116375

GERAGHTY & MILLER, INC.
Environmental Services

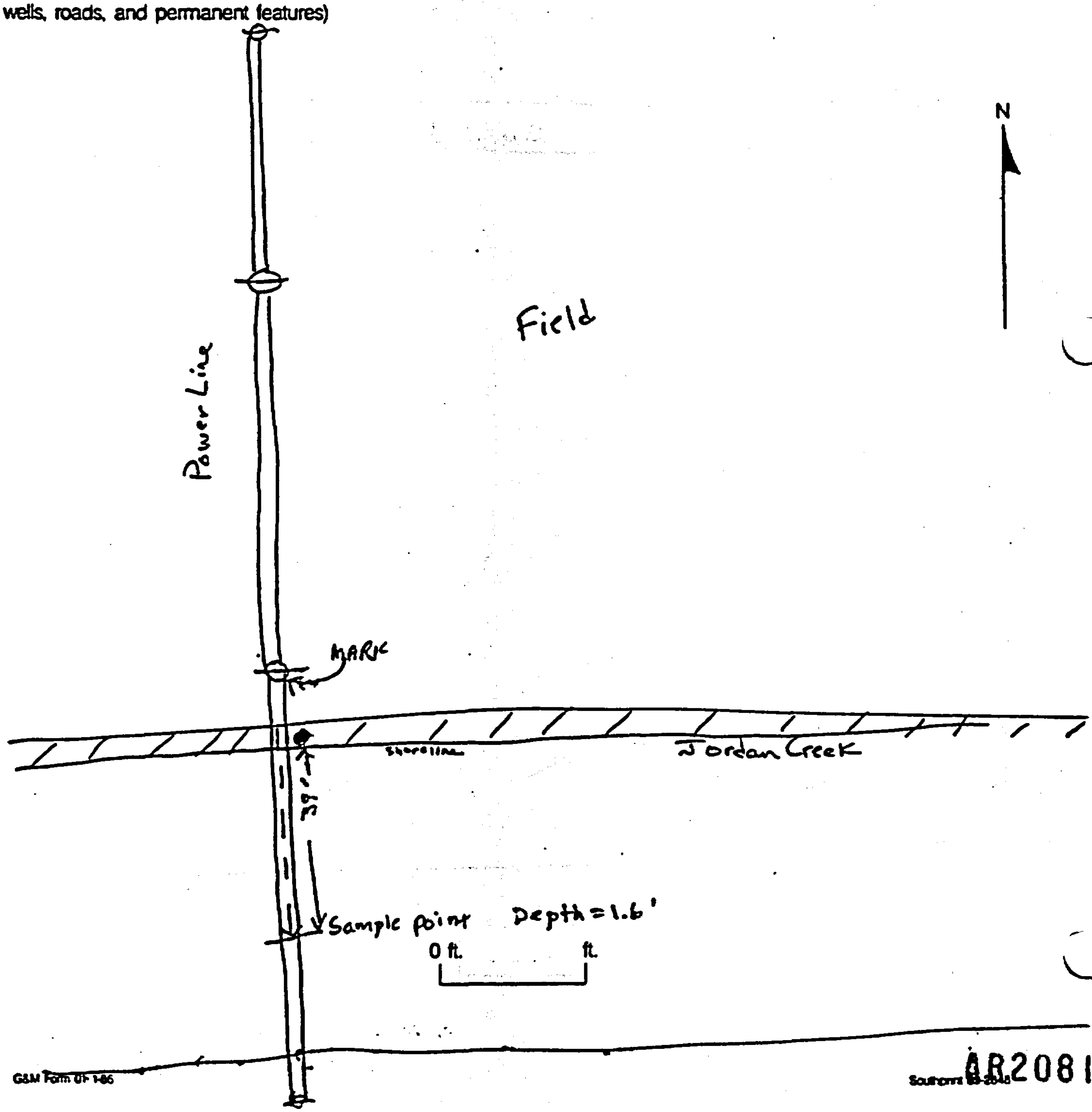
LOCATION SKETCH

Well(s)______ Project/No. NJ06403 Page____ of____

Site Location NSL-SD-14-01

Observer Bill Delaney

(Locate all wells, borings, etc. with reference to three permanent reference points; tape all distances; clearly label all wells, roads, and permanent features)



GERAGHTY & MILLER, INC.
Environmental Services

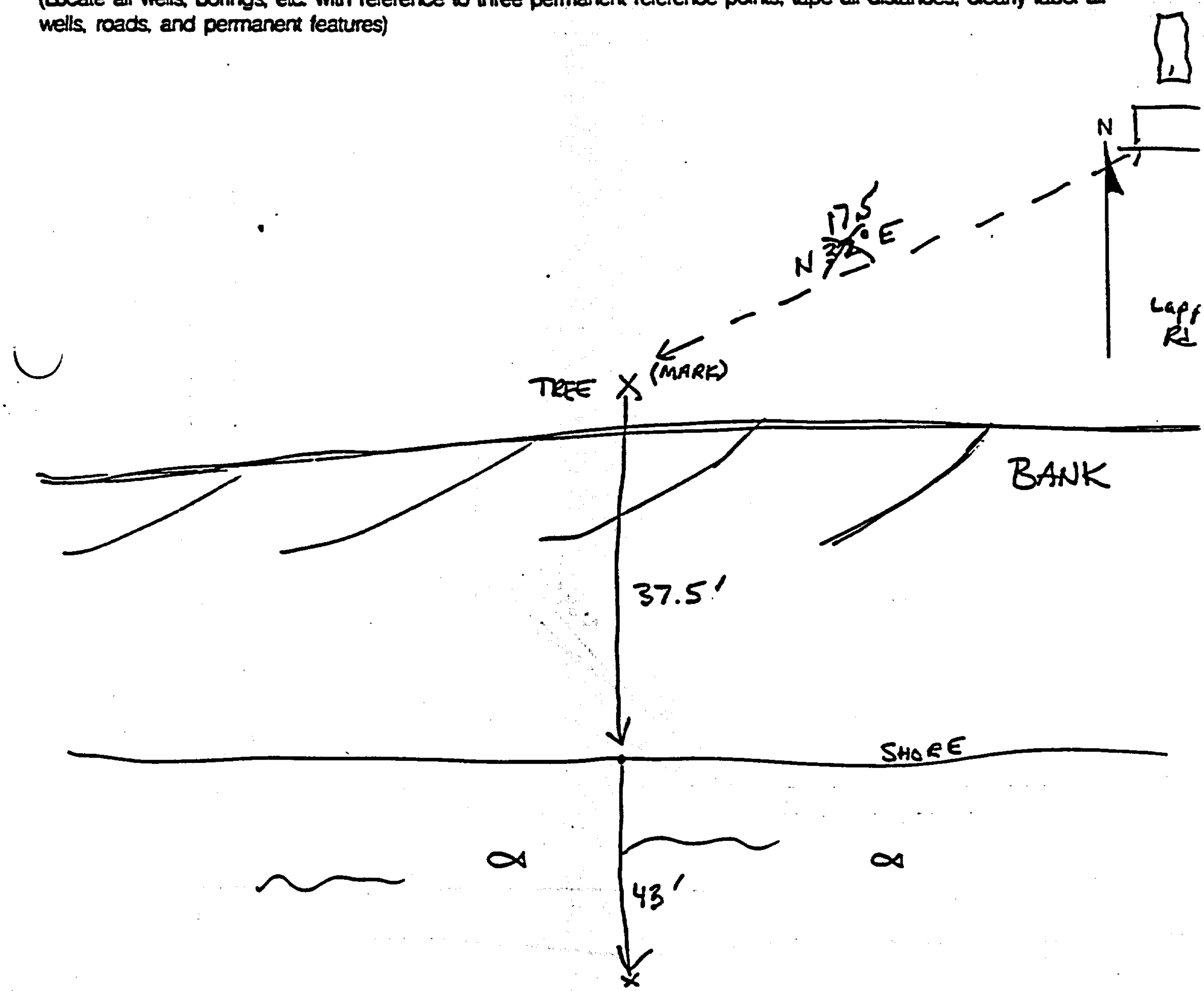
LOCATION SKETCH

Well(s)______ Project/No. NJ06403 Page 1 of ______

Site Location NSL-SD-15-01

Observer BILL DELANEY

(Locate all wells, borings, etc. with reference to three permanent reference points; tape all distances; clearly label all wells, roads, and permanent features)



0 ft. ft.

GERAGHTY & MILLER, INC.
Environmental Services

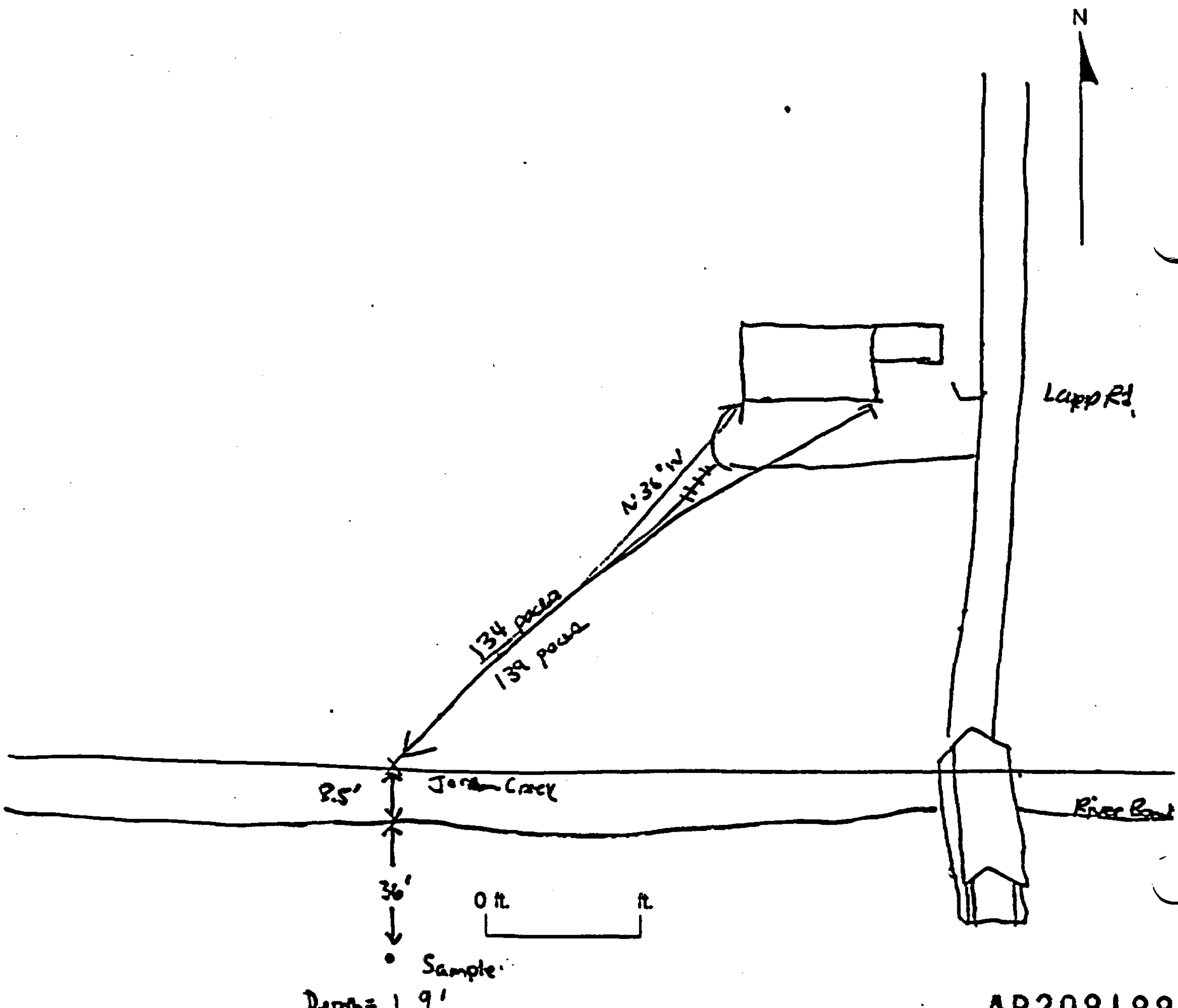
LOCATION SKETCH

Well(s)______ Project/No. NJ26403 Page_____ of_____

Site Location NSL-SD-16-9

Observer Bill Delaney

(Locate all wells, borings, etc. with reference to three permanent reference points; tape all distances; clearly label all wells, roads, and permanent features)



G&M Form 01 1-86

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ATTACHMENT F

ROCK QUALITY DESIGNATION (RQD) SYNOPSIS

ROCK QUALITY DESIGNATION (RQD) - DEERE (1986)

In order to provide a simple and direct means of indicating rock-mass properties, Deere (1986) developed the Rock Quality Designation (RQD). The RQD is based on a modified core recovery procedure which, in turn, is based indirectly on the number of fractures and the amount of softening or alternation in the rock mass as observed in the rock cores from the borehole. Core recovery is the ratio of the length of core recovered to the length drilled (i.e., no recovery = 0 and full recovery = 100). Instead of counting the fractures, an indirect measure is obtained by summing the total length of core recovered by counting only those pieces of hard and sound core which are 10 cm (4 in.) or greater in length and dividing that sum by the total length of that run.

RQD should not be applied to core less than 5.4 cm (2 in.) in diameter as a false RQD may be obtained because smaller cores can be frequently broken during the coring operation.

Care must be taken when removing the core from the core barrel. If a core is broken by handling or during drilling, the fresh broken pieces are fitted together and counted as one piece.

Some judgement is necessary in the case of thinly bedded sedimentary rocks and foliated metamorphic rocks. The method is not so exact in these cases as it is for igneous rock, thick bedded limestone, sandstones, etc. However, this procedure has been applied successfully even for shales, although it is necessary to log the core immediately upon removing them from the core barrel before air-slaking and cracking can occur.

This procedure obviously penalizes the rock where recovery is poor. This is appropriate because poor recovery usually reflects poor quality rock. However, poor drilling techniques and equipment can also cause poor recovery. It is for this reason, that proper equipment and procedure along with competent supervision of the drilling procedure are imperative.

As simple as the procedure appears, it has been found that as an indicator of general quality of rock for engineering purposes, the numerical value of the RQD is more sensitive and consistent than gross percentage core recovery.

Below is a simple example of using RQD.

Modified Core Recovery as an Index of Rock Quality

Core Recovery (cm)	Modified Core Recovery (cm)	Rock Quality Designation (RQD)	Description of Rock Quality
25	25	0 - 25	very poor
12	12	25 - 50	poor
5	0	50 - 75	fair
8	0	75 - 90	good
8	0	90 - 100	excellent
8	0		
10	10		
7	0		
13	13		
15	15		
8	0		
12	12		
10	10		
20	20		
15	15		
176 (cm)	132 (cm)		

185 cm - length of run
Core Recover = 176/185 = 95%

RQD = 132 = 71
therefore, RQD is fair

In this case, the core barrel was advanced 185 cm with a total recovery of 176 cm. However, due to fractures, soft zones, etc., the modified recovery was 132 cm. This translates to RQD of 71, which can be used as a modifier in the geologic description of the rock, which in this case would be "Fair".

ATTACHMENT G

REVISED TABLES FOR BASELINE RISK ASSESSMENT

Table A-   Occurrence of VOCs in Air Samples, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Frequency Detects / Total	Range of Detects Min - Max	Total Range Min - Max	Mean	UCL	EPC	Bkgd
Acetone	4 / 4	1.1E-03 - 2.3E-03	1.1E-03 - 2.3E-03	1.5E-03	2.2E-03	2.2E-03	1.3E-03 (1.8E-03)
Benzene	4 / 4	1.5E-03 - 5.6E-03	1.5E-03 - 5.6E-03	2.8E-03	5.0E-03	5.0E-03	1.9E-03 (2.2E-03)
2-Butanone	3 / 4	5.9E-04 - 8.6E-03	7.8E-05 - 8.6E-03	3.0E-03	7.6E-03	7.6E-03	3.5E-03 (4.7E-03)
Carbon disulfide	1 / 4	4.4E-04	1.5E-06 - 4.4E-04	1.1E-04	3.7E-04	3.7E-04	ND (< 7.0E-06)
Carbon tetrachloride	4 / 4	5.2E-04 - 9.1E-04	5.2E-04 - 9.1E-04	6.5E-04	8.6E-04	8.6E-04	5.3E-04 (5.8E-04)
Chloroform	1 / 4	3.1E-04	2.0E-06 - 3.1E-04	1.1E-04	2.7E-04	2.7E-04	1.2E-04 (1.8E-04)
1,2-Dichloroethane	1 / 4	3.1E-04	1.5E-06 - 3.1E-04	1.1E-04	2.7E-04	2.7E-04	ND (<1.2E-04)
Ethylbenzene	1 / 4	1.6E-03	1.5E-06 - 1.6E-03	4.1E-04	1.4E-03	1.4E-03	2.8E-04 (5.4E-04)
Methylene chloride	4 / 4	9.2E-04 - 8.7E-03	9.2E-04 - 8.7E-03	4.0E-03	8.5E-03	8.5E-03	6.6E-04 (7.8E-04)
Tetrachloroethene	1 / 4	9.4E-04	5.0E-06 - 9.4E-04	2.5E-04	7.9E-04	7.9E-04	1.8E-04 (3.5E-04)
Toluene	4 / 4	5.8E-04 - 8.4E-03	5.8E-04 - 8.4E-03	2.6E-03	7.2E-03	7.2E-03	2.6E-03 (3.9E-03)
1,1,1-Trichloroethane	4 / 4	7.3E-04 - 2.1E-03	7.3E-04 - 2.1E-03	1.2E-03	1.9E-03	1.9E-03	1.1E-03 (1.5E-03)
Trichloroethene	2 / 4	5.3E-04 - 1.7E-03	3.5E-06 - 1.7E-03	5.8E-04	1.5E-03	1.5E-03	9.9E-05 (2.0E-04)
Vinyl acetate	1 / 4	3.3E-04	1.5E-06 - 3.3E-04	9.1E-05	2.8E-04	2.8E-04	ND (< 1.6E-04)
Xylenes (total)	1 / 4	1.6E-02	7.0E-06 - 1.6E-02	3.9E-03	1.3E-02	1.3E-02	2.9E-03 (5.8E-03)

Concentrations are given in milligrams per cubic meter.

List includes all constituents which were detected at least once.

Total range	All values used in the mean and UCL calculations, including proxy concentrations for non-detects.
Mean	Arithmetic mean of the total number of samples, using proxy concentrations for non-detects.
UCL	95 percent upper confidence limit (one-tailed distribution) on the arithmetic mean.
EPC	Exposure point concentration; minimum of the maximum detect and the UCL.
Bkgd	The arithmetic mean (and maximum detect), or ND (and the sample quantitation limit). Background samples are the two upwind samples taken on the two sampling days (one each day).
ND	Not detected. The sample quantitation limit is given in parentheses.

Table A-12. Potentially Applicable or Relevant and Appropriate Standards or Criteria for Constituents Detected in Ground Water, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Standard or Criterion[a]
<u>Inorganics</u>	
Aluminum	0.05 - 0.2[i]
Ammonia	-
Barium	1.0
Beryllium	0.001[b]
Cadmium	0.005[c]
Calcium	-
Chloride	250
Chromium	0.05
Copper	1.3[j]
Cyanide	0.2[g]
Fluoride	2.0
Iron	0.3[i]
Lead	0.015[j]
Magnesium	-
Manganese	0.05[i]
Mercury	0.002
Nickel	0.1[b]
Nitrate (as nitrogen)	10
Potassium	-
Sodium	250[i]
Sulfate	400/500[e]
Vanadium	-
Zinc	5[i]
<u>VOCs</u>	
Acetone	-
Benzene	0.005[d]
Carbon disulfide	-
Chlorobenzene	0.1[e]
Chloroethane	-
1,1-Dichloroethane	-
1,2-Dichloroethene (cis/trans)	0.07/0.1[f]
1,2-Dichloropropane	0.005[b]

Footnotes appear on page 2.

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Table A-12. Potentially Applicable or Relevant and Appropriate Standards or Criteria for Constituents Detected in Ground Water, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Standard or Criterion[a]
trans-1,3-Dichloroproplene	-
Ethylbenzene	0.7[c]
4-Methyl-2-pentanone	-
Methylene chloride	0.005[b]
Styrene	0.1[c]
Tetrachloroethene	0.005[c]
1,1,1-Trichloroethane	0.20
Trichloroethene	0.005[d]
Trihalomethanes, total[g]	0.10[d]
Toluene	1.0[c]
Vinyl chloride	0.002
Xylenes	10[c]
<u>Semi-VOCs</u>	
Bis(2-ethylhexyl)phthalate	0.004[h]
1,2-Dichlorobenzene	0.6[c]
1,4-Dichlorobenzene	0.075[d]
4-Methylphenol	-
Naphthalene	-
Phthalates	0.004[b]

Concentrations reported in milligrams per liter (mg/L).

a Pennsylvania primary Maximum Contaminant Levels (MCLs), unless otherwise noted.
b USEPA proposed primary MCL.
c USEPA final primary MCL, effective July 1992.
d USEPA current primary MCL.
e USEPA proposed primary MCL. The USEPA is requesting public comment on which values (400 mg/L or 500 mg/L) is preferable as a primary level.
f USEPA final primary MCL for cis isomer (0.07 mg/L) and for trans isomer (0.1 mg/L).
g Trihalomethanes include chloroform, bromodichloromethane, bromoform, and dibromochloromethane.
h USEPA proposed primary MCL.
i USEPA final secondary MCL.
j USEPA action level based on treatment technique.

Table A-16. Reference Doses (RfDs), Cancer Slope Factors (CSFs), and USEPA Cancer Classifications for the Constituents of Concern, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Chronic RfD - Oral (mg/kg-day)	Chronic RfD - Inhalation (mg/kg-day)	CSF - Oral $(mg/kg\text{-}day)^{-1}$	CSF - Inhalation $(mg/kg\text{-}day)^{-1}$	USEPA Cancer Classification
VOCs					
Acetone	1.0E-01	NA	NA	NA	D
Benzene	NA	NA	2.9E-02	2.9E-02	A
Bromodichloromethane	2.0E-02	NA	1.3E-01	NA	UR
2-Butanone	5.0E-02	9.0E-02	NA	NA	D
Carbon disulfide	1.0E-01	2.9E-03	NA	NA	NE
Carbon tetrachloride	7.0E-04	NA	1.3E-01	1.3E-01	B2
Chlorobenzene	2.0E-02	5.0E-03	NA	NA	D
Chloroethane	2.0E-02	2.9E+00	NA	NA	NA
Chloroform	1.0E-02	NA	6.1E-03	8.1E-02	B2
Chloromethane	NA	NA	1.3E-02	6.3E-03	C
Dibromochloromethane	2.0E-02	NA	8.4E-02	NA	B2
1,1-Dichloroethane	1.0E-01	1.0E-01	NA	NA	C
1,2-Dichloroethane	2.5E-01	NA	9.1E-02	9.1E-02	B2
trans-1,2-Dichloroethene	2.0E-02	NA	NA	NA	D
1,2-Dichloropropane	NA	NA	6.8E-02	NA	B2
trans-1,3-Dichloropropene	3.0E-04	5.7E-03	1.8E-01	1.3E-01	B2
Ethylbenzene	1.0E-01	2.9E-01	NA	NA	D
Methylene chloride	6.0E-02	8.6E-01	7.5E-03	1.6E-03	B2

Footnotes appear on page 4

Table A-16. Reference Doses (RfDs), Cancer Slope Factors (CSFs), and USEPA Cancer Classifications for the Constituents of Concern, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Chronic RfD - Oral (mg/kg-day)	Chronic RfD - Inhalation (mg/kg-day)	CSF - Oral $(mg/kg\text{-}day)^{-1}$	CSF - Inhalation $(mg/kg\text{-}day)^{-1}$	USEPA Cancer Classification
4-Methyl-2-pentanone	5.0E-02	2.0E-02	NA	NA	NE
Styrene	2.0E-01	NA	3.0E-02	2.0E-03	B2
Tetrachloroethene	1.0E-02	NA	5.1E-02	1.8E-03	B2
Toluene	2.0E-01	5.7E-01	NA	NA	D
1,1,1-Trichloroethane	9.0E-02	3.0E-01	NA	NA	D
Trichloroethene	7.4E-03	NA	1.1E-02	1.7E-02	B2
Vinyl acetate	1E+00	5.7E-02	NA	NA	D
Vinyl chloride	1.3E-03[b]	1.3E-03[b]	1.9E+00	3.0E-01	A
Xylenes (total)	2.0E+00	8.6E-02	NA	NA	D
<u>Semi-VOCs</u>					
Benzoic acid	4.0E+00	NA	NA	NA	D
bis(2-ethylhexyl)phthalate	2.0E-02	NA	1.4E-02	NA	B2
Butylbenzylphthalate	2.0E-01	NA	NA	NA	C
Di-n-butyl phthalate	1.0E-01	NA	NA	NA	D
1,2-Dichlorobenzene	9.0E-02	4.0E-02	NA	NA	D
1,4-Dichlorobenzene	NA	2.0E-01	2.4E-02	NA	B2
Diethylphthalate	8.0E-01	NA	NA	NA	C
4-Methylphenol	5.0E-02	NA	NA	NA	C
c-PAHs (Benzo[a]pyrene)	NA	NA	1.2E+01	6.1E+00	B2

Footnotes appear on page 4

Table A-16. Reference Doses (RfDs), Cancer Slope Factors (CSFs), and USEPA Cancer Classifications for the Constituents of Concern, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Chronic RfD - Oral (mg/kg-day)	Chronic RfD - Inhalation (mg/kg-day)	CSF - Oral $(mg/kg\text{-}day)^{-1}$	CSF - Inhalation $(mg/kg\text{-}day)^{-1}$	USEPA Cancer Classification
t-PAHs (Naphthalene)	4.0E-03	NA	NA	NA	D
Inorganics					
Aluminum	NA	NA	NA	NA	NE
Ammonia	NA	2.9E-02	NA	NA	NE
Antimony	4.0E-04	NA	NA	NA	NE
Arsenic	3.0E-04	NA	1.8E+00	1.5E+01	A
Barium	7.0E-02	1.0E-04	NA	NA	NE
Beryllium	5.0E-03	NA	4.3E+00	8.4E+00	B2
Cadmium	5.0E-04	NA	NA	6.1E+00	B1
Chloride	NA	NA	NA	NA	NE
Chromium (VI)	5.0E-03	5.7E-07	NA	4.1E+01	A
Cobalt	NA	NA	NA	NA	NE
Copper	3.7E-02	NA	NA	NA	D
Cyanide, free	2.0E-02	NA	NA	NA	D
Fluoride, sol. Fluoride	6.0E-02	NA	NA	NA	NE
Lead	NA	NA	NA	NA	B2
Manganese	1.0E-01	1.1E-04	NA	NA	D
Mercury	3.0E-04	8.6E-05	NA	NA	D
Nickel	2.0E-02	NA	NA	8.4E-01	A

Footnotes appear on page 4

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Table A-16. Reference Doses (RfDs), Cancer Slope Factors (CSFs), and USEPA Cancer Classifications for the Constituents of Concern, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Chronic RfD - Oral (mg/kg-day)	Chronic RfD - Inhalation (mg/kg-day)	CSF - Oral $(mg/kg\text{-}day)^{-1}$	CSF - Inhalation $(mg/kg\text{-}day)^{-1}$	USEPA Cancer Classification
Nitrate	1.6E+00	NA	NA	NA	NE
Selenium	5.0E-03	NA	NA	NA	D
Silver	3.0E-03	NA	NA	NA	D
Vanadium	7.0E-03	NA	NA	NA	NE
Zinc	2.0E-01	NA	NA	NA	D

cPAHs Carcinogenic PAHs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene.

tPAHs Total PAHs: cPAHs, plus acenaphthene, anthracene, benzo(g,h,i)perylene, fluoranthene, naphthalene, phenanthrene, and pyrene.

References: The toxicity values were obtained from IRIS (1992) or USEPA (1991b).

NA Not available.

NE This constituent has not been evaluated by the USEPA for evidence of human carcinogenic potential.

UR The USEPA is currently evaluating this constituent for evidence of human carcinogenic potential. This does not imply that this chemical is necessarily a carcinogen.

Footnotes appear on page 4

Table A-19. VOC Concentrations Detected at the Novak Sanitary Landfill and Comparison to Pennsylvania Department of Environmental Regulation (PADER) Air Toxic Guidelines.

Constituents	C_a (mg/m³)	PADER Air Toxic Guidelines (mg/m³)
Acetone	2.2E-03	-
Benzene	5.0E-03	1.25E-02
2-Butanone	7.6E-03	-
Carbon disulfide	3.7E-04	-
Carbon tetrachloride	8.6E-04	6.7E-03
Chloroform	2.7E-04	4.4E-03
1,2-Dichloroethane	2.7E-04	-
Ethylbenzene	1.4E-03	-
Methylene chloride	8.5E-03	2.4E-02
Tetrachloroethene	7.9E-04	1.7E-01
1,1,1-Trichloroethane	7.2E-04	-
Trichloroethene	1.9E-03	7.7E-02
Toluene	1.5E-03	-
Vinyl acetate	2.8E-04	-
Xylenes (total)	1.3E-02	-

C_a Concentrations reported are 95 percent upper confidence limit on the arithmetic average (from Table A-6).

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Table ... F.....e Gr..... Wat... (On-Site ...ident... (Well) ...posure ... and ... Cal...ons f... Pote... Curr... Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	0.0010	2.7E-05	NA	1.2E-05	3.4E-07
Bromodichloromethane	0.00090	2.5E-05	1.2E-03	1.1E-05	1.4E-06
Carbon disulfide	0.00070	1.9E-05	1.9E-04	8.2E-06	NC
Chlorobenzene	0.00040	1.1E-05	2.2E-03	4.7E-06	NC
Chloroform	0.014	3.8E-04	3.8E-02	1.6E-04	1.0E-06
Dibromochloromethane	0.00050	1.4E-05	6.8E-04	5.9E-06	4.9E-07
1,1-Dichloroethane	0.00040	1.1E-05	1.1E-04	4.7E-06	NC
1,2-Dichloroethene (total)	0.016	4.4E-04	2.2E-02	1.9E-04	NC
Tetrachloroethene	0.0020	5.5E-05	5.5E-03	2.3E-05	1.2E-06
Trichloroethene	0.030	8.2E-04	1.1E-01	3.5E-04	3.9E-06
Vinyl chloride	0.0070	1.9E-04	1.5E-01	8.2E-05	1.6E-04
Inorganics					
Aluminum	0.044	1.2E-03	NA	5.2E-04	NC
Barium	0.10	2.7E-03	3.9E-02	1.2E-03	NC
Cadmium	0.0046	1.3E-04	2.5E-01	5.4E-05	NC
Chloride	610	1.7E+01	NA	7.2E+00	NC
Copper	0.017	4.7E-04	1.3E-02	2.0E-04	NC
Fluoride	0.14	3.8E-03	6.4E-02	1.6E-03	NC
Lead	0.0063	1.7E-04	NA	7.4E-05	NC
Manganese	0.0052	1.4E-04	1.4E-03	6.1E-05	NC
Mercury	0.00080	2.2E-05	7.3E-02	9.4E-06	NC
Nickel	0.035	9.6E-04	4.8E-02	4.1E-04	NC
Nitrate	0.60	1.6E-02	1.0E-02	7.0E-03	NC
Zinc	0.030	8.2E-04	4.1E-03	3.5E-04	NC
		Total	8.3E-01	Total	2E-04

Cw — Constituent concentration in the on-site residential wells (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD — Oral exposure dose from drinking water (mg/kg-day).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic by the oral route.

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Table . Fu... Grou... Water (On-Site Residential Wells) Exposure Doses and Risk Calculations for a Potential Future Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	0.0010	6.4E-05	NA	5.5E-06	1.6E-07
Bromodichloromethane	0.00090	5.8E-05	2.9E-03	4.9E-06	6.4E-07
Carbon disulfide	0.00070	4.5E-05	4.5E-04	3.8E-06	NC
Chlorobenzene	0.00040	2.6E-05	1.3E-03	2.2E-06	NC
Chloroform	0.014	8.9E-04	8.9E-02	7.7E-05	4.7E-07
Dibromochloromethane	0.00050	3.2E-05	1.6E-03	2.7E-06	2.3E-07
1,1-Dichloroethane	0.00040	2.6E-05	2.6E-04	2.2E-06	NC
1,2-Dichloroethene (total)	0.016	1.0E-03	5.1E-02	8.8E-05	NC
Tetrachloroethene	0.0020	1.3E-04	1.3E-02	1.1E-05	5.6E-07
Trichloroethene	0.030	1.9E-03	2.6E-01	1.6E-04	1.8E-06
Vinyl chloride	0.0070	4.5E-04	3.4E-01	3.8E-05	7.3E-05
Inorganics					
Aluminum	0.044	2.8E-03	NA	2.4E-04	NC
Barium	0.10	6.4E-03	9.1E-02	5.5E-04	NC
Cadmium	0.0046	2.9E-04	5.9E-01	2.5E-05	NC
Chloride	610	3.9E+01	NA	3.3E+00	NC
Copper	0.017	1.1E-03	2.9E-02	9.3E-05	NC
Fluoride	0.14	8.9E-03	1.5E-01	7.7E-04	NC
Lead	0.0063	4.0E-04	NA	3.5E-05	NC
Manganese	0.0052	3.3E-04	3.3E-03	2.8E-05	NC
Mercury	0.00080	5.1E-05	1.7E-01	4.4E-06	NC
Nickel	0.035	2.2E-03	1.1E-01	1.9E-04	NC
Nitrate	0.60	3.8E-02	2.4E-02	3.3E-03	NC
Zinc	0.030	1.9E-03	9.6E-03	1.6E-04	NC
		Total	1.9E+00	Total	8E-05

Cw — Constituent concentration in the on-site residential wells (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD — Oral exposure dose from drinking water (mg/kg-day).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic by the oral route.

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ble A-24a. Potable Ground-Water (NSL-RW-03) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.001	2.7E-05	2.7E-04	1.2E-05	NA
1,2-Dichloroethene (total)	0.0009	2.5E-05	1.2E-03	1.1E-05	NC
1.2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	0.001	2.7E-05	2.7E-03	1.2E-05	6.0E-07
1,1,1-Trichloroethane	0.003	8.2E-05	9.1E-04	3.5E-05	NC
Trichloroethene	0.0009	2.5E-05	3.3E-03	1.1E-05	1.2E-07
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	ND	NAP	NAP	NAP	NAP
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0372	1.0E-03	1.5E-02	4.4E-04	NA
Cadmium	ND	NAP	NAP	NAP	NAP
Chloride	71	1.9E+00	NA	8.3E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0166	4.5E-04	1.2E-02	1.9E-04	NC
Fluoride	ND	NAP	NAP	NAP	NAP
Lead	0.0024	6.6E-05	NA	2.8E-05	NA
Manganese	0.0032	8.8E-05	8.8E-04	3.8E-05	NC
Nickel	0.0193	5.3E-04	2.6E-02	2.3E-04	NA
Nitrate	3.6	9.9E-02	6.2E-02	4.2E-02	NA
Zinc	0.0279	7.6E-04	3.8E-03	3.3E-04	NC
		Total	1.3E-01	Total	7E-07

Footnotes appear on page 2.

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Table A-24a. Potable Ground-Water (NSL-RW-03) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-03 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-24b. Potable Ground-Water (NSL-RW-04) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	0.0006	1.6E-05	2.7E-04	7.0E-06	5.3E-08
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	1.28	3.5E-02	NA	1.5E-02	NA
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0859	2.4E-03	3.4E-02	1.0E-03	NA
Cadmium	0.0052	1.4E-04	2.8E-01	6.1E-05	NC
Chloride	64	1.8E+00	NA	7.5E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0117	3.2E-04	8.7E-03	1.4E-04	NC
Fluoride	0.24	6.6E-03	1.1E-01	2.8E-03	NA
Lead	0.0121	3.3E-04	NA	1.4E-04	NA
Manganese	0.0323	8.8E-04	8.8E-03	3.8E-04	NC
Nickel	0.038	1.0E-03	5.2E-02	4.5E-04	NA
Nitrate	3.5	9.6E-02	6.0E-02	4.1E-02	NA
Zinc	0.0467	1.3E-03	6.4E-03	5.5E-04	NC
		Total	5.6E-01	Total	5E-08

Footnotes appear on page 2.

Table A-24b. Potable Ground-Water (NSL-RW-04) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-04 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-24c. Potable Ground-Water (NSL-RW-06) Exposure Doses [illegible] Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, [illegible]ylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.0005	1.4E-05	1.4E-04	5.9E-06	NA
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1.2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	0.0002	5.5E-06	5.5E-04	2.3E-06	1.2E-07
1,1,1-Trichloroethane	0.0006	1.6E-05	1.8E-04	7.0E-06	NC
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	0.0538	1.5E-03	NA	6.3E-04	NA
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0504	1.4E-03	2.0E-02	5.9E-04	NA
Cadmium	0.0084	2.3E-04	4.6E-01	9.9E-05	NC
Chloride	28	7.7E-01	NA	3.3E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0143	3.9E-04	1.1E-02	1.7E-04	NC
Fluoride	0.2	5.5E-03	9.1E-02	2.3E-03	NA
Lead	0.0036	9.9E-05	NA	4.2E-05	NA
Manganese	0.0062	1.7E-04	1.7E-03	7.3E-05	NC
Nickel	0.0249	6.8E-04	3.4E-02	2.9E-04	NA
Nitrate	4.8	1.3E-01	8.2E-02	5.6E-02	NA
Zinc	0.0298	8.2E-04	4.1E-03	3.5E-04	NC
		Total	7.0E-01	Total	1E-07

Footnotes appear on page 2.

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Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-06 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

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Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	0.003	8.2E-05	NA	3.5E-05	1.0E-06
Chlorobenzene	0.015	4.1E-04	2.1E-02	1.8E-04	NC
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.001	2.7E-05	2.7E-04	1.2E-05	NA
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1.2-Dichloropropane	0.002	5.5E-05	NA	2.3E-05	1.6E-06
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	0.0009	2.5E-05	3.3E-03	1.1E-05	1.2E-07
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	0.0501	1.4E-03	NA	5.9E-04	NA
Ammonia	3.3	9.0E-02	NA	3.9E-02	NA
Barium	0.197	5.4E-03	7.7E-02	2.3E-03	NA
Cadmium	0.0098	2.7E-04	5.4E-01	1.2E-04	NC
Chloride	70	1.9E+00	NA	8.2E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0291	8.0E-04	2.2E-02	3.4E-04	NC
Fluoride	ND	NAP	NAP	NAP	NAP
Lead	0.0032	8.8E-05	NA	3.8E-05	NA
Manganese	0.243	6.7E-03	6.7E-02	2.9E-03	NC
Nickel	0.0314	8.6E-04	4.3E-02	3.7E-04	NA
Nitrate	0.065	1.8E-03	1.1E-03	7.6E-04	NA
Zinc	0.0305	8.4E-04	4.2E-03	3.6E-04	NC
		Total	7.7E-01	Total	3E-06

Footnotes appear on page 2.

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Table A-24c. [illegible] (NSL-RW-07) Exposure [illegible] Risk Calculation [illegible] a Potential Current Off-site [illegible] Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-07 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

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Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1.2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	0.0419	1.1E-03	NA	4.9E-04	NA
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0441	1.2E-03	1.7E-02	5.2E-04	NA
Cadmium	ND	NAP	NAP	NAP	NAP
Chloride	32	8.8E-01	NA	3.8E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0124	3.4E-04	9.2E-03	1.5E-04	NC
Fluoride	0.12	3.3E-03	5.5E-02	1.4E-03	NA
Lead	0.0154	4.2E-04	NA	1.8E-04	NA
Manganese	0.0033	9.0E-05	9.0E-04	3.9E-05	NC
Nickel	0.0243	6.7E-04	3.3E-02	2.9E-04	NA
Nitrate	2.6	7.1E-02	4.5E-02	3.1E-02	NA
Zinc	0.0513	1.4E-03	7.0E-03	6.0E-04	NC
		Total	1.7E-01	Total	NCP

Footnotes appear on page 2.

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Table A-24e. Potable Ground-Water (NSL-RW-09) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-09 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
NCP	No potential carcinogens detected in this well.
ND	Not detected.

Table A-24f. Potable Ground-Water (NSL-RW-10) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk		Cancer Risk	
		PGWExD	HQ	PGWExD	ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1.2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	0.0497	1.4E-03	NA	5.8E-04	NA
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0616	1.7E-03	2.4E-02	7.2E-04	NA
Cadmium	0.0041	1.1E-04	2.2E-01	4.8E-05	NC
Chloride	35	9.6E-01	NA	4.1E-01	NA
Chromium	0.0102	2.8E-04	5.6E-02	1.2E-04	NC
Copper	0.0184	5.0E-04	1.4E-02	2.2E-04	NC
Fluoride	0.1	2.7E-03	4.6E-02	1.2E-03	NA
Lead	0.0044	1.2E-04	NA	5.2E-05	NA
Manganese	0.0034	9.3E-05	9.3E-04	4.0E-05	NC
Nickel	0.0222	6.1E-04	3.0E-02	2.6E-04	NA
Nitrate	7.1	1.9E-01	1.2E-01	8.3E-02	NA
Zinc	0.0732	2.0E-03	1.0E-02	8.6E-04	NC
		Total	5.3E-01	Total	NCP

Footnotes appear on page 2.

Table A-24f. Potable Ground-Water (NSL-RW-10) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-10 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
NCP	No potential carcinogens detected in this well.
ND	Not detected.

Table A-24g. Potable Ground-Water (NSL-RW-12) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	0.0002	5.5E-06	5.5E-04	2.3E-06	1.4E-08
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1.2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	0.0002	5.5E-06	2.7E-06	2.3E-06	NC
Inorganics					
Aluminum	ND	NAP	NAP	NAP	NAP
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	ND	NAP	NAP	NAP	NAP
Cadmium	ND	NAP	NAP	NAP	NAP
Chloride	ND	NAP	NAP	NAP	NAP
Chromium	ND	NAP	NAP	NAP	NAP
Copper	ND	NAP	NAP	NAP	NAP
Fluoride	ND	NAP	NAP	NAP	NAP
Lead	ND	NAP	NAP	NAP	NAP
Manganese	ND	NAP	NAP	NAP	NAP
Nickel	ND	NAP	NAP	NAP	NAP
Nitrate	ND	NAP	NAP	NAP	NAP
Zinc	ND	NAP	NAP	NAP	NAP
		Total	5.5E-04	Total	1E-08

Footnotes appear on page 2.

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Table A-24g. Potable Ground-Water (NSL-RW-12) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-12 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-24h. Potable Ground-Water (NSL-RW-17) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	0.002	5.5E-05	2.7E-03	2.3E-05	2.0E-06
1,1-Dichloroethane	0.0004	1.1E-05	1.1E-04	4.7E-06	NA
1,2-Dichloroethene (total)	0.0008	2.2E-05	1.1E-03	9.4E-06	NC
1.2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	0.0003	8.2E-06	8.2E-04	3.5E-06	1.8E-07
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	ND	NAP	NAP	NAP	NAP
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	ND	NAP	NAP	NAP	NAP
Cadmium	ND	NAP	NAP	NAP	NAP
Chloride	ND	NAP	NAP	NAP	NAP
Chromium	ND	NAP	NAP	NAP	NAP
Copper	ND	NAP	NAP	NAP	NAP
Fluoride	ND	NAP	NAP	NAP	NAP
Lead	ND	NAP	NAP	NAP	NAP
Manganese	ND	NAP	NAP	NAP	NAP
Nickel	ND	NAP	NAP	NAP	NAP
Nitrate	ND	NAP	NAP	NAP	NAP
Zinc	ND	NAP	NAP	NAP	NAP
		Total	4.8E-03	Total	2E-06

Footnotes appear on page 2.

Table A-24h. Potable Ground-Water (NSL-RW-17) Exposure Doses and Risk Calculations for a Potential Current Off-Site Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-17 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-25a. Potable Ground-Water (NSL-RW-03) Exposure D... and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk		Cancer Risk	
		PGWExD	HQ	PGWExD	ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.001	6.4E-05	6.4E-04	5.5E-06	NA
1,2-Dichloroethene (total)	0.0009	5.8E-05	2.9E-03	4.9E-06	NC
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	0.001	6.4E-05	6.4E-03	5.5E-06	2.8E-07
1,1,1-Trichloroethane	0.003	1.9E-04	2.1E-03	1.6E-05	NC
Trichloroethene	0.0009	5.8E-05	7.8E-03	4.9E-06	5.4E-08
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	ND	NAP	NAP	NAP	NAP
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0372	2.4E-03	3.4E-02	2.0E-04	NA
Cadmium	ND	NAP	NAP	NAP	NAP
Chloride	71	4.5E+00	NA	3.9E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0166	1.1E-03	2.9E-02	9.1E-05	NC
Fluoride	ND	NAP	NAP	NAP	NAP
Lead	0.0024	1.5E-04	NA	1.3E-05	NA
Manganese	0.0032	2.0E-04	2.0E-03	1.8E-05	NC
Nickel	0.0193	1.2E-03	6.2E-02	1.1E-04	NA
Nitrate	3.6	2.3E-01	1.4E-01	2.0E-02	NA
Zinc	0.0279	1.8E-03	8.9E-03	1.5E-04	NC
		Total	3.0E-01	Total	3E-07

Footnotes appear on page 2.

Table A-25a. Potable Ground-Water (NSL-RW-03) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-03 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-25b. Potable Ground-Water (NSL-RW-04) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

		Non-Cancer Risk		Cancer Risk	
Constituent	Cw	PGWExD	HQ	PGWExD	ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	0.0006	3.8E-05	6.4E-04	3.3E-06	2.5E-08
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	1.28	8.2E-02	NA	7.0E-03	NA
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0859	5.5E-03	7.8E-02	4.7E-04	NA
Cadmium	0.0052	3.3E-04	6.6E-01	2.8E-05	NC
Chloride	64	4.1E+00	NA	3.5E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0117	7.5E-04	2.0E-02	6.4E-05	NC
Fluoride	0.24	1.5E-02	2.6E-01	1.3E-03	NA
Lead	0.0121	7.7E-04	NA	6.6E-05	NA
Manganese	0.0323	2.1E-03	2.1E-02	1.8E-04	NC
Nickel	0.038	2.4E-03	1.2E-01	2.1E-04	NA
Nitrate	3.5	2.2E-01	1.4E-01	1.9E-02	NA
Zinc	0.0467	3.0E-03	1.5E-02	2.6E-04	NC
		Total	1.3E+00	Total	2E-08

Footnotes appear on page 2.

Table A-25b. Potable Ground-Water (NSL-RW-04) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-04 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-25c. Potable Ground-Water (NSL-RW-06) Exposure D[illegible] and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.0005	3.2E-05	3.2E-04	2.7E-06	NA
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	0.0002	1.3E-05	1.3E-03	1.1E-06	5.6E-08
1,1,1-Trichloroethane	0.0006	3.8E-05	4.3E-04	3.3E-06	NC
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	0.0538	3.4E-03	NA	2.9E-04	NA
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0504	3.2E-03	4.6E-02	2.8E-04	NA
Cadmium	0.0084	5.4E-04	1.1E+00	4.6E-05	NC
Chloride	28	1.8E+00	NA	1.5E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0143	9.1E-04	2.5E-02	7.8E-05	NC
Fluoride	0.2	1.3E-02	2.1E-01	1.1E-03	NA
Lead	0.0036	2.3E-04	NA	2.0E-05	NA
Manganese	0.0062	4.0E-04	4.0E-03	3.4E-05	NC
Nickel	0.0249	1.6E-03	8.0E-02	1.4E-04	NA
Nitrate	4.8	3.1E-01	1.9E-01	2.6E-02	NA
Zinc	0.0298	1.9E-03	9.5E-03	1.6E-04	NC
		Total	1.6E+00	Total	6E-08

Footnotes appear on page 2.

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Table A-25c. Potable Ground-Water (NSL-RW-06) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-06 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-25d. Potable Ground-Water (NSL-RW-07) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk		Cancer Risk	
		PGWExD	HQ	PGWExD	ELCR
VOCs					
Benzene	0.003	1.9E-04	NA	1.6E-05	4.8E-07
Chlorobenzene	0.015	9.6E-04	4.8E-02	8.2E-05	NC
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.001	6.4E-05	6.4E-04	5.5E-06	NA
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	0.002	1.3E-04	NA	1.1E-05	7.5E-07
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	0.0009	5.8E-05	7.8E-03	4.9E-06	5.4E-08
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	0.0501	3.2E-03	NA	2.7E-04	NA
Ammonia	3.3	2.1E-01	NA	1.8E-02	NA
Barium	0.197	1.3E-02	1.8E-01	1.1E-03	NA
Cadmium	0.0098	6.3E-04	1.3E+00	5.4E-05	NC
Chloride	70	4.5E+00	NA	3.8E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0291	1.9E-03	5.0E-02	1.6E-04	NC
Fluoride	ND	NAP	NAP	NAP	NAP
Lead	0.0032	2.0E-04	NA	1.8E-05	NA
Manganese	0.243	1.6E-02	1.6E-01	1.3E-03	NC
Nickel	0.0314	2.0E-03	1.0E-01	1.7E-04	NA
Nitrate	0.065	4.2E-03	2.6E-03	3.6E-04	NA
Zinc	0.0305	1.9E-03	9.7E-03	1.7E-04	NC
		Total	**1.8E+00**	**Total**	**1E-06**

Footnotes appear on page 2.

Table A-25d. Potable Ground-Water (NSL-RW-07) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-07 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-25e. Potable Ground-Water (NSL-RW-09) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	0.0419	2.7E-03	NA	2.3E-04	NA
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0441	2.8E-03	4.0E-02	2.4E-04	NA
Cadmium	ND	NAP	NAP	NAP	NC
Chloride	32	2.0E+00	NA	1.8E-01	NA
Chromium	ND	NAP	NAP	NAP	NAP
Copper	0.0124	7.9E-04	2.1E-02	6.8E-05	NC
Fluoride	0.12	7.7E-03	1.3E-01	6.6E-04	NA
Lead	0.0154	9.8E-04	NA	8.4E-05	NA
Manganese	0.0033	2.1E-04	2.1E-03	1.8E-05	NC
Nickel	0.0243	1.6E-03	7.8E-02	1.3E-04	NA
Nitrate	2.6	1.7E-01	1.0E-01	1.4E-02	NA
Zinc	0.0513	3.3E-03	1.6E-02	2.8E-04	NC
		Total	3.9E-01	Total	NCP

Footnotes appear on page 2.

Table A-25e. Potable Ground-Water (NSL-RW-09) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-09 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
NCP	No potential carcinogens detected in this well.
ND	Not detected.

Table A-25f. Potable Ground-Water (NSL-RW-10) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

		Non-Cancer Risk		Cancer Risk	
Constituent	Cw	PGWExD	HQ	PGWExD	ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	0.0497	3.2E-03	NA	2.7E-04	NA
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	0.0616	3.9E-03	5.6E-02	3.4E-04	NA
Cadmium	0.0041	2.6E-04	5.2E-01	2.2E-05	NC
Chloride	35	2.2E+00	NA	1.9E-01	NA
Chromium	0.0102	6.5E-04	1.3E-01	5.6E-05	NC
Copper	0.0184	1.2E-03	3.2E-02	1.0E-04	NC
Fluoride	0.1	6.4E-03	1.1E-01	5.5E-04	NA
Lead	0.0044	2.8E-04	NA	2.4E-05	NA
Manganese	0.0034	2.2E-04	2.2E-03	1.9E-05	NC
Nickel	0.0222	1.4E-03	7.1E-02	1.2E-04	NA
Nitrate	7.1	4.5E-01	2.8E-01	3.9E-02	NA
Zinc	0.0732	4.7E-03	2.3E-02	4.0E-04	NC
		Total	1.2E+00	Total	NCP

Footnotes appear on page 2.

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Table A-25f. Potable Ground-Water (NSL-RW-10) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-10 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
NCP	No potential carcinogens detected in this well.
ND	Not detected.

Table A-25g. Potable Ground-Water (NSL-RW-12) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	0.0002	1.3E-05	1.3E-03	1.1E-06	6.7E-09
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene (total)	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	0.0002	1.3E-05	6.4E-06	1.1E-06	NC
Inorganics					
Aluminum	ND	NAP	NAP	NAP	NAP
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	ND	NAP	NAP	NAP	NAP
Cadmium	ND	NAP	NAP	NAP	NAP
Chloride	ND	NAP	NAP	NAP	NAP
Chromium	ND	NAP	NAP	NAP	NAP
Copper	ND	NAP	NAP	NAP	NAP
Fluoride	ND	NAP	NAP	NAP	NAP
Lead	ND	NAP	NAP	NAP	NAP
Manganese	ND	NAP	NAP	NAP	NAP
Nickel	ND	NAP	NAP	NAP	NAP
Nitrate	ND	NAP	NAP	NAP	NAP
Zinc	ND	NAP	NAP	NAP	NAP
		Total	1.3E-03	Total	7E-09

Footnotes appear on page 2.

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Table A-25g. Potable Ground-Water (NSL-RW-12) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-12 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-25h. Potable Ground-Water (NSL-RW-17) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	0.002	1.3E-04	6.4E-03	1.1E-05	9.2E-07
1,1-Dichloroethane	0.0004	2.6E-05	2.6E-04	2.2E-06	NA
1,2-Dichloroethene (total)	0.0008	5.1E-05	2.6E-03	4.4E-06	NC
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	0.0003	1.9E-05	1.9E-03	1.6E-06	8.4E-08
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
Inorganics					
Aluminum	ND	NAP	NAP	NAP	NAP
Ammonia	ND	NAP	NAP	NAP	NAP
Barium	ND	NAP	NAP	NAP	NAP
Cadmium	ND	NAP	NAP	NAP	NAP
Chloride	ND	NAP	NAP	NAP	NAP
Chromium	ND	NAP	NAP	NAP	NAP
Copper	ND	NAP	NAP	NAP	NAP
Fluoride	ND	NAP	NAP	NAP	NAP
Lead	ND	NAP	NAP	NAP	NAP
Manganese	ND	NAP	NAP	NAP	NAP
Nickel	ND	NAP	NAP	NAP	NAP
Nitrate	ND	NAP	NAP	NAP	NAP
Zinc	ND	NAP	NAP	NAP	NAP
		Total	1.1E-02	Total	1E-06

Footnotes appear on page 2.

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Table A-25h. Potable Ground-Water (NSL-RW-17) Exposure Doses and Risk Calculations for a Potential Current Off-Site Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-17 (mg/L).
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
ND	Not detected.

Table A-26. Potable Ground-Water (Pheasant Hill Well) Exposure ...ses and Risk Calculations for a Potential Current Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk		Cancer Risk	
		PWExD	HQ	PWExD	ELCR
Inorganics					
Aluminum	0.041	1.1E-03	NA	4.8E-04	NC
Chloride	14	3.8E-01	NA	1.6E-01	NC
Copper	0.011	3.0E-04	8.1E-03	1.3E-04	NC
Lead	0.010	2.7E-04	NA	1.2E-04	NC
Nickel	0.024	6.6E-04	3.3E-02	2.8E-04	NC
Nitrate	12	3.3E-01	2.1E-01	1.4E-01	NC
Zinc	0.051	1.4E-03	7.0E-03	6.0E-04	NC
		Total	2.5E-01	Total	NCP

Cw Constituent concentration in the Pheasant Hill well (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD Oral exposure dose from drinking water (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the oral route.
NCP No potential carcinogens detected in this well.

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Table A-27. Potable Ground-Water (Pheasant Hill Well) Exposure Doses and Risk Calculations for a Potential Current Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
Inorganics					
Aluminum	0.041	2.6E-03	NA	2.3E-04	NC
Chloride	14	8.9E-01	NA	7.7E-02	NC
Copper	0.011	7.0E-04	1.9E-02	6.0E-05	NC
Lead	0.010	6.4E-04	NA	5.5E-05	NC
Nickel	0.024	1.5E-03	7.7E-02	1.3E-04	NC
Nitrate	12	7.7E-01	4.8E-01	6.6E-02	NC
Zinc	0.051	3.3E-03	1.6E-02	2.8E-04	NC
		Total:	5.9E-01	Total:	NCP

Cw — Constituent concentration in the Pheasant Hill well (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD — Oral exposure dose from drinking water (mg/kg-day).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic by the oral route.
NCP — No potential carcinogens detected in this well.

Table A-28a. Potable Ground-Water (On-Site Monitor Wells at Cluster 1) Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Toluene	0.0022	6.0E-05	3.0E-04	2.6E-05	NC
Inorganics					
Aluminum	4.2	1.2E-01	NA	4.9E-02	NC
Barium	0.055	1.5E-03	2.2E-02	6.5E-04	NC
Beryllium	0.0018	4.9E-05	9.9E-03	2.1E-05	9.1E-05
Cadmium	0.0084	2.3E-04	4.6E-01	9.9E-05	NC
Calcium	37	1.0E+00	NA	4.3E-01	NC
Chloride	5.0	1.4E-01	NA	5.9E-02	NC
Chromium	0.012	3.3E-04	6.6E-02	1.4E-04	NC
Copper	0.035	9.6E-04	2.6E-02	4.1E-04	NC
Cyanide	0.019	5.2E-04	2.6E-02	2.2E-04	NC
Fluoride	0.19	5.2E-03	8.7E-02	2.2E-03	NC
Iron	17	4.7E-01	0.0E+00	2.0E-01	NC
Lead	0.010	2.7E-04	NA	1.2E-04	NC
Magnesium	17	4.7E-01	NA	2.0E-01	NC
Manganese	0.57	1.6E-02	1.6E-01	6.7E-03	NC
Nickel	0.030	8.2E-04	4.1E-02	3.5E-04	NC
Nitrate	0.051	1.4E-03	8.7E-04	6.0E-04	NC
Potassium	5.0	1.4E-01	NA	5.9E-02	NC
Sodium	11	3.0E-01	NA	1.3E-01	NC
Sulfate	9.9	2.7E-01	NA	1.2E-01	NC
Vanadium	0.027	7.4E-04	1.1E-01	3.2E-04	NC
Zinc	0.051	1.4E-03	7.0E-03	6.0E-04	NC
		Total	1.0E+00	Total	9E-05

Footnotes appear on page 2.

Table A-28a. Potable Ground-Water (On-Site Monitor Wells at Cluster 1) Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-10 and NSL-MW-11 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the oral route.

Table [illegible]b. Potable Ground-Water (On-Site Monitor Wells at Cluster 2) [illegible]sure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall T[illegible]ship, Pennsylvania.

Constituent	Cw	Non-Cancer Risk		Cancer Risk	
		PGWExD	HQ	PGWExD	ELCR
VOCs					
Carbon disulfide	0.0010	2.7E-05	2.7E-04	1.2E-05	NC
Chlorobenzene	0.0020	5.5E-05	2.7E-03	2.3E-05	NC
1,1-Dichloroethane	0.0020	5.5E-05	5.5E-04	2.3E-05	NC
1,2-Dichloroethene (total)	0.0030	8.2E-05	4.1E-03	3.5E-05	NC
Toluene	0.0096	2.6E-04	1.3E-03	1.1E-04	NC
Vinyl chloride	0.0060	1.6E-04	1.3E-01	7.0E-05	1.3E-04
Inorganics					
Aluminum	0.14	3.8E-03	NA	1.6E-03	NC
Ammonia	1.4	3.8E-02	NA	1.6E-02	NC
Barium	0.060	1.6E-03	2.3E-02	7.0E-04	NC
Calcium	85	2.3E+00	NA	1.0E+00	NC
Chloride	24	6.6E-01	NA	2.8E-01	NC
Copper	0.011	3.0E-04	8.1E-03	1.3E-04	NC
Fluoride	0.71	1.9E-02	3.2E-01	8.3E-03	NC
Iron	2.7	7.4E-02	NA	3.2E-02	NC
Lead	0.010	2.7E-04	NA	1.2E-04	NC
Magnesium	42	1.2E+00	NA	4.9E-01	NC
Manganese	0.20	5.5E-03	5.5E-02	2.3E-03	NC
Nickel	0.027	7.4E-04	3.7E-02	3.2E-04	NC
Nitrate	0.15	4.1E-03	2.6E-03	1.8E-03	NC
Potassium	5.6	1.5E-01	NA	6.6E-02	NC
Sodium	17	4.7E-01	NA	2.0E-01	NC
Sulfate	62	1.7E+00	NA	7.3E-01	NC
Vanadium	0.016	4.4E-04	6.3E-02	1.9E-04	NC
Zinc	0.040	1.1E-03	5.5E-03	4.7E-04	NC
		Total	6.5E-01	Total	1E-04

Footnotes appear on page 2.

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Table A-28b. Potable Ground-Water (On-Site Monitor Wells at Cluster 2) Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-2A, and NSL-MW-9 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the oral route.

Tabl 8c. Potable Ground-Water (On-Site Monitor Wells at Cluster 3 osure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Acetone	0.011	3.0E-04	3.0E-03	1.3E-04	NC
Benzene	0.0040	1.1E-04	NA	4.7E-05	1.4E-06
Chlorobenzene	0.024	6.6E-04	3.3E-02	2.8E-04	NC
1,1-Dichloroethane	0.0086	2.4E-04	2.4E-03	1.0E-04	NC
1,2-Dichloroethene (total)	0.0042	1.2E-04	5.8E-03	4.9E-05	NC
1,2-Dichloropropane	0.0020	5.5E-05	NA	2.3E-05	1.6E-06
trans-1,3-Dichloropropene	0.0020	5.5E-05	1.8E-01	2.3E-05	4.2E-06
Ethylbenzene	0.0040	1.1E-04	1.1E-03	4.7E-05	NC
4-Methyl-2-pentanone	0.0050	1.4E-04	2.7E-03	5.9E-05	NC
Tetrachloroethene	0.0010	2.7E-05	2.7E-03	1.2E-05	6.0E-07
Toluene	0.029	7.9E-04	4.0E-03	3.4E-04	NC
Trichloroethene	0.0020	5.5E-05	7.4E-03	2.3E-05	2.6E-07
Xylenes (total)	0.012	3.3E-04	1.6E-04	1.4E-04	NC
Semi-VOCs					
Bis(2-ethylhexyl)phthalate	0.0020	5.5E-05	2.7E-03	2.3E-05	3.3E-07
Di-n-butyl phthalate	0.0040	1.1E-04	1.1E-03	4.7E-05	NC
1,2-Dichlorobenzene	0.0055	1.5E-04	1.7E-03	6.5E-05	NC
1,4-Dichlorobenzene	0.013	3.6E-04	NA	1.5E-04	3.7E-06
t-PAHs	0.0030	8.2E-05	2.1E-02	-	-
Inorganics					
Ammonia	260	7.1E+00	NA	3.1E+00	NC
Chloride	88	2.4E+00	NA	1.0E+00	NC
Fluoride	0.46	1.3E-02	2.1E-01	5.4E-03	NC
Sulfate	12	3.3E-01	NA	1.4E-01	NC
		Total	4.8E-01	Total	1E-05

Footnotes appear on page 2.

Table A-28c. Potable Ground-Water (On-Site Monitor Wells at Cluster 3) Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-7 and NSL-MW-1C (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the oral route.

Tab 28d. Potable Ground-Water (On-Site Monitor Wells at Cluster) Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Acetone	0.0020	5.5E-05	5.5E-04	2.3E-05	NC
Benzene	0.0060	1.6E-04	NA	7.0E-05	2.0E-06
Chloroethane	0.034	9.3E-04	4.7E-02	4.0E-04	NC
1,1-Dichloroethane	0.16	4.4E-03	4.4E-02	1.9E-03	NC
1,2-Dichloroethene (total)	0.12	3.3E-03	1.6E-01	1.4E-03	NC
1,2-Dichloropropane	0.011	3.0E-04	NA	1.3E-04	8.8E-06
Ethylbenzene	0.0010	2.7E-05	2.7E-04	1.2E-05	NC
4-Methyl-2-pentanone	0.0040	1.1E-04	2.2E-03	4.7E-05	NC
Styrene	0.0010	2.7E-05	1.4E-04	1.2E-05	3.5E-07
Tetrachloroethene	0.0039	1.1E-04	1.1E-02	4.6E-05	2.3E-06
Toluene	0.050	1.4E-03	6.8E-03	5.9E-04	NC
1,1,1-Trichloroethane	0.0096	2.6E-04	2.9E-03	1.1E-04	NC
Trichloroethene	0.055	1.5E-03	2.0E-01	6.5E-04	7.1E-06
Vinyl chloride	0.0098	2.7E-04	2.1E-01	1.2E-04	2.2E-04
Xylenes (total)	0.0044	1.2E-04	6.0E-05	5.2E-05	NC
Semi-VOCs					
Diethylphthalate	0.0030	8.2E-05	1.0E-04	3.5E-05	NC
4-Methylphenol	0.050	1.4E-03	2.7E-02	5.9E-04	NC
Inorganics					
Ammonia	2.7	7.4E-02	NA	3.2E-02	NC
Chloride	30	8.2E-01	NA	3.5E-01	NC
Fluoride	0.83	2.3E-02	3.8E-01	9.7E-03	NC
Sulfate	46	1.3E+00	NA	5.4E-01	NC
		Total	1.1E+00	Total	2E-04

Footnotes appear on page 2.

Table A-28d. Potable Ground-Water (On-Site Monitor Wells at Cluster 4) Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-6 and NSL-MW-8 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the oral route.

Table A-29a. Potable Ground-Water (On-Site Monitor Wells at Cluster 1) Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Toluene	0.0022	1.4E-04	7.0E-04	1.2E-05	NC
Inorganics					
Aluminum	4.2	2.7E-01	NA	2.3E-02	NC
Barium	0.055	3.5E-03	5.0E-02	3.0E-04	NC
Beryllium	0.0018	1.2E-04	2.3E-02	9.9E-06	4.2E-05
Cadmium	0.0084	5.4E-04	1.1E+00	4.6E-05	NC
Calcium	37	2.4E+00	NA	2.0E-01	NC
Chloride	5.0	3.2E-01	NA	2.7E-02	NC
Chromium	0.012	7.7E-04	1.5E-01	6.6E-05	NC
Copper	0.035	2.2E-03	6.0E-02	1.9E-04	NC
Cyanide	0.019	1.2E-03	6.1E-02	1.0E-04	NC
Fluoride	0.19	1.2E-02	2.0E-01	1.0E-03	NC
Iron	17	1.1E+00	0.0E+00	9.3E-02	NC
Lead	0.010	6.4E-04	NA	5.5E-05	NC
Magnesium	17	1.1E+00	NA	9.3E-02	NC
Manganese	0.57	3.6E-02	3.6E-01	3.1E-03	NC
Nickel	0.030	1.9E-03	9.6E-02	1.6E-04	NC
Nitrate	0.051	3.3E-03	2.0E-03	2.8E-04	NC
Potassium	5.0	3.2E-01	NA	2.7E-02	NC
Sodium	11	7.0E-01	NA	6.0E-02	NC
Sulfate	9.9	6.3E-01	NA	5.4E-02	NC
Vanadium	0.027	1.7E-03	2.5E-01	1.5E-04	NC
Zinc	0.051	3.3E-03	1.6E-02	2.8E-04	NC
		Total	2.4E+00	Total	4E-05

Footnotes appear on page 2.

Table A-29a. Potable Ground-Water (On-Site Monitor Wells at Cluster 1) Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-10 and NSL-MW-11 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the oral route.

Table ‿9b. Potable Ground-Water (On-Site Monitor Wells at Cluster 2) ‿osure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfi‿ ‿uth Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Carbon disulfide	0.0010	6.4E-05	6.4E-04	5.5E-06	NC
Chlorobenzene	0.0020	1.3E-04	6.4E-03	1.1E-05	NC
1,1-Dichloroethane	0.0020	1.3E-04	1.3E-03	1.1E-05	NC
1,2-Dichloroethene (total)	0.0030	1.9E-04	9.6E-03	1.6E-05	NC
Toluene	0.0096	6.1E-04	3.1E-03	5.3E-05	NC
Vinyl chloride	0.0060	3.8E-04	3.0E-01	3.3E-05	6.2E-05
Inorganics					
Aluminum	0.14	8.9E-03	NA	7.7E-04	NC
Ammonia	1.4	8.9E-02	NA	7.7E-03	NC
Barium	0.060	3.8E-03	5.5E-02	3.3E-04	NC
Calcium	85	5.4E+00	NA	4.7E-01	NC
Chloride	24	1.5E+00	NA	1.3E-01	NC
Copper	0.011	7.0E-04	1.9E-02	6.0E-05	NC
Fluoride	0.71	4.5E-02	7.6E-01	3.9E-03	NC
Iron	2.7	1.7E-01	NA	1.5E-02	NC
Lead	0.010	6.4E-04	NA	5.5E-05	NC
Magnesium	42	2.7E+00	NA	2.3E-01	NC
Manganese	0.20	1.3E-02	1.3E-01	1.1E-03	NC
Nickel	0.027	1.7E-03	8.6E-02	1.5E-04	NC
Nitrate	0.15	9.6E-03	6.0E-03	8.2E-04	NC
Potassium	5.6	3.6E-01	NA	3.1E-02	NC
Sodium	17	1.1E+00	NA	9.3E-02	NC
Sulfate	62	4.0E+00	NA	3.4E-01	NC
Vanadium	0.016	1.0E-03	1.5E-01	8.8E-05	NC
Zinc	0.040	2.6E-03	1.3E-02	2.2E-04	NC
		Total	1.5E+00	Total	6E-05

Footnotes appear on page 2.

Table A-29b. **Potable Ground-Water (On-Site Monitor Wells at Cluster 2) Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.**

Cw	Constituent concentration in the on-site monitor wells NSL-MW-2A, and NSL-MW-9 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the oral route.

Table [illegible]c. Potable Ground-Water (On-Site Monitor Wells at Cluster 3) E[illegible]sure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfil[illegible] [illegible]uth Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Acetone	0.011	7.0E-04	7.0E-03	6.0E-05	NC
Benzene	0.0040	2.6E-04	NA	2.2E-05	6.4E-07
Chlorobenzene	0.024	1.5E-03	7.7E-02	1.3E-04	NC
1,1-Dichloroethane	0.0086	5.5E-04	5.5E-03	4.7E-05	NC
1,2-Dichloroethene (total)	0.0042	2.7E-04	1.3E-02	2.3E-05	NC
1,2-Dichloropropane	0.0020	1.3E-04	NA	1.1E-05	7.5E-07
trans-1,3-Dichloropropene	0.0020	1.3E-04	4.3E-01	1.1E-05	2.0E-06
Ethylbenzene	0.0040	2.6E-04	2.6E-03	2.2E-05	NC
4-Methyl-2-pentanone	0.0050	3.2E-04	6.4E-03	2.7E-05	NC
Tetrachloroethene	0.0010	6.4E-05	6.4E-03	5.5E-06	2.8E-07
Toluene	0.029	1.9E-03	9.3E-03	1.6E-04	NC
Trichloroethene	0.0020	1.3E-04	1.7E-02	1.1E-05	1.2E-07
Xylenes (total)	0.012	7.7E-04	3.8E-04	6.6E-05	NC
Semi-VOCs					
Bis(2-ethylhexyl)phthalate	0.0020	1.3E-04	6.4E-03	1.1E-05	1.5E-07
Di-n-butyl phthalate	0.0040	2.6E-04	2.6E-03	2.2E-05	NC
1,2-Dichlorobenzene	0.0055	3.5E-04	3.9E-03	3.0E-05	NC
1,4-Dichlorobenzene	0.013	8.3E-04	NA	7.1E-05	1.7E-06
t-PAHs	0.0030	1.9E-04	4.8E-02	-	-
Inorganics					
Ammonia	260	1.7E+01	NA	1.4E+00	NC
Chloride	88	5.6E+00	NA	4.8E-01	NC
Fluoride	0.46	2.9E-02	4.9E-01	2.5E-03	NC
Sulfate	12	7.7E-01	NA	6.6E-02	NC
		Total	1.1E+00	Total	6E-06

Footnotes appear on page 2.

Table A-29c. Potable Ground-Water (On-Site Monitor Wells at Cluster 3) Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-7 and NSL-MW-1C (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the oral route.

Table A-__d. Potable Ground-Water (On-Site Monitor Wells at Cluster 4) Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk PGWExD	Non-Cancer Risk HQ	Cancer Risk PGWExD	Cancer Risk ELCR
VOCs					
Acetone	0.0020	1.3E-04	1.3E-03	1.1E-05	NC
Benzene	0.0060	3.8E-04	NA	3.3E-05	9.5E-07
Chloroethane	0.034	2.2E-03	1.1E-01	1.9E-04	NC
1,1-Dichloroethane	0.16	1.0E-02	1.0E-01	8.8E-04	NC
1,2-Dichloroethene (total)	0.12	7.7E-03	3.8E-01	6.6E-04	NC
1,2-Dichloropropane	0.011	7.0E-04	NA	6.0E-05	4.1E-06
Ethylbenzene	0.0010	6.4E-05	6.4E-04	5.5E-06	NC
4-Methyl-2-pentanone	0.0040	2.6E-04	5.1E-03	2.2E-05	NC
Styrene	0.0010	6.4E-05	3.2E-04	5.5E-06	1.6E-07
Tetrachloroethene	0.0039	2.5E-04	2.5E-02	2.1E-05	1.1E-06
Toluene	0.050	3.2E-03	1.6E-02	2.7E-04	NC
1,1,1-Trichloroethane	0.0096	6.1E-04	6.8E-03	5.3E-05	NC
Trichloroethene	0.055	3.5E-03	4.8E-01	3.0E-04	3.3E-06
Vinyl chloride	0.0098	6.3E-04	4.8E-01	5.4E-05	1.0E-04
Xylenes (total)	0.0044	2.8E-04	1.4E-04	2.4E-05	NC
Semi-VOCs					
Diethylphthalate	0.0030	1.9E-04	2.4E-04	1.6E-05	NC
4-Methylphenol	0.050	3.2E-03	6.4E-02	2.7E-04	NC
Inorganics					
Ammonia	2.7	1.7E-01	NA	1.5E-02	NC
Chloride	30	1.9E+00	NA	1.6E-01	NC
Fluoride	0.83	5.3E-02	8.8E-01	4.5E-03	NC
Sulfate	46	2.9E+00	NA	2.5E-01	NC
		Total	2.6E+00	Total	1E-04

Footnotes appear on page 2.

Table A-29d. Potable Ground-Water (On-Site Monitor Wells at Cluster 4) Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-6 and NSL-MW-8 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
PGWExD	Oral exposure dose from drinking water (mg/kg-day).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the oral route.

Table A-30. Equations and Example Calculation For Inhalation Exposure to Volatile Organic Compounds in Shower Water (ShExD), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

The overall mass transfer coefficient (K_L) for each volatile organic compound (VOC) of interest is based on the two-film boundary theory:

(1) $K_L = (1/k_l + RT/Hk_g)^{-1}$

where

K_L	=	overall mass transfer coefficient (cm/hr),
H	=	Henry's Law Constant (atm-m^3/mol-K),
RT	=	2.404 x 10^{-2} atm-m^3/mole (gas constant of 8.206 x 10^{-5} atm-m^3/mol-K times absolute temperature of 293 K),
k_g	=	gas-film mass transfer coefficient (cm/hr),
	~	(3,000 cm/hr) x [(18 g/mol)/(molecular weight, g/mol)]$^{1/2}$, and
k_l	=	liquid-film mass transfer coefficient (cm/hr),
	~	(20 cm/hr) x [(44 g/mol)/(molecular weight, g/mol)]$^{1/2}$.

K_L is adjusted to the shower water temperature, T_s, by the following semi-empirical equation:

(2) $K_{aL} = K_L\,(T_1\mu_s/T_s\mu_1)^{-0.5}$

where:

K_{aL}	=	adjusted overall mass transfer coefficient (cm/hr),
T_1	=	calibration water temperature of K_L (293 K),
T_s	=	shower water temperature (318 K),
μ_1	=	water viscosity at T_1 (1 centipoise), and
μ_s	=	water viscosity at T_s (0.596 centipoise).

The concentration then leaving a shower droplet after a time t_s (C_{wd}) is obtained from a mass balance.

(3) $C_{wd} = C_w(1-\exp[-K_{aL}t_s/60d])$

where:

C_{wd}	=	concentration leaving shower droplet after time t_s (μg/L),
C_w	=	shower water concentration (μg/L),
d	=	shower droplet diameter (1 mm), and
t_s	=	shower droplet drop time (2 sec).

The generation of a VOC over time in the shower room is calculated as:

(4) $S = C_{wd}(FR)/(SV)$

where:

S	=	indoor VOC generation rate (μg/m^3-min),
FR	=	shower water flow rate (10 L/min), and
SV	=	shower room air volume (6 m^3).

Table A-30. Equations and Example Calculation For Inhalation Exposure to Volatile Organic Compounds in Shower Water (ShExD), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Given an initial indoor VOC generation rate, S, a differential equation to describe the rate of change in the indoor VOC air concentration (C_a) can be established:

(5) $dC_a/dt = -RC_a + S$

where:

C_a = indoor VOC air concentration ($\mu g/m^3$), and
R = air exchange rate (0.016/min).

Integration yields an estimation of the indoor air VOC concentration at time t ($C_a(t)$):

(6) $C_a(t_1) = (S/R)\ (1 - \exp[-R(t_1)])$ for $t_1 \leq D_s$

and

(7) $C_a(t_2) = (S/R)\ (\exp[RD_s] - 1)\ \exp[-R(t_2)]$ for $t_2 > D_s$

where:

$C_a(t)$ = indoor air VOC concentration at time t ($\mu g/m^3$),
D_s = shower duration (min), and
t_1, t_2 = time (min).

The inhalation exposure per shower can be calculated from:

(8) $Einh = [(BR)/(BW)\ (10^6)\ \int_0^{D_t} C_a\ (t)\ dt$

where:

Einh = inhalation exposure per shower (mg/kg/shower),
BR = breathing rate (L/min),
BW = body weight (kg), and
D_t = total duration in shower room (min).

This equation can be solved as:

(9) $Einh1 = \{(BR)\ (S)/[(BW)\ (R)\ (10^6)]\}\ [D_s - 1/R + \exp(-RD_s)/R]$

for inhalation exposure for shower duration, and

(10) $Einh2 = \{(BR)\ (S)/[(BW)\ (R)\ (10^6)]\ \{D_t + \exp\ (-RD_s)/R - \exp[R(D_s - D_t)]/R\}$

for inhalation exposure for total time in the bathroom.

The average daily inhalation exposure dose due to showering (ShExD) is calculated assuming an exposure frequency of 350 showers/year averaged over the exposure period (assumed residency of 30 years) for non-cancer effects or the average lifespan (70 years) for cancer effects.

(11) ShExD = (Einh2) (EF)(ED)/(AP)

Table A-30. **Equations and Example Calculation For Inhalation Exposure to Volatile Organic Compounds in Shower Water (ShExD), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.**

where:

ShExD	=	average inhalation exposure dose per day due to showering (mg/kg/day).
EF	=	exposure frequency = 350 showers/year.
ED	=	exposure duration = 30 years.
AP	=	averaging period (ED x 365 days/year for non-cancer effects, 70 years x 365 days/year for cancer effects).

ShExD Sample Calculation for Benzene in On-Site Monitor Wells at Cluster 3:

(1) $K_L = \left[\dfrac{1}{15.02\ \text{cm/hr}} + \dfrac{0.02404\ \text{atm-m}^3\text{/mol}}{(0.0055\ \text{atm-m}^3\text{/mol})\ (1440\ \text{cm/hr})}\right]^{-1}$

$= 14.36\ \text{cm/hr}$

(2) $K_{aL} = (14.36\ \text{cm/hr}) \times \left[\dfrac{(293\text{K})\ (0.596\ \text{centipoise})}{(318\text{K})\ (1\ \text{centipoise})}\right]^{-0.5}$

$= 19.4\ \text{cm/hr}$

(3) $C_{wd} = (4.0\ \mu\text{g/L}) \times \{1\text{-EXP}\ [(-19.4\ \text{cm/hr})(2\ \text{s})/(60 \times 1\text{mm})]\}$

$= 1.90\ \mu\text{g/L}$

(4) $S = \dfrac{(1.90\ \mu\text{g/L})\ (10\ \text{L/min})}{6\text{m}^3}$

$= 3.17\ \mu\text{g/m}^3\text{-min}$

(10) $Einh2 = \dfrac{(10\ \text{L/min})\ (3.17\ \mu\text{g/m}^3\text{-min})}{(70\ \text{kg})\ (0.016\text{/min})\ (1{,}000{,}000)} \times \left[15\ \text{min} + \dfrac{\text{EXP}[(-0.016\text{/min})(20\ \text{min})]}{0.016\text{/min}} - \dfrac{\text{EXP}[(0.016\text{/min})(15\ \text{min-}20\ \text{min})]}{0.016\text{/min}}\right]$

$= 0.0000761\ \text{mg/kg/shower}$

(11) For cancer effects:

$ShExD = \dfrac{(0.0000761\ \text{mg/kg/shower})(350\ \text{showers/year})(30\ \text{years})}{(365\ \text{days/year})(70\ \text{years})}$

$= 3.1\text{E-05 mg/kg/day}$

For non-cancer effects:

$ShExD = \dfrac{(0.0000761\ \text{mg/kg/shower})(350\ \text{showers/year})(30\ \text{years})}{(365\ \text{days/year})(30\ \text{years})}$

$= 7.3\text{E-05 mg/kg/day}$

Table A-31. Shower Exposure Doses and Calculations, Potential Current On-Site Residential Well, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk ShExD	Non-Cancer Risk HQ	Cancer Risk ShExD	Cancer Risk ELCR
VOCs					
Benzene	0.0010	1.8E-05	NA	7.8E-06	2.3E-07
Bromodichloromethane	0.00090	6.6E-06	NA	2.8E-06	NC
Carbon disulfide	0.00070	1.3E-05	4.5E-03	5.6E-06	NC
Chlorobenzene	0.00040	6.3E-06	1.3E-03	2.7E-06	NC
Chloroform	0.014	2.1E-04	NA	9.2E-05	7.4E-06
Dibromochloromethane	0.00050	6.3E-06	NA	2.7E-06	NC
1,1-Dichloroethane	0.00040	6.7E-06	6.7E-05	2.9E-06	NC
1,2-Dichloroethene (total)	0.016	2.7E-04	NA	1.2E-04	NC
Tetrachloroethene	0.0020	2.7E-05	NA	1.1E-05	2.1E-08
Trichloroethene	0.030	4.6E-04	NA	2.0E-04	3.3E-06
Vinyl chloride	0.0070	1.4E-04	1.1E-01	6.1E-05	1.8E-05
		Total	1.1E-01	Total	3E-05

Cw — Constituent concentration in the on-site residential well (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
ShExD — Inhalation exposure dose from showering (mg/kg-shower).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic by the inhalation route.

Table A-32a. Shower Exposure Doses and Risk Calculations, Potential Current Off-Site Residential Well NSL-RW-03, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

		Non-Cancer Risk		Cancer Risk	
Constituent	Cw	ShExD	HQ	ShExD	ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.001	1.7E-05	1.7E-04	7.3E-06	NC
1,2-Dichloroethene	0.0009	1.5E-05	NA	6.6E-06	NC
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	0.001	1.4E-05	NA	5.9E-06	1.1E-08
1,1,1-Trichloroethane	0.003	4.6E-05	1.5E-04	2.0E-05	NC
Trichloroethene	0.0009	1.4E-05	NA	5.9E-06	1.0E-07
Xylenes (total)	ND	NAP	NAP	NAP	NAP
		Total	3.2E-04	Total	1E-07

Cw Maximum detected constituent concentration in off-site residential well NSL-RW-03 (mg/L).
ShExD Inhalation exposure dose from showering (mg/kg-shower).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP Not applicable, constituent not detected.
NC Not carcinogenic by the oral route.
ND Not detected.

Table A-32b. Shower Exposure Doses and Risk Calculations, Potential Current Off-Site Residential Well NSL-RW-04, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk ShExD	Non-Cancer Risk HQ	Cancer Risk ShExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	0.0006	1.1E-05	1.2E-05	4.5E-06	7.2E-09
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
		Total	1.2E-05	Total	7E-09

Cw — Maximum detected constituent concentration in off-site residential well NSL-RW-04 (mg/L).
ShExD — Inhalation exposure dose from showering (mg/kg-shower).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NAP — Not applicable, constituent not detected.
ND — Not detected.

Table A-32c. Shower Exposure Doses and Risk Calculations, Potential Current Off-Site Residential Well NSL-RW-06, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk		Cancer Risk	
		ShExD	HQ	ShExD	ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.0005	8.5E-06	8.5E-05	3.6E-06	NC
1,2-Dichloroethene	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	0.0002	2.7E-06	NA	1.2E-06	2.1E-09
1,1,1-Trichloroethane	0.0006	9.2E-06	3.1E-05	4.0E-06	NC
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	ND	NAP	NAP	NAP	NAP
		Total	1.2E-04	Total	2E-09

Cw — Maximum detected constituent concentration in off-site residential well NSL-RW-06 (mg/L).
ShExD — Inhalation exposure dose from showering (mg/kg-shower).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP — Not applicable, constituent not detected.
NC — Not carcinogenic by the oral route.
ND — Not detected.

Table A-32d. Shower Exposure Doses and Risk Calculations, Potential Current Off-Site Residential Well NSL-RW-07, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk ShExD	Non-Cancer Risk HQ	Cancer Risk ShExD	Cancer Risk ELCR
VOCs					
Benzene	0.003	5.6E-05	NA	2.4E-05	6.9E-07
Chlorobenzene	0.015	2.4E-04	4.8E-02	1.0E-04	NC
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	0.001	1.7E-05	1.7E-04	7.3E-06	NC
1,2-Dichloroethene	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	0.002	3.2E-05	NA	1.4E-05	NA
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	0.0009	1.4E-05	NA	5.9E-06	1.0E-07
Xylenes (total)	ND	NAP	NAP	NAP	NAP
		Total	4.8E-02	Total	8E-07

Cw — Maximum detected constituent concentration in off-site residential well NSL-RW-07 (mg/L).
ShExD — Inhalation exposure dose from showering (mg/kg-shower).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP — Not applicable, constituent not detected.
NC — Not carcinogenic by the oral route.
ND — Not detected.

Table A-32e. Shower Exposure Doses and Risk Calculations, Potential Current Off-Site Residential Well NSL-RW-12, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk ShExD	Non-Cancer Risk HQ	Cancer Risk ShExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	0.0002	3.1E-06	NA	1.3E-06	1.1E-07
Dibromochloromethane	ND	NAP	NAP	NAP	NAP
1,1-Dichloroethane	ND	NAP	NAP	NAP	NAP
1,2-Dichloroethene	ND	NAP	NAP	NAP	NAP
1,2-Dichloropropane	ND	NAP	NAP	NAP	NAP
Methylene chloride	ND	NAP	NAP	NAP	NAP
Tetrachloroethene	ND	NAP	NAP	NAP	NAP
1,1,1-Trichloroethane	ND	NAP	NAP	NAP	NAP
Trichloroethene	ND	NAP	NAP	NAP	NAP
Xylenes (total)	0.0002	3.3E-06	3.9E-05	1.4E-06	NC
		Total	3.9E-05	Total	1E-07

Cw Maximum detected constituent concentration in off-site residential well NSL-RW-12 (mg/L).
ShExD Inhalation exposure dose from showering (mg/kg-shower).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP Not applicable, constituent not detected.
NC Not carcinogenic by the oral route.
ND Not detected.

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Table A-32f. Shower Exposure Doses and Risk Calculations, Potential Current Off-Site Residential Well NSL-RW-17, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Risk ShExD	Non-Cancer Risk HQ	Cancer Risk ShExD	Cancer Risk ELCR
VOCs					
Benzene	ND	NAP	NAP	NAP	NAP
Chlorobenzene	ND	NAP	NAP	NAP	NAP
Chloroform	ND	NAP	NAP	NAP	NAP
Dibromochloromethane	0.002	2.6E-05	NA	1.1E-05	NA
1,1-Dichloroethane	0.0004	6.8E-06	6.8E-05	2.9E-06	NC
1,2-Dichloroethene	0.0008	1.4E-05	NA	5.9E-06	NC
1,2-Dichloropropane	ND	NAP	NA	NAP	NAP
Methylene chloride	ND	NAP	ND	NAP	NAP
Tetrachloroethene	0.0003	4.1E-06	NA	1.8E-06	3.2E-09
1,1,1-Trichloroethane	ND	NAP	ND	NAP	NAP
Trichloroethene	ND	NAP	NA	NAP	NAP
Xylenes (total)	ND	NAP	ND	NAP	NAP
		Total	6.8E-05	Total	3E-09

Cw	Maximum detected constituent concentration in off-site residential well NSL-RW-17 (mg/L).
ShExD	Inhalation exposure dose from showering (mg/kg-shower).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable, toxicity factor (i.e., reference dose [RfD] or cancer slope factor [CSF]) not avaliable.
NAP	Not applicable, constituent not detected.
NC	Not carcinogenic by the oral route.
NCP	No potential carcinogens detected in this well.
ND	Not detected.

T A-33a. Shower Exposure Doses and Calculations, Future Hypotheti n-Site Resident (On-Site Monitor Wells at Cluster 1), Novak Sanitar Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Effects		Cancer Risk	
		ShExD	HQ	ShExD	ELCR
VOCs					
Toluene	0.002	3.5E-05	6.1E-05	1.5E-05	NC
		Total	6.1E-05	Total	NC

Cw Constituent concentration in the on-site monitor wells NSL-MW-10 and NSL-MW-11 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
ShExD Inhalation exposure dose from showering (mg/kg-shower).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the inhalation route.

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Table A-33b. Shower Exposure Doses and Calculations, Future Hypothetical On-Site Resident (On-Site Monitor Wells at Cluster 2), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Effects		Cancer Risk	
		ShExD	HQ	ShExD	ELCR
VOCs					
Carbon disulfide	0.0010	1.9E-05	6.5E-03	8.0E-06	NC
Chlorobenzene	0.0020	3.2E-05	6.3E-03	1.4E-05	NC
1,1-Dichloroethane	0.002	3.4E-05	3.4E-04	1.4E-05	NC
1,2-Dichloroethene (total)	0.003	5.1E-05	NA	2.2E-05	NC
Toluene	0.010	1.7E-04	2.9E-04	7.1E-05	NC
Vinyl chloride	0.0060	1.2E-04	9.3E-02	5.2E-05	1.6E-05
		Total	1.1E-01	Total	2E-05

Cw — Constituent concentration in the on-site monitor wells NSL-MW-2A and NSL-MW-9 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
ShExD — Inhalation exposure dose from showering (mg/kg-shower).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic by the inhalation route.

Table c. Shower Exposure Doses and Calculations, Future Hypothetical ite Resident (On-Site Monitor Wells at Cluster 3), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Effects		Cancer Risk	
		ShExD	HQ	ShExD	ELCR
VOCs					
Acetone	0.0110	4.3E-05	NA	1.9E-05	NC
Benzene	0.004	7.3E-05	NA	3.1E-05	9.1E-07
Chlorobenzene	0.0240	3.8E-04	7.6E-02	1.6E-04	NC
1,1-Dichloroethane	0.009	1.4E-04	1.4E-03	6.2E-05	NC
1,2-Dichloroethene (total)	0.004	7.1E-05	NA	3.1E-05	NC
1,2-Dichloropropane	0.0020	3.1E-05	NA	1.3E-05	NC
trans-1,3-Dichloropropene	0.0020	3.2E-05	5.5E-03	1.4E-05	1.8E-06
Ethylbenzene	0.0040	6.6E-05	2.3E-04	2.8E-05	NC
4-Methyl-2-pentanone	0.0050	6.4E-06	3.2E-04	2.7E-06	NC
Tetrachloroethene	0.0010	1.3E-05	NA	5.7E-06	1.0E-08
Toluene	0.029	5.0E-04	8.8E-04	2.2E-04	NC
Trichloroethene	0.002	3.1E-05	NA	1.3E-05	2.2E-07
Xylenes (total)	0.0120	2.0E-04	2.3E-03	8.4E-05	NC
Semi-VOCs					
Bis(2-ethylhexyl)phthalate	0.0020	9.7E-07	NA	4.2E-07	NC
Di-n-butylphthalate	0.0040	1.1E-05	NA	4.6E-06	NC
1,2-Dichlorobenzene	0.0055	7.6E-05	1.9E-03	3.3E-05	NC
1,4-Dichlorobenzene	0.0130	1.9E-04	9.3E-04	8.0E-05	NC
t-PAHs	0.0030	3.3E-05	NA	1.4E-05	NC
		Total	9.0E-02	Total	3E-06

Footnotes appear on page 2.

Table A-33c. Shower Exposure Doses and Calculations, Future Hypothetical On-Site Resident (On-Site Monitor Wells at Cluster 3), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-7 and NSL-MW-1C (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
ShExD	Inhalation exposure dose from showering (mg/kg-shower).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the inhalation route.

Table A . Shower Exposure Doses and Calculations, Future Hypothetical ...te Resident (On-Site Monitor Wells at Cluster 4), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cw	Non-Cancer Effects		Cancer Risk	
		ShExD	HQ	ShExD	ELCR
VOCs					
Acetone	0.0020	7.9E-06	NA	3.4E-06	NC
Benzene	0.0060	1.1E-04	NA	4.7E-05	1.4E-06
Chloroethane	0.034	6.7E-04	2.3E-04	2.9E-04	NC
1,1-Dichloroethane	0.160	2.7E-03	2.7E-02	1.2E-03	NC
1,2-Dichloroethene (total)	0.120	2.0E-03	NA	8.7E-04	NC
1,2-Dichloropropane	0.0110	1.7E-04	NA	7.3E-05	NC
Ethylbenzene	0.0010	1.7E-05	5.7E-05	7.1E-06	NC
4-Methyl-2-pentanone	0.0040	5.1E-06	2.5E-04	2.2E-06	NC
Styrene	0.0010	1.6E-05	NA	6.8E-06	1.4E-08
Tetrachloroethene	0.0039	5.2E-05	NA	2.2E-05	4.0E-08
Toluene	0.050	8.7E-04	1.5E-03	3.7E-04	NC
1,1,1-Trichloroethane	0.0096	1.5E-04	4.9E-04	6.3E-05	NC
Trichloroethene	0.055	8.4E-04	NA	3.6E-04	6.1E-06
Vinyl chloride	0.0098	2.0E-04	1.5E-01	8.5E-05	2.5E-05
Xylenes (total)	0.0044	7.2E-05	8.4E-04	3.1E-05	NC
Semi-VOCs					
Diethylphthalate	0.0030	1.6E-07	NA	6.7E-08	NC
4-Methylphenol	0.050	3.5E-06	NA	1.5E-06	NC
		Total	1.8E-01	Total	3E-05

Footnotes appear on page 2.

Table A-33d. Shower Exposure Doses and Calculations, Future Hypothetical On-Site Resident (On-Site Monitor Wells at Cluster 4), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Cw	Constituent concentration in the on-site monitor wells NSL-MW-6 and NSL-MW-8 (mg/L). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
ShExD	Inhalation exposure dose from showering (mg/kg-shower).
HQ	Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR	Excess lifetime cancer risk.
NA	Not applicable.
NC	Not carcinogenic by the inhalation route.

Table A-35. Soil Exposure Doses and Risk Calculations for a Potential Current Child Trespasser, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania

		Non-Cancer Risk			Cancer Risk		
Constituent	Cs	SExDod	SExDip	HQ	SExDod	SExDip	ELCR
Inorganics							
Aluminum	6,200	4.9E-02	8.8E-07	NA	6.3E-03	1.1E-07	NC
Arsenic	18	9.5E-06	2.6E-09	3.2E-02	1.2E-06	3.3E-10	2.2E-06
Barium	46	8.7E-05	6.5E-09	1.3E-03	1.1E-05	8.4E-10	NC
Cadmium	13	3.8E-05	1.8E-09	7.7E-02	4.9E-06	2.4E-10	1.4E-09
Chromium	14	4.8E-05	2.0E-09	1.3E-02	6.1E-06	2.6E-10	1.0E-08
Cobalt	16	1.4E-05	2.3E-09	NA	1.8E-06	2.9E-10	NC
Copper	14	8.7E-06	2.0E-09	2.3E-04	1.1E-06	2.6E-10	NC
Lead	92	4.4E-05	1.3E-08	NA	5.6E-06	1.7E-09	NC
Manganese	200	6.8E-04	2.8E-08	7.1E-03	8.7E-05	3.6E-09	NC
Nickel	28	9.5E-05	4.0E-09	4.8E-03	1.2E-05	5.1E-10	4.3E-10
Selenium	0.99	5.2E-07	1.4E-10	1.0E-04	6.7E-08	1.8E-11	NC
Vanadium	23	3.6E-04	3.3E-09	5.1E-02	4.6E-05	4.2E-10	NC
Zinc	80	4.3E-04	1.1E-08	2.2E-03	5.5E-05	1.5E-09	NC
			Total	1.9E-01		Total	2E-06

Cs — Constituent concentration in the soil (mg/kg). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
SExDod — Soil exposure dose from incidental ingestion and dermal contact (mg/kg-day).
SExDip — Soil exposure dose from inhalation of particulates (mg/kg-day).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic.

Table A-36. Soil Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cs	Non-Cancer Risk			Cancer Risk		
		SExDod	SExDip	HQ	SExDod	SExDip	ELCR
Inorganics							
Aluminum	6,200	1.9E-01	1.6E-05	NA	6.5E-02	5.5E-06	NC
Arsenic	18	3.6E-05	4.7E-08	1.2E-01	1.2E-05	1.6E-08	2.3E-05
Barium	46	3.3E-04	1.2E-07	5.9E-03	1.1E-04	4.1E-08	NC
Cadmium	13	1.5E-04	3.4E-08	2.9E-01	5.0E-05	1.2E-08	7.0E-08
Chromium	14	1.8E-04	3.6E-08	1.0E-01	6.3E-05	1.2E-08	5.1E-07
Cobalt	16	5.3E-05	4.1E-08	NA	1.8E-05	1.4E-08	NC
Copper	14	3.3E-05	3.6E-08	8.9E-04	1.1E-05	1.2E-08	NC
Lead	92	1.7E-04	2.4E-07	NA	5.7E-05	8.2E-08	NC
Manganese	200	2.6E-03	5.2E-07	3.1E-02	8.9E-04	1.8E-07	NC
Nickel	28	3.7E-04	7.2E-08	1.8E-02	1.3E-04	2.5E-08	2.1E-08
Selenium	0.99	2.0E-06	2.6E-09	4.0E-04	6.8E-07	8.8E-10	NC
Vanadium	23	1.4E-03	6.0E-08	2.0E-01	4.7E-04	2.0E-08	NC
Zinc	80	1.7E-03	2.1E-07	8.3E-03	5.7E-04	7.1E-08	NC
			Total	7.8E-01		Total	2E-05

Cs — Constituent concentration in the soil (mg/kg). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
SExDod — Soil exposure dose from incidental ingestion and dermal contact (mg/kg-day).
SExDip — Soil exposure dose from inhalation of particulates (mg/kg-day).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic.

Table A-37. Soil Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cs	Non-Cancer Risk			Cancer Risk		
		SExDod	SExDip	HQ	SExDod	SExDip	ELCR
Inorganics							
Aluminum	6,200	1.1E+00	7.5E-05	NA	9.7E-02	6.4E-06	NC
Arsenic	18	3.0E-04	2.2E-07	9.9E-01	2.5E-05	1.9E-08	4.6E-05
Barium	46	2.1E-03	5.6E-07	3.6E-02	1.8E-04	4.8E-08	NC
Cadmium	13	9.1E-04	1.6E-07	1.8E+00	7.8E-05	1.3E-08	8.2E-08
Chromium	14	1.1E-03	1.7E-07	5.2E-01	9.7E-05	1.4E-08	5.9E-07
Cobalt	16	3.8E-04	1.9E-07	NA	3.3E-05	1.7E-08	NC
Copper	14	2.6E-04	1.7E-07	7.0E-03	2.2E-05	1.4E-08	NC
Lead	92	1.5E-03	1.1E-06	NA	1.3E-04	9.5E-08	NC
Manganese	200	1.6E-02	2.4E-06	1.8E-01	1.4E-03	2.1E-07	NC
Nickel	28	2.3E-03	3.4E-07	1.1E-01	1.9E-04	2.9E-08	2.4E-08
Selenium	0.99	1.6E-05	1.2E-08	3.3E-03	1.4E-06	1.0E-09	NC
Vanadium	23	8.1E-03	2.8E-07	1.2E+00	6.9E-04	2.4E-08	NC
Zinc	80	1.0E-02	9.7E-07	5.0E-02	8.5E-04	8.3E-08	NC
			Total	4.9E+00		Total	5E-05

Cs — Constituent concentration in the soil (mg/kg). The lesser of the maximum detect and the 95 percent upper confidence limit is used.
SExDod — Soil exposure dose from incidental ingestion and dermal contact (mg/kg-day).
SExDip — Soil exposure dose from inhalation of particulates (mg/kg-day).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic.

Table A-39. Air Exposure Doses and Risk Calculations for a Potential Current Trespasser, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Ca	Non-Cancer Risk		Cancer Risk	
		AExD	HQ	AExD	ELCR
VOCs					
Acetone	0.0022	3.3E-05	NA	4.3E-06	NC
Benzene	0.0050	7.6E-05	NA	9.7E-06	2.8E-07
2-Butanone	0.0076	1.2E-04	1.3E-03	1.5E-05	NC
Carbon disulfide	0.00037	5.6E-06	1.9E-03	7.2E-07	NC
Carbon tetrachloride	0.00086	1.3E-05	NA	1.7E-06	2.2E-07
Chloroform	0.00027	4.1E-06	NA	5.3E-07	4.3E-08
1,2-Dichloroethane	0.00027	4.1E-06	NA	5.3E-07	4.8E-08
Ethylbenzene	0.0014	2.1E-05	7.3E-05	2.7E-06	NC
Methylene chloride	0.0085	1.3E-04	1.5E-03	1.7E-05	2.6E-08
Tetrachloroethene	0.00079	1.2E-05	NA	1.5E-06	2.8E-09
Toluene	0.0072	1.1E-04	1.9E-04	1.4E-05	NC
1,1,1-Trichloroethane	0.0019	2.9E-05	9.6E-05	3.7E-06	NC
Trichloroethene	0.0015	2.3E-05	NA	2.9E-06	5.0E-08
Vinyl acetate	0.00028	4.2E-06	7.4E-05	5.5E-07	NC
Xylenes (total)	0.0130	2.0E-04	2.3E-03	2.5E-05	NC
		Total	7.4E-03	Total	7E-07

Ca Constituent concentration in air (mg/m3). The lesser of the maximum detection and the 95 percent upper confidence limit is used.
AExD Exposure dose from inhaling VOCs in the air (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the inhalation route.

Table A-40. Air Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Ca	Non-Cancer Risk		Cancer Risk	
		AExD	HQ	AExD	ELCR
VOCs					
Acetone	0.0022	6.1E-04	NA	2.1E-04	NC
Benzene	0.0050	1.4E-03	NA	4.7E-04	1.4E-05
2-Butanone	0.0076	2.1E-03	2.3E-02	7.2E-04	NC
Carbon disulfide	0.00037	1.0E-04	3.5E-02	3.5E-05	NC
Carbon tetrachloride	0.00086	2.4E-04	NA	8.1E-05	1.1E-05
Chloroform	0.00027	7.5E-05	NA	2.6E-05	2.1E-06
1,2-Dichloroethane	0.00027	7.5E-05	NA	2.6E-05	2.3E-06
Ethylbenzene	0.0014	3.9E-04	1.3E-03	1.3E-04	NC
Methylene chloride	0.0085	2.3E-03	2.7E-03	8.0E-04	1.3E-06
Tetrachloroethene	0.00079	2.2E-04	NA	7.5E-05	1.3E-07
Toluene	0.0072	2.0E-03	3.5E-03	6.8E-04	NC
1,1,1-Trichloroethane	0.0019	5.2E-04	1.7E-03	1.8E-04	NC
Trichloroethene	0.0015	4.1E-04	NA	1.4E-04	2.4E-06
Vinyl acetate	0.00024	6.6E-05	1.2E-03	2.3E-05	NC
Xylenes (total)	0.013	3.6E-03	4.2E-02	1.2E-03	NC
		Total	1.1E-01	Total	3E-05

Ca Constituent concentration in air (mg/m3). The lesser of the maximum detection and the 95 percent upper confidence limit is used.
AExD Exposure dose from inhaling VOCs in the air (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the inhalation route.

Table A-41. Air Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident (Aged 0 to 6 Years), Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Ca	Non-Cancer Risk		Cancer Risk	
		AExD	HQ	AExD	ELCR
VOCs					
Acetone	0.0022	2.8E-03	NA	2.4E-04	NC
Benzene	0.0050	6.4E-03	NA	5.5E-04	1.6E-05
2-Butanone	0.0076	9.8E-03	1.1E-01	8.4E-04	NC
Carbon disulfide	0.00037	4.8E-04	1.6E-01	4.1E-05	NC
Carbon tetrachloride	0.00086	1.1E-03	NA	9.5E-05	1.2E-05
Chloroform	0.00027	3.5E-04	NA	3.0E-05	2.4E-06
1,2-Dichloroethane	0.00027	3.5E-04	NA	3.0E-05	2.7E-06
Ethylbenzene	0.0014	1.8E-03	6.2E-03	1.5E-04	NC
Methylene chloride	0.0085	1.1E-02	1.3E-02	9.4E-04	1.5E-06
Tetrachloroethene	0.00079	1.0E-03	NA	8.7E-05	1.6E-07
Toluene	0.0072	9.3E-03	1.6E-02	8.0E-04	NC
1,1,1-Trichloroethane	0.0019	2.4E-03	8.2E-03	2.1E-04	NC
Trichloroethene	0.00150	1.9E-03	NA	1.7E-04	2.8E-06
Vinyl acetate	0.00028	3.6E-04	6.3E-03	3.1E-05	NC
Xylenes (total)	0.013	1.7E-02	1.9E-01	1.4E-03	NC
		Total	5.2E-01	Total	4E-05

Ca Constituent concentration in air (mg/m3). The lesser of the maximum detection and the 95 percent upper confidence limit is used.
AExD Exposure dose from inhaling VOCs in the air (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the inhalation route.

Table A-42. Equations and Sample Calculations for Exposure to Leachate Seep Area, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Equation Definitions:

$$LExD = \frac{C_L \times (IR_L + [SSA \times PC \times UC1]) \times ET \times EF \times ED}{BW \times AP} + \frac{C_{Ls} \times (IR_{Ls} + [SSA \times SAR \times BAF]) \times EF \times ED}{BW \times AP \times UC2}$$

$$HQ = LExD/RfD_o$$

$$ELCR = LExD \times CSF_o$$

where:

AP	Averaging period (equal to ED x 365 days/year for non-cancer effects; 25,550 days [70 years x 365 days/year] for cancer effects) (USEPA, 1989a).
BAF	Bioavailability adjustment factor for dermal exposure (unitless) (from Table A-17).
BW	Body weight (70 kg for an adult; 38 kg for an older child [aged 6 to 15]; 15 kg for a young child [aged 0 to 6]) (USEPA, 1991a; USEPA, 1989d).
C_L	Constituent concentration in the leachate seep water (mg/L) (lesser of 95 percent upper confidence limit on the arithmetic average or maximum concentration).
C_{Ls}	Constituent concentration in the surficial soil collected in the vicinity of the leachate seep areas (mg/kg) (lesser of 95 percent upper confidence limit on the arithmetic average or maximum concentration).
CSF_o	Cancer slope factor for oral exposure $(mg/kg\text{-}day)^{-1}$ (Table A-16).
ED	Exposure duration (30 years for an adult; 9 years for an older child [aged 6 to 15]; 6 years for a young child [aged 0 to 6].
EF	Exposure frequency (50 days/year [1 day/week for 50 weeks/year] for a young child or older child; 12 days/year [1 day/month for 12 months/year for an adult).
ELCR	Excess lifetime cancer risk (unitless).
ET	Exposure time (1 hour/day for a young child or an older child; 0.5 hour/day for an adult).
HQ	Hazard quotient (unitless).
IR_L	Incidental ingestion rate of leachate seep water (0.005 L/hour).
IR_{Ls}	Incidental ingestion rate of surficial soil located in the vicinity of the leachate seep areas (100 mg/day).
LExD	Exposure dose from contact with seep water and surface soils collected in the vicinity of the leachate seep areas (mg/kg-day).
PC	Permeability constant (cm/hour) (from Table A-18).
SAR	Soil adherence rate ($1.45\ mg/cm^2$-day) (USEPA, 1989a).
SSA	Exposed skin surface area ($793\ cm^2$ for adult hands; $900\ cm^2$ for a young child [aged 0 to 6] hands and feet; $1,488\ cm^2$ for an older child [aged 6 to 15] hands and feet) (USEPA, 1989d).
RfD_o	Reference dose for oral exposure (mg/kg-day) (from Table A-16).
UC1	Unit conversion 1 ($10^{-3}\ L/cm^3$).
UC2	Unit conversion 2 (10^6 mg/kg).

Table A-42. Equations and Sample Calculations for Exposure to Leachate Seep Area, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Beryllium Sample Calculations: Potential Current Trespasser

Cancer Effects

$$\text{LExD} = \frac{(1.1\text{E-02 mg/L}) \times \{(0.005\text{ L/hr}) + [(1{,}488\text{ cm}^2) \times (8.0\text{E-04 cm/hr}) \times (10^{-3}\text{ L/cm}^3)]\} \times (1\text{ hr/d}) \times (50\text{ d/yr}) \times (9\text{ yr})}{(38\text{ kg}) \times (70\text{ yr} \times 365\text{ d/yr})}$$

$$+ \frac{(1.5\text{E+00 mg/kg}) \times \{(100\text{ mg/d}) + [(1{,}488\text{ cm}^2) \times (1.45\text{ mg/cm}^2\text{-d}) \times (0.1)]\} \times (50\text{ d/yr}) \times (9\text{ yr})}{(38\text{ kg}) \times (70\text{ yr} \times 365\text{ d/yr}) \times (10^6\text{ mg/kg})}$$

$$= 2.5\text{E-07 mg/kg-day}$$

$$\text{ELCR} = (2.5\text{E-07 mg/kg-day}) \times (4.3\text{E+00 (mg/kg-day)}^{-1})$$

$$= 1.1\text{E-06}$$

Non-Cancer Effects

$$\text{LExD} = \frac{(1.1\text{E-02 mg/L}) \times \{(0.005\text{ L/hour}) + [(1{,}488\text{ cm}^2) \times (8.0\text{E-04 cm/hour}) \times (10^{-3}\text{ L/cm}^3)]\} \times (1\text{ hr/d}) \times (50\text{ d/yr}) \times (9\text{ yr})}{(38\text{ kg}) \times (9\text{ yr})(365\text{ d/yr})}$$

$$+ \frac{(1.5\text{E+00 mg/kg}) \times \{(100\text{ mg/d}) + [(1{,}488\text{ cm}^2) \times (1.45\text{ mg/cm}^2\text{-d}) \times (0.1)]\} \times (50\text{ d/yr}) \times (9\text{ yr})}{(38\text{ kg}) \times (9\text{ yr} \times 365\text{ d/yr}) \times (10^6\text{ mg/kg})}$$

$$= 2.0\text{E-06 mg/kg-day}$$

$$\text{HQ} = (2.0\text{E-06 mg/kg-day})/(5.0\text{E-03 (mg/kg-day)})$$

$$= 3.9\text{E-04}$$

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Table A-43. Leachate Seep Area Exposure Doses and Risk Calculations for a Potential Current Trespasser, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cl	Cls	Non-Cancer Risk LExD	Non-Cancer Risk HQ	Cancer Risk LExD	Cancer Risk ELCR
VOCs						
Acetone	0.044	0.23	1.5E-06	1.5E-05	1.9E-07	NC
Benzene	0.0010	ND	6.1E-07	NA	7.9E-08	2.3E-09
2-Butanone	ND	0.015	3.5E-08	6.9E-07	4.4E-09	NC
Chlorobenzene	0.011	0.0090	1.3E-05	6.6E-04	1.7E-06	NC
Chloroethane	0.0040	ND	2.7E-07	1.3E-05	3.4E-08	NC
Chloromethane	ND	0.0040	9.2E-09	NA	1.2E-09	1.5E-11
Ethylbenzene	0.021	0.031	1.5E-04	1.5E-03	2.0E-05	NC
Toluene	0.018	ND	9.8E-05	4.9E-04	1.3E-05	NC
Xylenes (total)	0.019	0.13	7.0E-07	3.5E-07	9.0E-08	NC
Semi-VOCs						
Benzoic acid	0.46	0.10	6.3E-05	1.6E-05	8.1E-06	NC
Bis(2-ethylhexyl)phthalate	ND	12	1.4E-05	6.8E-04	1.8E-06	2.5E-08
Butylbenzylphthalate	ND	49	5.6E-05	2.8E-04	7.2E-06	NC
1,4-Dichlorobenzene	0.0030	ND	1.4E-06	NA	1.7E-07	4.2E-09
4-Methylphenol	0.093	0.60	1.1E-05	2.2E-04	1.4E-06	NC
c-PAHs	ND	6.7	-	-	1.0E-06	1.2E-05
t-PAHs	ND	12	1.5E-05	3.6E-03	-	-
Inorganics						
Aluminum	69	10,000	4.4E-02	NA	5.7E-03	NC
Ammonia	92	ND	1.5E-03	NA	2.6E-04	NC
Antimony	0.35	110	9.0E-04	2.3E+00	1.2E-04	NC
Arsenic	0.027	9.3	4.8E-06	1.6E-02	6.1E-07	1.1E-06
Barium	4.6	640	8.3E-04	1.2E-02	1.1E-04	NC
Beryllium	0.011	1.5	2.0E-06	3.9E-04	2.5E-07	1.1E-06

Footnotes appear on page 2.

Table A-43. Leachate Seep Area Exposure Doses and Risk Calculations for a Potential Current Trespasser, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	CI	CIs	Non-Cancer Risk LExD	Non-Cancer Risk HQ	Cancer Risk LExD	Cancer Risk ELCR
Cadmium	0.083	31	5.4E-05	1.1E-01	6.9E-06	NC
Chloride	200	ND	1.9E-06	NA	5.7E-04	NC
Chromium	0.21	20	4.3E-05	8.6E-03	5.5E-06	NC
Cobalt	0.12	19	1.4E-05	NA	1.9E-06	NC
Copper	0.29	22	1.7E-05	4.7E-04	2.2E-06	NC
Fluoride	6.4	ND	6.5E-06	1.1E-04	1.8E-05	NC
Lead	0.64	26	2.5E-05	NA	3.2E-06	NC
Manganese	16	430	1.2E-03	1.2E-02	1.5E-04	NC
Nickel	0.23	56	1.1E-04	5.6E-03	1.4E-05	NC
Selenium	0.0020	ND	4.5E-08	8.9E-06	5.7E-09	NC
Silver	0.029	2.8	2.3E-05	7.8E-03	3.0E-06	NC
Vanadium	0.32	35	2.9E-04	4.2E-02	3.8E-05	NC
Zinc	3.3	160	5.4E-04	2.7E-03	7.0E-05	NC
			Total	2.5E+00	Total	1E-05

CI Constituent concentration in the leachate seep water (mg/L). The lesser of the maximum and the 95 percent upper confidence limit is used.
CIs Constituent concentration in the surficial soil (mg/kg). The lesser of the maximum and the 95 percent upper confidence limit is used.
LExD Exposure dose from contact with seep water and surface soils (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the oral/dermal route.
ND Not detected.

Table A-44. Leachate Seep Area Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	CI	CIs	Non-Cancer Risk LExD	Non-Cancer Risk HQ	Cancer Risk LExD	Cancer Risk ELCR
VOCs						
Acetone	0.044	0.23	9.8E-08	9.80E-07	4.2E-08	NC
Benzene	0.0010	ND	2.2E-08	NA	9.4E-09	2.7E-10
2-Butanone	ND	0.015	2.7E-09	5.46E-08	1.2E-09	NC
Chlorobenzene	0.011	0.0090	4.7E-07	2.33E-05	2.0E-07	NC
Chloroethane	0.0040	ND	1.1E-08	5.70E-07	4.9E-09	NC
Chloromethane	ND	0.0040	7.3E-10	NA	3.1E-10	4.1E-12
Ethylbenzene	0.021	0.031	5.4E-06	5.39E-05	2.3E-06	NC
Toluene	0.018	ND	3.4E-06	1.70E-05	1.5E-06	NC
Xylenes (total)	0.019	0.13	4.8E-08	2.40E-08	2.1E-08	NC
Semi-VOCs						
Benzoic acid	0.46	0.10	2.4E-06	6.09E-07	1.0E-06	NC
Bis(2-ethylhexyl)phthalate	ND	12	1.2E-06	6.06E-05	5.2E-07	7.3E-09
Butylbenzylphthalate	ND	49	4.9E-06	2.47E-05	2.1E-06	NC
1,4-Dichlorobenzene	0.0030	ND	4.9E-08	NA	2.1E-08	5.0E-10
4-Methylphenol	0.093	0.60	4.7E-07	9.46E-06	2.0E-07	NC
c-PAHs	ND	6.7	-	-	3.1E-07	3.5E-06
t-PAHS	ND	12	1.3E-06	3.19E-04	-	-
Inorganics						
Aluminum	69	10,000	3.3E-03	NA	1.4E-03	NC
Ammonia	92	ND	1.2E-04	NA	5.2E-05	NC
Antimony	0.35	110	6.5E-05	1.63E-01	2.8E-05	NC
Arsenic	0.027	9.3	5.3E-07	1.76E-03	2.3E-07	4.1E-07
Barium	4.6	640	7.1E-05	1.01E-03	3.0E-05	NC

Footnotes appear on page 2.

Table A-44. Leachate Seep Area Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Cl	Cls	Non-Cancer Risk		Cancer Risk	
			LExD	HQ	LExD	ELCR
Beryllium	0.011	1.5	1.7E-07	3.32E-05	7.1E-08	3.1E-07
Cadmium	0.083	31	4.4E-06	8.82E-03	1.9E-06	NC
Chloride	200	ND	2.6E-04	NA	1.1E-04	NC
Chromium	0.21	20	3.4E-06	6.75E-04	1.4E-06	NC
Cobalt	0.12	19	1.4E-06	NA	6.0E-07	NC
Copper	0.29	22	1.6E-06	4.38E-05	6.9E-07	NC
Fluoride	6.4	ND	8.5E-06	1.41E-04	3.6E-06	NC
Lead	0.64	26	2.2E-06	NA	9.3E-07	NC
Manganese	16	430	8.8E-05	8.78E-04	3.8E-05	NC
Nickel	0.23	56	9.0E-06	4.49E-04	3.8E-06	NC
Selenium	0.0020	ND	2.6E-09	5.29E-07	1.1E-09	NC
Silver	0.029	2.8	1.7E-06	5.61E-04	7.2E-07	NC
Vanadium	0.32	35	2.1E-05	3.00E-03	9.0E-06	NC
Zinc	3.3	160	4.0E-05	2.02E-04	1.7E-05	NC
			Total	1.8E-01	Total	4E-06

Cl Constituent concentration in the leachate seep water (mg/L). The lesser of the maximum and the 95 percent upper confidence limit is used.
Cls Constituent concentration in the surficial soil (mg/kg). The lesser of the maximum and the 95 percent upper confidence limit is used.
LExD Exposure dose from contact with seep water and surface soils (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the oral/dermal route.
ND Not detectable.

Table A-45. Leachate Seep Area Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	CI	CIs	Non-Cancer Risk LExD	Non-Cancer Risk HQ	Cancer Risk LExD	Cancer Risk ELCR
VOCs						
Acetone	0.044	0.23	3.1E-06	3.1E-05	2.7E-07	NC
Benzene	0.0010	ND	9.6E-07	NA	8.2E-08	2.4E-09
2-Butanone	ND	0.015	5.8E-08	1.2E-06	5.0E-09	NC
Chlorobenzene	0.011	0.0090	2.0E-05	1.0E-03	1.8E-06	NC
Chloroethane	0.0040	ND	4.8E-07	2.4E-05	4.1E-08	NC
Chloromethane	ND	0.0040	1.6E-08	NA	1.3E-09	1.7E-11
Ethylbenzene	0.021	0.031	2.4E-04	2.4E-03	2.0E-05	NC
Toluene	0.018	ND	1.5E-04	7.5E-04	1.3E-05	NC
Xylenes (total)	0.019	0.13	1.5E-06	7.3E-07	1.3E-07	NC
Semi-VOCs						
Benzoic acid	0.46	0.10	1.0E-04	2.6E-05	8.9E-06	NC
Bis(2-ethylhexyl)phthalate	ND	12	2.5E-05	1.3E-03	2.2E-06	3.0E-08
Butylbenzylphthalate	ND	49	1.0E-04	5.2E-04	8.8E-06	NC
1,4-Dichlorobenzene	0.0030	ND	2.1E-06	NA	1.8E-07	4.4E-09
4-Methylphenol	0.093	0.60	1.9E-05	3.8E-04	1.6E-06	NC
c-PAHs	ND	6.7	-	-	1.3E-06	1.5E-05
t-PAHs	ND	12	2.7E-05	6.7E-03	-	-
Inorganics						
Aluminum	69	10,000	7.2E-02	NA	6.2E-03	NC
Ammonia	92	ND	4.8E-03	NA	4.1E-04	NC
Antimony	0.35	110	1.4E-03	3.6E+00	1.2E-04	NC
Arsenic	0.027	9.3	1.1E-05	3.7E-02	9.5E-07	1.7E-06
Barium	4.6	640	1.6E-03	2.3E-02	1.4E-04	NC
Beryllium	0.011	1.5	3.7E-06	7.5E-04	3.2E-07	1.4E-06

Footnotes appear on page 2.

Table A-45. Leachate Seep Area Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	CI	CIs	Non-Cancer Risk LExD	Non-Cancer Risk HQ	Cancer Risk LExD	Cancer Risk ELCR
Cadmium	0.083	31	9.5E-05	1.9E-01	5.9E-06	NC
Chloride	200	ND	1.0E-02	NA	9.0E-04	NC
Chromium	0.21	20	7.7E-05	1.5E-02	6.6E-06	NC
Cobalt	0.12	19	3.1E-05	NA	2.7E-06	NC
Copper	0.29	22	4.0E-05	1.1E-03	3.4E-06	NC
Fluoride	6.4	ND	3.3E-04	5.6E-03	2.9E-05	NC
Lead	0.64	26	6.1E-05	NA	5.2E-06	NC
Manganese	16	430	2.3E-03	2.3E-02	1.9E-04	NC
Nickel	0.23	56	2.0E-04	9.8E-03	1.7E-05	NC
Selenium	0.0020	ND	1.0E-07	2.1E-05	9.0E-09	NC
Silver	0.029	2.8	3.7E-05	1.2E-02	3.2E-06	NC
Vanadium	0.32	35	4.7E-04	6.7E-02	4.0E-05	NC
Zinc	3.3	160	9.5E-04	4.7E-03	8.1E-05	NC
			Total	4.0E+00	Total	2E-05

CI — Constituent concentration in the leachate seep water (mg/L). The lesser of the maximum and the 95 percent upper confidence limit is used.
CIs — Constituent concentration in the surficial soil (mg/kg). The lesser of the maximum and the 95 percent upper confidence limit is used.
LExD — Exposure dose from contact with seep water and surface soils (mg/kg-day).
HQ — Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR — Excess lifetime cancer risk.
NA — Not applicable.
NC — Not carcinogenic by the oral/dermal route.
ND — Not detectable.

Table A-47. Wading Exposure Doses and Risk Calculations for a Potential Current Child Trespasser, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Csw	Csd	Non-Cancer Risk		Cancer Risk	
			WExD	HQ	WExD	ELCR
VOCs						
Chlorobenzene	ND	0.0040	1.9E-09	9.4E-08	2.4E-10	NC
Ethylbenzene	ND	0.0055	2.6E-09	2.6E-08	3.3E-10	NC
Methylene chloride	0.0010	ND	4.9E-08	8.1E-07	6.3E-09	4.7E-11
Xylenes (total)	ND	0.0068	3.2E-09	1.6E-09	4.1E-10	NC
Semi-VOCs						
Di-n-butyl phthalate	0.010	ND	1.3E-07	1.3E-06	1.7E-08	NC
c-PAHs	ND	2.6	-	-	7.0E-08	8.4E-07
t-PAHs	ND	4.2	8.8E-07	2.2E-04	-	-
Inorganics						
Aluminum	0.50	13,000	1.2E-02	NA	1.6E-03	NC
Ammonia	2.6	ND	4.4E-05	4.6E-05	5.7E-06	NC
Antimony	0.045	18	3.5E-05	8.6E-02	4.4E-06	NC
Arsenic	ND	6.6	1.5E-07	5.1E-04	2.0E-08	3.5E-08
Barium	0.48	60	2.0E-05	2.8E-04	2.5E-06	NC
Beryllium	ND	1.9	3.6E-07	7.2E-05	4.6E-08	2.0E-07
Cadmium	0.017	8.3	3.0E-06	5.9E-03	3.8E-07	NC
Chloride	53	ND	9.0E-04	NA	1.2E-04	NC
Chromium	0.016	17	6.7E-06	1.3E-03	8.6E-07	NC
Cobalt	0.028	19	1.7E-06	NA	2.2E-07	NC
Copper	0.20	17	4.0E-06	1.1E-04	5.1E-07	NC
Cyanide	0.0082	ND	1.4E-07	7.0E-06	1.8E-08	NC

Footnotes appear on page 2.

Table A-47. Wading Exposure Doses and Risk Calculations for a Potential Current Child Trespasser, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Csw	Csd	Non-Cancer Risk WExD	Non-Cancer Risk HQ	Cancer Risk WExD	Cancer Risk ELCR
Fluoride	0.82	ND	1.4E-05	2.3E-04	1.8E-06	NC
Lead	0.034	18	8.8E-07	NA	1.1E-07	NC
Manganese	2.4	750	3.2E-04	3.2E-03	4.2E-05	NC
Mercury	0.00021	ND	3.6E-09	1.2E-05	4.6E-10	NC
Nickel	0.20	32	1.5E-05	7.7E-04	2.0E-06	NC
Nitrate	4.1	ND	7.0E-05	4.4E-05	9.0E-06	NC
Silver	ND	2.0	3.8E-06	1.3E-03	4.8E-07	NC
Vanadium	0.0093	30	5.6E-05	8.1E-03	7.3E-06	NC
Zinc	0.40	76	5.4E-05	2.7E-04	6.9E-06	NC
			Total	1.1E-01	Total	1E-06

Csw Constituent concentration in the surface water (mg/L). The lesser of the maximum and the 95 percent upper confidence limit is used.
Csd Constituent concentration in the sediment (mg/kg). The lesser of the maximum and the 95 percent upper confidence limit is used.
WExD Exposure dose from wading activity (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the oral/dermal route.
ND Not detected.

Ta -48. Wading Exposure Doses and Risk Calculations for a Future thetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Csw	Csd	Non-Cancer Risk WExD	Non-Cancer Risk HQ	Cancer Risk WExD	Cancer Risk ELCR
VOCs						
Chlorobenzene	ND	0.0040	1.2E-09	6.2E-08	5.3E-10	NC
Ethylbenzene	ND	0.0055	1.7E-09	1.7E-08	7.3E-10	NC
Methylene chloride	0.0010	ND	3.0E-08	5.1E-07	1.3E-08	9.8E-11
Xylenes (total)	ND	0.0068	2.1E-09	1.1E-09	9.0E-10	NC
Semi-VOCs						
Di-n-butyl phthalate	0.010	ND	7.1E-08	7.1E-07	3.1E-08	NC
c-PAHs	ND	2.6	-	-	1.5E-07	1.8E-06
t-PAHs	ND	4.2	5.7E-07	1.4E-04	-	-
Inorganics						
Aluminum	0.50	13,000	8.0E-03	NA	3.4E-03	NC
Ammonia	2.6	ND	2.5E-05	2.6E-05	1.1E-05	NC
Antimony	0.045	18	2.3E-05	5.7E-02	9.7E-06	NC
Arsenic	ND	6.6	9.8E-08	3.3E-04	4.2E-08	7.6E-08
Barium	0.48	60	1.2E-05	1.7E-04	5.2E-06	NC
Beryllium	ND	1.9	2.4E-07	4.7E-05	1.0E-07	4.4E-07
Cadmium	0.017	8.3	1.9E-06	3.8E-03	8.2E-07	NC
Chloride	53	ND	5.1E-04	NA	2.2E-04	NC
Chromium	0.016	17	4.4E-06	8.7E-04	1.9E-06	NC
Cobalt	0.028	19	1.1E-06	NA	4.6E-07	NC
Copper	0.20	17	2.3E-06	6.3E-05	9.9E-07	NC
Cyanide	0.0082	ND	7.9E-08	4.0E-06	3.4E-08	NC
Fluoride	0.82	ND	7.9E-06	1.3E-04	3.4E-06	NC
Lead	0.034	18	5.2E-07	NA	2.2E-07	NC
Manganese	2.4	750	2.1E-04	2.1E-03	8.9E-05	NC

Footnotes appear on page 2.

Table A-48. Wading Exposure Doses and Risk Calculations for a Future Hypothetical Adult Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Csw	Csd	Non-Cancer Risk		Cancer Risk	
			WExD	HQ	WExD	ELCR
Mercury	0.00021	ND	2.0E-09	6.8E-06	8.7E-10	NC
Nickel	0.20	32	9.9E-06	4.9E-04	4.2E-06	NC
Nitrate	4.1	ND	4.0E-05	2.5E-05	1.7E-05	NC
Silver	ND	2.0	2.5E-06	8.2E-04	1.1E-06	NC
Vanadium	0.0093	30	3.7E-05	5.3E-03	1.6E-05	NC
Zinc	0.40	76	3.5E-05	1.7E-04	1.5E-05	NC
			Total	7.1E-02	Total	2E-06

Csw Constituent concentration in the surface water (mg/L). The lesser of the maximum and the 95 percent upper confidence limit is used.
Csd Constituent concentration in the sediment (mg/kg). The lesser of the maximum and the 95 percent upper confidence limit is used.
WExD Exposure dose from wading activity (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the oral/dermal route.
ND Not detected.

Table A-49. Wading Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania

Constituent	Csw	Csd	Non-Cancer Risk WExD	Non-Cancer Risk HQ	Cancer Risk WExD	Cancer Risk ELCR
VOCs						
Chlorobenzene	ND	0.0040	4.7E-09	2.3E-07	4.0E-10	NC
Ethylbenzene	ND	0.0055	6.5E-09	6.5E-08	5.5E-10	NC
Methylene chloride	0.0010	ND	1.2E-07	2.0E-06	1.0E-08	7.8E-11
Xylenes (total)	ND	0.0068	8.0E-09	4.0E-09	6.8E-10	NC
Semi-VOCs						
Di-n-butyl phthalate	0.010	ND	3.3E-07	3.3E-06	2.9E-08	NC
c-PAHs	ND	2.6	-	-	1.2E-07	1.4E-06
t-PAHs	ND	4.2	2.2E-06	5.5E-04	-	-
Inorganics						
Aluminum	0.50	13,000	3.0E-02	NA	2.6E-03	NC
Ammonia	2.6	ND	1.1E-04	1.2E-04	9.6E-06	NC
Antimony	0.045	18	8.6E-05	2.2E-01	7.4E-06	NC
Arsenic	ND	6.6	3.8E-07	1.3E-03	3.3E-08	5.9E-08
Barium	0.48	60	4.9E-05	7.0E-04	4.2E-06	NC
Beryllium	ND	1.9	9.0E-07	1.8E-04	7.7E-08	3.3E-07
Cadmium	0.017	8.3	7.4E-06	1.5E-02	6.3E-07	NC
Chloride	53	ND	2.3E-03	NA	2.0E-04	NC
Chromium	0.016	17	1.7E-05	3.3E-03	1.4E-06	NC
Cobalt	0.028	19	4.3E-06	NA	3.6E-07	NC
Copper	0.20	17	1.0E-05	2.7E-04	8.6E-07	NC
Cyanide	0.0082	ND	3.5E-07	1.8E-05	3.0E-08	NC

Footnotes appear on page 2.

Table A-49. Wading Exposure Doses and Risk Calculations for a Future Hypothetical Child Resident, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania

Constituent	Csw	Csd	Non-Cancer Risk WExD	Non-Cancer Risk HQ	Cancer Risk WExD	Cancer Risk ELCR
Fluoride	0.82	ND	3.5E-05	5.9E-04	3.0E-06	NC
Lead	0.034	18	2.6E-06	NA	2.2E-07	NC
Manganese	2.4	750	8.1E-04	8.1E-03	6.9E-05	NC
Mercury	0.00021	ND	9.0E-09	3.0E-05	7.7E-10	NC
Nickel	0.20	32	3.9E-05	1.9E-03	3.3E-06	NC
Nitrate	4.1	ND	1.8E-04	1.1E-04	1.5E-05	NC
Silver	ND	2.0	9.4E-06	3.1E-03	8.0E-07	NC
Vanadium	0.0093	30	1.4E-04	2.0E-02	1.2E-05	NC
Zinc	0.40	76	1.3E-04	6.7E-04	1.2E-05	NC
			Total	2.7E-01	Total	2E-06

Csw Constituent concentration in the surface water (mg/L). The lesser of the maximum and the 95 percent upper confidence limit is used.
Csd Constituent concentration in the sediment (mg/kg). The lesser of the maximum and the 95 percent upper confidence limit is used.
WExD Exposure dose from wading activity (mg/kg-day).
HQ Hazard quotient. The sum of the hazard quotients is the hazard index (HI).
ELCR Excess lifetime cancer risk.
NA Not applicable.
NC Not carcinogenic by the oral/dermal route.
ND Not detected.

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Table A-51. Risk Estimation Summary, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

	Excess Lifetime[a] Cancer Risk	Hazard[b] Index
Potable Ground Water		
Ingestion:		
Potential Current On-Site (Private Well)		
Adult	2×10^{-4}	0.83
Child	8×10^{-5}	1.9
Potential Current Off-Site (Private Well NSL-RW-03)		
Adult	7×10^{-7}	0.13
Child	3×10^{-7}	0.3
Potential Current Off-Site (Private Well NSL-RW-04)		
Adult	5×10^{-8}	0.6
Child	2×10^{-8}	1.3
Potential Current Off-Site (Private Well NSL-RW-06)		
Adult	1×10^{-7}	0.7
Child	6×10^{-8}	1.6
Potential Current Off-Site (Private Well NSL-RW-07)		
Adult	3×10^{-6}	0.8
Child	1×10^{-6}	1.8
Potential Current Off-Site (Private Well NSL-RW-09)		
Adult	NCP	0.17
Child	NCP	0.4
Potential Current Off-Site (Private Well NSL-RW-10)		
Adult	NCP	0.5
Child	NCP	1.2
Potential Current Off-Site (Private Well NSL-RW-12)		
Adult	1×10^{-8}	0.0006
Child	7×10^{-9}	0.001

Footnotes appear on page 4.

Table A-51. Risk Estimation Summary, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

	Excess Lifetime[a] Cancer Risk	Hazard[b] Index
Potential Current Off-Site (Private Well NSL-RW-15)		
Adult	NAP	NAP
Child	NAP	NAP
Potential Current Off-Site (Private Well NSL-RW-16)		
Adult	NAP	NAP
Child	NAP	NAP
Potential Current Off-Site (Private Well NSL-RW-17)		
Adult	2×10^{-6}	0.005
Child	1×10^{-6}	0.01
Potential Current Off-Site (Community Supply Well)		
Adult	NC	0.25
Child	NC	0.59
Future Hypothetical On-Site (Cluster 1)		
Adult	9×10^{-5}	1.0
Child	4×10^{-5}	2.4
Future Hypothetical On-Site (Cluster 2)		
Adult	1×10^{-4}	0.65
Child	6×10^{-5}	1.5
Future Hypothetical On-Site (Cluster 3)		
Adult	1×10^{-5}	0.48
Child	6×10^{-6}	1.1
Future Hypothetical On-Site (Cluster 4)		
Adult	2×10^{-4}	1.1
Child	1×10^{-4}	2.6
Showering:		
Potential Current On-Site (Private Well)	3×10^{-5}	0.11

Footnotes appear on page 4.

Table A-51. Risk Estimation Summary, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

	Excess Lifetime[a] Cancer Risk	Hazard[b] Index
Potential Current Off-Site (Private Well NSL-RW-03)	1×10^{-7}	0.00032
Potential Current Off-Site (Private Well NSL-RW-04)	7×10^{-9}	0.000012
Potential Current Off-Site (Private Well NSL-RW-06)	2×10^{-9}	0.00012
Potential Current Off-Site (Private Well NSL-RW-07)	8×10^{-7}	0.048
Potential Current Off-Site (Private Well NSL-RW-09)	ND	ND
Potential Current Off-Site (Private Well NSL-RW-10)	ND	ND
Potential Current Off-Site (Private Well NSL-RW-12)	1×10^{-7}	0.000039
Potential Current Off-Site (Private Well NSL-RW-15)	ND	ND
Potential Current Off-Site (Private Well NSL-RW-16)	ND	ND
Potential Current Off-Site (Private Well NSL-RW-17)	3×10^{-9}	0.000068
Potential Current Off-Site (Community Supply Well)	ND	ND
Future Hypothetical On-Site (Cluster 1)	NC	0.000061
Future Hypothetical On-Site (Cluster 2)	2×10^{-5}	0.11
Future Hypothetical On-Site (Cluster 3)	3×10^{-6}	0.09
Future Hypothetical On-Site (Cluster 4)	3×10^{-5}	0.18
<u>Surface Soil</u>:		
Potential current trespasser	2×10^{-6}	0.19
Future hypothetical adult resident	2×10^{-5}	0.78
Future hypothetical child resident	5×10^{-5}	4.9
<u>Air (Vapors)</u>:		
Potential current trespasser	7×10^{-7}	0.0074
Future hypothetical adult resident	3×10^{-5}	0.11
Future hypothetical child resident	4×10^{-5}	0.52
<u>Seep Areas (Water and Soil)</u>:		
Potential current trespasser	1×10^{-5}	2.5
Future hypothetical adult resident	4×10^{-6}	0.18
Future hypothetical child resident	2×10^{-5}	4.0

Footnotes appear on page 4.

Table A-51. Risk Estimation Summary, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

	Excess Lifetime[a] Cancer Risk	Hazard[b] Index
Surface Water and Sediments (Wading):		
Potential current trespasser	1×10^{-6}	0.11
Future hypothetical adult resident	2×10^{-6}	0.071
Future hypothetical child resident	2×10^{-6}	0.27

a An excess lifetime cancer risk range between 1×10^{-4} and 1×10^{-6} is typically deemed "acceptable" by regulatory agencies (FR, 1990).

b A hazard index value less than or equal to 1 is typically deemed "acceptable" by regulatory agencies (FR, 1990).

NAP Not applicable, constituents of concern not detected in ground water from this well.

NC None of the constituents of concern detected in ground water are classified as carcinogens via the oral route.

NCP No potential carcinogens detected in ground water from this well.

ND No VOCs were detected in ground water from the this well.

Table A-52. Comparison of Constituents Detected in Landfill Surface-Water Bodies with Available Water-Quality Criteria, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Constituent	Mean Surface-Water Concentration	Water-Quality Criteria[a]	Does Surface Water Concentration Exceed Criteria
<u>VOCs</u>			
Methylene chloride	0.0010	2.368	No
<u>Semi-VOCs</u>			
Di-n-butyl phthalate	0.0067	0.021	No
<u>Inorganics</u>			
Aluminum	0.37	0.087[b]	Yes
Antimony	0.035	0.219	No
Barium	0.23	4.1	No
Cadmium	0.0099	0.0032[c]	Yes
Chromium	0.0097	0.011/0.62[d]	No
Cobalt	0.019	0.396	No
Copper	0.083	0.037[c]	Yes
Cyanide	0.0044	0.005	No
Lead	0.017	0.017	No
Manganese	1.1	1.5[e]	No
Mercury	0.00014	0.000012	Yes
Nickel	0.078	0.488	No
Vanadium	0.0068	0.103	No
Zinc	0.16	0.328	No
<u>Chemistry Parameters</u>			
Ammonia-nitrogen	1.3 (0.0051)[f]	0.0083[g]	No
Chloride	30	230[h]	No
Fluoride	0.53	–	No
Nitrate	1.7	90[i]	No

Footnotes appear on page 2.

Table A-52. Comparison of Constituents Detected in Landfill Surface-Water Bodies with Available Water-Quality Criteria, Novak Sanitary Landfill, South Whitehall Township, Pennsylvania.

Concentrations are given in milligrams per liter (mg/L).

- a Pennsylvania Water Quality Criteria for protection of aquatic life (via chronic exposure) unless specified otherwise.
- b USEPA proposed chronic FWQC (USEPA, 1988b).
- c Hardness-dependent criterion. Average hardness of on-site surface water is 380 mg/L $CaCO_3$. The chronic criterion presented is based on constituent-specific calculation of criterion using a hardness value of 380 mg/L (PADER, 1991).
- d Chronic FWQC for trivalent chromium. Hardness-dependent criterion using 380 mg/L hardness.
- e Value presented is not a criterion or standard but a threshold concentration below which no adverse effects to fish would be expected (USEPA, 1986).
- f Value in parentheses is the concentration of un-ionized ammonia estimated (assuming a water temperature of 20°C and a pH of 7.0) using USEPA (1984) method.
- g Chronic FWQC for un-ionized ammonia in surface waters where salmonids and other sensitive coldwater species are absent.
- h Chronic FWQC (USEPA, 1988e).
- i Value presented is not a criteria or standard but the level of nitrate at or below which no adverse effects to most warmwater fish is expected (USEPA, 1986).

ATTACHMENT H

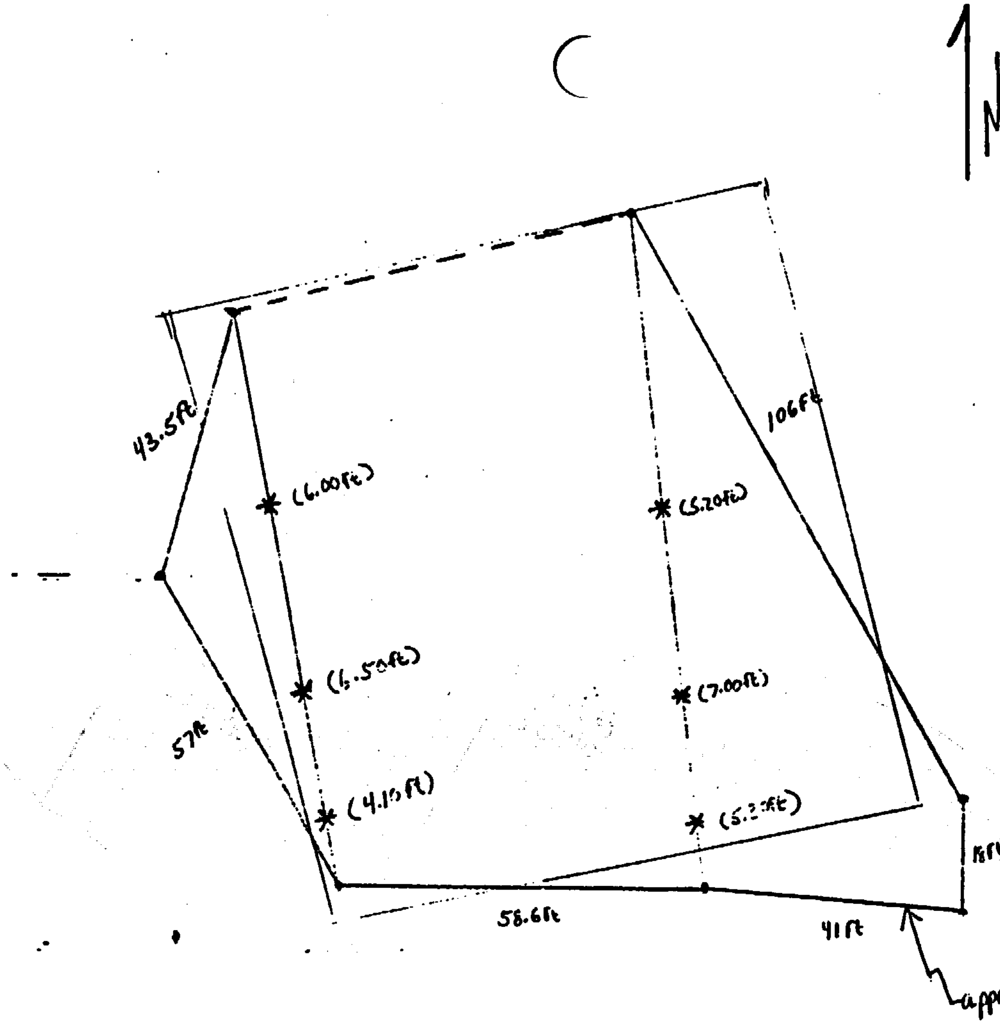
TABLE 2-2A
RUNOFF CURVE NUMBERS FOR URBAN AREAS

RETENTION BASIN FIELD NOTES

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.



South Impoundment "A"

"SOUTHERN SECTION OF SOUTHWES RETENTION POND"

Legend

—— Straight line Segment (Dashed where inferred)

● Horizontal control Point

* Vertical Control Point

(5.30) Vertical height above of impoundment

Drawn to Scale

0 20 40

Horizontal Scale
1 inch = 20 feet.

approximate trace of 376 Foot contour

Impoundment B (SE Corner of Landfill)

"Southeast Retention Pond"

Legend

— Straight line Segment (Dashed where inferred)

• Horizontal Control Point

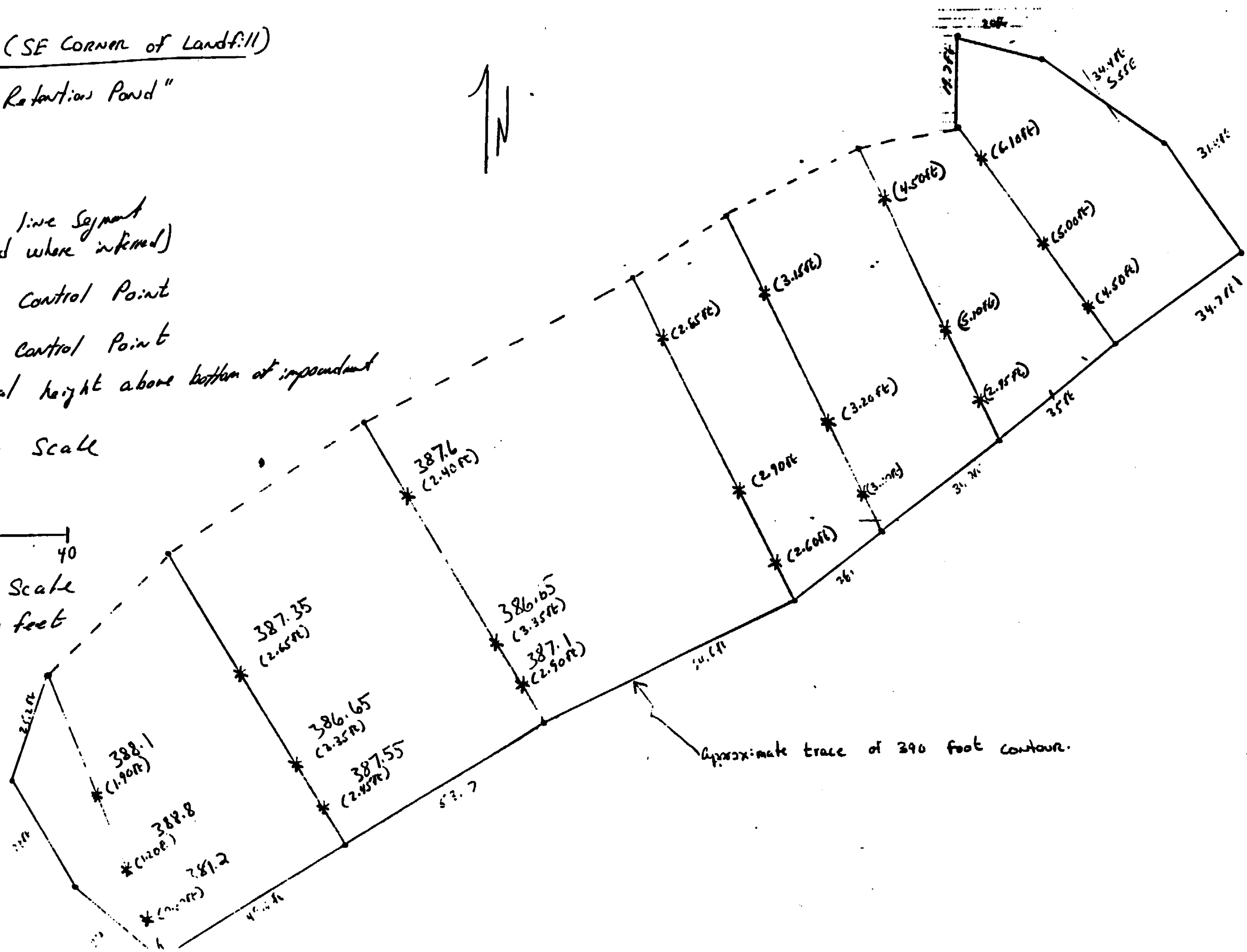
* Vertical Control Point

(4.5ft) Vertical height above bottom of impoundment

Drawn to Scale

0 20 40

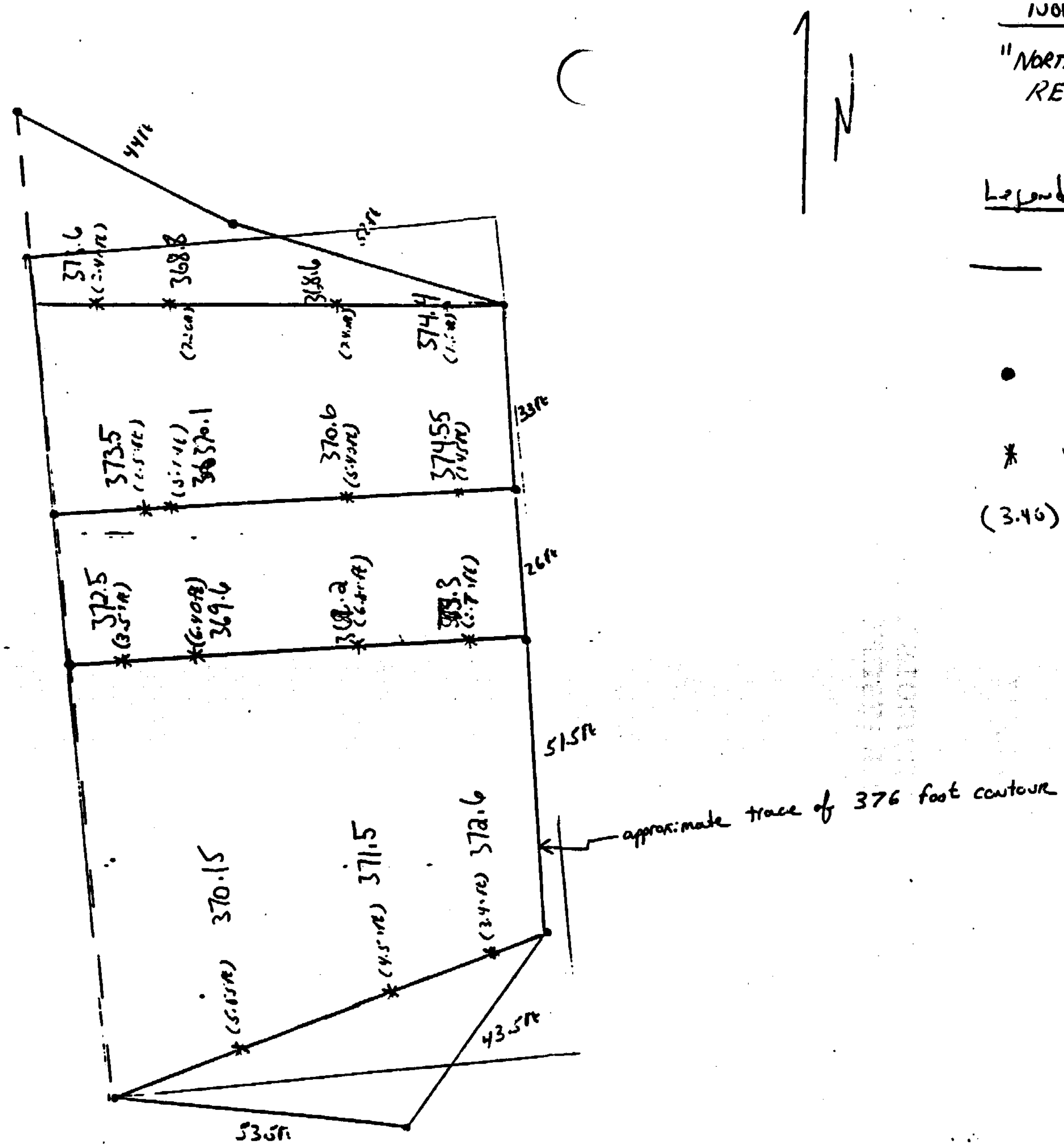
Horizontal Scale
1 inch = 20 feet



AR208298

NORTH IMPOUNDMENT ..

"NORTHERN SECTION OF SOUTHWEST RETENTION POND"



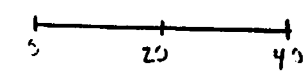
Legend

—— Straight Line Segment (dashed where inferred)

● Horizontal control point

✱ Vertical control point

(3.40) Vertical height above bottom of impoundment



Horizontal Scale

1 inch : 20 feet

AR208299

ATTACHMENT I

DEFINITION OF SYMBOLS USED
IN THE GEOTECHNICAL TESTING REPORT

DEFINITION OF SYMBOLS

W_L	Liquid Limit
W_P	Plastic Limit
W_{TRIM}	Water Content of Trimmings
W_O	Initial Water Content
W_C	Water Content After Consolidation
γ_{to}	Initial Total Unit Weight (Density)
γ_{do}	Initial Dry Unit Weight (Density)
γ_{tc}	Total Unit Weight (Density) After Consolidation
γ_{dc}	Dry Unit Weight (Density) After Consolidation
$\epsilon_{v,c}$	Volumetric Strain During Consolidation
$\bar{\sigma}_c$	Effective Consolidation Stress
U_b	Backpressure
i_o	Initial Hydraulic Gradient
tc	Consolidation Time
o/n	Overnight

ATTACHMENT J

"DEFINITIONS OF SURVEYING AND ASSOCIATED TERMS" AND HORIZONTAL CONTROL DATA SHEET

DEFINITIONS OF SURVEYING AND ASSOCIATED TERMS

Prepared by a Joint Committee of the
AMERICAN CONGRESSS ON SURVEYING AND MAPPING
and the
AMERICAN SOCIETY OF CIVIL ENGINEERS
1978 (rev.)

REPRINTED 1981

Library of Congress Catalogue Card No. 72-76107

(See United States Coast and Geodetic Survey Report for 1879, Appendix 8, pp. 112-114.)

datum, North American—The geodetic datum which is defined by the following geographic position of triangulation station Meades Ranch and the azimuth from that station to station Waldo, on the Clarke spheroid of 1866:

	°	′	″
Latitude of Meades Ranch	39	13	26.686 N.
Longitude of Meades Ranch	98	32	30.506 W.
Azimuth, Meades Ranch to Waldo	75	28	14.52

The North American datum is identical with the United States standard datum, the name of the datum being changed in 1913, when its adoption by the governments of Canada and of Mexico for their control surveys gave it an international character. See also *datum, North American, 1927.*

datum, North American, 1927 (1927 NAD)—This datum is identical with the North American datum at station Meade's Ranch, except that the azimuth, Meade's Ranch to Waldo was changed to 75°28′09.64″. It was adopted in 1927 after a readjustment of the triangulation of the entire country in which Laplace azimuths were introduced. It is now the standard geodetic datum on the North American continent. See also *datum, North American.*

datum plane—A surface used as a reference from which to reckon heights or depths. The plane is called a tidal datum when defined by a certain phase of the tide. The datum in most general use is based upon mean sea level and this is used as the reference for the first-order level net extending over the whole country. For hydrographic work, including soundings on charts and tidal predictions, a low-water datum is preferred. For this purpose the datum adopted is mean low water for the Atlantic coast of the United States and lower low water for the Pacific coast of the United States, including Alaska and island possessions. In many other parts of the world low water springs are used for hydrographic purposes. In order that they may be recovered when needed, datum planes are referenced to fixed points known as bench marks.

***Datum, Sea Level, 1929**—A determination of mean sea level that has been adopted as a standard datum for heights. The sea level is subject to some variations from year to year, but, as the permanency of any datum is of prime importance in engineering work, a sea-level datum after adoption should, in general, be maintained indefinitely even though differing slightly from later determinations of mean sea level based on longer series of observations.

The sea-level datum now used for the United States Coast and Geodetic Survey (now known as National Ocean Survey) level net is officially known as the "Sea Level Datum of 1929," the year referring to the last general adjustment of the net. The datum itself can be considered to be an adjustment based on the tide observations taken at various tide stations along the coasts of the United States over a number of years. See also *mean sea level; datum, tidal.*

datum, state plane coordinates—The surface onto which each point of concern is transferred mathematically from the corresponding point on the earth spheroid to give its map position. For illustrative purposes, the Lambert conformal projection datum is thought of as being represented by a cone and the Transverse Mercator projection datum by a cylinder, after each has been rolled out flat, or as a plane for other projections. Projection of distances between points on the ground to the datum is a two-stage process, first from the surface of the ground to the spheroid and, second, from there to the datum. Thus, the map, in effect, is a scale reproduction of the cone or cylinder rolled out flat. These datums are below the sea level arc of the earth between the lines of intersection of the cone or the cylinder with the spheroid, and are above the sea level arc for all segments of their surface outside such lines of intersection with the spheroid.

datum, tidal—Specific tide levels which are used as surfaces of reference for depth measurements in the sea and as a base for the determination of elevation on land. Many different datums have been used, particularly for leveling operations. Also called tidal datum plane. See also *Datum, Sea Level, 1929.*

datum, vertical—Any level surface (as for example, mean sea level) taken as a surface of reference from which to reckon elevations. Although a level surface is not a plane, the vertical datum is frequently referred to as the datum plane. Also called datum level, reference level, reference plane, vertical-control datum, vertical geodetic datum.

day—A measure of time based upon the rotation of the earth on its axis with respect to the Vernal Equinox, giving the sidereal day, and the sun, giving the solar day. See also *time, solar (interval); time, sidereal (interval).*

day, apparent sidereal—See *time, sidereal (interval).*

day, apparent solar—See *time, solar (interval).*

day, mean sidereal—See *time, sidereal (interval).*

day, mean solar—See *time, solar (interval).*

declination—1) (astronomy) The angle at the center of the celestial sphere between the radius passing through a celestial body and the plane of the celestial equator. Astronomic declination is measured by the arc of the hour circle between the celestial body and the equator; it is plus when the body is north of the equator, and minus when south of it. It corresponds to latitude on the earth, and with right ascension forms a pair of coordinates which define the position of a body on the celestial sphere. 2) (magnetic) The bearing (reckoned east or west from the north branch of the celestial meridian plane) of magnetic north as determined by the positive pole of a freely suspended magnetic needle which is subject to no transient artificial disturbance. In nautical and aeronautical navigation the term magnetic variation is used instead of magnetic declination, and the angle is termed variation of the compass or magnetic variation.

declination arc (solar compass)—A graduated arc on a surveyor's solar compass or on the solar attachment of an engineer's transit, on which the declination of the sun (corrected for refraction) is set off. This represents one side (polar distance) of the astronomical triangle which is solved mechanically by the solar compass or attachment.

declination arc (surveyor's compass)—A graduated arc attached to the alidade of a surveyor's compass or transit, on which the magnetic declination is set off. When the magnetic declination is set off on the declination arc of a surveyor's compass or transit, a reading of the needle will give a bearing corrected for that declination.

declination of grid north—See *gisement.*

declinometer—An instrument, often self-registering, for measuring or recording the declination of the magnetic needle.

decree—The court's decision in equity. A decree usually directs a defendant to do or not to do some specific thing, as opposed to a judgment for damages in a court of law. The same court may ordinarily sit either as a court of equity or a court of law.

dedication—To dedicate means to appropriate and set apart land from one's private property to some public use. The dedication may be either express or implied. It is express when there is an express manifestation on the part of the owner of his purpose to devote the land to a particular public use, such as the streets in platted subdivisions. It is implied when the owner's acts and conduct manifest an intention to devote the land to the public use. To make the dedication complete, there must not only be an intention on part of the owner to set apart the land for the use and benefit of the public, but there must be an acceptance by the public

Coast and Geodetic Survey
NORTH AMERICAN [illegible]

LATITUDE	40° 30' TO 41° 00'
LONGITUDE	75° 30' TO 76° 00'
DIAGRAM	NK 18-11 [illegible]

U.S. DEPARTMENT OF COMMERCE - COAST AND GEODETIC SURVEY

DESCRIPTION OF TRIANGULATION INTERSECTION STATION

Name of station: Allentown Radio Station [illegible]: center mast.

Chief of party: John [illegible] Year: 1960 State: Pennsylvania County: Lehigh

Description, including marks of objects: The station is the flashing red light mounted at the apex at the center mast of five of Radio Station [illegible]. Located about [illegible] miles north-northwest of the center of Allentown and about 0.9 mile east of State Highway [illegible]. It is a triangular shaped structure of laced steel, mounted on a swivel base, set in a concrete pillar. The structure is alternately painted orange and white and the overall height is approximately 5[illegible] feet. The masts are set in a northwest-northeast direction [illegible] feet apart.

Described by [illegible]

ADJUSTED HORIZONTAL CONTROL DATA

Name of station: ALLENTOWN RADIO [illegible] CEN MAST

State: PENNSYLVANIA Year: 1960 Order: THIRD

Source: G-12421

Geodetic latitude	40 39 35.[illegible]		
Geodetic longitude	75 30 [illegible]		

State or zone	Code	x	y	θ
PA S	3702	2,420,362.02	491,[illegible]	0 [illegible]

To station or object	Geodetic azimuth	Back azimuth	Code

ATTACHMENT K

CORRESPONDENCE TO USEPA FROM MARK TRAVERS
DATED FEBRUARY 28, 1992

de maximis, inc.

9041 Executive Park Drive
Suite 401
Knoxville, TN 37923
(615) 691-5052

February 28, 1992

VIA FACSIMILE AND FIRST CLASS MAIL

Mr. Cesar Lee, P.E.
United States Environmental Protection Agency
841 Chestnut Building
Philadelphia, Pennsylvania 19107

Re: Waste Characterization
Novak Sanitary Landfill Site ("NSL")
South Whitehall Township, Pennsylvania

Dear Mr. Lee:

This letter outlines the proposed revisions to the waste characterization section of the Remedial Investigation ("RI") report. These proposed revisions are intended to address the comments of the United States Environmental Protection Agency ("U.S. EPA") as provided in your January 17, 1992 correspondence, received January 20, 1992. This letter is being provided, as decided during our meeting on February 13, 1992, as a result of the extended consideration of U.S. EPA's comments a-c, Section 4.3.1, by the Novak RI/FS PRP Group ("Group") and U.S. EPA during the December 18, 1991 and February 13, 1992 meetings, and during subsequent conversation between the Group and U.S. EPA.

The U.S. EPA guidance for "Conducting Remedial Investigations/Feasibility Studies at CERCLA Municipal Landfill Sites" ("Landfill Guidance") describes the waste types typically disposed of in municipal landfills. It states that "municipal wastes disposed of in these landfills typically includes a heterogeneous mixture of materials primarily composed of household refuse such as yard and food wastes and paper, and commercial waste such as plastics, inert mineral waste, glass, and metals." Landfill Guidance, 1-2. It then notes that the landfills contain principally municipal waste, and to a lesser extent, hazardous waste, such as that resulting from small-quantity generators, household hazardous wastes, biodegradation of wastes and pre-RCRA operations. Id.

de maximis

The Landfill Guidance states that the characterization of such a landfill's contents is generally not necessary because containment of the landfill contents, which often is the most practicable technology, does not require such information. Landfill Guidance, ES-3. Characterization of a landfill's contents may provide valuable information for PRP determination, however, the objective of a RI is not to identify PRP's, but to determine the impacts of a facility or site on human health and the environment.[1] Id. In consideration of the guidance and the heterogeneous nature of the waste disposed at the NSL, the following text outlines the proposed revision to the Waste Characterization section of the RI report.

Outline of Proposed Revision

Since the landfill contents are the principal sources of impacts to human health and the environment at the NSL, the primary objective of the Waste Characterization section of the RI report is to describe the general categories of wastes that were accepted by the NSL during the years of operation. As provided for in the Landfill Guidance, characterization of a municipal landfill's contents should be based on a review of historical records, and need not require sampling of the landfill contents. Thus, the characterization of the contents of the NSL is based on a review of available records (e.g., responses to §104(e) requests) and other materials currently in the files of the U.S. EPA and/or the Pennsylvania Department of Environmental Resources ("PADER"). This approach is also consistent with the Work Plan for the RI/FS, as approved by EPA, which provided for a records review, but did not call for preparation of an appendix providing entity-specific information for approximately 900 entities (the current estimate of site users), 225 entities (the number

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1 To the extent U.S. EPA is seeking additional information about specific entities for the purposes of PRP identification, we note that the Group has actively assisted U.S. EPA in reviewing responses to §104(e) requests and related information to identify PRPs. The Group expects to submit the results of its most recent review to U.S. EPA shortly. In addition, a copy of the Complaint filed against other users of the NSL by certain Group members is enclosed with Ken Markowitz' copy of this letter, per his request at the February 13, 1992 meeting. This information should also be useful in identifying PRPs.

de maximis

Mr. Cesar Lee, P.E.
February 28, 1992
Page 3

selected by U.S. EPA in its comments), or some select portion thereof.

Information concerning the general characteristics of the wastes disposed at the NSL were obtained from the following sources: responses to §104(e) requests issued by the U.S. EPA; interviews with Louis C. Novak, Jr. and other persons with knowledge of landfill operations; landfill inspection records generated by the PADER; PADER correspondence. The information reviewed indicates that the landfill contents are typical of materials accepted by permitted municipal landfills during the period of time that NSL operated. Many of these same materials are accepted at currently permitted municipal landfills.

As the U.S. EPA and PADER are aware, the type of information that is available through such efforts does not routinely include results of laboratory analyses. In most instances, it also does not include the type of information requested by U.S. EPA in its comments; e.g., manufacturing processes and specific chemical constituents of resulting wastes for each entity that may have disposed of waste at the NSL. Furthermore, this type of information was not generally required of either a site operator or a waste generator, under any regulatory framework, during most of the time this or other similarly permitted facilities operated.

In general, the available information indicates that the NSL received dry refuse, construction debris and demolition material from municipal, residential, commercial, and industrial sources. This includes the following general categories of waste materials:

- Residential Trash
- Lawn Clippings
- Waste Paper and Cardboard
- Metallic Materials
- Construction and Demolition Debris (e.g., concrete, wood, asphaltic materials, metal)

Due to U.S. EPA's request for a more specific description regarding various waste types and quantities, the Group has undertaken an additional review of the existing documents. Based on that review, the Group proposes to incorporate the following information into the Waste Characterization section of the RI.

de maximis

Mr. Cesar Lee, P.E.
February 28, 1992
Page 4

A PADER memorandum from 1978 states that 80 percent of the materials being accepted by the NSL were paper and wood products, and residential trash.

In addition to the materials listed above, PADER records indicate that the landfill was authorized to accept waste sludges from select commercial and industrial sources. These materials were only accepted upon approval by PADER. The approval by PADER was required as a safeguard against the NSL accepting what PADER considered hazardous waste. A generic list of the sludges will be included in the RI once a review of available records has been completed. If laboratory analyses are available from the PADER files, such information will be appended to the RI report. Other materials not clearly identified at sludges but likely of similar consistency to sludges, and approved for disposal at the NSL include a neutralized label pulp.

PADER inspection reports contain references, on three occasions, to storage, not disposal, of drums/barrels. It is not clear whether the drums/barrels contained liquid. The first reference to the storage of drums/barrels at the NSL is in a September 28, 1978 inspection report prepared by PADER. The report orders the operator to remove all drums/barrels immediately. Inspection reports for October 20, 1978, and November 20, 1978 again refer to the drums/barrels and orders the owner/operator to remove the drums/barrels immediately. The drums/barrels were apparently removed after the third request by PADER since there is no reference to the drums/barrels in subsequent inspection reports. Since waste disposed of at the NSL was compacted throughout the site's operation, any drums which may have been disposed of in the landfill would have been crushed and compacted along with the other wastes. However, based on interviews with Louis C. Novak, Jr. and others familiar with the landfill operations, NSL did not accept drums and if a drum was identified in a load of material, it was removed.

In conclusion, the records review and results of leachate sampling and analysis demonstrate that the NSL should be classified as a Type I landfill site as defined in the Landfill Guidance, excepting specific reference to significant co-disposal of hazardous waste. Landfill Guidance 3-17. There are no known hot spot areas, and historical records and physical evidence, gathered during the RI, do not document any discrete subsurface disposal areas. As such, the information from the listed sources adequately characterizes wastes disposed of in the landfill for the purposes of selecting a remedy through the RI/FS process.

de maximis

Similar waste characterizations have been determined to be sufficient and appropriate for numerous other CERCLA sites that are municipal landfills, like the NSL. Examples of such sites in U.S. EPA Region II are the Dorney Road [Oswald], Old City of York and Reeser Landfills. In fact, some of these sites, unlike the NSL, were not permitted during their periods of operation. As such, even less information was likely to have been available for these sites. Nevertheless, it was not necessary to prepare an extensive appendix, listing users of the site, manufacturing processes and chemical constituents of waste, as is now being requested by EPA.

If you or your staff have any questions regarding the proposed format for revising the Waste Characterization section of the RI, please do not hesitate to contact me. We hope to hear from you within one week regarding U.S. EPA's response to this proposal.

Sincerely,

de maximis, inc.

Mark A. Travers
Senior Project Director

MAT/mml

cc: Julie A. Parker, Esq., Hannoch Weisman
Kenneth Markowitz, Esq., U.S. EPA (w/enclosure - Complaint)

ATTACHMENT L

**CORRESPONDENCE TO LAWRENCE W. DIAMOND FROM USEPA
DATED MARCH 9, 1992**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

Office of Superfund
SE Pennsylvania Remedial Section

Direct Dial (215) 597-8257
Mail Code 3HW21

Re: 3d

March 9, 1992

FACSIMILE # 201-403-0725
Mr. Lawrence W. Diamond
Hannoch Weisman
4 Becker Farm Road
Roseland, NJ 07068

SUBJECT: Novak Sanitary Landfill
Waste Characterization

Dear Mr. Diamond,

EPA has received and reviewed a February 28, 1992 letter from de maximis, inc., providing identification of certain remaining tasks that was promised to EPA by the Novak Sanitary Landfill ("NSL") Steering Committee as a result of our draft RI meeting regarding the NSL on February 13, 1992. Although we were pleased to see your letter, we are disappointed that your proposal was presented as an essentially narrative description of your concerns rather than as a crisp outline of remaining tasks. It appears, however, that we are in agreement on the basic tasks at hand. In order to keep things clear and to move this project forward, we are confirming below several tasks identified in your letter that the NSL Steering Committee will complete as part of the RI/FS.

1. Review of the 104(e) responses to extract information on substances present at the site.

We are pleased that your review of this is underway. As we have explained, this is an essential task in "detailing the specifics of disposal activities and of types and quantities of waste" (see attached EPA Guidance, Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites, No. 540/p-91/001, page 2-7). It is especially important for this Site, which operated for over 35 years, constitutes approximately 34 acres, contains over 1,000,000 cubic yards of refuse from approximately 900 site users, and which is located on a fracture area, as summarized in your RI/FS report.

2. **Review of DER files to extract information on substances present at the Site.**

Your letter mentions that a PADER memorandum from 1978 (pre-RCRA waste) states that 80 percent of the materials being accepted by the NSL were paper and wood products and residential trash. As explained above, the question of what constitutes the rest of the 20% of the materials disposed at the NSL is an important one that should be investigated and answered before the RI/FS goes out for public review and a remedy is selected. The referenced PADER memo should be attached in the RI/FS report as part of the supporting documentation, and all other relevant PADER information should be located and reviewed carefully. This is particularly important in view of the fact that we do not have 104(e) responses from all of the entities whose waste went to the NSL. PADER files may provide us direct information, and may help to fill in some of the gap that exists between our approximately two hundred (200) 104(e) responses and the nine hundred (900) contributors of waste.

3. **Present the obtained information in a useful, summary format.**

As we have discussed, it is not necessary for you to obtain information from sources other than the references (104(e) responses, PADER files, etc.) that you set forth in your letter. However, it is important that the RI/FS contain an informational and capsulized summary of the located information regarding wastes and substances disposed of at the Site. Such a summary will add a great deal of value by enabling report readers and reviewers to efficiently determine the wastes present at the Site. For this purpose, we recommend use of the summary tables which are attached to this letter. If you wish to propose an alternative format that could serve as an equivalent, we would be happy to evaluate it.

In addition to the above items, we note one correction to the information you presented in your February 28 letter: the citation to EPA Landfill Guidance. It appears that your citation to "3-17" may be in error, and may have been intended to refer to p. 3-1 (see page 3-1 of EPA Guidance 540/p-91/001 as attached). Please also check the contents of that citation since the phrase "...do not document any discrete subsurface disposal areas." means separate or unconnected areas such as the "Subtitle D study" in your RI/FS report and the "Region II landfills[1]". Therefore this citation should be amended since those situation do not exist at the NSL site.

EPA looks forward to receiving a description of the waste sent to the NSL Site, based on the detailed record review of available information that you have cited, and set forth in an informational and summarized format as in the attached example. This should be included with your submittal of the final RI, pursuant to the schedule agreed upon in our meeting of February 3, 1992. I would be happy to discuss the points raised in this letter should you believe it necessary.

Please call if you have any questions.

Sincerely,

Cesar Lee (3HW21)
Remedial Project Manager

Attachments

cc: P. Anderson (3HW21)
M. Snoparsky (3HW15)
K. Markowitz (3RC21)
C.K. Lee (3HW51)
M. Heffron, Dynamac
M. Mustard, PADER
J. Kunkle, PADER
M. Travers, de maximus (FACSIMILE # 615-691-6485)

IGT:CL:cl/030992A.NOV

1 Letter from Mr. Mark A. Travers, de maximis, inc. to Mr. Cesar Lee, US EPA dated February 28, 1992. Page 5, 1st paragraph.

TABLE (A): Solid Waste Summary

Solid Wastes	Approx. Quantity	Year Disposed	Location(unit) of Disposal	Waste Generator	Remarks
Restaurant Trash					
Residential Trash					
Lawn Cuts					
Farm Waste					
Construction Debris					
. etc. .					

TABLE (B): Specific Waste Summary

Specific Wastes	Approx. Quantity	Year Disposed	Location(unit) of Disposal	Waste Generator	Remarks
Waste Treatment Sludge					
Lab. Package					
Hospital Waste					
Incinerator Ash					
Waste Solvent					
. etc. .					

Section 3
SITE CHARACTERIZATION STRATEGIES

Once a work plan has been developed, field activities are undertaken to further characterize the site. The purpose of site characterization is to assess the risks to human health and the environment posed by the site and to develop a remediation strategy to mitigate these current and potential threats.

As described in Section 2, site characterization begins with an evaluation of previous data and analytical results. This information is combined with field investigations to fill in data gaps and to test hypotheses about the site developed during scoping. In this section, characterization activities are described by the different media that might be contaminated by a municipal landfill site, and different site characterization strategies for two types of municipal landfill sites are discussed.

Most municipal landfill sites on the NPL are co-disposal facilities that may or may not have known or suspected hot spots. Hot spots consist of highly toxic and/or highly mobile material and present a potential principal threat to human health or the environment (see 40 CFR Sec. 300.430(a)(1)(iii)(C)). Excavation or treatment of hot spots is generally practicable where the waste type or mixture of wastes is in a discrete, accessible location of a landfill. A hot spot should be large enough that its remediation will significantly reduce the risk posed by the overall site, but small enough that it is reasonable to consider removal and/or treatment.

The two principal types of municipal landfills are as follows:

- Landfill Type I. This is a co-disposal facility where records or some other form of evidence indicate that hazardous wastes were disposed of with municipal solid wastes. There are no known or suspected hot spot areas, and historical records and physical evidence, such as aerial photographs and the site visit, do not document any discrete subsurface disposal areas.

- Landfill Type II. This is a co-disposal facility where approximate locations of hot spots are known or suspected, either through documentation, physical evidence, or consistent employee/resident interviews. Small- to moderate-sized landfills (for example, less than 100,000 cubic yards) that pose a principal threat to human health and the environment are included in this group because it may be appropriate to consider excavating and/or treatment of the contents of these landfills.

Placing municipal landfill sites into these two categories allows more efficient characterization through avoidance of extensive and unnecessary sampling, and streamlines the RI/FS process. It should be noted that the distinction between these landfill types will not always be clear. Therefore, the application of the approaches described below should be flexible and adapted to the specific site characteristics.

In general, categorizing landfills into different types allows the site characterization to focus on detecting and then characterizing hot spots. Because there are no known or suspected hot spots, the feasibility study for Landfill Type I can focus on capping alternatives as part of an operable unit. This focused feasibility study could precede or be conducted concurrently with the groundwater investigation, particularly at sites where leachate is not a problem. At Landfill Type II, more effort can be expended on characterizing and remediating the hot spots. At these sites, the feasibility studies can focus on the operable units and remedial action alternatives for these units.

Site characterization strategies for the landfill types are described below by medium. The focus of the descriptions is primarily on those media most often requiring remediation at municipal landfill sites (e.g., groundwater, leachate, landfill contents, hot spots, and landfill gas). Other areas such as wetlands, surface water, and sediments are also discussed, but in less detail, since the nature of contamination is not unique

As mentioned above, the site description should include the areas, if any, of active landfilling operations; locations selected for sampling or well installation should consider the impact on the site's normal operation and maintenance. Meteorologic data should also be collected and considered during the development of the work plan. Meteorologic data can be used to determine appropriate times for site visits, to direct sampling efforts, and to evaluate remedial action alternatives, such as incineration, capping, or grading. Barometric pressure data are also useful for interpreting landfill gas volume collection data.

2.2.2 Site History

The site history section should detail, in chronological order, the history of previous regulatory actions, disposal activities, types and quantities of wastes, previous owners or operators, site uses, and site engineering studies. Significant effort should be expended in detailing the specifics of disposal activities and of types and quantities of wastes. Site records and interviews with nearby residents and former site operators are valuable sources of this information.

The history of previous disposal activities at a municipal landfill often directly affects the RI objectives, specifically the need to determine whether hot spots may be present and worthy of investigation. In addition to investigating a potential principal threat, the contents of hot spots are important for associating PRPs with the site. Identifying the chemical components may aid in identifying the sources of the waste in the hot spots.

A brief history of operations at adjoining or nearby facilities and other relevant environmental contamination at or near the site should also be included. These potential offsite sources of contamination should be considered during the development of the work plan. They may affect the choice of sampling and monitoring well locations and may contribute contamination to various media. Multiple sources of contaminants in the vicinity can make it difficult to identify all PRPs.

2.2.3 Regional and Site Geology and Hydrogeology

In addition to the preliminary site base map, preliminary geologic cross sections should be developed, if possible, to provide a three-dimensional overview of soils and geology and the possible extent of soil and groundwater contamination at the site. The purpose of this effort is to identify any changes or correlations in the type and movement of contamination and soil types and structure. This information will be used to:

- Estimate the depth of the landfill
- Estimate the depth to groundwater
- Identify the limits of subsurface sampling programs
- Select appropriate soil sampling and drilling methods

The preliminary soil/geologic cross-section can be developed from existing site maps, soil and geologic publications, reports on soil borings and monitoring well installation, and analytical results of soil sampling and groundwater sampling, if available. A suggested type of cross-section is shown in Figure 2-2. Features shown on a cross section of this type should include:

- Ground surface features (for example, buildings, above-ground tanks, roads)
- Soil horizons (for example, clay lenses or other soil layers with differing characteristics)
- Major geologic units
- Locations of domestic and/or public supply wells
- Locations of existing borings, wells, and test pits
- Existing sample locations, including the location of offsite sampling locations to

AR 208318

March 31, 1992

Not rec'd ?
Where's signature ?

VIA HAND DELIVERY

Mr. Cesar Lee
United States Environmental Protection Agency
841 Chestnut Street
Philadelphia, Pennsylvania

RE: Responses to Comments to the RI Report
Novak Sanitary Landfill Site

Dear Mr. Lee:

On behalf of the Novak RI/FS PRP Group, this letter transmits four copies of the responses to the comments of the United States Environmental Protection Agency (U.S. EPA) to the Remedial Investigation (RI) report. Dynamac Corporation and the Pennsylvania Department of Environmental Resources have been provided with one and two copies, respectively. As mutually agreed, the proposed revisions provided in the enclosed response document will be incorporated into a revised RI report within two weeks of receipt of U.S. EPA's comments to the response document.

In addition to the responses and proposed revisions provided in the enclosed response document the following should be noted:

- The basic conclusion of the risk assessment has not been changed by the revised method of calulating ground water exposures requested by the U.S. EPA.
- The waste characterization text will be revised if additional information relating to sludges is identified.

If you or your staff have any questions regarding the enclosed response document, or any other aspect of this project, please do not hesitate to contact me.

Sincerely,
de maximis, inc

Mark A. Travers
Senior Project Director

Enclosures

cc: Julie Parker, Esq., Hannoch Weisman
Joseph Keller, Geraghty & Miller
Vincent Uhl, Vincent Uhl & Associates
Novak RI/FS PRP Group

RECEIVED
APR 20 1992
HANNOCH WEISMAN

de maximis, inc.

9041 Executive Park Drive
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Knoxville, TN 37923
(615) 691-5052

April 16, 1992

VIA FACSIMILE AND
FIRST CLASS MAIL

Mr. Cesar Lee
United States Environmental Protection Agency
841 Chestnut Building
Philadelphia, Pennsylvania 19107

RE: Revision of the Feasibility Study Report
Novak Sanitary Landfill Site
South Whitehall Township, Pennsylvania

Dear Mr. Lee:

This letter memorializes the proposed schedule for submittal of the revised Feasibility Study report. As we discussed, the revised Feasibility Study report will be submitted four weeks after submittal of the revised Remedial Investigation report. This will allow sufficient time for incorporation of those comments to the Remedial Investigation report which impact the Feasibility Study report.

We interpret this to be a modification of paragraph VIII, Work to be Performed, subpart G, of the Administrative Order on Consent ("AOC") for this project. Pursuant to paragraph XXII, the AOC may be amended by mutual agreement of the U.S. EPA and the Respondents, and the concomitant modification to the Work Plan schedule may be made by mutual agreement of the Project Coordinators. Such modifications shall be made by an exchange of letters by the Project Coordinators. I therefore request that you provide, at your earliest convenience, a letter confirming U.S. EPA's agreement to the schedule as previously discussed.

If you have any questions regarding any aspect of the referenced project, please do not hesitate to contact me.

Sincerely,
de maximis, inc.

Mark A. Travers
Senior Project Director

psm

cc: Julie Parker, Esq., Hannoch Weisman
Joseph Keller, Geraghty & Miller
Vincent Uhl, Vincent Uhl & Associates
Novak RI/FS PRP Group Technical Committee

c:\wp51\nslrfsr

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RECEIVED
JUN 16 1992
HANNOCH WEISMAN

June 9, 1992

VIA OVERNIGHT COURIER

Mr. Cesar Lee
United States Environmental Protection Agency
841 Chestnut Building
Philadelphia, Pennsylvania

RE: Revised Remedial Investigation Report
Novak Sanitary Landfill Site
South Whitehall Township, Pennsylvania

Dear Mr. Lee:

Geraghty & Miller has transmitted under separate cover, on behalf of the Novak RI/FS PRP Group, four copies (one unbound) of the revised Remedial Investigation (RI) report for the Novak Sanitary Landfill site. In addition, three copies are being transmitted directly to the Pennsylvania Department of Environmental Resources (PADER) and one copy to Dynamac Corporation. The enclosed RI report has been revised consistent with the "Responses to the U.S. Environmental Protection Agency's Comments on the Novak Sanitary Landfill Remedial Investigation" dated March 1992 and the comments of the United States Environmental Protection Agency (U.S. EPA) dated May 26, 1992.

In addition to the revisions to the enclosed RI, there are a few comments which are not appropriate for incorporation in the RI report, but which the Group nevertheless believes are important to evaluation of the RI report. These comments are presented in the following text.

- Comparison of the ground water quality prior to purging with that of the ground water quality after purging is inconsistent with the procedures recommended by the U.S. EPA Ground Water Handbook (Ground Water Handbook, Volume II: Methodology, U.S. EPA , July 1991) and RCRA Guidance (RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, U.S. EPA, September, 1986). In addition, the U.S. EPA had requested at the time the initial RI/FS Work Plan was being prepared that all wells be purged so that the quality of the water in the aquifer could be determined, not the stagnant water within the well.

- Physical testing (e.g., gradation sieve analysis, organic content, percent water, and Ph) were not considered necessary in consideration of the objectives of the sampling and analysis of Jordan Creek sediments, nor did the U.S. EPA request that such information be collected. The information which was collected is sufficient for the intended use of the data. Finally, the U.S. EPA approved the Jordan Creek sampling and analysis program as proposed in the Addendum to the RI/FS Work Plan/Field Operations Plan and the Group believes it is inappropriate for the U.S. EPA to now question the usefulness of the resulting data.

- The waste characterization section of the RI report will be revised, if necessary, after each of the Group members have has the opportunity to review the report and attachments provided by the U.S. EPA (prepared by Dynamac Corporation, May 1992). The Group's position regarding this issue, and confirmation of its previous agreement with U.S. EPA, will be provided in a separate letter from the Group's Chair, Lawrence W. Diamond, to Kenneth Markowitz, U.S. EPA. The Group will act in accordance with the approach outlined in that letter.

- The landfill gas survey, which was conducted as part of the Feasibility Study (FS) field activities, encountered gas at the landfill perimeter which exceeded 90 percent of the lower explosive limit (LEL) for methane. Despite the determination of the extent of the landfill gas in the shallow subsurface, the U.S. EPA has requested that the Group perform a combustible gas survey in the basements of residents proximate to the landfill. As previously communicated to the U.S. EPA, the Group has agreed to undertake such a survey. The components of the a survey will be outlined in a separate letter to the U.S. EPA and the results similarly reported.

- Both the U.S. EPA and the PADER take the position that the Pennsylvania ARAR for ground water for hazardous substances is that all ground water be remediated to "background" quality as specified by 25 PA Code 264.90-264.100, specifically 25 PA Code 264.91 (i) and (j) and 264.100 (a) (9). The Group does not agree that this requirement is an ARAR or that this regulation requires all ground water to be remediated to background levels.

Assuming however that this requirement continues to be considered an ARAR for purposes of any ground water remediation (active or passive) at this site, the Group believes that the ARAR should be waived under Section 121 of CERCLA.

- In response to comment no. 1 of the U.S. EPA regarding 5.1.2 comments on "4.4.3.2 Bedrock Lithology", a copy of the original field notes concerning MW-7 have been provided at Appendix N. However, the Group objects to the comment of the U.S. EPA in that it suggests the Geraghty & Miller has or would engage in improper practices.

If you have any questions regarding any aspect of the enclosed revision to the RI report, or any other aspect of the referenced project, please do not hesitate to contact me.

Sincerely,
de maximis, inc.

Mark A. Travers
Senior Project Director

cc: Julie Parker, Esq., Hannoch Weisman
Joseph Keller, Geraghty & Miller
Vincent Uhl, Vincent Uhl & Associates
Novak RI/FS PRP Group
Diana Brems, PADER
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OF COUNSEL
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ROBERT A. MATTHEWS

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NEWARK, NJ 07101-9819

WRITER'S DIRECT LINE:
(201) 535-5493

FILE #
42668-2

June 16, 1992

VIA TELECOPIER AND FIRST CLASS MAIL

Kenneth Markowitz, Esq. (3RC23)
Assistant Regional Counsel
Remedial Enforcement Section
Office of Regional Counsel
U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

Re: Novak Sanitary Landfill, Inc.;
Waste Characterization Section
of Remedial Investigation Report

Dear Mr. Markowitz:

Pursuant to our conversation last week regarding the referenced subject, I telephoned you yesterday, and left a detailed voice mail message, requesting a further extension of time, until June 26, 1992, to respond to the Dynamac Report and to submit the Revised Waste Characterization Section of the RI Report. As I explained on the message, the Group Members are still preparing responses to company specific issues, some of which necessitate further follow-up with the companies. Based upon our previous conversation, it is my understanding that USEPA will approve the requested extension of time. We ask that you confirm approval in writing at your earliest convenience. In the interim, we will, of course, make every practicable effort to submit the responses prior to June 26.

HANNOCH WEISMAN

A PROFESSIONAL CORPORATION

Thank you for your anticipated cooperation.

Very truly yours,

HANNOCH WEISMAN

By: Julie A. Parker/mml
Julie A. Parker

JAP/mml

cc: Cesar Lee, P.E., USEPA (Via Telecopier)
Mark A. Travers, de maximis, inc. (Via Telecopier)

de maximis, inc.

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October 9, 1992

VIA FACSIMILE AND FIRST CLASS MAIL

Mr. Cesar Lee
Remedial Project Manager
United States Environmental Protection Agency
841 Chestnut Street
Philadelphia, Pennsylvania

RE: Force Majeure Report/Request for Schedule Extension
Novak Sanitary Landfill Site
South Whitehall Township, Lehigh County, Pennsylvania

Dear Mr. Lee:

This letter is written on behalf of the Novak RI/FS PRP Group ("Group") which are the Respondents to the Administrative Order by Consent ("Consent Order") in the matter of the Novak Sanitary Landfill Site ("NSL") in South Whitehall Township, Lehigh County, Pennsylvania. Pursuant to Section XVI of the Consent Order, you were notified by telephone on October 5, 1992 of circumstances the Group believes constitutes a force majeure event under the Consent Order. This verbal notice was provided within two business days after becoming aware of conditions constituting a force majeure event. This letter provides the follow-up written notice required by the Consent Order and specifically describes the nature of the delay. In addition, this letter provides the reasons the delay was unanticipated and beyond the reasonable control of the Group, the actions that have been and will be taken to mitigate the delay, the anticipated length of the delay, and the timetable/request for schedule extension.

The Force Majeure

The Group was informed by their contractor (Geraghty & Miller) on Thursday, October 1, 1992 that the U.S.EPA comments received on September 25 and September 28, 1992 required clarification by the U.S.EPA and a significant level of effort, including additional field work, to incorporate. Therefore, prior to revision of either the remedial investigation report ("RI") or the feasibility study report ("FS") a schedule modification would be necessary, because the 14 day response period set forth in Section VIII.G of the Consent Order for revision of the reports is insufficient. For example, the work required prior to revision of either report would include preparation of an addendum to the U.S.EPA approved RI/FS Work Plan ("Work Plan") and Field Operations Plan ("FOP"), followed by implementation of the associated field work upon receipt of approval from the U.S.EPA.

As required by Section VIII.G of the Consent Order, if the U.S.EPA disapproves of a revised preliminary or final Report the Group has 14 days from the receipt of the U.S.EPA's notice of disapproval to incorporate U.S.EPA's requested revisions and resubmit the report. The comments received from the U.S.EPA on September 25 and 28, 1992 are in excess of what the Group could reasonably have anticipated receiving from the U.S.EPA in the third round of comments. The most recent comments from the U.S.EPA include extensive comments to text which was previously submitted to the U.S.EPA (in response to the first round of the U.S.EPA's comments), and which the U.S.EPA did not previously comment upon. As such the Group is justified in considering such original language as approved and acceptable to the U.S.EPA.

It is the Group's opinion that the nature of the comments received from the U.S.EPA could not reasonably be anticipated in consideration of the responses received from previously revised documents, and could not have been within the contemplation of the parties in agreeing to the language provided in Section VIII.G of the Consent Order and paraphrased above.

The excessive number of comments to previously reviewed and apparently approved revisions, and the lack of an opportunity to confer with the specific individuals who provided the comments constitute additional basis for the force majeure and schedule extension.

Anticipated Delay

At the present time, it is not possible to quantify the anticipated delay caused by the event. The Group has attempted to arrange for a teleconference/meeting with the U.S.EPA to discuss the recently *received comments*; however, the U.S.EPA has informed the Group that the individuals which prepared a majority of the comments in question are not available until October 9, 1992 (the due date for the revised RI Report based on a 14 day response period). Thus, until the Group has the opportunity to discuss the comments in detail and resolve any outstanding issues, neither the RI nor the FS Reports can be revised. Therefore, the impact of this event cannot be predicted without further discussions with the U.S.EPA. However, Geraghty & Miller has informed the Group that to implement the activities requested in the recent comments from the U.S.EPA, an extension of approximately one year would need to be made to the schedule.

Steps Taken to Mitigate Schedule Impacts

The Group has undertaken several steps on parallel tracks in an effort to overcome the recent events and current situation.

On October 2, 1992, the U.S.EPA was contacted in order to arrange for a meeting or telephone conference to discuss the comments which had been received. A telephone conference was arranged for Monday, October 5, 1992 and subsequently canceled due to the unavailability of various individuals which had prepared the comments in question. This telephone conference was tentatively rescheduled for October 9, 1992.

The Group, in the interest of finalizing the RI and FS Reports, has authorized Geraghty & Miller to make those revisions which do not require further clarification from the U.S.EPA. These are primarily comments relating to further clarification of revisions made to the RI or FS reports in response to comments received from the U.S.EPA on May 26, 1992.

Finally, the Group has verbally presented alternatives to the U.S.EPA, for resolving those issues for which the Group is awaiting to discuss with the appropriate persons at the U.S.EPA.

Timetable/Request for Schedule Extension

The Group requests that the U.S.EPA approve an extension in the schedule for submittal of a revised Final RI and FS Reports. The extension is needed to allow for U.S.EPA to clarify various comments which were believed to have been resolved previously. The level of schedule extension necessary is dependent on further discussions with the U.S.EPA. If the U.S.EPA withdraws those comments which do not relate to clarification of comments provided in correspondence dated May 26, 1992, and considered previously acceptable, the necessary extension could be minimized (approximately two weeks). As stated above, incorporation of the U.S.EPA comments, without further clarification or revision, could require a schedule extension of one year or more.

Conclusion

It should be noted that the issues raised by the U.S.EPA in correspondence received September 25 and 28, 1992 were entirely unexpected considering the comments received on May 26, 1992 and subsequent discussion with the U.S.EPA. In addition, the comments received September 25 and 28, 1992 were received beyond the schedule provided for in Section VIII.G of the Consent Order. As provided for in the Consent Order, the U.S.EPA shall within 30 days of receipt of the revised report notify, in writing, the Respondents of U.S.EPA's approval or disapproval of the revised report. The comments were received well beyond the required 30 days after the U.S.EPA's receipt of the revised RI and FS reports.

In conclusion, it is the Group's opinion, based on review of the recent comments received from the U.S.EPA (to include the additional work items), that the U.S.EPA does not anticipate revision of the recommended alternative provided in the FS report, and is preparing the Proposed Remedial Action Plan (PRAP) for the NSL. In consideration of this fact, it seems inappropriate to delay issuance of the PRAP and the ultimate remedial action for one year or more. The Group has been extremely cooperative and undertaken activities which were clearly beyond the scope of the approved RI/FS Work Plan in the interest of moving this project forward. Any further study would not be in the interest of the public and apparently, based on communication with the U.S.EPA, would likely not impact the ultimate remedy for the NSL.

It is the Group's desire to meet with the U.S.EPA as soon as possible to discuss the issues outlined in this letter/force majeure and the recently received comments to the RI/FS reports. In the meantime, if you or any of your staff have any questions regarding any aspect of this project, please do not hesitate to contact me. I am confident, based on our discussions on October 8, 1992, that we will be able to resolve any outstanding issues and bring the RI/FS to an expenditious conclusion.

Sincerely,
de maximis, inc

Mark A. Travers
Senior Project Director

cc: Julie Parker, Esq., Hannoch Weisman
Joseph Keller, Geraghty & Miller
Novak RI/FS PRP Group
Novak RI/FS PRP Group Technical Committee

File:FMRnvk.ltr:dsk:2/3009

de maximis, inc.
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Fax (615) 691-6485

November 4, 1992

VIA OVERNIGHT COURIER

Mr. Cesar Lee
United States Environmental Protection Agency
841 Chestnut Street
Philadelphia, Pennsylvania

RE: Final Remedial Investigation and Feasibility Study Reports Novak Sanitary Landfill Site South Whitehall Township, Pennsylvania

Dear Mr. Lee:

This letter transmits, on behalf of the Novak RI/FS PRP Group ("Group"), four (4) copies of the Final Remedial Investigation and Feasibility Study reports plus 1 redline/delete version of the same. The reports have been revised in consideration of comments received from the United States Environmental Protection Agency (U.S. EPA) on October 21, 1992. The revisions also consider the recent conversations with the U.S. EPA regarding the commments.

The following letter report briefly responds, where responses are necessary, to the comments provided by the U.S. EPA on October 21, 1992. The comment of the U.S. EPA is provided prior to the Group's response. Each of the U.S. EPA comments is provided in the format provided in the U.S. EPA correspondence. The Group's responses is provided in bold. Not all of the comments required response; therefore, responses to all of U.S. EPA's comments are not provided below.

Responses to the U.S. EPA comments on the "REMEDIAL INVESTIGATION REPORT NOVAK SANITARY LANDFILL SOUTH WHITEHALL TOWNSHIP, PENNSYLVANIA" Report dated June 1992

1.0 COMMENTS ON "4.0 EXPOSURE CHARACTERIZATION"

COMMENTS ON "4.4 EXPOSURE DOSE CALCULATIONS"

COMMENTS ON "4.4.4 LEACHATE SEEP WATER AND ASSOCIATED SOIL"

Comment No. 1

Page A-75

The assumption of incidental ingestion of 5 mg/d of surficial soil from the vicinity of leachate seeps is underprotective. The scenario should assume that, on days when these soils are contracted, 100 mg of incidental ingestion occurs.

Response

> **Calculations regarding exposure doses were prepared using the incidental ingestion rate of 100 mg/day; it was an oversight that the text was not corrected. The text has been corrected for the final RI submittal.**

Comment No. 3

Table A-79: Risk Estimation Summary

...cancer risk to children is additive with that to adults. These risks should be combined.

Response

> **These risks were combined as noted in footnote C of Table A-79.**

Comment No. 4

The table should contain a risk summary for a potential current off-site resident - child (analogous to that for an adult, shown third from the top on page 1 of the table). Although the appropriate route-specific risks were presented in earlier tables, they were omitted from the summary table.

Response

> **The risks related to exposure of a current off-site resident - child (i.e., ingestion of ground water from residential well NSL-RW-07 [excess lifetime cancer risk = 1×10^{-6} and hazard index = 2) were inadvertently omitted from Table A-79. A risk summary (analogous to that presented for an adult) has been presented for a potential current off-site child resident in the revised Table A-79.**

2.0 COMMENTS ON "7.0 PHASE ONE BASELINE ECOLOGICAL EVALUATION"

Comment No. 1

It is suggested that the investigator modify all of Section 7 of the RI except for the portion related to endangered species, or Special Resources/Critical Habitats as referred to in the RI. They appear to have contacted the appropriate people in both state and federal government regarding this aspect.

It is recommended that the chapter be reorganized to include lists of flora and fauna found on site and in the surrounding areas and describe the habitats existing in support of these resources. Since it is a site demonstrating such diversity of habitat, an attempt should be made to census and map populations against habitats and to carry out a habitat impact assessment for the design alternatives during the pre-design phase. Details regarding appropriate habitat restoration will also be developed during the pre-design phase.

Response

The Phase I Baseline Ecological Evaluation presented in Section 7.0 of the RI is based on findings of three field evaluations conducted at the NSL: a site reconnaissance conducted from February 12 through February 20, 1990 (refer to Section 3.2.5 of the RI); a site walkover conducted on February 19, 1992 with a representative of the U.S. EPA (refer to Section 7.0 of the RI); and a preliminary wetlands evaluation conducted on March 11, 1992 (refer to Section 7.0 of the RI). In addition, Section 7.0 of the RI is supported by on-site drainageway, sediment and surface water sampling and analysis and off-site sediment sampling and analysis. All activities were conducted pursuant to the U.S. EPA approved RI/FS Work Plan amd Field Operations Plan.

Finally, it is our understanding that the reference to including a list of flora and fauna in Section 7 (beyond that currently included) would be done during the habitat impact assessment which may be conducted on-site during the RD phase of the project as a supplement to those activities conducted pursuant to the U.S. EPA approved RI/FS Work Plan and Field Operations Plan. In addition, it is our understanding that the reference to "appropriate habitat restoration" applies to the restoration of habitat which legally requires restoration.

COMMENTS ON "7.7 SEDIMENT AND SURFACE WATER SAMPLING"
Comments on "Jordan Creek sampling Analysis"

Comment No. 2

It is inappropriate to utilize soil contaminant levels to evaluate the potential impact of these contaminants in sediments for Jordan Creek and on-site sediments.

Response

The comparison between the constituent concentrations detected in Jordan Creek sediments and the soil contaminant concentrations presented in *Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States* (Shacklette and Boerngen, 1984) was provided as a general comparison to demonstrate that the lead concentrations detected in Jordan Creek sediments are within naturally occurring lead concentrations for soils. Soils are generally considered the natural source for constituents in sediments, particularly in areas where the bedrock is mantled by soil covers.

Based upon conversations with representatives of PADER, guidelines regarding typical constituent concentrations for freshwater sediments in Pennsylvania are not available. However, guidelines are available from other regulatory agencies and geographic areas. The comparison has been expanded with reference to sediment data from published sources. All lead concentrations detected in the Jordon Creek sediments were consistent with concentrations provided in the identified references.

COMMENTS ON "7.8 SUMMARY AND CONCLUSIONS"
Comment on "7.8.3 Conclusions"

Comment No. 3

EPA does not agree with the conclusions reached in this section, specifically. "Based upon the ecological investigations conducted during the RI, there has been little to no effect on off site ecological Characteristics" and "(a)lthough...practices (on site) have disturbed the ...ecological setting...no available evidence demonstrates any significant effects to the current ecological characteristics..."

We object to use of the term 'ecological investigations' as none was done to the best of our knowledge. In place of this, the consultant used a reconnaissance site visit by a member of EPA staff and a subsequent one-day visit by a site contractor. They have misrepresented the conversations and notes made by EPA staff as sufficient to fulfill the need for full flora and fauna characterization as well as habitat evaluation. Since ecological investigations were not carried out, it is obvious that evidence is not available to 'demonstrate any significant effects'.

It is instructive to note at this point that the reconnaissance site visit demonstrated that a very desirable set of habitat conditions are present and improving at the site. A rich mixture of uplands (open fields and immature forest), scattered wetlands (small pockets scattered over the site with at least three larger and well developed areas) were noted. With such a rich mixture, it would be difficult to complete a vegetation list during a one-day site visit. The one-day visit also showed a diversity of wildlife demonstrating that numerous wildlife receptors are prevalent on site.

In conclusion, it is recommended that flora and fauna characterizations be completed along with the various habitats located in the area and viewed through the perception of landscape. In this way, the ecological characterization can be viewed as a working whole rather than as *individual* parts. The vegetative cover should be described in terms of acreage. Design alternatives should be developed in terms of protecting and enhancing the current habitat and landscape conditions.

Response

It was not the intent of the March 11, 1992 site walk-through with EPA staff to replace a full flora and fauna characterization or habitat characterization. It was agreed upon at the February 13, 1992 meeting that this site reconnaissance visit would provide a perspective of the habitat values at the site and a preliminary wetlands evaluation.

Similarly, in conjunction with the site walk-through, it was agreed a preliminary wetlands evaluation would be conducted during the RI to obtain an initial perspective of potential wetland environments at the NSL. It was also agreed that a complete wetlands evaluation would not be conducted until the RD. In performing the preliminary wetlands evaluation, the site was inspected for evidence of wetland hydrologic conditions, the plant community composition was examined, and general site topography, man-made features, disturbances, and general drainage patterns were noted. This site visit was not the first but the third of three *activities* associated with documenting general site conditions including ecological evaluations.

As stated previously, it is our understanding that the U.S. EPA intends to request an assessment of on-site habitat(s) during the RD phase of the project to supplement the activities conducted to date pursuant to the U.S. EPA approved RI/FS Work Plan and Field Operations Plan. In addition, restoration of habitat eliminated by the RA will be conducted if determined to be appropriate and legally required.

remediation (active or passive) at this site, the Group believes that the ARAR should be waived under Section 121 of CERCLA."

If a waiver is to be considered, the Waiver of this Pennsylvania ARAR must comply with Section 121 (d)(4) of CERCLA and Section 300.430 (f)(1)(ii)(c) of the National Contingency Plan.

Response

The Group previously responded to this comment March 1992. The Clean Streams Law of Pennsylvania, the Pennsylvania Air Pollution Control Act, and the Pennsylvania Air Quality Management Regulations are identified in Section 8.4 of the RI. These ARARs would be triggered by the particular remedial activities that are selected to accomplish a selected remedy.

The second paragraph in Section 8.4 ACTION-SPECIFIC ARARs has been revised to state:

> **Action-specific ARARs are generally not identified until remedial alternatives are assembled during the FS. Therefore, the only action-specific requirements which will be considered during this preliminary identification of ARARS are the closure requirements for solid waste management facilities. These requirements are defined in RCRA Subtitle D (42 U.S.C. §§ 6907, 6944, 6949, 42 U.S.C. §§ 1345; 40 CFR §257 and 258), and the Pennsylvania Solid Waste Management Act (35 P.S. §§ 6018.101-6018.1003; Title 25 PA. Code. The Pennsylvania Clean Streams Law (35 P.S. §§ 619.1 et.seq.), Pennsylvania Air Pollution Control Act (35 P.S. §§ 4110, et.seq.) and Pennsylvania Air Pollution Control Regulations (25 PA Code §§123.1 et.seq. and 25 PA Code §§131.1 et.seq. are other action-specific ARARs that would be considered upon remedial design. Additional action-specific ARARs will be identified during the FS phase.**

The following footnote, used throughout the RI and FS, will be revised as follows and will be included in Section 8.4:

> **Both the U.S. EPA and PADER take the position that the Pennsylvania requirement for groundwater for hazardous substances is that all groundwater be remediated to "background" quality as specified in 25 PA Code 264.90 - 264.100, specifically 25 PA Code 264.97 (i) and (j) and 264.100 (a)(9). The Group does not agree that this requirement is an ARAR or that this regulation requires all ground water to be remediated to background levels. Assuming however that this requirement continues to be considered an ARAR for purposes of any ground-water remediation (active or passive)**

3.0 COMMENTS ON "8.0 PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)"

Comment No. 1

The following Pennsylvania Chemical Specific ARARs must be included and addressed in the Final Remedial Investigation Report for the Novak Sanitary Landfill Site:

- The Clean Streams Law of Pennsylvania, Act of June 22, 1937, P.L. 1987, 35 P.S. §§619.1 et.seq.,
- The Air Pollution Control Act, Act of January 8, 1960, P.L. 2119, 35 P.S. §§4110, et.seq.,
- Pennsylvania Air Quality Management Regulations:

  - 25 PA Code §§123.1 et. seq. (Chapter 123-Standards for Contaminants)

  - 25 {PA Code §§131.1 et. seq. (Chapter 131-Ambient Air Quality Standards)
- The Pennsylvania ARAR for groundwater for hazardous substances is that all groundwater must be remediated to "background" quality as specified by 25 PA Code §264.90-264.100, specifically 25 PA Code §§264.97 (i) and (j) and 264.100 (a)(9). The Commonwealth of Pennsylvania also maintains the requirement to remediate to background is found in other legal authorities including Article 1, Section 27 of the Pennsylvania Constitution, Section 301, 307, 401 and 402 of the Pennsylvania Clean Streams Law, and the Solid Waste Management Act. The Department has recently finalized a Ground Water Quality Protection Strategy dated February 1992 which also addresses remediation of groundwater within the Commonwealth of Pennsylvania. This Chemical Specific ARAR must be addressed due to the presence of hazardous substances found in the groundwater (i.e. TCE) above background levels.

The PRP's letter to EPA dated June 9, 1992 states:

> "Both the U.S. EPA and the PADER take the position that the Pennsylvania ARAR for groundwater for hazardous substances is that all groundwater be remediated to "background" quality as specified by 25 PA Code 264.90-264.100, specifically 25 PA Code 264.97 (i) and (j) and 264.100 (a)(9). The Group does not agree that this requirement is an ARAR or that this regulation requires all ground water to be remediated to background levels. Assuming however that this requirement continues to be considered an ARAR for purposes of any ground water

at this site, the Group believes that the ARAR should be waived under Section 121 (d) (4) of CERCLA and §300.430 (f)(1)(ii)(c) of the National Contingency Plan in that compliance with such a requirement would be technically impracticable from an engineering perspective due to the geologic setting of the site.

4.0 COMMENTS ON "APPENDIX A: PHASE ONE BASELINE RISK ASSESSMENT"

GENERAL COMMENTS

Comment No. 2

Nothing is provided to substantiate the "no impacts" conclusion. The absence of listed endangered species or critical habitats does not mean there are no adverse environmental effects to ecological resources associated with the site. Additional activities in the form of an habitat impact assessment may be conducted during the RD phase to supplement those activities conducted to date.

Response

The data from the RI and supplemental investigations do provide an indication of impacts to the ecological resources. Specifically, the work completed assessed the ecological resources and was approved by the U.S. EPA as part of the RI/FS Work Plan and Field Operations Plan.

5.0 COMMENTS ON "CHEMICAL DATA TABLES"

Comment No. 1

As per Region III guidance, all data tables in the main bodies of the RI and risk assessment should include detection limits and the code 'U' for all non-detect observations. (If a compound was not detected in any sample of a particular medium, however, it is reasonable to omit it from the summary tables, as was done.)

Response

The tables have been revised in accordance with discussions with the U.S. EPA (i.e., detection limits are provided in a different format than suggested by this comment).

**Responses to the U.S. EPA Comments on the "FEASIBILITY STUDY
NOVAK SANITARY LANDFILL
SOUTH WHITEHALL TOWNSHIP, PENNSYLVANIA
Report dated July 8, 1992**

GENERAL COMMENTS

Page ES-8, Paragraph 3, Sentence 1. Remedial Alternatives 4 through 8 do not meet the Pennsylvania ARAR for groundwater. Alternatives 7 and 8 may meet the PA groundwater ARAR if groundwater remediation continues until background quality is reached.

Response

In support of the Group's position regarding this matter and as previously stated, the footnote which appears throughout the RI has been revised.

Secondly, it is correct that Alternatives 7 and 8 may meet the Pennsylvania ground water requirement; however, it is unlikely considering the technical impracticalability of pumping the formation to restore ground-water quality or to contain any impacts to the ground water. Elimination of infiltration and subsequent leaching of the landfill, supplemented by monitoring of drinking water wells, would be more appropriate and equally protective.

1.0 INTRODUCTION

1.3 CHARACTERISTICS OF ENVIRONMENTAL MEDIA

1.3.2 Leachate

Page 1-25, 3rd Paragraph:

This section states, "The investigation determined that the standing liquid is primarily located along the southwestern corner of the surface fill area, between the surface fill area and the northwestern corner of the Trench Area in all five trenches." This determination did not take into account that the greatest factor associated with the presence of leachate in the gas vents is not the location of the vents, but the depth in which the vents are located below ground. Gas vents between 1.5 and 4.5 feet below the ground did not contain any standing liquid. Thirty-six percent of the vents between 4.5 and 5.5. feet below the ground contained standing liquid. Seventy-two percent of the gas vents 5.6 feet and deeper contained standing liquid. The deeper gas vents contained the majority of the standing liquid encountered in the upper zone of the landfill.

Ninety-three percent of the gas vents in the Trench Area were 5.6 feet below grade or deeper. The leachate appeared more prevalent in this area because the deeper vents made the leachate more accessible than the other areas of the landfill. Eighty-two percent of the gas vents in the northwestern portion of the Surface Fill Area were 4.4 feet below grade or less, which could account for the lack of standing water in the vents located in this area. Eighty percent of the gas vents 5.6 feet or deeper in the Old Mine Area contained standing liquid.

The leachate, or perched water in the landfill has not been fully characterized. A comprehensive investigation of the leachate at the landfill should be performed before the conclusions about the volume of the leachate to be removed, as discussed in this report, can be substantiated.

Response

The USEPA Landfill Guidance (EPA/540/P-91/001, February 1991) states that the objectives of leachate investigations are to:

- **determine location of leachate seeps;**
- **determine chemical characteristics of leachate;**
- **locate potential source areas; and**
- **determine leachate impact on ground water.**

The RI field investigations have identified these objectives; thus the leachate has been characterized. Further field investigations regarding the specific volume of leachate should be deferred until RD.

Finally, the volume of leachate in the fill is based on positive identification of liquid in the landfill gas vents. The lack of liquid was not considered an indication that no leachate existed just a lack of leachate at the depth penetrated by the gas vents.

1.3.3 Landfill Gas

Page 1-29:

This section clearly states that 10 of the landfill gas probes on the boundary of the landfill exceeded 90% the Lower Explosive Limit (LEL). According to *§ 258.23 of the Federal Register, Volume 26, No. 196, date October 9, 1991*, there are several mandates that are required when the LEL is exceeded at the property boundary. These mandates include, but are not limited to a minimum of quarterly monitoring, and notification of the State. EPA may wish to pursue a course of action regarding this issue.

Response

The Solid Waste Disposal Facility Criteria states at §258.23 "if the concentration of methane gas generated by the facility exceeds 25 percent of the lower explosive limit for methane in facility structures and exceeds the lower explosive limit for methane at the facility property boundary owners and operators of the municipal solid waste landfill must implement a routine methane monitoring program." These requirements routinely apply to measurements made in ambient air space not in the gases contained in the soil pore spaces as was measured during the perimeter gas survey.

These mandates are more appropriately addressed in Section 4.0 (Development of Remedial Alternatives) where Remedial Alternatives 2 through 8 discuss compliance with these mandates. Under these remedial alternatives, methods for controlling landfill gas migration would be implemented. As described in the FS, the specific methodology selected for controlling landfill gas migration would be determined during RD/RA. Procedures for monitoring the effectiveness of the selected remedy would be included in the remedy for controlling landfill gas migration.

Page 1-31

The new Maximum Contamination Limits (MCLs) should be incorporated in the discussion of contaminants exceeding drinking water standards. The following contaminants, and the fact that they exceeded the drinking water standards should be discussed:

Contaminant	Observed	MCL
Vinyl Chloride	10 ug/l	2 ug/l
1,2-trichloroethane	5 ug/l	5 ug/l
Benzene	7 ug/l	5 ug/l
Tetrachloroethylene	5 ug/l	5 ug/l
Cadmium	7.5 ug/l	5 ug/l
Nickel	197 ug/l	100 ug/l

Response

The new MCLs have been incorporated into Section 1.3.4. The last sentence of the U.S.EPA comments is incorrect, in that 4 of the 6 above-listed MCL's are exceeded; the remaining two are equal to (do not exceed) the MCL's.

1.3.8 Soils

Page 1-35, 2nd Paragraph

The sentence, "In summary all evidence suggests that the former activities at the NSL have not altered the quality of the soils at the site," should be removed as suggested in the original comments submitted March 12, 1992. The sediments of the leachate seep on the southern portion of the landfill revealed acetone at 230 ug/kg, 2-butanone at 15 ug/kg (Table 5-4 of the RI Report), and elevated levels of numerous semi-volatile compounds (Table 5-6 of RI Report). The sediments of the northeaster leachate seep revealed ethylbenzene at 31 ug/kg, xylenes at 130 ug/kg (Table 5-4 of RI Report), and elevated levels of semi-volatile compounds (Table 5-6 of RI Report).

Response

There is confusion regarding references to soils and on-site sediments. The sentence "In summary all evidence suggests that the former activities at the NSL have not altered the quality of the soils at the site" will remain in the report because this statement is supported by sampling and analysis performed strictly on soils during field investigations. The on-site sediments, which have been affected the leachate seeps, have been addressed in Section 1.3.7.2 - On-site Sediments.

2.0 IDENTIFICATION AND SCREENING TECHNOLOGIES

2.2 REMEDIAL ACTION OBJECTIVES

2.2.2 Site Specific Remedial Action Objectives

Page 2-4, Landfill Gas

Comment

As presented in the numerous comments previously submitted, the Ambient Air Monitoring Program conducted was very limited and not comprehensive. Based on this fact, the statement referring to this program should read, "Based upon a *very limited* Ambient Air Monitoring Program...". A statement should be added to address the fact that additional air monitoring will be conducted during the RD/RA phase of the project. During the March 31, 1992 meeting between the PRPs and the EPA, it was agreed that the Ambient Air Monitoring Program was very limited and that additional monitoring would be conducted during the RD/RA.

Response

The objective in the referenced statement has been revised to read "limited". The use of the adjective "very" seems excessive and inappropriate in consideration of

the scope provided in the U.S. EPA approved RI/FS Work Plan and Field Operations Plan. As previously discussed, two objectives were identified for the Ambient Air Monitoring Program. The first objective was to evaluate the ambient air quality of the site to identify air quality conditions from a health and safety perspective. The second objective was to screen the site for target VOCs, which, if identified, would have warranted further investigations. Those objectives were met and target VOCs were not detected above any health and safety guidelines. The U.S. EPA stated during the March 31, 1992 meeting that the ambient air monitoring program may be supplemented by additional monitoring performed during RD.

2.5 IDENTIFICATION OF AREAS AND VOLUMES TO BE REMEDIATED

2.5.3 Landfill Gas

Page 2-24, 3rd Sentence

The third sentence, and the other sentences throughout the report, should be rephrased to remove *"if any"*, which implies that the landfill gas evaluation may or may not be performed. As discussed during the March 31, 1992 meeting between the EPA and the PRPs and comments on the RI and FS Reports, the volume and composition of the landfill gas migrating from the site needs to be evaluated.

Response

The third sentence on page 2-24 has been revised to state:

"...During the RD/RA phase of the project, when the final configuration of the landfill and the landfill gas venting system is known, the volumes of landfill gas venting or migrating from the site can be evaluated." Appropriate revisions have also been made to other portions of Section 2.5.3.

4.0 DEVELOPMENT OF SITE WIDE REMEDIAL ALTERNATIVES

GENERAL COMMENTS

Comment No. 1

Deleted

Comment No. 2

Deleted

Comment No. 3

Remedial alternatives should be developed in terms of protecting and enhancing the current habitat and landscape conditions. The following recommendations are offered to point the direction of remediation with habitats in mind. It is not to be considered a complete and total set of suggestions, but merely a point of departure in remediating with ecological values as a primary consideration.

- Area 1 should be cleared of waste rubble and debris and enhanced for ecological values, i.e., diverse flora and fauna.
- The swale (area 8) should also be cleared of waste rubble, debris, etc. and designed to carry water slowly through it towards the proposed ponded are in the southwest corner of the property. Area 8 should also be revegetated with desirable wetlands species.
- The cap, if put in place, should be designed to duplicate the undulating cover so that swales and pocket wetlands emulate current conditions as closely as possible. Maintenance in swales, if required, should be carried out after the killing frost in autumn and the vegetation clipped at a height of 15 to 24 inches and no lower.
- The southeast retention pond should be expanded only with care as it is currently a high quality cattail wetlands in conjunction with a maturing forest on one side. This area represents good diversity and should be protected as much as possible.

Response

In developing remedial alternatives, the NCP states that nine criteria should be considered for evaluation: overall protection of human health and the environment, compliance with ARARs, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, cost, state acceptance and community acceptance. The NCP makes no mention with respect to enhancement of the current habitat and landscape conditions as criteria for evaluation. Remedial alternatives have been developed and evaluated regarding the nine evaluation criteria identified in the NCP.

The selected remedy may be enhanced as deemed appropriate by any on-site habitat impact conducted during the RD as determined to be legally required.

4.5 REMEDIAL ALTERNATIVE

The original comment on the temporary wells for dewatering was not addressed. The Remedial Measure LCH-3 proposes using temporary well points for the one time dewatering of leachate in the Surface Fill and Trench Area. The well construction and design needs to be discussed.

<u>Response</u>

As discussed in previous responses to the USEPA, well construction and design of the temporary well points are more appropriately discussed in detail during the RD phase of the project. However, the cost estimates provided in the FS do provide assumptions on well size, etc. Any additional details would not be appropriate during the RI/FS phase of the project.

7.0 REMEDIAL ALTERNATIVES SELECTION AND RECOMMENDATION

If the landfill is to undergo closure by October 9, 1993, the landfill must meet the requirements of the Final Rule on Solid Waste Disposal Facilities, as outlined in Federal Register No. 56, dated October 9, 1991. At a minimum, the following sections should be taken into account in the remedy selection:

§ 258.6 (a)(1)	The infiltration layer should have an infiltration rate of < 10 cm/sec, common borrow material may not meet these criteria, or PADER § 264.31(1) and 273.234(1)(2)(3) should be followed.
§ 258.23 (a)(2)	The state director should be notified. (c)(1)
§ 258,61 (a)(4)	A gas monitoring system must be implemented.
§ 258.61 (a)(2)	A leachate collection system in accordance with § 258.40 to maintain less than a 30-cm depth of leachate over the liner. Also, PADER § 264.310(6)(iii) and § 273.192(5) should be followed.

A pre-agreement with the Lehigh County Wastewater Pretreatment Plant should also be documented.

It should be mentioned that the final landfill gas venting system design will be modified according to the results of a Remedial Assessment Investigation.

<u>Response</u>

The closure/design criteria as described above from Subtitle D is more appropriately evaluated during RD.

It should be pointed out that the NSL was designed and permitted as a natural attenuation landfill and as such does not have a liner or a leachate collection system.

Verbal communications with representatives of the Lehigh County Wastewater Pretreatment Plant indicate that approval would be more appropriately provided closer to a point in time when the facility would ship liquids.

As previously stated, the landfill gas venting system would be more appropriately developed and modified following the results from any Remedial Design Investigations.

TABLES

TABLE 2-6 SUMMARY OF PRELIMINARY GOALS FOR GROUND WATER

Comment No. 1

Tables of preliminary remedial goals (PRGs) have been added, but these are inadequate in several ways.

First, PRGs are supposed to be developed in the scoping stage, in order to facilitate an early start on developing remedial alternatives. PRGs are intended to be revised on the basis of the RI and baseline risk assessment to consider the effects of (1) multiple contaminants, (2) multiple routes of exposure, and (3) site-specific exposure patterns. Presentation of single-contaminant, single-route PRGs in a feasibility study in effect was the information gained by the baseline risk assessment.

Second, PRGs have been presented only for groundwater and leachate. Surface soil, air, surface area, and sediments have been omitted despite the fact that all these medial present risks greater than 10^{-6} to some receptors.

Third, the groundwater PRGs consider only ingestion, even though inhalation exposure also presented significant risks.

To address this deficiency, it is suggested the following tabes of risk-based cleanup goals be added:

1. For non-carcinogenic effects, based on the most sensitive receptor (usually children for residential scenarios, adults for occupational scenarios, and teenagers for trespassing scenarios), one table for each receptor which exceeded a total hazard index of 1 for all exposure routes combined. For this site, this should include current on-site residents, current off-site residents, current trespassers, and hypothetical future on-site residents. Each table should list all substances

contributing 1% or more of the total hazard index, the exposure concentration used in the baseline risk assessment for each exposure route, and the concentration at which the total hazard index would be 1. There exists considerable latitude for exercising judgment in the last item, except that the total hazard index should be 1. These concentrations become the risk-based cleanup goals.

2. For carcinogenic effects, based on the sum of risk to adults and children, one table for each receptor which exceeded a total carcinogenic risk of 10^{-6} for all exposure routes combined. As for non-carcinogenic effects, each table should list all substances contributing 1% or more of the total risk, and the exposure concentration used in the baseline risk assessment for each exposure route. Instead of a single set of concentrations adding to a hazard index of 1, the table should contain three sets of concentrations adding to 10^{-4}, 10^{-5}, and 10^{-6} total cancer risk. As for non-carcinogens, judgment should be used to apportion risk among exposure routes and chemicals to arrive at these fixed risk levels.

Response

During the scoping phase of the RI for the NSL, the PRG guidance document was not available. In fact, prior to the release of the Human Health Evaluation Part B Manual in December 1991, USPA provided no guidance on the method to be used to calculate PRGs or any other type of remediation goals. The only risk assessment-related task included the USEPA approved work plan documents at that time was a preliminary risk assessment identifying constituents potentially present at a site. The PRG guidance document became available in December 1991, well into the Novak RI/FS.

PRGs were developed only for those exposure scenarios where the excess lifetime cancer risks exceeded 10^{-4} or the hazard index exceeded 1. This was done in accordance with following USEPA guidance which states that "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts. However, if MCLs or non-zero MCLGs are exceeded, action generally is warranted."(OSWER Directive 9355.0-30, April 22, 1991). The guidance document goes on to state that "The upper boundary of the risk range is not a discrete line at 1 x 10^{-4}, although EPA generally uses 10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions. ... Therefore, in certain cases EPA may consider risk estimates slightly greater than 1 x 10^{-4} to be protective." This guidance was followed when selecting the exposure pathways and media requiring development of PRGs.

Risk based remediation goals were developed following the methodology presented in the Human Health Evaluation Manual Part B for all environmental media with risks exceeding 10^{-6} or a hazard index exceeding 1 or to be conservative, if a combination of hazard indices when added together would exceed 1. This approach is considered to be consistent with current USEPA guidance. Within the Human Health Evaluation Manual Part B, only pathways for a particular medium are considered to be additive, and the individual constituent target risk level is set at 10^{-6}, "the NCP's point of departure for analysis of remedial alternatives." Furthermore, as stated in the Human Health Evaluation Manual Part B, "the total risk for noncarcinogenic effects is set at an HI of 1 for each chemical in a particular medium." Therefore, PRGs recalculated for ground water were calculated based on both ingestion and inhalation exposures. This procedure was followed for all pathways where more than one type of exposure could occur.

The Human Health Evaluation Manual Part B does not require or discuss apportioning risk among various media and exposure pathways for an individual receptor. If this approach had been followed, pathways which are considered to be unlikely to occur would be considered in developing remediation goals for pathways considered likely to occur. For example, private ground-water wells are used by residents near NSL where ingestion and inhalation exposure scenarios are likely to occur. However, it is not likely that an individual living near the NSL would contact surface water, sediments, soils, or leachate seeps at the site. Therefore, by including all of these pathways and apportioning the risks between the media, unrealistic and overly conservative remediation goals for the site would result.

Table A-1

Several readings are noted to have initially read 100% and then dropped to a lower level. This is very important fact and should be discussed in the text. If the needle on the explosimeter pegs and then returns to zero it is an indication that the readings exceeded the upper explosive limit. The quick peak and deflection to zero occurs because the gas mixture in the combustion cell is too rich to burn and causes the filament to conduct a current just as if the atmosphere contained no combustion at all. Geraghty and Miller should reassess their field notes to be sure that all soil gas locations that originally peaked on the explosimeter be included in the table. According to the EPA contractor's notes, LFG #81 and LFG #1 locations also exhibited a quick peak and then zero on the LEL meter.

Response

Geraghty & Miller reviewed the field notes from the soil gas survey. Landfill soil gas probe samples LFG #1 and #81 did not exhibit a quick peak and a deflection to zero. Without the USEPAs' contractors notes this section cannot be revised. Secondly, it is our understanding the U.S. EPA intends that a more extensive methane survey be conducted during the RD phase of this project.

de maximis

Please be informed that the Group was not aware of any misunderstanding that the USEPA may have had with respect to Section 7 of the RI Report dated June 1992. As you are aware, Section 7 was intended to further explain and summarize those activities related to a "preliminary ecological evaluation." This section of the RI Report was submitted to the USEPA in May 1992 without subsequent comments from USEPA. Section 7 of the RI Report was not intended to be a "substitute" for an ecological investigation. Please be reminded that such a study was not a component of the USEPA-approved RI/FS Workplan or Field Operations Plan. In addition, we strongly disagree with the USEPA's assertion that Tables 1-4 and 2-6 of the FS Report, which were revised and resubmitted to the USEPA on September 22, 1992, contain "significant inaccuracies". The text of the FS Report was not being revised because we had not received any comments on the text portion of the report from the USEPA subsequent to submittal. Tables 1-4 and 2-6 were revised to be consistent with the MCLs which were in effect upon submittal of the FS Report to the USEPA on July 8, 1992. The newer MCLs were not effective until July 17, 1992. Also, it was our understanding, based on subsequent numerous deliberate telephone conversations with the USEPA, that the USEPA comments dated September 25 and 28, 1992 were being withdrawn and that a new set of comments would be resubmitted to reflect the USEPA decision that some components of the work were not necessary or would be appropriately conducted during the RD phase.

As previously stated, those comments for which responses are not provided above, the comment was considered in revision of the appropriate sections of the Final RI and FS reports. If you or any of your staff have any question regarding the revised Final RI or FS reports, or any other aspect of this project, please do not hesitate to contact us.

Sincerely,
de maximis, inc.

Mark Travers/DAF

Mark A. Travers

Enclosures

cc: Julie Parker, Esquire
Joseph Keller, Geraghty & Miller, Inc.
Vincent Uhl, Vincent Uhl Associates
Michael Heffron, Dynamac Corporation
Meg Mustard, PADER
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