed for this exposure pathway are based on established risk assessment methods that do not employ site-specific factors. In addition, the default input parameters for these factors are generally accepted and used by EPA and other state agencies. The Department does not believe it is practicable to develop site-specific ARS through the modifications of these standard default input parameters. Therefore, ARS options for the ingestion-dermal pathway are limited to the two options listed below.

Alternative remediation standards calculated pursuant to this Appendix are applicable to ingestion-dermal remediation standards only. The person responsible for conducting the remediation is required to evaluate an ingestion-dermal ARS to determine if such an ARS impacts 1) human health via the inhalation exposure pathway, 2) ground water quality and 3) ecological receptors.

B. Alternative Remediation Standard Options

Option I– Site Specific Default Values (Lead Site Contamination)

The ingestion-dermal pathway uses EPA recommended default exposure parameters for residential and non-residential scenarios for all standards, except lead. These default parameters are generic and reflect a reasonable maximum exposure (RME) that may not be adjusted.

For lead, other risk assessment tools have been developed that use models to predict appropriate blood lead levels. The Department may accept an application for an ARS for residential exposure based on input parameters identified by the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) (USEPA, 1994)[1] using site-specific data for soil and dust lead concentrations. Site data may be used to refine estimates for other exposure-related model parameters such as bioavailability. However, except for lead, the Department will not accept

[1] U.S. Environmental Protection Agency (USEPA). 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9285.7-15-1.

applications for alternative remediation standards based on changes to bioavailability assumptions.

The Department may accept an application for alternative remediation standard for lead for non-residential site use based on input parameters identified in the document Recommendations of the Technical Review Workgroup (TRW) for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposures to Lead in Soil (USEPA, 1996)[2].

The Department may accept an application for an alternative remediation standard for a recreational land use at a lead site based on the assessment of non-continuous exposure for all ages identified in the EPA guidance, Assessing Intermittent or Variable Exposures at Lead Sites (USEPA, 2003)[3].

More information on the development of an alternative remediation standard for lead is provided in the ingestion dermal basis and background document which is available on the Department's web site at www.state.nj.us/dep/srp.

The Department does not require the remediation of a discharge to levels that are lower than natural background levels. See N.J.S.A. 58:10B-12(g)(4). The person responsible for conducting the remediation may conduct a site investigation to determine background levels in soil, pursuant to N.J.A.C. 7:26E-3.10 on a site specific basis.

Option II- Recreational Land Use Scenario

An alternative remediation standard may be based on use of the site for recreational purposes. Recreational purposes are site-specific uses that do not reflect either a residential or non-residential land use scenario. Alternative standards may be based on site-specific land use scenarios that effect the amount time that people are likely to spend at a site that is designated for recreational use. There are two basic types of recreational land use, active and passive, that may be considered. Examples of active recreational land use are sports playing fields and playgrounds. Examples of passive recreational land use are walking or bike trails. The approval of an alternative remediation standard for recreational land use will be contingent on the use of proper institutional controls to ensure the continued use of the site for the proposed recreational purpose.

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[2] U.S. Environmental Protection Agency (USEPA). 1996b. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil, USEPA Technical Workgroup for Lead. December, 1996.

[3] U.S. Environmental Protection Agency (USEPA). 2003b. Assessing Intermittent or Variable Exposures at Lead Sites, Office of Solid Waste and Emergency Response, OSWER 9285.7-76.

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APPENDIX 6
Methods for the Development of Alternative Inhalation Soil Remediation Standards

Pursuant to N.J.A.C. 7:26D-7.2, the person responsible for conducting the remediation may propose, for the Department's approval, an alternative soil remediation standard (ARS) for the inhalation exposure pathway for a site or an area of concern based on one of the options provided in this Appendix.

A. General Requirements

The inhalation exposure pathway has several ARS options. The soil remediation standards developed for this exposure pathway are based on established risk assessment methods that employ some factors that are not site-specific. In addition, the default input parameters for these factors are generally accepted and used by EPA and other state agencies. The Department does not believe it is practicable to develop a site-specific ARS through the modification of these standard default input parameters. Therefore, ARS options for the inhalation pathway are limited to the options listed below.

If the concentration of any alternative remediation standard derived pursuant to this Appendix exceeds the contaminant's C_{sat} value (Table 1), the contaminant is not regulated as a volatile phase contaminant by the inhalation exposure pathway. However, the contaminant may be regulated as a particulate if appropriate.

Alternative remediation standards calculated pursuant to this Appendix are applicable to inhalation remediation standards only. The person responsible for conducting the remediation is required to evaluate an inhalation ARS to determine if such an ARS impacts 1) human health via the ingestion-dermal exposure pathway, 2) ground water quality and/or 3) ecological receptors.

Multiple site-specific conditions may be used to calculate an ARS for a given contaminant. If an ARS is developed using a given site-specific physical and/or operational condition(s), that (those) condition(s) must be applied consistently.

B. Alternative Remediation Standard Options

Option I. Volatile Phase Contaminants

1. For volatile phase contaminants, three parameters can be varied to develop an ARS. These parameters are depth range of contamination, organic carbon content of the soil, and site size. These parameters are applicable to residential and non-residential scenarios as well as carcinogenic and noncarcinogenic health endpoints.

   i. Depth Range of Contamination

      (1) Determine the actual depth range of contamination by conducting sampling pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-4.

(2) Use the actual depth range of contamination in the Jury Model that is included in the EMSOFT software package to derive a site-specific volatilization factor (VF) following the methodology in Appendix I of the Inhalation Pathway Basis and Background.

(3) Substitute the derived site-specific volatilization factor into Equations 1 and 2 N.J.A.C. 7:26D, Appendix 2, to calculate an alternative inhalation remediation standard. Using a finite depth range reduces the mass of contaminant in the soil, which will reduce the average volatilization flux.

(4) The Department will not require the use of an institutional control pursuant to N.J.A.C. 7:26E-8 for an ARS based on depth range of contamination.

ii. Soil organic carbon content (f_{oc}):

(1) Collect a minimum of three samples from different locations at the site that are representative of each area of concern including soil type(s) and sample depth equivalent to the location of contamination. Samples may not be collected from areas with high levels of organic contamination (greater than 1,000 ppm).

(2) Analyze samples for soil organic carbon content using the Lloyd Kahn Method[4].

(3) Use the average soil organic carbon content as f_{oc} in the Soil-Water Partition Coefficient Equation (Appendix 2, Equation 5) to develop a site-specific Kd value. If f_{oc} values at a given area of concern vary by more than an order of magnitude, they may not be averaged to calculate a site-specific Kd value. In this case, the lowest f_{oc} value must be used to determine the K_d value for the soil in the area of concern.

(4) Use the site-specific Kd value in Equation 4, Appendix 2 to calculate a site-specific value for apparent diffusivity, DA.

(5) Use the site-specific value for apparent diffusivity, DA, in Equation 3, Appendix 2, to calculate a site-specific volatilization factor, VF.

(6) Substitute the site-specific volatilization factor into Equations 1 and 2, Appendix 2, to calculate an alternative inhalation remediation standard.

(7) The Department will not require the use of an institutional control pursuant to N.J.A.C. 7:26E-8 for an ARS based on soil organic carbon content.

[4] Determination of Total Organic Carbon in Sediment (Lloyd Khan Method). U.S. Environmental Protection Agency, Region II, Edison, New Jersey, 1988. (http://www.epa.gov/region02/qa/documents.htm)

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Option II. Particulate Phase Contaminants

1. **For Residential Exposure**

i. Vegetative Cover:

(1) Measure the actual amount of vegetative cover to determine the fraction of vegetative cover (V) on the site. An example of an acceptable vegetative cover would be areas of continuous grass where there is no bare ground.

(2) Use the measured fraction of vegetative cover (V) in Equation 11, Appendix 2 to calculate the particulate emission factor (PEF).

(3) Use the calculated particulate emission factor (PEF) in Equation 9 or 10 of Appendix 2 to calculate the volatile contaminant carcinogenic (Inh_vSRS_c) or noncarcinogenic (Inh_vSRS_n) soil remediation standard for the inhalation pathway, respectively.

(4) The Department will require the use of an institutional control pursuant to N.J.A.C. 7:26E-8 for an ARS based on an actual amount of vegetative cover to ensure that the basis for the ARS is maintained.

2. **For Non-residential Scenario**

i. Vehicle Trips Per Day ARS for nonresidential sites of two or more acres

(1) Determine the daily traffic count for an unpaved area (TC) (For future use, the entire site is assumed to be unpaved). The number of vehicle trips per day will be calculated by dividing the weekly total by the number of days of site operation for that week.

(2) Use the measured daily traffic count for an unpaved area (TC) in Equation 20, Appendix 2 to calculate the particulate emission rate for site traffic ($ER_{traffic}$).

(3) Use the calculated particulate soil remediation standards ($ER_{traffic}$) in Equation 19 to calculate the particulate emission factor from site activity (PEF_s).

(4) Use the calculated particulate emission factor from site activity (PEF_s) in Equation 18, Appendix 2 to calculate the exposure dose calculation (DOSE).

(5) Use the calculated exposure dose calculation (DOSE) in Equation 14 or 15 of Appendix 2 to calculate the particulate contaminant carcinogenic (Inh_pSRS_c) or the particulate contaminant noncarcinogenic (Inh_pSRS_n) soil remediation standard for the inhalation pathway, respectively.

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(6) The Department will require the use of an institutional control pursuant to N.J.A.C. 7:26E-8 for an ARS based on actual vehicle activity to ensure that the basis for the ARS is maintained.

Option III. Recreational Land Use Scenario

An alternative remediation standard may be based on use of the site for recreational purposes. Recreational purposes are site-specific uses that do not reflect either a residential or non-residential land use scenario. Alternative standards may be based on site-specific land use scenarios that effect the amount time that people are likely to spend at a site that is designated for recreational use. There are two basic types of recreational land use, active and passive, that may be considered. Examples of active recreational land use are sports playing fields and playgrounds. Examples of passive recreational land use are walking or bike trails. The approval of an alternative remediation standard for recreational land use will be contingent on the use of proper institutional controls to ensure the continued use of the site for the proposed recreational purpose.

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APPENDIX 7
Methods for the Development of Alternative Impact to Ground Water Soil Remediation Standards

Pursuant to N.J.A.C. 7:26D-7, the person responsible for conducting the remediation may propose, for the Department's approval, an alternative soil remediation standard (ARS) for the impact to ground water exposure pathway for a site or an area of concern based on one of the options provided in this Appendix.

A. General Requirements

The impact to ground water exposure pathway has several ARS options. Soil remediation standards developed for this pathway are based on established risk assessment methods that employ some factors that are not site-specific. In addition, the default input parameters for these factors are generally accepted and used by EPA and other state agencies. The Department does not believe it is practicable to develop a site-specific ARS through the modification of these standard default input parameters. Therefore, ARS options for the impact to ground water pathway are limited to the options listed below.

The concentration of any alternative remediation standard derived pursuant to this Appendix shall not exceed the contaminant's C_{sat} value (Table 1).

A generic dilution-attenuation factor of 13 may be used for mobile chemicals in the ARS options or a site specific dilution-attenuation factor (*DAF*) may be determined pursuant to Option I below.

A site specific leachate standard may be developed for low mobility and inorganic chemicals using a site specific *DAF*. The criterion is determined by multiplying the Class IIA health based Ground Water Quality Criterion by the site specific *DAF* determined pursuant to Option I below.

Alternative remediation standards calculated pursuant to this Appendix are applicable to impact to ground water remediation standards only. The person responsible for conducting the remediation is required to evaluate an impact to ground water ARS to determine if the ARS would impact 1) human health via the ingestion-dermal and inhalation exposure pathways or 2) ecological receptors.

B. Alternative Remediation Standard Options

Option I. Site Specific Modification of Soil-Water Partition Equation Input Parameters for Mobile Chemicals

1. An ARS may be developed for mobile chemicals by site-specifically modifying one or more of the input parameters used in the Soil-Water Partition Equation (SPE), Appendix 3, Equation 1. The options available are listed below. Adjust the SPE input parameters for site specific conditions as follows:

   i. Soil organic carbon content (f_{oc}):

(1) Collect a minimum of 3 samples from locations at the site that are representative of the area of concern including soil type and contaminant depth. Samples may not be collected from areas with high levels of organic contamination (greater than 1,000 ppm).

(2) Analyze samples for soil organic carbon content using the Lloyd Kahn Method[5].

(3) Use the average soil organic carbon content as f_{oc} in the Soil-Water Partition Equation (Appendix 3, Equation 1) to develop an alternative remediation standard. If f_{oc} values vary by more than an order of magnitude, they may not be averaged to calculate an ARS. In this case, the lowest f_{oc} value must be used to develop the alternative remediation standard.

ii. Soil pH (for ionizable phenols):

(1) Collect a minimum of 3 samples from locations at the site that are representative of the area of concern including soil type and contaminant depth.

(2) Measure the pH in each sample using standard methods.

(3) Use the pH value for each sample to select a soil organic carbon-water partition coefficient (K_{oc}) from Table 2 below reproduced from USEPA "Soil Screening Guidance: User's Guide"[6]. If the measured pH is less than 4.9, use the pH 4.9 K_{oc}. If the measured pH is higher than 8.0, use the K_{oc} value for pH 8.0.

(4) Use the resulting K_{oc} value in the Soil-Water Partition Equation (Appendix 3 Equation 1) to develop an alternative remediation standard for each sample. If the calculated ARS values vary by less than an order of magnitude, they may be averaged to determine the site specific ARS. If they vary by more than an order of magnitude, the lowest calculated ARS value must be used.

iii. Dilution Attenuation Factor (*DAF*) - The Dilution Attenuation Factor may be adjusted to reflect site-specific conditions. The following parameters in the *DAF* equations (Appendix 3, Equations 2 and 3) may be adjusted and substituted into equations for the mixing zone depth and the attenuation factor:

(1) Area of concern length (L):

(A) Measure the length of the area of concern parallel to ground water flow.

[5] Determination of Total Organic Carbon in Sediment (Lloyd Khan Method). U.S. Environmental Protection Agency, Region II, Edison, New Jersey,1988. (http://www.epa.gov/region02/qa/documents.htm)
[6] Soil Screening Guidance: User's Guide, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC, 1996, Table C-2

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(B) Use the length to develop a site-specific aquifer mixing zone depth using Equation 3. If the calculated aquifer mixing zone depth is greater than the aquifer thickness, set the mixing zone depth equal to the aquifer thickness.

(C) Substitute the site-specific values for the mixing zone depth and *L* into the equation for the dilution-attenuation factor (*DAF*) Appendix 3, Equation 2; and

(D) Use the resulting *DAF* value in the Soil-Water Partition Equation (Appendix 3 equation 1) to develop an alternative remediation standard.

(2) Ground water velocity parameters, (hydraulic conductivity, *K* and gradient, *i*):

(A) Determine *K* and *i* from field measurements pursuant to the Technical Requirements for Site Remediation N.J.A.C. 7:26E-3.7(e)3iv, 7:26E-4.4(h)3ii and 7:26E-4.4(h)3iii.

(B) Measure the length (*L*) of the area of concern parallel to ground water flow.

(C) Substitute the above values into the mixing zone equation (Appendix 3, Equation 3) to determine a site-specific aquifer mixing zone depth. If the calculated aquifer mixing zone depth is greater than the aquifer thickness, set the mixing zone depth equal to the aquifer thickness.

(D) Substitute the site-specific values for *K, i, L* and the mixing zone depth into the equation for the dilution-attenuation factor (*DAF*) (Appendix 3, Equation 2) to calculate a site specific *DAF*.

(E) Substitute the *DAF* value into the Soil-Water Partition Equation (Appendix 3 Equation 1) to develop an alternative remediation standard.

(3) Aquifer thickness (d_a):

(A) Aquifer thickness shall be measured in the field by logging continuous core in accordance with the Department's Field Sampling Procedures Manual or shall be determined using available data from the New Jersey Geological Survey or the United States Geological Survey where available.

(B) Measure the length (*L*) of the area of concern parallel to ground water flow.

(C) Use the site-specific aquifer thickness and the actual length of the area of concern in the mixing zone equation (Appendix 3, Equation 3) to calculate a site-specific mixing zone depth. If the calculated aquifer mixing zone depth is greater than the aquifer thickness, set the mixing zone depth equal to the aquifer thickness.

(D) Use the calculated site specific mixing zone depth, and the site specific value for L in the *DAF* equation to calculate a site specific *DAF* (Appendix 3, Equation 2).

(E) Substitute the site specific *DAF* into the Soil-Water Partition Equation (Appendix 3 Equation 1) to develop an alternative remediation standard.

Option II. Synthetic Precipitation Leaching Procedure

1. This option is not appropriate for volatile organic chemical contamination. After completing sections 2i through v below, one or more of the options described in sections 2vi through viii below may be used to calculate an ARS using the Synthetic Precipitation Leaching Procedure.

2. Develop an alternative soil remediation standard using SPLP as follows:

i. Collect soil samples for the site or each area of concern. The number of samples collected shall be determined by the size of the area initially being investigated pursuant to the Department's Technical Requirements for Site Remediation, N.J.A.C. 7:26E. A minimum of three samples must be collected, and should include the highest suspected concentrations of the contaminants on site. Additional samples that represent a range of contaminant concentrations will be useful in using options 2vi through viii below if some or all of the SPLP results exhibit unacceptable leachate concentrations. The samples should be representative of the variation in soil conditions over the area of concern, including variation with soil depth.

ii. Split each sample and analyze as follows:

(1) Analyze one sub-sample for total contaminant concentrations pursuant to the Technical Rules.

(2) Submit the other sub-sample for testing using the SPLP procedure described in USEPA SW-846, Analytical Method 1312, and analyze the leachate using appropriate analytical methods.

(3) Measure the pH of the resulting leachate sample at the end of the extraction.

iii. Report the following information for each sample collected for SPLP analysis:

(1) The total contaminant concentration in the soil, C_T.

(2) The leachate concentration C_L; and the adjusted leachate concentration C_{adj}, if necessary (see section iv below).

(3) The final pH of the leachate.

(4) The volume of the leachate, V_L.

(5) The dry weight of the soil sub-sample used in the SPLP test, M_S.

iv. The Department may require an alternative remediation standard to be developed using adjusted leachate concentrations when site conditions indicate that contaminants may be weakly adsorbed to soil. Leachate concentrations measured in the SPLP test may need to be adjusted to reflect the soil-to-water ratios that exist under field conditions.

(1) The leachate concentration must be adjusted when greater than 25% of the contaminant mass is in the leachate solution at the conclusion of the SPLP test.

(2) Determine the percent concentration of the contaminant in SPLP leachate using Equation 1 below:

$(C_L \times V_L)/(C_T \times M_S) \times 100$ = percent concentration of contaminant in leachate

Equation 1

Where:

V_L = volume of leachate in liters (2 L)
M_S = mass of the soil sample in kilograms (0.1 kg)
C_L = leachate concentration (mg/L)
C_T = total soil concentration (mg/kg)

(3) If the percent contaminant in the leachate is 25 or greater, calculate a K_d value for the contaminant in each sample using Equation 2 below:

$$Kd = \left[\frac{(C_T M_S - C_L V_L)/M_S}{C_L} \right]$$

Equation 2

Where:

K_d = is the soil water partition coefficient (L/kg)

C_T = the total concentration of the contaminant in the SPLP soil sample (mg/kg)

M_S = the total weight of the soil sample submitted for SPLP analysis (kg)

C_L = the concentration of contaminant in the SPLP leachate (mg/L)

V_L = the volume of the SPLP leachate (L)

(4) For each sample, substitute the K_d value in the following equation to calculate an adjusted leachate concentration:

Equation 3

$$C_{adj} = C_T[\rho_b/(K_d \times \rho_b + \theta_w)]$$

Where:

ρ_b = bulk density of the soil (1.5 kg/L)
θ_w = soil moisture (0.23)
C_{adj} = adjusted leachate concentration (mg/L)

(5) Use C_{adj} as C_L in sections vi. and vii below.

v. If option vi or viii below are to be used to calculate an alternate remediation standard, determine a "Leachate standard (LS)" for a contaminant of concern by using a generic LS (see Appendix 3, Table 2B or Table 2C for low mobility chemicals and inorganics respectively) or calculate it as follows:

(1) Determine the health-based Ground Water Quality Criterion, N.J.A.C. 7:9-6, Table 1, for each contaminant.

(2) Multiply the Ground Water Quality Criterion by the generic dilution attenuation factor of 13 or by a site specific *DAF* as described in Option I above to determine the LS.

(3) If the Practical Quantitation Limit (PQL) for the contaminant is higher than the Leachate standard, use the PQL.

vi. Compare the SPLP leachate (or adjusted leachate) concentration for each sample, to the Leachate standard (LS) to determine if existing contaminant levels in soil can be used as a site specific alternative remediation standard as follows:

(1) If all SPLP leachate (or adjusted leachate) concentrations are at or below the LS, the highest soil concentration tested can be used as a site-specific ARS. If this ARS represents the highest concentration of contaminant on site, no further investigation is required for the impact to ground water pathway.

(2) If one or more of the SPLP leachate (or adjusted leachate) concentrations are above the LS, identify the highest soil concentration for which this and all lower soil concentrations give leachate (or adjusted leachate) concentrations at or below the LS. This concentration can be used as a site specific alternative remediation standard.

vii. A site specific alternative remediation standard may also be calculated as follows:

(1) Use the total contaminant concentration in a soil sample (C_T), and the corresponding SPLP leachate concentration (C_L) in Equation 2 above to calculate a sample-specific soil-water partition coefficient (K_d).

(2) If the K_d values of all the samples vary by less than an order of magnitude, calculate the average K_d. If the K_d values of all the samples vary by more than an order of magnitude, select the lowest calculated K_d.

(3) Substitute the site-specific partition coefficient (K_d) determined in (2) above into Equation 4 to calculate a site-specific alternative remediation standard:

$$ARS = C_{gw}\left\{[K_d] + \frac{\theta_w + \theta_a H'}{\rho_b}\right\}DAF \qquad \text{Equation 4}$$

Where:

ARS = alternative remediation standard (mg/kg)

K_d = is the average, or lowest, calculated sample specific soil-water partition coefficient (L/kg)

θ_w = the water-filled soil porosity (0.23)

θ_a = the air-filled soil porosity (0.18)

H' = the dimensionless Henry's law constant for the contaminant of interest

ρ_b = dry soil bulk density (1.5 kg/L)

DAF = the dilution-attenuation factor (default DAF of 13, or site specific DAF)

C_{gw} = the ground water criteria for the contaminant (mg/L)

viii. A linear regression technique may be used to determine an alternative soil remediation standard if an adequate linear correlation exists between leachate (or adjusted leachate) concentrations and the corresponding total soil contaminant concentrations. Determine an adequate linear correlation as follows:

(1) For all samples where both the total soil concentration and the leachate (or adjusted leachate) concentration are above the PQL, plot all the leachate (or adjusted leachate) concentration data (in units of μg/L) on the y-axis as the dependent variable versus the total soil concentration for all samples (in units of mg/kg) on the x-axis as the independent variable.

(2) For the data to qualify for the linear regression technique:

(A) At least half of the total soil concentrations data points must lie at or above the midpoint of the range.

(B) The calculated Leachate standard (LS) must lie within the range of measured leachate (or adjusted leachate) concentrations.

(C) Conduct a linear least-squares regression analysis of the plotted points. If the R-square value is 0.7 or higher, the calculated linear regression line may be used to determine the acceptable total soil concentration.

(3) Calculate the acceptable total soil concentration using Equation 5 below:

$$ARS = \frac{LS - b}{m} \qquad \text{Equation 5}$$

Where:

ARS = the impact to ground water alternative remediation standard (mg/kg)
m = the slope of the best fit line obtained via linear regression analysis ((µg/L)/(mg/kg))
b = the intercept of the best fit line obtained via linear regression analysis (µg/L)
LS = the Leachate standard (µg/L)

Option III. Vadose Zone Transport Modeling using the SESOIL Model

1. An alternative remediation standard may be developed using the Seasonal Soil Compartment Model (SESOIL), version 6.2 or later, when clean soil exists between the soil contamination and the seasonal high water table. The SESOIL model shall be run per the following instructions:

i. Run the model in the monthly mode.

ii. Use climate data from the weather station nearest to the site. Use the climate databases that are included with model software.

iii. Use chemical properties as required for the model.

(1) Use default values for water solubility, Henry's law constant, and diffusion coefficients from Table 1 below.

(2) For mobile organic chemicals, use K_{oc} values from Table 1.

(3) For low mobility organic chemicals, use K_{oc} values from Table 1, or develop a site specific K_d value using the SPLP test (Option II above).

(4) For ionizable phenols, a pH-dependant site specific K_{oc} value may be developed as described in Option I above.

(5) For inorganic chemicals, use K_d values from Table 1, or develop a site specific K_d value using the SPLP test (Option II above).

(6) Degradation of contaminants may not be included except for benzene, toluene, ethylbenzene and xylene (BTEX). For BTEX contaminants use a one month half life

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biodegradation rate (biodegradation rate constant of 0.023 $days^{-1}$) in both the liquid and solid phases if aerobic conditions (>4 percent oxygen) can be demonstrated in the vadose zone.

(7) Hydrolysis rate constants may not be used.

iv. Use default soil properties for bulk density, intrinsic permeability, soil pore disconnectedness index, and effective porosity as contained in the model documentation. The cation exchange capacity shall be set to zero. The Freundlich exponent shall be set to one. The default soil texture shall be sand. The default soil organic carbon content shall be set to 0.2 percent. The same soil properties must be used for all existing soil layers. Site-specific values for soil texture and soil organic carbon content may be developed.

(1) To establish soil texture, collect soil cores using a Shelby Tube, direct push sampler, or split-spoon. The soil cores collected should be representative of the variation that occurs within the area of concern. The soil cores/samples shall be collected continuously (every two or four feet depending on the length of the sampling device) from the soil surface to the surface of the static water level. A soil texture analysis is then completed on the cores/samples. Samples should be analyzed every two feet or for each distinct soil layer. To determine soil texture, the Department will consider any of the following techniques acceptable: sieve analysis for the sand and gravel portions of a given sample with pipette or hydrometer measurements of the silt and clay fractions, rapid sediment analyzers, or electro-resistance multichannel particle size analyzers.

The percentages of sand, silt and clay for each sample are compared to the USDA Soil Texture Triangle to determine the soil texture classification (Figure 1 below). Using the USDA Soil Texture Triangle below, sands are considered particles between 0.05 mm and 2 mm, silts are between 0.05 mm and 0.002 mm and clays are less than 0.002 mm in size.

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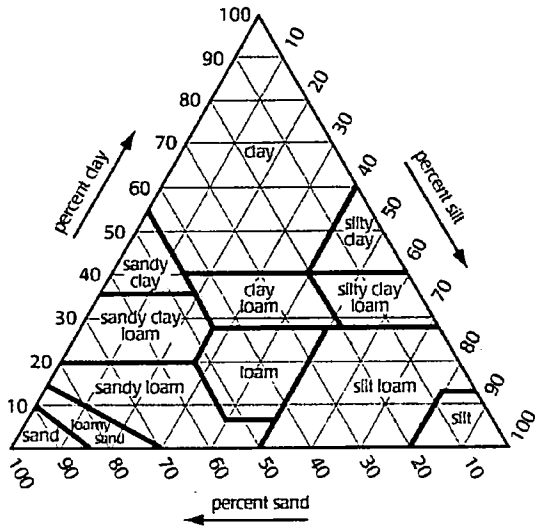
Figure 1



To allow the use of a soil texture in the SESOIL model other than sand, at least 75 percent of the soil vertical profile must be as fine as the selected soil texture. Otherwise, the coarsest soil texture measured must be used for modeling.

The Department's GIS Soil Survey Geographic Database (SSURGO) data layer should be examined in conjunction with the soil boring logs for a particular site of interest as a cross check to confirm that the correct soil texture is being used. This data may also provide a basis for requiring multiple soil boring locations if it indicates horizontal changes in soil texture are likely across the building footprint.

(2) Set the organic carbon content at the generic value of 0.2 percent, or use a site-specific value determined under Option I above. The Freundlich exponent must be set to "1" and soil properties must the same in all layers.

v. The sediment washload option shall not be used.

vi. One foot soil sublayers must be used with the model, and should cover the entire soil column from the soil surface to the water table.

vii. The "Load area" or "Application Area" in the model shall be set equal to the size of the Area of Concern., the appropriate latitude of the site shall be entered, and "instantaneous release" of contaminant at Time 0 of the simulation shall be selected.

viii. Contaminant concentrations (either existing concentrations or proposed remediation standards) must be entered as initial concentrations in the appropriate soil layers.

ix. All ratios of soil properties between soil layers shall be set to "1".

x. The contaminant load parameters POLIN, TRANS, LIG, ISRM and ASL must be set to zero. The VOLF parameter must be set to "1".

xi. Set the model run time at 100 years for low mobility contaminants. For all other contaminants, the model run time must be long enough to achieve peak concentrations in ground water.

xii. Compare the time-dependant concentration of the contaminant in the soil moisture in the deepest soil layer to the Leachate standard (LS) to determine compliance with ground water criteria. To determine the Leachate standard, multiply the GWQC by the generic or site specific DAF. If this product is lower than the PQL, the PQL is used as the LS.

If the model predicts that the concentration will not exceed the LS, then the soil contaminant concentration distribution as used in the model (either existing concentrations or proposed remediation standards) is an acceptable ARS.

xiii. If the model predicts that the ground water concentration will exceed the LS, then soil remediation is necessary.

xiv. The SESOIL model may be rerun varying the concentration distribution in soil in order to identify a distribution that will not result in an exceedance. This identified soil concentration distribution is an acceptable alternative soil remediation standard.

xv. Report the following information for the SESOIL runs submitted for NJDEP consideration:

(1) The value of all input parameters, and their source.

(2) Output of the soil moisture concentration for the bottom soil sublayer as a function of time. Graphical output is preferred.

(3) Other output summaries as provided by the software.

Option IV. Development of an alternative soil remediation goal using Vadose Zone /Ground Water Modeling (SESOIL/AT123D)

1. An alternative remediation standard for the impact to ground water pathway may be developed with the linked SESOIL/AT123D vadose zone/ground water contaminant transport model when:

i. Ground water quality is already degraded by contamination emanating from soil at the area of concern.

ii. The vertical and horizontal extent of ground water contamination emanating from the area of concern has been fully delineated pursuant to N.J.A.C. 7:26E-4.4(h)3i.

iii. A natural ground water remediation or active ground water remediation is approved by the Department.

iv. The Department has established a ground water classification exception area pursuant to N.J.A.C. 7:26E 8.3 as part of the remedy.

v. Ground water contaminated above the applicable ground water remediation standard will not reach the nearest downgradient receptor, as estimated by an appropriate ground water flow/contaminant transport model selected pursuant to N.J.A.C. 7:26E-4.4(h)3iv.

vi. The fate of the contaminant plume has been documented pursuant to N.J.A.C. 7:26E-8.3(b)2.

vii. Contaminant levels in ground water do not present a vapor risk to any receptors in in accordance with the Department's vapor intrusion guidance. This determination shall be made on a case-by-case basis.

viii. Predicted impacts to potential receptors are consistent with the current and potential ground water uses based on a 25-year planning horizon as projected by local and county land use documents. This shall include, without limitation, information pertaining to the existence of water lines, proposed future installation of water lines, local and/or county ordinances restricting installation of potable wells.

2. The SESOIL vadose zone transport model (Version 6.2 or later) shall be used to generate the contaminant source input data for the AT123D ground water transport model as described in Option III.

3. The concentration of soil contamination shall be varied in the SESOIL model until the compliance objectives outlined in 4i and ii, below are met.

i. If the AT123D model predicts that the compliance objectives detailed in 4i and 4ii below will be met, then the soil contaminant concentration distribution as used in the SESOIL model (either existing concentrations or proposed remediation standards) is an acceptable ARS.

ii. If the model predicts that the compliance objectives detailed 4i and 4ii below will not be met, then soil remediation is necessary.

iii. The SESOIL model may be rerun varying the concentration distribution in soil in order to identify a distribution that will meet the compliance objectives detailed in 4i and 4ii below. This identified soil concentration distribution is an acceptable alternative soil remediation standard.

4. Compliance with the Ground Water Quality Standards must be demonstrated by AT123D at two locations. the source area, and the downgradient compliance point.

i. The AT123D predicted concentrations of contaminants at the source area must meet the ground water quality standards within five years or less.

ii. The location of the downgradient compliance point shall be the downgradient edge of the delineated ground water contaminant plume. The peak ground water concentration predicted by AT123D at the downgradient compliance point shall never exceed the health based Ground Water Quality Criterion.

5. Run the AT123D model as follows:

i. The following input parameters shall be measured at the site:

(1) Hydraulic conductivity, pursuant to N.J.A.C. 7:26E-4.4(h)3iii.

(2) Hydraulic gradient, pursuant to N.J.A.C. 7:26E-4.4(h)3iii.

(3) Organic carbon content using the Lloyd Kahn Method[7]. A default value of 0.2 percent (0.002) may also be used.

(4) Longitudinal dispersivity shall be estimated based on the measured plume length using the following equation:

$$\alpha_L = 0.83(\log_{10} L)^{2.414} \qquad \text{Equation 6}$$

where:

α_L = longitudinal dispersivity

L = length of contaminant plume

(5) Transverse dispersivity shall be calculated as 1/10th the longitudinal dispersivity.

(6) Vertical dispersivity shall be calculated as 1/100th the longitudinal dispersivity.

(7) Aquifer thickness shall be measured in the field by logging continuous core in accordance with the Department's Field Sampling Procedures Manual or shall be determined using available data from the New Jersey Geological Survey or the United States Geological Survey where available.

ii. The following input parameter from a peer reviewed reference:

[7] (Determination of Total Organic Carbon in Sediment (Lloyd Khan Method). U.S. Environmental Protection Agency, Region II, Edison, New Jersey,1988). (http://www.epa.gov/region02/qa/documents.htm).

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(1) Effective porosity.

iii. The following input parameters fixed as follows:

(1) Soil bulk density.

(2) Aquifer width shall be set to "infinite".

(3) Eigen values shall be set between 500 and 1,000.

(4) Error tolerance shall be set to 0.001.

(5) First-Order decay coefficient shall be set to zero.

(6) AT123D release coordinates shall be identical to SESOIL source configuration.

(7) AT123D load parameters shall be set in the SESOIL model.

iv. The following input parameters shall be copied from Table 1:

(1) K_{oc} values.

(2) K_d values.

(3) Water diffusion coefficient.

6. A Department approved ground water monitoring program designed to monitor the predictions of the AT123D model shall be implemented.

7. Additional remediation is required when ground monitoring does not agree with AT123D predictions.

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Table 1. Chemical Properties for Calculation of Generic and Alternative Impact to Ground Water Soil Remediation Standards

Chemical	*CAS Number*	*Henry's law constant (atm-m³/mol)*	*Henry's law constant (dimensionless)*	*Water solubility (mg/L)*	*Diffusion coefficient in air (cm²/sec)*	*Diffusion coefficient in water (cm²/sec)*	*K_{oc} or K_d (L/kg)[a]*	*Soil Saturation Limit (mg/kg)*
Acenaphthene	83-32-9	1.55E-04	6.36E-03	4.24E+00	4.21E-02	7.69E-06	7.08E+03	-
Acenaphthylene	208-96-8	1.11E-04	4.51E-03	1.60E+01	4.40E-02	7.50E-06	2.76E+03	-
Acetone (2-propanone)	67-64-1	3.88E-05	1.59E-03	1.00E+06	1.24E-01	1.14E-05	5.75E-01	1.55E+05
Acetophenone	98-86-2	1.10E-05	4.51E-04	6.10E+03	6.00E-02	8.70E-06	3.70E+01	1.39E+03
Acrolein	107-02-8	1.20E-04	4.92E-03	2.10E+05	1.05E-01	1.20E-05	1.00E+00	3.27E+04
Acrylonitrile	107-13-1	1.00E-04	4.10E-03	7.40E+04	1.22E-01	1.30E-05	2.00E+00	1.17E+04
Aldrin	309-00-2	1.70E-04	6.97E-03	1.80E-01	1.32E-02	4.86E-06	2.45E+06	-
Aluminum (total)	7429-90-5	-	-	-	-	-	*1.50E+03*	-
Anthracene	120-12-7	6.50E-05	2.67E-03	4.34E-02	3.24E-02	7.74E-06	2.95E+04	-
Antimony (total)	7440-36-0	-	-	-	-	-	*4.50E+01*	-
Arsenic (total)	7440-38-2	-	-	-	-	-	*2.60E+01*	-
Atrazine	1912-24-9	2.96E-09	1.21E-07	7.00E+01	2.60E-02	6.70E-06	3.60E+02	-
Barium (total)	7440-39-3	-	-	-	-	-	*1.70E+01*	-
Benzaldehyde	100-52-7	2.67E-05	1.09E-03	3.00E+03	7.30E-02	9.10E-06	2.90E+01	6.34E+02
Benzene	71-43-2	5.55E-03	2.28E-01	1.75E+03	8.80E-02	9.80E-06	5.89E+01	5.22E+02
Benzidine	92-87-5	3.90E-11	1.60E-09	5.00E+02	3.40E-02	1.50E-05	4.70E+01	-
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	3.35E-06	1.37E-04	9.40E-03	5.10E-02	9.00E-06	3.98E+05	-
Benzo(a)pyrene	50-32-8	1.13E-06	4.63E-05	1.62E-03	4.30E-02	9.00E-06	1.02E+06	-
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	1.11E-04	4.55E-03	1.50E-03	2.26E-02	5.56E-06	1.23E+06	-
Benzo(ghi)perylene	191-24-2	1.40E-07	5.74E-06	2.60E-04	2.01E-02	5.30E-06	3.86E+06	-
Benzo(k)fluoranthene	207-08-9	8.29E-07	3.40E-05	8.00E-04	2.26E-02	5.56E-06	1.23E+06	-
Beryllium	7440-41-7	-	-	-	-	-	*3.50E+01*	-
1,1'-Biphenyl	92-52-4	3.00E-04	1.23E-02	6.00E+00	4.04E-02	8.20E-06	8.56E+03	-
Bis(2-chloroethyl)ether	111-44-4	1.80E-05	7.38E-04	1.72E+04	6.92E-02	7.53E-06	1.55E+01	3.17E+03
Bis(2-chloroisopropyl)ether (2,2'-oxybis(1-chloropropane))	108-60-1	7.40E-05	3.03E-03	1.30E+03	6.02E-02	6.40E-06	3.60E+02	1.14E+03
Bis(2-ethylhexyl)phthalate	117-81-7	1.02E-07	4.18E-06	3.40E-01	3.51E-02	3.66E-06	1.51E+07	1.03E+04
Bromodichloromethane (Dichlorobromomethane)	75-27-4	1.60E-03	6.56E-02	6.74E+03	2.98E-02	1.06E-05	5.50E+01	1.83E+03
Bromoform	75-25-2	5.35E-04	2.19E-02	3.10E+03	1.49E-02	1.03E-05	8.71E+01	1.02E+03
Bromomethane (Methyl bromide)	74-83-9	6.24E-03	2.56E-01	1.52E+04	7.28E-02	1.21E-05	1.05E+01	3.12E+03
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	5.60E-05	2.30E-03	2.20E+05	8.08E-02	9.80E-06	1.00E+00	3.42E+04
Butylbenzyl phthalate	85-68-7	1.26E-06	5.17E-05	2.69E+00	1.74E-02	4.83E-06	5.75E+04	3.10E+02
Cadmium	7440-43-9	-	-	-	-	-	*2.30E+01*	-
Caprolactam	105-60-2	3.66E-09	1.50E-07	3.01E+05	6.50E-02	9.00E-06	6.00E+00	-
Carbazole	86-74-8	1.53E-08	6.27E-07	7.48E+00	3.90E-02	7.03E-06	3.39E+03	-
Carbon disulfide	75-15-0	3.03E-02	1.24E+00	1.19E+03	1.04E-01	1.00E-05	4.57E+01	4.68E+02
Carbon tetrachloride	56-23-5	3.04E+02	1.25E+00	7.93E+02	7.80E-02	8.80E-06	1.74E+02	5.17E+02
Chlordane (alpha and gamma forms summed)	57-74-9	4.86E-05	1.99E-03	5.60E-02	1.18E-02	4.37E-06	1.20E+05	-
4-Chloroaniline (p-Chloroaniline)	106-47-8	3.31E-07	1.36E-05	5.30E+03	4.83E-02	1.01E-05	6.61E+01	-
Chlorobenzene	108-90-7	3.70E-03	1.52E-01	4.72E+02	7.30E-02	8.70E-06	2.19E+02	2.88E+02
Chloroethane	75-00-3	8.80E-03	3.61E-01	5.70E+03	2.71E-01	1.10E-05	1.50E+01	-
Chloroform	67-66-3	3.67E-03	1.50E-01	7.92E+03	1.04E-01	1.00E-05	3.98E+01	1.99E+03
Chloromethane (Methyl chloride)	74-87-3	8.80E-03	3.61E-01	5.30E+03	1.26E-01	6.50E-06	6.00E+00	-
4-Chloro-3-methyl phenol (p-Chloro-m-cresol)	59-50-7	4.00E-07	1.64E-05	3.80E+03	4.20E-02	9.50E-06	1.12E+03	-
2-Chlorophenol (o-Chlorophenol)	95-57-8	3.91E-04	1.60E-02	2.20E+04	5.01E-02	9.46E-06	3.98E+02	2.09E+04
Chromium (III) (Trivalent chromium)	16065-83-1	-	-	-	-	-	*8.10E+03*	-
Chromium (VI) (Hexavalent chromium)	18540-29-9	-	-	-	-	-	*2.80E+01*	-
Chromium (total)	7440-47-3	-	-	-	-	-	*2.80E+01*	-
Chrysene	218-01-9	9.46E-05	3.88E-03	1.60E-03	2.48E-02	6.21E-06	3.98E+05	-
Cobalt (total)	7440-48-4	-	-	-	-	-	*4.50E+01*	-
Copper (total)	7440-50-8	-	-	-	-	-	*4.30E+02*	-
Cyanide	57-12-5	-	-	-	-	-	*9.90E+00*	-
4,4'-DDD (p,p'-TDE)	72-54-8	4.00E-06	1.64E-04	9.00E-02	1.69E-02	4.76E-06	1.00E+06	-
4,4'-DDE (p,p'-DDX)	72-55-9	2.10E-05	8.61E-04	1.20E-01	1.44E-02	5.87E-06	4.47E+06	-
4,4'-DDT	50-29-3	8.10E-06	3.32E-04	2.50E-02	1.37E-02	4.95E-06	2.63E+06	-
Dibenz(a,h)anthracene	53-70-3	1.47E-08	6.03E-07	2.49E-03	2.02E-02	5.18E-06	3.80E+06	-
Dibenzofuran	132-64-9	1.30E-05	5.33E-04	1.00E+01	2.67E-02	6.00E-06	1.35E+04	2.71E+02
Dibromochloromethane (Chlorodibromomethane)	124-48-1	7.83E-04	3.21E-02	2.60E+03	1.96E-02	1.05E-05	6.31E+01	7.37E+02

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Chemical	*CAS Number*	*Henry's law constant (atm-m³/mol)*	*Henry's law constant (dimensionless)*	*Water solubility (mg/L)*	*Diffusion coefficient in air (cm²/sec)*	*Diffusion coefficient in water (cm²/sec)*	*K_{oc} or K_d (L/kg)[a]*	*Soil Saturation Limit (mg/kg)*
1,2-Dibromo-3-chloropropane	96-12-8	1.50E-04	6.15E-03	1.20E+03	2.12E-02	7.00E-06	7.90E+01	3.74E+02
1,2-Dibromoethane	106-93-4	7.40E-04	3.03E-02	4.20E+03	2.87E-02	8.10E-06	4.60E+01	1.05E+03
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	1.90E-03	7.79E-02	1.56E+02	6.90E-02	7.90E-06	6.17E+02	2.18E+02
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	3.10E-03	1.27E-01	1.30E+02	6.92E-02	7.90E-06	7.08E+02	2.06E+02
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	2.43E-03	9.96E-02	7.38E+01	6.90E-02	7.90E-06	6.17E+02	-
3,3'-Dichlorobenzidine	91-94-1	4.00E-09	1.64E-07	3.11E+00	1.94E-02	6.74E-06	7.24E+02	-
Dichlorodifluoromethane	75-71-8	3.40E-01	1.39E+01	2.80E+02	5.20E-02	1.00E-05	6.60E+01	-
1,1-Dichloroethane	75-34-3	5.62E-03	2.30E-01	5.06E+03	7.42E-02	1.05E-05	3.16E+01	1.24E+03
1,2-Dichloroethane	107-06-2	9.79E-04	4.01E-02	8.52E+03	1.04E-01	9.90E-06	1.74E+01	1.64E+03
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	2.61E-02	1.07E+00	2.25E+03	9.00E-02	1.04E-05	5.89E+01	8.99E+02
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	4.08E-03	1.67E-01	3.50E+03	7.36E-02	1.13E-05	3.55E+01	8.55E+02
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	9.38E-03	3.85E-01	6.30E+03	7.07E-02	1.19E-05	5.25E+01	1.92E+03
2,4-Dichlorophenol	120-83-2	3.16E-06	1.30E-04	4.50E+03	3.46E-02	8.77E-06	1.59E+02	-
1,2-Dichloropropane	78-87-5	2.80E-03	1.15E-01	2.80E+03	7.80E-02	8.73E-06	4.37E+01	7.13E+02
1,3-Dichloropropene (cis and trans) (summed)	542-75-6	1.77E-02	7.26E-01	2.80E+03	6.26E-02	1.00E-05	4.57E+01	9.29E+02
Dieldrin	60-57-1	1.51E-05	6.19E-04	1.95E-01	1.25E-02	4.74E-06	2.14E+04	-
Diethylphthalate	84-66-2	4.50E-07	1.85E-05	1.08E+03	2.56E-02	6.35E-06	2.88E+02	7.88E+02
2,4-Dimethylphenol	105-67-9	2.00E-06	8.20E-05	7.87E+03	5.84E-02	8.69E-06	2.09E+02	-
Dimethylphthalate	131-11-3	1.10E-07	4.51E-06	4.00E+03	5.68E-02	6.30E-06	3.70E+01	9.09E+02
Di-n-butyl phthalate	84-74-2	9.38E-10	3.85E-08	1.12E+01	4.38E-02	7.86E-06	3.39E+04	7.61E+02
4,6-Dinitro-2-methylphenol	534-52-1	4.30E-07	1.76E-05	2.00E+02	2.93E-02	6.90E-06	1.16E+02	-
2,4-Dinitrophenol	51-28-5	4.43E-07	1.82E-05	2.79E+03	2.73E-02	9.06E-06	1.78E-02	-
2,4-Dinitrotoluene	121-14-2	9.26E-08	3.80E-06	2.70E+02	2.03E-01	7.06E-06	9.55E+01	-
2,6-Dinitrotoluene	606-20-2	7.47E-07	3.06E-05	1.82E+02	3.27E-02	7.26E-06	6.92E+01	-
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	4.20E-07	1.72E-05	2.26E+02	1.18E-01	7.16E-06	8.24E+01	-
Di-n-octyl phthalate	117-84-0	6.68E-05	2.74E-03	2.00E-02	1.51E-02	3.58E-06	8.32E+07	3.33E+03
Dioxin (TCDD) (2,3,7,8-Tetrachlorodibenzo-p-dioxin)	1746-01-6	7.90E-05	3.24E-03	7.90E-06	1.04E-01	5.60E-06	2.45E+06	-
1,2-Diphenylhydrazine	122-66-7	1.50E-06	6.15E-05	6.80E+01	3.17E-02	7.40E-06	7.10E+02	-
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	1.12E-05	4.59E-04	5.10E-01	1.15E-02	4.55E-06	2.14E+03	-
Endosulfan sulfate	1031-07-8	2.10E-03	8.61E-02	6.40E+00	1.10E-02	4.40E-06	1.02E+03	-
Endrin	72-20-8	7.52E-06	3.08E-04	2.50E-01	1.25E-02	4.74E-06	1.23E+04	-
Ethylbenzene	100-41-4	7.88E-03	3.23E-01	1.69E+02	7.50E-02	7.80E-06	3.63E+02	1.55E+02
Fluoranthene	206-44-0	1.61E-05	6.60E-04	2.06E-01	3.02E-02	6.35E-06	1.07E+05	-
Fluorene	86-73-7	6.36E-05	2.61E-03	1.98E+00	3.63E-02	7.88E-06	1.38E+04	-
alpha-HCH (alpha-BHC)	319-84-6	1.06E-05	4.35E-04	2.00E+00	1.42E-02	7.34E-06	1.23E+03	-
beta-HCH (beta-BHC)	319-85-7	7.43E-07	3.05E-05	2.40E-01	1.42E-02	7.34E-06	1.26E+03	-
Heptachlor	76-44-8	1.09E-03	4.47E-02	1.80E-01	1.12E-02	5.69E-06	1.41E+06	-
Heptachlor epoxide	1024-57-3	9.50E-06	3.90E-04	2.00E-01	1.32E-02	4.23E-06	8.32E+04	-
Hexachlorobenzene	118-74-1	1.32E-03	5.41E-02	6.20E+00	5.42E-02	5.91E-06	5.50E+04	-
Hexachloro-1,3-butadiene	87-68-3	8.15E-03	3.34E-01	3.23E+00	5.61E-02	6.16E-06	5.37E+04	3.48E+02
Hexachlorocyclopentadiene	77-47-4	2.70E-02	1.11E+00	1.80E+00	1.61E-02	7.21E-06	2.00E+05	7.21E+02
Hexachloroethane	67-72-1	3.89E-03	1.59E-01	5.00E+01	2.50E-03	6.80E-06	1.78E+03	-
2-Hexanone	591-78-6	9.30E-05	3.80E-03	1.80E+04			2.40E+01	3.63E+03
Indeno(1,2,3-cd)pyrene	193-39-5	1.60E-06	6.56E-05	2.20E-05	1.90E-02	5.66E-06	3.47E+06	-
Isophorone	78-59-1	6.64E-06	2.72E-04	1.20E+04	6.23E-02	6.76E-06	4.68E+01	2.96E+03
Lead (total)	7439-92-1	-	-	-	-	-	*9.00E+02*	-
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	1.40E-05	5.74E-04	6.80E+00	1.42E-02	7.34E-06	1.07E+03	-
Manganese (total)	7439-96-5	-	-	-	-	-	*6.50E+01*	-
Mercury (total)	7439-97-6	-	-	-	-	-	*2.00E-01*	-
Methoxychlor	72-43-5	1.58E-05	6.48E-04	4.50E-02	1.56E-02	4.46E-06	9.77E+04	-
Methyl acetate	79-20-9	1.15E-04	4.72E-03	2.40E+05	1.04E-01	1.00E-05	2.00E+00	3.79E+04
Methylcyclohexane	108-87-2	4.30E-01	1.76E+01	1.40E+01	9.86E-02	8.50E-06	8.65E+02	5.59E+01
Methylene chloride (Dichloromethane)	75-09-2	2.19E-03	8.98E-02	1.30E+04	1.01E-01	1.17E-05	1.17E+01	2.44E+03
2-Methylnaphthalene	91-57-6	5.2E-04	2.13E-02	2.5E+01	5.22E-02	7.75E-06	6.82E+03	-
4-Methyl-2-pentanone (MIBK)	108-10-1	1.40E-04	5.74E-03	1.90E+04	7.50E-02	7.80E-06	1.50E+01	3.50E+03
2-Methylphenol (o-cresol)	95-48-7	1.20E-06	4.92E-05	2.60E+04	7.40E-02	8.30E-06	9.12E+01	-
4-Methylphenol (p-cresol)	106-44-5	7.90E-07	3.24E-05	2.20E+04	7.40E-02	1.00E-05	7.40E+01	-
MTBE (tert-butyl methyl ether)	1634-04-4	5.87E-04	2.40E-02	4.80E+04	1.02E-01	1.00E-05	8.00E+00	8.27E+03
Naphthalene	91-20-3	4.83E-04	1.98E-02	3.10E+01	5.90E-02	7.50E-06	2.00E+03	-
Nickel (total)	7440-02-0	-	-	-	-	-	*2.40E+01*	-
2-Nitroaniline	88-74-4	1.81E-08	7.42E-07	2.90E+02	7.30E-02	8.00E-06	7.40E+01	-

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Chemical	*CAS Number*	*Henry's law constant (atm-m³/mol)*	*Henry's law constant (dimensionless)*	*Water solubility (mg/L)*	*Diffusion coefficient in air (cm²/sec)*	*Diffusion coefficient in water (cm²/sec)*	*K_{oc} or K_d (L/kg)[a]*	*Soil Saturation Limit (mg/kg)*
Nitrobenzene	98-95-3	2.40E-05	9.84E-04	2.09E+03	7.60E-02	8.60E-06	6.46E+01	5.91E+02
4-Nitrophenol	100-02-7	4.20E-10	1.72E-08	1.20E+04	4.30E-02	9.60E-06	7.40E+01	-
N-Nitrosodimethylamine	62-75-9	1.20E-06	4.92E-05	1.00E+06	1.13E-01	1.20E-05	3.00E-01	1.54E+05
N-Nitrosodi-n-propylamine	621-64-7	2.25E-06	9.23E-05	9.89E+03	5.45E-02	8.17E-06	2.40E+01	-
N-Nitrosodiphenylamine	86-30-6	5.00E-06	2.05E-04	3.51E+01	3.12E-02	6.35E-06	1.29E+03	-
PCBs (Polychlorinated biphenyls) (summed)	1336-36-3	2.60E-03	1.07E-01	7.00E-01	1.75E-02	8.00E-06	3.09E+05	4.33E+02
Pentachlorophenol	87-86-5	2.44E-08	1.00E-06	1.95E+03	5.60E-02	6.10E-06	5.10E+03	-
Phenanthrene	85-01-8	2.30E-05	9.43E-04	1.10E+00	3.33E-02	7.50E-06	2.65E+04	-
Phenol	108-95-2	3.97E-07	1.63E-05	8.28E+04	8.20E-02	9.10E-06	2.88E+01	-
Pyrene	129-00-0	1.10E-05	4.51E-04	1.35E-01	2.72E-02	7.24E-06	1.05E+05	-
Selenium (total)	7782-49-2	-	-	-	-	-	*1.40E+01*	-
Silver (total)	7440-22-4	-	-	-	-	-	*2.60E-01*	-
Styrene	100-42-5	2.75E-05	1.13E-01	3.10E+02	7.10E-02	8.00E-06	7.76E+02	5.33E+02
Tertiary butyl alcohol (TBA)	75-65-0	9.05E-06	3.71E-04	1.00E+06	9.85E-02	1.14E-05	2.00E+00	-
1,1,2,2-Tetrachloroethane	79-34-5	3.45E-04	1.41E-02	2.97E+03	7.10E-02	7.90E-06	9.33E+01	1.01E+03
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1.84E-02	7.54E-01	2.00E+02	7.20E-02	8.20E-06	1.55E+02	1.11E+02
Thallium (total)	7440-28-0	-	-	-	-	-	*4.80E+01*	-
Toluene	108-88-3	6.64E-03	2.72E-01	5.26E+02	8.70E-02	8.60E-06	1.82E+02	2.89E+02
Toxaphene	8001-35-2	6.00E-06	2.46E-04	7.40E-01	1.16E-02	4.34E-06	2.57E+05	-
1,2,4-Trichlorobenzene	120-82-1	1.42E-03	5.82E-02	3.00E+02	3.00E-02	8.23E-06	1.78E+03	1.12E+03
1,1,1-Trichloroethane	71-55-6	1.72E-02	7.05E-01	1.33E+03	7.80E-02	8.80E-06	1.10E+02	6.09E+02
1,1,2-Trichloroethane	79-00-5	9.13E-04	3.74E-02	4.42E+03	7.80E-02	8.80E-06	5.01E+01	1.14E+03
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1.03E-02	4.22E-01	1.10E+03	7.90E-02	9.10E-06	1.66E+02	5.90E+02
Trichlorofluoromethane	75-69-4	9.70E-02	3.98E+00	1.10E+03	4.26E-02	1.00E-05	1.14E+02	9.44E+02
2,4,5-Trichlorophenol	95-95-4	4.33E-06	1.78E-04	1.20E+03	2.91E-02	7.03E-06	2.34E+03	-
2,4,6-Trichlorophenol	88-06-2	7.79E-06	3.19E-04	8.00E+02	3.18E-02	6.25E-06	9.99E+02	-
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	4.80E-01	1.97E+01	1.70E+02	7.80E-02	8.20E-06	4.10E+02	5.67E+02
Vanadium (total)	7440-62-2	-	-	-	-	-	*1.00E+03*	-
Vinyl chloride	75-01-4	2.70E-02	1.11E+00	2.76E+03	1.06E-01	1.23E-06	1.86E+01	-
Xylenes (total)	1330-20-7	6.73E-03	2.76E-01	1.75E+02	7.69E-02	8.44E-06	3.86E+02	1.68E+02
Zinc (total)	7440-66-6	-	-	-	-	-	*2.30E+01*	-

a Values in italics are Kd values

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Table 2. K_{oc} Values (L/kg) for Ionizing Organics as a Function of pH

pH	Benzoic Acid	2-Chloro-phenol	2,4-Dichloro-phenol	2,4- Dinitro-phenol	Pentachloro-phenol	2,3,4,5-Tetrachloro-phenol	2,3,4,6-Tetrachloro-phenol	2,4,5-Trichloro-phenol	2,4,6 Trichloro-phenol
4.9	5.54E+00	3.98E+02	1.59E+02	2.94E-02	9.05E+03	1.73E+04	4.45E+03	2.37E+03	1.04E+03
5.0	4.64E+00	3.98E+02	1.59E+02	2.55E-02	7.96E+03	1.72E+04	4.15E+03	2.36E+03	1.03E+03
5.1	3.88E+00	3.98E+02	1.59E+02	2.23E-02	6.93E+03	1.70E+04	3.83E+03	2.36E+03	1.02E+03
5.2	3.25E+00	3.98E+02	1.59E+02	1.98E-02	5.97E+03	1.67E+04	3.49E+03	2.35E+03	1.01 E+03
5.3	2.72E+00	3.98E+02	1.59E+02	1.78E-02	5.10E+03	1.65E+04	3.14E+03	2.34E+03	9.99E+02
5.4	2.29E+00	3.98E+02	1.58E+02	1.62E-02	4.32E+03	1.61 E+04	2.79E+03	2.33E+03	9.82E+02
5.5	1.94E+00	3.97E+02	1.58E+02	1.50E-02	3.65E+03	1.57E+04	2.45E+03	2.32E+03	9.62E+02
5.6	1.65E+00	3.97E+02	1.58E+02	1.40E-02	3.07E+03	1.52E+04	2.13E+03	2.31E+03	9.38E+02
5.7	1.42E+00	3.97E+02	1.58E+02	1.32E-02	2.58E+03	1.47E+04	1.83E+03	2.29E+03	9.10E+02
5.8	1.24E+00	3.97E+02	1.58E+02	1.25E-02	2.18E+03	1.40E+04	1.56E+03	2.27E+03	8.77E+02
5.9	1.09E+00	3.97E+02	1.57E+02	1.20E-02	1.84E+03	1.32E+04	1.32E+03	2.24E+03	8.39E+02
6.0	9.69E-01	3.96E+02	1.57E+02	1.16E-02	1.56E+03	1.24E+04	1.11 E+03	2.21 E+03	7.96E+02
6.1	8.75E-01	3.96E+02	1.57E+02	1.13E-02	1.33E+03	1.15E+04	9.27E+02	2.17E+03	7.48E+02
6.2	7.99E-01	3.96E+02	1.56E+02	1.10E-02	1.15E+03	1.05E+04	7.75E+02	2.12E+03	6.97E+02
6.3	7.36E-01	3.95E+02	1.55E+02	1.08E-02	9.98E+02	9.51 E+03	6.47E+02	2.06E+03	6.44E+02
6.4	6.89E-01	3.94E+02	1,54E+02	1.06E-02	8.77E+02	8.48E+03	5.42E+02	1.99E+03	5.89E+02
6.5	6.51 E-01	3.93E+02	1.53E+02	1.05E-02	7.81 E+02	7.47E+03	4.55E+02	1.91 E+03	5.33E+02
6.6	6.20E-01	3.92E+02	1.52E+02	1.04E-02	7.03E+02	6.49E+03	3.84E+02	1.82E+03	4.80E+02
6.7	5.95E-01	3.90E+02	1.50E+02	1.03E-02	6.40E+02	5.58E+03	3.27E+02	1.71E+03	4.29E+02
6.8	5.76E-01	3.88E+02	1.47E+02	1.02E-02	5.92E+02	4.74E+03	2.80E+02	1.60E+03	3.81 E+02
6.9	5.60E-01	3.86E+02	1.45E+02	1.02E-02	5.52E+02	3.99E+03	2.42E+02	1.47E+03	3.38E+02
7.0	5.47E-01	3.83E+02	1.41 E+02	1.02E-02	5.21 E+02	3.33E+03	2.13E+02	1.34E+03	3.00E+02
7.1	5.38E-01	3.79E+02	1.38E+02	1.02E-02	4.96E+02	2.76E+03	1.88E+02	1.21E+03	2.67E+02
7.2	5.32E-01	3.75E+02	1.33E+02	1.01 E-02	4.76E+02	2.28E+03	1.69E+02	1.07E+03	2.39E+02
7.3	5.25E-01	3.69E+02	1.28E+02	1.01E-02	4.61 E+02	1.87E+03	1.53E+02	9.43E+02	2.15E+02
7.4	5.19E-01	3.62E+02	1.21 E+02	1.01 E-02	4.47E+02	1.53E+03	1.41 E+02	8.19E+02	1.95E+02
7.5	5.16E-01	3.54E+02	1.14E+02	1.01 E-02	4.37E+02	1.25E+03	1.31 E+02	7.03E+02	1.78E+02
7.6	5.13E-01	3.44E+02	1.07E+02	1.01 E-02	4.29E+02	1.02E+03	1.23E+02	5.99E+02	1.64E+02
7.7	5.09E-01	3.33E+02	9.84E+01	1.00E-02	4.23E+02	8.31 E+02	1.17E+02	5.07E+02	1.53E+02
7.8	5.06E-01	3.19E+02	8.97E+01	1.00E-02	4.18E+02	6.79E+02	1.13E+02	4.26E+02	1.44E+02
7.9	5.06E-01	3.04E+02	8.07E+01	1.00E-02	4.14E+02	5.56E+02	1.08E+02	3.57E+02	1.37E+02
8.0	5.06E-01	2.86E+02	7.17E+01	1.00E-02	4.10E+02	4.58E+02	1.05E+02	2.98E+02	1.31 E+02

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APPENDIX 8

Alternative Soil Remediation Standard Application

A. SITE INFORMATION

1. Program Interest Name:_____

2. Program Interest Number (Preferred ID): _____

3. EPA site ID number, if applicable: _____

4. Street address: _____

5. City: _____

6. County: _____

7. Block and Lots of the site (duplicate if the site is located in more than one municipality):

   a. Name of the municipality in which the site is located: _____

   b. Block and Lots: _____

   c. Year of tax map: _____

8. The location of the site in a GIS-compatible format (State Plane Coordinates):

_____

B. APPLICANT INFORMATION:

   a. Name of applicant: _____

   b. Company name: _____

   c. Mailing address: _____

   d. Phone number: (__ __ __) __ __ __ - __ __ __ __

C. PROPOSED ALTERNATIVE SOIL REMEDIATION STANDARD INFORMATION
(Add additional pages as necessary)

1. Name and chemical abstract number of contaminant for which ARS is being sought:

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2. A summary of contaminant concentrations at the site for which the ARS is being sought.

3. Description of the exposure pathway for which the ARS is being sought:

4. Proposed numeric ARS:

5. Documentation to support proposed ARS, including but not limited to the following:

   a. New chemical toxicity.

   b. New risk assessment methodology or models.

   c. Alternative land use planned for the site.

   d. Site specific conditions that support modification of input parameters for models used to develop ARS pursuant to Appendices 4 through 6.

D. Oversight Document Information

1. Is the site for which the ARS is being sought being remediated pursuant to Department oversight: Yes____ No_____

2. If yes, the type of Department oversight pursuant to which the Department is reviewing the application:

Memorandum of Agreement

a. Effective date of Memorandum of Agreement _____

b. Name of Department contact person _____

Administrative Consent Order

a. Effective date of Administrative Consent Order _____

b. Name of Department contact person _____

Industrial Site Recovery Act Program

a. Name of Department contact person _____

Underground Storage Tank Program

a. Name of Department contact person _____

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3. If no, the applicant shall enter into a Memorandum of Agreement with the Department pursuant to N.J.A.C. 7:26C-3 prior to the Department reviewing the application. Upon the applicant entering into the Memorandum of Agreement, the applicant shall contact the Department with the following information.

a. Effective date of Memorandum of Agreement _____

b. Name of Department contact person _____

Chapter 26E

TECHNICAL REQUIREMENTS FOR SITE REMEDIATION

SUBCHAPTER 1 GENERAL INFORMATION

7:26E-1.3 Applicability

(a) - (c) (No change.)

(d) The person responsible for conducting the remediation of a site shall remediate soil:

1. To meet the remediation standards at N.J.A.C. 7:26D; or

2. To meet the standards or criteria developed by the Department under N.J.S.A. 58:10B-12a for that site prior to (effective date of N.J.A.C. 7:26D) provided:

i. A remedial action workplan or a remedial action report containing standards or criteria developed for the site under N.J.S.A. 58:10B-12a is submitted to the Department before (effective date of N.J.A.C. 7:26D plus 6 months);

ii. The remedial action workplan or a remedial action report meets the requirements of N.J.A.C. 7:26E-6; and

iii. The standards or criteria developed by the Department under N.J.S.A. 58:10B-12a for the site are not greater by an order of magnitude or more, than the soil remediation standards otherwise applicable under N.J.A.C. 7:26D.

[(d)] (e) (No change in text.)

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[7:26E-1.13 Minimum Ground Water and Surface Water Remediation Standards

(a) This section sets forth the minimum remediation standards that apply to ground water and surface water for purposes of the remediation of a contaminated site pursuant to this chapter.

(b) The minimum ground water remediation standards are:

1. The following numeric ground water remediation standards:

i. The Ground Water Quality Standards, N.J.A.C. 7:9-6, Appendix, Tables 1 and 2;

ii. The standards resulting from application of the procedures in N.J.A.C. 7:9-6.7(c)2 through 6, for the derivation of a new criterion where a specific contaminant is not listed in N.J.A.C. 7:9-6, Appendix, Table 1; and

iii. The standards resulting from application of the procedures in N.J.A.C. 7:9-6.7(c)3, for the derivation of a new criterion when the Department determines that current scientific information indicates that a specifically listed numeric criterion is no longer appropriate. The Department will post standards developed pursuant to (b)1ii and iii above on the Department's web site at http://www.state.nj.us/dep/wmm/bfbm /is_text.html; and

2. The following narrative ground water remediation standards:

i. The general ground water quality policies in N.J.A.C. 7:9-6.2;

ii. The narrative ground water quality criteria in N.J.A.C. 7:9-6.7;

iii. The ground water quality antidegradation policy in N.J.A.C. 7:9-6.8;

iv. The remediation requirements in N.J.A.C. 7:26E- 1 through 8 in order to both:

(1) Address the adverse impact of the contamination on the ground water itself; and

(2) Limit additional risks posed by the contamination to the public health and safety and to the environment;

v. Removal, treatment, or containment of free and residual product pursuant to N.J.A.C. 7:26E-6.1(d);

vi. Ensure no release of contaminants to the ground surface, structures or air in concentrations that pose a threat to human health; and

vii. The following factors, as applicable on a site-specific basis, for selecting an appropriate ground water remedial action:

(1) The location of the contaminated site relative to ground water use;

(2) The potential human and environmental exposure to the ground water contamination;

(3) The present, projected, and potential ground water use at the site and in the area surrounding the site over the 25 years after the selection of the ground water remedy;

(4) Ambient ground water quality at the site and in the area surrounding the site resulting from both natural and human activities;

(5) The physical and chemical characteristics of the contaminants of concern; and

(6) The criteria in N.J.A.C. 7:26E-6.3(d)1i, to determine when natural remediation is appropriate as a remedial action for ground water contamination.

(c) The person responsible for conducting the remediation is not required to remediate ground water to a level or concentration that is lower than the level or concentration of the regional natural background level or concentration for any particular hazardous substance or pollutant.

(d) The Department will not accept alternate numeric ground water remediation standards developed based on a site-specific risk assessment.

(e) The minimum surface water remediation standards are:

1. The more stringent of either the numeric New Jersey Surface Water Quality Standards pursuant to N.J.A.C. 7:9B-1.14(c) and (d) or the numeric Federal Surface Water Criteria, 40 CFR Part 131; and

2. The following narrative surface water remediation standards:

i. The general surface water quality policies included in N.J.A.C. 7:9B-1.5;

ii. The narrative surface water quality criteria included in N.J.A.C. 7:9B-1.14;

iii. The remediation requirements in N.J.A.C. 7:26E- 1 through 8 in order to both:

(1) Address the adverse impact of the contamination on the surface water itself; and

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(2) Limit additional risks posed by the contamination to the public health and safety and to the environment;

iv. Removal, treatment, or containment of free and residual product pursuant to N.J.A.C. 7:26E-6.1(d); and

v. The following narrative criteria, as applicable on a site-specific basis, for selecting an appropriate surface water remedial action:

(1) The location of the contaminated site relative to surface water use;

(2) The potential human and environmental exposure to the surface water contamination;

(3) The present and projected surface water use at the site and in the area surrounding the site;

(4) Ambient surface water quality at the site and in the area surrounding the site resulting from both natural and human activities; and

(5) The physical and chemical characteristics of the contaminants of concern.

(f) The Department will not accept alternate numeric surface water remediation standards developed based on a site-specific risk assessment.]

APPENDIX F

U.S. EPA Superfund ***Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.***

Exhibit A-2 Generic SSLs for Commercial/Industrial Scenario: Outdoor Worker Receptor

Peer Review Draft

December 2002

United States
Environmental Protection
Agency

Solid Waste and
Emergency Response

OSWER 9355.4-24
December 2002

Superfund

EPA

SUPPLEMENTAL GUIDANCE FOR DEVELOPING SOIL SCREENING LEVELS FOR SUPERFUND SITES

OSWER 9355.4-24
December 2002

SUPPLEMENTAL GUIDANCE FOR DEVELOPING SOIL SCREENING LEVELS FOR SUPERFUND SITES

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, DC 20460

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The project team especially wishes to note the contributions of the late Craig Mann of EQ, whose expert assistance in modeling inhalation exposures was critical to the development of both this document and the original Soil Screening Guidance. Craig was a prominent researcher in the air modeling field and programmer of the widely-used spreadsheet version of the Johnson and Ettinger (1991) model. We dedicate this document to him.

Disclaimer

This document provides guidance to EPA Regions concerning how the Agency intends to exercise its discretion in implementing one aspect of the CERCLA remedy selection process. The guidance is designed to implement national policy on these issues.

The statutory provisions and EPA regulations described in this document contain legally binding requirements. However, this document does not substitute for those provisions or regulations, nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. Any decisions regarding a particular remedy selection decision will be made based on the statute and regulations, and EPA decisionmakers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future.

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LIST OF ACRONYMS

ABS	Absorption fraction
AF	Skin-soil Adherence Factor
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
AT	Averaging Time
ATSDR	Agency for Toxic Substances and Disease Registry
BW	Body Weight
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C/I	Commercial/Industrial
C_{sat}	Soil Saturation Limit
CSF	Cancer Slope Factor
CSGWPP	Comprehensive State Ground Water Protection Plan
CSM	Conceptual Site Model
DAF	Dilution Attenuation Factor
DDT	p,p'-Dichlorodiphenyltrichloroethane
DOD	Department of Defense
DOE	Department of Energy
DQO	Data Quality Objectives
Eco-SSLs	Ecological Soil Screening Levels
ED	Exposure Duration
EF	Exposure Frequency
EPA	Environmental Protection Agency
EV	Event Frequency
HBL	Health Based Level
HEAST	Health Effects Assessment Summary Tables
HELP	Hydrologic Evaluation of Landfill Performance
HI	Hazard Index
HQ	Hazard Quotient
IC	Institutional Control
IF	Age-adjusted Soil Ingestion Factor
IR	Soil Ingestion Rate
IRIS	Integrated Risk Information System
ISC3	Industrial Source Complex Dispersion Model
MCL	Maximum Contaminant Level (in water)
MCLG	Maximum Contaminant Level Goal (in water)
MRL	Minimal Risk Level
NAPL	Nonaqueous Phase Liquid
NPDWR	National Primary Drinking Water Regulations
NPL	National Priorities List
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response

LIST OF ACRONYMS
(Continued)

PAH	Polycyclic Aromatic Hydrocarbon
PA/SI	Preliminary Assessment/Site Inspection
PCB	Polychlorinated biphenyl
PEF	Particulate Emission Factor
PRG	Preliminary Remediation Goal
QA/QC	Quality Assurance/Quality Control
Q/C	Site-Specific Dispersion Factor
RAGS	Risk Assessment Guidance for Superfund
RAS	Regulatory Analytical Services
RBCA	Risk-based Corrective Action
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
SA	Surface Area
SAP	Sampling and Analysis Plan
SCDM	Superfund Chemical Data Matrix
SCS	Soil Classification System
SPLP	Synthetic Precipitation Leachate Procedure
SSG	Soil Screening Guidance
SSL	Soil Screening Level
TBD	Technical Background Document
TC	Soil-to-dust Transfer Coefficient
THQ	Target Hazard Quotient
TR	Target Cancer Risk
TRW	Technical Review Workgroup for Lead
UCL	Upper Confidence Limit
URF	Unit Risk Factor
VF	Volatilization Factor
VOC	Volatile Organic Compound

1.0 INTRODUCTION

In 1996, EPA issued the *Soil Screening Guidance (SSG)*, a tool developed by the Agency to help standardize and accelerate the evaluation and cleanup of contaminated soils at sites on the National Priorities List (NPL). The *SSG* provides site managers with a tiered framework for developing risk-based, site-specific soil screening levels (SSLs).[1] SSLs are not national cleanup standards; instead, they are used to identify areas, chemicals, and pathways of concern at NPL sites that need further investigation (i.e., through the Remedial Investigation/Feasibility Study) and those that require no further attention under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).[2] The three-tiered framework includes a set of conservative, generic SSLs; a simple site-specific approach for calculating SSLs; and a detailed site-specific modeling approach for more comprehensive consideration of site conditions in establishing SSLs. The *SSG* emphasizes the simple site-specific approach as the most useful method for calculating SSLs.

In developing the 1996 *SSG*, EPA chose to focus exclusively on future residential use of NPL sites. At the time the guidance was developed, defining levels that would be safe for residential use was very important because of the significant number of NPL sites with people living on-site or in close proximity. In addition, the assumptions needed to calculate SSLs for residential use were better established and more widely accepted than those for other land uses.

One of the most prevalent suggestions made during the public comment period on the 1996 *SSG* was that EPA should develop additional screening approaches for non-residential land uses. This concern reflected the large number of NPL sites with anticipated non-residential future land uses and the desire on the part of site managers to develop SSLs that are not overly conservative for these sites.

Another concern raised during public comment addressed the risk to workers and others from exposures to soil contaminants during construction activity. In the 1996 *SSG*, EPA presented equations for developing SSLs for the inhalation of volatiles and fugitive dusts assuming that a site was undisturbed by anthropogenic processes. This is likely to be a reasonable assumption for many potential future activities at these sites, but not for construction that may be required to redevelop a site. Activities such as excavation and traffic on unpaved roads can result in extensive soil

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[1] EPA uses the term "site manager" in this guidance to refer to the primary user of this document. However, EPA encourages site managers to obtain technical support from risk assessors, site engineers, and others during all steps of the soil screening process.

[2] SSLs also can be incorporated into the framework for risk assessment planning, reporting, and review that EPA has described in the *Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual Part D (RAGS, Part D)* (U.S. EPA, 1998). Specifically, SSLs can be incorporated into Standard Table 2 within this guidance, which is designed to compile data to support the identification of chemicals of concern at sites.

disturbance and dust generation that may lead to increased emissions of volatiles and particulates for the duration of the construction project. Such increased short-term exposures are not addressed by the 1996 *SSG*.

With this guidance document, EPA addresses the development of SSLs for residential land use, non-residential land use, and construction activities.

1.1 Purpose and Scope

This document is intended as companion guidance to the 1996 *SSG* for residential use scenarios at NPL sites. It builds upon the soil screening framework established in the original guidance, adding new scenarios for soil screening evaluations. It also updates the residential scenario in the 1996 *SSG*, adding exposure pathways and incorporating new modeling data. The following specific changes included in this document supersede the 1996 *SSG*:

- New methods for developing SSLs based on non-residential land use[3] and construction activities;
- New residential SSL equations for combined exposures via ingestion and dermal absorption[4];
- Updated dispersion modeling data for the soil screening guidance air exposure model; and
- New methods to develop residential and non-residential SSLs for the migration of volatiles from subsurface sources into indoor air.

RELATIONSHIP OF NON-RESIDENTIAL SSL FRAMEWORK TO *RAGS*

EPA has previously provided guidance on evaluating exposure and risk for non-residential use scenarios at NPL sites in the following documents:

- *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (HHEM), Supplemental Guidance, Standard Default Exposure Factors, Interim Guidance* (U.S. EPA, 1991a).
- *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (HHEM), Part B, Development of Risk-based Preliminary Remediation Goals* (U.S. EPA, 1991b).

These two documents include default values and exposure equations for a generic commercial/industrial exposure scenario that have been widely used and that form the basis of many state site cleanup programs, as well as RCRA's *Risk Based Corrective Action (RBCA) Provisional Standard for Chemical Releases.* However, the approaches detailed in these documents may not always account for the full range of activities and exposures within commercial and industrial land uses. The models, equations, and default assumptions presented in this guidance supersede those presented in the *RAGS Supplemental Guidance* and *RAGS Part B* documents for evaluating exposures under non-residential land use assumptions.

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[3] A detailed discussion of EPA's recommended practices for identifying reasonably anticipated future land use can be found in the EPA directive *Land Use in the CERCLA Remedy Selection Process* (1995a).

[4] This document may be used in conjunction with the draft *Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) - Interim Guidance* (U.S. EPA, 2001)

Except for these new equations and updated modeling data, the soil screening process remains the same as the one presented in the 1996 *SSG*. Therefore, this document presents the process in less detail than the original guidance and focuses instead on the specific elements of soil screening evaluation that differ for residential, non-residential, and construction scenarios. Users of this guidance should refer to the *SSG User's Guide* and *Technical Background Document* (U.S. EPA, 1996c and 1996b) for additional information on modeling approaches, data sources, and other important details of conducting soil screening evaluations at NPL sites.

Although certain exposure pathways can be addressed using generic assumptions, this document emphasizes the simple site-specific approach for developing SSLs. EPA believes that this approach provides the best combination of site-specificity and ease of use. Exhibits 1-1 and 1-2 summarize the simple site-specific screening approaches discussed in this document. They address three soil exposure scenarios: residential, non-residential (commercial/industrial), and construction. Exhibit 1-1 describes the exposure characteristics and pathways of concern for each of the receptors under these scenarios, and Exhibit 1-2 presents the relevant exposure factors. Pathways and exposure factors listed in bold typeface under the residential scenario indicate changes from the residential soil screening scenario originally presented in the 1996 *SSG*. These changes reflect updates to EPA's method for evaluating exposures via the dermal contact and inhalation of indoor vapors pathways. (See Chapter 3 for a detailed explanation of these methods.)

This document also discusses the detailed site-specific modeling approach to developing SSLs. This approach can be used to conduct a more in-depth evaluation of any residential or commercial/industrial scenario, but also is needed to develop SSLs for exposure scenarios associated with additional non-residential land uses, such as recreational or agricultural use. These land uses may involve exposure pathways that are not included in the generic and simple site-specific approaches (e.g., ingestion of contaminated foods) and, therefore, require detailed site-specific modeling.

The flowchart in Exhibit 1-3 provides an overview of the residential, commercial/industrial, and construction exposure scenarios, illustrating the relationships among them and indicating the sections of this document relevant to developing SSLs under each of the scenarios. As shown in the flowchart, a soil screening evaluation involves identifying the likely anticipated future land use of a site; selecting an approach to SSL development; developing SSLs according to EPA's seven-step process; calculating supplemental construction SSLs (if necessary); and comparing site soil concentrations to all applicable SSLs. In addition, because SSLs are based on conceptual site models comprised of a complex set of assumptions about future land use and exposure scenarios, care should be taken to ensure that future site activities are consistent with these assumptions (e.g., through the use of institutional controls).

This guidance document focuses solely on risks to humans from exposure to soil contamination; it does not address ecological risks. For any soil screening evaluation (residential or non-residential), an ecological assessment should be performed, independently of the soil screening process for human health, to evaluate potential risks to ecological receptors. Assumptions about human exposure pathways under specific land use scenarios are not relevant to assessing ecological risks. Therefore, site managers should conduct a separate evaluation of risks to ecological receptors.

Exhibit 1-1
SUMMARY OF EXPOSURE SCENARIO CHARACTERISTICS AND PATHWAYS OF CONCERN FOR SIMPLE SITE-SPECIFIC SOIL SCREENING EVALUATIONS

Scenario[1]	Residential[2]	Non-Residential (Commercial/Industrial)		Construction	
Receptor	**On-site Resident**	**Outdoor Worker**	**Indoor Worker**	**Construction Worker**	**Off-site Resident**
Exposure Characteristics	• Substantial soil exposures (esp. children) • Significant time spent indoors • Long-term exposure	• Substantial soil exposures • Long-term exposure	• Minimal soil exposures (no direct contact with outdoor soils, potential for contact through ingestion of soil tracked in from outside) • Long-term exposure	• Exposed during construction activities only • Potentially high ingestion and inhalation exposures to surface and subsurface soil contaminants • Short-term exposure	• Located at the site boundary • Exposed during and post-construction • Potentially high inhalation exposures to soil contaminants • Short- and long-term exposure
Pathways of Concern	• Ingestion (surface and shallow sub-surface soils) • **Dermal absorption (surface and shallow sub-surface soils)[2]** • Inhalation (fugitive dust, outdoor vapors) • **Inhalation (indoor vapors)** • Migration to ground water	• Ingestion (surface and shallow sub-surface soils) • Dermal absorption (surface and shallow sub-surface soils) • Inhalation (fugitive dust, outdoor vapors) • Migration to ground water	• Inhalation (indoor vapors) • Ingestion (indoor dust) • Migration to ground water	• Ingestion (surface and subsurface soil) • Dermal absorption (surface and subsurface soil) • Inhalation (fugitive dust, outdoor vapors)	• Inhalation (fugitive dust)

1 This exhibit presents information on simple site-specific soil screening evaluations for three exposure scenarios -- residential, commercial/industrial, and construction. Additional exposure scenarios (e.g., agricultural and recreational) may be appropriate for certain sites. Given the lack of generic information available for these scenarios, site managers typically will need to use detailed site-specific modeling to develop SSLs for them.

2 Bold typeface indicates residential pathways that have changed since the 1996 *SSG*.

Exhibit 1-2
SUMMARY OF DEFAULT EXPOSURE FACTORS FOR SIMPLE SITE-SPECIFIC SOIL SCREENING EVALUATIONS

Scenario[1]	Residential	Non-Residential (Commercial/Industrial)		Construction	
Receptor	**On-site Resident[2]**	**Outdoor Worker**	**Indoor Worker**	**Construction Worker**	**Off-site Resident**
Exposure Frequency (d/yr)	350	225	250	site-specific	site-specific
Exposure Duration (yr)	30 [6 (child)[4] for non-cancer effects]	25	25	site-specific	site-specific
Event Frequency (events/d)	1	1	NA	1	NA
Soil Ingestion Rate (mg/d)	200 (child) 100 (adult)	100	50	330	NA
Ground Water Ingestion Rate[3] (L/d)	2	2	2	NA	NA
Inhalation Rate (m^3/d)	20[5]	20	20	20	20
Surface Area Exposed (cm^2)	**2,800 (child) 5,700 (adult)**	3,300	NA	3,300	NA
Adherence Factor (mg/cm^2)	**0.2 (child) 0.07 (adult)**	0.2	NA	0.3	NA
Body Weight (kg)	15 (child) 70 (adult)	70	70	70	70
Lifetime (yr)	70	70	70	70	70

1 This exhibit presents information on simple site-specific soil screening evaluations for three exposure scenarios -- residential, commercial/industrial, and construction. Additional exposure scenarios (e.g., agricultural and recreational) may be appropriate for certain sites. Given the lack of generic information available for these scenarios, site managers will typically need to use detailed site-specific modeling to develop SSLs for them.

2 Items in bold represent changes to the residential soil screening exposure scenario presented in the 1996 *SSG*.

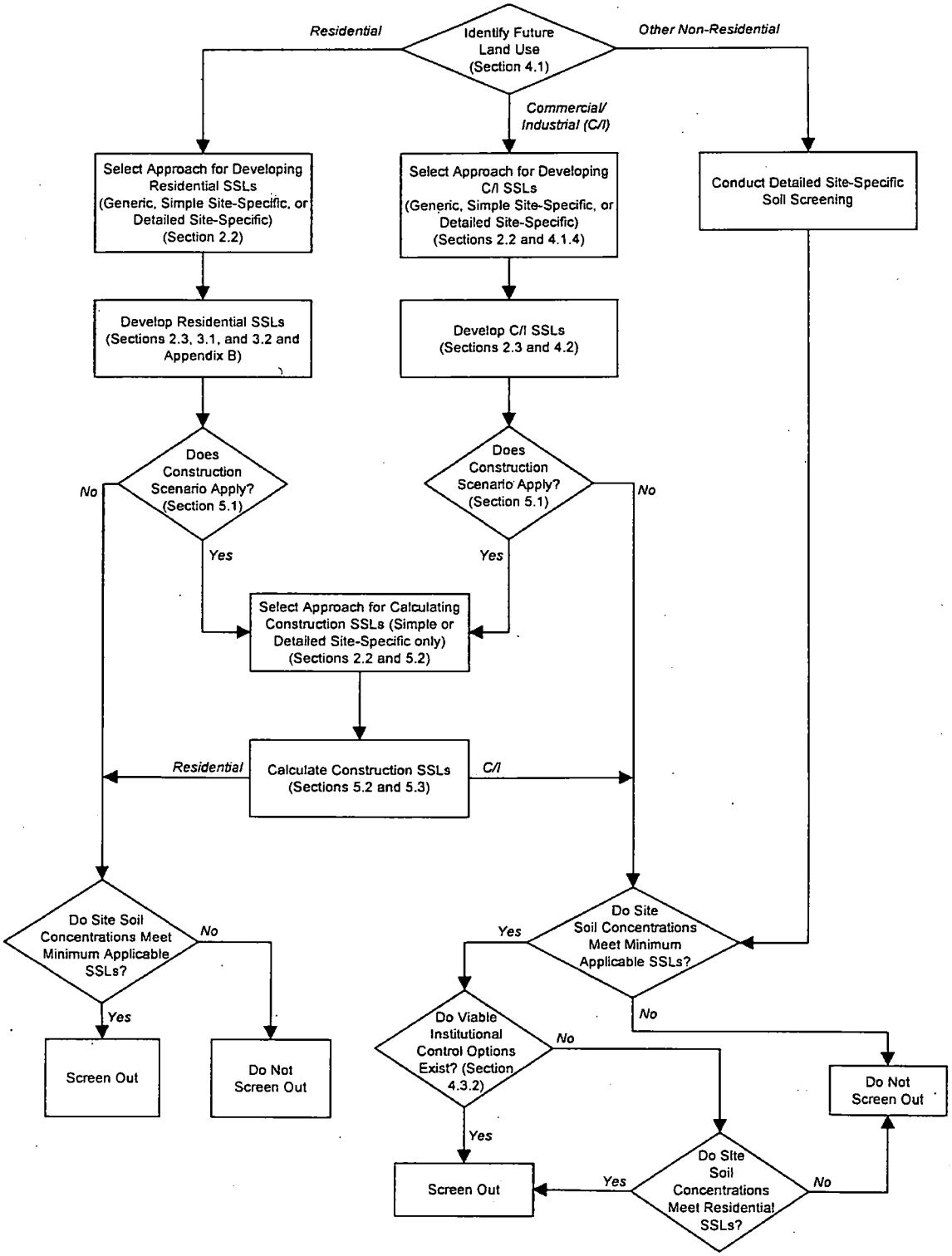
3 SSLs for the migration to ground water pathway are based on acceptable ground water concentrations, which are, in order of preference: a non-zero Maximum Contaminant Level Goal (MCLG), a Maximum Contaminant Level (MCL), or a health-based level (HBL) based on a 1×10^{-6} incremental lifetime cancer risk or a hazard quotient of one due to ingestion of contaminated ground water. When an HBL is used, it is based on these ground water ingestion rate values.

4 A child is defined as an individual between one and six years of age.

5 We evaluate residential inhalation exposure to children and adults using the RfC toxicity criterion, which is based on an inhalation rate of 20 m^3 /day. No comparable toxicity criterion specific to childhood exposures is currently available. EPA has convened a workgroup to identify suitable default values for modeling childhood inhalation exposures, as well as possible approaches for adjusting toxicity values for application to such exposures.

Exhibit 1-3

SOIL SCREENING OVERVIEW



EPA is currently working with a multi-stakeholder workgroup to develop scientifically sound, ecologically-based soil screening levels. The workgroup includes representatives from EPA, Environment Canada, Department of Energy (DOE), Department of Defense (DOD), academia, states, industry, and private consulting. This collaborative project will result in a Superfund guidance document that includes a look-up table of generic ecological soil screening levels (Eco-SSLs) for up to 24 chemicals that frequently are of ecological concern at Superfund sites. These Eco-SSLs will be soil concentrations that are expected to be protective of the mammalian, avian, plant, and invertebrate populations or communities that could be exposed to these chemicals.

1.2 Organization of Document

The remainder of this document is organized into four major chapters. Chapter 2 presents a brief overview of soil screening evaluations. It discusses the soil screening concept, the three-tiered screening framework, and the seven-step soil screening process. Chapter 3 focuses on the exposure pathways considered in soil screening evaluation. It lists the key exposure pathways for the three soil screening scenarios (residential, commercial/industrial, and construction) and presents new methods for calculating SSLs for two exposure pathways — dermal absorption (which addresses the potential for concurrent exposure via the direct ingestion and dermal pathways) and the migration of volatiles into indoor air. Chapter 4 addresses the development of non-residential SSLs. It discusses approaches to identifying future land use, presents a non-residential exposure framework, and provides equations for calculating site-specific non-residential SSLs. In addition, Chapter 4 also discusses issues related to the derivation and application of non-residential SSLs, including the importance of involving community representatives in identifying future land uses; the selection and implementation of institutional controls to ensure that future site activities are consistent with non-residential land use assumptions; and the relative roles of SSLs and OSHA standards in protecting future workers from exposure to residual contamination at non-residential sites. Finally, Chapter 5 describes methods for the development of construction SSLs that address exposures due to construction activities occurring during site redevelopment.

Five appendices to this document provide supporting information for the development of SSLs. Appendix A presents generic SSLs for residential and non-residential exposure scenarios. The generic residential SSLs in Appendix A have been updated to reflect the changes discussed in this document and supersede all previously published generic SSLs. Appendix B presents the complete set of simple site-specific SSL equations for the residential exposure scenario that incorporates changes to the 1996 *SSG*. Appendix C consists of chemical-specific information on chemical and physical properties, as well as human health toxicity values for use in developing SSLs. Appendix D provides tables of coefficients for calculating site-specific dispersion factors for inclusion in the air dispersion equations used to calculate simple site-specific SSLs for the inhalation pathway. Finally, Appendix E describes suggested modeling approaches that can be used to develop detailed site-specific inhalation SSLs for the non-residential and construction scenarios.

2.0 OVERVIEW OF SOIL SCREENING

This chapter of the guidance document provides a brief overview of soil screening evaluations for sites on the NPL. It begins with a definition of the soil screening concept and a discussion of its applicability and limitations, then describes three approaches to conducting soil screening evaluations, and concludes with a review of EPA's seven-step soil screening process. For a more in-depth and comprehensive discussion of these topics, please refer to Chapter 1.0 of EPA's 1996 *SSG*.

2.1 The Screening Concept

As used in this guidance, screening refers to the process of identifying and defining areas, contaminants, and conditions at a site that do not warrant further federal attention under CERCLA. Site managers make these determinations by comparing measured soil contaminant concentrations to soil screening levels (SSLs). SSLs are soil contaminant concentrations below which no further action or study regarding the soil at a site is warranted under CERCLA, provided that conditions associated with the SSLs are met. In general, areas with measured concentrations of contaminants below SSLs may be screened from further federal attention; if actual concentrations in the soil are at or above SSLs, further study, though not necessarily cleanup action, is warranted.[4] Exhibit 2-1 summarizes the definition and the applicability of the soil screening process and the associated SSLs.

SSLs are risk-based soil concentrations derived for individual chemicals of concern from standardized sets of equations. These equations combine EPA chemical toxicity data with parameters defined by assumed future land uses and exposure scenarios, including receptor characteristics and potential exposure pathways. Residential SSLs, initially described in the 1996 *SSG* and updated in this document, are based on exposure scenarios associated with residential activities, while non-residential SSLs are based on scenarios associated with non-residential activities.

For each chemical, SSLs are back-calculated from target risk levels. For the inhalation pathway and for the combined direct ingestion/dermal absorption pathway (see Section 3.2), target risk levels for soil exposures are a one-in-a-million (1×10^{-6}) excess lifetime cancer risk for carcinogens and a hazard quotient (HQ) of one for non-carcinogens. SSLs for the migration to ground water pathway are back-calculated from the following ground water concentration limits (in order of preference): non-zero maximum contaminant level goals (MCLGs); maximum contaminant levels (MCLs); or health-based limits (based on a cancer risk of 1×10^{-6} or an HQ of one).

[4] Areas meeting federal SSLs may still warrant further study. Some EPA Regional Offices and states have developed separate soil screening levels and/or preliminary remediation goals (PRGs) that may be more stringent than those presented in this guidance (though these alternative levels are based on the same general methodology described in this guidance). It is important that site managers confer with regional and state risk assessors when conducting soil screening evaluations to ensure that any SSLs developed will be consistent with their accepted soil levels.

Exhibit 2-1 A GENERAL GUIDE TO THE SCREENING AND SSL CONCEPTS	
Screening **Is:**	Screening **Is Not:**
• A method for identifying and defining areas, contaminants, and conditions at a site that generally do not warrant further federal attention; • A means of focusing the Remedial Investigation/ Feasibility Study (RI/FS) and site risk assessment; • A means for gathering data for later phases of the Superfund site remediation process.	• Mandatory; • A substitute for an RI/FS or risk assessment; • Valid unless conditions associated with SSLs (e.g., assumed future land use and site activities) are met.
SSLs **Are:**	SSLs **Are Not:**
• Human health risk-based concentrations; • Levels below which no further action or study is warranted under CERCLA, provided conditions concerning potential exposures and receptors (e.g., future land use) are met; • Specific to assumed exposures and site conditions; • Potentially suitable for use as PRGs.	• National cleanup standards; • Uniform across all sites; • Applicable to radioactive contaminants.

Although SSLs are "risk-based," the soil screening process does not eliminate the need to conduct site-specific risk assessments as part of the Superfund cleanup process. However, the screening process can help focus the risk assessment for a site on specific areas, contaminants, and pathways, and data collected during the screening process can be used in the risk assessment. Similarly, SSLs are not national cleanup standards, and exceedances of SSLs do not trigger the need for response actions at NPL sites.

In addition, because SSLs are based on a set of assumptions about likely future land use and site activities, they are only pertinent to the extent that future activities are consistent with these assumptions. Institutional controls may serve to limit future land uses and associated exposures to those assumed in a non-residential screening analysis, helping to ensure that the non-residential SSLs (which may be based on less conservative exposure assumptions than residential SSLs) are adequately protective. Institutional controls are not generally necessary for sites screened using residential SSLs because the conservative assumptions incorporated in the residential exposure scenario yield SSLs that are protective of non-residential uses as well. Further discussion of these issues can be found in *Land Use in the CERCLA Remedy Selection Process* (U.S. EPA 1995a).

The use of SSLs for screening purposes during site investigation at CERCLA sites is not mandatory. However, it is recommended by EPA as a tool to focus the RI/FS and site risk assessment by identifying the contaminants and areas of concern, and to gather necessary information for later phases of the RI/FS process.[5]

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[5] SSLs developed in accordance with this guidance can also be applied to Resource Conservation and Recovery Act (RCRA) corrective action sites as "action levels," where appropriate, since the RCRA corrective action program currently views the role of action levels as generally serving the same purpose as soil screening levels. For more information, see 61 *Federal Register* 19432, 19439, and 19446 (May 1, 1996).

SSLs also can be used as Preliminary Remediation Goals (PRGs) provided conditions found during subsequent investigations at a specific site are the same as the conditions assumed in developing the SSLs. EPA recognizes, however, that certain conservative assumptions built into the generic and simple site-specific approaches to SSL development, while appropriate for a screening analysis, may be overly conservative for setting PRGs and, ultimately, site cleanup levels. For example, as described in the 1996 *SSG*, EPA chose to base generic and simple site-specific SSLs for non-carcinogenic contaminants via soil ingestion on a conservative, childhood-only, six-year exposure duration because several studies suggest that inadvertent soil ingestion is common among children age 6 and younger (Calabrese et al., 1989; Davis et al., 1990; and VanWinjen et al., 1990). The SAB noted that the combination of the six-year childhood exposure with a chronic RfD may be appropriate for chemicals with toxic endpoints specific to children or with steep dose-repsonse curves, but is likely to be overly protective for most contaminants (U.S. EPA, 1993). EPA believes this protectiveness is appropriate for soil screening evaluations, but such conservatism may not be necessary for developing PRGs and cleanup levels for many contaminants. Therefore, site managers wishing to use SSLs as a basis for developing PRGs should carefully consider the assumptions built into the SSLs and whether it may be appropriate to relax any of these assumptions for calculating PRGs.

2.2 The Tiered Screening Framework /Selecting a Screening Approach

EPA's framework for soil screening assessment provides site managers with three approaches to establish SSLs for comparison to soil contaminant concentrations:

- Apply **generic** SSLs developed by EPA;
- Develop SSLs using a **simple site-specific** methodology; or
- Develop SSLs using a more **detailed site-specific** modeling approach.

These approaches involve using increasingly detailed site-specific information to replace generic assumptions, thereby tailoring the screening model to more accurately reflect site conditions, potential exposure pathways, and receptor characteristics. Additionally, progression from generic to detailed site-specific methods generally results in less stringent screening levels because conservative assumptions are often replaced with site-specific information while maintaining a constant target risk level.

The first approach for developing screening levels is the simplest and least site-specific. This approach assumes a generic exposure scenario, intended to be broadly protective under a wide array of site conditions. The site manager simply compares measured soil concentrations to chemical-specific SSLs derived by EPA based on the conservative generic scenario and provided in a look-up table. (These tables, together with additional guidance on applying the generic SSLs to individual sites, are presented in Appendix A of this document.) While this approach offers the benefits of simplicity and ease of use, the generic SSLs are calculated using conservative assumptions about site conditions and are thus likely to be more stringent than SSLs developed using more site-specific approaches. Where site conditions differ substantially from the scenario used to

derive the generic SSLs, generic levels may not be appropriate for identifying areas that can be "screened out." The specific assumptions underlying the generic SSLs are identified in the equations presented in Section 4.2.3 (non-residential exposure scenario) and in Appendix B (residential exposure scenario).

The second approach, the simple site-specific methodology, allows site managers to calculate SSLs using the same equations used to derive the generic SSLs. Unlike the generic approach, the simple site-specific methodology offers some flexibility in the use of site-specific data for developing SSLs. Though the target risk for SSLs remains the same, some of the generic default input values may be replaced by site-specific information such as data on hydrological, soil, and meteorological conditions. Thus, the simple site-specific approach retains much of the ease and simplicity of the generic approach, while providing site managers increased freedom to replace the conservative assumptions of the generic approach with data that more accurately reflect site conditions. The result will be more tailored SSLs that are likely to be less stringent than the generic values. As site managers change the assumptions used in developing the SSLs to reflect site-specific information, they should have the changes reviewed by the regional risk assessor associated with the site. Site managers should also document any changes they make to the exposure parameters from the default values in order to develop simple site-specific SSLs.

As the name suggests, the detailed site-specific modeling approach is the most rigorous of the three approaches and incorporates site-specific data to the greatest extent. This approach is useful for developing SSLs that take into account more complex site conditions than those assumed in the simple site-specific approach. The detailed approach may be appropriate, for example, to demonstrate that the migration of soil contaminants to ground water does not apply at a particular site, or to model distinct or unusual site conditions. Technical details supporting the use of this approach can be found in Appendices D and E of this document and in the *Technical Background Document* (*TBD*) for the 1996 *SSG*.

The decision regarding which of the three approaches is most appropriate for a given site must balance the need for accuracy with considerations of cost and timeliness. While progression from generic SSLs to a detailed site-specific modeling approach increases the accuracy of the screening process, it also generally involves an increase in the resources, time, and costs required. Deciding which option to use typically requires balancing the increased investigation effort with the potential savings associated with higher (but still protective) SSLs. In general, EPA believes the most useful approach to apply is the simple site-specific methodology, which provides a reasonable compromise in terms of effort and site-specificity.

Although the simple site-specific approach is generally expected to be the most useful, there are times when the generic or the detailed site-specific modeling approaches may be more appropriate. The former can be used as an initial screening tool or as a "crude yardstick" to quickly identify those areas which clearly do not pose threats to human health or the environment. In such cases where exclusion appears clearly warranted, there is little need for more site-specific information to justify this decision. The generic approach can also be used to quickly screen out chemicals and focus the subsequent investigation on the key chemicals of concern. Generally, detailed site-specific modeling is most useful in cases where: 1) the ability to conduct sophisticated analyses, incorporating mostly site-specific data, could result in substantial savings in site

investigation and cleanup costs due to an increase in the site area "screened out" of the remedial process under CERCLA; or 2) site conditions are unique. For example, the detailed approach could be used to assess unusual exposure pathways or conditions or to conduct fate and transport analyses that describe the leaching of contaminants to ground water in a specific hydrogeologic setting.

2.3 The Seven-Step Soil Screening Process

Regardless of the screening approach chosen, the soil screening analysis consists of the seven steps discussed in this section. EPA emphasizes that the overall seven-step site screening process is not changing, and the same process is applied to residential and non-residential scenarios. However, the evaluation of the non-residential and construction exposure scenarios described in this guidance requires modifications to the steps of the screening process, especially to Steps 1, 2, and 5. These modifications are described in Section 4.2 and Section 5.3 of this document for the non-residential and construction scenarios, respectively.

The seven-step soil screening process established in the 1996 *SSG* was designed to evaluate the significance of soil contaminant concentrations at residential sites. Although some of the default values and assumptions of the residential approach do not apply to commercial/industrial or construction exposure scenarios, the same overall screening framework can be used to evaluate sites under these scenarios. The basic elements of the seven steps are described below. Exhibit 2-2 presents a useful one-page summary of the full soil screening process. Please refer to the 1996 *SSG* for additional information on the soil screening steps.

Step 1: Develop Conceptual Site Model

Developing a conceptual site model (CSM) is a critical step in properly implementing the soil screening process at a site. The CSM is a comprehensive representation of the site that documents current site conditions. It characterizes the distribution of contaminant concentrations across the site in three dimensions and identifies all potential exposure pathways, migration routes, and potential receptors. The CSM is initially developed from existing site data. This site data should include input from community members about their site knowledge, concerns, and interests. The CSM is a key component of the RI/FS and EPA's Data Quality Objectives (DQO) process, and should be continually revised as new site investigations produce updated or more accurate information. CSM summary forms and detailed information on the development of CSMs are presented in Attachment A of the 1996 *SSG User's Guide*.

In addition, *RAGS Part D*, which is intended to assist site managers in standardizing risk assessment planning, reporting, and review at CERCLA sites, provides a template that site mangers can use to summarize and update data on the CSM. This template is the first in a series of standard tables that EPA has developed to document important parameters, data, calculations, and conclusions from all stages of Superfund human health risk assessments.

Exhibit 2-2

SOIL SCREENING PROCESS

Step 1: **Develop Conceptual Site Model**

- Collect existing site data (historical records, aerial photographs, maps, PA/SI data, available background information, state soil surveys, etc.)
- Collect community input
- Organize and analyze existing site data
  - Identify known sources of contamination
  - Identify affected media
  - Identify potential migration routes, exposure pathways, and receptors
- Construct a preliminary diagram of the CSM
- Perform site reconnaissance
  - Confirm and/or modify CSM
  - Identify remaining data gaps

Step 2: **Compare CSM to SSL Scenario**

- Identify sources, pathways, and receptors likely to be present at the site and addressed by the soil screening scenario
- Identify additional sources, pathways, and receptors likely to be present at the site but not addressed by the soil screening scenario

Step 3: **Define Data Collection Needs for Soils**

- Develop hypothesis about distribution of soil contamination
- Develop sampling and analysis plan for determining soil contaminant concentrations
  - Sampling strategy for surface soils following Data Quality Objectives (DQOs)
  - Sampling strategy for subsurface soils following Data Quality Objectives (DQOs)
  - Sampling strategy to measure soil characteristics (bulk density, moisture and organic carbon content, porosity, pH)
- Determine appropriate field methods and establish QA/QC protocols

Step 4: **Sample and Analyze Soils**

- Identify contaminants
- Delineate area and depth of sources
- Determine soil characteristics
- Revise CSM, as appropriate

Step 5: **Calculate Site- and Pathway-Specific SSLs**

- Identify SSL equations for relevant pathways
- Identify chemicals of concern for dermal exposure
- Obtain site-specific input parameters from CSM summary
- Replace variables in SSL equations with site-specific data gathered in Step 4
- Calculate SSLs
  - Account for exposure to multiple contaminants

Step 6: **Compare Site Soil Contaminant Concentrations to Calculated SSLs**

- For surface soils characterized using composite samples, screen out exposure areas where all composite samples do not exceed SSLs by a factor of two
- For surface soils characterized using discrete samples, screen out areas where the 95 percent upper confidence limit (UCL_{95}) on the mean concentration for each contaminant does not exceed the corresponding SSL
- For subsurface soils with indirect exposures, screen out source areas where the mean concentration of each contaminant in each soil boring does not exceed the applicable SSL
- For subsurface soils with direct exposures, screen out source areas where the highest soil boring concentration for each contaminant does not exceed the applicable SSL
- Evaluate whether background levels exceed SSLs

Step 7: **Address Areas Identified for Further Study**

- Consider likelihood that additional areas can be screened out with more data
- Integrate soil data with other media in the baseline risk assessment to estimate cumulative risk at the site
- Determine the need for action
- Use SSLs as PRGs, if appropriate

Step 2: Compare CSM to SSL Scenario

In this step, the CSM for a site is compared to the SSL scenario and assumptions for calculating generic and simple site-specific SSLs. This comparison should determine whether the CSM is sufficiently similar to the SSL scenario so that use of the generic or simple site-specific SSL scenario is appropriate. If the CSM contains sources, pathways, or receptors not covered by the general SSL scenario, comparison to generic or simple site-specific SSLs alone may not be sufficient to fully evaluate the site, suggesting the need to conduct detailed site-specific modeling. However, it may be sufficient to eliminate some pathways or chemicals from further consideration. It is crucial to engage in these efforts at this early stage in order to identify areas or conditions where generic or simple site-specific SSLs are not sufficiently informative, so that other characterization and response efforts can be considered when planning the sampling strategy (Step 3).

Step 3: Define Data Collection Needs for Soils

Upon initiating a soil screening evaluation, a site manager develops a Sampling and Analysis Plan (SAP). The SAP should identify sampling strategies for filling any data gaps in the CSM requiring collection of site-specific information. These strategies typically address contaminant concentrations in surface and subsurface soil, as well as soil characteristics.

Before developing the SAP, the site manager should define the specific areas(s) to which the soil screening process will be applied. Existing data can be used to determine what level and type of investigation may be appropriate. Areas with known contamination will be thoroughly investigated and characterized in the RI/FS. Areas that are unlikely to be contaminated based on good historical documentation of the location of current and past storage, handling, or disposal of hazardous materials at the site may generally be screened out at this stage; however, samples should be taken to confirm this hypothesis. The remaining areas, those with uncertain contamination levels and historical activities, are most appropriate for the soil screening sampling strategy outlined in the 1996 *SSG*.

For purposes of soil screening analyses, EPA distinguishes between surface and subsurface soils as follows: surface soils are located within two centimeters of the ground surface, and subsurface soils are located more than two centimeters below the surface. Because exposure to contaminants in these two soil regions may occur via different mechanisms, sampling plans for these two categories of soil should be designed to collect reliable data appropriate to the exposure models involved. For example, the surface soil strategy should collect data appropriate for evaluating exposure via direct ingestion, dermal contact, and inhalation of fugitive dusts as individuals move randomly around a site. Typically, this requires a reliable estimate of the arithmetic mean of contaminant concentrations in surface soils in exposure areas of concern. In general, the subsurface soil sampling strategy should provide data to model the types of indirect exposure to subsurface contamination that occurs when chemicals migrate up to the soil surface or down to an underlying aquifer. Modeling these pathways usually requires an estimate of the average contaminant concentration through each source, estimates of the dimensions of the source, and average soil properties within the source. However, as discussed below, at some sites a sampling plan designed to evaluate direct contact exposures may be appropriate for some subsurface soils.

Site managers have two options for developing an SAP for surface soils: composite sampling or discrete sampling. Either approach should allow you to calculate a reliable estimate of the arithmetic mean of contaminant concentrations in surface soils. Composite sampling involves the physical mixing of soils from multiple locations and then collecting one or more sub-samples from the mixture. Details of a composite-based SAP are presented in the 1996 *SSG*. The maximum contaminant concentration from composite sampling is a conservative estimate of the mean concentration and can be used for soil screening evaluations. This approach can be an effective way to estimate the mean contaminant concentration with lower sampling costs, because fewer samples are needed. However, the mixing of soils in composite samples may disperse volatile contaminants and also may dilute concentrations of other contaminants, resulting in less sensitivity to hot spots and to other variations in contaminant concentrations. Alternatively, site managers can collect discrete un-composited samples using a simple random sampling scheme (SRS), a stratified SRS[6], or systematic grid sampling with a random starting point. Details of alternative SAPs for discrete sampling can be found in *Guidance for Choosing a Sampling Design for Environmental Data Collection* (EPA 2000a). Because there is no spatial averaging of soil concentrations with this method, a much larger number of soil samples is required to produce a reliable estimate of the mean contaminant concentration. As a result, EPA recommends estimating the 95th percentile upper confidence limit (UCL_{95}) on the mean contaminant concentration as a conservative estimate of the mean when performing a soil screening evaluation with data sets of un-composited samples.[7]

The 1996 *SSG* subsurface soil sampling strategy addresses exposure to subsurface contamination that occurs when chemicals migrate up to the soil surface or down to an underlying aquifer. It focuses on collecting the data required for modeling volatilization and migration to ground water. As a result, the goals of this strategy are to measure the area and depth of contamination, the average contaminant concentration in each source area, and the characteristics of the soil. Accurately determining the mean concentration of subsurface soils using current investigative techniques and statistical methods would require a costly and intensive sampling program that is beyond the level of effort required for a screening analysis. Therefore, EPA recommends that conservative assumptions be used to develop hypotheses on likely contaminant distributions. EPA recommends taking 2 or 3 soil borings located in the areas suspected of having the highest contaminant concentrations within each source. Because the subsurface sampling approach is likely to be less comprehensive than the surface soil SAP, the soil screening analysis focuses on the highest mean soil boring contaminant concentration within the source as a conservative estimate of the mean contaminant concentration for the entire source area. The subsurface SAP also should include the collection of site characteristics needed to determine site-specific SSLs, including the following soil parameters: Soil Classification System (SCS) soil type, dry bulk density (ρ_b), soil organic carbon content (f_{oc}), and pH. Additional detail on this approach can be found in the 1996 *SSG User's Guide* and *Technical Background Document*.

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[6]Stratified SRS allows for random sample collection within sampling blocks designed to reflect anticipated site activity patterns; thus, it more effectively targets areas where exposures are expected to occur.

[7]EPA's *Calculating Upper Confidence Limits For Exposure Point Concentrations at Hazardous Waste Sites*, provides a survey of statistical methods that may be used by site managers to estimate UCL_{95} values (U.S. EPA,2002a).

For some CSMs, these three sampling approaches will suffice to characterize exposures to contaminants in soil. However, other CSMs may feature residential activities (e.g., gardening) or commercial/industrial (e.g., outdoor maintenance or landscaping) or construction activities that may disturb soils to a depth of up to two feet, potentially exposing receptors to contaminants in subsurface soil via direct contact pathways such as ingestion and dermal absorption. In such cases, EPA anticipates that site managers will need to characterize contaminant levels by taking shallow subsurface borings where appropriate. The specific locations of such borings should be determined by the likelihood of direct contact with these subsurface soils and by the likelihood that soil contamination is present at that depth. Given that contamination in these deeper soils is unlikely to be characterized to the same extent as contamination in surface soils, the maximum measured concentration of each contaminant in these borings should used as a conservative estimate of the mean contaminant concentration for purposes of the soil screening evaluation.

Alternatively, if available evidence strongly indicates that contaminated subsurface soils will be disturbed and brought to the surface (e.g., as the result of redevelopment activities), site managers will need to characterize subsurface contamination more thoroughly and should collect a sufficient number of samples to develop a UCL_{95} value for use in the soil screening evaluation.

For both surface and subsurface soils, site managers should use the Data Quality Objectives (DQO) process in developing SAPs to ensure that sufficient data are collected to properly assess site contamination and support decision-making concerning future Superfund site activities. The DQO process is a systematic planning process designed to ensure that sufficient data are collected to support EPA decision-making. Section 2.3 of the 1996 *SSG* describes this process in detail.

Step 4: Sample and Analyze Site Soils

Once sampling strategies have been developed and implemented, the samples are analyzed according to the methods specified in the SAP. The analytic results provide the concentration data for contaminants of concern that are used in the comparison to SSLs (Step 6). Soil analysis also helps to define the areal extent and depth of contamination, as well as soil characteristics data. This information is needed to calculate site-specific SSLs for the inhalation of volatiles and migration to ground water pathways.

The analyses of soil contaminants and characteristics may reveal new information about site conditions. It is critical that the CSM be updated to reflect this information.

Step 5: Calculate Site- and Pathway-Specific SSLs

Using the data collected in Step 4 above, site-specific soil screening levels can be calculated according to the methods presented under this step of the *SSG*. (If generic SSLs are used for comparison with site contaminant concentrations, this step may be omitted.) Both the 1996 *SSG* and this guidance document provide equations necessary to develop simple site-specific SSLs. Also, an interactive SSL calculator for simple site-specific equations is available online at http://risk.lsd.ornl.gov/calc_start.htm.[8] Descriptions of how these equations were developed and background information on underlying assumptions and limitations are available in the *TBD* for the 1996 *SSG* as well as in Chapters 3, 4, and 5 of this document. The default exposure assumptions and equations for calculating residential SSLs can be found in Chapter 3 and in Appendix B of this document. Additional information on default residential assumptions can be found in the 1996 *SSG User's Guide* and *TBD*. The default assumptions and equations for calculating non-residential SSLs are presented in Chapter 4. (Alternatively, tables of generic SSLs for these two scenarios are presented in Appendix A.) The equations used to calculate SSLs based on construction activities are presented in Chapter 5.

All SSL equations in the 1996 *SSG* were designed to be consistent with the concept of Reasonable Maximum Exposure (RME) in the residential setting. In following the Superfund program's approach for estimating RME, EPA uses reasonably conservative defaults for intake and exposure duration, combined with values for site-specific parameters (e.g., for soil or hydrologic conditions) that reflect average or typical site conditions, to develop risk-based SSLs. EPA bases SSLs on RME assumptions rather than central tendency conditions because this approach results in a conservative (though not a worst case) estimate of long-term exposure that is protective of the majority of the population.

The 1996 *SSG* quantitatively addresses four exposure pathways — direct ingestion, inhalation of fugitive dusts, inhalation of volatiles in outdoor air, and ingestion of ground water contaminated by the migration of contaminants through soil to an underlying potable aquifer. This guidance includes these four pathways plus dermal contact exposures and inhalation of volatiles in indoor air from vapor intrusion.

Step 6: Compare Site Soil Contaminant Concentrations to Calculated SSLs

Once site-specific SSLs have been calculated (or the appropriate generic SSLs from Appendix A have been identified), they are compared to the measured concentrations of contaminants of concern. At this point, it is important to review the CSM to confirm its accuracy in light of the actual site data that have been collected in previous steps of the soil screening process. This also will help to ensure that the SSL scenarios are applicable to the site.

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[8] The SSL calculator currently includes default values for residential exposures; however, users can adjust these defaults to reflect non-residential exposure scenarios.

The following are four methods for deciding whether an exposure area can be screened from further investigation — two for surface soil contamination and two for subsurface soil contamination. Each method specifies a particular estimator of the true mean concentration to be used in a screening evaluation, as well as the screening level to which the estimate is compared.

- **Compare Maximum Composite Concentration to 2 x SSL (Surface Soils).** For surface soils that have been sampled using composite samples in accordance with the DQOs discussed in the 1996 *SSG*, the maximum composite sample concentration is compared to two times the SSL; areas where the maximum composite sample concentration is less than two times the SSL can be screened out. Further study is needed for areas where any composite sample concentration equals or exceeds twice the applicable SSL for one or more contaminants.[9] The 1996 *SSG* notes that the surface soil max test strategy that employs composites is applicable for semivolatiles, inorganics, and pesticides only.

- **Compare 95 Percent Upper Confidence Limit on the Mean to SSL (Surface Soils).** For data sets consisting of discrete samples or data sets of limited sample size, EPA uses statistical methods to calculate a conservative estimate of the arithmetic mean concentration for each contaminant in an exposure area. This estimate, the 95 percent upper confidence limit (UCL_{95}) on the mean is used to avoid underestimating the true mean (and thereby ensure that the screening process is protective of human health). The UCL_{95} may be estimated by a variety of statistical methods depending on the characteristics of the data set (e.g., the Chebyshev inequality, the bootstrap method, and the jackknife method); these methods are described in *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (U.S. EPA, 2002a).

- **Compare Mean Concentration in Soil Borings to SSL (Subsurface Soils/Indirect Exposure).** Where direct contact exposure to subsurface soil is not an issue, subsurface soil sampling under the SSL DQOs is generally limited to two or three borings *per source area.* As discussed in Step 3, subsurface soil sampling strategies focus on the collection of data for modeling the volatilization and migration to ground water pathways (i.e., the area and depth of contamination, soil characteristics, and the average contaminant concentration in each source area. Because the expense and level of effort involved in a precise determination of these values for a subsurface contamination source is well beyond the level of effort generally

[9] Given the sampling approach described in the 1996 *SSG*, which focused on a strategy of collecting composite samples, two times the SSL was determined to be a reasonable upper limit for comparison that would still be protective of human health. See the 1996 *SSG TBD* for a complete discussion of the protectiveness of this level (U.S. EPA, 1996b).

appropriate for a screening evaluation, these soils tend not to be characterized to the same extent as surface soils. Therefore, for these soils, the *SSG* adopts a conservative approach for soil screening decisions of comparing mean concentrations from each boring directly to the SSL. In areas where the mean concentrations of all borings fall below the SSL, the area may be screened out. In all other areas, further study is required.[10]

- **Compare Maximum Concentration in Soil Borings to SSL (Subsurface Soils/Direct Exposure).** At sites where activities may disturb subsurface soils and result in direct contact exposures to contaminants in those soils, EPA anticipates that site managers will characterize contaminant levels by taking samples from additional subsurface borings in areas of soil likely to be disturbed. Given that contamination in these deeper soils is unlikely to be characterized to the same extent as contamination in surface soils, the maximum measured concentration of each contaminant in these borings should used as a conservative estimate of the mean contaminant concentration and compared directly with the appropriate SSL. If the maximum concentration of each contaminant in a given area falls below its SSL, the area may be screened out. For all other areas, additional study is required.[11]

Exposures to Multiple Chemicals

Exposures to multiple chemicals are treated similarly for non-residential and residential soil screening evaluations. The project manager should coordinate with the risk assessor to determine the health end points caused by each chemical and combinations of several chemicals. EPA believes that the $1x10^{-6}$ target cancer risk level for individual chemicals and pathways generally will lead to cumulative site risks within the $1x10^{-4}$ to $1x10^{-6}$ risk range for the combinations of chemicals typically found at NPL sites. For non-carcinogens, EPA recommends that non-carcinogenic contaminants be grouped according to the critical effect listed as the basis for the RfD/RfC. If more than one chemical detected at a site affects the same target organ or organ system, SSLs for those chemicals should be divided by the number of chemicals present in the group

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[10] The SSL DQO sampling approach will not yield sufficient data for calculating a 95 percent UCL for the arithmetic mean contaminant concentration in subsurface soil. However, should there be sufficient data for this calculation, site managers have the option of comparing either the 95 UCL value for the site or the contaminant concentrations in each boring to the SSL.

[11] Alternatively, if available evidence indicates that contaminated subsurface soils will be disturbed and brought to the surface (e.g., as the result of redevelopment activities), site managers will need to characterize subsurface contamination more thoroughly and should collect a sufficient number of samples to develop a UCL_{95} value for comparison to the SSL.

Step 7: Address Areas Identified for Further Study

Areas that have been identified for further study become the subject of the RI/FS. The results of the baseline risk assessment, which is part of the RI/FS, will establish the basis for taking any remedial action; however, the threshold for initiating this action differs from the screening criteria. As outlined in *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (U.S. EPA, 1991c), remedial action at NPL sites is generally warranted where cumulative risks (i.e., total risk from exposure to multiple contaminants at a site) for a current or future land use exceed 1×10^{-4} for carcinogens or a hazard index (HI) of one for non-carcinogens. The data collected for soil screening evaluations will be useful in developing the baseline risk assessment. However, site managers will probably need to collect additional data during future site investigations conducted as part of the RI/FS. These additional data will allow site managers to better define the risks at a site and could ultimately indicate that no action is required. If a decision is made to initiate remedial action, the SSLs may then serve as PRGs. For further guidance on this issue, please consult Sections 1.2 and 2.7 of the 1996 *SSG*.

3.0 EXPOSURE PATHWAYS

The 1996 *SSG* provides quantitative methods to derive SSLs for the following exposure pathways under a residential soil exposure scenario:

- Direct ingestion,
- Inhalation of volatiles outdoors,
- Inhalation of fugitive dust outdoors, and
- Ingestion of ground water contaminated by the migration of soil leachate to an underlying aquifer.

In addition, that document qualitatively addressed dermal absorption of contaminants from soil exposure. Together, these five pathways formed the basis for EPA's generic and simple site-specific approaches to residential soil screening evaluations.

This chapter updates the 1996 *SSG* in three ways. First, it presents a list of key exposure pathways for three soil screening exposure scenarios: residential, commercial/industrial, and construction. Second, it presents equations for a combined soil ingestion/dermal absorption SSL that includes a new quantitative approach for evaluating dermal absorption. Third, it presents a new quantitative approach for evaluating the inhalation of volatile contaminants present in indoor air as the result of vapor intrusion.

3.1 Exposure Pathways by Exposure Scenario

Exhibit 3-1 lists default soil exposure pathways for each of three soil screening exposure scenarios: residential, commercial/industrial, and construction. The list of pathways for each scenario is not intended to be exhaustive; instead, each list represents a set of typical exposure pathways likely to account for the majority of exposure to soil contaminants at a site. The actual exposure pathways evaluated in a soil screening evaluation depend on the contaminants present, the site conditions, and the expected receptors and site activities described in the CSM. A CSM may include additional receptors or exposure pathways not addressed by this document or by the 1996 *SSG* (e.g., ingestion of contaminated fish by subsistence anglers). Conversely, not all the pathways listed in Exhibit 3-1 for a particular scenario may apply to a given site. As a result, it is important to compare the CSM with the assumptions and limitations associated with each applicable exposure scenario to identify whether additional or more detailed assessments are needed for particular exposure pathways. Early identification of the need for additional analysis is important because it facilitates development of a comprehensive sampling strategy.

Exhibit 3-1

RECOMMENDED EXPOSURE PATHWAYS FOR SOIL SCREENING EXPOSURE SCENARIOS

Potential Exposure Pathways	Residential		Commercial/Industrial				Construction			
			Outdoor Worker		Indoor Worker		Construction Worker		Off-Site Resident	
	Surface Soil[1]	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
Direct ingestion	✓	✓	✓	✓	✓		✓	✓		
Dermal absorption	✓	✓	✓	✓			✓	✓		
Inhalation of volatiles outdoors		✓		✓				✓		
Inhalation of fugitive dust outdoors	✓		✓				✓		✓	
Migration of volatiles into indoor air		✓				✓				
Ingestion of ground water contaminated by the migration of leachate to an underlying aquifer		✓		✓		✓				

[1] For the purposes of soil screening evaluations, EPA defines surface soil as consisting of the top two centimeters of soil, and subsurface soil as soils located beneath the top two centimeters. However, at sites where the CSM suggests that receptors will frequently come into direct contact with soils at depths greater than two centimeters, contaminant concentrations in these soils should be compared to SSLs developed for surface soils.

The methods for evaluating exposures via the inhalation of volatiles outdoors, the inhalation of fugitive dust outdoors, and the ingestion of leachate-contaminated ground water under the residential scenario have not changed since the publication of the 1996 *SSG*; detailed information about the modeling approaches for these exposure pathways can be found in the 1996 *SSG User's Guide* and *Technical Background Document.* Section 3.2 of this document discusses new methods for developing SSLs for combined exposures via soil ingestion and dermal absorption and for the migration of volatiles into indoor air. It also presents residential SSL equations for the soil ingestion/dermal absorption pathway and directs readers to the spreadsheet models that can be used to evaluate the indoor air pathway. For convenience, the complete set of residential SSL equations and default assumptions has been reproduced in Appendix B. (SSL equations for the commercial/industrial and construction scenarios are presented in Chapters 4 and 5, respectively.) In addition, an interactive SSL calculator is available online at http://risk.lsd.ornl.gov/calc_start.htm.

In general, each exposure scenario uses a similar modeling approach for a given exposure pathway. Differences in exposure scenarios are reflected primarily in the specific default model input values associated with the different types of exposures. However, in the case of the migration to ground water pathway, both the modeling approach and model inputs for the residential and commercial/industrial scenarios are identical, and hence so are the associated SSLs.[10] This approach is consistent with EPA's policy to protect potentially potable ground water resources. The treatment of migration to ground water SSLs for commercial/industrial scenarios is discussed further in Section 4.2.3.

3.2 Exposure Pathway Updates

Since publishing the 1996 *SSG*, EPA has developed new technical approaches for two exposure pathways relevant to soil screening evaluations: dermal absorption and inhalation of volatiles present in indoor air as the result of vapor intrusion. In addition, although EPA has not changed the way it models soil ingestion exposures, this guidance provides site managers with new SSL equations that combine soil ingestion and dermal absorption. This section presents an overview of these new approaches to SSL development and includes the associated SSL equations for residential exposure scenarios. (The residential SSL equations presented in this guidance supersede the equations described in the 1996 *SSG*.) Chapter 4 of this document includes a discussion of the application of these methods to non-residential exposure scenarios, and Chapter 5 addresses the application of the ingestion/dermal approach for construction scenarios.

[10] This pathway is not evaluated under the construction exposure scenario. Since the construction scenario supplements either the residential or commercial/industrial scenario, migration to ground water SSLs from either of those chronic exposure scenarios are expected to be protective of subchronic exposures via this pathway during construction.

3.2.1 Direct Ingestion and Dermal Absorption of Soil Contaminants

EPA has developed an approach that site managers can use to calculate SSLs for concurrent exposures to contaminants via the direct ingestion and dermal absorption pathways. This approach consists of a set of equations that allows a site manager to estimate the soil contaminant concentration for which the combined potential exposure via these two pathways is equivalent to an incremental lifetime cancer risk of 1×10^{-6} or an HQ of one — the same target risks used for other pathways. This yields SSLs that are protective of exposures that occur via these pathways simultaneously. EPA developed this approach because concurrent exposures via these two pathways are very likely during activities such as gardening, outdoor work, children's outdoor play, and excavation.[11]

Equations 3-1 and 3-2 present EPA's approach to developing combined SSLs for the ingestion and dermal pathways. Equation 3-1 is appropriate for addressing exposure to carcinogenic compounds, and Equation 3-2 covers exposure to non-carcinogenic compounds. Site data may be used to derive site-specific input values for the model parameters that appear in bold typeface. EPA provides default values for these parameters that can be used when site-specific data are not available. Appendix A presents generic ingestion/dermal SSLs for the residential exposure scenario that were calculated using these equations and the specified default values.

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[11] Although these activities also may lead to exposure via inhalation, EPA will continue to evaluate these exposures separately because of the potential for different health effects via the inhalation route. Differences in health effects can be associated with differences in metabolic processes for contaminants entering the body via the ingestion/dermal and inhalation exposure routes. As a result, EPA recommends developing separate SSLs for exposures via inhalation.

Equation 3-1
Screening Level Equation for Combined Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil - Residential Scenario

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365\,d/yr}{(EF \times 10^{-6} kg/mg)\,[(SF_o \times IF_{soil/adj}) + (SF_{ABS} \times SFS \times ABS_d \times EV)]}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (years)	70
EF/exposure frequency (days/year)	350
SF_{ABS}/dermally adjusted cancer slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Equation 3-3)
SFS/age-adjusted dermal factor (mg-yr/kg-event)	**360 (Equation 3-5)**
ABS_d/dermal absorption fraction (unitless)	chemical-specific (Exhibit 3-3 and Appendix C)
EV/event frequency (events/day)	1
SF_o/oral cancer slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Appendix C)
$IF_{soil/adj}$/age-adjusted soil ingestion factor (mg-yr/kg-d)	114[a]

[a] Calculated per *RAGS, PART B* Equation 3. (U.S. EPA, 1991b)

Direct Ingestion

The components of Equations 3-1 and 3-2 that reflect modeling of exposures via soil ingestion remain unchanged from the approach used in the 1996 *SSG*. For carcinogens, Equation 3-1 assumes a high end exposure duration (30 years) and incorporates a time-weighted average soil ingestion rate for children and adults (incorporated in the soil ingestion factor, $IF_{soil/adj}$), because exposure is higher during childhood and decreases with age. For non-carcinogens, Equation 3-2 focuses on childhood ingestion exposures only, a conservative approach that EPA believes is appropriate for a screening analysis and is consistent with RME exposure.

Equation 3-2
Screening Level Equation for Combined Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Contaminants in Soil - Residential Scenario

$$\text{Screening Level (mg/kg)} = \frac{THQ \times BW \times AT \times 365\,d/yr}{(EF \times ED \times 10^{-6} kg/mg)\left[\left(\frac{1}{RfD_o} \times IR\right) + \left(\frac{1}{RfD_{ABS}} \times AF \times ABS_d \times EV \times SA\right)\right]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
BW/body weight (kg)	15
AT/averaging time (years)	6[a]
EF/exposure frequency (days/year)	350
ED/exposure duration (years)	6
RfD_o/oral reference dose (mg/kg-d)	chemical-specific (Appendix C)
IR/soil ingestion rate (mg/d)	200
RfD_{ABS}/dermally-adjusted reference dose (mg/kg-d)	chemical-specific (Equation 3-4)
AF/skin-soil adherence factor (mg/cm^2-event)	**0.2**
ABS_d/dermal absorption factor (unitless)	chemical-specific (Exhibit 3-3 and Appendix C)
EV/event frequency (events/day)	1
SA/skin surface area exposed-child (cm^2)	**2,800**

[a] For non-carcinogens, averaging time equals exposure duration.

Dermal Absorption

Although the 1996 *SSG* acknowledged that contaminant exposure through dermal absorption could be a significant source of human health risks at contaminated sites, data limitations precluded the development of broadly applicable simple site-specific equations for this pathway. EPA's original approach recommended that dermal screening levels be calculated by dividing ingestion SSLs in half for those compounds exhibiting significant (i.e., greater that ten percent) dermal absorption. EPA based this approach on the assumption that exposures via the dermal route would

be roughly equivalent to the ingestion route when dermal absorption from soil exceeds ten percent.[12] At the time, only pentachlorophenol had been shown to exceed the ten percent absorption threshold; for all other compounds, the dermal route did not need to be considered.

Since 1996, EPA has expanded its dermal absorption database to include more contaminants. This information can be found in EPA's *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment* (*RAGS Part E - Interim Guidance,* U.S. EPA, 2001). The modeling approach presented in this soil screening guidance is derived from the risk assessment methodology presented in *RAGS Part E.* This revised approach provides a consistent and more broadly applicable methodology for assessing the dermal pathway for Superfund human health risk assessments.

Exhibit 3-2

SOIL CONTAMINANTS EVALUATED FOR DERMAL EXPOSURES

Arsenic
Benzo(*a*)pyrene
Cadmium
Chlordane
DDT
Lindane
PAHs
Pentachlorophenol
Semi-volatile organic compounds

The dermal pathway should be evaluated for both residential and non-residential soil exposure scenarios depending on the types of activities occurring at a site (e.g., landscaping) and on the contaminants of concern present. The approach to modeling dermal absorption in this guidance supersedes EPA's original approach and should therefore be used instead of the dermal absorption method presented in the 1996 *SSG.* Exhibit 3-2 presents a list of contaminants for which data are available to develop dermal SSLs.[13] This exhibit includes seven individual compounds and two classes of compounds — polycyclic aromatic hydrocarbons (PAHs) and semi-volatile organic compounds — demonstrating significant dermal absorption potential in EPA's dermal absorption database. EPA will provide updates to this list as adequate absorption data are developed for additional chemicals.

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[12]Dermal absorption efficiency is a function of the length of time that contaminated soils (or other media) contact the skin of a receptor. Consistent with EPA's RAGS Part E interim guidance document for evaluating dermal exposures to contaminants (U.S. EPA, 2001), all dermal absorption efficiency values reported in this document assume 24-hour exposure events.

[13] Dermal absorption data are also available for PCBs and for 2,3,7,8-tetrachlorodibenzodioxin (TCDD); however, EPA is developing separate guidance to address risks from release of these compounds. For PCBs, EPA is in the process of updating its 1990 *Guidance on Remedial Actions for Superfund Sites with PCB Contamination.* For TCDD and other chlorinated dioxins and furans, please consult the *Draft Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds* (U.S. EPA, 2000c).

Because no toxicity data are presently available for directly evaluating dermal exposures to contaminants, EPA has developed a method to extrapolate oral toxicity values for use in dermal risk assessments. This extrapolation method, shown in Equations 3-3 and 3-4, is necessary because most oral RfDs and cancer slope factors are based on an administered dose (e.g., in food or water) while dermal exposure equations estimate an absorbed dose. Specifically, dermal exposure equations account for the relative ability of a given contaminant to pass through the skin and into the bloodstream. The extrapolation method applies a gastro-intestinal absorption factor (ABS_{GI}) to the available oral toxicity values to account for the absorption efficiency of an administered dose across the gastro-intestinal tract and into the bloodstream. Oral toxicity values should be adjusted when the gastro-intestinal absorption of the chemical in question is significantly less than 50 percent; this cutoff reflects the intrinsic variability in the analysis of absorption studies. A list of chemical-specific ABS_{GI} factors for specific compounds is presented as Exhibit C-7 in Appendix C.

Equation 3-3
Calculation of Carcinogenic Dermal Toxicity Values

$$SF_{ABS} = \frac{SF_O}{ABS_{GI}}$$

Parameter/Definition (units)	Default
SF_{ABS}/dermally adjusted slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific
SF_O/oral slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Appendix C)
ABS_{GI}/gastro-intestinal absorption factor (unitless)	chemical-specific (Appendix C)

Equation 3-4
Calculation of Non-Carcinogenic Dermal Toxicity Values

$$RfD_{ABS} = RfD_O \times ABS_{GI}$$

Parameter/Definition (units)	Default
RfD_{ABS}/dermally adjusted reference dose (mg/kg-d)	chemical-specific
RfD_O/oral reference dose (mg/kg-d)	chemical-specific (Appendix C)
ABS_{GI}/gastro-intestinal absorption factor (unitless)	chemical-specific (Appendix C)

To be protective of exposures to carcinogens in a residential setting, Superfund focuses on individuals who may live in an area for an extended period of time (e.g., 30 years) from childhood through adulthood. Equation 3-1 uses an age-adjusted dermal factor (SFS) to account for changes in skin surface area, body weight, and adherence factor. The SFS, presented in Equation 3-5, is a time-weighted average of these parameters for receptors exposed from age one to 31. EPA recommends that a default SFS of 360 mg-yr/kg-event be used. For more information regarding the derivation of this time-weighted average value, please consult *RAGS, Part E* Section 3.2.2.5, Equation 3.20.

Equation 3-5
Derivation of the Age-Adjusted Dermal Factor

$$SFS = \left[\frac{SA_{1-6} \times AF_{1-6} \times ED_{1-6}}{BW_{1-6}}\right] + \left[\frac{SA_{7-31} \times AF_{7-31} \times ED_{7-31}}{BW_{7-31}}\right]$$

Parameter/Definition (units)	Default
SFS/age-adjusted dermal factor (mg-yr/kg-event)	360
SA_{1-6}/skin surface area exposed-child (cm^2)	**2,800**
SA_{7-31}/skin surface area exposed-adult (cm^2)	**5,700**
AF_{1-6}/skin-soil adherence factor-child (mg/cm^2 - event)	**0.2**
AF_{7-31}/skin-soil adherence factor-adult (mg/cm^2 - event)	**0.07**
ED_{1-6}/exposure duration-child (years)	6
ED_{7-31}/exposure duration-adult (years)	24
BW_{1-6}/body weight-child (kg)	15
BW_{7-31}/body weight-adult (kg)	70

Although children will have a smaller total skin surface area (SA) exposed than adult receptors, they are assumed to have a much higher soil to skin adherence factor (AF). Recent data provide evidence to demonstrate that: 1) soil properties influence adherence, 2) soil adherence varies considerably across different parts of the body, and 3) soil adherence varies with activity (Kissel *et al.,* 1996, Kissel *et al.,*1998, Holmes *et al.,* 1999). Because children are assumed to have additional, more sensitive body parts exposed (e.g., feet) and to engage in higher soil contact activities (e.g., playing in wet soil), this guidance recommends the use of a body part-weighted AF of 0.2 for children and 0.07 for adults in residential exposure scenarios. In order to remain adequately protective, EPA bases SSLs for residential exposures to non-carcinogenic contaminants via the ingestion/dermal absorption pathways on a conservative "childhood only" scenario in which the receptor is assumed to be between ages one through six. This is the approach reflected in Equation 3-2. For more information regarding the calculation of body part-weighted adherence factors, please refer to Section 3.2.2 in *RAGS, Part E.*

Suggested default RME values in *RAGS, Part E* are appropriate for the dermal absorption-related inputs to Equations 3-1, 3-2, and 3-5. The default values for these inputs are also consistent with the residential scenario presented in the 1996 *SSG.* In addition to those inputs described above, default values have been developed for event frequency (EV) and skin surface area exposed (SA). Event frequency (EV, the number of events per day) is assumed to be equal to one. Children are assumed to have 2,800 cm^2 of exposed skin surface area (face, forearms, hands, lower legs, and feet), while adults are assumed to have 5,700 cm^2 exposed (face, forearms, hands, and lower legs). These SA values represent the median (50th percentile) values for all children and adults (U.S. EPA, 1997a).

The last input needed to calculate the dermal portion of the ingestion/dermal SSLs is the chemical-specific dermal absorption fraction (ABS_d). Values for seven individual compounds and two classes of compounds are presented in Exhibit 3-3.[14] For those compounds that are classified as both semi-volatile and as a PAH, the ABS_d default for PAHs should be applied.

Exhibit 3-3

RECOMMENDED DERMAL ABSORPTION FRACTIONS

Compound	Dermal Absorption Fraction (ABS_d)
Arsenic	0.03
Benzo(*a*)pyrene	0.13
Cadmium	0.001
Chlordane	0.04
DDT	0.03
Lindane	0.04
PAHs	0.13
Pentachlorophenol	0.25
Semi-volatile organic compounds	0.1

Source: U.S. EPA, *RAGS, Part E, Supplemental Guidance for Dermal Risk Assessment, Interim Guidance, 2001.*

3.2.2 Migration of Volatiles Into Indoor Air

Subsurface contamination in either soil or ground water may adversely affect indoor air quality through the infiltration of contaminant vapors into the basement or ground floor of an on-site building. The potential for inhalation exposure via this pathway elicited substantial comment during the development of the 1996 *SSG*.

In this update, EPA is incorporating vapor intrusion and the subsequent inhalation of volatiles in indoor air into the soil screening process. This pathway may apply to both residential and non-residential scenarios. A site manager's decision to evaluate this pathway should be based

[14] The U.S. Environmental Protection Agency is developing separate guidance documents which address the dermal risk from exposure to PCBs (*Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, U.S. EPA 1990, currently being updated) and dioxins (*Draft Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds*, U.S. EPA, 2000c).

on current and expected future site conditions (i.e., the current and/or potential future existence of a building on or near a source area) and on the contaminants of concern at the site. Compounds most likely to pose a significant risk via this pathway include volatile organic compounds (VOCs), such as benzene, trichloroethylene, and vinyl chloride. This pathway may also apply to mercury, the only metal that has an appreciable vapor pressure.

EPA recommends that this pathway be evaluated at sites where volatile contaminants have been detected in subsurface soil or soil gas, or in groundwater above MCLs, and where buildings either currently exist or are expected to be developed above or near the contamination. OSWER has developed a draft guidance document that includes a tiered approach to help site managers identify whether the vapor intrusion exposure pathway is complete at a given site, and if so, whether it results in exposures above levels of concern (U.S. EPA, 2002b). We recommend site managers consult this document if uncertain about the applicability of this exposure pathway at a given site.

The Johnson and Ettinger (1991) vapor intrusion model can by used by site managers if the inhalation of volatile contaminants in indoor air is an exposure pathway of concern. This model simulates both convective and diffusive transport of contaminant vapors from a contaminated source area into a building directly above the source. The model may be used for buildings with basements or with slab-on-grade foundations. The model treats the entire building as a single chamber, and therefore does not consider room to room variation in ventilation. It uses chemical-specific data, soil characteristics, and the structural properties of the building to generate an attenuation coefficient that relates the indoor air contaminant concentration to the contaminant vapor concentration at the source area. The output is a risk-based soil-screening concentration derived from a steady-state concentration indoors that represents either a 1×10^{-6} individual lifetime cancer risk or a hazard quotient of one for non-cancer effects, whichever yields the more stringent SSL.

EPA has developed a series of computer spreadsheets that allow for site-specific application of the Johnson and Ettinger model (1991). Because there is substantial variation in the values for the parameters used in the Johnson and Ettinger model, it is very difficult to identify suitable default values for inputs such as building dimensions and the distance between contamination and a building's foundation. As a result, EPA has not developed generic values for soil or other media for this pathway. Instead, site managers are encouraged to calculate site-specific values for this pathway using the spreadsheets provided and site-specific values for key input parameters (e.g. building size and ventilation rate).

The vapor intrusion spreadsheets are available for calculating risk or risk-based concentrations for contaminants in soil, soil gas, or ground water. Each medium-specific spreadsheet is available in two versions: one designed for a simple site-specific screening approach (e.g., SL-SCREEN) and one designed for a detailed site-specific modeling approach (e.g., SL-ADV). The simple site-specific version employs conservative default values for many model input parameters but allows the user to define values for several key variables (e.g., soil porosity, depth of contamination). The detailed modeling version allows the user to select values for all model variables and define multiple soil strata between the area of contamination and the building.

Although EPA provides Johnson and Ettinger model spreadsheets for the calculation of risk-based soil concentrations, these values are likely to be characterized by significant uncertainty. As noted in EPA's draft vapor intrusion guidance document (2002b), this uncertainty arises from both measurement error associated with the analysis of volatile compounds in soil samples and from uncertainties in modeling the partitioning of volatile compounds in soil. If the CSM for a site indicates that vapor intrusion may be an exposure pathway of concern, EPA recommends that the pathway be evaluated using measured soil gas data and, if applicable, ground water data. These data may be used in conjunction with the advanced versions of the Johnson and Ettinger model as part of a site-specific analysis of the vapor intrusion pathway.

The model includes default input values based on a review of data for existing hazardous waste sites. Although the default values used are conservative, because of the natural variation in key parameters across sites, EPA recommends taking a range of outcomes into consideration, as opposed to a single value, when conducting a soil screening evaluation. The site manager can assess a range of values after focusing on the most sensitive input variables. In general, the default inputs will yield conservative values. The vapor intrusion SSL spreadsheets and a user's guide that describes the Johnson and Ettinger model in greater detail can be downloaded from the EPA web site at http://www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm.[15]

[15]Revised spreadsheets consistent with the draft vapor intrusion guidance are currently being developed, and are expected to be posted to the EPA website in January 2003.

4.0 DEVELOPING SSLS FOR NON-RESIDENTIAL EXPOSURE SCENARIOS

This chapter of the guidance document presents soil screening procedures for developing SSLs for sites with non-residential future land use. It first discusses approaches to identifying and categorizing future non-residential land use and presents EPA's framework for developing non-residential SSLs. Next, it presents the specific modifications to the soil screening process required to calculate non-residential SSLs. Finally, it highlights key issues to be considered when conducting a non-residential soil screening assessment.

4.1 Identification of Non-Residential Land Use

The appropriate characterization of future land use at a site during the development of the conceptual site model (CSM) enables a site manager to identify or calculate proper soil screening levels for the site. It also enables future site investigations, such as the baseline risk assessment and feasibility study, to focus on the development of practical and cost-effective remedial alternatives that are consistent with the anticipated future land use. This section discusses the process for identifying anticipated future site land uses and describes the implications of the results for the soil screening process. It begins with a brief discussion of factors to consider when identifying future land use, then provides an overview of the types of land uses included in the "non-residential" universe, and concludes with a description of EPA's approach to integrating non-residential land use into the soil screening framework.

4.1.1 Factors to Consider in Identifying Future Land Use

A detailed discussion of EPA's recommended practices for identifying reasonably anticipated future land use can be found in the EPA directive *Land Use in the CERCLA Remedy Selection Process* (1995a).[1] In brief, that document stresses the importance of developing realistic assumptions about the likely future uses of NPL sites through community involvement, including early discussions with local land use planning authorities, local officials, and the public. The Community Contact Coordinator could facilitate these discussions with the community. The directive also provides examples of information sources that can be useful in identifying likely future land uses such as: current land use, zoning laws and maps, population growth patterns, existing institutional controls and land use designations, presence of endangered or threatened species, and adjacent and nearby land uses.

Identification of future land use in the context of soil screening evaluations goes beyond simply making assumptions about categories of use. It involves identifying the kinds of human receptors that may be present (e.g., workers) and the types of activities they are likely to engage in at the site. Risk from contamination at a site is a function of the specific activities that receptors

[1] This document may be obtained from the EPA web site at: http://www.epa.gov/superfund/resources/landuse.htm.

undertake and the exposures to contaminants that are associated with those activities. The activities can vary considerably, even across sites that fall within the same land use category; thus, when developing the CSM, the assumptions about receptor activities at a site are as critical to the screening process as assumptions about land use.

4.1.2 Categories of Non-Residential Land Use and Exposure Activities

The term "non-residential land use" encompasses a broad range of possible site uses, including commercial, industrial, agricultural, and recreational. The commercial and industrial categories are each individually quite broad as well; commercial uses range from churches and day care centers to automobile repair shops and large-scale warehouse operations, and industrial uses can include public utilities, transportation services, and a wide range of manufacturing activities.

The range of human activities at sites with non-residential uses may also vary considerably in terms of location (e.g., indoors versus outdoors), physical exertion, frequency, and the potential for contact with site contamination. These differences determine the types and intensity of exposures likely to be experienced by receptors. For example, an indoor office worker is generally not engaged in physically strenuous labor during the work day and experiences minimal exposures to potentially contaminated site soil compared to a construction worker performing excavation work. The office worker, however, may inhale volatilized compounds that migrate from contaminated soil or ground water into the office space. Activities may vary even between sites within the same land use category. For example, activities (and receptors) at a day care center are quite different from activities at a store, though both would be considered commercial establishments. Thus, as mentioned earlier, careful identification of activities associated with the likely future use of a site is critical to proper assessment of potential exposure.

4.1.3 Framework for Developing SSLs for Non-Residential Land Uses

The non-residential screening framework focuses on a single non-residential land use category that encompasses both commercial and industrial land uses. EPA selected this approach for two reasons. First, as discussed in Section 3.2, it can be difficult to distinguish between commercial and industrial sites on the basis of exposure potential. A wide range of potential exposure levels (as determined by the range of potential site activities) characterizes both the commercial and industrial categories, and because these ranges overlap, one category can not be considered to have a consistently higher exposure potential than the other. Second, the screening process focuses on *future* land use, and for many NPL sites, considerable uncertainty exists about the specific activities likely to occur in the future. Therefore, the non-residential soil screening framework includes one set of generic SSLs and SSL equations that apply to both commercial and industrial land uses. In addition, the simple site-specific approach allows site managers to differentiate between commercial and industrial sites when calculating SSLs by focusing on the receptors and activities specific to the assumed future use.

Normally, under the generic and simple site-specific screening methodologies, the receptors for the commercial/industrial scenario are limited to workers. EPA does not warrant evaluation of exposures to members of the public under a non-residential land use scenario for two reasons. First, because public access is generally restricted at industrial sites, workers are the sole on-site receptor. Second, even though the public usually has access to commercial sites (e.g., as customers), SSLs that are protective of workers, who have a much higher exposure potential because they spend substantially more time at a site, will also be protective of customers. **However, if a future commercial or industrial land use is likely to involve substantial exposure to the public (e.g., nursing homes, day care centers), the site should be evaluated using the residential soil screening framework or a detailed site-specific screening methodology.**

As shown in Exhibit 4-1, two potential worker receptors are addressed under the commercial/industrial scenario. They are characterized by the intensity and location of their activities, and by the frequency and duration of their exposures.

- **Outdoor Worker.** This is a long-term receptor exposed during the work day who is a full time employee of the company operating on-site and who spends most of the workday conducting maintenance activities outdoors. The activities for this receptor (e.g., moderate digging, landscaping) typically involve on-site exposures to surface and shallow subsurface soils (at depths of zero to two feet). The outdoor worker is expected to have an elevated soil ingestion rate (100 mg per day) and is assumed to be exposed to contaminants via the following pathways: incidental ingestion of soil, dermal absorption of contaminants from soil, inhalation of fugitive dust, inhalation of volatiles outdoors, and ingestion of ground water contaminated by leachate.[2, 3] The outdoor worker is expected to be the most highly exposed receptor in the outdoor environment under commercial/industrial conditions. Thus, SSLs for this receptor are protective of other reasonably anticipated outdoor activities at commercial/industrial facilities.

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[2] The soil ingestion rate of 100 mg per day for the outdoor worker is equal to the default residential adult ingestion rate recommended in *RAGS Volume I: Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors,* OSWER Directive 9285.6-03 (U.S. EPA, 1991a). The document recommends an ingestion rate of 50 mg per day for a commercial/industrial worker and 100 mg per day for an adult resident. EPA selected the latter value to reflect the increased ingestion exposures experienced by outdoor workers during landscaping or other soil disturbing activities. Research is ongoing to gain better information on soil ingestion rates. The recommended default values are subject to change as better data become available.

[3] The ingestion of contaminated ground water exposure pathway for non-residential receptors is addressed by SSLs for the migration of contaminants from soil into an underlying potable aquifer. The SSL equations and default values used to model this pathway are identical to those used for residential exposure scenarios (See Section 3.1). In addition, the rationale for a consistent set of migration to ground water SSLs across residential and commercial/industrial uses is described in detail on page 4-24.

Exhibit 4-1 SUMMARY OF THE COMMERCIAL/INDUSTRIAL EXPOSURE FRAMEWORK FOR SOIL SCREENING EVALUATIONS		
	Receptors	
	Outdoor Worker	**Indoor Worker**
Exposure Characteristics	• Substantial soil exposures • Long-term exposure	• Minimal soil exposures (little or no direct contact with outdoor soils, potential for contact through ingestion of soil tracked in from outside) • Long-term exposure
Pathways of Concern	• Ingestion (surface and shallow subsurface soils) • Dermal absorption (surface and shallow subsurface soils) • Inhalation (fugitive dust, outdoor vapors) • Ingestion of contaminated ground water[1]	• Ingestion (indoor dust) • Inhalation (indoor vapors) • Ingestion of contaminated ground water[1]
Default Exposure Factors		
Exposure Frequency (d/yr)	225	250
Exposure Duration (yr)	25	25
Soil Ingestion Rate (mg/d)	100	50
Inhalation Rate (m^3/d)	20	20
Body Weight (kg)	70	70
Lifetime (yr)	70	70

[1] The same equations and default inputs (e.g., ground water ingestion rates) are used to calculate both residential and commercial/industrial SSLs for this pathway because of concern for off-site residents who may be exposed to contaminated ground water that migrates off-site.

- **Indoor Worker.** This receptor spends most, if not all, of the workday indoors. Thus, an indoor worker has no direct contact with outdoor soils. This worker may, however, be exposed to contaminants through ingestion of contaminated soils that have been incorporated into indoor dust, ingestion of contaminated ground water, and the inhalation of contaminants present in indoor air as the result of vapor intrusion.[4] SSLs calculated for this receptor

[4] The soil ingestion rate for the indoor worker, 50 mg per day, reflects decreased soil exposures relative to the outdoor worker and is consistent with the default commercial/industrial soil ingestion rate recommended in *RAGS Volume I: Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors,* OSWER directive 9285.6-03 (U.S. EPA, 1991a). Research is ongoing to gain better information on soil ingestion rates. The recommended default values are subject to change as better data become available.

are expected to be protective of both workers engaged in low intensity activities such as office work and those engaged in more strenuous activity (e.g., factory or warehouse workers).

The commercial/industrial scenario does not include exposures during construction activities. However, EPA recognizes that construction is likely to occur at many NPL sites and that it may lead to significant short-term exposures. A separate soil screening scenario and SSL methodology for construction activities designed to supplement either the residential or commercial/industrial SSL is presented in Chapter 5.

4.1.4 Land Use and the Selection of a Screening Approach

The assumptions about future land use and future site activities may influence the selection of a soil screening approach. In general, sites where the reasonably anticipated future use is either commercial or industrial may be evaluated using any of the three screening approaches: the generic approach, the simple site-specific approach, or the detailed site-specific modeling approach. However, commercial sites with exposures akin to residential scenarios (i.e., where the future use involves the housing, education, and/or care of children, the elderly, the infirm, or other sensitive subpopulations) should be evaluated using the residential soil screening framework, if appropriate, or using a detailed site-specific screening approach. Examples of such uses include, but are not limited to: schools or other educational facilities, day care centers, nursing homes, elder care facilities, hospitals, and churches.

Sites where the anticipated future land use is agricultural or recreational typically require site managers to apply the detailed site-specific modeling approach for developing SSLs. For example, agricultural sites may require site-specific modeling to address exposure pathways that are not included in the generic and simple site-specific approaches (e.g., ingestion of contaminated foods). In other situations, such as an evaluation of future recreational use, exposure scenarios may be analogous to residential exposures, and application of residential SSLs to the site may be a reasonable alternative to the detailed site-specific modeling approach.

Lastly, a soil screening evaluation of a construction scenario, which is described separately in Chapter 5, should be conducted using either the simple site-specific or detailed site-specific modeling approaches. Because of the difficulty of establishing default input values for a "standard" construction project, these screenings can not be conducted using the generic approach.

4.2 Modifications to the Soil Screening Process for Sites With Non-Residential Exposure Scenarios

To conduct a soil screening evaluation for a non-residential exposure scenario, a site manager should employ the same basic seven-step soil screening process outlined in Section 2.3. However, there are some fundamental differences in the potential for exposure under non-residential scenarios that necessitate modifications to certain steps of the framework. This section describes in detail the key differences in these steps for the non-residential soil screening process.

Of the seven steps in the screening process, three must be adjusted for a non-residential soil screening evaluation — Step 1: Develop Conceptual Site Model (CSM); Step 2: Compare CSM to SSL Scenario; and Step 5: Calculate Site- and Pathway-specific SSLs. The remaining steps, consisting of Step 3: Define Data Collection Needs for Soils; Step 4: Sample and Analyze Site Soils; Step 6: Compare Site Soil Contaminant Concentrations to Calculated SSLs; and Step 7: Address Areas Identified for Further Study, are essentially unchanged. For detailed guidance on performing these latter steps, please consult the 1996 *SSG*.

Regarding Step 3, EPA recommends that site managers develop a sampling plan for surface soil that will provide a reliable estimate of the arithmetic mean of contaminant concentrations. Section 2.3.2 of the 1996 *SSG* describes such a sampling plan utilizing composite samples. Guidance on developing other sampling plans using discrete samples can be found in *Guidance for Choosing a Sampling Design for Environmental Data Collection* (U.S. EPA 2000a). Although there may be differences in the activities and exposures likely to occur under non-residential and residential use scenarios, EPA is not recommending specific changes to the surface soil sampling approach when performing non-residential soil screening evaluations. Unless there is site-specific evidence to the contrary, an individual receptor is assumed to have random exposure to surface soils at both residential and non-residential sites.

However, as in the 1996 *SSG*, EPA emphasizes that the depth over which soils are sampled should reflect the type of exposures expected. Activities typical for non-residential site uses (e.g., landscaping and other outdoor maintenance activities) may result in direct contact exposure for certain receptors to contaminants in shallow subsurface soils at depths of up to two feet. EPA expects that site managers will characterize contaminant levels in the top two feet of the soil column by taking shallow subsurface borings where appropriate. The specific locations of such borings should be determined by the likelihood of direct contact with these subsurface soils and by the likelihood that soil contamination is present at that depth. Given that these deeper soils are not characterized to the same extent as the top two centimeters of soil, the maximum measured contaminant concentration in the borings in a given exposure area should be compared directly with the SSLs, as described in Section 2.3, Step 6. Alternatively, if available evidence indicates that contaminated subsurface soils will be disturbed and brought to the surface (e.g., as the result of redevelopment activities), site managers will need to characterize subsurface contamination more thoroughly and should collect a sufficient number of samples to develop a UCL_{95} value for use in the soil screening evaluation.

4.2.1 Step 1: Develop Conceptual Site Model

The process of developing a CSM — a comprehensive representation of a site that illustrates contaminant distributions in three dimensions, along with release mechanisms, exposure pathways, migration routes, and potential receptors — is similar for non-residential and residential soil screening evaluations. The key differences in developing a CSM for a site with anticipated non-residential future land use are:

- **Identification of Land Use.** Identifying the reasonably anticipated future land use for an NPL site is critical to the development of the CSM. It is the first step toward identifying the future site receptors and activities that determine the key exposure pathways of concern. Future land use may also influence the selection of a screening approach by a site manager. Future industrial or commercial sites may be evaluated using any of the three screening approaches (generic, simple site-specific, or detailed site-specific modeling); sites with other non-residential future land uses (e.g., agriculture, recreation) are appropriately addressed using a detailed site-specific modeling approach.

- **Receptors for Non-Residential Uses.** When developing CSMs for commercial or industrial sites, the focus should be on worker receptors, unless anticipated future site activities are expected to result in substantial exposures to members of the public and/or children visiting the site (see Section 4.1.3). CSMs for commercial or industrial sites should include long-term receptors (e.g., indoor workers and outdoor workers) and, if appropriate, short-term, high intensity receptors (e.g., construction workers). For sites with future agricultural or recreational uses, CSMs should address a wider range of potential receptors (e.g., farm workers and children/adults exposed to contamination through consumption of agricultural products or children/adults engaged in recreational activities).

- **Activities for Non-Residential Uses.** In order to identify the exposure pathways pertinent to future exposures, site managers should consider the potential future site activities that may contribute to exposure. Examples of activities likely to occur at commercial/industrial sites include: outdoor maintenance work and landscaping, indoor commercial activities (e.g. wholesale or retail sales) and office work.

A key part of CSM development for all soil screening evaluations is the identification of ground water use. Site managers should consult EPA's policy on ground water classification (presented in Section 4.2.3) and should coordinate with state or local authorities responsible for ground water use and classification to determine whether the aquifer beneath or adjacent to the site is a potential source of drinking water. The migration to ground water pathway is applicable to all potentially potable aquifers, regardless of current or future land use.

4.2.2 Step 2: Compare Conceptual Site Model to SSL Scenario

The non-residential soil screening scenario used in the generic and simple site-specific screening approaches is likely to be appropriate for a wide range of commercial and industrial sites. However, the CSM for agricultural or recreational sites, as well as for some commercial or industrial sites, may include sources, exposure pathways, and receptors not covered by the commercial/industrial scenario described in this document. Comparison of the CSM with this scenario enables site managers to determine whether additional or more detailed assessments are needed to address specific site contaminants or characteristics.

Six exposure pathways are included in the commercial/industrial soil screening scenario. These pathways, as well as the relevant receptors for each pathway, are listed below:

Surface soil pathways:

- Incidental direct ingestion — indoor worker and outdoor worker.
- Dermal absorption — outdoor worker.
- Inhalation of fugitive dusts — outdoor worker.

Subsurface soil pathways:

- Inhalation of volatiles resulting from vapor intrusion into indoor air — indoor worker.
- Inhalation of volatiles migrating from soil to outdoor air — outdoor worker.
- Ingestion of contaminated ground water caused by migration of chemicals through soil to an underlying potable aquifer — indoor worker and outdoor worker.

Site managers should consider these pathways and make thoughtful determinations about whether receptors are likely to be exposed via each pathway.

It is important to carefully consider each of the possible pathways as part of the screening process, even though a site manager may quickly decide that one or more specific pathways are not relevant for a site. If, based on an analysis of reasonably anticipated future site activities, the site manager identifies pertinent exposure pathways other than those listed above, these additional pathways should be addressed using a detailed site-specific modeling approach.

The commercial/industrial soil screening scenario does not evaluate exposures to off-site receptors, except via the ingestion of ground water contaminated by soil leachate. In general, off-site receptors are assumed to have very limited or no access to the site, which precludes direct exposures. Indirect exposure to off-site residents (e.g., outdoor exposure to soil vapors and to particulates due to wind erosion) is possible. Modeling results indicate that the on-site outdoor worker is exposed to higher particulate and vapor concentrations than an off-site receptor located at the site property line. As a result, outdoor worker SSLs for the inhalation of volatiles and particulates outdoors should be protective of an off-site worker with similar exposure frequency and duration. Off-site residents, however, have a higher exposure frequency and duration than workers, and therefore SSLs based on modeling for these off-site receptors could be slightly lower than SSLs based on outdoor worker exposures.

An analysis of these pathways that used very conservative (i.e., health protective) assumptions to model emissions and transport of vapors and particulates to an off-site receptor indicates that for most contaminants, SSLs calculated for on-site receptors would be protective of indirect exposures to off-site residents.[5] For some compounds, the modeled SSL for indirect off-site exposure is less than the most protective SSL for commercial/industrial on-site receptors; however, for most of these, the off-site SSL is within 30 percent of the on-site value.[6] The significance of this difference depends on several factors that need to be evaluated on a site-specific basis, such as the nature and toxicity of the chemicals of concern, source characteristics, and the actual distance to off-site receptors. Also, if the migration to ground water pathway is being evaluated at a site (assuming a DAF of 20), on-site SSLs will likely be protective of indirect inhalation exposures to off-site residents for nearly all contaminants in Appendix A, even using conservative modeling assumptions.[7] Given the results of this analysis, the Agency does not recommend evaluating volatile or particulate exposures to off-site residents under the simple site-specific commercial/industrial scenario.[8] If a CSM suggests that off-site receptors may experience significant exposures to site contaminants via pathways other than ingestion of ground water, these exposures should be evaluated using a detailed site-specific modeling approach.

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[5]The conservative assumptions include the presence of an infinite source, the presence of volatiles in surface soils, and the location of the off-site receptor just beyond the site boundary.

[6]Exceptions for the inhalation of volatiles pathway include 1,1,2-trichloroethane (36 percent lower for off-site receptor), hexachlorobenzene (37 percent lower for off-site receptor), mercury (94 percent lower for off-site receptor), and tetrachloroethylene (32 percent lower for off-site receptor). Chromium (VI) was the lone exception for the inhalation of particulates pathway (50 percent lower for off-site receptor). If the migration to ground water pathway is being evaluated, on-site SSLs would be sufficiently protective (using the conservative default assumptions) for all but hexachlorobenzene, mercury, and chromium (VI).

[7]The only four contaminants for which on-site SSLs would not be protective under this scenario are chloroform (27 percent lower for off-site receptor), hexachlorobenzene (37percent lower for off-site receptor), hexachloropentadiene (6 percent lower for off-site receptor), and mercury (94 percent lower for off-site receptor).

[8] As discussed in Chapter 5, exposures to an off-site resident receptor may need to be evaluated if a future construction event is reasonably likely.

4.2.3 Step 5: Calculate Site- and Pathway-Specific SSLs

This section presents equations appropriate for calculating SSLs for the generic and simple site-specific soil screening approaches for each pathway in the commercial/industrial soil screening scenario (with the exception of the indoor vapor intrusion pathway, which requires a spreadsheet model to calculate SSLs). These equations and the default input values are designed to reflect reasonable maximum exposure (RME) for chronic exposures in a commercial or industrial setting. They incorporate reasonably conservative values for intake and duration and average or typical values for all site-specific inputs describing soil, aquifer, and meteorologic characteristics.

For each equation, site-specific input parameters are indicated in bold.[9] Where possible, default values are provided for these parameters for use when site-specific data are not available. These defaults were not selected to represent worst case conditions; however, they are conservative. The generic SSLs for the commercial/industrial scenario were calculated using these equations and the specified default values. Generic commercial/industrial SSLs are presented in Appendix A. In addition, an interactive SSL calculator for the simple site-specific equations is available on-line at http://risk.lsd.ornl.gov/calc_start.htm.[10] The SSL calculator is updated periodically to reflect changes in Agency guidance (e.g., additional pathways, updated toxicity values); users should confirm that the calculator's chemical-specific inputs are consistent with the latest values available.

Chemical-specific data, including toxicity values, for use in developing simple site-specific SSLs are provided in Appendix C. **Prior to calculating SSLs at a site, each relevant chemical-specific value in Appendix C should be checked against the most recent version of its source and updated, if necessary.** Toxicity values for the inhalation exposure route are not available for all chemicals. The *TBD* to the 1996 *SSG* presents the results of EPA's review of methods for extrapolating inhalation toxicity values from oral values. EPA found that route-to-route extrapolations are not necessary if migration to ground water is considered, because the SSLs for that pathway are sufficiently protective to address any underestimation of risk resulting from the lack of inhalation toxicity data. If the migration to ground water pathway is not applicable to the site, oral-to-inhalation extrapolations should be considered on a case-by-case basis. For information on extrapolation methods, please consult EPA's *Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry* (U.S. EPA, 1994).

In general, the basic forms of the SSL equations presented here are the same as those used for the residential scenario; however, EPA has developed the following default input values that reflect a commercial/industrial RME scenario:

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[9] The use of distributions for exposure factors (in a probabilistic risk assessment) is reserved for a detailed site-specific modeling approach. Refer to EPA's *Guiding Principles for Monte Carlo Analysis* (U.S. EPA, 1997b) and *Policy for Use of Probabilistic Analysis in Risk Assessment* (U.S. EPA, 1997d) for further information.

[10] The SSL calculator currently includes default values for residential exposure scenarios; however, users can adjust these defaults to reflect the non-residential exposure scenarios.

- **Exposure frequency.** For outdoor workers, EPA has established a default exposure frequency of 225 days/year. This value is based on data from the U.S. Census Bureau's *1990 Earnings by Occupation and Education Survey* and represents the average number of days worked per year by male and female workers engaged in activities likely to be similar to those of the outdoor worker receptor.[11] Because we assume exposure frequency is equal to the number of days worked per year, we recognize that this value may overestimate exposures for receptors in regions of the U.S. where extreme winters preclude exposure to site soils for extended periods during the year. Similarly, the default may potentially underestimate exposures in more temperate climates. Therefore, site managers conducting simple or detailed site-specific soil screening evaluations may propose alternative, site-specific values for this parameter that are supported by specific information on climatic influences. For indoor workers, EPA has established a default exposure frequency of 250 days/year. This value is based on a work scenario of five days per week for 50 weeks per year (assuming two weeks of vacation).

- **Exposure duration.** Exposure duration is assumed to be equivalent to job tenure for receptors in the non-residential soil screening scenario. EPA has selected a value of 25 years as the default for this exposure factor. This is the same value used in *RAGS Part B* (U.S. EPA, 1991b). It is supported by an analysis of Bureau of Labor Statistics data which shows that the 95th percentile value for job tenure for men and women in the manufacturing sector are 25 years and 19 years, respectively (Burmaster, 1999). Job tenure for non-industrial workers varies widely. The 95th percentile job tenure values for workers in the transportation/utility and wholesale sectors are only somewhat less than manufacturing workers — 22 years and 18 years for men and women, respectively. Values are lower for other non-industrial sectors — approximately 13 years for workers in the finance and service sectors, and seven years for retail workers. Thus, the 25-year default value is protective of workers across a wide spectrum of industrial and commercial sectors. Site managers conducting simple or detailed site-specific screening evaluations may propose alternative exposure durations supported by job tenure data and the anticipated site use.

Other changes to default exposure factors that apply to individual pathways are discussed below, along with their respective SSL equations.

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[11] The exposure frequency value of 225 days/year for outdoor workers assumes an eight-hour workday and is based on data from the following occupational categories in the U.S. Census Bureau's *1990 Earnings by Occupation and Education Survey:* groundskeepers and gardeners, except farm; specified mechanics and repairers, not elsewhere classified; not specified mechanics and repairers; painters, construction and maintenance; and construction laborers.

SSL Equations for Surface Soils

The relevant pathways for exposure to surface soils for the commercial/industrial use scenarios include direct ingestion, dermal absorption, and inhalation of fugitive dusts. As in the residential soil screening process, the SSL equations for direct ingestion and dermal absorption have been combined to reflect the concurrent nature of these exposures. The combined direct ingestion/dermal absorption exposure pathway should be routinely considered in screening evaluations that use the commercial/industrial scenario, though dermal absorption can not be evaluated currently for all contaminants. (Where dermal absorption data are not available, the ingestion/dermal SSL equations can be used to calculate an SSL based on the ingestion pathway only.)

Typical activities for commercial/industrial site use, such as landscaping and outdoor maintenance, may result in direct exposure to soils at depths of up to two feet. Thus, site managers may need to extend the analysis of exposure through the direct ingestion, dermal absorption, and inhalation of fugitive dusts pathways to include contaminants found in these subsurface soils. The likelihood of these receptor activities occurring at a site should be addressed in the CSM and reflected in the development of site-specific SSLs.

Direct Ingestion and Dermal Absorption. Equations 4-1 and 4-2 are appropriate for addressing chronic ingestion and dermal absorption exposure of commercial/industrial receptors to carcinogens and non-carcinogens, respectively. The equations produce SSLs protective of concurrent exposures to these receptors via these two pathways.

As mentioned in Section 4.1.3, the commercial/industrial scenario does not evaluate exposures to children. Thus, unlike the residential SSLs, the commercial/industrial direct ingestion/dermal absorption SSLs for non-carcinogens are based on exposures to adults only.

The default recommended soil ingestion rate for workers depends on the type of activity being performed. EPA recommends a 50 mg/day dust ingestion rate for indoor workers, as suggested in *RAGS Volume I: Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*, OSWER directive 9285.6-03 (U.S. EPA, 1991a). The soil ingestion SSLs for indoor employees protect against the ingestion of contaminants in indoor dust that are derived from contaminated outdoor soil. In setting a default ingestion rate for outdoor workers, we follow the same rationale as EPA's Technical Review Workgroup for Lead (TRW); we assume that a higher ingestion rate is reasonable for a commercial/industrial worker engaged in contact-intensive activities. Because outdoor workers are likely to experience more significant exposures to surface soils than their indoor counterparts, EPA has adopted a default soil ingestion rate of 100 mg/day for this receptor.

SSLs for chronic exposures to contaminants via dermal absorption under the commercial/industrial scenario are calculated based on the same methodology discussed in Section 3.2.1. The suggested default input values for the dermal exposure portion of the direct ingestion/dermal absorption equations are consistent with those recommended in EPA's *RAGS, Part E* with the exception of exposure frequency (U.S. EPA, 2001). This soil screening guidance recommends that a default of 225 days per year be used for workers at commercial or industrial sites as opposed to the 250 days per year suggested in *RAGS, Part E*. As described above, this recommendation is based on occupational data from the U.S. Census Bureau. Event frequency (EV, the number of events per day) is assumed to be equal to one. Adults are assumed to have their face, forearms, and hands exposed. Therefore, this guidance recommends that a value of 3,300 cm^2 be used as an estimate of the skin surface area exposed (SA). We also assume a default adherence factor (AF) of 0.2 mg soil per square centimeter of exposed skin. Both the SA and AF default values represent the median (50th percentile) values for all adult workers at commercial and industrial sites based on EPA studies (U.S. EPA, 1997a). The chemical-specific dermal absorption fractions (ABS_d) are presented in Appendix C. For those compounds classified as both semi-volatile and as a PAH, the ABS_d default for PAHs should be applied.

Equation 4-1
Screening Level Equation for Combined Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil - Commercial/Industrial Scenario

$$\text{Screening Level (mg/kg)} = \frac{TR \times BW \times AT \times 365\,d/yr}{(EF \times ED \times 10^{-6} kg/mg)((SF_o \times IR) + (SF_{ABS} \times AF \times ABS_d \times SA \times EV))}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
BW/body weight (kg)	70
AT/averaging time (years)	70
EF/exposure frequency (days/year)	
outdoor worker	**225**
indoor worker	250
ED/exposure duration (years)	
outdoor worker	**25**
indoor worker	25
SF_o/oral cancer slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Appendix C)
IR/soil ingestion rate (mg/d)	
outdoor worker	100
indoor worker	50
SF_{ABS}/dermally-adjusted cancer slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Equation 3-3)
AF/skin-soil adherence factor (mg/cm^2-event)	**0.2**
ABS_d/dermal absorption fraction (unitless)	chemical-specific (Exhibit 3-3 and Appendix C)
SA/skin surface exposed (cm^2)	**3,300**
EV/event frequency (events/day)	
outdoor worker	**1**
indoor worker	**0**

Equation 4-2
Screening Level Equation for Combined Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Contaminants in Soil - Commercial/Industrial Scenario

$$\text{Screening Level (mg/kg)} = \frac{THQ \times BW \times AT \times 365\,d/yr}{(EF \times ED \times 10^{-6} kg/mg)\left[\left(\frac{1}{RfD_o} \times IR\right) + \left(\frac{1}{RfD_{ABS}} \times AF \times ABS_d \times SA \times EV\right)\right]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
BW/body weight (kg)	70
AT/averaging time (years)	25[a]
EF/exposure frequency (days/year)	
outdoor worker	**225**
indoor worker	250
ED/exposure duration (years)	
outdoor worker	**25**
indoor worker	25
RfD_o/oral reference dose (mg/kg-d)	chemical-specific (Appendix C)
IR/soil ingestion rate (mg/d)	
outdoor worker	100
indoor worker	50
RfD_{ABS}/dermally-adjusted reference dose (mg/kg-d)	chemical-specific (Equation 3-4)
AF/skin-soil adherence factor (mg/cm^2-event)	**0.2**
ABS_d/dermal absorption fraction (unitless)	chemical-specific (Exhibit 3-3 and Appendix C)
SA/skin surface exposed (cm^2)	**3,300**
EV/event frequency (events/day)	
outdoor worker	**1**
indoor worker	**0**

[a] For non-carcinogens, averaging time equals exposure duration.

Inhalation of Fugitive Dusts. Inhalation of fugitive dusts generated by wind erosion may be of concern under the commercial/industrial scenario for semi-volatile organic compounds and metals in surface soils. However, as in the residential scenario, the fugitive dust exposure route need not be routinely considered for semi-volatile organics under the commercial/industrial scenario for two reasons: (1) the default ingestion/dermal absorption SSLs for these compounds are often several orders of magnitude lower (i.e., more stringent) than the corresponding default fugitive dust SSLs; and (2) EPA believes the ingestion/dermal absorption route always should be evaluated when screening surface soils. Thus, EPA considers ingestion/dermal absorption SSLs to be adequately protective of fugitive dust exposures to semi-volatile organic chemicals in surface soils under typical commercial/industrial conditions.

Similarly, generic ingestion/dermal absorption SSLs for most metals are more conservative than the fugitive dust SSLs. Thus, fugitive dust SSLs do not need to be calculated for most metals with the exception of chromium. The carcinogenicity of the hexavalent form of chromium (Cr^{+6}) via the inhalation route results in a generic fugitive dust SSL that is more stringent than the ingestion/dermal absorption SSL. As a result the fugitive dust pathway should be evaluated routinely for chromium.

The fugitive dust pathway should be considered carefully when developing the CSM at sites with future commercial/industrial land use. The above rules of thumb for fugitive dust SSLs may not be valid for site conditions or activities at sites that are expected to result in particularly high fugitive dust emissions. Examples of conditions that contribute to potentially high fugitive dust emissions include dry soils (moisture content less than approximately eight percent), finely divided or dusty soils (high silt or clay content); high average annual wind speeds (greater than approximately 5.3 m/s); and less than 50 percent vegetative cover. Examples of activities likely to generate high dust levels include heavy truck traffic on unpaved roads and other construction-related activities. Chapter 5 presents a method for addressing increased particulate exposures during construction. For other scenarios characterized by high fugitive dust calculations, EPA recommends using a detailed site-specific modeling approach to develop fugitive dust SSLs (see Appendix E).

Equations 4-3 and 4-4 are appropriate for calculating fugitive dust SSLs for carcinogens and non-carcinogens. These equations are unchanged from the 1996 *SSG*. However, different default values are provided that reflect appropriate exposure frequency, exposure duration, and averaging time (for exposures to non-carcinogens) for workers.

Equation 4-5 is used to calculate the particulate emission factor (PEF). This factor represents an estimate of the relationship between soil contaminant concentrations and the concentration of these contaminants in air as a consequence of particle suspension. Equation 4-5 is unchanged and includes the same defaults as those provided in the 1996 *SSG*, with the exception of the dispersion factor for wind erosion, Q/C_{wind}, which has been modified slightly to reflect updated dispersion modeling.

Equation 4-3
Screening Level Equation for Inhalation of Carcinogenic Fugitive Dusts - Commercial/Industrial Scenario

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365\,d/yr}{URF \times 1{,}000\,\mu g/mg \times EF \times ED \times \frac{1}{PEF}}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (yr)	70
URF/inhalation unit risk factor $(\mu g/m^3)^{-1}$	chemical-specific (Appendix C)
EF/exposure frequency (d/yr)	
Outdoor Worker	**225**
ED/exposure duration (yr)	
Outdoor Worker	**25**
PEF/particulate emission factor (m^3/kg)	**1.36×10^9 (Equation 4-5)**

Equation 4-4
Screening Level Equation for Inhalation of Non-carcinogenic Fugitive Dusts - Commercial/Industrial Scenario

$$\text{Screening Level (mg/kg)} = \frac{THQ \times AT \times 365\,d/yr}{EF \times ED \times [\frac{1}{RfC} \times \frac{1}{PEF}]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (yr)	
Outdoor Worker	**25[a]**
EF/exposure frequency (d/yr)	
Outdoor Worker	**225**
ED/exposure duration (yr)	
Outdoor Worker	**25**
RfC/inhalation reference concentration (mg/m^3)	chemical-specific (Appendix C)
PEF/particulate emission factor (m^3/kg)	**1.36×10^9 (Equation 4-5)**

[a] For non-carcinogens, averaging time equals exposure duration.

Equation 4-5
Derivation of the Particulate Emission Factor
- Commercial/Industrial Scenario

$$PEF = Q/C_{wind} \times \frac{3{,}600 s/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$$

Parameter/Definition (units)	Default
PEF/particulate emission factor (m^3/kg)	1.36×10^9
Q/C_{wind}/inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source (g/m^2-s per kg/m^3)	**93.77[a]**
V/fraction of vegetative cover (unitless)	**0.5 (50%)**
U_m/mean annual windspeed (m/s)	**4.69**
U_t/equivalent threshold value of windspeed at 7m (m/s)	**11.32**
F(x)/function dependent on U_m/U_t derived using Cowherd et al. (1985) (unitless)	**0.194**

[a] Assumes a 0.5 acre emission source; for site-specific values, consult Appendix D.

As a result of the updated modeling, Q/C_{wind} can now be derived for any source size between 0.5 and 500 acres using the equation and look-up table in Appendix D, Exhibit D-2. (The default Q/C_{wind} factor assumes a 0.5 acre source size, the size of a typical exposure unit.) The look-up table in Exhibit D-2 provides the three constants for the Q/C_{wind} equation (A, B, and C) for each of 29 cities selected to be representative of the range of meteorologic conditions across the country. The Q/C_{wind} constants for each city were derived from the results of EPA's Industrial Source Complex (ISC3) dispersion model run in short-term mode using five years of hourly meteorological data.

To calculate a site-specific Q/C_{wind} factor, the site manager must first identify the climatic zone and city most representative of meteorological conditions at the site. Appendix D includes a map of climatic zones to help site managers select the appropriate Q/C_{wind} equation constants for the site. Once the equation constants have been identified, Q/C_{wind} can be calculated for any source size between 0.5 and 500 acres and input into Equation 4-5 to derive a site-specific PEF.

SSL Equations for Subsurface Soils

This guidance addresses three exposure pathways that are pertinent to contamination in subsurface soils. These pathways include:

- Inhalation of volatiles migrating from soil to indoor air;
- Inhalation of volatiles migrating from soil to outdoor air; and

- Ingestion of contaminated ground water resulting from the leaching of chemicals from soil and their migration to an underlying potable aquifer.

Because the equations developed to calculate SSLs for the last two of these three pathways assume an infinite source, they can violate mass-balance considerations, especially for small sources. To address this concern, the guidance also includes SSL equations for these pathways that allow for mass-limits. These equations can be used only when the volume (i.e., area and depth) of the contaminated soil source is known or can be estimated with confidence.

Exhibit 4-2 lists site-specific parameters necessary to calculate SSLs for the outdoor inhalation of volatiles and the ingestion of ground water pathways, along with recommended sources and measurement methods. The exhibit includes both key parameters used directly in the SSL equations (solid dots) and supporting data or assumptions (hollow dots) used to estimate key parameter values. Site-specific parameters for the migration of volatiles into indoor air pathway are described in spreadsheets developed by EPA (described below).

Inhalation of Volatiles — Indoors. As discussed in Section 3.2.2, vapors resulting from the volatilization of contaminants in soil may be transported into indoor spaces through cracks or gaps in a building's foundation. The inhalation of these vapors by indoor workers may be an important exposure pathway at sites with current or future commercial/industrial land use. To facilitate the development of SSLs for this pathway, EPA has constructed a series of spreadsheets that allow for the site-specific application of a screening-level model for indoor vapor intrusion developed by Johnson and Ettinger (1991). These spreadsheets are available from the EPA web site at http://www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm.

The vapor intrusion spreadsheets are available for calculating risk or risk-based concentrations for contaminants in soil, soil gas, or ground water. Each medium-specific spreadsheet is available in two versions: one designed for a simple site-specific screening approach (e.g., SL-SCREEN) and one designed for a detailed site-specific modeling approach (e.g., SL-ADV). The simple site-specific version employs conservative default values for many model input parameters but allows the user to define values for several key variables (e.g., soil porosity, depth of contamination). The detailed modeling version allows the user to select values for all model input parameters and define multiple soil strata between the area of contamination and the building. Thus, site managers wanting to develop vapor intrusion SSLs using site-specific building parameters should use the SL-ADV spreadsheets.

These spreadsheets employ toxicity values (inhalation unit risk values for cancer and reference concentrations for non-cancer effects) based on an adult inhalation rate of 20 m^3/day to calculate SSLs for indoor vapor intrusion. This is the same rate used to develop residential SSLs for this pathway. Because workers are typically exposed via this pathway for shorter periods than residents, (eight to 10 hours each day versus up to 24 hours) the 20 m^3/day inhalation rate is likely to be a conservative estimate for some workers. However, data on worker activity levels and

Exhibit 4-2

SITE-SPECIFIC PARAMETERS FOR CALCULATING SUBSURFACE SSLs

Parameter	SSL Pathway: Inhalation of Volatiles - Outdoors	SSL Pathway: Ingestion of Ground Water	Data Source	Method for Estimating Parameter
Source Characteristics				
Source area (A)	• •		Sampling data	Measure total area of contaminated soil.
Source length (L)	• •	• •	Sampling data	Measure length of source parallel to ground water flow.
Source depth	• •	• •	Sampling data	Measure depth of contamination or use conservative assumption.
Soil Characteristics				
Soil texture	• •	• •	Lab measurement	Particle size analysis (Gee & Bauder, 1986) and USDA classification; used to estimate θ_w & I
Dry soil bulk density (ρ_b)	• •	• •	Field measurement	All soils: ASTM D 2937; shallow soils: ASTM D 1556, ASTM D 2167, ASTM D 2922
Soil moisture content (w)	• •	• •	Lab measurement	ASTM D 2216; used to estimate dry soil bulk density
Soil organic carbon (f_{oc})	• •	• •	Lab measurement	Nelson and Sommers (1982)
Soil pH	• •	• •	Field measurement	McLean (1982); used to select pH-specific K_{OC} (ionizable organics) and K_d (metals)
Moisture retention exponent (b)	• •	• •	Look-up	Attachment A to 1996 SSG; used to calculate θ_w
Saturated Hydraulic conductivity (K_S)	• •	• •	Look-up	Attachment A to 1996 SSG; used to calculate θ_w
Avg. soil moisture content (θ_w)	• •	• •	Calculated	Attachment A to 1996 SSG
Meteorological Data				
Air dispersion factor (Q/C)	• •		Q/C tables (Appendix D)	Select value corresponding to source area, climatic zone, and city with conditions similar to site.
Hydrogeologic Characteristics (DAF)				
Hydrogeologic setting		• •	Conceptual site model	Place site in hydrogeologic setting from Aller et al. (1987) for estimation of parameters below (see Attachment A to 1996 TBD).
Infiltration/recharge (I)		• •	HELP model; Regional estimates	HELP (Schroeder et al., 1984) may be used for site-specific infiltration estimates; recharge estimates also may be taken from Aller et al. (1987) or may be based on knowledge of local meteorologic and hydrogeologic conditions.
Hydraulic conductivity (K)		• •	Field measurement; Regional estimates	Aquifer tests (i.e., pump tests, slug tests) preferred; estimates also may be taken from Aller et al. (1987) or Newell et al. (1990) or may be based on knowledge of local hydrogeologic conditions.
Hydraulic gradient (i)		• •	Field measurement; Regional estimates	Measured on map of site's water table (preferred); estimates also may be taken from Newell et al. (1990) or may be based on knowledge of local hydrogeologic conditions.
Aquifer thickness (d)		• •	Field measurement; Regional estimates	Site-specific measurement (i.e., from soil boring logs) preferred; estimates also may be taken from Newell et al. (1990) or may be based on knowledge of local hydrogeologic conditions.

• • Indicates key parameters used in the SSL equation for each pathway.
• • Indicates supporting data/assumptions used to develop estimates of the values of the key parameters.

inhalation rates reveal two distinct sets of indoor workers: those working primarily in an office setting (daily inhalation rates ranging from 5.4 m^3/day to 12.6 m^3/day, with an average of 9.3 m^3/day), and those engaged in physically demanding tasks for roughly half of their work day (daily inhalation rates ranging from 13.6 m^3/day to 18.5 m^3/day, with an average of 16.2 m^3/day) (U.S. Department of Commerce, 1985; US EPA, 1989a; US EPA, 1997a). Thus, EPA believes that the 20 m^3/day rate is a reasonable estimate of RME that is protective of indoor workers engaged in strenuous workday activities associated with elevated breathing rates.

As noted in Section 3.2.2, risk-based concentrations for contaminants in soil calculated using the Johnson and Ettinger spreadsheets may be highly uncertain. If the CSM for a site indicates that vapor intrusion may be an exposure pathway of concern, EPA recommends that the pathway be evaluated using measured soil gas data and, if applicable, ground water data. These data may be used in conjunction with the advanced versions of the Johnson and Ettinger model as part of a site-specific analysis of the vapor intrusion pathway.

Inhalation of Volatiles — Outdoors. Equations 4-6 through 4-9 are appropriate for calculating SSLs for the outdoor inhalation of volatiles pathway using the simple site-specific approach. (A detailed site-specific modeling approach to this pathway is discussed in Appendix E).

EPA recommends evaluating this pathway at sites where volatile contaminants have been detected in subsurface source areas and where the surface soils covering those sources are undisturbed (e.g. a covered lagoon). Equations 4-6 and 4-7 calculate the SSLs for the inhalation of carcinogenic and non-carcinogenic volatile compounds, respectively. Each of these equations incorporates a soil-to-air volatilization factor (VF) that relates the concentration of a contaminant in soil to the concentration of the contaminant in air resulting from volatilization. Equation 4-8 is appropriate for calculating the VF. Finally, to ensure that the VF model is applicable to soil contaminant conditions at a site, a soil saturation limit (C_{sat}) must be calculated for each volatile compound. Equation 4-9 is appropriate for calculating this value.

Relative to the inhalation modeling for the residential exposure scenario, the only differences for commercial/industrial soil screening evaluations are the default values for exposure frequency, exposure duration, and averaging time (for non-carcinogenic exposures) in Equations 4-6 and 4-7. The toxicity values used in these equations (inhalation unit risk factors for cancer and reference concentrations for non-cancer effects) are based on an adult inhalation rate of 20 m^3/day, the same rate used to evaluate the migration of volatiles into indoor air. As discussed in the previous section, use of this value for outdoor workers is supported by data on the activity levels and associated inhalation rates for different classes of workers (U.S. Department of Commerce, 1985; US EPA, 1989a; US EPA, 1997a) and is protective of workers engaged in strenuous activities.

Equation 4-6
Screening Level Equation for Inhalation of Carcinogenic Volatile Contaminants in Soil - Commercial/Industrial Scenario

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365 d/yr}{URF \times 1{,}000 \mu g/mg \times EF \times ED \times \frac{1}{VF}}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (yr)	70
URF/inhalation unit risk factor $(\mu g/m^3)^{-1}$	chemical-specific (Appendix C)
EF/exposure frequency (d/yr)	
Outdoor Worker	**225**
ED/exposure duration (yr)	
Outdoor Worker	**25**
VF/soil-to-air volatilization factor (m^3/kg)	**chemical-specific (Equation 4-8)**

Equation 4-7
Screening Level Equation for Inhalation of Non-carcinogenic Volatile Contaminants in Soil - Commercial/Industrial Scenario

$$\text{Screening Level (mg/kg)} = \frac{THQ \times AT \times 365 d/yr}{EF \times ED \times [\frac{1}{RfC} \times \frac{1}{VF}]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (yr) **Outdoor Worker**	**25[a]**
EF/exposure frequency (d/yr) **Outdoor Worker**	**225**
ED/exposure duration (yr) **Outdoor Worker**	**25**
RfC/inhalation reference concentration (mg/m^3)	chemical-specific (Appendix C)
VF/soil-to-air volatilization factor (m^3/kg)	**chemical-specific (Equation 4-8)**

[a] For non-carcinogens, averaging time equals exposure duration.

The VF equation for the commercial/industrial scenario (Equation 4-8) is identical to the one included in the 1996 *SSG* for screening sites with future residential land use and is based on the model developed by Jury et al. (1984). However, the dispersion factor (Q/C_{vol}) can now be derived for any source size between 0.5 and 500 acres using the equation and look-up table in Appendix D, Exhibit D-3. (The default Q/C_{vol} factor assumes a 0.5 acre source size. As reported in Appendix A to the 1996 *SSG*, SSLs for a 0.5 acre source calculated under the infinite source assumption are protective of uniformly contaminated 30-acre source areas of significant depth — up to 21 meters depending on contaminant and pathway, approximately 10 meters on average.) The look-up table in Exhibit D-3 provides the three constants for the Q/C_{vol} equation (A, B, and C) for each of 29 cities selected to be representative of a range of meteorologic conditions across the country. The Q/C_{vol} constants for each city were derived from the results of modeling runs of EPA's ISC3 dispersion model run in short-term mode using five years of hourly meteorological data.

Equation 4-8
Derivation of the Volatilization Factor
- Commercial/Industrial Scenario

$$VF = \frac{Q/C_{vol} \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4} (m^2/cm^2)}{(2 \times \rho_b \times D_A)}$$

where:

$$D_A = \frac{[(\theta_a^{10/3} D_i H' + \theta_w^{10/3} D_w) / n^2]}{\rho_b K_d + \theta_w + \theta_a H'}$$

Parameter/Definition (units)	Default
VF/volatilization factor (m^3/kg)	chemical-specific
D_A/apparent diffusivity (cm^2/s)	chemical-specific
Q/C_{vol} /inverse of the ratio of the geometric mean air concentration to the volatilization flux at center of a square source (g/m^2-s per kg/m^3)	**68.18[a]**
T/exposure interval (s)	9.5×10^8
ρ_b/dry soil bulk density (g/cm^3)	**1.5**
θ_a/air-filled soil porosity (L_{air}/L_{soil})	$n-\theta_w$
n/total soil porosity (L_{pore}/L_{soil})	$1-(\rho_b/\rho_s)$
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.15**
ρ_s/soil particle density (g/cm^3)	2.65
D_i/diffusivity in air (cm^2/s)	chemical-specific[b]
H'/dimensionless Henry's law constant	chemical-specific[b]
D_w/diffusivity in water (cm^2/s)	chemical-specific[b]
K_d/soil-water partition coefficient (cm^3/g)	for organics: $K_d = K_{oc} \times f_{oc}$ for inorganics: see Appendix C[c]
K_{oc}/soil organic carbon partition coefficient (cm^3/g)	chemical-specific[b]
f_{oc}/fraction organic carbon in soil (g/g)	**0.006 (0.6%)**

[a] Assumes a 0.5 acre emission source; for site-specific values, consult Appendix D.
[b] See Appendix C.
[c] Assume a pH of 6.8 when selecting default K_d values for metals.

To calculate a site-specific Q/C_{vol} factor, site managers must first identify the climatic zone and city most representative of meteorological conditions at the site. Appendix D includes a map of climatic zones to help site managers select the appropriate Q/C_{vol} equation constants for the site. The site manager should also consult with the site hydrogeologist to determine Q/C_{vol} inputs. Once the Q/C_{vol} equation constants have been identified, a dispersion factor can be calculated for any source size between 0.5 and 500 acres and input into Equation 4-8 to derive a site-specific VF.

The C_{sat} equation (Equation 4-9) is also unchanged from the residential guidance; it measures the contaminant concentration at which all soil pore space (both air- and water-filled) is saturated with the compound and the adsorptive limits of the soil particles have been reached.

Equation 4-9
Derivation of the Soil Saturation Limit

$$C_{sat} = \frac{S}{\rho_b}(K_d\rho_b + \theta_w + H'\,\theta_a)$$

Parameter/Definition (units)	Default
C_{sat}/soil saturation concentration (mg/kg)	chemical-specific[a]
S/solubility in water (mg/L-water)	chemical-specific[a]
ρ_b/dry soil bulk density (kg/L)	**1.5**
K_d/soil-water partition coefficient (L/kg)	organics = $K_{oc} \times f_{oc}$ inorganics = see Appendix C[b]
K_{oc}/organic carbon partition coefficient (L/kg)	chemical-specific[a]
f_{oc}/fraction organic carbon in soil (g/g)	**0.006 (0.6%)**
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.15**
H'/dimensionless Henry's law constant	chemical-specific[a]
θ_a/air-filled soil porosity (L_{air}/L_{soil})	$n - \theta_w$
n/total soil porosity (L_{pore}/L_{soil})	$1 - (\rho_b/\rho_s)$
ρ_s/soil particle density (kg/L)	2.65

[a] See Appendix C.
[b] Assume a pH of 6.8 when selecting default K_d values for metals.

C_{sat} represents an upper bound on the applicability of the VF model, because compounds exceeding C_{sat} may be present in free phase, which would violate a key principle of the model (i.e., that Henry's Law applies). C_{sat} values should be calculated using the same site-specific soil characteristics used to calculate SSLs. Because VF-based inhalation SSLs are reliable only if they are less than or equal to C_{sat}, these SSLs should be compared to C_{sat} concentrations before they are used in a soil screening evaluation. If the calculated SSL exceeds C_{sat} and the contaminant is liquid at typical soil temperatures (see Appendix C, Exhibit C-3), the SSL is set at C_{sat}. If an organic compound is liquid at soil temperature, concentrations exceeding C_{sat} indicate the potential for nonaqueous phase liquid (NAPL) to be present in soil. This poses a possible risk to ground water, and more investigation may be warranted. For organic compounds that are solid at soil temperatures, concentrations above C_{sat} do not pose a significant inhalation risk nor are they indicative of NAPL contamination. Soil screening decisions for these compounds should be based on SSLs for other exposure pathways. For more information on C_{sat} and the proper selection of SSLs, please refer to the 1996 *SSG*.

Migration to Ground Water.

This guidance calculates commercial/industrial SSLs for the ingestion of leachate-contaminated ground water using the same set of equations and default input values presented in the 1996 *SSG*. Thus, the generic SSLs for this pathway are the same under commercial/industrial and residential land use scenarios.

EPA has adopted this approach for two reasons. First, it protects off-site receptors, including residents, who may ingest contaminated ground water that migrates from the site. Second, it protects potentially potable ground water aquifers that may exist beneath commercial/ industrial properties. (See text box for EPA's policy on ground water classification). Thus, this approach is appropriate for protecting ground water resources and human health; however, it may necessitate that sites meet stringent SSLs if the migration to ground water pathway applies, regardless of future land use.

Ground Water Classification

In order to demonstrate that the ingestion of ground water exposure pathway is not applicable for a site, site managers may either perform a detailed fate and transport analysis (as discussed in the *TBD* to the 1996 *SSG*), or may show that the underlying ground water has been classified as non-potable. EPA's current policy regarding ground water classification for Superfund sites is outlined in an OSWER directive (U.S. EPA, 1997e). EPA evaluates ground water at a site according to the federal ground water classification system, which includes four classes:

1 - sole source aquifers;
2A - currently used for drinking water;
2B - potentially usable for drinking water; and
3 - not usable for drinking water.

Generally, this pathway applies to all potentially potable water (i.e., classes 1, 2A, and 2B), unless the state has made a different determination through a process analogous to the Comprehensive State Ground Water Protection Plan (CSGWPP). Through this process, ground water classification is based on an aquifer or watershed analysis of relevant hydrogeological information, with public participation, in consultation with water suppliers, and using a methodology that is consistently applied throughout the state. If a state has no CSGWPP or similar plan, EPA will defer to the state's ground water classification only if it is more protective than EPA's. As of February 2001, 11 states (AL, CT, DE, GA, IL, MA, NH, NV, OK, VT, and WI) have approved CSGWPP plans.

The simple site-specific ground water approach consists of two steps. First, it employs a simple linear equilibrium soil/water partition equation to estimate the contaminant concentration in soil leachate. Alternatively, the synthetic precipitation leachate procedure (SPLP) can be used to estimate this concentration. Next, a simple water balance equation is used to calculate a dilution factor to account for reduction of soil leachate concentration from mixing in an aquifer. This calculation is based on conservative, simplified assumptions about the release and transport of contaminants in the subsurface (see Exhibit 4-3). These assumptions should be reviewed for consistency with the CSM to determine the applicability of SSLs to the migration to ground water pathway.

Equation 4-10 is the soil/water partition equation; it is appropriate for calculating SSLs corresponding to target leachate contaminant concentrations in the zone of contamination. Equations 4-11 and 4-12 are appropriate for determining the dilution attenuation factor (DAF) by which concentrations are reduced when leachate mixes with a clean aquifer. Because of the wide variability in subsurface conditions that affect contaminant migration in ground water, default values are not provided for input parameters for these dilution equations. Instead, EPA has

developed two possible default DAFs (DAF=20 and DAF=1) that are appropriate for deriving generic SSLs for this pathway. The selection of a default DAF is discussed in Appendix A, and the derivation of these defaults is described in the *TBD* to the 1996 *SSG*. The default DAFs also can be used for calculating simple site-specific SSLs, or the site manager can develop a site-specific DAF using equations 4-11 and 4-12.

To calculate SSLs for the migration to ground water pathway, the acceptable ground water concentration is multiplied by the DAF to obtain a target soil leachate concentration (C_w).[12] For example, if the DAF is 20 and the acceptable ground water concentration is 0.05 mg/L, the target soil leachate concentration would be 1.0 mg/L. Next, the partition equation is used to calculate the total soil concentration (i.e., SSL) corresponding to this soil leachate concentration. Alternatively, if a leach test is used, the target soil leachate concentration is compared directly to extract concentrations from the leach tests.

Exhibit 4-3

Simplifying Assumptions for the SSL Migration to Ground Water Pathway

- Infinite source (i.e., steady-state concentrations are maintained over the exposure period)
- Uniformly distributed contamination from the surface to the top of the aquifer
- No contaminant attenuation (i.e., adsorption, biodegradation, chemical degradation) in soil
- Instantaneous and linear equilibrium soil/water partitioning
- Unconfined, unconsolidated aquifer with homogeneous and isotropic hydrologic properties
- Receptor well at the downgradient edge of the source and screened within the plume
- No contaminant attenuation in the aquifer
- No NAPLs present (if NAPLs are present, the SSLs do not apply)

For more information on the development of SSLs for this pathway, please consult the 1996 *SSG*.

Mass-Limit SSLs. Equations 4-13 and 4-14 present models for calculating mass-limit SSLs for the outdoor inhalation of volatiles and migration to ground water pathways, respectively. These models can be used only if the depth and area of contamination are known or can be estimated with confidence. These equations are identical to those in the 1996 *SSG*. Please consult that guidance for information on using mass-limit SSL models.

[12] The acceptable ground water concentration is, in order of preference: a non-zero Maximum Contaminant Level Goal (MCLG), a Maximum Contaminant Level (MCL), or a health-based level (HBL) calculated based on an ingestion rate of 2L/day and a target cancer risk of 1×10^{-6} or an HQ of 1. These values are presented in Appendix C.

Equation 4-10
Soil Screening Level Partitioning Equation for Migration to Ground Water

$$\text{Screening Level in Soil (mg/kg)} = C_w \left[K_D + \frac{(\theta_w + \theta_a H')}{\rho_b} \right]$$

Parameter/Definition (units)	Default
C_w/target soil leachate concentration (mg/L)	(nonzero MCLG, MCL, or HBL)[a] × dilution factor
K_d/soil-water partition coefficient (L/kg)	for organics: $K_d = K_{oc} \times f_{oc}$ for inorganics: see Appendix C[b]
K_{oc}/soil organic carbon/water partition coefficient (L/kg)	chemical-specific[c]
f_{oc}/fraction organic carbon in soil (g/g)	**0.002 (0.2%)**
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.3**
θ_a/air-filled soil porosity (L_{air}/L_{soil})	$n - \theta_w$
ρ_b/dry soil bulk density (kg/L)	**1.5**
n/soil porosity (L_{pore}/L_{soil})	$1 - (\rho_b/\rho_s)$
ρ_s/soil particle density (kg/L)	2.65
H′/dimensionless Henry's law constant	chemical-specific[c] (assume to be zero for inorganic contaminants except mercury)

[a] Chemical-specific (see Appendix C).
[b] Assume a pH of 6.8 when selecting default K_d values for metals.
[c] See Appendix C.

Equation 4-11
Derivation of Dilution Attenuation Factor

$$\text{Dilution Attenuation Factor (DAF)} = 1 + \frac{K \times i \times d}{I \times L}$$

Parameter/Definition (units)	Default
DAF/dilution attenuation factor (unitless)	**20 or 1 (0.5-acre source)**
K/aquifer hydraulic conductivity (m/yr)	**Site-specific**
i/hydraulic gradient (m/m)	**Site-specific**
I/infiltration rate (m/yr)	**Site-specific**
d/mixing zone depth (m)	**Site-specific**
L/source length parallel to ground water flow (m)	**Site-specific**

Equation 4-12
Estimation of Mixing Zone Depth

$$d = (0.0112L^2)^{0.5} + d_a(1 - \exp[(-L \times I)/(K \times i \times d_a)])$$

Parameter/Definition (units)	Default
d/mixing zone depth (m)	Site-specific
L/source length parallel to ground water flow (m)	Site-specific
I/infiltration rate (m/yr)	Site-specific
K/aquifer hydraulic conductivity (m/yr)	Site-specific
i/hydraulic gradient (m/m)	Site-specific
d_a/aquifer thickness (m)	Site-specific

Equation 4-13
Mass-Limit Volatilization Factor - Commercial/Industrial Scenario

$$VF = Q/C_{vol} \times \frac{[T \times (3.15 \times 10^7 s/yr)]}{(\rho_b \times d_s \times 10^6 g/Mg)}$$

Parameter/Definition (units)	Default
d_s/average source depth (m)	site-specific
T/exposure interval (yr)	30
Q/C_{vol}/inverse of the ratio of the geometric mean air concentration to the volatilization flux at the center of a square source (g/m^2-s per kg/m^3)	68.18[a]
ρ_b/dry soil bulk density (kg/L or Mg/m^3)	1.5

[a] Assumes a 0.5 acre emission source

Equation 4-14
Mass-Limit Soil Screening Level for Migration to Ground Water

$$\text{Screening Level in Soil (mg/kg)} = \frac{(C_w \times I \times ED)}{\rho_b \times d_s}$$

Parameter/Definition (units)	Default
C_w/target soil leachate concentration (mg/L)	(nonzero MCLG, MCL, or HBL)[a] × dilution factor
d_s/depth of source (m)	site-specific
I/infiltration rate (m/yr)	0.18
ED/exposure duration (yr)	70
ρ_b/dry soil bulk density (kg/L)	1.5

[a] Chemical-specific, see Appendix C.

4.3 Additional Considerations for the Evaluation of Non-Residential Exposure Scenarios

As described in this guidance document, conducting soil screening evaluations for non-residential land use scenarios involves making well-reasoned assumptions about site use, potential exposure pathways, and potential receptors. These decisions raise the following issues about the derivation and application of non-residential SSLs:

- The importance of involving community representatives in identifying the likely future land use (and associated activities) at sites;
- The selection and implementation of institutional controls to ensure that future site uses and activities will be consistent with the non-residential land use assumptions used to derive SSLs; and
- The relative roles of SSLs and OSHA standards in protecting future workers from exposure to residual contamination at non-residential sites.

This section provides guidance on these issues, outlining EPA policy and highlighting useful resources.

4.3.1 Involving the Public in Identifying Future Land Use at Sites

The potential for site managers to apply non-residential land use assumptions in developing SSLs is most useful when the likely future land use for a site can be identified early in the Superfund process. As discussed in Section 3.1, community representatives (including local land use planners, local officials and members of the general public) can provide a great deal of insight about the reasonably anticipated future land use of sites. This can be one of the most important aspects of overall community involvement, especially for sites that have been abandoned by previous owners or sites where land use is likely to change. Site managers should look to the community as a source of information about both current and reasonably anticipated future site activities, which can help identify relevant exposure pathways that should be reflected in the CSM.

Early interaction with community representatives and local government officials can help to ensure that the assumptions used in the soil screening evaluation will be supported by the community. This also may lead to greater community support of subsequent Superfund activities at a site, such as the baseline risk assessment and selection of remedies, which may be based, in part, on these assumptions. EPA has developed guidance, *Community Involvement in Superfund Risk Assessments, A Supplement to RAGS Part A*, to assist site managers in working with communities and soliciting their input (U.S. EPA, 1999b). Site managers also can consult the

OSWER directive, *Land Use in the CERCLA Remedy Selection Process* (U.S. EPA, 1995a) for information on community involvement in the identification of future land use.[13]

4.3.2 Institutional Controls

Non-residential SSLs are based on specific assumptions about land use and access. These assumptions are typically less conservative than those used to develop residential SSLs; thus, non-residential SSLs may be less stringent than the corresponding residential values. These non-residential SSLs can be protective of the key receptors associated with reasonably anticipated future non-residential land uses, but they may not be universally protective of all receptors and activities. Therefore, ensuring that contaminant levels are protective of exposures at sites or areas of sites that are screened out under these less stringent SSLs depends on site use, activities, and accessibility remaining consistent with the conceptual site model upon which screening decisions are based. Effective, enforceable institutional controls (ICs) may be a very important tool for preventing inappropriate land uses and activities that may result in unacceptable exposures. EPA defines ICs as "non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use" (U.S. EPA, 2000b).[14]

A non-residential screening assessment should include an evaluation of the implementability and potential effectiveness of ICs for areas that are screened out. This evaluation, which may consider multiple IC options, allows the site manager to identify the best available means (if any) to ensure long-term protectiveness at areas of sites screened out under less stringent, non-residential SSLs. It should provide sufficient evidence to conclude that effective implementation of ICs is feasible and can serve to "prevent an unanticipated change in land use that could result in unacceptable exposures to residual contamination or, at a minimum, alert future users to residual risks and monitor for any changes in use" (U.S. EPA, 1995a). If it does not appear likely that such ICs can be established in the future, then it is inappropriate to screen out a site or area of a site under non-residential SSLs. Instead, site managers may compare soil contaminant concentrations to residential SSLs that would be protective given unrestricted land use.

A variety of ICs exist that can be used to prevent or limit exposure at a site. In general, these fall into the four major categories summarized below (U.S. EPA, 2000b).

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[13] See http://www.epa.gov/oerrpage/superfund/resources/landuse.htm.

[14] EPA also stresses that ICs are generally to be used in conjunction with engineering measures; that they can be used during all stages of the cleanup process; and that they should ideally be "layered" (i.e. the simultaneous application of multiple ICs) or implemented in series to provide overlapping assurances of protection from contamination (U.S. EPA, 2000b).

- **State and Local Government Controls**. Government controls are usually implemented and enforced by a state or local government and can include zoning restrictions, ordinances, statutes, building permits, or other provisions that restrict land or resource use at a site. Since this category of ICs is put in place under local jurisdiction, they may be changed or terminated with little notice to EPA, and EPA generally has no authority to enforce such controls.

- **Proprietary Controls**. These controls have their basis in property law and are unique in that they generally create legal property interests. In other words, proprietary controls involve legal instruments placed in the chain of title of the site or property. Common examples include covenants or easements restricting future land use or prohibiting activities that may compromise specific engineering remedies. The benefit of proprietary controls is that they can be binding on subsequent purchasers of the property (successors in title) and transferable, which may make them more reliable in the long term than other types of ICs. However, property law is complex, and variations in property laws across states can make it difficult to establish and enforce appropriate proprietary controls.

- **Enforcement Tools with IC Components**. Under section 106(a) of CERCLA, EPA has the authority to issue administrative orders to compel land owners to limit certain site activities at both Federal and private sites. Although this tool is frequently used by site managers, it may have significant shortcomings that should be thoroughly evaluated. For example, property restrictions that are part of an enforcement action are binding only on the signatories and are not transferred through a property transaction, which limits their long-term protectiveness.

- **Informational Devices**. Informational tools provide information or notification that residual or capped contamination may remain on site. Common examples include state registries of contaminated properties, deed notices, and advisories. Because such devices are not legally enforceable, it is important to carefully consider the objective of this category of IC. Informational devices are most likely to be used as a secondary "layer" to help ensure the overall reliability of other ICs.

Early and careful consideration of ICs can be valuable for soil screening evaluations because it focuses attention on land use assumptions that can be maintained over time. In the context of soil screening analyses, the IC evaluation should identify the types of ICs available, the existence of the authority necessary to implement an IC, the willingness and ability of the appropriate entity to effectively implement and enforce the IC in both the short and long term, and the relative cost associated with the implementation and maintenance of any IC. Incorporating such considerations as a part of the screening assessment allows site managers to anticipate and consider potential barriers to the implementation of ICs.

In addition, early consideration of IC options assists site managers in identifying those parties (e.g., local government agencies) who would be instrumental in ensuring the effective implementation and management of any IC selected. For example, a local government's ability to effectively maintain or enforce an IC may affect not only the type of IC selected, but also the decision of whether it is appropriate to utilize ICs to help achieve protection of human health. Consideration of IC options is thus a valuable tool for increasing the overall reliability of screening decisions and should not be viewed as an afterthought to the soil screening process.

For more detailed information on how to evaluate and implement ICs, please consult the following publications:

Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups. Office of Solid Waste and Emergency Response. EPA 540-F-00. OSWER 9355-0-24-FS-P. September 2000.

Land Use in the Remedy Selection Process. OSWER Directive No. 9355.7-04. May 1995.

4.3.3 Applicability of OSHA Standards at NPL Sites

Conducting soil screening evaluations at sites where workers are the primary receptors of concern raises questions about the roles of commercial/industrial SSLs and OSHA standards in protecting these receptors. Although both OSHA standards and SSLs protect the health of workers exposed to toxic substances, the conditions of exposure implicit in each set of values differ. As a result, OSHA standards are not suitable substitutes for SSLs.

The key distinctions between OSHA standards and commercial/industrial SSLs include the underlying assumptions about the context of workplace exposures, the characteristics of the workers being protected, and the level of protection afforded to workers (U.S. EPA, 1995b).

- **Context of Workplace Exposure.** OSHA standards assume that workers are exposed to hazardous chemicals used in or generated as a result of routine work activities. These workers are assumed to be aware of the chemicals to which they are exposed and can obtain information on them through Right-to-Know laws. Further, they tacitly accept certain risks associated with exposure because they receive a benefit (i.e., higher wages) to compensate them for additional hazard. On the other hand, commercial/industrial SSLs address worker exposures to general environmental pollution — contaminants whose presence at a site may be independent of any current or future work activity (though work activities, such as excavation, may lead to exposure).

- **Characteristics of Worker Receptors.** OSHA standards protect workers who are likely, through self-selection, to be less sensitive to the chemicals to which they are exposed; a worker who finds that he or she is highly sensitive to a compound that is used during daily work activities would be able to proactively seek other jobs or alternative job responsibilities that do not involve exposure to that compound. Thus, unlike SSLs, which are based on an RME scenario, OSHA standards are not designed to protect against exposures to sensitive sub-populations.

- **Level of Protection Afforded to Workers.** OSHA standards assume not only that workers are knowingly exposed to specific chemicals in the workplace, but also that they receive additional protection and training to mitigate exposures. OSHA requires workers to be trained to control or prevent exceedances of its exposure standards (including the use of personal protective clothing and gear to help prevent excessive exposures). OSHA also requires periodic worker health monitoring to ensure that excessive exposures are not occurring. In contrast, *RAGS Part A* (U.S. EPA, 1989b) indicates that a Superfund risk assessment is an analysis of potential adverse health effects (current or future) caused by hazardous substances released from a site *in the absence of any actions or controls to mitigate exposures*.

5.0 CALCULATION OF SSLS FOR A CONSTRUCTION SCENARIO

Construction is likely to occur as part of the redevelopment process at many NPL sites, regardless of the anticipated future land use. Although construction is typically of relatively short duration (a year or less), it may lead to significant exposures to construction workers and off-site residents as a result of soil-disturbing activities that include excavation and vehicle traffic on unpaved roads. To help address this potential concern, EPA has developed a construction soil screening scenario that site managers can use to develop construction SSLs.

EPA designed the construction scenario to supplement the residential and non-residential screening scenarios. When appropriate, site managers should calculate construction SSLs *in addition to* the SSLs for the appropriate land use scenario. This chapter of the guidance explains when construction SSLs should be calculated, presents the exposure framework for the construction scenario, and provides equations for calculating simple site-specific SSLs that reflect potential exposure during construction activities. Information on using more detailed site-specific modeling to develop construction SSLs is presented in Appendix E.

5.1 Applicability of the Construction Scenario

The construction scenario assumes that one or more residential or commercial buildings will be erected on a site and that construction will occur within areas of residual soil contamination. Because the activities associated with such a project are likely to result in significant direct contact soil exposures (i.e., ingestion and dermal absorption) to construction workers and are likely to increase emissions of both volatiles and particulate matter from contaminated soils during the construction period, EPA recommends that site managers evaluate the construction exposure scenario whenever major construction is anticipated at a site. However, EPA realizes that developing SSLs based on a construction scenario may be difficult, especially if there is considerable uncertainty surrounding the details of future construction. In such cases, site managers can evaluate several plausible construction scenarios representing a range of activities, areal extents, and durations. The results of these evaluations can provide valuable information to help guide and focus future construction activities.

EPA anticipates that the potential for increased exposure during construction will be a concern at many sites. While we recognize that the construction scenario may produce SSLs that are more stringent than those for the other scenarios, we emphasize that SSLs are not cleanup levels; rather they are used to assist site managers in scoping the analyses that comprise the Superfund process. In addition, construction SSLs can be used to inform future construction plans, highlighting areas and construction activities that may pose significant risks to construction workers or other receptors in the absence of mitigating measures.

There are conditions under which site managers may choose not to evaluate the construction scenario. These include:

- **No Redevelopment Currently Anticipated.** If there are no existing plans for redeveloping a site, the site manager may opt not to evaluate the construction scenario at the time of the initial soil screening evaluation. However, in this case, the soil screening evaluation should be accompanied by an analysis that demonstrates the feasibility of implementing institutional controls in the future to restrict activities that would disturb residual site contamination, such as excavation or digging a well, unless screened out site areas are re-evaluated.

- **Construction Will Not Disturb Contamination.** If a site manager can demonstrate that the proposed excavation does not include any areas of soil contamination and that any unpaved roads created on-site for construction vehicle traffic will not cross areas of surficial soil contamination, the construction scenario need not be evaluated. Again, the soil screening evaluation should identify effective institutional controls that can be implemented in the future to restrict activities in the event that subsequent construction would disturb residual soil contamination.

5.2 Soil Screening Exposure Framework for Construction Scenario

The construction soil screening scenario evaluates exposures to construction workers present throughout a construction project, as well as exposures to nearby off-site residents. These receptors are potentially subject to higher contaminant exposures via increased volatile and fugitive dust emissions during construction activities.

Exhibit 5-1 summarizes the exposure framework for construction workers and off-site residents.

- **Construction Worker.** This is a short-term adult receptor who is exposed to soil contaminants during the work day for the duration of a single construction project (typically a year or less). If multiple non-concurrent construction projects are anticipated, it is assumed that different workers will be employed for each project. The activities for this receptor typically involve substantial on-site exposures to surface and subsurface soils. The construction worker is expected to have a very high soil ingestion rate and is assumed to be exposed to contaminants via the following direct and indirect pathways: incidental soil ingestion, dermal absorption, inhalation of volatiles outdoors, and inhalation of fugitive dust.

Exhibit 5-1

SUMMARY OF THE CONSTRUCTION SCENARIO EXPOSURE FRAMEWORK FOR SOIL SCREENING

	Receptors	
	Construction Worker	**Off-site Resident**
Exposure Characteristics	• Exposed during construction activities only • Potentially high ingestion and inhalation exposures to surface and subsurface soil contaminants • Short-term (subchronic) exposure	• Resides at the site boundary • Exposed both during and post-construction • Potentially high inhalation exposures to contaminants in fugitive dust • Long-term (chronic) exposure
Pathways of Concern[1]	• Ingestion (surface and subsurface soil) • Dermal contact (surface and subsurface soil) • Inhalation of volatiles outdoors (subsurface soil) • Inhalation of fugitive dust due to traffic on unpaved roads (surface soil)[2]	• Inhalation of fugitive dust due to traffic on unpaved roads and wind erosion (surface soil)
Default Exposure Factors		
Exposure Frequency (d/yr)	250	350
Exposure Duration (yr)	1	30
Soil Ingestion Rate[3] (mg/d)	330	NA
Inhalation Rate (m^3/d)	20	20[4]
Body Weight (kg)	70	70
Lifetime (yr)	70	70

[1] The inhalation of volatiles is not included as a pathway of concern for off-site residents because SSLs developed for this pathway for the construction worker (short-term) and for the on-site worker receptor under the commercial/industrial scenario (long-term) were shown to be protective for this receptor.

[2] Analyses of the inhalation of fugitive dust pathway suggest that the most significant contribution to exposure comes from disturbance of surface soil by traffic on unpaved roads. Therefore, the framework for simple site-specific soil screening evaluation for this pathway focuses on surface soil. If a site manager determines that excavation of subsurface soil or other earth-moving activities may lead to significant exposure to fugitive dust, it may be appropriate to use a more detailed site-specific modeling approach to develop a construction SSL for this pathway. Appendix E provides guidance on conducting such modeling.

[3] The soil ingestion rate is revised from the previous default ingestion rate of 480 mg/d. See the discussion of ingestion rate in section 5.3.2.

[4] Residential inhalation exposure to children and adults is evaluated using the RfC toxicity criterion, which is based on an inhalation rate of 20 m^3/day. No comparable toxicity criterion specific to childhood exposures is currently available. EPA has convened a workgroup to identify suitable default values for modeling childhood inhalation exposures, as well as possible approaches for adjusting toxicity values for application to such exposures.

- **Off-site Resident.** This receptor is similar to the one evaluated in the residential soil screening scenario but is located at the site boundary.[21] The off-site resident is exposed to contaminants both during and after construction, for a total of 30 years. This receptor has no direct contact with on-site soils. Under this framework, the only exposure pathway evaluated for this receptor is the inhalation of fugitive dust, which is likely to be exacerbated during construction as a result of dust generated by truck traffic on unpaved roads.

EPA's recommendations for focusing on specific exposure pathways and receptors are based on analyses of the potential exposure levels resulting from different activities. EPA's analysis of the impacts of different construction activities on fugitive dust emissions demonstrated that vehicle traffic on contaminated unpaved roads typically accounts for the majority of emissions, with wind erosion, excavation soil dumping, dozing, grading, and filling operations contributing lesser emissions. Based on this analysis, EPA has focused the simple site-specific construction scenario on fugitive dust emissions from traffic on contaminated unpaved roads. Information on evaluating fugitive dust emissions resulting from other construction activities as part of a detailed site-specific approach can be found in Appendix E.

In the case of volatile contaminants, excavation during construction can increase volatile emissions by unearthing soil contamination and bringing it into direct contact with the air; this increases the flux of volatile contaminants from the soil into the air. The equations for developing simple site-specific SSLs for both the commercial/industrial and construction scenarios are based on the assumption that contaminants are present at the soil surface. The complexity of modeling the volatilization of contaminants from buried waste precludes the development of SSLs for this situation under the simple site-specific approach. SSLs that reflect buried contamination can be calculated for any scenario using the detailed site-specific approach (see Appendix E). Under the conservative assumptions of the simple site-specific approach, SSLs for volatiles developed for the outdoor worker receptor under the commercial/industrial scenario (or for a resident) should be protective of the off-site resident under the construction scenario. (See discussion of the relative exposures for on- and off-site receptors in Section 4.2.2).

EPA also conducted an analysis comparing the subchronic exposure levels to volatile contaminants for on-site construction workers with those for off-site residents and found little difference between the resulting SSLs for the two receptors. The difference in SSLs for these receptors is less than 20 percent, well within the uncertainty associated with emissions modeling.[22]

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[21] This is a conservative assumption, since the highest exposure concentrations for off-site residents occur at the site boundary.

[22] Modeling results indicate that a construction worker, who is located on-site, is exposed to higher concentrations of volatiles than an off-site resident. However, an off-site resident is assumed to have a higher exposure frequency than a construction worker during the construction period (i.e., seven days per week versus five days per week). The net result is a slightly lower SSL for an off-site resident, approximately 18 percent lower than the SSL for a construction worker. This difference is small relative to the uncertainty in the emission, dispersion, and exposure modeling; thus, EPA believes that the construction worker SSL is sufficiently protective of subchronic exposures to off-site residents.

Therefore, EPA recommends that only construction workers be evaluated for subchronic exposure to volatiles during construction activities.

In some cases, site managers also may wish to evaluate direct ingestion and dermal contact exposures of off-site residents to contaminated dust that is deposited on an off-site property during construction activities. For sites where contaminant concentrations meet residential SSLs, this pathway is unlikely to result in significant risks, due to the reduction of contaminant concentrations expected to occur as deposited dust mixes with uncontaminated soils. For sites meeting commercial/industrial SSLs, this may be a pathway of concern for some contaminants, especially metals, for which the commercial/industrial SSL for ingestion/dermal contact exposure is significantly higher than the corresponding residential SSL that would apply to the off-site exposure. For these contaminants, off-site deposition could potentially lead to concentrations that exceed residential direct contact SSLs. However, the complexity of modeling off-site deposition of contaminated dusts precludes EPA from developing an average default factor for estimating the off-site concentration resulting from deposition, relative to on-site contamination levels. Therefore, this pathway should be addressed on a site-specific basis.

5.3 Calculating SSLs for the Construction Scenario

This section presents EPA's recommended approach to calculating SSLs for construction-related exposures. First, it describes key differences between the calculation of construction SSLs and the calculation of residential or commercial/industrial SSLs. Then, it presents the equations used to calculate construction SSLs using the simple site-specific soil screening approach.

5.3.1 Calculation of Construction SSLs - Key Differences

Besides differences in receptors and exposure factors, there are three key differences between construction SSLs and residential or commercial/industrial SSLs:

- **Absence of Generic SSLs.** EPA does not present generic SSLs for the construction scenario. This decision reflects the difficulty of developing standardized default exposure assumptions and other model input parameters for a construction scenario. Construction-related exposures depend on many parameters including, but not limited to: the size of the site; the size of the contaminated source area; the dimensions of the building(s) being constructed and its location relative to the source area and to the site boundary; the type of building being constructed (e.g., a slab-on-grade structure versus a building with a basement); and the overall duration of the construction project. These parameters can vary considerably from project to project, and current data do not allow EPA to identify a reasonable set of generic default values (either central tendency or high end) for all of them.

Therefore, EPA has not established generic SSLs for construction activities, and the equations presented below do not include suggested default values for all model input parameters. Site managers having difficulty determining a site-specific value may wish to calculate SSLs using a range of plausible values.

- **Subchronic Exposures.** Under the guidelines established by the Superfund program, exposures to construction workers of one year or less are classified as subchronic exposures.[23] This short exposure duration affects how site managers use toxicity values in calculating SSLs for non-carcinogenic effects. Specifically, calculations of SSLs based on non-carcinogenic effects associated with *subchronic* exposures should incorporate toxicity values for subchronic, not chronic, effects.[24] Subchronic toxicity values are not as widely available as chronic values, and unlike chronic RfDs and RfCs, no EPA work group exists to review and verify subchronic RfDs or RfCs. Subchronic toxicity values for a limited number of compounds are available from EPA's *Health Effects Assessment Summary Tables* (HEAST).[25] We recommend that site managers seek assistance from EPA's regional risk assessors and from EPA's Superfund Technical Support Center when researching appropriate subchronic toxicity values. In addition, the Agency for Toxic Substances and Disease Registry (ATSDR) publishes Minimal Risk Levels (MRLs) that may be suitable for use as subchronic toxicity values.[26] The SSL equations for the construction worker use the generic term "Health Based Level" (HBL) to refer to these subchronic toxicity values. When calculating SSLs for this receptor, site managers can use a subchronic RfD or RfC from HEAST, a value recommended by the Superfund Technical Support Center, an MRL, or another suitable subchronic value (accompanied by appropriate documentation) as the HBL, as opposed to chronic or acute toxicity values.

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[23] EPA defines subchronic exposures for Superfund purposes as exposures lasting between two weeks and seven years. See U.S. EPA., 1989b, Chapters 6, 7, and 8.

[24] There is no change with respect to SSLs based on carcinogenic effects, because the methodology averages exposures over a lifetime.

[25] HEAST presents tables of chemical-specific toxicity information and values based on data from Health Effects Assessments, Health and Environmental Effects Documents, Health and Environmental Effects Profiles, Health Assessment Documents, or Ambient Air Quality Criteria Documents. HEAST summarizes interim (and some verified) RfDs and RfCs, as well as other toxicity information for specific chemicals. Although the HEAST data do not have the agency-wide consensus of the IRIS data, the information contained in HEAST represents current toxicity data generated by EPA. The most recent printed version of HEAST was printed in 1997.

[26] ATSDR MRLs were developed in response to a CERCLA mandate and represent the highest exposure levels that would not lead to the development of non-cancer health effects in humans based on acute (1-14 days), subchronic (15-364 days), and chronic (365 days and longer) exposures via oral and inhalation pathways. MRLs are based on non-cancer health effects only. MRLs are available from ATSDR'S website, http://atsdr1.atsdr.cdc.gov:8080/mrls.html.

- **Focus on Subsurface Soil.** Construction SSLs for the combined direct ingestion/dermal absorption exposure pathway should be used to evaluate contaminant concentrations in both surface and subsurface soils. The focus on subsurface soils is appropriate because excavation and other earth-moving activities could result in substantial exposures to soils at depths greater than two centimeters (the 1996 *SSG* definition of surface soils).

5.3.2 SSL Equations for the Construction Scenario

This section presents the equations used to calculate construction SSLs for surface and subsurface soils using the simple site-specific soil screening approach. As noted above, a generic approach is not appropriate for evaluating the construction scenario. As an alternative to the simple site-specific approach, site managers can perform detailed site-specific modeling to evaluate this scenario; Appendix E presents suggestions for modeling inhalation pathways under construction conditions using the detailed site-specific approach.

For each equation, site-specific input parameters are indicated in bold. Where possible, default values for these parameters are provided for use when site-specific data are not available. As in the other exposure scenarios, all site-specific inputs describing soil, aquifer, and meteorologic characteristics should represent average or typical site conditions in order to produce risk-based SSLs that reflect reasonable maximum exposure (RME).

Chemical-specific data, including chronic toxicity criteria, for use in developing simple site-specific SSLs are provided in Appendix C. Prior to calculating SSLs, each relevant chemical-specific value in Appendix C should be checked against the most recent version of its source and updated, if necessary.

In general, the basic forms of the SSL equations for the construction scenario are similar to those used for the other scenarios. Changes to default exposure parameters that apply to individual pathways are discussed below, along with their respective SSL equations.

SSL Equations for Surface Soils

The relevant pathways for exposure to surface soils under the construction scenario include direct ingestion and dermal absorption for construction workers, and inhalation of fugitive dusts by both construction workers and off-site residents.

Direct Ingestion and Dermal Absorption. Equations 5-1 and 5-2 are appropriate for addressing subchronic ingestion and dermal absorption exposure of construction workers to carcinogens and non-carcinogens, respectively. These equations produce SSLs for combined exposure of construction workers via these pathways.

Equation 5-1
Screening Level Equation for Combined Subchronic Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil
Construction Scenario - Construction Worker

$$\text{Screening Level (mg/kg)} = \frac{TR \times BW \times AT \times 365\,d/yr}{(EF \times ED \times 10^{-6} kg/mg)[(SF_o \times IR) + (SF_{ABS} \times AF \times ABS_d \times SA \times EV)]}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
BW/body weight (kg)	70
AT/averaging time (years)	70
EF/exposure frequency (days/year)	**site-specific**
ED/exposure duration (years)	**site-specific**
SF_o/oral cancer slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Appendix C)
IR/soil ingestion rate (mg/d)	330
SF_{ABS}/dermally adjusted cancer slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Equation 3-3)
AF/skin-soil adherence factor (mg/cm^2-event)	**0.3**
ABS_d/dermal absorption fraction (unitless)	chemical-specific (Exhibit 3-3 and Appendix C)
SA/skin surface area exposed (cm^2)	**3,300**
EV/event frequency (events/day)	**1**

Equation 5-2
Screening Level Equation for Combined Subchronic Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Contaminants in Soil
Construction Scenario - Construction Worker

$$\text{Screening Level (mg/kg)} = \frac{THQ \times BW \times AT \times 365\,d/yr}{(EF \times ED \times 10^{-6} kg/mg)\left[\left(\frac{1}{HBL_{sc}} \times IR\right) + \left(\frac{1}{HBL_{ABS}} \times AF \times ABS_d \times SA \times EV\right)\right]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
BW/body weight (kg)	70
AT/averaging time (years)	**site specific**[a]
EF/exposure frequency (days/year)	**site specific**
ED/exposure duration (years)	**site specific**
HBL_{sc}/subchronic health-based limit (mg/kg-d)	chemical-specific
IR/soil ingestion rate (mg/d)	330
HBL_{ABS}/dermally-adjusted subchronic health-based limit (mg/kg-d)	chemical-specific (Equation 3-4)
AF/skin-soil adherence factor (mg/cm²-event)	**0.3**
ABS_d/dermal absorption fraction (unitless)	chemical-specific (Exhibit 3-3 and Appendix C)
SA/skin surface exposed (cm²)	**3,300**
EV/event frequency (events/day)	**1**

[a] For non-carcinogens, averaging time equals to exposure duration.

Data on soil ingestion rates for adults engaged in outdoor work are not currently available. However, EPA believes construction workers are likely to experience substantial exposures to soils during excavation and other work activities; therefore, a high-end soil ingestion rate has been selected to estimate exposures under this scenario. The default value of 330 mg/day (Stanek et al., 1997) listed in Equations 5-1 and 5-2 replaces the previous default ingestion rate of 480 mg/day (Hawley, 1985). While the Hawley value was based on a theoretical calculation for adults engaged in outdoor physical activity, the revised default ingestion rate is based on the 95th percentile value for adult soil intake rates reported in a soil ingestion mass-balance study.[27]

[27]Research is on-going to refine our knowledge about adult soil ingestion and to produce better ingestion rate estimates for individuals engaged in strenuous activities. This default is therefore subject to change as better data become available.

The dermal absorption components of Equations 5-1 and 5-2 are based on the same methodology discussed in Section 3.2.1, and they can be used to calculate SSLs for the same seven compounds and two compound classes discussed in that section. The suggested default input values for the dermal exposure equations are consistent with those recommended in EPA's interim dermal guidance (U.S. EPA, 2001). Event frequency (EV, the number of events per day) is assumed to be one. Construction workers are assumed to have their face, forearms, and hands exposed. Therefore, this guidance recommends that a value of 3,300 cm^2 be used as an estimate of the skin surface area exposed (SA). We also assume a default adherence factor (AF) of 0.3 mg soil per square centimeter of exposed skin. The SA default value is the same as that used for commercial/industrial outdoor worker receptors; the AF value represents the 95th percentile value for construction workers. The chemical-specific dermal absorption fractions (ABS_d) are presented in Appendix C. For those compounds that are classified as both semi-volatiles and as PAHs, the ABS_d default for PAHs should be applied. Subchronic oral toxicity values used to calculate this SSL should be adjusted in the same manner as chronic oral RfDs (see Equation 3-4).

Inhalation of Fugitive Dusts. Under a construction scenario, fugitive dusts may be generated from surface soils by wind erosion, construction vehicle traffic on temporary unpaved roads and other construction activities. Inhalation of these dusts containing semi-volatile organic compounds and metals may be of concern to construction workers and off-site residents. As described in Section 4.2.3, site managers need only evaluate the fugitive dust pathway for a single contaminant, hexavalent chromium (Cr^{+6}) under the residential and commercial/industrial scenarios; however, due to the potential for increased dust exposure from truck traffic on unpaved roads during construction, EPA recommends that SSLs for the construction scenario be calculated for semi-volatile compounds and for all metals.[28]

Equations 5-3 and 5-4 are appropriate for calculating fugitive dust SSLs for carcinogens and non-carcinogens for subchronic construction worker exposure. These equations are similar to the fugitive dust SSL equations for other scenarios, with the exception of the health based limit subchronic toxicity value term (HBL_{sc}). In addition, the equation to calculate the subchronic particulate emission factor (PEF_{sc}, Equation 5-5) is significantly different from the residential and non-residential PEF equations. The PEF_{sc} in Equation 5-5 focuses exclusively on emissions from truck traffic on unpaved roads, which typically contribute the majority of dust emissions during construction. This equation requires estimates of parameters such as the number of days with at least 0.01 inches of rainfall, the mean vehicle weight, and the sum of fleet vehicle distance traveled during construction.

[28] For purposes of this guidance, semi-volatile compounds are defined as those listed on EPA's Contract Laboratory Program list of target semi-volatile compounds (see http://www.epa.gov/superfund/programs/clp/target.htm). These compounds are identified on the exhibits in Appendix A. In addition, metals are listed at the bottom of each exhibit in Appendix A.

Equation 5-3
Screening Level Equation for Subchronic Inhalation of Carcinogenic Fugitive Dusts
Construction Scenario - Construction Worker

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365 d/yr}{URF \times 1{,}000 \mu g/mg \times EF \times ED \times \frac{1}{PEF_{sc}}}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (years)	70
URF/inhalation unit risk factor $(\mu g/m^3)^{-1}$	chemical -specific (Appendix C)
EF/exposure frequency (days/year)	**site-specific**
ED/exposure duration (years)	**site-specific**
PEF_{sc}/subchronic road particulate emission factor (m^3/kg)	**site-specific (Equation 5-5)**

Equation 5-4
Screening Level Equation for Subchronic Inhalation of Non-carcinogenic Fugitive Dusts
Construction Scenario - Construction Worker

$$\text{Screening Level (mg/kg)} = \frac{THQ \times AT \times 365 d/yr}{EF \times ED \times \left(\frac{1}{HBL_{sc}} \times \frac{1}{PEF_{sc}} \right)}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (years)	**site-specific[a]**
EF/exposure frequency (days/year)	**site-specific**
ED/exposure duration (years)	**site-specific**
HBL_{sc}/subchronic health-based limit (mg/m^3)	chemical-specific
PEF_{sc}/subchronic road particulate emission factor (m^3/kg)	**site-specific (Equation 5-5)**

[a] For non-carcinogens, averaging time equals exposure duration.

Equation 5-5
Derivation of the Particulate Emission Factor
Construction Scenario - Construction Worker

$$PEF_{sc} = Q/C_{sr} \times \frac{1}{F_D} \times \left[\frac{T \times A_R}{556 \times (W/3)^{0.4} \times \frac{(365d/yr - p)}{365d/yr} \times \Sigma VKT} \right]$$

Parameter/Definition (units)	Default
PEF_{sc}/subchronic road particulate emission factor (m^3/kg)	**site-specific**
Q/C_{sr}/ inverse of the ratio of the 1-h geometric mean air concentration to the emission flux along a straight road segment bisecting a square site (g/m^2-s per kg/m^3)	**23.02[a] (Equation 5-6)**
F_D/dispersion correction factor (unitless)	0.185 (Appendix E)
T/total time over which construction occurs (s)	**site-specific**
A_R/surface area of contaminated road segment (m^2) **L_R/length of road segment (ft)** **W_R/width of road segment (ft)**	**274.213** **($A_R = L_R \times W_R \times 0.092903 m^2/ft^2$)**
W/mean vehicle weight (tons)	**site-specific**
p/number of days with at least 0.01 inches of precipitation (days/year)	**site-specific (Exhibit 5-2)**
ΣVKT/sum of fleet vehicle kilometers traveled during the exposure duration (km)	**site-specific**

[a] Assumes a 0.5 acre site

The number of days with at least 0.01 inches of rainfall can be estimated using Exhibit 5-2. Mean vehicle weight (W) can be estimated by assuming the numbers and weights of different types of vehicles. For example, assuming that the daily unpaved road traffic consists of 20 two-ton cars and 10 twenty-ton trucks, the mean vehicle weight would be:

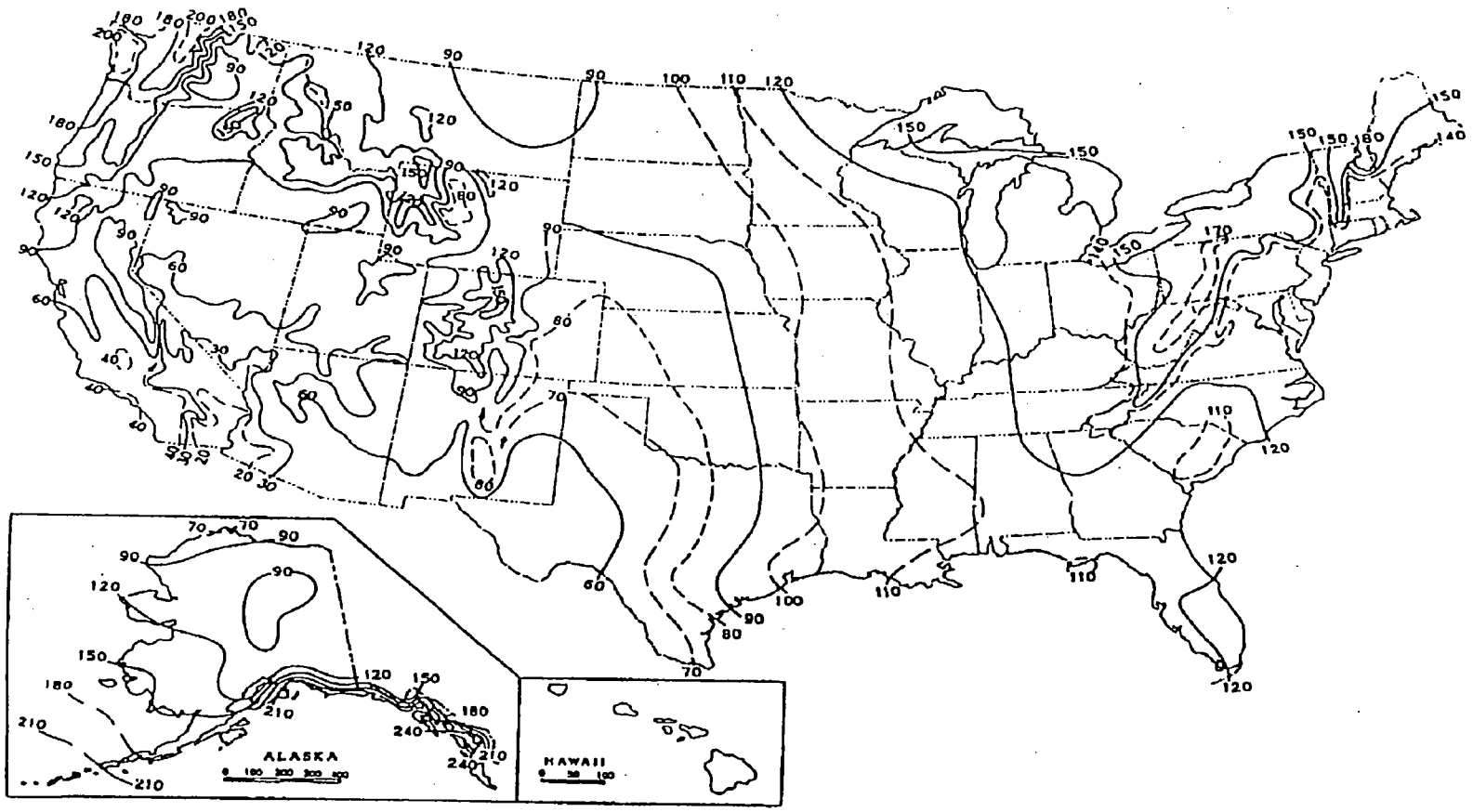
$$W = [(20 \text{ cars} \times 2 \text{ tons/car}) + (10 \text{ trucks} \times 20 \text{ tons/truck})]/30 \text{ vehicles} = 8 \text{ tons}$$

The sum of the fleet vehicle kilometers traveled during construction (ΣVKT) can be estimated based on the size of the area of surface soil contamination, assuming the configuration of the unpaved road, and the amount of vehicle traffic on the road. For example, if the area of surface soil contamination is 0.5 acres (or 2,024 m^2), and one assumes that this area is configured as a square with the unpaved road segment dividing the square evenly, the road length would be equal to the square root of 2,024 m^2, 45 m (or 0.045 km). Assuming that each vehicle travels the length of the road once per day, 5 days per week for a total of 6 months, the total fleet vehicle kilometers traveled would be:

$$\Sigma VKT = 30 \text{ vehicles} \times 0.045 \text{ km/day} \times (52 \text{ wks/yr} \div 2) \times 5 \text{ days/wk} = 175.5 \text{ km}$$

Exhibit 5-2

MEAN NUMBER OF DAYS WITH 0.01 INCH OR MORE OF ANNUAL PRECIPITATION



The equation for the subchronic dispersion factor for dust generated by unpaved road traffic, Q/C_{sr}, is presented in Equation 5-6. Q/C_{sr} was derived using EPA's ISC3 dispersion model for a hypothetical site under a wide range of meteorological conditions. Unlike the Q/C values for the other scenarios, the Q/C_{sr} for the construction scenario's simple site-specific approach can be modified only to reflect different site sizes between 0.5 and 500 acres; it cannot be modified for climatic zone. Users conducting a detailed site-specific analysis for the construction scenario can develop a site-specific Q/C_{sr} value by running the ISC3 model. Further details on the derivation of Q/C_{sr} can be found in Appendix E.

Equation 5-6
Derivation of the Dispersion Factor for Particulate Emissions from Unpaved Roads - Construction Scenario

$$Q/C_{sr} = A \times \exp\left[\frac{(\ln A_s - B)^2}{C}\right]$$

Parameter/Definition (units)	Default
Q/C_{sr} /inverse of the ratio of the 1-h geometric mean air concentration to the emission flux along a straight road segment bisecting a square site (g/m^2-s per kg/m^3)	23.02[a]
A/constant (unitless)	12.9351
A_s/areal extent of site surface soil contamination (acres)	0.5
B/constant (unitless)	5.7383
C/constant (unitless)	71.7711

[a] Assumes a 0.5 acre site

Equations 5-7 and 5-8 are appropriate for calculating fugitive dust SSLs for carcinogens and non-carcinogens based on chronic exposure to off-site residents. The fugitive dust SSL is calculated for off-site residents who are exposed both during construction and after construction is complete. During site construction, off-site residents are assumed to be exposed to fugitive dust emissions from site traffic on temporary unpaved roads. After construction, receptors are assumed to be exposed to emissions from wind erosion. Although the construction exposure duration is considerably shorter than the post-construction exposure duration, the magnitude of emissions due to unpaved road traffic may be substantially higher than that due to wind erosion. For this reason, we evaluate chronic exposure to off-site residents by combining the total mass emitted from both unpaved road traffic during construction and wind erosion post-construction, normalizing this value over the total exposure duration.

Equation 5-7
Screening Level Equation for Chronic Inhalation of Carcinogenic Fugitive Dust Construction Scenario - Off-Site Resident

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365d/yr}{URF \times 1{,}000\mu g/mg \times EF \times ED \times \frac{1}{PEF_{off}}}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (years)	70
URF/inhalation unit risk factor $(\mu g/m^3)^{-1}$	chemical-specific (Appendix C)
EF/exposure frequency (days/year)	**350**
ED/exposure duration (years)	**30**
PEF_{off}/off-site particulate emission factor (m^3/kg)	**4.40×10^8 (Equation 5-9)**

Equation 5-8
Screening Level Equation for Chronic Inhalation of Non-carcinogenic Fugitive Dust Construction Scenario - Off-Site Resident

$$\text{Screening Level (mg/kg)} = \frac{THQ \times AT \times 365d/yr}{EF \times ED \times \left[\frac{1}{RfC} \times \frac{1}{PEF_{off}}\right]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (years)	**30[a]**
EF/exposure frequency (days/year)	**350**
ED/exposure duration (years)	**30**
RfC/inhalation reference concentration (mg/m^3)	chemical-specific (Appendix C)
PEF_{off}/off-site particulate emission factor (m^3/kg)	**4.40×10^8 (Equation 5-9)**

[a] For non-carcinogens, averaging time equals exposure duration.

Equation 5-9 calculates the particulate emission factor for off-site residents (PEF_{off}). Because it normalizes the mass of fugitive dust emitted over 30 years, this equation requires separate estimates of the mass of dust emitted by traffic on unpaved roads during construction and the mass of dust emitted by wind erosion. These are calculated using Equation 5-10 (based on U.S. EPA, 1985) and Equation 5-11 (based on Cowherd et al., 1985), respectively.

Q/C_{off} can be derived for any source size between 0.5 and 500 acres using the equation and look-up table in Appendix D, Exhibit D-4. (The default Q/C_{off} factor assumes a 0.5 acre source size.) The look-up table in Exhibit D-4 provides the three coefficients for the Q/C_{off} equation (A, B, and C) for each of 29 cities selected to be representative of the range of meteorologic conditions across the country. The Q/C_{off} equation for each city was derived from the results of modeling runs of EPA's ISC3 dispersion model using five years of meteorological data. To calculate a site-specific Q/C_{off} factor, the site manager must first identify the climatic zone and city most representative of meteorological conditions at the site. Appendix D includes a map of climatic zones to help site managers select the appropriate Q/C_{off} coefficients. Once the coefficients have been identified, Q/C_{off} can be calculated for any source size between 0.5 and 500 acres and input into Equation 5-9 to derive a site-specific PEF_{off}.

Equation 5-9
Derivation of the Particulate Emission Factor
Construction Scenario - Off-Site Resident

$$PEF_{off} = Q/C_{off} \times \frac{1}{J_T}$$

where:

$$J_T = \frac{M_{road} + M_{wind}}{A_{site} \times ED \times (3.1536 \times 10^7 s/yr)}$$

Parameter/Definition (units)	Default
PEF_{off}/off-site particulate emission factor (m^3/kg)	4.40×10^8
Q/C_{off}/inverse of ratio of the geometric mean air concentration to the emission flux at the boundary of a square source (g/m^2-s per kg/m^3)	**89.03[a] (Appendix D, Appendix E)**
J_T/total time-averaged emission flux (g/m^2-s)	**site-specific**
M_{road}/unit mass emitted from unpaved road traffic (g)	**site-specific (Equation 5-10)**
M_{wind}/unit mass emitted from wind erosion (g)	**site-specific (Equation 5-11)**
A_{site}/areal extent of site (m^2)	**2,024**
ED/exposure duration (year)	**30**

[a] Assumes a 0.5 acre emission source

Equation 5-10
Mass of Dust Emitted by Road Traffic
Construction Scenario - Off-Site Resident

$$M_{road} = 556(W/3)^{0.4} \times \left[\frac{(365d/yr - p)}{365d/yr}\right] \times \Sigma VKT$$

Parameter/Definition (units)	Default
M_{road}/unit mass emitted from unpaved road traffic (g)	site-specific
W/mean vehicle weight (tons)	site-specific
p/number of days per year with at least 0.01 inches of precipitation (days/year)	site-specific (Exhibit 5-2)
ΣVKT/sum of fleet vehicle kilometers traveled during construction (km)	site-specific

Equation 5-11
Mass of Dust Emitted by Wind Erosion
Construction Scenario - Off-Site Resident

$$M_{wind} = 0.036 \times (1 - V) \times \left(\frac{U_m}{U_t}\right)^3 \times F(x) \times A_{surf} \times ED \times 8{,}760hr/yr$$

Parameter/Definition (units)	Default
M_{wind}/unit mass emitted from wind erosion (g)	1.32E+05
V/fraction of vegetative cover (unitless)	0.5
U_m/mean annual windspeed (m/s)	4.69
U_t/equivalent threshold value of windspeed at 7m (m/s)	11.32
F(x)/function dependent on U_m/U_t derived from Cowherd, et al., 1985 (unitless)	0.194
A_{surf}/areal extent of site with undisturbed surface soil contamination (m^2)	2,024
ED/exposure duration (years)	30

SSL Equations for Subsurface Soils

The relevant pathways for exposure to subsurface soils for the construction scenario include direct ingestion, dermal absorption, and inhalation of volatiles outdoors. As noted above, these pathways are evaluated for construction workers only. SSLs for ingestion and dermal absorption exposure to subsurface soils are calculated in the same way as those for surface soils and as described in the previous section.

Inhalation of Volatiles. Equations 5-12 through 5-15 are appropriate for calculating SSLs for subchronic outdoor inhalation of volatiles by construction workers. These equations are appropriate for the simple site-specific approach; the detailed site-specific modeling approach to this pathway is discussed in Appendix E. Equations 5-12 and 5-13 calculate the SSLs for the subchronic inhalation of carcinogenic and non-carcinogenic volatile compounds, respectively. Equation 5-14 is appropriate for calculating the soil-to-air volatilization factor (VF_{sc}) that relates the concentration of a contaminant in soil to the concentration in air resulting from volatilization. The equation for the subchronic dispersion factor for volatiles, Q/C_{sa}, is presented in Equation 5-15. Q/C_{sa} was derived using EPA's SCREEN3 dispersion model for a hypothetical site under a wide range of meteorological conditions. Unlike the Q/C values for the other scenarios, the Q/C_{sa} for the construction scenario's simple site-specific approach can be modified only to reflect different site sizes between 0.5 and 500 acres; it cannot be modified for climatic zone. Site managers conducting a detailed site-specific analysis for the construction scenario can develop a site-specific Q/C value by running the SCREEN3 model. Further details on the derivation of Q/C_{sa} can be found in Appendix E.

Equation 5-12
Screening Level Equation for Subchronic Inhalation of Carcinogenic Volatile Contaminants in Soil
Construction Scenario - Construction Worker

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365 d/yr}{URF \times 1{,}000 \mu g/mg \times EF \times ED \times \frac{1}{VF_{sc}}}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (years)	70
URF/inhalation unit risk factor $(\mu g/m^3)^{-1}$	chemical-specific (Appendix C)
EF/exposure frequency (days/year)	**site-specific**
ED/exposure duration (years)	**site-specific**
VF_{sc}/subchronic soil-to-air volatilization factor (m^3/kg)	**chemical-specific (Equation 5-14)**

Equation 5-13
Screening Level Equation for Subchronic Inhalation of Non-Carcinogenic Volatile Contaminants in Soil Construction Scenario - Construction Worker

$$\text{Screening Level (mg/kg)} = \frac{THQ \times AT \times 365 d/yr}{EF \times ED \times \left(\frac{1}{HBL_{sc}} \times \frac{1}{VF_{sc}} \right)}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (years)	**site-specific[a]**
EF/exposure frequency (days/year)	**site-specific**
ED/exposure duration (years)	**site-specific**
HBL_{sc} /subchronic health-based limit (mg/m^3)	chemical-specific
VF_{sc} /subchronic soil-to-air volatilization factor (m^3/kg)	**chemical-specific (Equation 5-14)**

[a] For non-carcinogens, averaging time equals exposure duration.

Equation 5-16 is appropriate for calculating the soil saturation limit (C_{sat}) for each volatile compound. As discussed in Section 4.2.3, C_{sat} represents an upper bound on SSLs calculated using the VF model. If the calculated SSL exceeds C_{sat} and the contaminant is liquid at soil temperatures (see Appendix C, Exhibit C-3), the SSL should be set at C_{sat}. Soil screening decisions for organic compounds that are solid at soil temperatures should be based on SSLs for other exposure pathways.

Because the equations developed to calculate SSLs for the inhalation of volatiles outdoors assume an infinite source, they can violate mass-balance considerations, especially for small sources. To address this concern, a mass-limit SSL equation for this pathway may be used (Equation 5-17). This equation can be used only when the volume (i.e., area and depth) of the contaminated soil source is known or can be estimated with confidence.

As discussed above, the simple site-specific approach for calculating construction scenario SSLs uses the same emission model for volatiles as that used in the residential and non-residential scenarios. However, the conservative nature of this model (i.e., it assumes all contamination is at the surface) makes it sufficiently protective of construction worker exposures to volatiles. The toxicity values used in these equations (inhalation unit risk factors for cancer and subchronic reference concentrations for non-cancer effects) are based on an adult inhalation rate of 20 m^3/day. This is consistent with the rate used for residential and commercial/industrial SSLs. Although construction worker receptors are exposed for shorter periods each day than residents (generally eight to 10 hours versus 24 hours), data on worker-related activity levels and associated inhalation rates suggest that the 20 m^3/day rate is a reasonable estimate of RME for these workers (see Section 4.2.3 for a more complete discussion of these data).

Equation 5-14
Derivation of the Subchronic Volatilization Factor
Construction Scenario - Construction Worker

$$VF_{sc} = \left[\frac{(3.14 \times D_A \times T)^{1/2}}{2 \times \rho_b \times D_A}\right] \times 10^{-4} m^2/cm^2 \times Q/C_{sa} \times \frac{1}{F_D}$$

where:

$$D_A = \frac{[(\theta_a^{10/3} D_i H' + \theta_w^{10/3} D_w)/n^2]}{\rho_b K_d + \theta_w + \theta_a H'}$$

Parameter/Definition (units)	Default
VF_{sc}/subchronic volatilization factor (m^3/kg)	chemical-specific[a]
D_A/apparent diffusivity (cm^2/s)	chemical-specific[a]
T/total time over which construction occurs (s)	**site-specific**
ρ_b/dry soil bulk density (g/cm^3)	1.5
Q/C_{sa}/inverse of the ratio of the 1-h geometric mean air concentration to the volatilization flux at the center of a square site (g/m^2-s per kg/m^3)	**14.31[b] (Equation 5-15)**
F_D/dispersion correction factor (unitless)	0.185
θ_a/air-filled soil porosity (L_{air}/L_{soil})	$n-\theta_w$
n/total soil porosity (L_{pore}/L_{soil})	$1-(\rho_b/\rho_s)$
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.15**
ρ_s/soil particle density (g/cm^3)	2.65
D_i/diffusivity in air (cm^2/s)	chemical-specific[a]
H'/dimensionless Henry's law constant	chemical-specific[a]
D_w/diffusivity in water (cm^2/s)	chemical-specific[a]
K_d/soil-water partition coefficient (cm^3/g)	for organics: $K_d = K_{oc} \times f_{oc}$ for inorganics: see Appendix C[c]
K_{oc}/soil organic carbon partition coefficient (cm^3/g)	chemical-specific[a]
f_{oc}/fraction organic carbon in soil (g/g)	**0.006 (0.6%)**

[a] See Appendix C
[b] Assumes a 0.5 acre site
[c] Assume a pH of 6.8 when selecting default K_d values

Equation 5-15
Derivation of the Dispersion Factor for Subchronic Volatile Contaminant Emissions Construction Scenario - Construction Worker

$$Q/C_{sa} = A \times \exp\left[\frac{(\ln A_c - B)^2}{C}\right]$$

Parameter/Definition (units)	Default
Q/C_{sa}/inverse of the ratio of the 1-h geometric mean air concentration to the volatilization flux at the center of the square source (g/m^2-s per kg/m^3)	**14.31[a]**
A/constant (unitless)	**2.4538**
A_c/areal extent of site soil contamination (acres)	**0.5**
B/constant (unitless)	**17.5660**
C/constant (unitless)	**189.0426**

[a] Assumes a 0.5 acre emission source

Equation 5-16
Derivation of the Soil Saturation Limit

$$C_{sat} = \frac{S}{\rho_b}(K_d \rho_b + \theta_w + H' \theta_a)$$

Parameter/Definition (units)	Default
C_{sat}/soil saturation concentration (mg/kg)	chemical-specific
S/solubility in water (mg/L-water)	chemical-specific (Appendix C)
ρ_b/dry soil bulk density (kg/L)	**1.5**
K_d/soil-water partition coefficient (L/kg)	organic = K_{oc} x f_{oc} inorganic = see Appendix C[a]
K_{oc}/organic carbon partition coefficient (L/kg)	chemical-specific (Appendix C)
f_{oc}/fraction organic carbon in soil (g/g)	**0.006 (0.6%)**
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.15**
H'/dimensionless Henry's law constant	chemical-specific (Appendix C)
θ_a/air-filled soil porosity (L_{air}/L_{soil})	n - θ_w
n/total soil porosity (L_{pore}/L_{soil})	1 - (ρ_b/ρ_s)
ρ_s/soil particle density (kg/L)	2.65

[a] Assume a pH of 6.8 when selecting default K_d values

Equation 5-17
Mass-Limit Volatilization Factor
Construction Scenario - Construction Worker

$$VF_{sc} = Q/C_{sa} \times \frac{1}{F_D} \times \frac{T \times (3.15 \times 10^7 s/yr)}{\rho_b \times d_s \times 10^6 g/Mg}$$

Parameter/Definition (units)	Default
VF_{sc}/volatilization factor (m^3/kg)	–
Q/C_{sa}/inverse of the ratio of the 1-h geometric mean air concentration to the volatilization flux at the center of a square source (g/m^2-s per kg/m^3)	**14.31[a] (Equation 5-15)**
F_D/dispersion correction factor (unitless)	0.185 (Appendix E)
T/exposure interval (year)	**site-specific (=ED)**
ρ_b/dry soil bulk density (kg/L or Mg/m^3)	**1.5**
d_s/average source depth (m)	**site-specific**

[a] Assumes a 0.5 acre emission source

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APPENDIX G

U.S. Code of Federal Regulations (CFR)Title 40: Protection of Environment. Part 141: National Primary Drinking Water Regulations Subpart G: National Revised Primary Drinking Water Regulations: Maximum Contaminant Levels.

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APPENDIX A

GENERIC SSLs FOR THE RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SCENARIOS

This appendix provides generic SSLs for 109 chemicals under residential and non-residential (i.e., commercial/industrial) exposure scenarios. Exhibit A-1 presents updated generic SSLs for the residential exposure scenario. The generic SSLs for three of the pathways in this exhibit — inhalation of volatiles in outdoor air, inhalation of fugitive dust, and migration to ground water — were calculated using the same equations and default values for exposure assumptions found in the 1996 *SSG* (and reproduced in Appendix B of this document). However, they incorporate updated values for dispersion factors, for toxicity, and for other chemical-specific parameters presented in Appendix C. The exhibit also presents new SSLs for concurrent exposures via soil ingestion and dermal absorption that are based, in part, on a new quantitative approach for evaluating dermal absorption. SSLs for combined direct ingestion and dermal absorption exposures to contaminants were calculated according to the method described in Section 3.2.1 of this document. The generic residential SSLs in Exhibit A-1 supersede those published in the 1996 *SSG*.

Exhibits A-2 and A-3 present commercial/industrial SSLs for the outdoor worker and indoor worker receptors, respectively. These SSLs have been calculated using the equations and the default values for exposure assumptions and other input parameters presented in Section 4.2.3 of this guidance document. All generic SSLs presented in this appendix, both residential and commercial/industrial, are rounded to two significant figures, with the exception of values less than 10 mg/kg, which are rounded to one significant figure.

As noted above, the values in this Appendix are based on chemical-specific physical and toxicological parameters presented in Appendix C. The values in Appendix C represent the most recent values available and are current as of the date of publication of this guidance. However, physical/chemical and toxicological data are subject to revision and should therefore be confirmed before referencing screening levels in the following tables. Trichloroethylene, in particular, is based on a draft risk assessment, and because the document is still undergoing review, the health benchmark values should be considered provisional.

EPA does not present generic SSLs for the construction exposure scenario because the complexity and variability of exposure conditions for construction activities precludes the development of such values. For information on developing SSLs for exposures during construction activities, users should refer to Chapter 5 or Appendix E of the guidance document.

The generic residential and non-residential SSLs are not necessarily protective of all known human exposure pathways or ecological threats. Before applying SSLs, it is therefore necessary to compare the conceptual site model (developed in Step 1 of the soil screening process) with the assumptions underlying the generic SSLs to ensure that site conditions and exposure pathways are consistent with these assumptions (See Exhibit A-4.) If this comparison indicates that the site is more complex than the generic SSL scenario, or that there are significant exposure pathways not accounted for by the SSL scenario, then generic SSLs alone are **not** sufficient to evaluate the site, and additional, more detailed site-specific investigation is necessary.

In each exhibit, the first column presents SSLs based on the combined soil ingestion and dermal absorption exposure pathway. When data on dermal absorption from soil are unavailable, these SSLs are based on ingestion exposures only. SSLs for this pathway may be updated in the future as dermal absorption data become available for other contaminants.

The second column in Exhibits A-1 and A-2 presents SSLs for the outdoor inhalation of volatiles pathway. Although residential receptors and indoor workers are potentially exposed to volatiles in indoor air as well, EPA has not calculated generic SSLs for migration of volatiles into indoor air because it is very difficult to identify suitable standardized default values for inputs such as dimensions of commercial buildings and the distance between contamination and a building's foundation. EPA provides spreadsheet models that can be used to calculate SSLs for this pathway using the simple site-specific or detailed site-specific approaches.[1] The third column in Exhibit A-1 and A-2 lists SSLs for the inhalation of fugitive dusts pathway. Because inhalation of fugitive dust is typically not a concern for organic compounds, SSLs for this pathway are presented only for inorganic compounds, which are listed at the end of each exhibit. Conversely, with the exception of mercury, no SSLs for the inhalation of volatiles pathway are provided for inorganic compounds because these chemicals exhibit extremely low volatility.

The user should note that several of the generic SSLs for the inhalation of volatiles pathway are determined by the chemical-specific soil saturation limit (C_{sat}) which is used to screen for the presence of non-aqueous phase liquids (NAPLs). As indicated in Section 4.2.3, in situations where the residual concentration of a compound that is a liquid at ambient soil temperature exceeds C_{sat}, the compound may exist as free-phase liquid (see Exhibit C-3 in Appendix C for a list of those compounds present in liquid phase at typical ambient soil temperatures). In these cases, further investigation will be required.

The final two columns in Exhibits A-1 through A-3 present generic SSLs for the migration to ground water pathway. The generic commercial/industrial SSLs for this pathway are the same as those for residential use and are unchanged from the 1996 *SSG*. As discussed in Section 4.2.3, this approach protects potential potable ground water resources that may be present beneath sites with commercial/industrial uses and protects off-site residents who may ingest ground water contaminated by the site. The migration to ground water SSLs are back-calculated from an acceptable target soil leachate concentration using a dilution-attenuation factor (DAF). The first of the two columns of SSLs for this pathway presents levels calculated using a DAF of 20 to account for reductions in contaminant concentration due to natural processes occurring in the subsurface. The second column presents SSL values for the migration to ground water pathway calculated assuming a DAF of one (i.e., no dilution or attenuation between the source and the receptor well). These levels should be used at sites where little or no dilution or attenuation of soil leachate concentrations is expected; this will be the case at sites with characteristics such as shallow water tables, fractured media, karst topography, or source size greater than 30 acres.

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[1] The vapor intrusion spreadsheets can be found on EPA's web site at http://www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm.

After all possible SSLs for all potential receptors at a site have been identified from the tables in Exhibits A-1 through A-3, the site manager should select the lowest applicable SSL for each exposure pathway to be used for comparison to site contaminant concentrations in soil. Generally, where the relevant SSL for a given pathway of concern is not exceeded, the user may eliminate the pathway from further investigation. If all pathways of concern are eliminated for an area of the site based on comparison with residential SSLs, that area can be eliminated from further investigation. However, if commercial/industrial SSLs are used in soil screening evaluations, elimination of an area from further consideration is contingent on an analysis of institutional control options. Users should consult Section 4.3.2 of the guidance document for more information.

The final exhibit in this appendix (Exhibit A-4) presents the default values for physical site characteristics that are used in calculating SSLs (both residential and commercial/industrial) for the inhalation and migration to ground water pathways. These values describe the nature of the contaminant source area, the characteristics of site soil, meteorologic conditions, and hydrogeologic characteristics, and serve either as direct input parameters for SSL equations or as assumptions for developing input parameters for the equations.

This appendix does not include SSLs for lead, dioxin, or PCBs, because EPA has issued separate documents that specify risk-based concentrations for these contaminants in soil. For guidance on addressing soil contaminated with lead, dioxin, or PCBs, please refer to the following sources:

Lead:

- U.S. EPA, 1994. *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, EPA/540/F-94/043, Office of Solid Waste and Emergency Response, Washington, D.C. Directive 9355.4-12.

- U.S. EPA, 1996. *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil*, Technical Review Workgroup for Lead (TRW), Washington, D.C.

- US EPA, 1999. *Frequently Asked Questions on the Adult Lead Model: Guidance Document*. Technical Review Workgroup for Lead (TRW), Washington, D.C. http://www.epa.gov/oerrpage/superfund/programs/lead/ adfaqs.htm

PCBs:

- US EPA, 1990. *Guidance on Remedial Actions for Superfund Sites with PCB Contamination.* Office of Solid Waste and Emergency Response, Washington, D.C. NTIS PB91-921206CDH. (Currently being updated by the EPA PCB work group.)

Dioxin:

- U.S. EPA. 1998. *Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites.* OSWER Directive 9200.4-26.

- U.S. EPA. 2000. *Draft Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-*p*-Dioxin (TCDD) and Related Compounds.* Office of Research and Development, Washington, D.C. EPA/600/P-00/001Bg. September.

Analysis of Effects of Source Size on Generic SSLs

The generic SSLs presented have been developed assuming an infinite source and a 0.5 acre source size. For an analysis of the sensitivity of generic SSLs to changes in source size and the depths to which infinite source SSLs are protective at larger sites, please refer to Attachment A and Table A-3 in the *Technical Background Document* of the 1996 *SSG*. Additional detail is also provided in the guidance documents specifically addressing screening levels for soils contaminated with lead, dioxin, or PCBs (listed above).

Exhibit A-1

GENERIC SSLs FOR RESIDENTIAL SCENARIO[a]

Compound	CAS No.	Ingestion-Dermal (mg/kg)	Inhalation of Volatiles (mg/kg)	Inhalation of Fugitive Particulates (mg/kg)	Migration to Ground Water	
					DAF=20 (mg/kg)	DAF=1 (mg/kg)
Organics						
Acenaphthene	83-32-9	3,400 [b]	— [c]	—	570 [b]	29 [b]
Acetone (2-Propanone)	67-64-1	7,800 [b,c]	— [c]	—	16 [b]	0.8 [b]
Aldrin	309-00-2	0.04 [c,e]	3 [e]	—	0.5 [e]	0.02 [e]
Anthracene	120-12-7	17,000 [b]	— [c]	—	12,000 [b]	590 [b]
Benz(a)anthracene	56-55-3	0.6 [e]	— [c]	—	2 [e]	0.08 [e,f]
Benzene	71-43-2	12 [c,e]	0.8 [e]	—	0.03	0.002 [f]
Benzo(b)fluoranthene	205-99-2	0.6 [e]	— [c]	—	5 [e]	0.2 [e,f]
Benzo(k)fluoranthene	207-08-9	6 [e]	— [c]	—	49 [e]	2 [e]
Benzoic acid	65-85-0	310,000 [b,c]	— [c]	—	400 [b,k]	20 [b,k]
Benzo(a)pyrene	50-32-8	0.06 [e,f]	— [c]	—	8	0.4
Bis(2-chloroethyl)ether	111-44-4	0.4 [e]	0.2 [e,f]	—	0.0004 [e,f]	0.00002 [e,f]
Bis(2-ethylhexyl)phthalate	117-81-7	35 [e]	— [c]	—	3,600	180
Bromodichloromethane	75-27-4	10 [c,e]	— [c]	—	0.6	0.03
Bromoform (tribromomethane)	75-25-2	81 [c,e]	52 [e]	—	0.8	0.04
Butanol	71-36-3	7,800 [b,c]	— [c]	—	17 [b]	0.9 [b]
Butyl benzyl phthalate	85-68-7	12,000 [b]	— [c]	—	930 [d]	810 [b]
Carbazole	86-74-8	24 [e]	— [c]	—	0.6 [e]	0.03 [e,f]
Carbon disulfide	75-15-0	7,800 [b,c]	720 [d]	—	32 [b]	2 [b]
Carbon tetrachloride	56-23-5	5 [c,e]	0.3 [e]	—	0.07	0.003 [f]
Chlordane	57-74-9	2 [e]	72 [e]	—	10	0.5
p-Chloroaniline	106-47-8	240 [b]	— [c]	—	0.7 [b]	0.03 [b,f]
Chlorobenzene	108-90-7	1,600 [b,c]	380 [b]	—	1	0.07
Chlorodibromomethane	124-48-1	8 [c,e]	— [c]	—	0.4	0.02
Chloroform	67-66-3	780 [b,c]	— [c]	—	0.6	0.03
2-Chlorophenol	95-57-8	310 [b]	— [c]	—	4 [b,k]	0.2 [b,f,k]
Chrysene	218-01-9	62 [e]	— [c]	—	160 [e]	8 [e]
DDD	72-54-8	3 [c,e]	— [c]	—	16 [e]	0.8 [e]
DDE	72-55-9	2 [c,e]	— [c]	—	54 [e]	3 [e]
DDT	50-29-3	2 [e]	— [g]	—	32 [e]	2 [e]
Dibenz(a,h)anthracene	53-70-3	0.06 [e,f]	— [c]	—	2 [e]	0.08 [e,f]
Di-n-butyl phthalate	84-74-2	6,100 [b]	— [c]	—	2,300 [d]	270 [b]
1,2-Dichlorobenzene	95-50-1	5,500 [b]	600 [d]	—	17	0.9
1,4-Dichlorobenzene	106-46-7	20 [e]	— [g]	—	2	0.1 [f]
3,3-Dichlorobenzidine	91-94-1	1 [e]	— [c]	—	0.007 [e,f]	0.0003 [e,f]
1,1-Dichloroethane	75-34-3	7,800 [b,c]	1,200 [b]	—	23 [b]	1 [b]
1,2-Dichloroethane	107-06-2	7 [c,e]	0.4 [e]	—	0.02	0.001 [f]
1,1-Dichloroethylene	75-35-4	3900 [b,c]	290 [b]	—	0.06	0.003 [f]
cis-1,2-Dichloroethylene	156-59-2	780 [b,c]	— [c]	—	0.4	0.02
trans-1,2-Dichloroethylene	156-60-5	1,600 [b,c]	— [c]	—	0.7	0.03
2,4-Dichlorophenol	120-83-2	180 [b]	— [c]	—	1 [b,k]	0.05 [b,f,k]
2,4-Dichlorophenoxy-acetic acid	94-75-7	690 [b]	— [c]	—	0.4 [b,k]	0.02 [b,k]
1,2-Dichloropropane	78-87-5	9 [c,e]	15 [b]	—	0.03	0.001 [f]
1,3-Dichloropropene	542-75-6	6 [c,e]	1 [e]	—	0.004 [e]	0.0002 [e]

Exhibit A-1 (continued)

GENERIC SSLs FOR RESIDENTIAL SCENARIO[a]

Compound	CAS No.	Ingestion-Dermal (mg/kg)	Inhalation of Volatiles (mg/kg)	Inhalation of Fugitive Particulates (mg/kg)	Migration to Ground Water	
					DAF=20 (mg/kg)	DAF=1 (mg/kg)
Organics (continued)						
Dieldrin	60-57-1	0.04 [c,e]	1 [e]	—	0.004 [e]	0.0002 [e,f]
Diethylphthalate	84-66-2	49,000 [b]	— [c]	—	470 [b]	23 [b]
2,4-Dimethylphenol	105-67-9	1,200 [b]	— [c]	—	9 [b]	0.4 [b]
2,4-Dinitrophenol	51-28-5	120 [b]	— [c]	—	0.2 [b,f,k]	0.008 [b,f,k]
2,4-Dinitrotoluene	121-14-2	0.7 [e]	— [c]	—	0.0008 [e,f]	0.00004 [e,f]
2,6-Dinitrotoluene	606-20-2	0.7 [e]	— [c]	—	0.0007 [e,f]	0.00003 [e,f]
Di-n-octyl phthalate	117-84-0	1,200 [b]	— [c]	—	10,000 [d]	10,000 [d]
Endosulfan	115-29-7	470 [b,c]	— [c]	—	18 [b]	0.9 [b]
Endrin	72-20-8	23 [b,c]	— [c]	—	1	0.05
Ethylbenzene	100-41-4	7,800 [b,c]	400 [d]	—	13	0.7
Fluoranthene	206-44-0	2,300 [b]	— [c]	—	4,300 [b]	210 [b]
Fluorene	86-73-7	2,300 [b]	— [c]	—	560 [b]	28 [b]
Heptachlor	76-44-8	0.1 [c,e]	4 [e]	—	23	1
Heptachlor Epoxide	1024-57-3	0.07 [c,e]	5 [e]	—	0.7	0.03
Hexachlorobenzene	118-74-1	0.3 [e]	1 [e]	—	2	0.1 [f]
Hexachloro-1,3-butadiene	87-68-3	6 [e]	8 [e]	—	2	0.1 [f]
α-HCH (α-BHC)	319-84-6	0.1 [c,e]	0.7 [e]	—	0.0005 [e,f]	0.00003 [e,f]
β-HCH(β-BHC)	319-85-7	0.4 [c,e]	6 [e]	—	0.003 [e]	0.0001 [e,f]
γ-HCH(Lindane)	58-89-9	0.4 [e]	— [c]	—	0.009	0.0005 [f]
Hexachlorocyclopentadiene	77-47-4	370 [b]	29 [b]	—	400	20
Hexachloroethane	67-72-1	35 [e]	54 [e]	—	0.5 [e]	0.02 [e,f]
Indeno(1,2,3-cd)pyrene	193-39-5	0.6 [e]	— [c]	—	14 [e]	0.7 [e]
Isophorone	78-59-1	510 [e]	— [c]	—	0.5 [e]	0.03 [e,f]
Methoxychlor	72-43-5	390 [b,c]	— [c]	—	160	8
Methyl bromide	74-83-9	110 [b,c]	9 [b]	—	0.2 [b]	0.01 [b,f]
Methylene chloride	75-09-2	85 [c,e]	13 [e]	—	0.02 [e]	0.001 [e,f]
2-Methylphenol (o-cresol)	95-48-7	3,100 [b]	— [c]	—	15 [b]	0.8 [b]
Naphthalene	91-20-3	1,100 [b]	170 [c]	—	84 [b]	4 [b]
Nitrobenzene	98-95-3	31 [b]	90 [b]	—	0.1 [b,f]	0.007 [b,f]
N-Nitrosodiphenylamine	86-30-6	99 [c]	— [c]	—	1 [e]	0.06 [e,f]
N-Nitrosodi-n-propylamine	621-64-7	0.07 [e,f]	— [c]	—	0.0000 [e,f]	0.000002 [e,f]
Pentachlorophenol	87-86-5	3 [e]	— [c]	—	0.03 [f,k]	0.001 [f,k]
Phenol	108-95-2	18,000 [b]	— [c]	—	100 [b]	5 [b]
Pyrene	129-00-0	1,700 [b]	— [c]	—	4,200 [b]	210 [b]
Styrene	100-42-5	16,000 [b,c]	1,500 [d]	—	4	0.2
1,1,2,2-Tetrachloroethane	79-34-5	3 [c,e]	0.6 [e]	—	0.003 [e,f]	0.0002 [e,f]
Tetrachloroethylene	127-18-4	1 [c,e]	1 [e]	—	0.06	0.003 [f]
Toluene	108-88-3	16,000 [b,c]	650 [d]	—	12	0.6
Toxaphene	8001-35-2	0.6 [c,e]	87 [e]	—	31	2
1,2,4-Trichlorobenzene	120-82-1	610 [b]	3,200 [d]	—	5	0.3 [f]
1,1,1-Trichloroethane	71-55-6	— [c]	1,200 [d]	—	2	0.1
1,1,2-Trichloroethane	79-00-5	11 [c,e]	1 [e]	—	0.02	0.0009 [f]
Trichloroethylene[†]	79-01-6	2 [c,e]	0.07 [e]	—	0.06	0.003 [f]
2,4,5-Trichlorophenol	95-95-4	6,100 [b]	— [c]	—	270 [b,k]	14 [b,k]
2,4,6-Trichlorophenol	88-06-2	44 [c]	200 [e]	—	0.2 [e,f,k]	0.008 [e,f,k]

Exhibit A-1 (continued)

GENERIC SSLs FOR RESIDENTIAL SCENARIO[a]

Compound	CAS No.	Ingestion-Dermal (mg/kg)	Inhalation of Volatiles (mg/kg)	Inhalation of Fugitive Particulates (mg/kg)	Migration to Ground Water	
					DAF=20 (mg/kg)	DAF=1 (mg/kg)
Organics (continued)						
Vinyl acetate	108-05-4	78,000 [b,c]	980 [b]	—	170 [b]	8 [b]
Vinyl chloride (chloroethene)	75-01-4	0.4 [c,e,h]	0.6 [e,i]	—	0.01 [f,k,l]	0.0007 [f,l]
m-Xylene	108-38-3	160,000 [b,c]	— [c]	—	210	10
o-Xylene	95-47-6	160,000 [b,c]	— [c]	—	190	9
p-Xylene	106-42-3	160,000 [b,c]	— [c]	—	200	10
Inorganics						
Antimony	7440-36-0	31 [b,c]	—	— [c]	5	0.3
Arsenic	7440-38-2	0.4 [e]	—	770 [e]	29 [k]	1 [k]
Barium	7440-39-3	5,500 [b,c]	—	710,000 [b]	1,600 [k]	82 [k]
Beryllium	7440-41-7	160 [c,e]	—	1,400 [e]	63 [k]	3 [k]
Cadmium	7440-43-9	70 [b,j]	—	1,800 [e]	8 [k]	0.4 [k]
Chromium (total)	7440-47-3	230 [b,c]	—	280 [e]	38 [k]	2 [k]
Chromium (III)	16065-83-1	120,000 [b,c]	—	— [c]	— [g]	— [g]
Chromium (VI)	18540-29-9	230 [b,c]	—	280 [e]	38 [k]	2 [k]
Cyanide (amenable)	57-12-5	1,600 [b,c]	—	— [c]	40	2
Mercury	7439-97-6	23 [b,c,l]	10 [b,k]	—	2 [k]	0.1 [k]
Nickel	7440-02-0	1,600 [b,c]	—	14,000 [e]	130 [k]	7 [k]
Selenium	7782-49-2	390 [b,c]	—	— [c]	5 [k]	0.3 [k]
Silver	7440-22-4	390 [b,c]	—	— [c]	34 [b,k]	2 [b,k]
Thallium	7440-28-0	6 [b,c,m]	—	— [c]	0.7 [k]	0.04 [k]
Vanadium	7440-62-2	550 [b,c]	—	— [c]	6,000 [b]	300 [b]
Zinc	7440-66-6	23,000 [b,c]	—	— [c]	12,000 [b,k]	620 [b,k]

DAF = Dilution Attenuation Factor

[a] Screening level based on human health criteria only

[b] Calculated values correspond to a noncancer hazard quotient of 1. For exposure to multiple non-carcinogens, EPA evaluates contaminants according to their critical effect. See section 2.3 for further discussion.

[c] Ingestion-Dermal pathway: no dermal absorption data available; calculated based on ingestion data only. Inhalation of volatiles pathway: no toxicity criteria available

[d] Soil Saturation Limit (Csat)

[e] Calculated values correspond to a cancer risk of 1 in 1,000,000. For multiple carcinogens, EPA believes values will accumulate to be within acceptable risk levels. See section 2.3 for further discussion.

[f] Level is at or below Contract Laboratory Program required quantification limit for Regular Analytical Services (RAS)

[g] Chemical-specific properties are such that this pathway is not of concern at any soil contaminant concentration

[h] SSL is based on continuous exposure to vinyl chloride over a lifetime.

[i] SSL is based on continuous exposure to vinyl chloride during adulthood.

[j] SSL is based on dietary RfD for Cadmium

[k] SSL for pH of 6.8

[l] SSL is based on RfD for mercuric chloride (CAS No. 007847-94-7)

[m] SSL is based on RfD for thallium chloride (CAS No. 7791-12-0)

[†] Health benchmark values are based on NCEA's *Trichloroethylene Health Risk Assessment: Synthesis and Characterization - External Review Draft* (ORD, August, 2001). The trichloroethylene draft risk assessment is still under review. As a result, the health benchmark values are subject to change.

Exhibit A-2

GENERIC SSLs FOR COMMERCIAL/INDUSTRIAL SCENARIO: OUTDOOR WORKER RECEPTOR[a]

Compound	CAS No.	Ingestion-Dermal (mg/kg)	Inhalation of Volatiles (mg/kg)	Inhalation of Fugitive Particulates (mg/kg)	Migration to Ground Water	
					DAF=20 (mg/kg)	DAF=1 (mg/kg)
Organics						
Acenaphthene	83-32-9	37,000 [b]	— [c]	—	570 [b]	29 [b]
Acetone (2-Propanone)	67-64-1	110,000 [b,c]	— [c]	—	16 [b]	0.8 [b]
Aldrin	309-00-2	0.2 [c,e]	6 [e]	—	0.5 [e]	0.02 [e]
Anthracene	120-12-7	180,000 [b]	— [c]	—	12,000 [b]	590 [b]
Benz(a)anthracene	56-55-3	2 [e]	— [c]	—	2 [e]	0.08 [e,f]
Benzene	71-43-2	58 [c,e]	1 [e]	—	0.03	0.002 [f]
Benzo(b)fluoranthene	205-99-2	2 [e]	— [c]	—	5 [e]	0.2 [e,f]
Benzo(k)fluoranthene	207-08-9	23 [e]	— [c]	—	49 [e]	2 [e]
Benzoic acid	65-85-0	1,000,000 [b,c]	— [c]	—	400 [b,j]	20 [b,j]
Benzo(a)pyrene	50-32-8	0.2 [e]	— [c]	—	8	0.4
Bis(2-chloroethyl)ether	111-44-4	2 [e]	0.4 [e]	—	0.0004 [e,f]	0.00002 [e,f]
Bis(2-ethylhexyl)phthalate	117-81-7	140 [e]	— [c]	—	3,600	180
Bromodichloromethane	75-27-4	51 [c,e]	— [c]	—	0.6	0.03
Bromoform (tribromomethane)	75-25-2	400 [c,e]	88 [e]	—	0.8	0.04
Butanol	71-36-3	110,000 [b,c]	— [c]	—	17 [b]	0.9 [b]
Butyl benzyl phthalate	85-68-7	140,000 [b]	— [c]	—	930 [d]	810 [b]
Carbazole	86-74-8	96 [e]	— [c]	—	0.6 [e]	0.03 [e,f]
Carbon disulfide	75-15-0	110,000 [b,c]	720 [d]	—	32 [b]	2 [b]
Carbon tetrachloride	56-23-5	24 [c,e]	0.6 [e]	—	0.07	0.003 [f]
Chlordane	57-74-9	7 [e]	120 [e]	—	10	0.5
p-Chloroaniline	106-47-8	2,700 [b]	— [c]	—	0.7 [b]	0.03 [b,f]
Chlorobenzene	108-90-7	23,000 [b,c]	540 [b]	—	1	0.07
Chlorodibromomethane	124-48-1	38 [c,e]	— [c]	—	0.4	0.02
Chloroform	67-66-3	11,000 [b,c]	— [c]	—	0.6	0.03
2-Chlorophenol	95-57-8	3,400 [b]	— [c]	—	4 [b,j]	0.2 [b,f,j]
Chrysene	218-01-9	230 [e]	— [c]	—	160 [e]	8 [e]
DDD	72-54-8	13 [c,e]	— [c]	—	16 [e]	0.8 [e]
DDE	72-55-9	9 [c,e]	— [c]	—	54 [e]	3 [e]
DDT	50-29-3	8 [e]	— [g]	—	32 [e]	2 [e]
Dibenz(a,h)anthracene	53-70-3	0.2 [e]	— [c]	—	2 [e]	0.08 [e,f]
Di-n-butyl phthalate	84-74-2	68,000 [b]	— [c]	—	2,300 [d]	270 [b]
1,2-Dichlorobenzene	95-50-1	62,000 [b]	600 [d]	—	17	0.9
1,4-Dichlorobenzene	106-46-7	80 [e]	— [g]	—	2	0.1 [f]
3,3-Dichlorobenzidine	91-94-1	4 [e]	— [c]	—	0.007 [e,f]	0.0003 [e,f]
1,1-Dichloroethane	75-34-3	110,000 [b,c]	1,700 [d]	—	23 [b]	1 [b]
1,2-Dichloroethane	107-06-2	35 [c,e]	0.6 [e]	—	0.02	0.001 [f]
1,1-Dichloroethylene	75-35-4	57,000 [b,c]	410 [b]	—	0.06	0.003 [f]
cis-1,2-Dichloroethylene	156-59-2	11,000 [b,c]	— [c]	—	0.4	0.02
trans-1,2-Dichloroethylene	156-60-5	23,000 [b,c]	— [c]	—	0.7	0.03
2,4-Dichlorophenol	120-83-2	2,100 [b]	— [c]	—	1 [b,j]	0.05 [b,f,j]
2,4-Dichlorophenoxy-acetic acid	94-75-7	8,500 [b]	— [c]	—	0.4 [b,j]	0.02 [b,j]
1,2-Dichloropropane	78-87-5	47 [c,e]	21 [b]	—	0.03	0.001 [f]
1,3-Dichloropropene	542-75-6	32 [c,e]	2 [e]	—	0.004 [e]	0.0002 [e]

Exhibit A-2 (continued)

GENERIC SSLs FOR COMMERCIAL/INDUSTRIAL SCENARIO: OUTDOOR WORKER RECEPTOR[a]

Compound	CAS No.	Ingestion-Dermal (mg/kg)	Inhalation of Volatiles (mg/kg)	Inhalation of Fugitive Particulates (mg/kg)	Migration to Ground Water	
					DAF=20 (mg/kg)	DAF=1 (mg/kg)
Organics (continued)						
Dieldrin	60-57-1	0.2 [c,e]	2 [e]	—	0.004 [e]	0.0002 [e,f]
Diethylphthalate	84-66-2	550,000 [b]	— [c]	—	470 [b]	23 [b]
2,4-Dimethylphenol	105-67-9	14,000 [b]	— [c]	—	9 [b]	0.4 [b]
2,4-Dinitrophenol	51-28-5	1,400 [b]	— [c]	—	0.2 [b,f,j]	0.008 [b,f,j]
2,4-Dinitrotoluene	121-14-2	3 [e]	— [c]	—	0.0008 [e,f]	0.00004 [e,f]
2,6-Dinitrotoluene	606-20-2	3 [e]	— [c]	—	0.0007 [e,f]	0.00003 [e,f]
Di-n-octyl phthalate	117-84-0	14,000 [b]	— [c]	—	10,000 [d]	10,000 [d]
Endosulfan	115-29-7	6,800 [b,c]	— [c]	—	18 [b]	0.9 [b]
Endrin	72-20-8	340 [b,c]	— [c]	—	1	0.05
Ethylbenzene	100-41-4	110,000 [b,c]	400 [d]	—	13	0.7
Fluoranthene	206-44-0	24,000 [b]	— [c]	—	4,300 [b]	210 [b]
Fluorene	86-73-7	24,000 [b]	— [c]	—	560 [b]	28 [b]
Heptachlor	76-44-8	0.7 [c,e]	7 [e]	—	23	1
Heptachlor Epoxide	1024-57-3	0.3 [c,e]	8 [e]	—	0.7	0.03
Hexachlorobenzene	118-74-1	1 [e]	2 [e]	—	2	0.1 [f]
Hexachloro-1,3-butadiene	87-68-3	25 [e]	13 [e]	—	2	0.1 [f]
α-HCH (α-BHC)	319-84-6	0.5 [c,e]	1 [e]	—	0.0005 [e,f]	0.00003 [e,f]
β-HCH(β-BHC)	319-85-7	2 [c,e]	— [g]	—	0.003 [e]	0.0001 [e,f]
γ-HCH(Lindane)	58-89-9	2 [e]	— [c]	—	0.009	0.0005 [f]
Hexachlorocyclopentadiene	77-47-4	4,100 [b]	41 [b]	—	400	20
Hexachloroethane	67-72-1	140 [e]	92 [e]	—	0.5 [e]	0.02 [e,f]
Indeno(1,2,3-cd)pyrene	193-39-5	2 [e]	— [c]	—	14 [e]	0.7 [e]
Isophorone	78-59-1	2,000 [e]	— [c]	—	0.5 [e]	0.03 [e,f]
Methoxychlor	72-43-5	5,700 [b,c]	— [c]	—	160	8
Methyl bromide	74-83-9	1,600 [b,c]	13 [b]	—	0.2 [b]	0.01 [b,f]
Methylene chloride	75-09-2	420 [c,e]	22 [e]	—	0.02 [e]	0.001 [e,f]
2-Methylphenol (o-cresol)	95-48-7	34,000 [b]	— [c]	—	15 [b]	0.8 [b]
Naphthalene	91-20-3	12,000 [b]	240 [b]	—	84 [b]	4 [b]
Nitrobenzene	98-95-3	340 [b]	130 [b]	—	0.1 [b,f]	0.007 [b,f]
N-Nitrosodiphenylamine	86-30-6	390 [e]	— [c]	—	1 [e]	0.06 [e,f]
N-Nitrosodi-n-propylamine	621-64-7	0.3 [e]	— [c]	—	0.00005 [e,f]	0.000002 [e,f]
Pentachlorophenol	87-86-5	10 [e]	— [c]	—	0.03 [f,j]	0.001 [f,j]
Phenol	108-95-2	210,000 [b]	— [c]	—	100 [b]	5 [b]
Pyrene	129-00-0	18,000 [b]	— [c]	—	4,200 [b]	210 [b]
Styrene	100-42-5	230,000 [b,c]	1,500 [d]	—	4	0.2
1,1,2,2-Tetrachloroethane	79-34-5	16 [c,e]	1 [e]	—	0.003 [e,f]	0.0002 [e,f]
Tetrachloroethylene	127-18-4	6 [c,e]	2 [e]	—	0.06	0.003 [f]
Toluene	108-88-3	230,000 [b,c]	650 [d]	—	12	0.6
Toxaphene	8001-35-2	3 [c,e]	150 [e]	—	31	2
1,2,4-Trichlorobenzene	120-82-1	6,800 [b]	3,200 [d]	—	5	0.3 [f]
1,1,1-Trichloroethane	71-55-6	— [c]	1,200 [d]	—	2	0.1
1,1,2-Trichloroethane	79-00-5	56 [c,e]	2 [e]	—	0.02	0.0009 [f]
Trichloroethylene[†]	79-01-6	8 [c,e]	0.1 [e]	—	0.06	0.003 [f]
2,4,5-Trichlorophenol	95-95-4	68,000 [b]	— [c]	—	270 [b,j]	14 [b,j]
2,4,6-Trichlorophenol	88-06-2	170 [e]	340 [e]	—	0.2 [e,f,j]	0.008 [e,f,j]

Exhibit A-2 (continued)

GENERIC SSLs FOR COMMERCIAL/INDUSTRIAL SCENARIO: OUTDOOR WORKER RECEPTOR[a]

Compound	CAS No.	Ingestion-Dermal (mg/kg)	Inhalation of Volatiles (mg/kg)	Inhalation of Fugitive Particulates (mg/kg)	Migration to Ground Water	
					DAF=20 (mg/kg)	DAF=1 (mg/kg)
***Organics* (continued)**						
Vinyl acetate	108-05-4	1,000,000 [b,c]	1,400 [b]	—	170 [b]	8 [b]
Vinyl chloride (chloroethene)	75-01-4	4 [c,e,h]	1 [e,h]	—	0.01 [f,h,j]	0.0007 [f,h]
m-Xylene	108-38-3	1,000,000 [b,c]	— [c]	—	210	10
o-Xylene	95-47-6	1,000,000 [b,c]	— [c]	—	190	9
p-Xylene	106-42-3	1,000,000 [b,c]	— [c]	—	200	10
Inorganics						
Antimony	7440-36-0	450 [b,c]	—	— [c]	5	0.3
Arsenic	7440-38-2	2 [e]	—	1,400 [e]	29 [j]	1 [j]
Barium	7440-39-3	79,000 [b,c]	—	1,000,000 [b]	1,600 [j]	82 [j]
Beryllium	7440-41-7	2,300 [c,e]	—	2,600 [e]	63 [j]	3 [j]
Cadmium	7440-43-9	900 [b,i]	—	3,400 [e]	8 [j]	0.4 [j]
Chromium (total)	7440-47-3	3,400 [b,c]	—	510 [e]	38 [j]	2 [j]
Chromium (III)	16065-83-1	1,000,000 [b,c]	—	— [c]	— [g]	— [g]
Chromium (VI)	18540-29-9	3,400 [b,c]	—	510 [e]	38 [j]	2 [j]
Cyanide (amenable)	57-12-5	23,000 [b,c]	—	— [c]	40	2
Mercury	7439-97-6	340 [b,c,k]	14 [b,k]	—	2 [j]	0.1 [j]
Nickel	7440-02-0	23,000 [b,c]	—	26,000 [e]	130 [j]	7 [j]
Selenium	7782-49-2	5,700 [b,c]	—	— [c]	5 [j]	0.3 [j]
Silver	7440-22-4	5,700 [b,c]	—	— [c]	34 [b,j]	2 [b,j]
Thallium	7440-28-0	91 [b,c,l]	—	— [c]	0.7 [j]	0.04 [j]
Vanadium	7440-62-2	7,900 [b,c]	—	— [c]	6,000 [b]	300 [b]
Zinc	7440-66-6	340,000 [b,c]	—	— [c]	12,000 [b,j]	620 [b,j]

DAF = Dilution Attenuation Factor

[a] Screening level based on human health criteria only

[b] Calculated values correspond to a noncancer hazard quotient of 1. For exposure to multiple non-carcinogens, EPA evaluates contaminants according to their critical effect. See section 2.3 for further discussion.

[c] Ingestion-Dermal pathway: no dermal absorption data available; calculated based on ingestion data only. Inhalation of volatiles pathway: no toxicity criteria available

[d] Soil Saturation Limit (Csat)

[e] Calculated values correspond to a cancer risk of 1 in 1,000,000. For multiple carcinogens, EPA believes values will accumulate to be within acceptable risk levels. See section 2.3 for further discussion.

[f] Level is at or below Contract Laboratory Program required quantification limit for Regular Analytical Services (RAS)

[g] Chemical-specific properties are such that this pathway is not of concern at any soil contaminant concentration

[h] SSL is based on continuous exposure to vinyl chloride during adulthood.

[i] SSL is based on dietary RfD for Cadmium

[j] SSL for pH of 6.8

[k] SSL is based on RfD for mercuric chloride (CAS No. 007847-94-7)

[l] SSL is based on RfD for thallium chloride (CAS No. 7791-12-0)

[†] Health benchmark values are based on NCEA's *Trichloroethylene Health Risk Assessment: Synthesis and Characterization - External Review Draft* (ORD, August, 2001). The trichloroethylene draft risk assessment is still under review. As a result, the health benchmark values are subject to change.

Exhibit A-3

GENERIC SSLs FOR COMMERCIAL/INDUSTRIAL SCENARIO: INDOOR WORKER RECEPTOR[a]

Compound	CAS No.	Ingestion-Dermal* (mg/kg)	Migration to Ground Water	
			DAF=20 (mg/kg)	DAF=1 (mg/kg)
Organics				
Acenaphthene	83-32-9	120,000 [b]	570 [b]	29 [b]
Acetone (2-Propanone)	67-64-1	200,000 [b]	16 [b]	0.8 [b]
Aldrin	309-00-2	0.3 [e]	0.5 [e]	0.02 [e]
Anthracene	120-12-7	610,000 [b]	12,000 [b]	590 [b]
Benz(a)anthracene	56-55-3	8 [e]	2 [e]	0.08 [e,f]
Benzene	71-43-2	100 [e]	0.03	0.002 [f]
Benzo(b)fluoranthene	205-99-2	8 [e]	5 [e]	0.2 [e,f]
Benzo(k)fluoranthene	207-08-9	78 [e]	49 [e]	2 [e]
Benzoic acid	65-85-0	1,000,000 [b]	400 [b,j]	20 [b,j]
Benzo(a)pyrene	50-32-8	0.8 [e]	8	0.4
Bis(2-chloroethyl)ether	111-44-4	5 [e]	0.0004 [e,f]	0.00002 [e,f]
Bis(2-ethylhexyl)phthalate	117-81-7	410 [e]	3,600	180
Bromodichloromethane	75-27-4	92 [e]	0.6	0.03
Bromoform (tribromomethane)	75-25-2	720 [e]	0.8	0.04
Butanol	71-36-3	200,000 [b]	17 [b]	0.9 [b]
Butyl benzyl phthalate	85-68-7	410,000 [b]	930 [d]	810 [b]
Carbazole	86-74-8	290 [e]	0.6 [e]	0.03 [e,f]
Carbon disulfide	75-15-0	200,000 [b]	32 [b]	2 [b]
Carbon tetrachloride	56-23-5	44 [e]	0.07	0.003 [f]
Chlordane	57-74-9	16 [e]	10	0.5
p-Chloroaniline	106-47-8	8,200 [b]	0.7 [b]	0.03 [b,f]
Chlorobenzene	108-90-7	41,000 [b]	1	0.07
Chlorodibromomethane	124-48-1	68 [e]	0.4	0.02
Chloroform	67-66-3	20,000 [b]	0.6	0.03
2-Chlorophenol	95-57-8	10,000 [b]	4 [b,j]	0.2 [b,f,j]
Chrysene	218-01-9	780 [e]	160 [e]	8 [e]
DDD	72-54-8	24 [e]	16 [e]	0.8 [e]
DDE	72-55-9	17 [e]	54 [e]	3 [e]
DDT	50-29-3	17 [e]	32 [e]	2 [e]
Dibenz(a,h)anthracene	53-70-3	0.8 [e]	2 [e]	0.08 [e,f]
Di-n-butyl phthalate	84-74-2	200,000 [b]	2,300 [d]	270 [b]
1,2-Dichlorobenzene	95-50-1	180,000 [b]	17	0.9
1,4-Dichlorobenzene	106-46-7	240 [e]	2	0.1 [f]
3,3-Dichlorobenzidine	91-94-1	13 [e]	0.007 [e,f]	0.0003 [e,f]
1,1-Dichloroethane	75-34-3	200,000 [b]	23 [b]	1 [b]
1,2-Dichloroethane	107-06-2	63 [e]	0.02	0.001 [f]
1,1-Dichloroethylene	75-35-4	100,000 [b]	0.06	0.003 [f]
cis-1,2-Dichloroethylene	156-59-2	20,000 [b]	0.4	0.02
trans-1,2-Dichloroethylene	156-60-5	41,000 [b]	0.7	0.03
2,4-Dichlorophenol	120-83-2	6,100 [b]	1 [b,j]	0.05 [b,f,j]
2,4-Dichlorophenoxy-acetic acid	94-75-7	20,000 [b]	0.4 [b]	0.02 [b,j]

Exhibit A-3 (continued)

GENERIC SSLs FOR COMMERCIAL/INDUSTRIAL SCENARIO: INDOOR WORKER RECEPTOR[a]

Compound	CAS No.	Ingestion-Dermal* (mg/kg)		Migration to Ground Water DAF=20 (mg/kg)		Migration to Ground Water DAF=1 (mg/kg)	
Organics(continued)							
1,2-Dichloropropane	78-87-5	84	e	0.03		0.001	f
1,3-Dichloropropene	542-75-6	57	e	0.004	e	0.0002	e
Dieldrin	60-57-1	0.4	e	0.004	e	0.0002	e,f
Diethylphthalate	84-66-2	1,000,000	b	470	b	23	b
2,4-Dimethylphenol	105-67-9	41,000	b	9	b	0.4	b
2,4-Dinitrophenol	51-28-5	4,100	b	0.2	b,f,j	0.008	b,f,j
2,4-Dinitrotoluene	121-14-2	8	e	0.0008	e,f	0.00004	e,f
2,6-Dinitrotoluene	606-20-2	8	e	0.0007	e,f	0.00003	e,f
Di-n-octyl phthalate	117-84-0	41,000	b	10,000	d	10,000	d
Endosulfan	115-29-7	12,000	b	18	b	0.9	b
Endrin	72-20-8	610	b	1		0.05	
Ethylbenzene	100-41-4	200,000	b	13		0.7	
Fluoranthene	206-44-0	82,000	b	4,300	b	210	b
Fluorene	86-73-7	82,000	b	560	b	28	b
Heptachlor	76-44-8	1	e	23		1	
Heptachlor Epoxide	1024-57-3	0.6	e	0.7		0.03	
Hexachlorobenzene	118-74-1	4	e	2		0.1	f
Hexachloro-1,3-butadiene	87-68-3	73	e	2		0.1	f
α-HCH (α-BHC)	319-84-6	0.9	e	0.0005	e,f	0.00003	e,f
β-HCH(β-BHC)	319-85-7	3	e	0.003	e	0.0001	e,f
γ-HCH(Lindane)	58-89-9	4	e	0.009		0.0005	f
Hexachlorocyclopentadiene	77-47-4	12,000	b	400		20	
Hexachloroethane	67-72-1	410	e	0.5	e	0.02	e,f
Indeno(1,2,3-cd)pyrene	193-39-5	8	e	14	e	0.7	e
Isophorone	78-59-1	6,000	e	0.5	e	0.03	e,f
Methoxychlor	72-43-5	10,000	b	160		8	
Methyl bromide	74-83-9	2,900	b	0.2	b	0.01	b,f
Methylene chloride	75-09-2	760	e	0.02	e	0.001	e,f
2-Methylphenol (o-cresol)	95-48-7	100,000	b	15	b	0.8	b
Naphthalene	91-20-3	41,000	b	84	b	4	b
Nitrobenzene	98-95-3	1,000	b	0.1	b,f	0.007	b,f
N-Nitrosodiphenylamine	86-30-6	1,200	e	1	e	0.06	e,f
N-Nitrosodi-n-propylamine	621-64-7	0.8	e	0.00005	e,f	0.000002	e,f
Pentachlorophenol	87-86-5	48	e	0.03	f,j	0.001	f,j
Phenol	108-95-2	610,000	b	100	b	5	b
Pyrene	129-00-0	61,000	b	4,200	b	210	b
Styrene	100-42-5	410,000	b	4		0.2	
1,1,2,2-Tetrachloroethane	79-34-5	29	e	0.003	e,f	0.0002	e,f
Tetrachloroethylene	127-18-4	11	e	0.06		0.003	f
Toluene	108-88-3	410,000	b	12		0.6	
Toxaphene	8001-35-2	5	e	31		2	
1,2,4-Trichlorobenzene	120-82-1	20,000	b	5		0.3	f
1,1,1-Trichloroethane	71-55-6	—	c	2		0.1	
1,1,2-Trichloroethane	79-00-5	100	e	0.02		0.0009	f
Trichloroethylene[†]	79-01-6	14	e	0.06		0.003	f
2,4,5-Trichlorophenol	95-95-4	200,000	b	270	b,j	14	b,j

Exhibit A-3 (continued)

GENERIC SSLs FOR COMMERCIAL/INDUSTRIAL SCENARIO: INDOOR WORKER RECEPTOR[a]

Compound	CAS No.	Ingestion-Dermal* (mg/kg)	Migration to Ground Water	
			DAF=20 (mg/kg)	DAF=1 (mg/kg)
Organics(continued)				
2,4,6-Trichlorophenol	88-06-2	520 [e]	0.2 [e,f,j]	0.008 [e,f,j]
Vinyl acetate	108-05-4	1,000,000 [b,c]	170 [b]	8 [b]
Vinyl chloride (chloroethene)	75-01-4	8 [e,h]	0.01 [f,h,j]	0.0007 [f,h]
m-Xylene	108-38-3	1,000,000 [b]	210	10
o-Xylene	95-47-6	1,000,000 [b]	190	9
p-Xylene	106-42-3	1,000,000 [b]	200	10
Inorganics				
Antimony	7440-36-0	820 [b]	5	0.3
Arsenic	7440-38-2	4 [e]	29 [j]	1 [j]
Barium	7440-39-3	140,000 [b]	1,600 [j]	82 [j]
Beryllium	7440-41-7	4,100 [b]	63 [j]	3 [j]
Cadmium	7440-43-9	2,000 [b,i]	8 [j]	0.4 [j]
Chromium (total)	7440-47-3	6,100 [b]	38 [j]	2 [j]
Chromium (III)	16065-83-1	1,000,000 [b]	— [g]	— [g]
Chromium (VI)	18540-29-9	6,100 [b]	38 [j]	2 [j]
Cyanide (amenable)	57-12-5	41,000 [b]	40	2
Mercury	7439-97-6	610 [b,k]	2 [j]	0.1 [j]
Nickel	7440-02-0	41,000 [b]	130 [j]	7 [j]
Selenium	7782-49-2	10,000 [b]	5 [j]	0.3 [j]
Silver	7440-22-4	10,000 [b]	34 [b,j]	2 [b,j]
Thallium	7440-28-0	160 [b,l]	0.7 [j]	0.04 [j]
Vanadium	7440-62-2	14,000 [b]	6,000 [b]	300 [b]
Zinc	7440-66-6	610,000 [b]	12,000 [b,j]	620 [b,j]

DAF = Dilution Attenuation Factor

* No dermal absorption data available for indoor worker receptor; calculated based on ingestion data only

[a] Screening level based on human health criteria only

[b] Calculated values correspond to a noncancer hazard quotient of 1

[c] Ingestion-Dermal pathway: no dermal absorption data available; calculated based on ingestion data only. Inhalation of volatiles pathway: no toxicity criteria available

[d] Soil Saturation Limit (Csat)

[e] Calculated values correspond to a cancer risk of 1 in 1,000,000

[f] Level is at or below Contract Laboratory Program required quantification limit for Regular Analytical Services (RAS)

[g] Chemical-specific properties are such that this pathway is not of concern at any soil contaminant concentration

[h] SSL is based on continuous exposure to vinyl chloride during adulthood.

[i] SSL is based on dietary RfD for Cadmium

[j] SSL for pH of 6.8

[k] SSL is based on RfD for mercuric chloride (CAS No. 007847-94-7)

[l] SSL is based on RfD for thallium chloride (CAS No. 7791-12-0)

† Health benchmark values are based on NCEA's *Trichloroethylene Health Risk Assessment: Synthesis and Characterization - External Review Draft* (ORD, August, 2001). The trichloroethylene draft risk assessment is still under review. As a result, the health benchmark values are subject to change.

Exhibit A-4

GENERIC SSLs: DEFAULT VALUES FOR PARAMETERS DESCRIBING SITE CONDITIONS - INHALATION AND MIGRATION TO GROUND WATER PATHWAYS

Parameter	SSL Pathway		Method
	Inhalation	Migration to Ground Water	
Source Characteristics			
Continuous vegetative cover	• •		50 percent
Roughness height	• •		0.5 cm for open terrain; used to derive $U_{t,7}$
Source area (A)	•	•	0.5 acres (2,024m^2); used to derive L for GW
Source length (L)		• •	45 m (assumes square source)
Source depth		• •	Extends to water table (i.e., no attenuation in unsaturated zone)
Soil Characteristics			
Soil texture	•	•	Loam; defines soil characteristics/parameters
Dry soil bulk density (ρ_b)	•	•	1.5 kg/L
Soil porosity (n)	•	•	0.43
Vol. soil water content (θ_w)	•	•	0.15 (INH); 0.30 (GW; Indoor INH)*
Vol. soil air content (θ_a)	•	•	0.28 (INH); 0.13 (GW; Indoor INH)*
Soil organic carbon (f_{oc})	•	•	0.006 (0.6%, INH); 0.002 (0.2%, GW)
Soil pH	•	•	6.8; used to determine pH-specific K_d (metals) and K_{OC} (ionizable organics)
Mode soil aggregate size	• •		0.5 mm; used to derive $U_{t,7}$
Threshold windspeed @ 7 m ($U_{t,7}$)	• •		11.32 m/s
Meteorological Data			
Mean annual windspeed (U_m)	• •		4.69 m/s (Minneapolis, MN)
Air dispersion factor (Q/C)	• •		90th percentile conterminous U.S.
Volatilization Q/C	• •		68.18; Los Angeles, CA; 0.5-acre source
Fugitive particulate Q/C	• •		93.77; Minneapolis, MN; 0.5-acre source
Hydrogeologic Characteristics (DAF)			
Hydrogeologic setting		• •	Generic (national); surficial aquifer
Dilution/attenuation factor (DAF)		• •	20 or 1

• • Indicates parameters used directly in the SSL equations.
• • Indicates parameters/assumptions used to develop input parameters for SSL equations.
INH = Inhalation pathway.
GW = Migration to ground water pathway.
Indoor INH = Inhalation of volatiles in indoor air pathway.
* The inhalation of volatiles in indoor air pathway is evaluated using subsurface soil defaults for θ_w and θ_a. The model's default parameters assume contamination located directly beneath a basement floor that is two meters below the ground surface.

APPENDIX B

SSL EQUATIONS FOR RESIDENTIAL SCENARIO

This appendix provides equations for the simple site-specific approach to developing SSLs for the residential exposure scenario. These equations, along with the default values for exposure assumptions and other model parameters listed below them, were used to develop the generic residential SSLs presented in Appendix A, Exhibit A-1. Site-specific parameters are indicated in bold. Site managers can use site-specific values for these parameters when developing SSLs; the default values for these parameters should be used when site-specific data are not available.

These equations allow site managers to calculate simple site-specific SSLs for chronic exposures to contaminants via the combined routes of direct ingestion and dermal absorption, outdoor inhalation of volatiles, outdoor inhalation of fugitive dust, and ingestion of leachate contaminated ground water. With the exception of the combined equations for direct ingestion and dermal absorption (Equations B-1 and B-2), the equations in this appendix are identical to those presented in the 1996 *Soil Screening Guidance*, though users should note that the default values for the fugitive dust and volatiles dispersion factors have been updated since the original guidance was published. For information on the applicability and use of these equations, users should refer to Section 2.5 of the 1996 *SSG* for ingestion, inhalation, and ground water exposures, and Section 3.2 of *RAGS, Part E* for dermal exposures. The specific equations provided in this appendix are:

- **Equations B-1 through B-5.** Screening level equations for combined ingestion and dermal absorption exposures to carcinogenic and non-carcinogenic soil contaminants, including calculation of dermal toxicity values and the age-adjusted dermal factor.

- **Equations B-6 through B-8.** Screening level equations for inhalation of carcinogenic and non-carcinogenic contaminants in fugitive dust, including calculation of the Particulate Emission Factor (PEF).

- **Equations B-9 through B-12.** Screening level equations for inhalation of carcinogenic and non-carcinogenic volatile contaminants, including calculation of the Volatilization Factor (VF) and the chemical-specific soil saturation limits (C_{sat}).

- **Equations B-13 through B-17.** Screening level equations for ingestion of contaminants in ground water, including calculation of chemical-specific dilution attenuation factors, site-specific mixing-zone depth, and mass limit volatilization factors.

Equation B-1
Screening Level Equation for Combined Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil - Residential Scenario

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365\,d/yr}{(EF \times 10^{-6} kg/mg)[(SF_o \times IF_{soil/adj}) + (SF_{ABS} \times SFS \times ABS_d \times EV)]}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (years)	70
EF/exposure frequency (days/year)	350
SF_{ABS}/dermally adjusted cancer slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Equation B-3)
SFS/age-adjusted dermal factor (mg-yr/kg-event)	**360 (Equation B-5)**
ABS_d/dermal absorption fraction (unitless)	chemical-specific (Appendix C)
EV/event frequency (events/day)	1
SF_o/oral cancer slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Appendix C)
$IF_{soil/adj}$/age-adjusted soil ingestion factor (mg-yr/kg-d)	114[a]

[a] Calculated per *RAGS, Part B,* Equation 3.

Equation B-2
Screening Level Equation for Combined Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Contaminants in Soil - Residential Scenario

$$\text{Screening Level (mg/kg)} = \frac{THQ \times BW \times AT \times 365\,d/yr}{(EF \times ED \times 10^{-6} kg/mg)\left[\left(\frac{1}{RfD_o} \times IR\right) + \left(\frac{1}{RfD_{ABS}} \times AF \times ABS_d \times EV \times SA\right)\right]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
BW/body weight (kg)	15
AT/averaging time (years)	6[a]
EF/exposure frequency (days/year)	350
ED/exposure duration (years)	6
RfD_o/oral reference dose (mg/kg-d)	chemical-specific (Appendix C)
IR/soil ingestion rate (mg/d)	200
RfD_{ABS}/dermally-adjusted reference dose (mg/kg-d)	chemical-specific (Equation B-4)
AF/skin-soil adherence factor (mg/cm^2-event)	**0.2**
ABS_d/dermal absorption factor (unitless)	chemical-specific (Appendix C)
EV/event frequency (events/day)	1
SA/skin surface area exposed-child (cm^2)	**2,800**

[a] For non-carcinogens, averaging time equals to exposure duration.

Equation B-3
Calculation of Dermal Carcinogenic Toxicity Values

$$SF_{ABS} = \frac{SF_O}{ABS_{GI}}$$

Parameter/Definition (units)	Default
SF_{ABS}/dermally adjusted slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific
SF_O/oral slope factor $(mg/kg\text{-}d)^{-1}$	chemical-specific (Appendix C)
ABS_{GI}/gastro-intestinal absorption factor (unitless)	chemical-specific (Appendix C)

Equation B-4
Calculation of Dermal Non-Carcinogenic Toxicity Values

$$RfD_{ABS} = RfD_O \times ABS_{GI}$$

Parameter/Definition (units)	Default
RfD_{ABS}/dermally adjusted reference dose (mg/kg-d)	chemical-specific
RfD_O/oral reference dose (mg/kg-d)	chemical-specific (Appendix C)
ABS_{GI}/gastro-intestinal absorption factor (unitless)	chemical-specific (Appendix C)

Equation B-5
Derivation of the Age-Adjusted Dermal Factor

$$SFS = \left[\frac{SA_{1-6} \times AF_{1-6} \times ED_{1-6}}{BW_{1-6}}\right] + \left[\frac{SA_{7-31} \times AF_{7-31} \times ED_{7-31}}{BW_{7-31}}\right]$$

Parameter/Definition (units)	Default
SFS/age-adjusted dermal factor (mg-yr/kg-event)	360
SA_{1-6}/skin surface area exposed-child (cm2)	**2,800**
SA_{7-31}/skin surface area exposed-adult (cm2)	**5,700**
AF_{1-6}/skin-soil adherence factor-child (mg/cm2 - event)	**0.2**
AF_{7-31}/skin-soil adherence factor-adult (mg/cm2 - event)	**0.07**
ED_{1-6}/exposure duration-child (years)	6
ED_{7-31}/exposure duration-adult (years)	24
BW_{1-6}/body weight-child (kg)	15
BW_{7-31}/body weight-adult (kg)	70

Equation B-6
Screening Level Equation for Inhalation of Carcinogenic Fugitive Dusts - Residential Scenario

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365\,d/yr}{URF \times 1{,}000\,\mu g/mg \times EF \times ED \times \frac{1}{PEF}}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (yr)	70
URF/inhalation unit risk factor $(\mu g/m^3)^{-1}$	chemical-specific (Appendix C)
EF/exposure frequency (d/yr)	350
ED/exposure duration (yr)	30
PEF/particulate emission factor (m^3/kg)	**1.36×10^9 (Equation B-8)**

Equation B-7
Screening Level Equation for Inhalation of Non-carcinogenic Fugitive Dusts - Residential Scenario

$$\text{Screening Level (mg/kg)} = \frac{THQ \times AT \times 365\,d/yr}{EF \times ED \times [\frac{1}{RfC} \times \frac{1}{PEF}]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (yr)	30[a]
EF/exposure frequency (d/yr)	350
ED/exposure duration (yr)	30
RfC/inhalation reference concentration (mg/m^3)	chemical-specific (Appendix C)
PEF/particulate emission factor (m^3/kg)	**1.36×10^9 (Equation B-8)**

[a] For non-carcinogens, averaging time equals exposure duration.

Equation B-8
Derivation of the Particulate Emission Factor
- Residential Scenario

$$PEF = Q/C_{wind} \times \frac{3{,}600 s/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$$

Parameter/Definition (units)	Default
PEF/particulate emission factor (m^3/kg)	1.36×10^9
Q/C_{wind}/inverse of the ratio of the geometric mean air concentration to the emission flux at center of a square source (g/m^2-s per kg/m^3)	**93.77[a]**
V/fraction of vegetative cover (unitless)	**0.5 (50%)**
U_m/mean annual windspeed (m/s)	**4.69**
U_t/equivalent threshold value of windspeed at 7m (m/s)	**11.32**
F(x)/function dependent on U_m/U_t derived using Cowherd et al. (1985) (unitless)	**0.194**

[a] Assumes as 0.5 acre source; for site-specific values, consult Appendix D.

Equation B-9
Screening Level Equation for Inhalation of Carcinogenic Volatile Contaminants in Soil
- Residential Scenario

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365 d/yr}{URF \times 1{,}000 \mu g/mg \times EF \times ED \times \frac{1}{VF}}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
AT/averaging time (yr)	70
URF/inhalation unit risk factor $(\mu g/m^3)^{-1}$	chemical-specific (Appendix C)
EF/exposure frequency (d/yr)	350
ED/exposure duration (yr)	30
VF/soil-to-air volatilization factor (m^3/kg)	**chemical-specific (Equation B-11)**

Equation B-10
Screening Level Equation for Inhalation of Non-carcinogenic Volatile Contaminants in Soil - Residential Scenario

$$\text{Screening Level (mg/kg)} = \frac{THQ \times AT \times 365 d/yr}{EF \times ED \times [\frac{1}{RfC} \times \frac{1}{VF}]}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (yr) Outdoor Worker	30[a]
EF/exposure frequency (d/yr)	350
ED/exposure duration (yr)	30
RfC/inhalation reference concentration (mg/m^3)	chemical-specific (Appendix C)
VF/soil-to-air volatilization factor (m^3/kg)	**chemical-specific (Equation B-11)**

[a] For non-carcinogens, averaging time equals exposure duration.

Equation B-11
Derivation of the Volatilization Factor
- Residential Scenario

$$VF = \frac{Q/C_{vol} \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4} (m^2/cm^2)}{(2 \times \rho_b \times D_A)}$$

where:

$$D_A = \frac{[(\theta_a^{10/3} D_i H' + \theta_w^{10/3} D_w) / n^2]}{\rho_b K_d + \theta_w + \theta_a H'}$$

Parameter/Definition (units)	Default
VF/volatilization factor (m^3/kg)	—
D_A/apparent diffusivity (cm^2/s)	—
Q/C_{vol}/inverse of the geometric mean air concentration to the volatilization flux at the center of a square source (g/m^2-s per kg/m^3)	**68.18[a]**
T/exposure interval (s)	9.5×10^8
ρ_b/dry soil bulk density (g/cm^3)	**1.5**
θ_a/air-filled soil porosity (L_{air}/L_{soil})	$n-\theta_w$
n/total soil porosity (L_{pore}/L_{soil})	$1-(\rho_b/\rho_s)$
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.15**
ρ_s/soil particle density (g/cm^3)	2.65
D_i/diffusivity in air (cm^2/s)	chemical-specific[b]
H'/dimensionless Henry's law constant	chemical-specific[b]
D_w/diffusivity in water (cm^2/s)	chemical-specific[b]
K_d/soil-water partition coefficient (cm^3/g)	organics = $K_{oc} \times f_{oc}$ inorganics = see Appendix C[c]
K_{oc}/soil organic carbon partition coefficient (cm^3/g)	chemical-specific[b]
f_{oc}/fraction organic carbon in soil (g/g)	**0.006 (0.6%)**

[a] Assumes a 0.5 acre source; for site-specific values, consult Appendix D.
[b] See Appendix C.
[c] Assume a pH of 6.8 when selecting default K_d values for metals.

Equation B-12
Derivation of the Soil Saturation Limit

$$C_{sat} = \frac{S}{\rho_b}(K_d\rho_b + \theta_w + H'\,\theta_a)$$

Parameter/Definition (units)	Default
C_{sat}/soil saturation concentration (mg/kg)	–
S/solubility in water (mg/L-water)	chemical-specific[a]
ρ_b/dry soil bulk density (kg/L)	**1.5**
K_d/soil-water partition coefficient (L/kg)	organics = $K_{oc} \times f_{oc}$ inorganics = see Appendix C[b]
K_{oc}/organic carbon partition coefficient (L/kg)	chemical-specific[a]
f_{oc}/fraction organic carbon in soil (g/g)	**0.006 (0.6%)**
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.15**
H'/dimensionless Henry's law constant	chemical-specific[a]
θ_a/air-filled soil porosity (L_{air}/L_{soil})	$n - \theta_w$
n/total soil porosity (L_{pore}/L_{soil})	$1 - (\rho_b/\rho_s)$
ρ_s/soil particle density (kg/L)	2.65

[a] See Appendix C.
[b] Assume a pH of 6.8 when selecting default K_d values for metals.

Equation B-13
Soil Screening Level Partitioning Equation for Migration to Ground Water

$$\text{Screening Level in Soil (mg/kg)} = C_w \left[K_D + \frac{(\theta_w + \theta_a H')}{\rho_b} \right]$$

Parameter/Definition (units)	Default
C_w/target soil leachate concentration (mg/L)	(nonzero MCLG, MCL, or HBL)[a] × dilution factor
K_d/soil-water partition coefficient (L/kg)	organics = $K_{oc} \times f_{oc}$ inorganics = see Appendix C[b]
K_{oc}/soil organic carbon/water partition coefficient (L/kg)	chemical-specific[c]
f_{oc}/fraction organic carbon in soil (g/g)	**0.002 (0.2%)**
θ_w/water-filled soil porosity (L_{water}/L_{soil})	**0.3**
θ_a/air-filled soil porosity (L_{air}/L_{soil})	$n - \theta_w$
ρ_b/dry soil bulk density (kg/L)	**1.5**
n/soil porosity (L_{pore}/L_{soil})	$1 - (\rho_b/\rho_s)$
ρ_s/soil particle density (kg/L)	2.65
H′/dimensionless Henry's law constant	chemical-specific[c] (assume to be zero for inorganic contaminants except mercury)

[a] Chemical-specific (see Appendix C).
[b] Assume a pH of 6.8 when selecting default K_d values for metals.
[c] See Appendix C.

Equation B-14
Derivation of Dilution Attenuation Factor

$$\text{Dilution Attenuation Factor (DAF)} = 1 + \frac{K \times i \times d}{I \times L}$$

Parameter/Definition (units)	Default
DAF/dilution attenuation factor (unitless)	20 or 1 (0.5-acre source)
K/aquifer hydraulic conductivity (m/yr)	Site-specific
i/hydraulic gradient (m/m)	Site-specific
I/infiltration rate (m/yr)	Site-specific
d/mixing zone depth (m)	Site-specific
L/source length parallel to ground water flow (m)	Site-specific

Equation B-15
Estimation of Mixing Zone Depth

$$d = (0.0112L^2)^{0.5} + d_a(1 - \exp[(-L \times I)/(K \times i \times d_a)])$$

Parameter/Definition (units)	Default
d/mixing zone depth (m)	Site-specific
L/source length parallel to ground water flow (m)	Site-specific
I/infiltration rate (m/yr)	Site-specific
K/aquifer hydraulic conductivity (m/yr)	Site-specific
i/hydraulic gradient (m/m)	Site-specific
d_a/aquifer thickness (m)	Site-specific

Equation B-16
Mass-Limit Volatilization Factor - Residential Scenario

$$VF = Q/C_{vol} \times \frac{[T \times (3.15 \times 10^7 s/yr)]}{(\rho_b \times d_s \times 10^6 g/Mg)}$$

Parameter/Definition (units)	Default
d_s/average source depth (m)	**site-specific**
T/exposure interval (yr)	30
Q/C_{vol}/inverse of the geometric mean air concentration to the volatilization flux at the center of a square source (g/m^2-s per kg/m^3)	**68.18[a]**
ρ_b/dry soil bulk density (kg/L or Mg/m^3)	**1.5**

[a] Assumes a 0.5 acre source; for site-specific values, consult Appendix D.

Equation B-17
Mass-Limit Soil Screening Level for Migration to Ground Water

$$\text{Screening Level in Soil (mg/kg)} = \frac{(C_w \times I \times ED)}{\rho_b \times d_s}$$

Parameter/Definition (units)	Default
C_w/target soil leachate concentration (mg/L)	(nonzero MCLG, MCL, or HBL)[a] × dilution factor
d_s/depth of source (m)	**site-specific**
I/infiltration rate (m/yr)	**0.18**
ED/exposure duration (yr)	70
ρ_b/dry soil bulk density (kg/L)	**1.5**

[a] Chemical-specific, see Appendix C.

APPENDIX C

Chemical Properties and Regulatory/Human Health Benchmarks for SSL Calculations

This appendix provides the chemical properties and regulatory and human health benchmarks necessary to calculate SSLs for 109 chemicals commonly found at NPL sites. It consists of the following exhibits:

- Exhibit C-1 provides chemical-specific organic carbon-water partition coefficients (K_{oc}), air and water diffusivities (D_a and D_w), water solubilities (S), and dimensionless Henry's law constants (H').

- Exhibit C-2 provides pH-specific K_{oc} values for 10 organic contaminants that ionize under natural pH conditions. Site-specific soil pH measurements (see EPA's 1996 *SSG*, Section 2.3.5) can be used to select appropriate K_{oc} values for these contaminants. Where site-specific soil pH values are not available, values corresponding to a pH of 6.8 should be used. Note that K_{oc} values presented in Exhibit C-1 for these contaminants are based on a default pH of 6.8).

- Exhibit C-3 provides the physical state (liquid or solid) for organic contaminants. This information is needed to apply and interpret soil saturation limit (C_{sat}) results when calculating SSLs for the inhalation of volatiles in outdoor air pathway.

- Exhibit C-4 provides pH-specific soil-water partition coefficients (K_d) for metals. Site-specific soil pH measurements (see 1996 *SSG*, Section 2.3.5) can be used to select appropriate K_d values for these metals. Where site-specific soil pH values are not available, values corresponding to a pH of 6.8 should be used.

- Exhibit C-5 provides chemical-specific regulatory and human health benchmarks for organic and inorganic contaminants. The chemical-specific Maximum Contaminant Level Goal (MCLG), Maximum Contaminant Level (MCL), Water Health Based Limit (HBL), Cancer Slope Factor (CSF), Unit Risk Factor (URF), Reference Dose (RfD), and Reference Concentration (RfC) values presented in this exhibit are used as inputs in the SSL equations in Sections 3, 4, and 5 of this document.

- Exhibit C-6 presents chemical-specific absorption percentages for dermal contact (ABS_d) for all contaminants for which this pathway is relevant. The values presented represent the average dermal absorption values across a range of soil types, loading rates, and chemical concentrations for these contaminants.

- Exhibit C-7 provides gastrointestinal absorption factors (ABS_{GI}) for contaminants of concern for the dermal pathway. These values are used for route-to-route extrapolation of toxicity values. Specifically, these factors are used to adjust the oral reference dose (RfD) and cancer slope factor (SF) for a contaminant, which is based

on administered dose, to more accurately reflect the dermal dose, which is an absorbed dose. Where there is greater than 50 percent gastrointestinal absorption (e.g., ABS_{GI}>.5), no adjustment is made.

With the exception of values for air diffusivity (D_a), water diffusivity (D_w), and certain K_{oc} values, all of the chemical properties used to calculate SSLs are also reported in the Superfund Chemical Data Matrix (SCDM). Water and air diffusivities were obtained from EPA's CHEMDAT8 and WATER8 models. For more information on the derivation of K_{oc} values, or for a more detailed discussion of the chemical properties presented in Exhibits C-1 through C-4, please refer to the *Technical Background Document* for the 1996 *Soil Screening Guidance* (*SSG*).[1]

The sources for the regulatory and human health benchmarks include the list of National Primary Drinking Water Regulations (NPDWRs), maintained by EPA's Office of Ground Water and Drinking Water, and EPA's *Integrated Risk Information System* (IRIS).[2] The full list of sources for the regulatory and chronic human health benchmarks is presented at the end of Exhibit C-5. Chemical-specific dermal and gastro-intestinal absorption fractions for the dermal contact pathway were obtained from EPA's *RAGS, Part E, Supplemental Guidance for Dermal Risk Assessment* (U.S. EPA, 2001).

All of the sources of the values listed in Exhibits C-1 through C-5 are regularly updated by EPA. In addition, the information in Exhibits C-6 and C-7 was obtained from *RAGS, Part E*. Therefore, prior to calculating SSLs for a site, regulatory/health benchmarks and chemical properties should be checked against the most recent versions of the appropriate sources to ensure that they are up to date. These sources may also be useful for identifying properties and benchmarks for additional contaminants of concern not included in this appendix. Several of these sources are available on-line at the following EPA web sites:

IRIS:	http://www.epa.gov/iriswebp/iris/index.html
NPDWRs:	http://www.epa.gov/safewater/mcl.html
SCDM:	http://www.epa.gov/superfund/resources/scdm/index.htm
CHEMDAT8:	http://www.epa.gov/ttn/chief/index.html
WATER8:	http://www.epa.gov/ttn/chief/index.html

[1] The K_{oc} value for 2,4-Dichlorophenoxyacetic acid was estimated using information from the *1996 Technical Background Document* and the *Chemical Database for HWIR99* (U.S. EPA, 1999) along with the Office of Solid Waste's Multimedia, Multipathway, and Multireceptor (3MRA) Assessment Model (U.S. EPA, 2001, Version 1.01).

[2] The National Primary Drinking Water Regulations can be found at www.epa.gov/safewater/mcl.html. Human health benchmarks are available through EPA's IRIS system which can be found at www.epa.gov/iris.

Exhibit C-1

CHEMICAL-SPECIFIC PROPERTIES USED IN SSL CALCULATIONS

CAS No.	Compound	K_{oc} (L/kg)	D_i (cm^2/s)	D_w (cm^2/s)	S (mg/L)	H' (dimensionless)
83-32-9	Acenaphthene	7.08E+03	4.21E-02	7.69E-06	4.24E+00	6.36E-03
67-64-1	Acetone	5.75E-01	1.24E-01	1.14E-05	1.00E+06	1.59E-03
309-00-2	Aldrin	2.45E+06	1.32E-02	4.86E-06	1.80E-01	6.97E-03
120-12-7	Anthracene	2.95E+04	3.24E-02	7.74E-06	4.34E-02	2.67E-03
56-55-3	Benz(*a*)anthracene	3.98E+05	5.10E-02	9.00E-06	9.40E-03	1.37E-04
71-43-2	Benzene	5.89E+01	8.80E-02	9.80E-06	1.75E+03	2.28E-01
205-99-2	Benzo(*b*)fluoranthene	1.23E+06	2.26E-02	5.56E-06	1.50E-03	4.55E-03
207-08-9	Benzo(*k*)fluoranthene	1.23E+06	2.26E-02	5.56E-06	8.00E-04	3.40E-05
65-85-0	Benzoic acid	5.76E-01	5.36E-02	7.97E-06	3.50E+03	6.31E-05
50-32-8	Benzo(*a*)pyrene	1.02E+06	4.30E-02	9.00E-06	1.62E-03	4.63E-05
111-44-4	Bis(2-chloroethyl)ether	1.55E+01	6.92E-02	7.53E-06	1.72E+04	7.38E-04
117-81-7	Bis(2-ethylhexyl)phthalate	1.51E+07	3.51E-02	3.66E-06	3.40E-01	4.18E-06
75-27-4	Bromodichloromethane	5.50E+01	2.98E-02	1.06E-05	6.74E+03	6.56E-02
75-25-2	Bromoform	8.71E+01	1.49E-02	1.03E-05	3.10E+03	2.19E-02
71-36-3	Butanol	6.92E+00	8.00E-02	9.30E-06	7.40E+04	3.61E-04
85-68-7	Butyl benzyl phthalate	5.75E+04	1.74E-02	4.83E-06	2.69E+00	5.17E-05
86-74-8	Carbazole	3.39E+03	3.90E-02	7.03E-06	7.48E+00	6.26E-07
75-15-0	Carbon disulfide	4.57E+01	1.04E-01	1.00E-05	1.19E+03	1.24E+00
56-23-5	Carbon tetrachloride	1.74E+02	7.80E-02	8.80E-06	7.93E+02	1.25E+00
57-74-9	Chlordane	1.20E+05	1.18E-02	4.37E-06	5.60E-02	1.99E-03
106-47-8	*p*-Chloroaniline	6.61E+01	4.83E-02	1.01E-05	5.30E+03	1.36E-05
108-90-7	Chlorobenzene	2.19E+02	7.30E-02	8.70E-06	4.72E+02	1.52E-01
124-48-1	Chlorodibromomethane	6.31E+01	1.96E-02	1.05E-05	2.60E+03	3.21E-02
67-66-3	Chloroform	3.98E+01	1.04E-01	1.00E-05	7.92E+03	1.50E-01
95-57-8	2-Chlorophenol	3.88E+02	5.01E-02	9.46E-06	2.20E+04	1.60E-02
218-01-9	Chrysene	3.98E+05	2.48E-02	6.21E-06	1.60E-03	3.88E-03
72-54-8	DDD	1.00E+06	1.69E-02	4.76E-06	9.00E-02	1.64E-04
72-55-9	DDE	4.47E+06	1.44E-02	5.87E-06	1.20E-01	8.61E-04
50-29-3	DDT	2.63E+06	1.37E-02	4.95E-06	2.50E-02	3.32E-04
53-70-3	Dibenz(*a,h*)anthracene	3.80E+06	2.02E-02	5.18E-06	2.49E-03	6.03E-07
84-74-2	Di-*n*-butyl phthalate	3.39E+04	4.38E-02	7.86E-06	1.12E+01	3.85E-08
95-50-1	1,2-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	1.56E+02	7.79E-02
106-46-7	1,4-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	7.38E+01	9.96E-02
91-94-1	3,3-Dichlorobenzidine	7.24E+02	1.94E-02	6.74E-06	3.11E+00	1.64E-07
75-34-3	1,1-Dichloroethane	3.16E+01	7.42E-02	1.05E-05	5.06E+03	2.30E-01
107-06-2	1,2-Dichloroethane	1.74E+01	1.04E-01	9.90E-06	8.52E+03	4.01E-02
75-35-4	1,1-Dichloroethylene	5.89E+01	9.00E-02	1.04E-05	2.25E+03	1.07E+00
156-59-2	*cis*-1,2-Dichloroethylene	3.55E+01	7.36E-02	1.13E-05	3.50E+03	1.67E-01
156-60-5	*trans*-1,2-Dichloroethylene	5.25E+01	7.07E-02	1.19E-05	6.30E+03	3.85E-01
120-83-2	2,4-Dichlorophenol	1.47E+02	3.46E-02	8.77E-06	4.50E+03	1.30E-04
94-75-7	2,4-Dichlorophenoxyacetic acid	2.62E+01	2.31E-02	7.31E-06	6.80E+02	4.10E-07
78-87-5	1,2-Dichloropropane	4.37E+01	7.82E-02	8.73E-06	2.80E+03	1.15E-01
542-75-6	1,3-Dichloropropene	4.57E+01	6.26E-02	1.00E-05	2.80E+03	7.26E-01
60-57-1	Dieldrin	2.14E+04	1.25E-02	4.74E-06	1.95E-01	6.19E-04
84-66-2	Diethylphthalate	2.88E+02	2.56E-02	6.35E-06	1.08E+03	1.85E-05
105-67-9	2,4-Dimethylphenol	2.09E+02	5.84E-02	8.69E-06	7.87E+03	8.20E-05
51-28-5	2,4-Dinitrophenol	1.02E-02	2.73E-02	9.06E-06	2.79E+03	1.82E-05
121-14-2	2,4-Dinitrotoluene	9.55E+01	2.03E-01	7.06E-06	2.70E+02	3.80E-06
117-84-0	Di-*n*-octyl phthalate	8.32E+07	1.51E-02	3.58E-06	2.00E-02	2.74E-03

Exhibit-C-1 (continued)

CHEMICAL-SPECIFIC PROPERTIES USED IN SSL CALCULATIONS

CAS No.	Compound	K_{oc} (L/kg)	D_i (cm^2/s)	D_w (cm^2/s)	S (mg/L)	H' (dimensionless)
115-29-7	Endosulfan	2.14E+03	1.15E-02	4.55E-06	5.10E-01	4.59E-04
72-20-8	Endrin	1.23E+04	1.25E-02	4.74E-06	2.50E-01	3.08E-04
100-41-4	Ethylbenzene	3.63E+02	7.50E-02	7.80E-06	1.69E+02	3.23E-01
206-44-0	Fluoranthene	1.07E+05	3.02E-02	6.35E-06	2.06E-01	6.60E-04
86-73-7	Fluorene	1.38E+04	3.63E-02	7.88E-06	1.98E+00	2.61E-03
76-44-8	Heptachlor	1.41E+06	1.12E-02	5.69E-06	1.80E-01	4.47E-02
1024-57-3	Heptachlor epoxide	8.32E+04	1.32E-02	4.23E-06	2.00E-01	3.90E-04
118-74-1	Hexachlorobenzene	5.50E+04	5.42E-02	5.91E-06	6.20E+00	5.41E-02
87-68-3	Hexachloro-1,3-butadiene	5.37E+04	5.61E-02	6.16E-06	3.23E+00	3.34E-01
319-84-6	α-HCH (α-BHC)	1.23E+03	1.42E-02	7.34E-06	2.00E+00	4.35E-04
319-85-7	β-HCH (β-BHC)	1.26E+03	1.42E-02	7.34E-06	2.40E-01	3.05E-05
58-89-9	γ-HCH (Lindane)	1.07E+03	1.42E-02	7.34E-06	6.80E+00	5.74E-04
77-47-4	Hexachlorocyclopentadiene	2.00E+05	1.61E-02	7.21E-06	1.80E+00	1.11E+00
67-72-1	Hexachloroethane	1.78E+03	2.50E-03	6.80E-06	5.00E+01	1.59E-01
193-39-5	Indeno(1,2,3-*cd*)pyrene	3.47E+06	1.90E-02	5.66E-06	2.20E-05	6.56E-05
78-59-1	Isophorone	4.68E+01	6.23E-02	6.76E-06	1.20E+04	2.72E-04
7439-97-6	Mercury	—	3.07E-02	6.30E-06	—	4.67E-01
72-43-5	Methoxychlor	9.77E+04	1.56E-02	4.46E-06	4.50E-02	6.48E-04
74-83-9	Methyl bromide	1.05E+01	7.28E-02	1.21E-05	1.52E+04	2.56E-01
75-09-2	Methylene chloride	1.17E+01	1.01E-01	1.17E-05	1.30E+04	8.98E-02
95-48-7	2-Methylphenol	9.12E+01	7.40E-02	8.30E-06	2.60E+04	4.92E-05
91-20-3	Naphthalene	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02
98-95-3	Nitrobenzene	6.46E+01	7.60E-02	8.60E-06	2.09E+03	9.84E-04
86-30-6	*N*-Nitrosodiphenylamine	1.29E+03	3.12E-02	6.35E-06	3.51E+01	2.05E-04
621-64-7	*N*-Nitrosodi-*n*-propylamine	2.40E+01	5.45E-02	8.17E-06	9.89E+03	9.23E-05
87-86-5	Pentachlorophenol	5.92E+02	5.60E-02	6.10E-06	1.95E+03	1.00E-06
108-95-2	Phenol	2.88E+01	8.20E-02	9.10E-06	8.28E+04	1.63E-05
129-00-0	Pyrene	1.05E+05	2.72E-02	7.24E-06	1.35E-01	4.51E-04
100-42-5	Styrene	7.76E+02	7.10E-02	8.00E-06	3.10E+02	1.13E-01
79-34-5	1,1,2,2-Tetrachloroethane	9.33E+01	7.10E-02	7.90E-06	2.97E+03	1.41E-02
127-18-4	Tetrachloroethylene	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01
108-88-3	Toluene	1.82E+02	8.70E-02	8.60E-06	5.26E+02	2.72E-01
8001-35-2	Toxaphene	2.57E+05	1.16E-02	4.34E-06	7.40E-01	2.46E-04
120-82-1	1,2,4-Trichlorobenzene	1.78E+03	3.00E-02	8.23E-06	3.00E+02	5.82E-02
71-55-6	1,1,1-Trichloroethane	1.10E+02	7.80E-02	8.80E-06	1.33E+03	7.05E-01
79-00-5	1,1,2-Trichloroethane	5.01E+01	7.80E-02	8.80E-06	4.42E+03	3.74E-02
79-01-6	Trichloroethylene	1.66E+02	7.90E-02	9.10E-06	1.10E+03	4.22E-01
95-95-4	2,4,5-Trichlorophenol	1.60E+03	2.91E-02	7.03E-06	1.20E+03	1.78E-04
88-06-2	2,4,6-Trichlorophenol	3.81E+02	3.18E-02	6.25E-06	8.00E+02	3.19E-04
108-05-4	Vinyl acetate	5.25E+00	8.50E-02	9.20E-06	2.00E+04	2.10E-02
75-01-4	Vinyl chloride	1.86E+01	1.06E-01	1.23E-05	2.76E+03	1.11E+00
108-38-3	*m*-Xylene	4.07E+02	7.00E-02	7.80E-06	1.61E+02	3.01E-01
95-47-6	*o*-Xylene	3.63E+02	8.70E-02	1.00E-05	1.78E+02	2.13E-01
106-42-3	*p*-Xylene	3.89E+02	7.69E-02	8.44E-06	1.85E+02	3.14E-01

K_{oc} = Organic carbon partition coefficient.
D_i = Diffusivity in air (25°C).
D_w = Diffusivity in water (25°C).
S = Solubility in water (20-25°C).
H' = Dimensionless Henry's Law Constant (HLC [atm-m^3/mol] * 41) (25° C).

Exhibit C-2

K_{oc} VALUES FOR IONIZING ORGANICS AS A FUNCTION OF pH

pH	Benzoic Acid	2-Chloro-phenol	2,4-Dichloro-phenoxy-acetic acid	2,4-Dichloro-phenol	2,4-Dinitro-phenol	Penta-chloro-phenol	2,3,4,5-Tetrachloro-phenol	2,4,6-Tetrachloro-phenol	2,4,5-Trichloro-phenol	2,4,6-Trichloro-phenol
4.9	5.54E+00	3.98E+02	6.53E+01	1.59E+02	2.94E-02	9.05E+03	1.73E+04	4.45E+03	2.37E+03	1.04E+03
5.0	4.64E+00	3.98E+02	5.72E+01	1.59E+02	2.55E-02	7.96E+03	1.72E+04	4.15E+03	2.36E+03	1.03E+03
5.1	3.88E+00	3.98E+02	5.08E+01	1.59E+02	2.23E-02	6.93E+03	1.70E+04	3.83E+03	2.36E+03	1.02E+03
5.2	3.25E+00	3.98E+02	4.57E+01	1.59E+02	1.98E-02	5.97E+03	1.67E+04	3.49E+03	2.35E+03	1.01E+03
5.3	2.72E+00	3.98E+02	4.16E+01	1.59E+02	1.78E-02	5.10E+03	1.65E+04	3.14E+03	2.34E+03	9.99E+02
5.4	2.29E+00	3.98E+02	3.83E+01	1.58E+02	1.62E-02	4.32E+03	1.61E+04	2.79E+03	2.33E+03	9.82E+02
5.5	1.94E+00	3.97E+02	3.57E+01	1.58E+02	1.50E-02	3.65E+03	1.57E+04	2.45E+03	2.32E+03	9.62E+02
5.6	1.65E+00	3.97E+02	3.37E+01	1.58E+02	1.40E-02	3.07E+03	1.52E+04	2.13E+03	2.31E+03	9.38E+02
5.7	1.42E+00	3.97E+02	3.20E+01	1.58E+02	1.32E-02	2.58E+03	1.47E+04	1.83E+03	2.29E+03	9.10E+02
5.8	1.24E+00	3.97E+02	3.07E+01	1.58E+02	1.25E-02	2.18E+03	1.40E+04	1.56E+03	2.27E+03	8.77E+02
5.9	1.09E+00	3.97E+02	2.97E+01	1.57E+02	1.20E-02	1.84E+03	1.32E+04	1.32E+03	2.24E+03	8.39E+02
6.0	9.69E-01	3.96E+02	2.89E+01	1.57E+02	1.16E-02	1.56E+03	1.24E+04	1.11E+03	2.21E+03	7.96E+02
6.1	8.75E-01	3.96E+02	2.82E+01	1.57E+02	1.13E-02	1.33E+03	1.15E+04	9.27E+02	2.17E+03	7.48E+02
6.2	7.99E-01	3.96E+02	2.77E+01	1.56E+02	1.10E-02	1.15E+03	1.05E+04	7.75E+02	2.12E+03	6.97E+02
6.3	7.36E-01	3.95E+02	2.73E+01	1.55E+02	1.08E-02	9.98E+02	9.51E+03	6.47E+02	2.06E+03	6.44E+02
6.4	6.89E-01	3.94E+02	2.69E+01	1.54E+02	1.06E-02	8.77E+02	8.48E+03	5.42E+02	1.99E+03	5.89E+02
6.5	6.51E-01	3.93E+02	2.67E+01	1.53E+02	1.05E-02	7.81E+02	7.47E+03	4.55E+02	1.91E+03	5.33E+02
6.6	6.20E-01	3.92E+02	2.65E+01	1.52E+02	1.04E-02	7.03E+02	6.49E+03	3.84E+02	1.82E+03	4.80E+02
6.7	5.95E-01	3.90E+02	2.63E+01	1.50E+02	1.03E-02	6.40E+02	5.58E+03	3.27E+02	1.71E+03	4.29E+02
6.8	5.76E-01	3.88E+02	2.62E+01	1.47E+02	1.02E-02	5.92E+02	4.74E+03	2.80E+02	1.60E+03	3.81E+02
6.9	5.60E-01	3.86E+02	2.61E+01	1.45E+02	1.02E-02	5.52E+02	3.99E+03	2.42E+02	1.47E+03	3.38E+02
7.0	5.47E-01	3.83E+02	2.60E+01	1.41E+02	1.02E-02	5.21E+02	3.33E+03	2.13E+02	1.34E+03	3.00E+02
7.1	5.38E-01	3.79E+02	2.59E+01	1.38E+02	1.02E-02	4.96E+02	2.76E+03	1.88E+02	1.21E+03	2.67E+02
7.2	5.32E-01	3.75E+02	2.59E+01	1.33E+02	1.01E-02	4.76E+02	2.28E+03	1.69E+02	1.07E+03	2.39E+02
7.3	5.25E-01	3.69E+02	2.58E+01	1.28E+02	1.01E-02	4.61E+02	1.87E+03	1.53E+02	9.43E+02	2.15E+02
7.4	5.19E-01	3.62E+02	2.58E+01	1.21E+02	1.01E-02	4.47E+02	1.53E+03	1.41E+02	8.19E+02	1.95E+02
7.5	5.16E-01	3.54E+02	2.58E+01	1.14E+02	1.01E-02	4.37E+02	1.25E+03	1.31E+02	7.03E+02	1.78E+02
7.6	5.13E-01	3.44E+02	2.57E+01	1.07E+02	1.01E-02	4.29E+02	1.02E+03	1.23E+02	5.99E+02	1.64E+02
7.7	5.09E-01	3.33E+02	2.57E+01	9.84E+01	1.00E-02	4.23E+02	8.31E+02	1.17E+02	5.07E+02	1.53E+02
7.8	5.06E-01	3.19E+02	2.57E+01	8.97E+01	1.00E-02	4.18E+02	6.79E+02	1.13E+02	4.26E+02	1.44E+02
7.9	5.06E-01	3.04E+02	2.57E+01	8.07E+01	1.00E-02	4.14E+02	5.56E+02	1.08E+02	3.57E+02	1.37E+02
8.0	5.06E-01	2.86E+02	2.57E+01	7.17E+01	1.00E-02	4.10E+02	4.58E+02	1.05E+02	2.98E+02	1.31E+02

Exhibit C-3 PHYSICAL STATE OF ORGANIC CHEMICALS AT TYPICAL SOIL TEMPERATURES					
Compounds Present in Liquid Phase			Compounds Present in Solid Phase		
CAS No.	Chemical	Melting Point (°C)	CAS No.	Chemical	Melting Point (°C)
67-64-1	Acetone	-94.8	83-32-9	Acenaphthene	93.4
71-43-2	Benzene	5.5	309-00-2	Aldrin	104
117-81-7	Bis(2-ethylhexyl)phthalate	-55	120-12-7	Anthracene	215
111-44-4	Bis(2-chloroethyl)ether	-51.9	56-55-3	Benz(*a*)anthracene	84
75-27-4	Bromodichloromethane	-57	50-32-8	Benzo(*b*)pyrene	176.5
75-25-2	Bromoform	8	205-99-2	Benzo(*b*)fluoranthene	168
71-36-3	Butanol	-89.8	207-08-9	Benzo(*k*)fluoranthene	217
85-68-7	Butyl benzyl phthalate	-35	65-85-0	Benzoic acid	122.4
75-15-0	Carbon disulfide	-115	86-74-8	Carbazole	246.2
56-23-5	Carbon tetrachloride	-23	57-74-9	Chlordane	106
108-90-7	Chlorobenzene	-45.2	106-47-8	*p*-Chloroaniline	72.5
124-48-1	Chlorodibromomethane	-20	218-01-9	Chrysene	258.2
67-66-3	Chloroform	-63.6	72-54-8	DDD	109.5
95-57-8	2-Chlorophenol	9.8	72-55-9	DDE	89
84-74-2	Di-*n*-butyl phthalate	-35	50-29-3	DDT	108.5
95-50-1	1,2-Dichlorobenzene	-16.7	53-70-3	Dibenzo(*a*,*h*)anthracene	269.5
75-34-3	1,1-Dichloroethane	-96.9	106-46-7	1,4-Dichlorobenzene	52.7
107-06-2	1,2-Dichloroethane	-35.5	91-94-1	3,3-Dichlorobenzidine	132.5
75-35-4	1,1Dichloroethylene	-122.5	120-83-2	2,4-Dichlorophenol	45
156-59-2	*cis*-1,2-Dichloroethylene	-80	94-75-7	2,4-Dichlorophenoxyacetic acid	140.5
156-60-5	*trans*-1,2-Dichloroethylene	-49.8	60-57-1	Dieldrin	175.5
78-87-5	1,2-Dichloropropane	-70	105-67-9	2,4-Dimethylphenol	24.5
542-75-6	1,3-Dichloropropene	N/A	51-28-5	2,4-Dinitrophenol	115-116
84-66-2	Diethylphthalate	-40.5	121-14-2	2,4-Dinitrotoluene	71
117-84-0	Di-*n*-octyl phthalate	-30	606-20-2	2,6-Dinitrotoluene	66
100-41-4	Ethylbenzene	-94.9	72-20-8	Endrin	200
87-68-3	Hexachloro-1,3-butadiene	-21	115-29-7	Endosulfan	106
77-47-4	Hexachlorocyclopentadiene	-9	206-44-0	Fluoranthene	107.8
78-59-1	Isophorone	-8.1	86-73-7	Fluorene	114.8
74-83-9	Methyl bromide	-93.7	76-44-8	Heptachlor	95.5
75-09-2	Methylene chloride	-95.1	1024-57-3	Heptachlor epoxide	160
98-95-3	Nitrobenzene	5.7	118-74-1	Hexachlorobenzene	231.8
100-42-5	Styrene	-31	319-84-6	α-HCH (α-BHC)	160
79-34-5	1,1,2,2-Tetrachloroethane	-43.8	319-85-7	β-HCH (β-BHC)	315
127-18-4	Tetrachloroethylene	-22.3	58-89-9	γ-HCH (Lindane)	112.5
108-88-3	Toluene	-94.9	67-72-1	Hexachloroethane	187
120-82-1	1,2,4-Trichlorobenzene	17	193-39-5	Indeno(1,2,3-*cd*)pyrene	161.5
71-55-6	1,1,1-Trichloroethane	-30.4	72-43-5	Methoxychlor	87
79-00-5	1,1,2-Trichloroethane	-36.6	95-48-7	2-Methylphenol	29.8
79-01-6	Trichloroethylene	-84.7	621-64-7	*N*-Nitrosodi-*n*-propylamine	N/A
108-05-4	Vinyl acetate	-93.2	86-30-6	*N*-Nitrosodiphenylamine	66.5
75-01-4	Vinyl chloride	-153.7	91-20-3	Naphthalene	80.2
108-38-3	*m*-Xylene	-47.8	87-86-5	Pentachlorophenol	174
95-47-6	*o*-Xylene	-25.2	108-95-2	Phenol	40.9
106-42-3	*p*-Xylene	13.2	129-00-0	Pyrene	151.2
			8001-35-2	Toxaphene	65-90
			95-95-4	2,4,5-Trichlorophenol	69
			88-06-2	2,4,6-Trichlorophenol	69

Exhibit C-4

METAL K_d VALUES (L/kg) AS A FUNCTION OF pH[a]

pH	Arsenic	Barium	Beryllium	Cadmium	Chromium (+III)	Chromium (+VI)	Mercury	Nickel	Silver	Selenium	Thallium	Zinc
4.9	2.5E+01	1.1E+01	2.3E+01	1.5E+01	1.2E+03	3.1E+01	4.0E-02	1.6E+01	1.0E-01	1.8E+01	4.4E+01	1.6E+01
5.0	2.5E+01	1.2E+01	2.6E+01	1.7E+01	1.9E+03	3.1E+01	6.0E-02	1.8E+01	1.3E-01	1.7E+01	4.5E+01	1.8E+01
5.1	2.5E+01	1.4E+01	2.8E+01	1.9E+01	3.0E+03	3.0E+01	9.0E-02	2.0E+01	1.6E-01	1.6E+01	4.6E+01	1.9E+01
5.2	2.6E+01	1.5E+01	3.1E+01	2.1E+01	4.9E+03	2.9E+01	1.4E-01	2.2E+01	2.1E-01	1.5E+01	4.7E+01	2.1E+01
5.3	2.6E+01	1.7E+01	3.5E+01	2.3E+01	8.1E+03	2.8E+01	2.0E-01	2.4E+01	2.6E-01	1.4E+01	4.8E+01	2.3E+01
5.4	2.6E+01	1.9E+01	3.8E+01	2.5E+01	1.3E+04	2.7E+01	3.0E-01	2.6E+01	3.3E-01	1.3E+01	5.0E+01	2.5E+01
5.5	2.6E+01	2.1E+01	4.2E+01	2.7E+01	2.1E+04	2.7E+01	4.6E-01	2.8E+01	4.2E-01	1.2E+01	5.1E+01	2.6E+01
5.6	2.6E+01	2.2E+01	4.7E+01	2.9E+01	3.5E+04	2.6E+01	6.9E-01	3.0E+01	5.3E-01	1.1E+01	5.2E+01	2.8E+01
5.7	2.7E+01	2.4E+01	5.3E+01	3.1E+01	5.5E+04	2.5E+01	1.0E+00	3.2E+01	6.7E-01	1.1E+01	5.4E+01	3.0E+01
5.8	2.7E+01	2.6E+01	6.0E+01	3.3E+01	8.7E+04	2.5E+01	1.6E+00	3.4E+01	8.4E-01	9.8E+00	5.5E+01	3.2E+01
5.9	2.7E+01	2.8E+01	6.9E+01	3.5E+01	1.3E+05	2.4E+01	2.3E+00	3.6E+01	1.1E+00	9.2E+00	5.6E+01	3.4E+01
6.0	2.7E+01	3.0E+01	8.2E+01	3.7E+01	2.0E+05	2.3E+01	3.5E+00	3.8E+01	1.3E+00	8.6E+00	5.8E+01	3.6E+01
6.1	2.7E+01	3.1E+01	9.9E+01	4.0E+01	3.0E+05	2.3E+01	5.1E+00	4.0E+01	1.7E+00	8.0E+00	5.9E+01	3.9E+01
6.2	2.8E+01	3.3E+01	1.2E+02	4.2E+01	4.2E+05	2.2E+01	7.5E+00	4.2E+01	2.1E+00	7.5E+00	6.1E+01	4.2E+01
6.3	2.8E+01	3.5E+01	1.6E+02	4.4E+01	5.8E+05	2.2E+01	1.1E+01	4.5E+01	2.7E+00	7.0E+00	6.2E+01	4.4E+01
6.4	2.8E+01	3.6E+01	2.1E+02	4.8E+01	7.7E+05	2.1E+01	1.6E+01	4.7E+01	3.4E+00	6.5E+00	6.4E+01	4.7E+01
6.5	2.8E+01	3.7E+01	2.8E+02	5.2E+01	9.9E+05	2.0E+01	2.2E+01	5.0E+01	4.2E+00	6.1E+00	6.6E+01	5.1E+01
6.6	2.8E+01	3.9E+01	3.9E+02	5.7E+01	1.2E+06	2.0E+01	3.0E+01	5.4E+01	5.3E+00	5.7E+00	6.7E+01	5.4E+01
6.7	2.9E+01	4.0E+01	5.5E+02	6.4E+01	1.5E+06	1.9E+01	4.0E+01	5.8E+01	6.6E+00	5.3E+00	6.9E+01	5.8E+01
6.8	2.9E+01	4.1E+01	7.9E+02	7.5E+01	1.8E+06	1.9E+01	5.2E+01	6.5E+01	8.3E+00	5.0E+00	7.1E+01	6.2E+01
6.9	2.9E+01	4.2E+01	1.1E+03	9.1E+01	2.1E+06	1.8E+01	6.6E+01	7.4E+01	1.0E+01	4.7E+00	7.3E+01	6.8E+01
7.0	2.9E+01	4.2E+01	1.7E+03	1.1E+02	2.5E+06	1.8E+01	8.2E+01	8.8E+01	1.3E+01	4.3E+00	7.4E+01	7.5E+01
7.1	2.9E+01	4.3E+01	2.5E+03	1.5E+02	2.8E+06	1.7E+01	9.9E+01	1.1E+02	1.6E+01	4.1E+00	7.6E+01	8.3E+01
7.2	3.0E+01	4.4E+01	3.8E+03	2.0E+02	3.1E+06	1.7E+01	1.2E+02	1.4E+02	2.0E+01	3.8E+00	7.8E+01	9.5E+01
7.3	3.0E+01	4.4E+01	5.7E+03	2.8E+02	3.4E+06	1.6E+01	1.3E+02	1.8E+02	2.5E+01	3.5E+00	8.0E+01	1.1E+02
7.4	3.0E+01	4.5E+01	8.6E+03	4.0E+02	3.7E+06	1.6E+01	1.5E+02	2.5E+02	3.1E+01	3.3E+00	8.2E+01	1.3E+02
7.5	3.0E+01	4.6E+01	1.3E+04	5.9E+02	3.9E+06	1.6E+01	1.6E+02	3.5E+02	3.9E+01	3.1E+00	8.5E+01	1.6E+02
7.6	3.1E+01	4.6E+01	2.0E+04	8.7E+02	4.1E+06	1.5E+01	1.7E+02	4.9E+02	4.8E+01	2.9E+00	8.7E+01	1.9E+02
7.7	3.1E+01	4.7E+01	3.0E+04	1.3E+03	4.2E+06	1.5E+01	1.8E+02	7.0E+02	5.9E+01	2.7E+00	8.9E+01	2.4E+02
7.8	3.1E+01	4.9E+01	4.6E+04	1.9E+03	4.3E+06	1.4E+01	1.9E+02	9.9E+02	7.3E+01	2.5E+00	9.1E+01	3.1E+02
7.9	3.1E+01	5.0E+01	6.9E+04	2.9E+03	4.3E+06	1.4E+01	1.9E+02	1.4E+03	8.9E+01	2.4E+00	9.4E+01	4.0E+02
8.0	3.1E+01	5.2E+01	1.0E+05	4.3E+03	4.3E+06	1.4E+01	2.0E+02	1.9E+03	1.1E+02	2.2E+00	9.6E+01	5.3E+02

[a] Non pH-dependent inorganic K_d values for antimony, cyanide, and vanadium are 45, 9.9, and 1,000 (L/kg), respectively.

Exhibit C-5

REGULATORY AND HUMAN HEALTH BENCHMARKS USED TO DEVELOP SSLs

CAS No.	Compound	Maximum Contaminant Level Goal (mg/L)		Maximum Contaminant Level (mg/L)		Water Health Based Limit (mg/L)		Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$			Unit Risk Factor $(\mu g/m^3)^{-1}$			Reference Dose (mg/kg-d)		Reference Concentration (mg/m^3)	
		MCLG (PCMLG)	Ref[a]	MCL (PMCL)	Ref[a]	HBL[b]	Basis[a]	Carc. Class[c]	SF_o	Ref[a]	Carc. Class[c]	URF	Ref[a]	RfD	Ref[a]	RfC	Ref[a]
83-32-9	Acenaphthene					2E+00	RfD							6.0E-02	1		
67-64-1	Acetone (2-Propanone)					4E+00	RfD	D			D			1.0E-01	1		
309-00-2	Aldrin					5E-06	SF_o	B2	1.7E+01	1	B2	4.9E-03	1	3.0E-05	1		
120-12-7	Anthracene					1E+01	RfD	D			D			3.0E-01	1		
7440-36-0	Antimony	6E-03	3	6E-03	3									4.0E-04	1		
7440-38-2	Arsenic			5E-02	3			A	1.5E+00	1	A	4.3E-03	1	3.0E-04	1		
7440-39-3	Barium	2E+00	3	2E+00	3									7.0E-02	1	5.0E-04	2b
56-55-3	Benz(*a*)anthracene					1E-04	SF_o	B2	7.3E-01	4	B2						
71-43-2	Benzene			5E-03	3			A	5.5E-02	1	A	7.8E-06	1				
205-99-2	Benzo(*b*)fluoranthene					1E-04	SF_o	B2	7.3E-01	4	B2						
207-08-9	Benzo(*k*)fluoranthene					1E-03	SF_o	B2	7.3E-02	4	B2						
65-85-0	Benzoic acid					1E+02	RfD							4.0E+00	1		
50-32-8	Benzo(*a*)pyrene			2E-04	3			B2	7.3E+00	1	B2						
7440-41-7	Beryllium	4E-03	3	4E-03	3						B1	2.4E-03	1	2.0E-03	1	2.0E-05	1
111-44-4	Bis(2-chloroethyl)ether					8E-05	SF_o	B2	1.1E+00	1	B2	3.3E-04	1				
117-81-7	Bis(2-ethylhexyl)phthalate			6E-03	3			B2	1.4E-02	1	B2			2.0E-02	1		
75-27-4	Bromodichloromethane			1E-01*	3			B2	6.2E-02	1	B2			2.0E-02	1		
75-25-2	Bromoform (tribromomethane)			1E-01*	3			B2	7.9E-03	1	B2	1.1E-06	1	2.0E-02	1		
71-36-3	Butanol					4E+00	RfD	D			D			1.0E-01	1		
85-68-7	Butyl benzyl phthalate					7E+00	RfD	C			C			2.0E-01	1		
7440-43-9	Cadmium	5E-03	3	5E-03	3						B1	1.8E-03	1	1.0E-03[f]	1		
86-74-8	Carbazole					4E-03	SF_o	B2	2.0E-02	2a							
75-15-0	Carbon disulfide					4E+00	RfD							1.0E-01	1	7.0E-01	1
56-23-5	Carbon tetrachloride			5E-03	3			B2	1.3E-01	1	B2	1.5E-05	1	7.0E-04	1		
57-74-9	Chlordane			2E-03	3			B2	3.5E-01	1	B2	1.0E-04	1	5.0E-04	1	7.0E-04	1
106-47-8	*p*-Chloroaniline					1E-01	RfD							4.0E-03	1		
108-90-7	Chlorobenzene	1E-01	3	1E-01	3			D			D			2.0E-02	1	6.0E-02	5
124-48-1	Chlorodibromomethane	6E-02	3	1E-01*	3			C	8.4E-02	1	C			2.0E-02	1		
67-66-3	Chloroform			1E-01*	3			B2			B2			1.0E-02	1		

* Proposed MCL = 0.08 mg/L, *Drinking Water Regulations and Health Advisories*, U.S. EPA (1995).
[f] Cadmium RfD is based on dietary exposure.

Exhibit C-5 (Continued)

REGULATORY AND HUMAN HEALTH BENCHMARKS USED TO DEVELOP SSLs

CAS No.	Compound	Maximum Contaminant Level Goal (mg/L)		Maximum Contaminant Level (mg/L)		Water Health Based Limit (mg/L)		Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$			Unit Risk Factor $(\mu g/m^3)^{-1}$			Reference Dose (mg/kg-d)		Reference Concentration (mg/m^3)	
		MCLG (PCMLG)	Ref[a]	MCL (PMCL)	Ref[a]	HBL[b]	Basis[a]	Carc. Class[c]	SF_o	Ref[a]	Carc. Class[c]	URF	Ref[a]	RfD	Ref[a]	RfC	Ref[a]
95-57-8	2-Chlorophenol					2E-01	RfD							5.0E-03	1		
7440-47-3	Chromium	1E-01	3	1E-01	3			A			A	1.2E-02	1	3.0E-03	1		
16065-83-1	Chromium (III)					4E+01	RfD							1.5E+00	1		
18540-29-9	Chromium (VI)			1E-01*	3			A			A	1.2E-02	1	3.0E-03	1	1.0E-04‡	1
218-01-9	Chrysene					1E-02	SF_o	B2	7.3E-03	4							
57-12-5	Cyanide (amenable)	2E-01	3	2E-01	3			D			D			2.0E-02	1		
72-54-8	DDD					4E-04	SF_o	B2	2.4E-01	1	B2						
72-55-9	DDE					3E-04	SF_o	B2	3.4E-01	1	B2						
50-29-3	DDT					3E-04	SF_o	B2	3.4E-01	1	B2	9.7E-05	1	5.0E-04	1		
53-70-3	Dibenz(*a,h*)anthracene					1E-05	SF_o	B2	7.3E+00	4	B2						
84-74-2	Di-*n*-butyl phthalate					4E+00	RfD	D			D			1.0E-01	1		
95-50-1	1,2-Dichlorobenzene	6E-01	3	6E-01	3			D			D			9.0E-02	1	2.0E-01	2b
106-46-7	1,4-Dichlorobenzene	7E-02	3	7E-02	3			C	2.4E-02	2a	C					8.0E-01	1
91-94-1	3,3-Dichlorobenzidine					2E-04	SF_o	B2	4.5E-01	1	B2						
75-34-3	1,1-Dichloroethane					4E+00	RfD	C			C			1.0E-01	2a	5.0E-01	2b
107-06-2	1,2-Dichloroethane			5E-03	3			B2	9.1E-02	1	B2	2.6E-05	1				
75-35-4	1,1-Dichloroethylene	7E-03	3	7E-03	3			C			C			5.0E-02	1	2.0E-01	1
156-59-2	*cis*-1,2-Dichloroethylene	7E-02	3	7E-02	3			D			D			1.0E-02	5		
156-60-5	*trans*-1,2-Dichloroethylene	1E-01	3	1E-01	3									2.0E-02	1		
120-83-2	2,4-Dichlorophenol					1E-01	RfD							3.0E-03	1		
94-75-7	2,4-Dichlorophenoxyacetic acid	7E-02	3	7E-02	3									1.0E-02	1		
78-87-5	1,2-Dichloropropane			5E-03	3			B2	6.8E-02	2a	B2					4.0E-03	1
542-75-6	1,3-Dichloropropene					5E-04	SF_o	B2	1.0E-01	1	B2	4.0E-06	1	3.0E-02	1	2.0E-02	1
60-57-1	Dieldrin					5E-06	SF_o	B2	1.6E+01	1	B2	4.6E-03	1	5.0E-05	1		
84-66-2	Diethylphthalate					3E+01	RfD	D			D			8.0E-01	1		
105-67-9	2,4-Dimethylphenol					7E-01	RfD							2.0E-02	1		
51-28-5	2,4-Dinitrophenol					4E-02	RfD							2.0E-03	1		
121-14-2	2,4-Dinitrotoluene†					1E-04	SF_o	B2	6.8E-01	1				2.0E-03	1		
606-20-2	2,6-Dinitrotoluene†					1E-04	SF_o	B2	6.8E-01	1				1.0E-03	2a		
117-84-0	Di-*n*-octyl phthalate					7E-01	RfD							2.0E-02	2a		

* MCL for total chromium is based on Cr (VI) toxicity.
† Cancer Slope Factor is for 2,4-, 2,6-Dinitrotoluene mixture.
‡ RfC for Chromium (VI) is based on exposure to Cr (VI) particulates.

Exhibit C-5 (Continued)

REGULATORY AND HUMAN HEALTH BENCHMARKS USED TO DEVELOP SSLs

CAS No.	Compound	Maximum Contaminant Level Goal (mg/L)		Maximum Contaminant Level (mg/L)		Water Health Based Limit (mg/L)		Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$			Unit Risk Factor $(\mu g/m^3)^{-1}$			Reference Dose (mg/kg-d)		Reference Concentration (mg/m^3)	
		MCLG (PCMLG)	Ref[a]	MCL (PMCL)	Ref[a]	HBL[b]	Basis[a]	Carc. Class[c]	SF_o	Ref[a]	Carc. Class[c]	URF	Ref[a]	RfD	Ref[a]	RfC	Ref[a]
115-29-7	Endosulfan					2E-01	RfD							6.0E-03	1		
72-20-8	Endrin	2E-03	3	2E-03	3			D			D			3.0E-04	1		
100-41-4	Ethylbenzene	7E-01	3	7E-01	3			D			D			1.0E-01	1	1.0E+00	1
206-44-0	Fluoranthene					1E+00	RfD	D			D			4.0E-02	1		
86-73-7	Fluorene					1E+00	RfD	D						4.0E-02	1		
76-44-8	Heptachlor			4E-04	3			B2	4.5E+00	1	B2	1.3E-03	1	5.0E-04	1		
1024-57-3	Heptachlor Epoxide			2E-04	3			B2	9.1E+00	1	B2	2.6E-03	1	1.3E-05	1		
118-74-1	Hexachlorobenzene			1E-03	3			B2	1.6E+00	1	B2	4.6E-04	1	8.0E-04	1		
87-68-3	Hexachloro-1,3-butadiene	1E-03	3			1E-03	SF_o	C	7.8E-02	1	C	2.2E-05	1	2.0E-04	2a		
319-84-6	α-HCH (α-BHC)					1E-05	SF_o	B2	6.3E+00	1	B2	1.8E-03	1				
319-85-7	β-HCH (β-BHC)					5E-05	SF_o	C	1.8E+00	1	C	5.3E-04	1				
58-89-9	γ-HCH (Lindane)	2E-04	3	2E-04	3			B2	1.3E+00	2a	C			3.0E-04	1		
77-47-4	Hexachlorocyclopentadiene	5E-02	3	5E-02	3			D			D			6.0E-03	1	2.0E-04	1
67-72-1	Hexachloroethane					6E-03	SF_o	C	1.4E-02	1	C	4.0E-06	1	1.0E-03	1		
193-39-5	Indeno(1,2,3-*cd*)pyrene					1E-04	SF_o	B2	7.3E-01	4	B2						
78-59-1	Isophorone					9E-02	SF_o	C	9.5E-04	1	C			2.0E-01	1		
7439-97-6	Mercury	2E-03	3	2E-03	3			D			D			3.0E-04*	2a	3.0E-04	1
72-43-5	Methoxychlor	4E-02	3	4E-02	3			D			D			5.0E-03	1		
74-83-9	Methyl bromide					5E-02	RfD	D			D			1.4E-03	1	5.0E-03	1
75-09-2	Methylene chloride			5E-03	3			B2	7.5E-03	1	B2	4.7E-07	1	6.0E-02	1	3.0E+00	2a
95-48-7	2-Methylphenol (*o*-cresol)					2E+00	RfD	C			C			5.0E-02	1		
91-20-3	Naphthalene					1E+00	RfD	C			C			2.0E-02	1	3.0E-03	1
7440-02-0	Nickel					1E-01	HA**	A			A	2.4E-04	1	2.0E-02	1		
98-95-3	Nitrobenzene					2E-02	RfD	D			D			5.0E-04	1	2.0E-03	2b
86-30-6	*N*-Nitrosodiphenylamine					2E-02	SF_o	B2	4.9E-03	1	B2						
621-64-7	*N*-Nitrosodi-*n*-propylamine					1E-05	SF_o	B2	7.0E+00	1	B2						
87-86-5	Pentachlorophenol			1E-03	3			B2	1.2E-01	1	B2			3.0E-02	1		
108-95-2	Phenol					2E+01	RfD	D			D			3.0E-01	1		
129-00-0	Pyrene					1E+00	RfD	D			D			3.0E-02	1		
7782-49-2	Selenium	5E-02	3	5E-02	3			D			D			5.0E-03	1		
7440-22-4	Silver						RfD	D			D			5.0E-03	1		

* RfD is for mercuric chloride (CAS No. 007847-94-7).
** Health advisory for nickel (MCL is currently remanded); EPA Office of Science and Technology, 7/10/95.

Exhibit C-5 (Continued)

REGULATORY AND HUMAN HEALTH BENCHMARKS USED TO DEVELOP SSLs

CAS No.	Compound	Maximum Contaminant Level Goal (mg/L)		Maximum Contaminant Level (mg/L)		Water Health Based Limit (mg/L)		Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$			Unit Risk Factor $(\mu g/m^3)^{-1}$			Reference Dose (mg/kg-d)		Reference Concentration (mg/m^3)	
		MCLG (PCMLG)	Ref[a]	MCL (PMCL)	Ref[a]	HBL[b]	Basis[a]	Carc. Class[c]	SF_o	Ref[a]	Carc. Class[c]	URF	Ref[a]	RfD	Ref[a]	RfC	Ref[a]
100-42-5	Styrene	1E-01	3	1E-01	3									2.0E-01	1	1.0E+00	1
79-34-5	1,1,2,2-Tetrachloroethane					4E-04	SF_o	C	2.0E-01	1	C	5.8E-05	1				
127-18-4	Tetrachloroethylene			5E-03	3				5.4E-01	6		5.9E-06	6	1.0E-02	1		
7440-28-0	Thallium	5E-04	3	2E-03	3									8.0E-05	1		
108-88-3	Toluene	1E+00	3	1E+00	3			D			D			2.0E-01	1	4.0E-01	1
8001-35-2	Toxaphene			3E-03	3			B2	1.1E+00	1	B2	3.2E-04	1				
120-82-1	1,2,4-Trichlorobenzene	7E-02	3	7E-02	3			D			D			1.0E-02	1	2.0E-01	2a
71-55-6	1,1,1-Trichloroethane	2E-01	3	2E-01	3			D			D					2.2E+00	5
79-00-5	1,1,2-Trichloroethane	3E-03	3	5E-03	3			C	5.7E-02	1	C	1.6E-05	1	4.0E-03	1		
79-01-6	Trichloroethylene[f]	zero	3	5E-03	3				4.0E-01*	5		1.1E-04**	5	3.0E-04	5	4.0E-02	5
95-95-4	2,4,5-Trichlorophenol					4E+00	RfD							1.0E-01	1		
88-06-2	2,4,6-Trichlorophenol					8E-03	SF_o	B2	1.1E-02	1	B2	3.1E-06	1				
7440-62-2	Vanadium					3E-01	RfD							7.0E-03	2a		
108-05-4	Vinyl acetate					4E+01	RfD							1.0E+00	2a	2.0E-01	1
75-01-4	Vinyl chloride[d] (chloroethene)			2E-03	3			A	7.2E-01 (Adult) 1.5E+00 (Lifetime)	1 1	A	4.4E-06 (Adult) 8.8E-06 (Lifetime)	1 1	3.0E-03	1	1.0E-01	1
108-38-3	*m*-Xylene[e]	1E+01	3	1E+01	3			D			D			2.0E+00	2a		
95-47-6	*o*-Xylene[e]	1E+01	3	1E+01	3			D			D			2.0E+00	2a		
106-42-3	*p*-Xylene[e]	1E+01	3	1E+01	3			D			D			2.0E+00	1		
7440-66-6	Zinc					1E+01	RfD	D			D			3.0E-01	1		

[f] Health benchmark values are based on NCEA's *Trichloroethylene Health Risk Assessment: Synthesis and Characterization - External Review Draft* (ORD, August, 2001). The trichloroethylene draft risk assessment is still under review. As a result, the health benchmark values are subject to change.

* The cancer slope factor is the upper end of the range given in the risk assessment. This conservative value is appropriate given that the SSL is used for screening purposes.

** The unit risk factor is extrapolated from an upper bound cancer slope factor of 4×10^{-1} per mg/kg-d. This extrapolation is supported by evidence of similar carcinogenic effects via both inhalation and ingestion pathways.

[a] References:

1 = IRIS, U.S. EPA (2002c)
2a = HEAST, U.S. EPA (1997c)
2b = HEAST values from alternative tables, U.S. EPA (1997c)
3 = National Primary Drinking Water Standards, U.S. EPA (2002d)
4 = Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, Office of Health and Environmental Assessment, U.S. EPA (1993)
5 = National Center for Environmental Assessment (NCEA), personal communication (2002)
6 = California EPA, Toxicity Criteria Database, www.oehha.ca.gov/risk/chemicaldb (2002)
Note:OHEA is now part of the National Center for Environmental Assessment (NCEA).

[b] Health Based Limits calculated for 30-year exposure duration, 10^{-6} cancer risk or hazard quotient=1. Assumes an ingestion rate of 2 L / day. RfD = 2 mg/kg-day

[c] Carcinogen Class based on overall weight of evidence for human carcinogenicity:

Group A: human carcinogen
Group B: probable human carcinogen
B1: limited evidence from epidemiologic studies
B2: "sufficient" evidence from animal studies and "inadequate" evidence or "no data" from epidemiologic studies
Group C: possible human carcinogen
Group D: not classifiable as to human carcinogenicity
Group E: evidence of non-carcinogenicity for humans

[d] Both adult and lifetime cancer slope factors and unit risk factors are listed for vinyl chloride. The lifetime exposure pathway is used to calculate the SSL in the direct contact exposure pathway (ingestion-dermal) for the residential scenario. The adult value is appropriate for the other residential pathways & the commercial/industrial pathways.

[e] Values listed are those for total xylenes: [CAS No. 1330-20-7] MCLG/MCL = 10 mg/L

Exhibit C-6

DERMAL ABSORPTION FRACTION FROM SOIL

Compound	Dermal Absorption Fraction (ABS_d)[a]	Reference
Arsenic	0.03	Wester, *et al.* (1993a)
Cadmium	0.001	Wester, *et al.* (1992a) U.S. EPA (1992a)
Chlordane	0.04	Wester, *et al.* (1992b)
DDT	0.03	Wester, *et al.* (1990)
2,4-Dichlorophenoxyacetic acid	0.05	Wester, *et al.* (1996)
Lindane	0.04	Duff & Kissel (1996)
PAHs	0.13	Wester, *et al.* (1990)
Pentachlorophenol	0.25	Wester, *et al.* (1993c)
Generic default *for screening*		
Semivolatile organic compounds	0.1	

[a] The values presented are mean values from empirical data.

Source: *RAGS Part E*, U.S. EPA, 2001.

Exhibit C-7 GASTROINTESTINAL ABSORPTION EFFICIENCIES AND ADJUSTMENT OF DERMAL TOXICITY FACTORS			
CAS Number	**Compound**	**Percent Absorbed***	**ABS_{GI}**
Organics			
57-74-9	Chlordane	80%	1
50-29-3	DDT	70-90%	1
94-75-7	2,4-Dichlorophenoxyacetic acid	>90%	1
87-86-5	Pentachlorophenol	76-100%	1
N/A	Polycyclic aromatic hydrocarbons (PAHs)	58-89%	1
N/A	All other organic compounds	generally >50%	1
Inorganics			
7440-38-2	Arsenic	95%	1
7440-43-9	Cadmium	2.5-5%	0.025
* *RAGS Part E*, U.S. EPA, 2001.			

APPENDIX H

NEW JERSEY TURNPIKE DUMP # 5 SITE

TRIP REPORTS

SAMPLING TRIP REPORT

Site Name: Turnpike Dump Site #5
Sampling Date: February 12 - 23, 2007

1. Site Location:

   Jersey City, Hudson County, New Jersey

2. Sample Descriptions:

   Refer to Table 1

3. Laboratories Receiving Samples:

Sample Type	Laboratory Code	Name and Address of Laboratory
TAL – Total Metals	DATAC	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City, UT 84123
TCL Pesticides/PCBs/VOCs	LIBRTY	Liberty Analytical Corporation 501 Madison Ave. Cary, NC 27513
TAL – Total Metals	LIBRTY	Liberty Analytical Corporation 501 Madison Ave. Cary, NC 27513
TCL Pesticides/PCBs/VOCs	DATAC	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City, UT 84123

4. **Sample Dispatch Data:**

From February 12 - 23, 2007, surface and sub-surface soil samples were collected from 60 predetermined sampling locations within the subject site. Surface samples were collected from all sampling locations. Subsurface soil samples from an interval of 1.5 to 2.0 feet below ground surface were collected at 46 locations. Subsurface soil samples from a depth of 2.0 feet belowground surface to six feet below ground surface were collected at 47 locations. At each location the depth of the sample interval was denoted as follows: a soil sample collected from 0-6 inches below ground surface: NJTP5-Location#-01; a soil sample collected from 1.5 to 2.0 feet below ground surface: NJTP5-Location#-02; a soil sample collected from 2.0 feet below ground surface to 6 feet below ground surface (or above groundwater): NJTP5-Location#-03. All sample locations at predetermined sample depths were analyzed for Target Analyte List (TAL) total metals. Samples collected from lower depths were also collected and analyzed for the determination of Target Compound List (TCL) Pesticides, PCBs,

Pesticides/PCBs and/or volatile organics. The required analytical parameters required at each sampling location and depth can been seen in Figure 1. The samples were shipped daily to the CLP laboratories listed on page one of this document.

On February 12, 2007, a total of ten soil samples were collected from four separate locations. The samples were collected from depths varying from 6 inches to 3.0 feet below ground surface. All samples were collected for the analysis of TAL metals. Nine samples were collected for the analysis of TCL PCBs only, one sample was collected for both TCL pesticides and PCBs analysis and three samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs. The samples were held in the DESA Lab Branch walk-in cooler overnight and shipped overnight the following day.

On February 13, 2007, a total of eight soil samples were collected from four separate locations. The samples were collected from depths varying from six inches to two feet below ground surface. All samples were collected for the analysis of TAL metals. Seven samples were collected for the analysis of TCL PCBs only, one sample was collected for both TCL pesticides and PCBs analysis and two samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs as well as one trip blank for the analysis of TCL VOCs only.

On February 15, 2007, a total of 21 soil samples were collected from 12 separate locations. The samples were collected from depth varying from six inches to 5.5 feet below ground surface. All samples were collected for the analysis of TAL metals. Sixteen samples were collected for the analysis of TCL PCBs only, six samples were collected for both TCL pesticides and PCBs analysis and eight samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs as well as one trip blank for the analysis of TCL VOCs only.

On February 20, 2007, a total of 19 soil samples were collected from 10 separate locations. The samples were collected from depth varying from six inches to six feet below ground surface. All samples were collected for the analysis of TAL metals. Fifteen samples were collected for the analysis of TCL PCBs only, five samples were collected for both TCL pesticides and PCBs analysis and seven samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs. Two field duplicate samples and one MS/MSD sample was collected on this sampling day.

On February 21, 2007, a total of 36 soil samples were collected from 20 separate locations. The samples were collected from depth varying from six inches to six feet below ground surface. All samples were collected for the analysis of TAL metals. Thirty samples were collected for the analysis of TCL PCBs only, six samples were collected for both TCL pesticides and PCBs analysis and 14 samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and

TCL VOCs. One field duplicate sample and one MS/MSD sample was collected on this sampling day.

On February 22, 2007, a total of 37 soil samples were collected from 22 separate locations. The samples were collected from depth varying from six inches to six feet below ground surface. All samples were collected for the analysis of TAL metals. Thirty three samples were collected for the analysis of TCL PCBs only, five samples were collected for both TCL pesticides and PCBs analysis and 14 samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs. Four field duplicate pair samples and four MS/MSD samples were collected on this sampling day. Samples collected from a depth indicated as exactly 6 feet were revisited after previous rejection with a hand auger and collected with the use of a back hoe.

On February 23, 2007, a total of 24 soil samples were collected from 15 separate locations. The samples were collected from depth varying from six inches to six feet below ground surface. All samples were collected for the analysis of TAL metals. Twenty two samples were collected for the analysis of TCL PCBs only, two samples were collected for both TCL pesticides and PCBs analysis and 14 samples for TCL VOC analysis. Additionally, one aqueous rinse blank was collected for the analysis of TAL metals, TCL Pesticides/PCBs and TCL VOCs. Two field duplicate pair samples were collected on this sampling day. Samples collected from a depth indicated as exactly 6 feet were revisited after previous rejection with a hand auger and collected with the use of a back hoe.

The Traffic Reports and Chain of Custody Records can be found in Appendix A.

5. Sampling Personnel:

Name	Organization	Site Duties
Robert C. Finke	U.S. EPA Region 2 DESA/HWSB Superfund Support Team	Project Manager/Sample Management
Mark Denno	U.S. EPA Region 2 DESA/HWSB Superfund Support Team	Field Personnel
Christina Leung	U.S. EPA Region 2 DESA/HWSB Superfund Support Team	Field Personnel
Diane Salkie	U.S. EPA Region 2 DESA/HWSB Superfund Support Team	Field Personnel
Pat Sheridan	U.S. EPA Region 2 DESA/HWSB Superfund Support Team	Quality Assurance Officer

6. Additional Comments:

The number of samples includes:

- 153 soil samples
- 60 locations
- 8 field duplicate samples (laboratory and field quality control sample)
- 6 matrix spike/matrix spike duplicate samples (laboratory quality control sample)
- 7 rinsate blank/trip samples (field quality control sample)

The following Sample Numbers were used for laboratory and/or field quality control:

Laboratory Quality Control (QC) Samples	
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)/Analysis	**Field Duplicate**
NJTP5-B8-03: TAL, PCBs, VOCs	NJTP5-B7-22 is a duplicate of NJTP5-B7-02
NJTP5-G11-02: TAL, PCBs	NJTP5-B8-04 is a duplicate of NJTP5-B8-03
NJTP5A6-03: TAL, PCBs	NJTP5-C5-33 is a duplicate of NJTP5-C5-03
NJTP5-RB-022207: TAL, Pest/PCBs, VOCs	NJTP5-E5-22 is a duplicate of NJTP5-E5-02
NJTP5-E5-02: TAL, PCBS, VOCs	NJTP5-E7-11 is a duplicate of NJTP5-E7-01
NJTP5-D10-03: TAL, PCBs, VOCs	NJTP5-E3-22 is a duplicate of NJTP5-E3-02
	NJTP5-E8-33 is a duplicate of NJTP5-E8-03
	NJTP5-F9-33 is a duplicate of NJTP5-F9-03

Report Prepared By: Robert C. Finke Date March 9, 2007

TABLE 1
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Northeast Corner	Surface Soil 0 – 6"	02/12/07	1115	NJTP5-A9-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
North	Sub-Surface Soil 18 - 24"	02/12/07	1140	NJTP5-A9-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
North	Surface Soil 0 - 6"	02/12/07	1152	NJTP5-A8-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
North	Sub-Surface Soil 18 - 24"	02/12/07	1159	NJTP5-A8-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Cyanide	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
North	Sub-Surface Soil 3.0 feet	02/12/07	1222	NJTP5-A8-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
North	Surface Soil 0 – 6"	02/12/07	1330	NJTP5-A7-01	TAL, Pesticides, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
North	Sub-Surface Soil 18 – 24"	02/12/07	1405	NJTP5-A7-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
North	Sub-Surface Soil 3.0 feet	02/12/07	1422	NJTP5-A7-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
North	Surface Soil 0 – 6"	02/12/07	1445	NJTP5-A6-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Rinsate Blank	------	02/12/07	0900	NJTP5-RB021207	TAL, Pest./PCBs VOCs	Total Metals	(1) 1 lt. HDPE container	1 lt.	HNO^3 to pH < 2; Cool to 4°C
						Pesticides/ PCBs	(2) 1 lt. Amber glass with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to ph <2 Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
North	Sub-Surface Soil 18 – 24"	02/12/07	1445	NJTP5-A6-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
North	Surface Soil 0 – 6"	02/13/07	1120	NJTP5-A5-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
North	Sub-Surface Soil 18 – 24"	02/13/07	1145	NJTP5-A5-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	4 oz	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
North	Surface Soil 0 – 6"	02/13/07	1215	NJTP5-A4-01	TAL, Pest./PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
North	Sub-Surface Soil 18 – 24"	02/13/07	1240	NJTP5-A4-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
North	Surface Soil 0 – 6"	02/13/07	1450	NJTP5-A3-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
North	Sub-Surface Soil 18 –24"	02/13/07	1500	NJTP5-A3-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Northwest	Surface Soil 0 – 6"	02/13/07	1518	NJTP5-A2-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Northwest	Sub-Surface Soil 18 – 24"	02/13/07	1530	NJTP5-A2-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Rinsate Blank	------	02/13/07	0900	NJTP5-RB021307	TAL, Pest./PCBs VOCs	Total Metals	(1) 1 lt. HDPE container	1 lt.	HNO^3 to pH < 2; Cool to 4°C
						Pesticides/ PCBs	(2) 1 lt. Amber glass with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to ph <2 Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Trip Blank	------	02/13/07	1735	NJTP5-TB021207	VOCs	VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to ph <2 Cool to 4°C
Northeast	Surface Soil 0 – 6"	02/15/07	1310	NJTP5-B11-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil 18 – 24"	02/15/07	1320	NJTP5-B11-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Northeast	Surface Soil 0 – 6"	02/15/07	1115	NJTP5-B12-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil 18 – 24"	02/15/07	1120	NJTP5-B12-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Northeast	Sub-Surface Soil 2.5 feet	02/15/07	1135	NJTP5-B12-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Northeast	Surface Soil 0 – 6"	02/15/07	1040	NJTP5-B13-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West	Surface Soil 0 – 6"	02/15/07	1015	NJTP5-C2-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West-Edge of Primary Debris Area	Surface Soil 0 – 6"	02/15/07	1105	NJTP5-C3-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West-Edge of Primary Debris Area	Sub-Surface Soil 5.0 – 5.5 feet	02/15/07	1135	NJTP5-C3-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	4 oz	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
West-Primary Debris Area	Surface Soil 0 – 6"	02/15/07	1335	NJTP5-C5-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Center-Primary Debris Area	Surface Soil 0 – 6"	02/15/07	1420	NJTP5-C6-01	TAL, Pest./PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pest./PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West	Surface Soil 0 – 6"	02/15/07	1025	NJTP5-A1-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West	Sub-Surface Soil 18 – 24"	02/15/07	1040	NJTP5-A1-02	TAL, Pest./ PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
West	Surface Soil 0 – 6"	02/15/07	1105	NJTP5-B2-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
West	Sub-Surface Soil 18 - 24"	02/15/07	1115	NJTP5-B2-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	4 oz	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
West-Edge of Primary Debris Area	Surface Soil 0 – 6"	02/15/07	1335	NJTP5-B3-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West-Edge of Primary Debris Area	Sub-Surface Soil 18 - 24"	02/15/07	1400	NJTP5-B3-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Rinsate Blank	------	02/15/07	0830	NJTP5-RB021207	TAL, Pest./ PCBs VOCs	Total Metals	(1) 1 lt. HDPE container	1 lt.	HNO^3 to pH < 2; Cool to 4°C
						Pesticides/ PCBs	(2) 1 lt. Amber glass with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to ph <2 Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Northeast	Surface Soil 0 – 6"	02/15/07	1345	NJTP5-B10-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil 18 - 24"	02/15/07	1350	NJTP5-B10-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Trip Blank	------	02/15/07	0840	NJTP5-TB021507	VOCs	VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to ph <2 Cool to 4°C
Center-Primary Debris Area	Surface Soil 0 – 6"	02/20/07	1103	NJTP5-B5-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Center-Primary Debris Area	Sub-Surface Soil 5.5 – 6.0 feet	02/20/07	1123	NJTP5-B5-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Central-Primary Debris Pile	Surface Soil 0 – 6"	02/20/07	1157	NJTP5-B6-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central	Surface Soil 0 – 6"	02/20/07	1415	NJTP5-B7-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central	Sub-Surface Soil 18 – 24"	02/20/07	1445	NJTP5-B7-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Central	Sub-Surface Soil 18 – 24"	02/20/07	1500	NJTP5-B7-22 **(Duplicate of NJTP5-B7-02)**	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Central	Surface Soil 0 – 6"	02/20/07	1152	NJTP5-B8-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 – Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Central	Sub-Surface Soil 18 – 24"	02/20/07	1230	NJTP5-B8-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central	Sub-Surface Soil 4.0 - 4.5 feet	02/20/07	1245	NJTP5-B8-03 MS/MSD	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Central	Sub-Surface Soil 4.0 - 4.5 feet	02/20/07	1245	NJTP5-B8-04 **(Duplicate of NJTP5-B8-03)**	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Central	Surface Soil 0 – 6"	02/20/07	1057	NJTP5-B9-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central	Sub-Surface Soil 18 – 24"	02/20/07	1125	NJTP5-B9-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Central-East Boarder Debris Pile	Surface Soil 0 – 6"	02/20/07	1530	NJTP5-C7-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central	Surface Soil 0 – 6"	02/20/07	1550	NJTP5-C8-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
South-Central	Surface Soil 0 – 6"	02/20/07	1520	NJTP5-E9-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
South-Central	Sub-Surface Soil 18 – 24"	02/20/07	1540	NJTP5-E9-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Surface Soil 0 – 6"	02/20/07	1430	NJTP5-F10-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Southeast	Surface Soil 0 – 6"	02/20/07	1439	NJTP5-F9-01	TAL, Pest./PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Sub-Surface Soil 18 – 24"	02/20/07	1525	NJTP5-F9-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Rinsate Blank	------	02/20/07	0745	NJTP5-RB022007	TAL, Pest./PCBs, VOCs	Total Metals	(1) 1 lt. HDPE container	1 lt.	HNO^3 to pH < 2; Cool to 4°C
						Pesticides/ PCBs	(2) 1 lt. Amber glass with Teflon lid	2 lt.	Cool to 4°C
						VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to pH <2 Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
East	Surface Soil 0 – 6"	02/21/07	1330	NJTP5-C10-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Surface Soil 0 – 6"	02/21/07	1350	NJTP5-C11-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Sub-Surface Soil 18 – 24"	02/21/07	1430	NJTP5-C11-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Surface Soil 0 – 6"	02/21/07	1315	NJTP5-C12-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Sub-Surface Soil 18 – 24"	02/20/07	1335	NJTP5-C12-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
East	Surface Soil 0 – 6"	02/21/07	1130	NJTP5-D11-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West	Surface Soil 0 – 6"	02/21/07	1130	NJTP5-D2-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
West	Surface Soil 0 – 6"	02/21/07	0950	NJTP5-D4-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
West	Sub-Surface Soil 4.5 – 5.5 feet	02/21/07	1025	NJTP5-D4-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
West	Surface Soil 0 – 6"	02/21/07	0900	NJTP5-D3-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West	Sub-Surface Soil 4.5 – 5.5 feet	02/21/07	0920	NJTP5-D3-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
West	Surface Soil 0 – 6"	02/21/07	0950	NJTP5-D4-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Southwest	Surface Soil 0 – 6"	02/21/07	1145	NJTP5-D5-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides, PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southwest	Surface Soil 0 – 6"	02/21/07	1330	NJTP5-D6-01	TAL, PCBs,	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southwest	Sub-Surface Soil 4.0 – 5.0 feet	02/21/07	1345	NJTP5-D6-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
South-central	Surface Soil 0 – 6"	02/21/07	1420	NJTP5-D7-01	TAL, PCBs,	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
South-central	Sub-Surface Soil 3.5 – 4.5 feet	02/21/07	1445	NJTP5-D7-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Surface Soil 0 – 6"	02/21/07	0945	NJTP5-E11-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Sub-Surface Soil 18 - 24"	02/21/07	1015	NJTP5-E11-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Southeast	Sub-Surface Soil 5.5 – 6.0 feet	02/21/07	1040	NJTP5-E11-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Southeast	Surface Soil 0 – 6"	02/21/07	0845	NJTP5-G11-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Surface Soil 0 – 6"	02/21/07	0920	NJTP5-G12-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Surface Soil 0 – 6"	02/21/07	0903	NJTP5-F11-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Southeast	Sub-Surface Soil 18 – 24"	02/21/07	0920	NJTP5-F11-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Southeast	Surface Soil 0 – 6"	02/21/07	1105	NJTP5-F12-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Sub-Surface Soil 18 – 24"	02/21/07	1140	NJTP5-F12-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central-Primary Debris Area	Sub-Surface Soil 4.5 – 5.5 feet	02/21/07	1330	NJTP5-C5-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Central-Primary Debris Area	Sub-Surface Soil 4.5 – 5.5 feet	02/21/07	1340	NJTP5-C5-33 **(Field Duplicate of NJTP5-C5-03)**	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Southeast	Sub-Surface Soil 4.5 – 5.0 feet	02/21/07	1410	NJTP5-F9-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Sub-Surface Soil 4.5 – 5.0 feet	02/21/07	1415	NJTP5-F9-33 **(Field Duplicate of NJTP5-F9-03)**	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Sub-Surface Soil 4.5 – 5.5 feet	02/21/07	1430	NJTP5-E9-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Southeast	Sub-Surface Soil 18 – 24"	02/21/07	1450	NJTP5-G11-02 (Spike Sample MS/MSD)	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Sub-Surface Soil 5.5 – 6.0 feet	02/21/07	1457	NJTP5-G11-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Southeast	Sub-Surface Soil 5.5 – 6.0 feet	02/21/07	1530	NJTP5-F11-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central – Primary Debris Area	Surface Soil 0 – 6"	02/21/07	1520	NJTP5-D8-01	TAL, Pest., PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Central – Primary Debris Area	Sub-Surface Soil 5.5 feet	02/21/07	1540	NJTP5-D8-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Rinsate Blank	------	02/21/07	0715	NJTP5-RB-022107	TAL, Pest./PCB, VOCs	Total Metals	(1) 1 lt. HDPE container	1 lt.	HNO^3 to pH < 2; Cool to 4°C
						Pesticides/ PCBs	(2) 1 lt. Amber glass with Teflon lid	2 lt.	Cool to 4°C
						VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to pH <2 Cool to 4°C
North	Sub-Surface Soil 4.5 – 5.0 feet	02/22/07	1435	NJTP5-A6-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil 5.5 feet	02/22/07	1432	NJTP5-A9-03	TAL, Pest./PCBs VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Central – Primary Debris Area	Sub-Surface Soil 5.5 feet	02/22/07	1420	NJTP5-B10-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Northeast	Sub-Surface Soil 6.0 feet	02/22/07	1405	NJTP5-B11-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central-Primary Debris Area	Sub-Surface Soil 6.0 feet	02/22/07	1440	NJTP5-B6-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Northeast	Sub-Surface Soil 6.0 feet	02/22/07	1425	NJTP5-B9-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Northeast	Sub-Surface Soil 6.0 feet	02/22/07	1425	NJTP5-B9-33 **(Field Duplicate of NJTP5-B9-03)**	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Sub-Surface Soil 6.0 feet	02/22/07	1159	NJTP5-C11-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
East	Surface Soil 0 – 6"	02/22/07	1115	NJTP5-C13-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil 18 – 24"	02/22/07	1135	NJTP5-C13-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
East	Surface Soil 0 – 6"	02/22/07	1045	NJTP5-C9-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Sub-Surface Soil 18 - 24"	02/22/07	1110	NJTP5-C9-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Surface Soil 0 – 6"	02/22/07	0945	NJTP5-D10-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Sub-Surface Soil 18 – 24"	02/22/07	1015	NJTP5-D10-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Sub-Surface Soil 18 – 24"	02/22/07	1432	NJTP5-D11-02	TAL, PCBs VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservat
		Date	Time		Parameter	Fraction			
East	Sub-Surface Soil 6 feet	02/22/07	1150	NJTP5-D11-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4
East	Surface Soil 0 - 6"	02/22/07	1050	NJTP5-D12-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4
East	Surface Soil 0 – 6"	02/22/07	1015	NJTP5-D12-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4
East	Surface Soil 0 – 6"	02/22/07	0945	NJTP5-D13-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
East	Sub-Surface Soil 18 – 24"	02/22/07	1000	NJTP5-D13-02	TAL, PCBs VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
East	Sub-Surface Soil 6 feet	02/22/07	1030	NJTP5-D13-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central – East of Primary Debris Area	Surface Soil 0 – 6"	02/22/07	1145	NJTP5-D9-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
South-Central	Surface Soil 0 – 6"	02/22/07	0935	NJTP5-E10-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
East	Sub-Surface Soil 18 – 24"	02/22/07	0955	NJTP5-E10-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
East	Sub-Surface Soil 6 feet	02/22/07	1045	NJTP5-D10-03	TAL, PCBs VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
East	Surface Soil 0 – 6"	02/22/07	1035	NJTP5-E12-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Surface Soil 18 – 24"	02/22/07	1100	NJTP5-E12-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
South-Primary Debris Area	Surface Soil 0 – 6"	02/22/07	1445	NJTP5-E5-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
South-Primary Debris Area	Sub-Surface Soil 18 – 24"	02/22/07	1455	NJTP5-E5-02 **(Spike Sample MS/MSD)**	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Southern Boundary Primary Debris Area	Sub-Surface Soil 18 – 24"	02/22/07	1447	NJTP5-E5-22 (Field Duplicate of NJTP5-E5-02)	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Southern Boundary Primary Debris Area	Surface Soil 0 – 6"	02/22/07	1400	NJTP5-E6-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southern Boundary Primary Debris Area	Sub-Surface Soil 18 – 24"	02/22/07	1410	NJTP5-E6-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southern Boundary Primary Debris Area	Surface Soil 0 – 6"	02/22/07	1345	NJTP5-E7-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Southern Boundary Primary Debris Area	Sub-Surface Soil 6 feet	02/22/07	1502	NJTP5-E7-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Southern Boundary Primary Debris Area	Surface Soil 0 – 6"	02/22/07	1347	NJTP5-E7-11 (Field Duplicate of NJTP5-E7-01)	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southeast	Sub-Surface Soil 18 – 24"	02/22/07	0950	NJTP5-G12-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Southeast	Sub-Surface Soil 6 feet	02/22/07	1000	NJTP5-G12-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
North-Central Boundary Primary Debris Area	Sub-Surface Soil 6 feet	02/23/07	1110	NJTP5-B7-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
West	Sub-Surface Soil 18 – 24"	02/23/07	1400	NJTP5-C2-02	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central-Primary Debris Area	Sub-Surface Soil 6 feet	02/23/07	1135	NJTP5-C6-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Central Boundary Primary Debris Area	Sub-Surface Soil 6 feet	02/23/07	1105	NJTP5-C7-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Central Boundary Primary Debris Area	Sub-Surface Soil 18 – 24"	02/23/07	1030	NJTP5-C8-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Central Boundary Primary Debris Area	Sub-Surface Soil 6 feet	02/23/07	1035	NJTP5-C8-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Central	Sub-Surface Soil 6 feet	02/23/07	1450	NJTP5-C6-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Central	Sub-Surface Soil 18 – 24"	02/23/07	1400	NJTP5-D2-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservatio
		Date	Time		Parameter	Fraction			
Central Boundary Primary Debris Area	Sub-Surface Soil 18 – 24"	02/23/07	1440	NJTP5-D9-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Central Boundary Primary Debris Area	Sub-Surface Soil 6 feet	02/23/07	1445	NJTP5-D9-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southwest-Boarder Primary Debris Area	Surface Soil 0 – 6"	02/23/07	1115	NJTP5-E3-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
Southwest-Boarder Primary Debris Area	Sub-Surface Soil 18 – 24"	02/23/07	1130	NJTP5-E3-02	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservatio
		Date	Time		Parameter	Fraction			
Southwest-Boarder Primary Debris Area	Surface Soil 0 – 6"	02/23/07	1045	NJTP5-E4-01	TAL, Pest./ PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°(
						Pesticides/ PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°(
Southwest-Boarder Primary Debris Area	Sub-Surface Soil 18 – 24"	02/23/07	1050	NJTP5-E4-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°(
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°(
South-Central-Boarder Primary Debris Area	Surface Soil 0 – 6"	02/23/07	0930	NJTP5-E8-01	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°(
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°(
South-Central-Boarder Primary Debris Area	Sub-Surface Soil 6 feet	02/23/07	1000	NJTP5-E8-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°(
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°(
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°(

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservatic
		Date	Time		Parameter	Fraction			
Southeast	Sub-Surface Soil 6 feet	02/23/07	1005	NJTP5-E11-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°
Southeast	Sub-Surface Soil 6 feet	02/23/07	1000	NJTP5-E12-03	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°
Southeast	Sub-Surface Soil 18 – 24"	02/23/07	1455	NJTP5-F10-02	TAL, PCBs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°
Southeast	Sub-Surface Soil 6 feet	02/23/07	1500	NJTP5-F10-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Southeast	Sub-Surface Soil 6 feet	02/23/07	1510	NJTP5-F12-03	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
Southwest-Boarder Primary Debris Area	Sub-Surface Soil 18 – 24"	02/23/07	1135	NJTP5-E3-22 **(Field Duplicate of NJTP5-E3-02)**	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C
South-Central-Boarder Primary Debris Area	Sub-Surface Soil 6 feet	02/23/07	1005	NJTP5-E8-33 **(Field Duplicate of NJTP5-E8-03)**	TAL, PCBs, VOCs	Total Metals	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						PCBs	(1) 8 oz. jar with Teflon lid	8 oz.	Cool to 4°C
						VOCs	(3) Encore® push samplers	5 grams	Cool to 4°C

TABLE 1 - Continued
SAMPLE DESCRIPTIONS
TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
Rinsate Blank	------	02/22/07	0730	NJTP5-RB-022207	TAL, Pest./PCB, VOCs	Total Metals	(1) 1 lt. HDPE container	1 lt.	HNO^3 to pH < 2; Cool to 4°C
						Pesticides/ PCBs	(2) 1 lt. Amber glass with Teflon lid	2 lt.	Cool to 4°C
						VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to pH <2 Cool to 4°C
Rinsate Blank	------	02/23/07	0730	NJTP5-RB-022307	TAL, Pest./PCB, VOCs	Total Metals	(1) 1 lt. HDPE container	1 lt.	HNO^3 to pH < 2; Cool to 4°C
						Pesticides/ PCBs	(2) 1 lt. Amber glass with Teflon lid	2 lt.	Cool to 4°C
						VOCs	(3) 40 ml. vials with Teflon lid	8 oz.	HCl to pH <2 Cool to 4°C

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/14/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110082806	1 [illegible] 2/14/07	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
B45W3	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A9-01	S: 2/12/2007	11:15	B45W3 ✓	–
B45W4	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A9-02	S: 2/12/2007	11:40	B45W4 ✓	–
B45W5	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A8-01	S: 2/12/2007	11:52	B45W5 ✓	–
B45W6	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A8-02	S: 2/12/2007	11:59	B45W6 ✓	–
B45W7	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A8-03	S: 2/12/2007	12:22	B45W7 ✓	–
B45W8	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A7-01	S: 2/12/2007	13:30	B45W8 ✓	–
B45W9	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A7-02	S: 2/12/2007	14:05	B45W9 ✓	–
B45X0	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A7-03	S: 2/12/2007	14:22	B45X0 ✓	–
B45X1	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A6-01	S: 2/12/2007	14:45	B45X1 ✓	–
B45X2	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A6-02	S: 2/12/2007	15:05	B45X2 ✓	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? Y
1 = CLP TAL Total Metals			

Case Number: 2-043013577-021407-0003

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EPA USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/14/2007
Project Code:		Carrier Name:	UPS
Account Code:		Airbill:	1Z0615472110002815
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700
Spill ID:	026A		
Site Name/State:	New Jersey Turnpike Dump #5/NJ		
Project Leader:	Robert Finke		
Action:	Remedial Action		
Sampling Co:			

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1 [signature]	2/14/07 1700		
2			
3			
4			

Sampler Signature:

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB45X3	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A5-01	S: 2/13/2007	11:20	B45X3 ✓	–
MB45X4	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A5-02	S: 2/13/2007	11:45	B45X4 ✓	–
MB45X5	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A4-01	S: 2/13/2007	12:15	B45X5 ✓	–
MB45X6	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A4-02	S: 2/13/2007	12:40	B45X6 ✓	–
MB45X7	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A3-01	S: 2/13/2007	14:50	B45X7 ✓	–
MB45X8	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A3-02	S: 2/13/2007	15:00	B45X8	–
MB45X9	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A2-01	S: 2/13/2007	15:18	B45X9 ✓	–
MB45Y0	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A2-02	S: 2/13/2007	15:30	B45Y0 ✓	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? ✓

R Number: 2-043013577-021407-0004

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region: 2	Date Shipped: 2/14/2007	Chain of Custody Record		Sampler Signature:	
Project Code:	Carrier Name: UPS	Relinquished By	(Date / Time)	Received By	(Date / Time)
Account Code:	Airbill: 1Z0615472110002806	1 [illegible]	2/14/07 [illegible]		
CERCLIS ID:	Shipped to: Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2			
Spill ID: 026A		3			
Site Name/State: New Jersey Turnpike Dump #5/NJ		4			
Project Leader: Robert Finke					
Action: Remedial Action					
Sampling Co:					

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB45Y1	Field QC/ Robert Finke	L/G	TM (21)	(HNO3) (1)	NJTP5-RB021207	S: 2/12/2007	9:00	B45Y1 ✓	Rinsate

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? ✓

TR Number: 2-043013577-021407-0007

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Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/14/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002806	1 [illegible] 2/14/07 2:13 00	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Split ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B45W3	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A9-01	S: 2/12/2007	11:15	MB45W3	–
B45W4	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A9-02	S: 2/12/2007	11:40	MB45W4	–
B45W5	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A8-01	S: 2/12/2007	11:52	MB45W5	–
B45W6	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A8-02	S: 2/12/2007	11:59	MB45W6	–
B45W7	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A8-03	S: 2/12/2007	12:22	MB45W7	–
B45W8	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(1)	NJTP5-A7-01	S: 2/12/2007	13:30	MB45W8	–
B45W9	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A7-02	S: 2/12/2007	14:05	MB45W9	–
B45X0	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A7-03	S: 2/12/2007	14:22	MB45X0	–
B45X1	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A6-01	S: 2/12/2007	14:45	MB45X1	–
B45X2	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A6-02	S: 2/12/2007	15:05	MB45X2	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? X
PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs			

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Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
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Region:	2	Date Shipped:	2/14/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002815	1 [illegible] 2/14/07 1300	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B45X3	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A5-01	S: 2/13/2007	11:20	MB45X3	–
345X4	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A5-02	S: 2/13/2007	11:45	MB45X4	–
345X5	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(1)	NJTP5-A4-01	S: 2/13/2007	12:15	MB45X5	–
345X6	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A4-02	S: 2/13/2007	12:40	MB45X6	–
345X7	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A3-01	S: 2/13/2007	14:50	MB45X7	–
145X8	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A3-02	S: 2/13/2007	15:00	MB45X8	–
145X9	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A2-01	S: 2/13/2007	15:18	MB45X9	–
45Y0	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-A2-02	S: 2/13/2007	15:30	MB45Y0	–

ipment for Case omplete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
alysis Key: CB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? Y

Number: 2-043013577-021407-0006

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Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

gion:	2
oject Code:	
ount Code:	
ERCLIS ID:	
ill ID:	026A
te Name/State:	New Jersey Turnpike Dump #5/NJ
roject Leader:	Robert Finke
ction:	Remedial Action
ampling Co:	

Date Shipped:	2/13/2007
Carrier Name:	UPS
Airbill:	1Z0615472110002977
Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1 KG Finke	2/13/07 2000		
2			
3			
4			

Sampler Signature:

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
5W6	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-A8-02	S: 2/12/2007	11:59	MB45W6	--
45X0	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-A7-03	S: 2/12/2007	14:22	MB45X0	--
45X2	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-A6-02	S: 2/12/2007	15:05	MB45X2	--
45X4	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-A5-02	S: 2/13/2007	11:45	MB45X4	--
345X8	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-A3-02	S: 2/13/2007	15:00	MB45X8	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: VOA = CLP TCL Volatiles	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? Y

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/14/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002806	1 [illegible] 2/14/07 1300	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	INORGANIC SAMPLE No.	QC Type
B45Y1	Field QC/ Robert Finke	L/G	PCB only (21), Pest. only (21)	(Ice Only) (2)	NJTP5-RB021207	S: 2/12/2007 9:00	MB45Y1	Rinsate

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? Y

PCB only = TCL PCB only, Pest. only = Pesticides only

TR Number: 2-043013577-021407-0009

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/14/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002815	1 [illegible] 2/14/2 1300	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MB45Y3	Field QC/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-RB021307	S: 2/13/2007 9:00	B45Y3	Rinsate

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? Y

TR Number: 2-043013577-021407-0008

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USEPA Contract Laboratory Program
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Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/13/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002977	1 RC/Mr 2/13/07 2600	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B45Y1	Field QC/ Robert Finke	L/G	VOA (21)	(HCL) (3)	NJTP5-RB021207	S: 2/12/2007	9:00	MB45Y1	Rinsate
B45Y2	Field QC/ Robert Finke	L/G	VOA (21)	(HCL) (3)	NJTP5-TB021307	S: 2/13/2007	17:35		Trip Blank
B45Y3	Field QC/ Robert Finke	L/G	VOA (21)	(HCL) (3)	NJTP5-RB021307	S: 2/13/2007	9:00	MB45Y3	Rinsate

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: VOA = CLP TCL Volatiles	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? Y

TR Number: 2-043013577-021307-0002

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/14/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002815	1 RCGill 2/14/07: 1300	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	INORGANIC SAMPLE No.	QC Type
B45Y3	Field QC/ Robert Finke	L/G	PCB only (21), Pest. only (21)	(Ice Only) (2)	NJTP5-RB021307	S: 2/13/2007 9:00	MB45Y3	Rinsate

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: PCB only = TCL PCB only, Pest. only = Pesticides only	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? Y

TR Number: 2-043013577-021407-0010

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region: 2	Date Shipped: 2/15/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 1Z0615472110002968	1	
CERCLIS ID:	Shipped to: Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB45Z3	Field QC/ Robert Finke	L/G	TM (21)	(HNO3) (1)	NJTP5-RB02021507	S: 2/15/2007	8:30	B45Z3	Rinsate
MB45Z5	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A1-01	S: 2/15/2007	10:25	B45Z5	--
MB45Z6	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A1-02	S: 2/15/2007	10:40	B45Z6	--
MB45Z7	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B2-01	S: 2/15/2007	11:05	B45Z7	--
MB45Z8	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B2-02	S: 2/15/2007	11:15	B45Z8	--
MB45Z9	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B3-01	S: 2/15/2007	13:35	B45Z9	--
MB4600	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B3-02	S: 2/15/2007	14:00	B4600	--
MB4601	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B4-01	S: 2/15/2007	14:27	B4601	--
MB4602	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B4-03	S: 2/15/2007	14:55	B4602	--
MB4603	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B10-01	S: 2/15/2007	13:45	B4603	--
MB4604	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B10-02	S: 2/15/2007	13:50	B4604	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-021507-0013

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/15/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002968	1 [illegible] 2/15/2007	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4605	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B11-01	S: 2/15/2007	13:10	B4605 ✓	–
MB4606	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B11-02	S: 2/15/2007	13:20	B4606 ✓	–
MB4607	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B12-01	S: 2/15/2007	11:15	B4607 ✓	–
MB4608	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B12-02	S: 2/15/2007	11:20	B4608 ✓	–
MB4609	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B12-03	S: 2/15/2007	11:35	B4609 ✓	–
MB4610	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B13-01	S: 2/15/2007	10:40	B4610 ✓	–
MB4611	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C2-01	S: 2/15/2007	10:15	B4611 ✓	–
MB4612	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C3-01	S: 2/15/2007	11:05	B4612 ✓	–
MB4613	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C3-03	S: 2/15/2007	11:35	B4613 ✓	–
MB4614	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C5-01	S: 2/15/2007	13:35	B4614 ✓	–
MB4615	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C6-01	S: 2/15/2007	14:20	B4615 ✓	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

TR Number: 2-043013577-021507-0013

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/15/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	A5588495853	1 [illegible] 2/15/07, 1900	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B45Z3	Field QC/ Robert Finke	L/G	PEST (21), VOA (21)	(HCL), (Ice Only) (5)	NJTP5-RB02021507	S: 2/15/2007	8:30	MB45Z3	Rinsate
B45Z4	Field QC/ Robert Finke	L/G	VOA (21)	(HCL) (3)	NJTP5-TB02021507	S: 2/15/2007	8:40		Rinsate
B45Z5	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-A1-01	S: 2/15/2007	10:25	MB45Z5	--
B45Z6	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-A1-02	S: 2/15/2007	10:40	MB45Z6	--
B45Z7	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-B2-01	S: 2/15/2007	11:05	MB45Z7	--
B45Z8	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B2-02	S: 2/15/2007	11:15	MB45Z8	--
B45Z9	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B3-01	S: 2/15/2007	13:35	MB45Z9	--
B4600	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B3-02	S: 2/15/2007	14:00	MB4600	--
B4601	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B4-01	S: 2/15/2007	14:27	MB4601	--
B4602	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B4-03	S: 2/15/2007	14:55	MB4602	--
B4603	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B10-01	S: 2/15/2007	13:45	MB4603	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-021507-0014

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region: 2	Date Shipped: 2/15/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: A5588495853	1 [illegible] 2/15/07, 1900	
CERCLIS ID:	Shipped to: Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B4604	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B10-02	S: 2/15/2007	13:50	MB4604	--
B4605	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-B11-01	S: 2/15/2007	13:10	MB4605	--
B4606	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B11-02	S: 2/15/2007	13:20	MB4606	--
B4607	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B12-01	S: 2/15/2007	11:15	MB4607	--
B4608	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B12-02	S: 2/15/2007	11:20	MB4608	--
B4609	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B12-03	S: 2/15/2007	11:35	MB4609	--
B4610	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B13-01	S: 2/15/2007	10:40	MB4610	--
B4611	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C2-01	S: 2/15/2007	10:15	MB4611	--
B4612	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-C3-01	S: 2/15/2007	11:05	MB4612	--
B4613	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-C3-03	S: 2/15/2007	11:35	MB4613	--
B4614	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C5-01	S: 2/15/2007	13:35	MB4614	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-021507-0014

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/15/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	A5588495853	1 [illegible] 2/6/07, 1900	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	INORGANIC SAMPLE No.	QC Type
B4615	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-C6-01	S: 2/15/2007 14:20	MB4615	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-021507-0014

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USEPA Contract Laboratory Program
Generic Chain of Custody

Reference Case: 36183
Client No:

R

Region:	2	Date Shipped:	2/15/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	A5588495853	R Finke 2/15/07 1900	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		QC Type
B45Z8	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B2-02	S: 2/15/2007	11:15	--
B4602	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B4-03	S: 2/15/2007	14:55	--
B4606	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B11-02	S: 2/15/2007	13:20	--
B4609	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B12-03	S: 2/15/2007	11:35	--
B4613	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-C3-03	S: 2/15/2007	11:35	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: Perc Moist = Percent Moisture	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-021507-0012

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/20/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110000737	1 RJFinke 2/21/2007	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A RN			3	
Site Name/State:	~~New Jersey~~ Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4616	Field QC/ Robert Finke	L/G	TM (21)	(HNO3) (1)	~~NJTP5-RB02207~~ NJTP5-RB022007	S: 2/20/2007	7:45	B4616	Rinsate
MB4617	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B5-01	S: 2/20/2007	11:03	B4617	–
MB4618	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B5-03	S: 2/20/2007	11:23	B4618	–
MB4619	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B6-01	S: 2/20/2007	11:57	B4619	–
MB4620	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B7-01	S: 2/20/2007	14:15	B4620	–
MB4621	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B7-02	S: 2/20/2007	14:45	B4621	–
MB4622	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B7-22	S: 2/20/2007	15:00	B4622	Field Duplicate
MB4623	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B8-01	S: 2/20/2007	11:52	B4623	–
MB4624	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B8-02	S: 2/20/2007	12:30	B4624	–
MB4625	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B8-03	S: 2/20/2007	12:45	B4625	Spike
MB4626	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B8-04	S: 2/20/2007	12:55	B4626	Field Duplicate

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4625	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022007-0002

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region: 2	Date Shipped: 2/20/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 1Z0615472110000737	1 R Finke 2/20/07, 2:30	
CERCLIS ID:	Shipped to: Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID: 026A RV		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
B4627	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B9-01	S: 2/20/2007	10:57	B4627	–
B4628	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B9-02	S: 2/20/2007	11:25	B4628	–
B4629	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C7-01	S: 2/20/2007	15:30	B4629	–
B4630	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C8-01	S: 2/20/2007	15:50	B4630	–
B4631	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E9-01	S: 2/20/2007	15:20	B4631	–
B4632	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E9-02	S: 2/20/2007	15:40	B4632	–
B4633	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F10-01	S: 2/20/2007	14:30	B4633	–
B4634	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F9-01	S: 2/20/2007	14:39	B4634	–
B4635	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F9-02	S: 2/20/2007	15:25	B4635	–

hipment for Case omplete? N	Sample(s) to be used for laboratory QC: MB4625	Additional Sampler Signature(s):	Chain of Custody Seal Number:
nalysis Key: M = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

R Number: 2-043013577-022007-0002

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/20/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110000728	1 [signature] 2/20/07, 2130	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	~~New Jersey~~ Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B4616	Field QC/ Robert Finke	L/G	PEST (21), VOA (21)	(HCL), (Ice Only) (5)	~~NJTP5-RB02207~~ NJTP5-022007	S: 2/20/2007	7:45	MB4616	Rinsate
B4617	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-B5-01	S: 2/20/2007	11:03	MB4617	–
B4618	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B5-03	S: 2/20/2007	11:23	MB4618	–
B4619	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-B6-01	S: 2/20/2007	11:57	MB4619	–
B4620	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B7-01	S: 2/20/2007	14:15	MB4620	–
B4621	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B7-02	S: 2/20/2007	14:45	MB4621	–
B4622	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B7-22	S: 2/20/2007	15:00	MB4622	Field Duplicate
B4623	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-B8-01	S: 2/20/2007	11:52	MB4623	–
B4624	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B8-02	S: 2/20/2007	12:30	MB4624	–
B4625	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (5)	NJTP5-B8-03	S: 2/20/2007	12:45	MB4625	Spike
B4626	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B8-04	S: 2/20/2007	12:55	MB4626	Field Duplicate

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B4625	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-022007-0003

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/20/2007
Project Code:		Carrier Name:	UPS
Account Code:		Airbill:	1Z0615472110000728
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100
Split ID:	026A		
Site Name/State:	New Jersey Turnpike Dump #5/NJ		
Project Leader:	Robert Finke		
Action:	Remedial Action		
Sampling Co:			

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1	2/20/07, 2:35		
2			
3			
4			

Sampler Signature:

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B4627	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B9-01	S: 2/20/2007	10:57	MB4627	–
B4628	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B9-02	S: 2/20/2007	11:25	MB4628	–
B4629	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C7-01	S: 2/20/2007	15:30	MB4629	–
B4630	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C8-01	S: 2/20/2007	15:50	MB4630	–
B4631	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E9-01	S: 2/20/2007	15:20	MB4631	–
B4632	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E9-02	S: 2/20/2007	15:40	MB4632	–
B4633	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-F10-01	S: 2/20/2007	14:30	MB4633	–
B4634	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-F9-01	S: 2/20/2007	14:39	MB4634	–
B4635	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-F9-02	S: 2/20/2007	15:25	MB4635	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B4625	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-022007-0003

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USEPA Contract Laboratory Program
Generic Chain of Custody

Reference Case: 36183
Client No:

Region:	2	Date Shipped:	2/20/2007	**Chain of Custody Record**	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time
Account Code:		Airbill:	1Z0615472110000728	1 [illegible] 2/20/07, 2030	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	~~New Jersey~~ Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	QC Type
B4618	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B5-03	S: 2/20/2007 11:23	–
B4621	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B7-02	S: 2/20/2007 14:45	–
B4622	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B7-22	S: 2/20/2007 15:00	Field Duplicate
B4625	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B8-03	S: 2/20/2007 12:45	Spike
B4626	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B8-04	S: 2/20/2007 12:55	Field Duplicate
B4628	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B9-02	S: 2/20/2007 11:25	–
B4635	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-F9-02	S: 2/20/2007 15:25	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

Perc Moist = Percent Moisture

TR Number: 2-043013577-022007-0001

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/21/2007
Project Code:		Carrier Name:	UPS
Account Code:		Airbill:	1Z0615472110000746
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700
Spill ID:	026A		
Site Name/State:	New Jersey Turnpike Dump #5/NJ		
Project Leader:	Robert Finke		
Action:	Remedial Action		
Sampling Co:			

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Tim
1 [signature]	2/21/07/2030		
2			
3			
4			

Sampler Signature:

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4658	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-G12-01 ✓	S: 2/21/2007	9:20	B4658 ✓	--
MB4659	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F11-01 ✓	S: 2/21/2007	9:03	B4659 ✓	--
MB4660	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F11-02 ✓	S: 2/21/2007	9:20	B4660 ✓	--
MB4661	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F12-01 ✓	S: 2/21/2007	11:05	B4661 ✓	--
MB4662	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F12-02 ✓	S: 2/21/2007	11:40	B4662	--
MB4663	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C05-03 ✓	S: 2/21/2007	13:30	B4663 ✓	--
MB4664	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C05-33 ✓	S: 2/21/2007	13:40	B4664 ✓	Field Duplicate
MB4666	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F9-03 ✓	S: 2/21/2007	14:10	B4666 ✓	--
MB4667	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F9-33 ✓	S: 2/21/2007	14:15	B4667 ✓	Field Dupl
MB4668	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E9-03 ✓	S: 2/21/2007	14:30	B4668 ✓	--
MB4669	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-G11-02 ✓	S: 2/21/2007	14:50	B4669 ✓	Spike

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4669, MB4666 RX	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022107-0001

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region: 2	Date Shipped: 2/21/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Time
Account Code:	Airbill: 1Z0615472110000746	1 RJ Finke 2/21/07/2330	
CERCLIS ID:	Shipped to: Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4670	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-G11-03	S: 2/21/2007	14:57	B4670	–
MB4671	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F11-03	S: 2/21/2007	15:30	B4671	–
MB4672	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D8-01	S: 2/21/2007	15:20	B4672	–
MB4673	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D8-03	S: 2/21/2007	15:40	B4673	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4669, MB4660 RZ	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022107-0001

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region: 2	Date Shipped: 2/21/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Ti
Account Code:	Airbill: 1Z0615472110000746	1 R Finke 2/21/07 2030	
CERCLIS ID:	Shipped to: Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4636	Field QC/ Robert Finke	L/G	TM (21)	(HNO3) (1)	NJTP-RB-022107	S: 2/21/2007	7:15	B4636 ✓	Rinsate
MB4637	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C10-01 ✓	S: 2/21/2007	13:30	B4637 ✓	–
MB4638	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C11-01 ✓	S: 2/21/2007	13:50	B4638 ✓	–
MB4639	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C11-02 ✓	S: 2/21/2007	14:30	B4639 ✓	–
MB4640	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C12-01 ✓	S: 2/21/2007	13:15	B4640 ✓	–
MB4641	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C12-02 ✓	S: 2/21/2007	13:35	B4641 ✓	–
MB4642	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D11-01 ✓	S: 2/21/2007	11:30	B4642 ✓	–
MB4643	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D2-01 ✓	S: 2/21/2007	11:30	B4643 ✓	–
MB4644	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D3-01 ✓	S: 2/21/2007	9:00	B4644 ✓	–
MB4645	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D3-03 ✓	S: 2/21/2007	9:20	B4645 ✓	–
MB4646	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D4-01 ✓	S: 2/21/2007	9:50	B4646 ✓	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4669, MB4660 RZ	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022107-0001

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region: 2	Date Shipped: 2/21/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Tim
Account Code:	Airbill: 1Z0615472110000746	1 [illegible] 2/21/07/2030	
CERCLIS ID:	Shipped to: Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4647	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D4-03	S: 2/21/2007	10:25	B4647	–
MB4648	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D5-01	S: 2/21/2007	11:45	B4648	–
MB4649	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D5-03	S: 2/21/2007	12:05	B4649	–
MB4650	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D6-01	S: 2/21/2007	13:30	B4650	–
MB4651	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D6-03	S: 2/21/2007	13:45	B4651	–
MB4652	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D7-01	S: 2/21/2007	14:20	B4652	–
MB4653	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D7-03	S: 2/21/2007	14:45	B4653	–
MB4654	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E11-01	S: 2/21/2007	9:45	B4654	–
MB4655	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E11-02	S: 2/21/2007	10:15	B4655	–
MB4656	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E11-03	S: 2/21/2007	10:40	B4656	–
MB4657	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-G11-01	S: 2/21/2007	8:45	B4657	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4669, MB4660	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

R Number: 2-043013577-022107-0001

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region: 2	Date Shipped: 2/21/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Tim
Account Code:	Airbill: 1Z0615472110000719	1 [illegible] 2/21/07/2030	
CERCLIS ID:	Shipped to: Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B4636	Field QC/ Robert Finke	L/G	VOA (21)	(HCL) (3)	NJTP-RB-022107	S: 2/21/2007	7:15	MB4636	Rinsate
B4641	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-C12-02	S: 2/21/2007	13:35	MB4641	--
B4645	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-D3-03	S: 2/21/2007	9:20	MB4645	--
B4647	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-D4-03	S: 2/21/2007	10:25	MB4647	--
B4649	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-D5-03	S: 2/21/2007	12:05	MB4649	--
B4651	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-D6-03	S: 2/21/2007	13:45	MB4651	--
B4653	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-D7-03	S: 2/21/2007	14:45	MB4653	--
B4654	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E11-01	S: 2/21/2007	9:45	MB4654	--
B4655	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E11-02	S: 2/21/2007	10:15	MB4655	--
B4656	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-E11-03	S: 2/21/2007	10:40	MB4656	--
B4657	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-G11-01	S: 2/21/2007	8:45	MB4657	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B4660, B4669	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: PCB only = TCL PCB only, VOA = CLP TCL Volatiles	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

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Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

R

Region: 2	Date Shipped: 2/21/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 1Z0615472110000719	1 2/21/07, 1203	
CERCLIS ID:	Shipped to: Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	INORGANIC SAMPLE No.	QC Type
B4658	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-G12-01	S: 2/21/2007 9:20	MB4658	--
B4659	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-F11-01	S: 2/21/2007 9:03	MB4659	--
B4660	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-F11-02	S: 2/21/2007 9:20	MB4660	--
B4662	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-F12-02	S: 2/21/2007 11:40	MB4662	--
B4663	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-C05-03	S: 2/21/2007 13:30	MB4663	--
B4664	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-C05-33	S: 2/21/2007 13:40	MB4664	Field Duplicate
B4666	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-F9-03	S: 2/21/2007 14:10	MB4666	--
B4667	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-F9-33	S: 2/21/2007 14:15	MB4667	--
B4668	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-E9-03	S: 2/21/2007 14:30	MB4668	--
B4669	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (2)	NJTP5-G11-02	S: 2/21/2007 14:50	MB4669	Spike
B4670	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-G11-03	S: 2/21/2007 14:57	MB4670	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B4660, B4669	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, VOA = CLP TCL Volatiles

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Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/21/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110000719	1 [illegible] 2/21/07/2030	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B4671	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-F11-03	S: 2/21/2007	15:30	MB4671	--
B4673	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-D8-03	S: 2/21/2007	15:40	MB4673	--
B4661	Soil/Sed. Robert Finke	L/G	PEST/PCB	(Ice)	NJTP5-F12-01	2/21/07	1105	MB4661	

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B4660, B4669	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, VOA = CLP TCL Volatiles

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Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/22/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110000693	1 [illegible] 2/22/2007	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4674	Field QC/ Robert Finke	L/G	TM (21)	(HNO3) (1)	NJTP5-RB-022207	S: 2/22/2007	7:30	B4674	Spike
MB4675	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A6-03	S: 2/22/2007	14:35	B4675	Spike
MB4676	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-A9-03	S: 2/22/2007	14:32	B4676	–
MB4677	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B10-03	S: 2/22/2007	14:20	B4677	–
MB4678	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B11-03	S: 2/22/2007	14:05	B4678	–
MB4679	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B6-03	S: 2/22/2007	14:40	B4679	–
MB4680	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B9-03	S: 2/22/2007	14:25	B4680	–
MB4681	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B9-33	S: 2/22/2007	14:30	B4681	Field Dup
MB4682	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C11-03	S: 2/22/2007	11:59	B4682	–
MB4683	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C13-01	S: 2/22/2007	11:15	B4683	–
MB4684	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C13-02	S: 2/22/2007	11:35	B4684	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4675, MB46A3, MB46A7, MB46B2	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022207-0001

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Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/22/2007
Project Code:		Carrier Name:	UPS
Account Code:		Airbill:	1Z0615472110000693
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700
Spill ID:	026A		
Site Name/State:	New Jersey Turnpike Dump #5/NJ		
Project Leader:	Robert Finke		
Action:	Remedial Action		
Sampling Co:			

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1 [illegible]	2/22/2007		
2			
3			
4			

Sampler Signature:

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4685	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C9-01	S: 2/22/2007	10:45	B4685	–
MB4686	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C9-02	S: 2/22/2007	11:10	B4686	–
MB4687	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D10-01	S: 2/22/2007	9:45	B4687	–
MB4688	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D10-02	S: 2/22/2007	10:15	B4688	–
MB4689	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D11-02	S: 2/22/2007	11:45	B4689	–
MB4690	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D11-03	S: 2/22/2007	11:50	B4690	–
MB4691	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D12-01	S: 2/22/2007	10:50	B4691	–
MB4692	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D13-01	S: 2/22/2007	9:45	B4692	–
MB4693	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D13-02	S: 2/22/2007	10:00	B4693	–
MB4694	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D13-03	S: 2/22/2007	10:30	B4694	–
MB4695	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D9-01	S: 2/22/2007	11:45	B4695	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4675, MB46A3, MB46A7, MB46B2	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022207-0001

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

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Region: 2	Date Shipped: 2/22/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 1Z0615472110000693	1 [illegible] 2/22/07/2000	
CERCLIS ID:	Shipped to: Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB4696	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E10-01	S: 2/22/2007	9:35	B4696	–
MB4697	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E10-02	S: 2/22/2007	9:55	B4697	–
MB4698	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E10-03	S: 2/22/2007	10:45	B4698	–
MB4699	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E12-01	S: 2/22/2007	10:35	B4699	–
MB46A0	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E12-02	S: 2/22/2007	11:00	B46A0	–
MB46A2	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E5-01	S: 2/22/2007	14:45	B46A2	–
MB46A3	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E5-02	S: 2/22/2007	14:55	B46A3	Spike
MB46A4	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E5-22	S: 2/22/2007	14:47	B46A4	Field Duplicate
MB46A5	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E6-01	S: 2/22/2007	14:00	B46A5	–
MB46A6	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E6-02	S: 2/22/2007	14:10	B46A6	–
MB46A7	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E7-01	S: 2/22/2007	13:45	B46A7	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4675, MB46A3, MB46A7, MB46B2	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022207-0001

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Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/22/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Tim
Account Code:		Airbill:	1Z0615472110000693	1 RDM 2/22/07 2200	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB46A8	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E7-03 ✓	S: 2/22/2007	15:01	B46A8 ✓	–
MB46A9	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E7-11 ✓	S: 2/22/2007	13:47	B46A9 ✓	Field Duplicate
MB46B0	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-G12-02 ✓	S: 2/22/2007	9:50	B46B0 ✓	–
MB46B1	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-G12-03 ✓	S: 2/22/2007	10:00	B46B1 ✓	–
MB46B2	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D10-03 ✓	S: 2/22/2007	10:55	B46B2 ✓	Spike

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MB4675, MB46A3, MB46A7, MB46B2	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022207-0001

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USEPA Contract Laboratory Program
Generic Chain of Custody

Reference Case: 36183
Client No:

R

Region:	2	Date Shipped:	2/22/2007	**Chain of Custody Record**	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110000675	1 [signature] 2/22/7 2000	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		QC Type
B4676	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-A9-03	S: 2/22/2007	14:32	--
B4677	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B10-03	S: 2/22/2007	14:20	--
B4679	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-B6-03	S: 2/22/2007	14:40	--
B4682	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-C11-03	S: 2/22/2007	11:59	--
B4689	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-D11-02	S: 2/22/2007	11:45	--
B4693	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-D13-02	S: 2/22/2007	10:00	--
B4697	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-E10-02	S: 2/22/2007	9:55	--
B46A0	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-E12-02	S: 2/22/2007	11:00	--
B46A3	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-E5-02	S: 2/22/2007	14:55	Spike
B46A4	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-E5-22	S: 2/22/2007	14:47	Field Duplicate
B46A8	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-E7-03	S: 2/22/2007	15:01	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: Perc Moist = Percent Moisture	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

TR Number: 2-043013577-022207-0003

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USEPA Contract Laboratory Program
Generic Chain of Custody

Reference Case: 36183
Client No:

Region:	2	Date Shipped:	2/22/2007
Project Code:		Carrier Name:	UPS
Account Code:		Airbill:	1Z0615472110000675
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100
Spill ID:	026A		
Site Name/State:	New Jersey Turnpike Dump #5/NJ		
Project Leader:	Robert Finke		
Action:	Remedial Action		
Sampling Co:			

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1 R Finke	2/22/07 2000		
2			
3			
4			

Sampler Signature:

SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	QC Type
B46B0	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-G12-02	S: 2/22/2007 9:50	–
B46B2	Soil/Sediment/ Robert Finke	L/G	Perc Moist (21)	(Ice Only) (1)	NJTP5-D10-03	S: 2/22/2007 10:55	Spike

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: Perc Moist = Percent Moisture	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

TR Number: 2-043013577-022207-0003

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Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/22/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110000675	1 [illegible] 2/22/07 2000	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B4674	Field QC/ Robert Finke	L/G	PEST (21), VOA (21)	(HCL), (Ice Only) (5)	NJTP5-RB-022207	S: 2/22/2007	7:30	MB4674	Spike
B4675	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (2)	NJTP5-A6-03	S: 2/22/2007	14:35	MB4675	Spike
B4676	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-A9-03	S: 2/22/2007	14:32	MB4676	--
B4677	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B10-03	S: 2/22/2007	14:20	MB4677	--
B4678	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B11-03	S: 2/22/2007	14:05	MB4678	--
B4679	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-B6-03	S: 2/22/2007	14:40	MB4679	--
B4680	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B9-03	S: 2/22/2007	14:25	MB4680	--
B4681	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B9-33	S: 2/22/2007	14:30	MB4681	--
B4682	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-C11-03	S: 2/22/2007	11:59	MB4682	--
B4687	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-D10-01	S: 2/22/2007	9:45	MB4687	--
B4688	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-D10-02	S: 2/22/2007	10:15	MB4688	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B4675, B46B2	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-022207-0004

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/22/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Tim
Account Code:		Airbill:	1Z0615472110000675	1 [illegible] 2/22/07/2000	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B4689	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-D11-02	S: 2/22/2007	11:45	MB4689	--
B4690	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-D11-03	S: 2/22/2007	11:50	MB4690	--
B4691	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-D12-01	S: 2/22/2007	10:50	MB4691	--
B4692	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-D13-01	S: 2/22/2007	9:45	MB4692	--
B4693	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-D13-02	S: 2/22/2007	10:00	MB4693	--
B4694	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-D13-03	S: 2/22/2007	10:30	MB4694	--
B4695	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-D9-01	S: 2/22/2007	11:45	MB4695	--
B4697	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-E10-02	S: 2/22/2007	9:55	MB4697	--
B46A0	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-E12-02	S: 2/22/2007	11:00	MB46A0	--
B46A3	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-E5-02	S: 2/22/2007	14:55	MB46A3	Spike
B46A4	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-E5-22	S: 2/22/2007	14:47	MB46A4	Field Duplicate

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B4675, B46B2	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-022207-0004

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/22/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Tin
Account Code:		Airbill:	1Z0615472110000675	1 [illegible] 2/22/2007	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B46A8	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-E7-03	S: 2/22/2007	15:01	MB46A8	--
B46B0	Soil/Sediment/ Robert Finke	L/G	VOA (21)	(Ice Only) (3)	NJTP5-G12-02	S: 2/22/2007	9:50	MB46B0	--
B46B2	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (5)	NJTP5-D10-03	S: 2/22/2007	10:55	MB46B2	Spike

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B4675, B46B2	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-022207-0004

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region: 2	Date Shipped: 2/22/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Time
Account Code:	Airbill: 1Z0615472110002799	1 [illegible] 2/22/2007	
CERCLIS ID:	Shipped to: Liberty Analytical Corporation, 501 Madison Avenue, Cary NC 27513, (919) 379-4100	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B4682	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C11-03	S: 2/22/2007	11:59	MB4682	--
B4683	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C13-01	S: 2/22/2007	11:15	MB4683	--
B4684	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C13-02	S: 2/22/2007	11:35	MB4684	--
B4685	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-C9-01	S: 2/22/2007	10:45	MB4685	--
B4686	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C9-02	S: 2/22/2007	11:10	MB4686	--
B4696	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-E10-01	S: 2/22/2007	9:35	MB4696	--
B4697	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E10-02	S: 2/22/2007	9:55	MB4697	--
B4698	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E10-03	S: 2/22/2007	10:45	MB4698	--
B4699	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E12-01	S: 2/22/2007	10:35	MB4699	--
B46A0	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E12-02	S: 2/22/2007	11:00	MB46A0	--
B46A2	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E5-01	S: 2/22/2007	14:45	MB46A2	--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B46A3, B46A7	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022207-0002

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/22/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Tin
Account Code:		Airbill:	1Z0615472110002799	1 [illegible] 2/22/2007	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B46A3	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (2)	NJTP5-E5-02	S: 2/22/2007	14:55	MB46A3	Spike
B46A4	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E5-22	S: 2/22/2007	14:47	MB46A4	Field Duplicate
B46A5	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E6-01	S: 2/22/2007	14:00	MB46A5	–
B46A6	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E6-02	S: 2/22/2007	14:10	MB46A6	–
B46A7	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (2)	NJTP5-E7-01	S: 2/22/2007	13:45	MB46A7	–
B46A8	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E7-03	S: 2/22/2007	15:01	MB46A8	–
B46A9	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(Ice Only) (1)	NJTP5-E7-11	S: 2/22/2007	13:47	MB46A9	Field Duplicate
B46B0	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-G12-02	S: 2/22/2007	9:50	MB46B0	–
B46B1	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-G12-03	S: 2/22/2007	10:00	MB46B1	–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: B46A3, B46A7	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

TR Number: 2-043013577-022207-0002

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

R

Region:	2	Date Shipped:	2/23/2007
Project Code:		Carrier Name:	UPS
Account Code:		Airbill:	1Z0615472110000684
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700
Spill ID:	026A		
Site Name/State:	New Jersey Turnpike Dump #5/NJ		
Project Leader:	Robert Finke		
Action:	Remedial Action		
Sampling Co:			

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1 [signature]	2/23/07 2200		
2			
3			
4			

Sampler Signature:

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB46B3	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-B7-03	S: 2/23/2007	11:10	B46B3	–
MB46B6	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C2-02	S: 2/23/2007	14:00	B46B6	–
MB46B7	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C6-03	S: 2/23/2007	11:35	B46B7	–
MB46B8	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C7-03	S: 2/23/2007	11:05	B46B8	–
MB46B9	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C8-02	S: 2/23/2007	10:30	B46B9	–
MB46C0	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C8-03	S: 2/23/2007	10:35	B46C0	–
MB46C1	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-C9-03	S: 2/23/2007	14:50	B46C1	–
MB46C5	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D2-02	S: 2/23/2007	14:00	B46C5	–
MB46C6	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D9-02	S: 2/23/2007	14:40	B46C6	–
MB46C7	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-D9-03	S: 2/23/2007	14:45	B46C7	–
MB46C9	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E3-01	S: 2/23/2007	11:15	B46C9	–

Shipment for Case Complete? Y	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022207-0005

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/23/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110000684	1 [signature] 2/22/07 2200	
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB46D0	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E3-02 ✓	S: 2/23/2007	11:30	B46D0 ✓	--
MB46D1	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E4-01 ✓	S: 2/23/2007	10:45	B46D1 ✓	--
MB46D2	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E4-02 ✓	S: 2/23/2007	10:50	B46D2 ✓	--
MB46D3	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E8-01 ✓	S: 2/23/2007	9:30	B46D3 ✓	--
MB46D4	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E8-03 ✓	S: 2/23/2007	10:00	B46D4 ✓	--
MB46D5	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E11-03 ✓	S: 2/23/2007	10:05	B46D5 ✓	--
MB46D6	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E12-03 ✓	S: 2/23/2007	10:00	B46D6 ✓	--
MB46D7	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F10-02 ✓	S: 2/23/2007	14:55	B46D7 ✓	--
MB46D8	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F10-03 ✓	S: 2/23/2007	15:00	B46D8 ✓	--
MB46D9	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-F12-03 ✓	S: 2/23/2007	15:10	B46D9 ✓	--
MB46E0	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E3-22 ✓	S: 2/23/2007	11:35	B46E0 ✓	Field Duplicate

Shipment for Case Complete? Y	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022207-0005

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/23/2007
Project Code:		Carrier Name:	UPS
Account Code:		Airbill:	1Z0615472110000684
CERCLIS ID:		Shipped to:	Datachem Laboratories, Inc. 960 West LeVoy Drive Salt Lake City UT 84123 (801) 266-7700
Spill ID:	026A		
Site Name/State:	New Jersey Turnpike Dump #5/NJ		
Project Leader:	Robert Finke		
Action:	Remedial Action		
Sampling Co:			

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1 [signature]	2/23/07 | 2207		
2			
3			
4			

Sampler Signature:

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MB46E1	Soil/Sediment/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-E8-33 ✓	S: 2/23/2007	10:05	B46E1	Field Duplicate
MB46E2	Field QC/ Robert Finke	L/G	TM (21)	(Ice Only) (1)	NJTP5-RB022307 ✓	S: 2/23/2007	7:30	B46E2	Rinsate

Shipment for Case Complete? Y	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key: TM = CLP TAL Total Metals	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

TR Number: 2-043013577-022207-0005

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:

Region:	2	Date Shipped:	2/23/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002780	1 [illegible] 2/23/07/2000	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B46B3	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-B7-03	S: 2/23/2007	11:10	MB46B3	--
B46B6	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C2-02	S: 2/23/2007	14:00	MB46B6	--
B46B7	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-C6-03	S: 2/23/2007	11:35	MB46B7	--
B46B8	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-C7-03	S: 2/23/2007	11:05	MB46B8	--
B46B9	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-C8-02	S: 2/23/2007	10:30	MB46B9	--
B46C0	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-C8-03	S: 2/23/2007	10:35	MB46C0	--
B46C1	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-C9-03	S: 2/23/2007	14:50	MB46C1	--
B46C5	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-D2-02	S: 2/23/2007	14:00	MB46C5	--
B46C6	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-D9-02	S: 2/23/2007	14:40	MB46C6	--
B46C7	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-D9-03	S: 2/23/2007	14:45	MB46C7	--
B46C9	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E3-01	S: 2/23/2007	11:15	MB46C9	--

Shipment for Case Complete? Y	Sample(s) to be used for laboratory QC: B46E0, B46E1	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region: 2	Date Shipped: 2/23/2007	Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name: UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 1Z0615472110002780	1 [illegible] 2/22/07 2200	
CERCLIS ID:	Shipped to: Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID: 026A		3	
Site Name/State: New Jersey Turnpike Dump #5/NJ		4	
Project Leader: Robert Finke			
Action: Remedial Action			
Sampling Co:			

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B46D0	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-E3-02	S: 2/23/2007	11:30	MB46D0	–
B46D1	Soil/Sediment/ Robert Finke	L/G	PEST (21)	(1)	NJTP5-E4-01	S: 2/23/2007	10:45	MB46D1	–
B46D2	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E4-02	S: 2/23/2007	10:50	MB46D2	–
B46D3	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E8-01	S: 2/23/2007	9:30	MB46D3	–
B46D4	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-E8-03	S: 2/23/2007	10:00	MB46D4	–
B46D5	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-E11-03	S: 2/23/2007	10:05	MB46D5	–
B46D6	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-E12-03	S: 2/23/2007	10:00	MB46D6	–
B46D7	Soil/Sediment/ Robert Finke	L/G	PCB only (21)	(Ice Only) (1)	NJTP5-F10-02	S: 2/23/2007	14:55	MB46D7	–
B46D8	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-F10-03	S: 2/23/2007	15:00	MB46D8	–
B46D9	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (4)	NJTP5-F12-03	S: 2/23/2007	15:10	MB46D9	–
B46E0	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (5)	NJTP5-E3-22	S: 2/23/2007	11:35	MB46E0	Field Duplicate

Shipment for Case Complete? Y	Sample(s) to be used for laboratory QC: B46E0, B46E1	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

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USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 36183
DAS No:
R

Region:	2	Date Shipped:	2/23/2007	Chain of Custody Record	Sampler Signature:
Project Code:		Carrier Name:	UPS	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	1Z0615472110002780	1 [illegible] 2/23/07/2200	
CERCLIS ID:		Shipped to:	Liberty Analytical Corporation 501 Madison Avenue Cary NC 27513 (919) 379-4100	2	
Spill ID:	026A			3	
Site Name/State:	New Jersey Turnpike Dump #5/NJ			4	
Project Leader:	Robert Finke				
Action:	Remedial Action				
Sampling Co:					

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		INORGANIC SAMPLE No.	QC Type
B46E1	Soil/Sediment/ Robert Finke	L/G	PCB only (21), VOA (21)	(Ice Only) (5)	NJTP5-E8-33	S: 2/23/2007	10:05	MB46E1	Field Duplicate
B46E2	Field QC/ Robert Finke	L/G	PEST (21), VOA (21)	(HCL), (Ice Only) (5)	NJTP5-RB022307	S: 2/23/2007	7:30	MB46E2	Rinsate

Shipment for Case Complete? Y	Sample(s) to be used for laboratory QC: B46E0, B46E1	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____

PCB only = TCL PCB only, PEST = CLP TCL Pesticide/PCBs, VOA = CLP TCL Volatiles

TR Number: 2-043013577-022207-0006

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TABLE 1 (Continued)
SAMPLE DESCRIPTIONS
NEW JERSEY TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
East-Central	Sub-Surface Soil (5.0')	04/23/07	1112	NJTP5-D12-03	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1145	NJTP5-D13-02	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1145	NJTP5-D13-02	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1145	NJTP5-D13-02	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (5.5')	04/23/07	1150	NJTP5-D13-03	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
East-Central	Sub-Surface Soil (5.5')	04/23/07	1150	NJTP5-D13-03	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (5.5')	04/23/07	1150	NJTP5-D13-03	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (5.5')	04/23/07	1155	NJTP5-D13-33	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
East-Central	Sub-Surface Soil (5.5')	04/23/07	1155	NJTP5-D13-33	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (5.5')	04/23/07	1155	NJTP5-D13-33	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil (2.5')	04/23/07	1220	NJTP5-B13-02	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
Northeast	Sub-Surface Soil (2.5')	04/23/07	1220	NJTP5-B13-02	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil (2.5')	04/23/07	1220	NJTP5-B13-02	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil (5.0')	04/23/07	1230	NJTP5-B13-03	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
Northeast	Sub-Surface Soil (5.0')	04/23/07	1230	NJTP5-B13-03	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
Northeast	Sub-Surface Soil (5.0')	04/23/07	1230	NJTP5-B13-03	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C

TABLE 1
SAMPLE DESCRIPTIONS
NEW JERSEY TURNPIKE DUMP #5 SITE
JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Sample Location	Sample Type	Sample Collection		Sample Number	Analysis Requested		Sample Container	Required Sample Volume	Sample Preservation
		Date	Time		Parameter	Fraction			
West-Central	Surface Soil (0-6")	04/23/07	1000	NJTP5-C4-01	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
West-Central	Surface Soil (0-6")	04/23/07	1000	NJTP5-C4-01	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
West-Central	Surface Soil (0-6")	04/23/07	1000	NJTP5-C4-01	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
West-Central	Sub-Surface Soil (6.0')	04/23/07	1020	NJTP5-C4-03	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
West-Central	Sub-Surface Soil (6.0')	04/23/07	1020	NJTP5-C4-03	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
West-Central	Sub-Surface Soil (6.0')	04/23/07	1020	NJTP5-C4-03	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1050	NJTP5-C10-02	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1050	NJTP5-C10-02	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1050	NJTP5-C10-02	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (5.0')	04/23/07	1055	NJTP5-C4-03	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
East-Central	Sub-Surface Soil (5.0')	04/23/07	1055	NJTP5-C4-03	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (5.0')	04/23/07	1055	NJTP5-C4-03	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1107	NJTP5-D12-02	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1107	NJTP5-D12-02	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (2.5')	04/23/07	1107	NJTP5-D12-02	TCL PCBs	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C
East-Central	Sub-Surface Soil (5.0')	04/23/07	1112	NJTP5-D12-03	TCL VOCs	Soil	(3) direct push core samples	15.0 g.	Cool to 4°C
East-Central	Sub-Surface Soil (5.0')	04/23/07	1112	NJTP5-D12-03	TAL Metals/Hg	Soil	(1) 8 oz. glass jar	8 oz.	Cool to 4°C

5. **Sampling Personnel:**

Name	Organization	Site Duties
Robert C. Finke	U.S. EPA Region 2 DESA/HWSB Superfund Support Team	Project Manager/Sample Management
Christina Leung	U.S. EPA Region 2 DESA/HWSB Superfund Support Team	Field Personnel

6. **Additional Comments:**

The number of samples includes:

- 1 surface soil sample
- 9 sub-surface soil samples
- 1 field duplicate samples (field quality control sample)
- 1 trip blank
- 1 rinsate blank samples (field quality control sample)

The following Sample Numbers were used for laboratory and/or field quality control:

CLP Standard Operating Procedure (SOP)	Laboratory Quality Control (QC) Samples	
	Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	Field Duplicate
DESA Lab: Target Analyte List Metals + Mercury (SOP# C-109)	N/A	NJTP5-C13-03/NJTP5-C13-33
DESA Lab: Target Compound List PCBs (SOP# C-119)	N/A	NJTP5-C13-03/NJTP5-C13-33
DESA Lab: Target Compound List Volatile Organics (SOP# C-89)	N/A	NJTP5-C13-03/NJTP5-C13-33

Report Prepared By: Robert C. Finke Date April 25, 2007

SAMPLING TRIP REPORT

Site Name: Turnpike Dump #5

Sampling Date: April 23, 2007

1. **Site Location:**

   Jersey City, Hudson County, New Jersey

2. **Sample Descriptions:**

   Refer to Table 1

3. **Laboratories Receiving Samples:**

Sample Type	Laboratory Code	Name and Address of Laboratory
TAL Metals/Mercury, TCL PCBs/VOCs in Soil	LABB	U.S. EPA, Region 2 DESA/Laboratory Branch 2890 Woodbridge Ave. Edison, NJ 08837
TAL Metals/Mercury, TCL PCBs/VOCs in Soil	LABB	U.S. EPA, Region 2 DESA/Laboratory Branch 2890 Woodbridge Ave. Edison, NJ 08837

4. **Sample Dispatch Data:**

   On April 23, 2007, one surface and ten sub-surface soil samples were collected from 5 separate locations at the New Jersey Turnpike Dump #5 site, Jersey City, Hudson County, New Jersey. The samples were denoted as follows: NJTP5+Location+Depth Interval. The depth intervals included: 01 (surface to 6inches below ground surface); 02: (1.5 – 2.5 feet below ground surface); and 03: 4 – 6 feet below ground surface). The trip blank was denoted as NJTP5-TB-042307 and the Rinse Blank as NJTP5-RB-042307. All samples were submitted to the EPA Region 2 laboratory for the analysis of Target Analyte List Metals plus mercury and TCL Volatile Organics and PCBs. All samples were collected with either a decontaminated stainless steel hand auger/trough or disposable hand trough and homogenized in a decontaminated stainless steel bowl. Samples collected for the analysis of volatile organics were collected with approved direct push core sampling devices.

   The Chain-of-Custody/Field Data Form can be found as Appendix A.

US EPA REGION 2 LABORATORY

CHAIN OF CUSTODY/ FIELD DATA FORM

SURVEY NAME & LOCALITY Turnpike Dump #5

PROJECT LEADER Robert Finke

PROGRAM: SF ☒ : SITE ID _____ OPERABLE UNIT _____ PROGRAM RESULTS CODE _____

Decision Unit Code Y206

RCRA ☐ D210 | RCRA ENF ☐ D307 | NPDES ☐ B304 | SDWA ☐ C215 | AM ☐ B224 | CAA ☐ A305 | TSCA ☐ L306 | OD ☐ B253 | FIFRA ☐ | CRIMINAL ENF ☐

Permit #: –

LAB ID/ FIELD ID	# OF CONTERS	MATRIX	CHECK IF SPLIT SAMPLE	DESCRIPTION & INSTRUCTIONS INCLUDING LOCATION, ESTIMATED CONCENTRATIONS, SPECIAL REPORTING LIMITS,	Res CL Checked	Preservative (circle)	Collection Time (24hr clock) Begin	End	Collection Date mm/dd/yy
JTP5-TB-042307	3	A	☐	VOCs (low Level)	☐	0 1 2 3 4 5 6 7 8 9 10	0755	0755	04/23/07
JTP5-RB-042307	6	A	☐	VOCs, Pest/PCBs/TAL Metals	☐	0 1 2 3 4 5 6 7 8 9 10	0805	0805	04/23/07
JTP5-C4-04	2	C	☐	PCBs only, TAL Metals+Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1000	1000	04/23/07
JTP5-C4-03	5	C	☐	VOCs, PCBs only, TAL Metals+Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1020	1020	04/23/07
JTP5-C10-02	5	C	☐	VOCs, PCBs only, TAL Metals+Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1050	1050	04/23/07
JTP5-C10-03	2	C	☐	PCBs only, TAL Metals+Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1055	1055	04/23/07
JTP5-D12-02	2	C	☐	PCBs only, TAL Metals+Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1107	1107	04/23/07
JTP5-D12-03	5	C	☐	VOCs, PCBs only, TAL Metals+Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1112	1112	04/23/07
JTP5-C13-02	2	C	☐	PCBs only, TAL Metals+Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1145	1145	04/23/07
JTP5-C13-03	5	C	☐	VOCs, PCBs only, Metals+Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1150	1150	04/23/07

COMMENTS & SPECIAL REQUIREMENTS:

VOCs in Soil include three (3) push type samples

4/07

Preservative Added & Checked

0=ice
1=H2SO4 pH<2
2=HNO3 pH<2
3=HCl pH<2
4=Na2S2O3
5=NaOH pH>9
6=Ascorbic Acid
7=FAS
8=ZnAc
9=NaOH pH>12
10=NH4Cl

Matrix:

A=aqueous
B=aqueous (chlorinated)
C=soil
D=sediment
E=sludge
F=multiphasic
G=solvent
H=biota
I=oil
J=other

		Time	Date
Person Assuming Responsibility for Sample(s): Robert C. Finke		1700	4/23/07
Relinquished By: Robert C. Finke	Received By: [signature]	930	4/24/07
Relinquished By: [signature]	Received By: [signature]	1020	4/24/07
Relinquished By:	Received By:		

Survey Complete? Y ☒ N ☐

revised 10/25/2004

US EPA REGION 2 LABORATORY

CHAIN OF CUSTODY/ FIELD DATA FORM

SURVEY NAME & LOCALITY Tinnecum Ave. Dump #5

PROJECT LEADER Robert Finke

PROGRAM: SF ☒ : SITE ID _____ OPERABLE UNIT _____

PROGRAM RESULTS CODE _____

	RCRA ☐	RCRA ENF ☐	NPDES ☐	SDWA ☐	AM ☐	CAA ☐	TSCA ☐	OD ☐	FIFRA ☐	CRIMINAL ENF ☐
Decision Unit Code Y206	D210	D307	B304	C215	B224	A305	L306	B253		

Permit #:

LAB ID/ FIELD ID	# OF CONTERS	MATRIX	CHECK IF SPLIT SAMPLE	DESCRIPTION & INSTRUCTIONS INCLUDING LOCATION, ESTIMATED CONCENTRATIONS, SPECIAL REPORTING LIMITS,	Res CL Checked	Preservative (circle)	Collection Time (24hr clock) Begin	End	Collection Date mm/dd/yy
NTP5-C13-33	5	C	☐	VOCs, PCBs only*, TAL Metals + Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1155	1155	04/23/07
NTP5-B13-02	5	C	☐	VOCs, PCBs only, TAL Metals + Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1220	1220	04/23/07
NTP5-B13-03	2	C	☐	PCBs only, TAL Metals + Hg	☐	0 1 2 3 4 5 6 7 8 9 10	1230	1230	04/23/07
			☐		☐	0 1 2 3 4 5 6 7 8 9 10			
			☐		☐	0 1 2 3 4 5 6 7 8 9 10			
			☐		☐	0 1 2 3 4 5 6 7 8 9 10			
			☐		☐	0 1 2 3 4 5 6 7 8 9 10			
			☐		☐	0 1 2 3 4 5 6 7 8 9 10			
			☐		☐	0 1 2 3 4 5 6 7 8 9 10			
			☐		☐	0 1 2 3 4 5 6 7 8 9 10			

COMMENTS & SPECIAL REQUIREMENTS:

* PCBs only NOT Pest/PCBs

Preservative Added & Checked

0=ice
1=H2SO4 pH<2
2=HNO3 pH<2
3=HCl pH<2
4=Na2S2O3
5=NaOH pH>9
6=Ascorbic Acid
7=FAS
8=ZnAc
9=NaOH pH>12
10=NH4Cl

	Time	Date
Person Assuming Responsibility for Sample(s): Robert C. Finke	1700	4/23/07
Relinquished By: Robert C. Finke / Received By: [signature]	930	4/24/07
Relinquished By: [signature] / Received By: [signature]	10:20	4/24/07
Relinquished By: / Received By:		

Matrix:

A=aqueous
B=aqueous (chlorinated)
C=soil
D=sediment
E=sludge
F=multiphasic
G=solvent
H=biota
I=oil
J=other

Survey Complete? Y ☒ N ☐

revised 10/25/2004