

PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC.

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March 4, 1999

02103



Ms. Alicia Allen
CEHNC-PM-ND
U.S. Army Corps of Engineers
4820 University Square
Huntsville, AL 35816-1822

154

SUBJECT: Submittal of Response to EPA Comments Dated December 29, 1998 and Replacement Pages for the Final Remedial Investigation (RI) for SEAD-25 (Fire Training and Demonstration Pad) and SEAD-26 (Fire Training Pit)

Dear Ms. Allen:

Parsons Engineering Science (Parsons ES) is pleased to submit responses to EPA's comments dated December 29, 1998 and replacement pages for the Final Remedial Investigation (RI) for SEAD-25 and SEAD-26 at the Seneca Army Depot Activity located in Romulus, New York. This work was performed in accordance with the Scope of Work (SOW) for Delivery Order 0001 to the Parsons ES Contract DACA87-95-D0031. Instructions for insertion of the replacement pages are provided.

Parsons ES appreciates the opportunity to provide you with these responses. Should you have any questions, please do not hesitate to call me at (781) 401-2492.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

A handwritten signature in black ink, appearing to read "Michael Duchesneau".

Michael Duchesneau, P.E.
Project Manager

cc: Ms. Janet Fallo, CENAN-PP-HE
Mr. Keith Hoddinott, USACHPPM (Prov.)
Mr. John Buck, USAEC
Mr. Edward Agy, AMSIO-EQE

Mr. Don Williams, CEMRD-EP-C
Mr. Stephen Absolom, SEDA

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March 4, 1999

Ms. Carla Struble
US Environmental Protection Agency, Region II
Emergency and Remedial Response Division
290 Broadway, 18th Floor, E-3
New York, NY 10007-1866

Mr. James Quinn
New York State Department of Environmental Conservation
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
50 Wolf Road
Albany, NY 12233-7010

SUBJECT: Submittal of Response to EPA Comments Dated December 29, 1998 and Replacement Pages for the Final Remedial Investigation (RI) for SEAD-25 (Fire Training and Demonstration Pad) and SEAD-26 (Fire Training Pit)

Dear Ms. Struble and Mr. Quinn:

Parsons Engineering Science (Parsons ES) is pleased to submit responses to EPA's comments dated December 29, 1998 and replacement pages for the Final Remedial Investigation (RI) for SEAD-25 and SEAD-26 at the Seneca Army Depot Activity located in Romulus, New York. Instructions for insertion of the replacement pages are provided. Parsons ES appreciates the opportunity to provide you with these responses. Should you have any questions, please do not hesitate to call me at (781) 401-2492.

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Michael Duchesneau, P.E.
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Mr. Stephen Absolom, SEDA
Ms. Alicia Allen CEHNC-PM-ND

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INSTRUCTIONS FOR UPDATING THE REPORT TITLED:

Remedial Investigation Report for Fire Training and Demonstration Pad (SEAD-25) and the Fire Training Pit and Area (SEAD-26) at the Seneca Army Depot Activity, Romulus, NY

To update the text of the report:

1. Remove pages 5-54 through 5-58, and replace them with the enclosed pages numbered 5-54 through 5-58A.

To update the Appendices of the report:

1. Insert the enclosed Response to Comments into Appendix K.

- The first-order decay model results are likely to be conservative because the model does not account for decay of the dissolved constituents in the source zone; the model assumes biodegradation starts immediately downgradient of the source, and that it does not depress the concentrations of dissolved organics in the source zone itself.
- The compliance point (0.005 mg/l) for the first-order reaction is approximately 200 feet downgradient of the source along the plume centerline.

It is possible that a combination of the first-order decay model and an instantaneous reaction model represents the best fit model. Because the sulfate and methane concentrations were not obtained from site for the instantaneous reaction model, it is possible that, given the lack of strong redox conditions at the site, sulfate reduction and methanogenesis processes have much less impact. New Bioscreen instantaneous reaction model runs where sulfate reduction and methanogenesis processes are not a factor in the instantaneous reaction, show that the model can be better calibrated to the data (compared to the initial model), provided the calibration includes modification of the longitudinal dispersivity value (i.e. it was adjusted up by approximately one order of magnitude). However, the first order decay model still provides the best fit to the site data.

Predictive Simulations of Plume

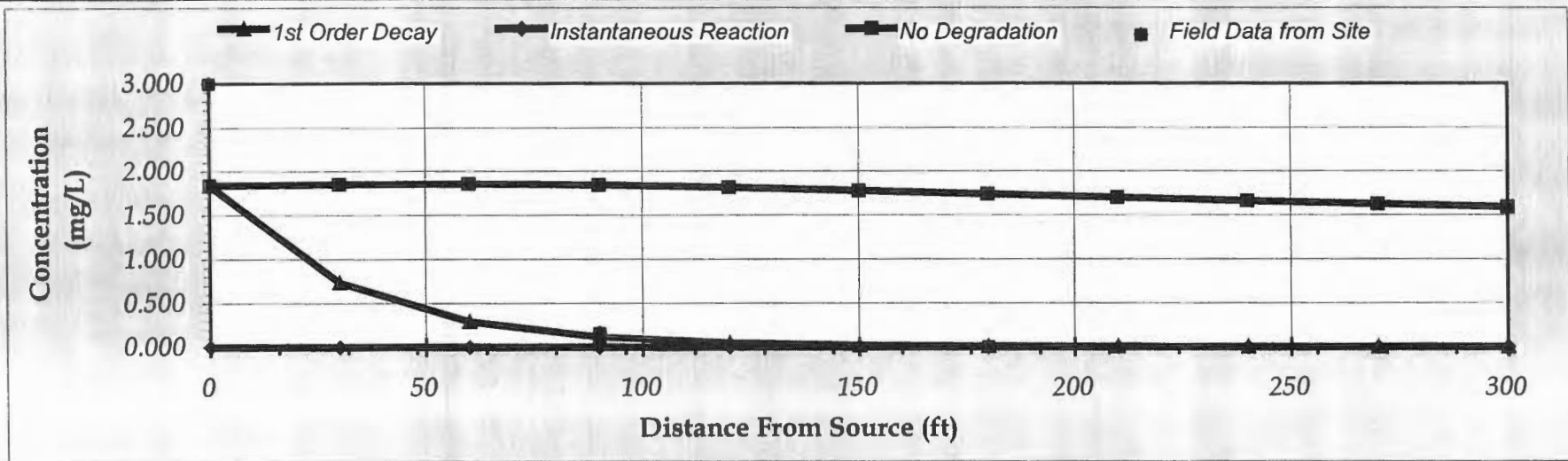
Simulations were also run to represent 20 and 100 years from the current plume conditions (in 1995); these runs were for 40 years and 120 years and they used the same input data as the 20 year calibration simulation. Figures 5-4 and 5-5 show the centerline output for these simulation periods. The 20 year simulation showed that the solute source zone concentration decreased and there was a slight shift in the compliance point. The 100 year simulation showed a further reduction in the solute source zone concentration and a shift in the compliance point to 180 feet downgradient along the plume centerline. The model indicates that after 100 years the source zone concentration would decrease to approximately 1.8 mg/l. This source zone concentration, however, is still well above the compliance concentrations of 0.7 to 5ug/L.

Predictive model runs using the instantaneous reaction model without sulfate reduction and methanogenesis indicate that the source area concentrations remain well above the applicable compliance concentrations (approximately 500 ug/L after 100 years).

Based upon USEPA comments, it is the opinion of the USEPA that the BIOSCREEN model results cannot be used to predict past or future concentrations of contaminants on the site since data are available for only one time period. USEPA states that, the model cannot be calibrated for temporal variation, therefore, it is not possible to realistically assess natural attenuation using this modeling effort.

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

TYPE OF MODEL	Distance from Source (ft)										
	0	30	60	90	120	150	180	210	240	270	300
No Degradation	1.838	1.850	1.856	1.842	1.813	1.777	1.737	1.698	1.660	1.624	1.591
1st Order Decay	1.838	0.734	0.292	0.115	0.045	0.018	0.007	0.003	0.001	0.000	0.000
Inst. Reaction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site	3.000			0.165			0.005				



Calculate Animation

Time:
120 Years

Return to Input

Recalculate This Sheet

electron acceptor. Electron donors include natural organic material and fuel hydrocarbons. Electron acceptors are elements or compounds that occur in relatively oxidized states. The more important electron acceptors in groundwater include dissolved oxygen, nitrate, iron (III), sulfate, and carbon dioxide. (page B5-2)

Soon after fuel hydrocarbon contamination enters the groundwater system, rapid depletion of dissolved oxygen caused by increased levels of microbial respiration results in the establishment of anaerobic conditions within the dissolved contaminant plume. (page B5-18)

A reduction in dissolved oxygen concentrations within an existing BTEX plume is a strong indication that indigenous bacteria are already established and actively biodegrading fuel contamination through aerobic respiration. In general, dissolved oxygen concentrations will be lower than background levels in groundwater that contains BTEX. (page B5-15)

A contour map showing both dissolved oxygen and BTEX contours has been prepared using available site data from SEAD-25 (Figure 5-6). The area with depleted dissolved oxygen corresponds with the area of elevated BTEX concentrations.

According to Wiedemeier et. al (1995) anaerobic biodegradation can occur by denitrification, iron (III) reduction, sulfate reduction, or methanogenesis. In a typical aquifer denitrification typically occurs first, followed by iron (III) reduction, sulfate reduction, and methanogenesis.

In areas where denitrification is occurring, there will be a strong correlation between areas with elevated dissolved BTEX concentrations and depleted nitrate concentrations relative to measured background concentrations. The absence of nitrate in contaminated groundwater suggests that nitrate may be functioning as an electron acceptor. Nitrate can only function as an electron acceptor in microbially facilitated BTEX degradation reactions if the groundwater system has been depleted of dissolved oxygen. (page B5-21)

Figure 5-7 presents nitrate data from SEAD-25 on the BTEX contour map. This figure shows depleted nitrate concentrations in areas with BTEX contamination. That is, an active zone of anaerobic hydrocarbon biodegradation is present and denitrification is occurring.

It is now known with a high degree of certainty that BTEX compounds can be degraded in anaerobic groundwater. According to Wiedemeier et al (1995),

Certain requirements must be met in order for anaerobic bacteria to degrade fuel hydrocarbons including: absence of dissolved oxygen (anaerobic bacteria generally cannot

Response to Comments
United States Environmental Protection Agency (USEPA), December 29, 1998
Revised Draft Remedial Investigation Report for Fire Training and Demonstration Pad
(SEAD 25)
and the Fire Training Pit and Area (SEAD-26)
at the
Seneca Army Depot Activity, Romulus, NY

Based on our review we believe that the BIOSCREEN model provides an estimate of the plume length and a gross estimate of the remediation time of the dissolved phase plume undergoing natural attenuation. Based on the review of the geochemical data presented it is evident that natural attenuation is occurring at the site. However, several issues concerning the natural attenuation study need to be addressed, or at least more clearly stated, in the Groundwater Contaminant Transport sections of the Remedial Investigation Report to address the uncertainties involved in the predicting the effectiveness of natural attenuation:

Comment #1 Based on the calculations provided by the BIOSCREEN model, after a period of 100 years, the source area concentration is still 1,800 ug/L, almost three to four orders of magnitude greater than the compliance concentrations of 0.7 to 5 ug/L. This would suggest that the time to reach cleanup goals by natural attenuation alone, under current site conditions, is unrealistic.

Response #1: Agreed. The time to reach the clean-up goals by natural attenuation alone, is not a realistic time frame for the site, because as mentioned above, the compliance concentrations will in all likelihood not be reached, even after 100 years. While this type of a discussion is best suited for the SEAD-25 Feasibility Study, the text has been clarified, and now it includes a statement about the expected lack of compliance under the existing site conditions. Specifically, the text now notes that the source zone concentration in the plume after 100 years (1,800 µg/L) is still well above the applicable compliance concentrations of 0.7 to 5 µg/L. The new text was added to the end of the first paragraph of the subsection titled, Predictive Simulations of Plume (page 5-54).

Comment #2 While the modeling effort provides a gross estimate of natural attenuation, the only way to document the natural attenuation process with certainty is through long-term monitoring. After a period of several years of groundwater sampling and analysis, the long-term monitoring results should show decreasing concentrations throughout the plume. To date, this is not true. For example, at SEAD-25 the benzene concentrations have more than double from 3,000 ug/L to 6,220 ug/L between sample Round 1 (Fall of 1995) and sample Round 2 (Spring of 1996). While these changes may represent seasonal fluctuations, they also represent an unstable plume indicating that the plume source area may still be active and require removal in order for the dissolved-phase portion of the plume to naturally attenuate.

Response #2 Agreed. Long term monitoring provides data that would document the natural attenuation process with relative certainty. We disagree, however, with the statement in the comment that implies that long term monitoring has been

conducted at SEAD-25, and that the existing data (Fall of 1995 and Spring of 1996) constitutes long term monitoring over which a trend in decreasing concentrations would be observed; the concentrations cited in the comment above are from the source zone of the plume. We acknowledge that the source zone concentrations will likely persists for quite some time, and that the concentrations in the source zone of the plume will likely fluctuate with seasonal changes in the water table elevation, as the water table intersects different zones of VOC-impacted soil. We also agree that source control is a necessary, and typical part of implementing monitored natural attenuation for the dissolved-phase portion of the plume. This approach is well documented by many authors, including (Wilson, 1989). Currently, monitored natural attenuation with source control/remediation is an alternative that is being evaluated for the SEAD-25 FS. However, a discussion of source control issues and remedial response alternatives is more appropriate for the SEAD-25 Feasibility Study (FS) and not the RI report. Given this, text has been added to the report that states that long term monitoring provides data that would document the natural attenuation process with relative certainty. This new text was added to the end of the subsection titled, Additional Data Supporting Biodegradation (page 5-58A).

Comment #3 The assumption of a first-order decay model may not be correct. The first-order decay model assumes that sufficient carbon and electron acceptors are available and that the microbial population is the rate limited factor. Perhaps it is likely that the best fit model is a combination of an instantaneous reaction model and a first-order decay model. The instantaneous reaction model is likely applicable to aerobic respiration and can be documented by the lack of dissolved oxygen within the plume. The instantaneous model may also be applicable to nitrification and possible iron reduction, however, as can be seen from Table 1, the role of these two processes in the natural attenuation process is very small. The first-order decay model appears to be applicable for sulfate reduction and methanogenesis, which are by far, the major processes involved with the natural attenuation process at the site. It should be noted that the sulfate and methane concentrations were not based on field data, but on data provided by BIOSCREEN and Ash Landfill Data (Table 5-6 from the RI). Also, sulfate reduction and methanogenesis may not even be occurring, since these processes occur under strongly reducing conditions (-100mV) and the redox conditions within the plume are greater than +50mV.

Response #3: Agreed. It is possible that a combination of the first-order decay model and an instantaneous reaction model represents the best fit model, given the evidence cited in the comment above. However, the model shows that the first-order decay model fits the actual site data well. For reasons cited in the comment above, it is possible that sulfate reduction and methanogenesis processes have much less impact than was initially considered for the instantaneous reaction model. New Bioscreen instantaneous reaction model runs where sulfate

reduction and methanogenesis processes are not a factor in degradation indicate that the instantaneous reaction model can be better calibrated to the data (compared to the initial model), provided the calibration includes modification of the longitudinal dispersivity value (i.e., it was adjusted up by approximately one order of magnitude). This increased the amount of mixing between hydrocarbons and electron acceptors. However, predictive model runs using this type of instantaneous reaction model input indicate that the source area concentrations would remain well above the applicable compliance concentrations (approximately 500 ug/L) after 100 years. To address this comment, the text has been clarified to include a short discussion of the possibility that the data may support instantaneous reaction model, even though the first order decay model provides the best fit. The text was clarified on page 5-54 of the transport section.

TABLE I
Assimilative capacities for SEAD-25
(Based on Table 5-6 from the RI)

Electron Acceptor/ By-Product	Concentration between background and source (mg/L)	Assimilative Capacity (mg/L)	Comments
O ₂	3.28	1.0	Based on Field data
N ₀₃	0.15	0.0	Based on field data
Fe(II)	4.9	0.2	No background concentration provided
S ₀₄	46.3	9.7	No field data. Data extrapolated from Ash Landfill and BIOSCREEN.
CH ₄	6.6	8.5	No field data. Based on BIOSCREEN data.

References

Wilson, John T., 1989, Risk Management of Monitored Natural Attenuation, in Seminars: Monitored Natural Attenuation for Ground Water, EPA/625/K-98/001.

6.5.4 Future Land Use On-Site Construction Worker

Potential health risks were estimated for the future construction worker for exposures via inhalation of ambient air and dust, ingestion and dermal contact with on site soils. Cancer and non-cancer risk estimates are presented for these pathways in Tables 6-71 to 6-78. Risks from each exposure pathway are discussed below, followed by an overall summary for this scenario. A summary of the total RME and CT hazard indices for the on-site construction worker scenario are presented in Tables 6-79 and 6-80.

6.5.4.1 Inhalation of Volatiles in Ambient Air

The chemical specific hazard quotients, cancer risks and total hazard indices for this pathway are presented in Tables 6-71 and 6-72. The cumulative cancer risk from inhalation of volatiles in ambient air is 3×10^{-6} and 9×10^{-6} for both the RME and CT, respectively. These risks are within the USEPA target range of 10^{-6} to 10^{-4} . The non-cancer hazard index is 4 for both the RME and CT, respectively. These hazard indices are above the USEPA-defined target of 1 and are primarily the result of potential exposure to benzene (RME HQ = 4). All other chemicals of concern are below the USEPA-defined target of 1.

6.5.4.2 Inhalation of Dust in Ambient Air

The chemical specific hazard quotients, cancer risks and total hazard indices for this pathway are presented in Tables 6-73 and 6-74 for RME and CT. The cumulative cancer risk from inhalation of dust in ambient air is 3×10^{-12} for both the RME and CT. These cancer risks are significantly below the USEPA target cancer range. The pathway RME hazard index of 6×10^{-7} and the CT hazard index of 5×10^{-7} are well below the USEPA-defined target of 1 indicating that this pathway is not a major contributor of non-cancer and carcinogenic health effects and risk.

6.5.4.3 Ingestion of Soil

The chemical specific hazard quotients, cancer risks and total hazard indices for this pathway are presented in Tables 6-75 and 6-76. The cumulative cancer risk from ingestion of on-site soil is 8×10^{-7} and 2×10^{-7} for the RME and CT, respectively. These cancer risks are below the USEPA target range of 10^{-6} to 10^{-4} .

The pathway RME hazard index of 0.02 is below the USEPA-defined target of 1. The pathway CT hazard index of 0.005 is also below the USEPA-defined target of 1.

6.5.4.4 Dermal Exposure to Soil

The chemical specific hazard quotients, cancer risks and total hazard indices for this pathway are presented in Tables 6-77 and 6-78. The cumulative cancer risk from dermal contact with soil is 2×10^{-9} and 1×10^{-9} , for the RME and CT, respectively.

The RME and CT hazard indices are 0.003 and 0.002 and are below the USEPA-defined target of 1.

6.5.4.5 Construction Worker Summary

Summaries of the calculation of total noncarcinogenic and carcinogenic for RME and CT are presented in Tables 6-79 and 6-80. The total RME cancer risk of 4×10^{-6} and the CT cancer risk of 3×10^{-6} are within the USEPA target range of 10^{-6} to 10^{-4} and are primarily due to the inhalation of volatile organic compounds in ambient air.

The total RME and CT hazard index of 4 are also due primarily to inhalation of volatile organic compounds.

6.5.5 Uncertainty Assessment

All risk assessments involve the use of assumptions, judgments, and imperfect data to varying degrees. This results in uncertainty in the final estimates of risk. There are several categories of uncertainties associated with risk assessments. One is the initial selection of substances used to characterize exposures and risk on the basis of the sampling data and available toxicity information. Other sources of uncertainty are inherent in the toxicity values for each substance used to characterize risk. Uncertainties are also inherent in the exposure assessments for individual substances and individual exposures. These uncertainties are usually driven by uncertainty in the chemical monitoring data, but can also be driven by population intake parameters. Finally, additional uncertainties are incorporated into the risk assessment when exposures to several substances across multiple pathways are summed.

TABLE 6-7
 CALCULATION OF VOLATILE ORGANIC COMPOUNDS IN AMBIENT AIR
 CONSTRUCTION WORKER EXPOSURE (FUTURE LAND USE)
 REASONABLE MAXIMUM EXPOSURE (RME)
 SENECA ARMY DEPOT, ROMULUS, NEW YORK - SEAD 25

COMPOUND	Air [C] Onsite (mg/m ³)	Soil Conc (mg/kg)	Soil Conc (ug/kg)	Vapor Pressure (mm Hg)	Molecular Weight (g/mole)	Initial ER(ps) (g/sec)	Contam. Mass Excav Rate (g/sec)	Substitute Maximum ER(ps) (g/sec)	Soil Conc (g/cm3)	C/P	ER(diff) (g/sec)	ER(tot) (g/sec)	Pore Space Conc C _v (ug/m3)	Partial Pressure P _i (mm Hg)
Volatile Organics														
1,1,1-Trichloroethane	2.8E-02	8.1E-02	81	123	133.41	1.67	1.69E-03	5.57E-04	1E-07	4E-06	1.56E-03	2.12E-03	2.19E+05	0.0305
1,2-Dichloroethene (total)	2.3E-02	6.0E-02	60	324	96.94	4.41	1.25E-03	4.13E-04	9E-08	3E-06	1.37E-03	1.78E-03	1.62E+05	0.0311
2-Butanone	3.0E-03	6.8E-03	6.8	100	72.12	1.36	1.42E-04	4.68E-05	1E-08	2E-06	1.81E-04	2.28E-04	1.84E+04	0.0047
Acetone	7.6E-02	1.6E-01	160	266	58.08	3.62	3.33E-03	1.10E-03	2E-07	2E-06	4.77E-03	5.87E-03	4.32E+05	0.1383
Benzene	3.2E-02	7.6E-02	76	95	78.11	1.30	1.58E-03	5.23E-04	1E-07	2E-06	1.94E-03	2.47E-03	2.05E+05	0.0489
Carbon Disulfide	2.5E-03	5.9E-03	5.9	366	76.14	4.98	1.23E-04	4.06E-05	9E-09	2E-06	1.53E-04	1.93E-04	1.59E+04	0.0039
Chloroform	2.5E-03	6.9E-03	6.9	208	119.39	2.83	1.44E-04	4.74E-05	1E-08	4E-06	1.41E-04	1.89E-04	1.86E+04	0.0029
Ethylbenzene	6.7E-02	1.8E-01	180	10	106.16	0.14	3.75E-03	1.24E-03	3E-07	3E-06	3.92E-03	5.16E-03	4.86E+05	0.0852
Methylene Chloride	2.1E-02	5.1E-02	51	362	84.94	4.93	1.06E-03	3.51E-04	8E-08	3E-06	1.25E-03	1.60E-03	1.38E+05	0.0302
Toluene	4.7E-02	1.2E-01	120	30	92.13	0.41	2.50E-03	8.25E-04	2E-07	3E-06	2.81E-03	3.64E-03	3.24E+05	0.0654
Trichloroethene	2.1E-02	6.1E-02	61	75	131.38	1.02	1.27E-03	4.19E-04	9E-08	4E-06	1.19E-03	1.61E-03	1.65E+05	0.0233
Xylene (total)	1.4E+00	3.7E+00	3700	8	106.16	0.11	7.71E-02	2.54E-02	6E-06	3E-06	8.06E-02	1.06E-01	9.99E+06	1.7503
Excavation Rate =	0.0139	m3/sec												
Soil Bulk Density =	1.5	g/cm3												
Exposed Surface Area =	115	m2												
				C =	E	(U) (W) (H)								
							Variables;							
							E = emission rate, g/sec							
							U = wind speed, m/sec							
							W = crosswind width of the area source, m (assume 100 meter area)							
							H = mixing height, m (assume 1.75 m to breathing zone)							

TABLE 6-12

**CALCULATION OF INTAKE FROM INHALATION OF VOLATILE ORGANICS IN AMBIENT AIR
CONSTRUCTION WORKER EXPOSURE (FUTURE LAND USE)
REASONABLE MAXIMUM EXPOSURE (RME)
SENECA ARMY DEPOT, ROMULUS, NEW YORK - SEAD 25**

Analyte	Intake (Nc) (mg/kg-day)	Intake (Car) (mg/kg-day)	EPC Air (mg/m ³)	Inhalation Rate (m ³ /day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
								Nc	Car
Volatile Organics									
1,1,1-Trichloroethane	5.4E-03		2.75E-02	20	250	1	70	365	25,550
1,2-Dichloroethene (total)			2.32E-02	20	250	1	70	365	25,550
2-Butanone	5.8E-04		2.96E-03	20	250	1	70	365	25,550
Acetone			7.63E-02	20	250	1	70	365	25,550
Benzene	6.3E-03	9.0E-05	3.20E-02	20	250	1	70	365	25,550
Carbon Disulfide		7.0E-06	2.51E-03	20	250	1	70	365	25,550
Chloroform	4.8E-04		2.45E-03	20	250	1	70	365	25,550
Ethylbenzene	1.3E-02		6.70E-02	20	250	1	70	365	25,550
Methylene Chloride	4.1E-03	5.8E-05	2.08E-02	20	250	1	70	365	25,550
Toluene	9.3E-03		4.73E-02	20	250	1	70	365	25,550
Trichloroethene		5.8E-05	2.09E-02	20	250	1	70	365	25,550
Xylene (total)			1.38E+00	20	250	1	70	365	25,550

EQUATION:

Intake (mg/kg-day) =

$$\frac{CA \times IR \times EF \times ED}{BW \times AT}$$

Variables:

CA = Chemical Concentration in Air (mg/m³)
 IR = Inhalation Rate (m³/day)
 EF = Exposure Frequency (days/yr)
 ED = Exposure Duration (years)
 BW = Bodyweight (kg)
 AT = Averaging Time (days)

Assumptions:

95th UCL Air Model Data - RME
 20 (all receptors)
 250 (RME Construction Workers)
 1 (Upper bound period of Construction Worker)
 70 (Adult Male)
 1 x 365 (Nc) 70 x 365 (Car)

Note: Cells in this table were intentionally left blank due to a lack of toxicity data.

TABLE 6-13

**CALCULATION OF INTAKE FROM INHALATION OF VOLATILE ORGANICS IN AMBIENT AIR
CONSTRUCTION WORKER EXPOSURE (FUTURE LAND USE)
CENTRAL TENDENCY (CT)
SENECA ARMY DEPOT, ROMULUS, NEW YORK - SEAD 25**

Analyte	Intake (Nc) (mg/kg-day)	Intake (Car) (mg/kg-day)	EPC Air (mg/m ³)	Inhalation Rate (m ³ /day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
								Nc	Car
Volatile Organics									
1,1,1-Trichloroethane	5.0E-03		2.75E-02	20	234	1	70	365	25,550
1,2-Dichloroethene (total)			2.32E-02	20	234	1	70	365	25,550
2-Butanone	5.4E-04		2.96E-03	20	234	1	70	365	25,550
Acetone			7.63E-02	20	234	1	70	365	25,550
Benzene	5.9E-03	8.4E-05	3.20E-02	20	234	1	70	365	25,550
Carbon Disulfide		6.6E-06	2.51E-03	20	234	1	70	365	25,550
Chloroform	4.5E-04		2.45E-03	20	234	1	70	365	25,550
Ethylbenzene	1.2E-02		6.70E-02	20	234	1	70	365	25,550
Methylene Chloride	3.8E-03	5.4E-05	2.08E-02	20	234	1	70	365	25,550
Toluene	8.7E-03		4.73E-02	20	234	1	70	365	25,550
Trichloroethene		5.5E-05	2.09E-02	20	234	1	70	365	25,550
Xylene (total)			1.38E+00	20	234	1	70	365	25,550

EQUATION:

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

Variables:

- CA = Chemical Concentration in Air (mg/m³)
- IR = Inhalation Rate (m³/day)
- EF = Exposure Frequency (days/yr)
- ED = Exposure Duration (years)
- BW = Bodyweight (kg)
- AT = Averaging Time (days)

Assumptions:

- 95th UCL Air Model Data - CT
- 20 (all receptors)
- 234 (CT Construction Workers)
- 1 (Upper bound period of Construction Worker)
- 70 (Adult Male)
- 1 x 365 (Nc) 70 x 365 (Car)

Note: Cells in this table were intentionally left blank due to a lack of toxicity data.

TABLE 6-71
CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS
FROM INHALATION OF VOLATILE ORGANICS IN AMBIENT AIR
CONSTRUCTION WORKER EXPOSURE (FUTURE LAND USE)
REASONABLE MAXIMUM EXPOSURE (RME)
SENECA ARMY DEPOT, ROMULUS, NEW YORK - SEAD 25

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	Inhalation RfD (mg/kg-day)	Carc. Slope Inhalation (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Volatile Organics						
1,1,1-Trichloroethane	5.4E-03		2.9E-01	NA	2E-02	
1,2-Dichloroethene (total)			NA	NA		
2-Butanone	5.8E-04		2.9E-01	NA	2E-03	
Acetone			NA	NA		
Benzene	6.3E-03	9.0E-05	1.7E-03	2.9E-02	4E+00	3E-06
Carbon Disulfide		7.0E-06	NA	3.9E-03		3E-08
Chloroform	4.8E-04		2.0E-01	NA	2E-03	
Ethylbenzene	1.3E-02		2.9E-01	NA	5E-02	
Methylene Chloride	4.1E-03	5.8E-05	8.6E-01	1.7E-03	5E-03	1E-07
Toluene	9.3E-03		1.1E-01	NA	8E-02	
Trichloroethene		5.8E-05	NA	6.0E-03		4E-07
Xylene (total)			NA	NA		
Total HQ & CR					4E+00	3E-06

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) / Reference Concentration

Cancer Risk = Chronic Daily Intake (Carcinogenic) x Inhalation Slope Factor

Note: Cells in this table were intentionally left blank due to a lack of toxicity data.

TABLE 6-72
CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS
FROM INHALATION OF VOLATILE ORGANICS IN AMBIENT AIR
CONSTRUCTION WORKER EXPOSURE (FUTURE LAND USE)
CENTRAL TENDENCY (CT)
SENECA ARMY DEPOT, ROMULUS, NEW YORK - SEAD 25

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	Inhalation RfD (mg/kg-day)	Carc. Slope Inhalation (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Volatile Organics						
1,1,1-Trichloroethane	5.0E-03		2.9E-01	NA	2E-02	
1,2-Dichloroethene (total)			NA	NA		
2-Butanone	5.4E-04		2.9E-01	NA	2E-03	
Acetone			NA	NA		
Benzene	5.9E-03	8.4E-05	1.7E-03	2.9E-02	3E+00	2E-06
Carbon Disulfide		6.6E-06	NA	3.9E-03		3E-08
Chloroform	4.5E-04		2.0E-01	NA	2E-03	
Ethylbenzene	1.2E-02		2.9E-01	NA	4E-02	
Methylene Chloride	3.8E-03	5.4E-05	8.6E-01	1.7E-03	4E-03	9E-08
Toluene	8.7E-03		1.1E-01	NA	8E-02	
Trichloroethene		5.5E-05	NA	6.0E-03		3E-07
Xylene (total)			NA	NA		
Total HQ & CR					4E+00	3E-06

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) / Reference Concentration

Cancer Risk = Chronic Daily Intake (Carcinogenic) x Inhalation Slope Factor

Note: Cells in this table were intentionally left blank due to a lack of toxicity data.

TABLE 6-79
 CALCULATION OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
 REASONABLE MAXIMUM EXPOSURE
 SENECA ARMY DEPOT, ROMULUS, NEW YORK - SEAD 25

RECEPTOR	EXPOSURE ROUTE	EXPOSURE ASSESSMENT Table Number	RISK CHARACTERIZATION Table Number	CHILD HAZARD INDEX	ADULT HAZARD INDEX	CANCER RISK
CURRENT SITE WORKER	Inhalation of Volatile Organics in Ambient Air	Table 6-7	Table 6-51	NA	2E-05	5E-10
	Inhalation of Dust in Ambient Air	Table 6-18	NA	NA	NQ	NQ
	Ingestion of Onsite Soils	Table 6-24	Table 6-53	NA	1E-03	2E-07
	Dermal Contact to Onsite Soils	Table 6-30	NA	NA	NQ	NQ
TOTAL RECEPTOR RISK (Nc & CAR)				NA	1E-03	2E-07
FUTURE RESIDENTIAL (Child and Adult)	Inhalation of Volatile Organics in Ambient Air	Table 6-9	Table 6-55	2E-03	4E-04	2E-08
	Inhalation of Dust in Ambient Air	Table 6-20	NA	NQ	NQ	NQ
	Ingestion of Onsite Soils	Table 6-26	Table 6-57	2E-01	2E-02	1E-05
	Dermal Contact to Onsite Soils	Table 6-32	NA	NQ	NQ	NQ
	Ingestion of Groundwater (Daily)	Table 6-36	Table 6-59	8E+00	4E+00	2E-04
	Dermal Contact to Groundwater while Showering	Table 6-38	Table 6-61	9E-01	5E-01	3E-05
	Inhalation of Groundwater while Showering	Table 6-42	Table 6-63	3E+00	1E+00	3E-05
	Dermal Contact to Surface Water while Wading	Table 6-44	Table 6-65	8E-03	7E-03	2E-08
	Dermal Contact to Sediment	Table 6-48	Table 6-69	3E-03	2E-03	8E-08
	Ingestion of Onsite Sediment	Table 6-46	Table 6-67	9E-01	9E-02	7E-04
TOTAL RECEPTOR RISK (Nc & CAR)				1E+01	5E+00	1E-03
FUTURE ON-SITE CONSTRUCTION WORKERS	Inhalation of Volatile Organics in Ambient Air	Table 6-12	Table 6-71	NA	4E+00	3E-06
	Inhalation of Dust in Ambient Air	Table 6-22	Table 6-73	NA	6E-07	3E-12
	Ingestion of Onsite Soils	Table 6-28	Table 6-75	NA	2E-02	8E-07
	Dermal Contact to Onsite Soils	Table 6-34	Table 6-77	NA	3E-03	2E-09
TOTAL RECEPTOR RISK (Nc & CAR)				NA	4E+00	4E-06

Notes:

NA: Not Applicable

NQ: Not Quantified; toxicity or skin absorption factors not available for compounds with EPCs.

TABLE 6-80
 CALCULATION OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
 CENTRAL TENDENCY (CT)
 SENECA ARMY DEPOT, ROMULUS, NEW YORK - SEAD 25

RECEPTOR	EXPOSURE ROUTE	EXPOSURE ASSESSMENT Table Number	RISK CHARACTERIZATION Table Number	CHILD HAZARD INDEX	ADULT HAZARD INDEX	CANCER RISK
CURRENT SITE WORKER	Inhalation of Volatile Organics in Ambient Air	Table 6-8	Table 6-52	NA	2E-05	1E-10
	Inhalation of Dust in Ambient Air	Table 6-19	NA	NA	NQ	NQ
	Ingestion of Onsite Soils	Table 6-25	Table 6-54	NA	3E-04	9E-09
	Dermal Contact to Onsite Soils	Table 6-31	NA	NA	NQ	NQ
TOTAL RECEPTOR RISK (Nc & CAR)				NA	3E-04	9E-09
FUTURE RESIDENTIAL (Child and Adult)	Inhalation of Volatile Organics in Ambient Air	Table 6-10	Table 6-56	3E-03	6E-04	8E-09
	Inhalation of Dust in Ambient Air	Table 6-21	NA	NQ	NQ	NQ
	Ingestion of Onsite Soils	Table 6-27	Table 6-58	7E-02	8E-03	1E-06
	Dermal Contact to Onsite Soils	Table 6-33	NA	NQ	NQ	NQ
	Ingestion of Groundwater (Daily)	Table 6-37	Table 6-60	4E+00	2E+00	3E-05
	Dermal Contact to Groundwater while Showering	Table 6-39	Table 6-62	5E-01	3E-01	5E-06
	Inhalation of Groundwater while Showering	Table 6-43	Table 6-64	6E-01	3E-01	2E-06
	Dermal Contact to Surface Water while Wading	Table 6-45	Table 6-66	3E-03	3E-03	8E-10
	Dermal Contact to Sediment	Table 6-49	Table 6-70	1E-04	1E-04	1E-09
	Ingestion of Onsite Sediment	Table 6-47	Table 6-68	1E-01	2E-02	4E-05
TOTAL RECEPTOR RISK (Nc & CAR)				5E+00	2E+00	8E-05
FUTURE ON-SITE CONSTRUCTION WORKERS	Inhalation of Volatile Organics in Ambient Air	Table 6-13	Table 6-72	NA	4E+00	3E-06
	Inhalation of Dust in Ambient Air	Table 6-23	Table 6-74	NA	5E-07	3E-12
	Ingestion of Onsite Soils	Table 6-29	Table 6-76	NA	5E-03	2E-07
	Dermal Contact to Onsite Soils	Table 6-35	Table 6-78	NA	2E-03	1E-09
TOTAL RECEPTOR RISK (Nc & CAR)				NA	4E+00	3E-06

Notes:

NA: Not Applicable

NQ: Not Quantified; toxicity or skin absorption factors not available for compounds with EPCs.