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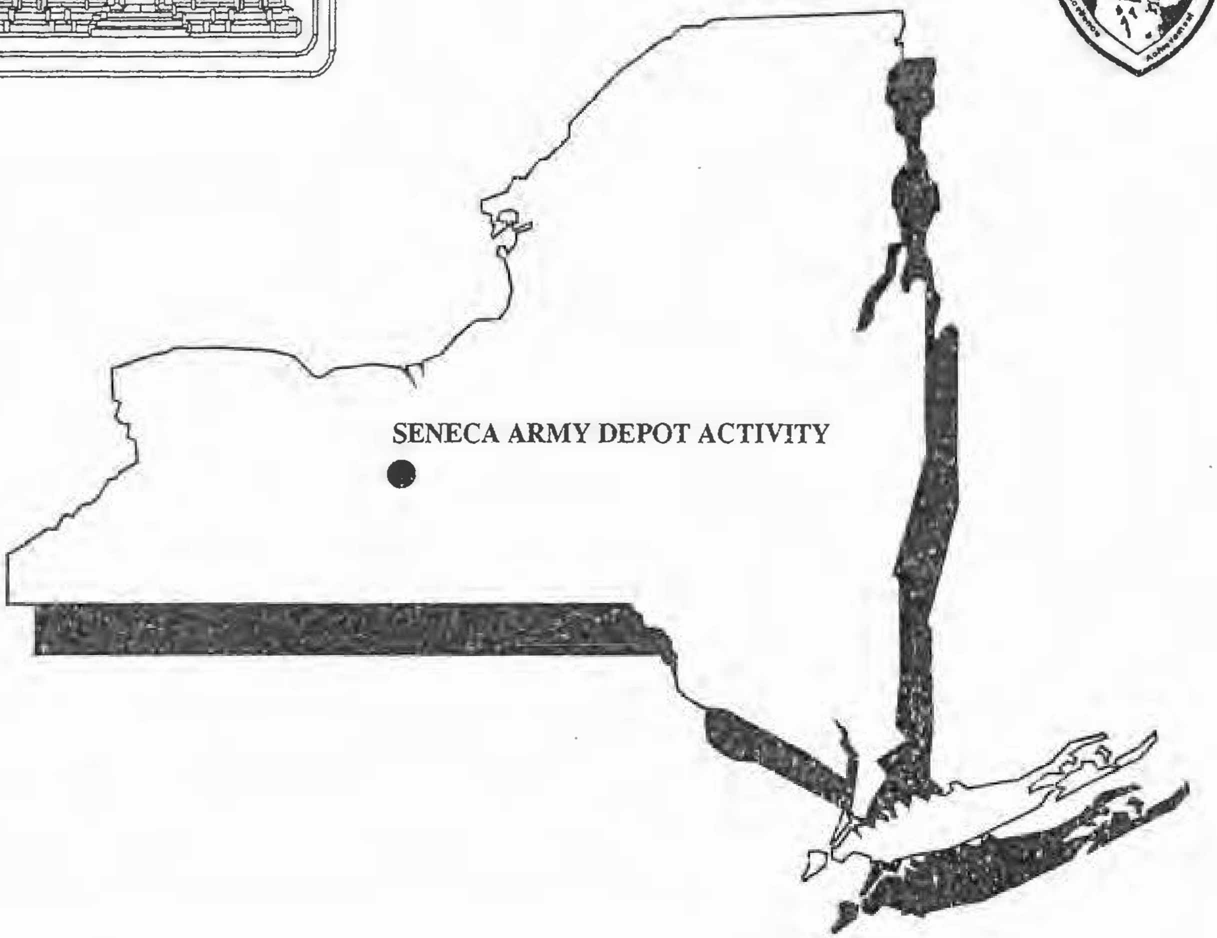
U.S. ARMY ENGINEER DIVISION
HUNTSVILLE, ALABAMA



SENECA ARMY DEPOT ACTIVITY (SEDA)

PEER REVIEW QUESTIONNAIRE PACKAGE
SEAD-52/60 AMMUNITION BREAKDOWN AREA

APRIL/MAY 1998

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May 1, 1998

Commander
U.S. Army Corps of Engineers
Engineering and Support Center, Huntsville
ATTN: CEHNC-PM-ND (Ms. Alicia Allen)
4820 University Square
Huntsville, AL 35816

SUBJECT: **Submittal of Peer Review Questionnaire and Background Information for SEAD-11, SEAD-13, SEAD-45 and SEAD-52/60 at the Seneca Army Depot Activity (SEDA)**

Dear Ms. Allen:

Parsons Engineering Science (Parsons ES) is pleased to submit the Peer Review Questionnaire and background information for sites, SEAD-11, SEAD-13, SEAD-45 and SEAD-52/60, at the Seneca Army Depot Activity located in Romulus, New York. This work was performed in accordance with the Scope of Work (SOW) for Task Order 004 to Parsons ES Contract DACA87-95-D-0031.

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

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Michael Duchesneau, P.E.
Project Manager

cc:
Mr. Stephen Absolom, SEDA
Mr. Kevin Healy, CEHNC
Mr. Ed Agy, IOC
Mr. Randall Battaglia, CENAN
Ms. Joan Jackson, AEC
Mr. John Buck, AEC
Mr. Kieth Hoddinott, USACHPPM
Mr. Jim Quinn, NYSDEC
Mr. Daniel Geraghty, NYSDOH
Mr. Robert Scott, NYSDEC, Region 8
Ms. Carla Struble USEPA, Region II

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U.S. Army Environmental Peer Review Program
Installation Information Form

SITE SUMMARY QUESTIONNAIRE

SEAD-52/60 The Ammunition Breakdown Area

1. Summarize the basis for environmental concern at this site (i.e. Why was Preliminary Assessment (PA) performed?). Use a site-specific conceptual site model (CSM) similar to the generic example, to address the following questions for each contaminant source under investigation at the facility.

1) The basis for environmental concern at this SWMU is the operation that was performed at this facility which included separating the explosive components of the projectile from the warhead. Releases to the environment may have occurred during the operation of the facility such as during transportation, storage or spillage of the soils. The Ammunition Breakdown Area, SEAD-52, is located in the southeastern portion of SEDA as shown in the Figure titled 'Site Location and Land Use Plan'. The Ammunition Breakdown Area has been an active site from the 1940s to the present time. The site consists of four buildings of concern which include Buildings 608, 610, 611 and Building 612. Building 612 has been used for the breakdown and maintenance of ammunitions; Building 608 has been used for the storage of ammunition magazines although no ammunition magazines are currently stored in the building; Building 610 has been used for ammunition powder collection; and Building 611 has been used for storage of equipment, paints, and solvents. Cleaning procedures of Buildings 610 and 612 included hosing the floors with a water hose and releasing the water to the ground surface outside through the doors.

The materials handled at the Ammunitions Breakdown Area are not considered wastes. The materials are either reused or stored for later use. If the materials become obsolete, they are taken to the demolition grounds. Once at the demolition grounds, the materials are considered wastes and demilitarized. A detailed site plan is shown on Figure 1-2.

In January 1980, this SWMU was identified as a location of known or suspected waste materials by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) in their report, "Installation Assessment of Seneca Army Depot". In 1987, the facility was deleted from the SWMU submission list by the U.S. Army Environmental Hygiene Agency (Groundwater Contamination Survey No. 38-26-0868-88). The reason for deleting the unit was due to the fact that there was no handling of waste at the SWMU. This facility was not identified by USATHAMA as a SWMU in the "Update of the Initial Installation Assessment of the Seneca Army Depot, NY, August 1988. The facility was again added to the SWMU list in August, 1988 by the New York State Department of Environmental Conservation (RCRA Facility Assessment Report, draft August 1988). The SWMU Classification Report (SCR) Resolution Meeting

Minutes of September 25, 1992 indicated that limited sampling should be conducted at the site. Limited sampling was performed in December 1993 as part of the SWMU Classification Study update. The purpose of this sampling program was to collect data that would be used to determine whether or not this SWMU could be classified as a No-Action SWMU or if a Site Investigation (SI) was required. Based on the results of the limited sampling program presented in the final SWMU Classification Report (Parsons ES, September 1994), NYSDEC determined that a threat may exist at SEAD-52 due to the presence of explosive compounds in the surface soils. NYSDEC recommended that further investigations be performed at SEAD-52.

SEAD-60 is a former fuel oil spill area at SEDA in Romulus, NY and is referred to as the Oil Discharge area adjacent to Building 609. SEAD-60 is located in the southeastern portion of SEDA. The site is located immediately west of Brady Road. Building 612, which is not part of SEAD-60, is located approximately 120 feet south of Building 609. A detailed site plan is shown in Figure 1-2. A groundwater elevation map is shown in Figure 3-3.

Most of the historical information for SEAD-60 is related to a release of oil on the site. Building 609 has historically been a boiler house for Building 612. It is believed that overflow from an aboveground storage tank located in Building 609 was discharged from a pipe in the wall of Building 609 resulting in a spill adjacent to the southwest corner of the building. According to SEDA personnel, the aboveground storage tank contains No. 2 fuel oil. No information is available on the date of the spill or the volume of oil released.

In accordance with the decision process outlined in the Interagency Agreement (IAG) between the USACOE, EPA, and NYSDEC, an Expanded Site Inspection (ESI) was performed at SEAD-60 in 1994. This investigation included sampling of surface soils, subsurface soils, groundwater, surface water and sediment to identify hazardous constituents or wastes that may have been released to the environment. The sampling data were compared to state and federal guidelines and standards to determine whether this AOC posed a potential threat or risk to human health and the environment. The draft ESI report (Parsons ES, April 1995) indicated that impacts to soils, groundwater, and sediment exceeding state and federal standard and guidelines had occurred at SEAD-60. As part of the ESI report a CERCLA RI/FS was recommended for SEAD-60.

The attached Exposure Pathway Summary figure presents the conceptual site model for the Ammunition Breakdown Area.

a) Describe the potential sources of contamination at each site that are being evaluated.

a) The potential sources of contamination include residual materials that may have been released during the operation of ammunition breakdown operation.

b) Describe the potential migration pathway and receptors for each pathway being evaluated in the CSM. Discuss the release mechanism, the transport media, the potential exposure being evaluated, and the data needed to characterize identified chemical migration pathways, i.e., from the source to the receptor.

b) The attached Exposure Pathway Summary figure, Figure 52-1, presents the conceptual site model for the Ammunitions Breakdown Area, (SEAD-52/60). Migration pathways and transport mechanisms have been identified as :

- Suspension of soil particulates due to the wind;
- Direct deposition of demilitarization residues in the surface soil;
- Leaching of ordnance residues due to dissolution with infiltrating rainfall;

The site is currently used as an ammunition breakdown area by SEDA workers. Future uses included recreational/conservation uses. Following BRAC closure, this site will be part of a large recreational/conservation area that will potentially be used for hiking, camping, etc. There is also a potential that the area could be a managed recreational area. Realistic future human exposure scenarios include: an adult site worker (ranger), an adult and child site visitor (camper) and a future construction worker. The potential for constructing a shower facility for campers and the site worker have been included, since the site may be used by the state in this manner. The actual future use of the facility has not been established with certainty, other than as a conservation/recreational area, because discussions with the State of New York Fish and Wildlife Service regarding their willingness to accept this and other sites are still ongoing. Based upon the understanding that the site will be used for these purposes, the migration pathways for human health receptors, as shown in Figure 52-1, include the following;

Pathway	Receptors
Inhalation of fugitive dust from atmospheric resuspension of surface soil;	Current/Future Site Worker, Future Adult/Child Site Visitor, Future Construction Worker, Terrestrial Biota
Ingestion and dermal contact from surface soil;	Current/Future Site Worker, Future Adult/Child Site Visitor, Future Construction Worker, Terrestrial Biota
Inhalation, ingestion and dermal contact to groundwater from drinking and showering;	Future Site Worker, Future Adult/Child Site Visitor

The release mechanisms for these pathways include;

Pathway	**Release Mechanisms**
Dust	Atmospheric resuspension of soil;
Surface Soil	Direct deposition;
Groundwater	Infiltration and percolation;

In order to completely evaluate these potential chemical migration pathways, data needs to include the following;

Pathway	**Data Needs**
Dust	Surface soils samples
Surface Soil	Surface soil samples
Groundwater	Monitoring wells and ground water samples

c) Describe the potential contaminants of concern (COCs) for each source and chemical migration pathway.

c) The source of COCs are residues from ammunition breakdown activities and any releases from oil handling or storage activities that occur at sites SEAD-52 and SEAD-60. The primary constituents of concern include:

- Explosives (Nitroaromatics),
- Semi-volatiles, (PAHs)
- PCBs and
- Metals

The chemical migration pathways have been described in Part b.

2. For each identified source, pathway, receptor combination, identify the decisions to be made using the data that have been (will be) collected. For each decision, identify the decision criteria to be used to make the decision. Please identify the specific criteria for making the decisions. Examples of Decision Criteria (D.C.) are shown below:

- *Risk (human health or ecological)*
- *Applicable, Relevant, or Appropriate Requirements (ARARs)*
- *Technology, or*
- *Other (please specify)*

2) Investigatory and remedial efforts have been performed in accordance with the decision process outlined in the Interagency Agreement (IAG), also known as the Federal Facility Agreement (FFA), the requirements of the Army, the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency, Region II (EPA). The IAG established an incremental agenda that began with an initial identification of each SWMU and culminates with a Record of Decision (ROD) for each SWMU. On-going clarifications, improvements and refinements have been incorporated into the decision process.

The overall decision process is depicted in Figure 52-2 titled " Seneca Army Depot Activity Decision Criteria Remediation Flowchart". A key aspect of the process is to allow for a site to exit the process, requiring no further action, if site conditions are shown to meet the decision criteria. In many instances exiting the process occurs prior to conducting a full RI/FS program. This was essential given the nature and extent of contamination at many of the sites and the number of sites that have been identified at SEDA that will required a final outcome decision.

The decision process involves implementing a series of baseline actions. Decisions are integrated into the baseline action process to justify the actions to be taken. Supplemental actions, such as collecting additional data, are conducted, where necessary, to provide support for the baseline actions. The final action for each SWMU or AOC involves preparation of either a completion report, a ROD or a closeout report. These reports provide documentation that site conditions have met the requirements of the decision process.

The process is divided into six (6) distinct phases. These include:

1. The Site Classification Phase,
2. The Preliminary Assessment Phase,
3. The Interim Remedial Measures (IRM) Phase,
4. The Remedial Investigation Phase (RI) Phase,
5. The Feasibility Study (FS) Phase and

6. The Remedial Design/Remedial Action (RD/RA) Phase.

Each phase is further divided into a series of actions that result from the decisions. As depicted in Figure 52-2, each decision is identified with a letter, whereas each action is identified with a number so that the status of each site can be identified. This provides an easy mechanism to understand what decisions have been made and what decisions need to be made. Each of the six phases of the process allow the site to exit the process. The effort involved in exiting the process is dependent upon the phase involved and the information required to document that conditions are within the required limits. In some cases this involves a comparison to an appropriate State and Federal Standard, Guideline and Criteria (SGC). In other instances, this will involve completion of a remedial action or an Interim Remedial Measure (IRM).

The first phase is the site classification phase. Site classification begins with an initial identification of a site and ends with a determination that the site has either impacted the environment or it has not, in which case no further action is required and unrestricted use is allowed. At SEDA, the list of potential sites were compiled, by SEDA staff, during the preparation of the RCRA Part B permit, that requires a listing of SWMUs. The list of SWMUs was developed from a variety of sources. Active, on-going depot operations involving waste generation and management were obvious candidates for SWMUs. Past operations and lesser known disposal practices were identified from interviews with current and former depot employees. The initial list of SWMUs identified in the Part B permit application was 72. Recently, as part of the BRAC closure process, the Environmental Baseline Survey (EBS) was prepared that involved additional interviews with former employees and field reconnaissance. These efforts identified an additional 25 potential SWMUs. The key decision point in this phase involves determining whether or not site conditions have impacted the environment. In many instances this decision was made from historical records or an understanding of the processes involved, without collecting additional field data. In other instances, this required some limited sampling. Twenty-four (24) SWMUs have been eliminated from further consideration during this phases as No-Action SWMUs, although some of the newly identified sites have not been evaluated yet. SWMUs that proceed further in the process are considered to be Areas of Concern (AOC).

The second phase is the Preliminary Assessment Phase. This phase begins with collection of data as part of an Expanded Site Inspection (ESI), as shown in Action 5 of Figure 52-2. The ESI data is then evaluated to determine whether a threat exists at the AOC. This determination is based upon direct comparisons of the site data to background or an appropriate State and/or Federal Standards, Guidelines and Criteria (SGC). Exceedances of an appropriate standard, guideline, or criteria is used to indicate that a threat exists. A quantitative risk analysis is not performed to quantify the threat. Professional judgments are also used to evaluate the significance of the exceedances and are incorporated into the recommendations for either no further action or additional evaluations, as shown in Decision No. C or Figure 52-2.

Each media have unique SGCs that are used for comparison. Soil data, collected during the ESI, are compared to background concentrations, or the TAGM value for soil. In some instances, in particular for metals in soil, the TAGM value is either background or a pre-determined value. In instances where the TAGM value is background the value chosen represents the 95th percentile of the background data set that has been accumulated at the SEDA. The 95th percentile of the background database was chosen to reduce the possibility of concluding that an exceedance had occurred from a release when the exceedance was from a site sample that represents the high end of background distribution in soil. If no exceedances are determined then the recommendation is for no further action (NFA). However, if exceedances of TAGMs or other media specific SGC are noted then further evaluation of the data is required to determine if exceedances over the Preliminary Remedial Goals (PRG)s, see Decision No. D of Figure 52-2.

As described in the attached letters, PRGs have not been accepted by the NYSDEC or EPA, Region 2. Although the approach of using, site-wide PRG values as a mechanism for determining if a site can be deemed a no further action site is not acceptable, PRGs have value as milestones for determining if conducting a screening risk assessment is worthwhile. PRGs have been developed for each Potential Chemical of Concern (PCOC) and for both human health and ecological protection. The process of developing PRGs has involved backcalculation of allowable soil concentrations from an acceptable risk level. For non-carcinogenic compound this is a Hazard Index (HI) of 1, for carcinogenic compounds this value was 1E-06. For human exposure to soil, ingestion was used as the only pathway as ingestion of soil is normally the pathway that governs all other pathways. PRG values for human exposure were developed for an industrial scenario, a recreational scenario and a construction scenario.

PRG values have also been developed for an ecological receptor. Ecological PRGs were calculated based on the toxicological response of the field mouse to chemicals in the soil. The field mouse has been identified as the ecological receptor for all of the ecological risk assessments that have been conducted at SEDA to date. The route of exposure was assumed to be ingestion with the mouse's diet being chemical containing plants, insects, and soil. The mouse is further assumed to have its entire range wholly contained in the site. The evaluation was conducted using an Ecological Quotient (EQ) approach, similar to the non-carcinogenic calculations performed for the human health evaluation. Ecological Quotients, representing quantitative expressions of risk, were calculated for each chemical of concern. The EQs assumed for this evaluation were 10.

If exceedances of a PRG are noted then it is almost certain that the mini-risk assessment will yield unacceptable risk and therefore there is no need to perform the screening risk assessment. In this instance the decision process enters the Interim Remedial Measures (IRM) phase which begins with performing a hot spot analysis. If on the other hand, if a PRG is not exceeded then performing the mini-risk assessment is a mechanism of documenting that the site conditions are acceptable and no further action is required. The mini-risk assessment is used to provide a quantitative risk value that can be supportive of a no further action decision. The mini-risk assessment utilizes identical procedures as what would be used for a

Baseline Risk Assessment (BRA) but uses the maximum detected concentration as the Exposure Point Concentration (EPC) instead of the Upper 95th Confidence Limit of the mean due to the uncertainties associated with evaluating a site with the smaller ESI database. If the results of the mini-risk assessment indicate acceptable risk, i.e. carcinogenic risks are less than 1E-04 or the HI is less than 1, then the site conditions meet the requirements for no further action. Otherwise the site conditions are not acceptable and the site enters the Interim Remedial Measure (IRM) phase, Decision No. E Figure 52-2.

The IRM phase involves evaluating whether the site can attain a no further action designation via implementation of an IRM. An IRM is most likely to be a non-time critical removal action and are generally considered appropriate if :

- The problems can be attributed to discrete soil or sediment "hot spots";
- The extent of soil or sediment to be excavated is less than 1000 CYs;
- The technologies are limited to "low tech" technologies such as off-site disposal or capping;
- The pollutants involved are amenable to such technologies such as off-site disposal or capping;
- Groundwater or surface water conditions are acceptable

If deemed appropriate, an IRM can be used to eliminate a site from further consideration by preparing an Engineering Evaluation/Cost Analysis (EE/CA). The EECA is the decision document that presents the goals and rational for implementing the IRM and discusses the evaluations that have been conducted in support of the IRM. After the removal action has been performed, confirmatory sampling is required to document the effectiveness of the IRM in attaining the IRM goals. This information is then documented in the project completion report and the ROD.

If the conditions of the site are such that the problems are not readily solvable via an IRM then the site moves into the RI phase. This phase is identical to the process described by CERCLA and involves a multi-media sampling effort and Baseline Risk Assessment (BRA). The results of the BRA may support a no further action if the risk conditions are below the EPA target limits for risk. Otherwise, the site enters the FS stage.

The FS phase involves an initial evaluation of presumptive remedies. Presumptive remedies includes a variety of technologies for both groundwater and soil such as bioventing, off-site disposal, capping or deed restriction for soils and alternative water supply, air sparging, zero-valence iron treatment or natural attenuation with monitoring for groundwater. If presumptive remedies are not appropriate then an FS is prepared.

The final phase is the preparation of a remedial design and implementation of the remedial action. Both the FS and the RD/RA will follow guidance provided by both the EPA and the NYSDEC.

3. Has a re-use plan been developed and agreed upon for the site? If so, please attach the plan and a corresponding map. Compare the current use to the planned re-use and explain how the relationship between contaminant sources and chemical transport from these sources was used to develop the planned re-use.

A reuse plan for the Seneca Army Depot was developed by RKG Associates, Inc. in December of 1996. This is shown the figure titled "Final Land Use Plan". The current use for this site is as a munitions destruction area. The proposed future use for this site is for conservation and recreational purposes. The proposed future use was not based upon a review of the present nature of potential contaminants at this site.

4. What COCs were identified for each source? Were COCs compared to risk-based screening criteria? Was planned reuse used to determine the future land use exposure scenarios for the risk assessment?

SEAD-52

A Limited Sampling Program was performed at SEAD-52 in December 1993. A total of eighteen (18) surface soil samples were collected from a depth of 0 to 2" below ground surface and chemically analyzed for explosives by EPA Method 8330. The samples were collected from locations around Buildings 608, 611 and 612 as shown in Figure 3-1. A description of the program is presented below.

Bldg. 608 - Four surface soil samples, at 0-2" depth, were collected; one from each corner of the building.

Bldg. 611 - Four surface soil samples, at 0-2" depth, were collected; one from each corner of the building.

Bldg. 612 - Ten surface soil samples, at 0-2" depth, were collected; one from each corner of the building, two from the long sides of the building, approximately 100 feet apart, and one from the middle of each of the shorter sides.

SEAD-60

Soil, surface water, sediment and groundwater were sampled as part of the ESI conducted at SEAD-60 in 1994. Sampling and analyses were based upon historical information of an oil release on site. The results of this investigation were detailed in the draft ESI report (Parsons ES, April 1995).

A total of 3 surface and 6 subsurface soil samples were collected at SEAD-60 in the immediate vicinity of the oil-stained soil. To assess the potential impact from surface water runoff, 3 surface water and sediment samples were collected in drainage ditches north of the site that are suspected to receive surface water

runoff from the site; one of these three sample locations (SWSD60-1) is an upstream sample. Three monitoring wells were also sampled as part of this investigation. The following sections describe the nature and extent of contamination identified at SEAD-60. The sample locations are shown in Figure 3-2.

Summary of SEAD 52/60 Soil Data

Soil at SEAD 52/60 was compared to NYSDEC TAGMs as is presented in the attached Collapsed Data Summary and Summary Statistics tables. The following sections describe the nature and extent of contamination in SEAD-52/60 soils.

Volatile Organic Compounds

Nine volatile organic compounds were detected in the 9 soil samples collected. All were found at concentrations well below the associated TAGM values. The maximum detected concentration was 160 μg/kg of acetone. The volatile organic compounds toluene, ethylbenzene, and tetrachloroethane can be found in fuel oils. While the surface soil sample from boring SB60-2-00 clearly contained the greatest number of volatile organic compounds, low concentrations of toluene and tetrachloroethane (up to 3 μg/kg) were also detected in deeper samples from this boring.

The volatile organic compound, carbon disulfide, was found in only two samples at concentrations of up to 2 μg/kg. The TAGM value for carbon disulfide is 2,700 μg/kg.

Some of the volatile organic compounds detected in the soil are common laboratory contaminants. These are acetone, which was found in one sample; methylene chloride, which was found in 5 samples; 2-butanone, which was found in one sample; and toluene, which was found in 3 samples. These compounds can be potentially attributed to the laboratory and not site conditions.

Semivolatile Organic Compounds

A total of 20 semivolatile organic compounds, most of which were PAH compounds, were found at varying concentrations in the soil samples collected at SEAD-60. Most compounds were detected in only the surface soils (0 to 0.2 feet) at each of the three boring locations. The highest concentrations were found in the surface sample from soil boring SB60-2-00, located at the visibly oil stained area near the southwest corner of Building 609. Values of up to an estimated concentration of 17,000J μg/kg were measured for several individual compounds at this location. Concentrations of up to an estimated concentration of 2,000J μg/kg were measured in surface soil samples from the other two borings, however, all three surface soil samples contained compounds in concentrations exceeding the associated TAGM values. TAGM values were exceeded for benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenz(a,h)anthracene. Generally, SB60-2-00 was impacted by the highest concentrations and the greatest

number of semivolatile organic compounds, followed by SB60-3, the topographically downgradient boring. The total PAH concentrations in the surface soils and sediments are shown in Figure 3-4.

Two semivolatile organic compounds, di-n-butylphthalate and bis(2-ethylhexyl)phthalate, were detected in three and four samples, respectively. These compounds are common laboratory contaminants and can be potentially attributed to the laboratory and not site conditions.

Pesticides and PCBs

Twelve pesticide and PCB compounds were detected in the 9 soil samples collected. The distribution of pesticides and PCBs was similar to that found for the semivolatile organic compounds. The surface soil samples contained the highest concentrations and the greatest number of individual compounds.

Metals

A total of 21 metals were detected in the 9 soil samples collected at SEAD-60. Five metals (barium, copper, lead, magnesium, and zinc) were found in one or more samples at concentrations which exceeded the TAGM values. The largest number of TAGM value exceedances occurred in surface soil samples SB60-2 (located in the oil-stained area) and SB60-3 (located 30 feet topographically downgradient of the oil-stained area).

Total Petroleum Hydrocarbons

Total petroleum hydrocarbons (TPH) were detected in nearly all of the soil samples. The highest concentrations, 218,000 mg/kg and 50,900 mg/kg were detected in surface soil samples from SB60-2 and SB60-3, respectively. The remaining soil samples contained TPH concentrations that were considerably lower (a maximum of 332 mg/kg). As with the SVOC results, the highest concentration was found in the surface soil sample from SB60-2. The downgradient drainage ditch sample, SB60-3 contained the next highest concentration. The TPH concentrations in surface soils are shown in Figure 3-4.

The soil collected at SEAD 52/60 was also compared to Ecological and Recreational PRGs as presented in the attached Collapsed Data Summary and Summary Statistics tables. One nitroaromatic, 2,4-dinitrotoluene, and one metal, barium, were found at concentrations which exceeded their respective Ecological PRGs. Of the analytes detected in SEAD 52/60 soils, there were no exceedances of the Recreational PRGs.

Summary of SEAD 52/60 Groundwater Data

Three monitoring wells were installed and sampled as part of the ESI conducted at SEAD-60. The locations of the wells are shown in Figures 3-1 and 3-2. The following sections describe the nature and

extent of groundwater contamination identified at SEAD-52/60. Concentrations of constituents were compared to the NY AWQS Class GA groundwater criteria and the Federal Primary and Secondary Drinking Water Maximum Contaminant Levels (MCLs). The attached Collapsed Data Summary and Summary Statistics tables detail the comparison of the groundwater data to the NYSDEC Class GA standards.

Volatile Organic Compounds

Two volatile organic compounds, acetone and benzene, were detected in two of the groundwater samples collected at SEAD-60. Monitoring well MW60-1, the background well, contained 48 µg/L of acetone and an estimated concentration of 1J µg/L of benzene. The concentration of benzene detected in MW60-1 exceeded the state criteria value of 0.7 µg/L but did not exceed the federal criteria of 5 µg/L. Benzene was detected only in the background well, MW60-1. Only acetone (77J µg/L) was detected in MW60-2.

Acetone is a common laboratory contaminant and can be potentially attributed to the laboratory and not site conditions.

Pesticides and PCBs

One pesticide, beta-BHC, was detected at an estimated concentration of 0.049 µg/L, which is below the method detection limit, in the groundwater sample collected from MW60-3. The state groundwater criteria for beta-BHC is 5 µg/L. No PCBs were detected in the three monitoring wells sampled for this investigation.

Metals

Sixteen metals were detected in groundwater samples from SEAD 52/60. The four metals, benzene, iron, manganese, and sodium were the only analytes detected at concentrations which exceeded the Class GA standards.

Total Petroleum Hydrocarbons

Two of the groundwater samples had detectable concentrations of total petroleum hydrocarbons. Monitoring well MW60-1, the background well, contained the highest TPH concentration (2.2 mg/L) and monitoring well, MW60-2, contained approximately one half of this amount (1.22 mg/L). There is no NYSDEC Class GA nor federal criteria value for TPH. Furthermore, the TPH analysis may also detect high molecular compounds of natural origin other than fuels. The TPH concentrations in groundwater are shown in Figure 3-5.

The groundwater data collected at SEAD 52/60 was compared to the to the Drinking Water PRGs. The attached Collapsed Data Summary and Summary Statistics tables present this comparison. Benzene, barium, chromium, and manganese were the only analytes detected at concentrations which exceeded the Drinking Water PRGs.

Summary of SEAD 52/60 Surface Water and Sediment Data

Three surface water samples were collected as part of the ESI at SEAD-52/60. SEAD 52/60 has been classified by NYSDEC as Class C and therefore surface water collected on-site were compared to the NYSDEC Class C Ambient Water Quality Standards presented in the NYSDEC Division of Water, Technical and Operational Guidance Series 1.1.1 (TOGS). A summary of this comparison is presented in the attached Collapsed Data Summary and Summary Statistics tables for surface water. No volatile organic compounds, semi-volatile organic compounds, pesticides, PCBs, or TPHs were detected in the surface water samples collected at SEAD-52/60. Aluminum and iron were the only 2 analytes detected at concentrations which exceeded these standards. The exceedances each occurred in one of the 3 surface water samples collected.

A total of three sediment samples were collected as part of the ESI at SEAD-60. The sediment samples were collected in the same locations as the surface water samples discussed above. Sediment in SEAD 52/60 has been classified by NYSDEC as Class C and therefore sediment collected on-site was compared to the NYSDEC Class C Ambient Water Quality Standards presented in the NYSDEC Division of Water, Technical and Operational Guidance Series 1.1.1 (TOGS). A summary of this comparison is presented in the attached Collapsed Data Summary and Summary Statistics tables for sediment.

The following sections describe the nature and extent of sediment contamination identified at SEAD-60.

Volatile Organic Compounds

Only one volatile organic compound was detected in the sediment samples. Chloroform was detected at an estimated concentration of 3J µg/kg in sample SD60-2.

Semivolatile Organic Compounds

A total of eleven SVOCs were identified in the three sediment samples collected at SEAD-60. The SVOCs detected were all PAHs, six of which were found at concentrations above their respective NYSDEC criteria values. Concentrations of PAHs, in samples SD60-2 and SD60-3 were above the associated criteria.

One SVOC, bis(2-ethylhexyl)phthalate, which was found in three samples, is a common laboratory contaminant and can be potentially attributed to the laboratory and not site conditions.

Pesticides and PCBs

Four pesticide compounds were detected in the downgradient sediment sample SD60-3. Three of the four compounds were detected in concentrations exceeding their respective NYSDEC criteria values. The three pesticides, endosulfan I, 4,4'-DDE, and alpha chlordane, were found at estimated concentrations of 2.1J µg/kg, 5.4J µg/kg and 1.9J µg/kg, respectively.

Metals

A number of metals were detected in the three sediment samples collected at SEAD-60. Copper, iron, manganese, and nickel were the only 4 analytes detected at concentrations which exceeded the NYSDEC Class C standards.

Total Petroleum Hydrocarbons

Total petroleum hydrocarbons were detected in only one sample, SD60-2, at a concentration of 149 mg/kg. This sample was collected in a drainage ditch approximately 340 feet downgradient of the oil spill area in a location receiving direct run-off from the site.

5. For each source area, identify the decisions that supported the need for additional investigation. Identify the data used to evaluate the alternative of additional investigation compared to a removal action option. Was this removal action considered? As part of the decision making process, were COC concentrations compared to risk-based criteria, either site-specific or generic screening level risk-based criteria?

- The initial decision to perform a preliminary site assessment at SEAD-52/60 was based upon the uncontrolled release of metals, semivolatile compounds and explosives as part of the demilitarization process. The conclusions within the ESI report for SEAD-52/60 recommended that a limited removal action could address the present site threat.

6. Was a site-specific risk assessment performed? Describe the results:

a) Did site-specific current or potential future health risks exceed the acceptable carcinogenic risk range or Hazard Index (HI) level? Define these with respect to the site.

b) If the answer to 6a is yes, please identify the media, pathway(s), and receptor(s) that had potentially unacceptable health risk. Identify any deviations from USEPA risk assessment guidance that were used to estimate potential risk.

An Expanded Site Inspection (ESI) has been completed at SEAD-52/60, however, no risk assessment has been performed.

7. Was an alternatives analysis performed (i.e. Feasibility Study/Corrective Measures Study (FS/CMS))? If so, describe the analysis and the selected alternative.

Only an Expanded Site Inspection (ESI) has been completed at SEAD-52/60. No Feasibility Study or Corrective Measures Study has been performed to date.

8. Identify and discuss the data used to support the decision that remediation to risk-based criteria was practicable.

a) If remediation to risk-based criteria was practicable, was a remedial action (RA) completed? Describe the completed RA and the remedial alternatives considered.

b) If remediation to risk-based criteria was not practicable, was an interim removal action (IRA) completed? Describe the completed IRA and any alternatives considered.

The work at SEAD-52/60 has not progressed to this point. While an Interim Removal Action (IRA) has not been completed, this step was evaluated as a possible recommendation of the ESI report.

9. What is the current site status? If applicable, provide a discussion of long-term monitoring requirements including frequency of monitoring, list of measured parameters, number of sample locations, and the criteria established to terminate or complete the monitoring program.

An ESI has been completed at SEAD-52/60. This project is waiting to perform an RI/BRA.

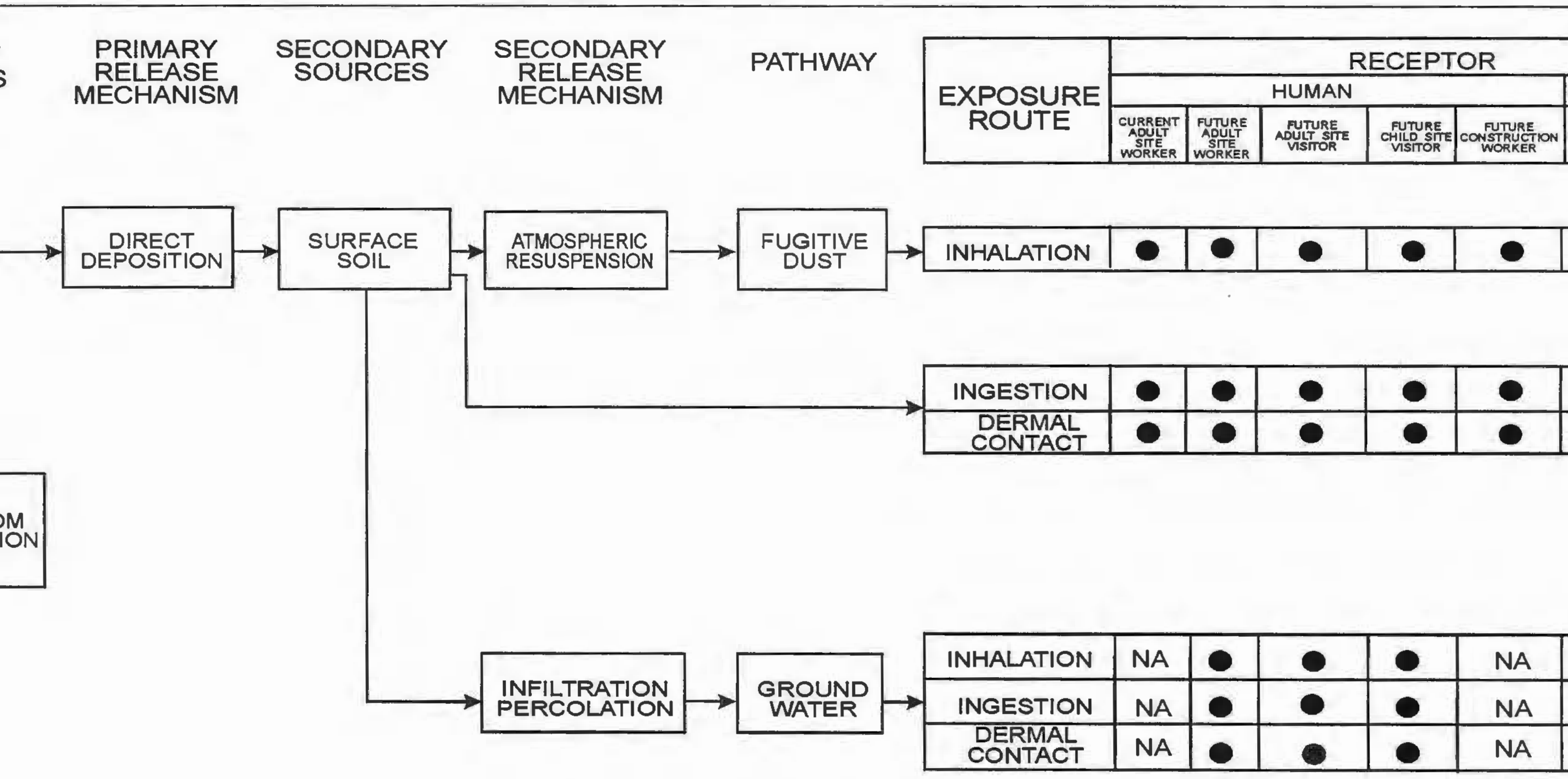
Project Funding

1. Provide total past environmental restoration expenditures.
2. Provide total planned environmental restoration expenditures (with schedule).

Attachments

Maps: Location maps, boring maps with data, well maps with data, potentiometric surface maps, geologic maps, etc.

Data Tables: Tabular presentation of data that is considered to be a driver for additional work, risk, or clean-up.



EXPOSURE ROUTE	RECEPTOR				
	HUMAN				
	CURRENT ADULT SITE WORKER	FUTURE ADULT SITE WORKER	FUTURE ADULT SITE VISITOR	FUTURE CHILD SITE VISITOR	FUTURE CONSTRUCTION WORKER
INHALATION	●	●	●	●	●
INGESTION	●	●	●	●	●
DERMAL CONTACT	●	●	●	●	●
INHALATION	NA	●	●	●	NA
INGESTION	NA	●	●	●	NA
DERMAL CONTACT	NA	●	●	●	NA

● - PATHWAY CONSIDERED TO POSE POTENTIAL RISK
NA - NOT APPLICABLE TO RECEPTOR
FUTURE LAND USE - CONSERVATION/RECREATION

PARSONS
PARSONS ENGINEERING SCIE

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
ENVIRONMENTAL PEER
PROGRAM

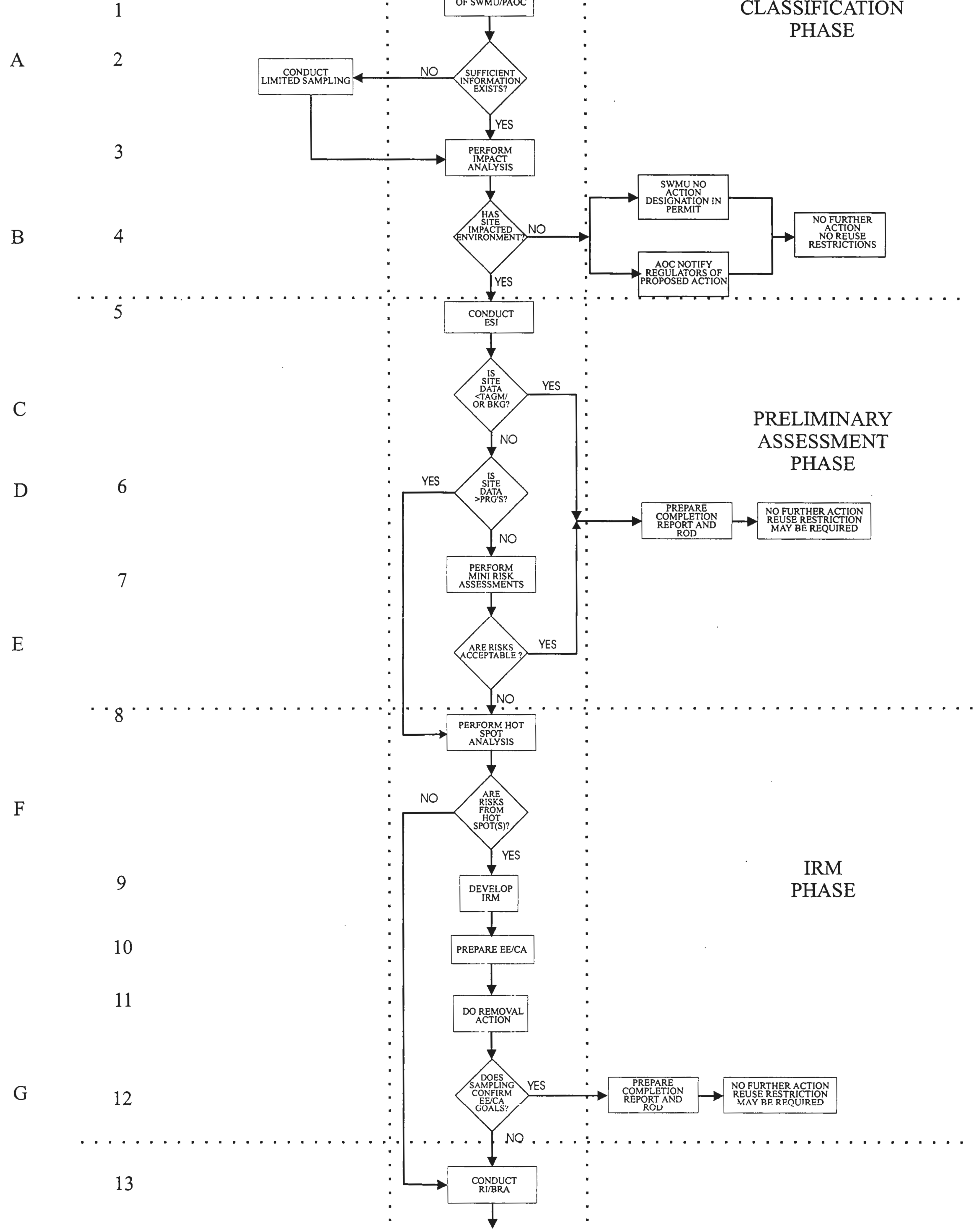
DEPT. ENVIRONMENTAL ENGINEERING
DWG NO

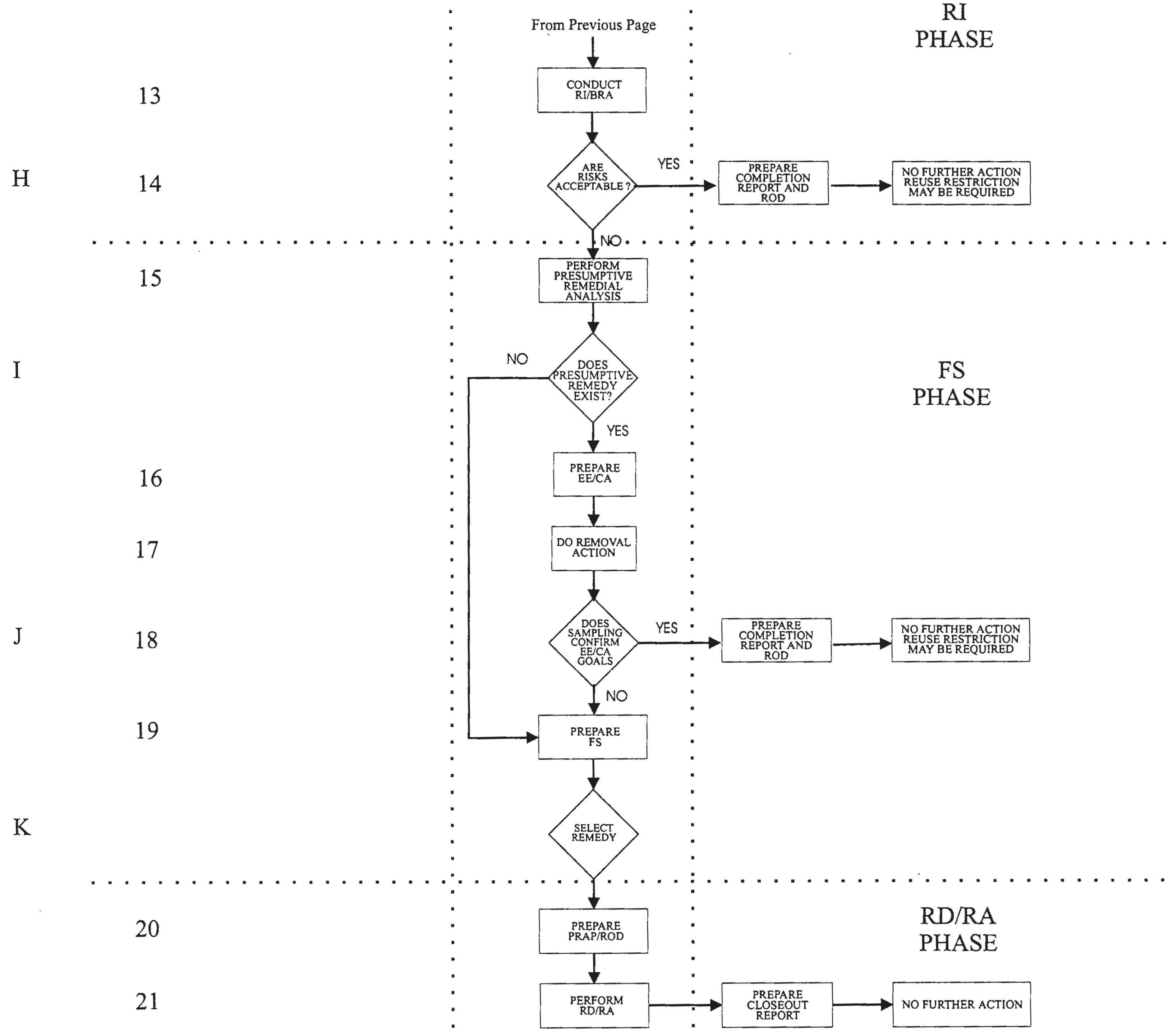
FIGURE 52-1

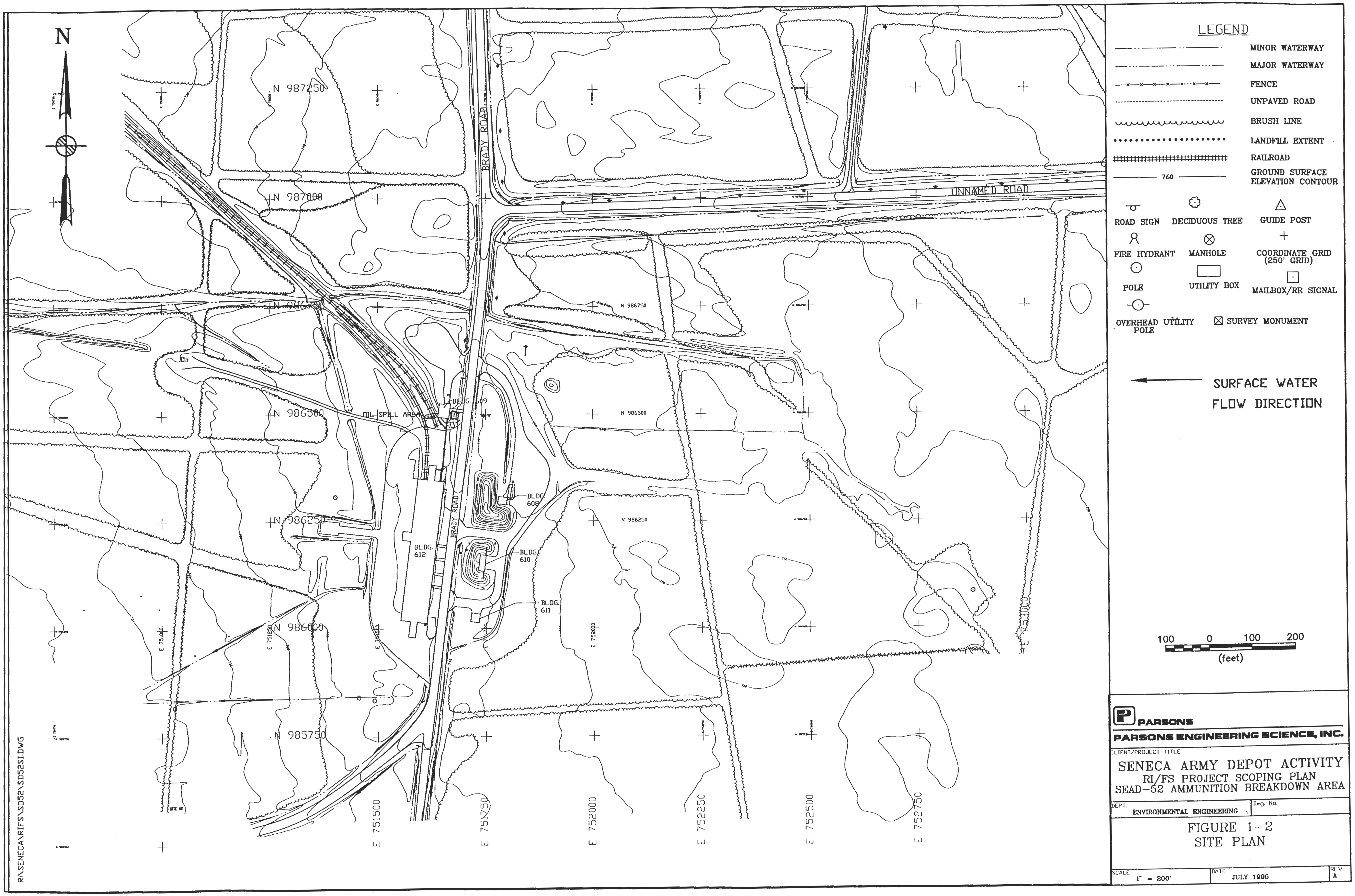
EXPOSURE PATHWAY SU
FOR SEAD-52

SCALE NA
DATE APRI

SM\EXP52.CDR


CLASSIFICATION PHASE
1
OF SWMU/PAOC
A
2
SUFFICIENT INFORMATION EXISTS?
NO
CONDUCT LIMITED SAMPLING
YES
3
PERFORM IMPACT ANALYSIS
B
4
HAS SITE IMPACTED ENVIRONMENT?
NO
SWMU NO ACTION DESIGNATION IN PERMIT
AOC NOTIFY REGULATORS OF PROPOSED ACTION
NO FURTHER ACTION NO REUSE RESTRICTIONS
YES
5
CONDUCT ESI
PRELIMINARY ASSESSMENT PHASE
C
IS SITE DATA <TAGM/ OR BKG?
YES
NO
D
6
IS SITE DATA >PRG'S?
YES
NO
PREPARE COMPLETION REPORT AND ROD
NO FURTHER ACTION REUSE RESTRICTION MAY BE REQUIRED
7
PERFORM MINI RISK ASSESSMENTS
E
ARE RISKS ACCEPTABLE ?
YES
NO
8
PERFORM HOT SPOT ANALYSIS
IRM PHASE
F
ARE RISKS FROM HOT SPOT(S)?
NO
YES
9
DEVELOP IRM
10
PREPARE EE/CA
11
DO REMOVAL ACTION
G
12
DOES SAMPLING CONFIRM EE/CA GOALS?
YES
PREPARE COMPLETION REPORT AND ROD
NO FURTHER ACTION REUSE RESTRICTION MAY BE REQUIRED
NO
13
CONDUCT RI/BRA
See Next Page


From Previous Page
RI
PHASE
13
CONDUCT RI/BRA
H
14
ARE RISKS ACCEPTABLE ?
YES
PREPARE COMPLETION REPORT AND ROD
NO FURTHER ACTION REUSE RESTRICTION MAY BE REQUIRED
NO
15
PERFORM PRESUMPTIVE REMEDIAL ANALYSIS
I
NO
DOES PRESUMPTIVE REMEDY EXIST?
FS
PHASE
YES
16
PREPARE EE/CA
17
DO REMOVAL ACTION
J
18
DOES SAMPLING CONFIRM EE/CA GOALS
YES
PREPARE COMPLETION REPORT AND ROD
NO FURTHER ACTION REUSE RESTRICTION MAY BE REQUIRED
NO
19
PREPARE FS
K
SELECT REMEDY
20
PREPARE PRAP/ROD
RD/RA
PHASE
21
PERFORM RD/RA
PREPARE CLOSEOUT REPORT
NO FURTHER ACTION



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-52 AMMUNITION BREAKDOWN AREA

DEPT. ENVIRONMENTAL ENGINEERING

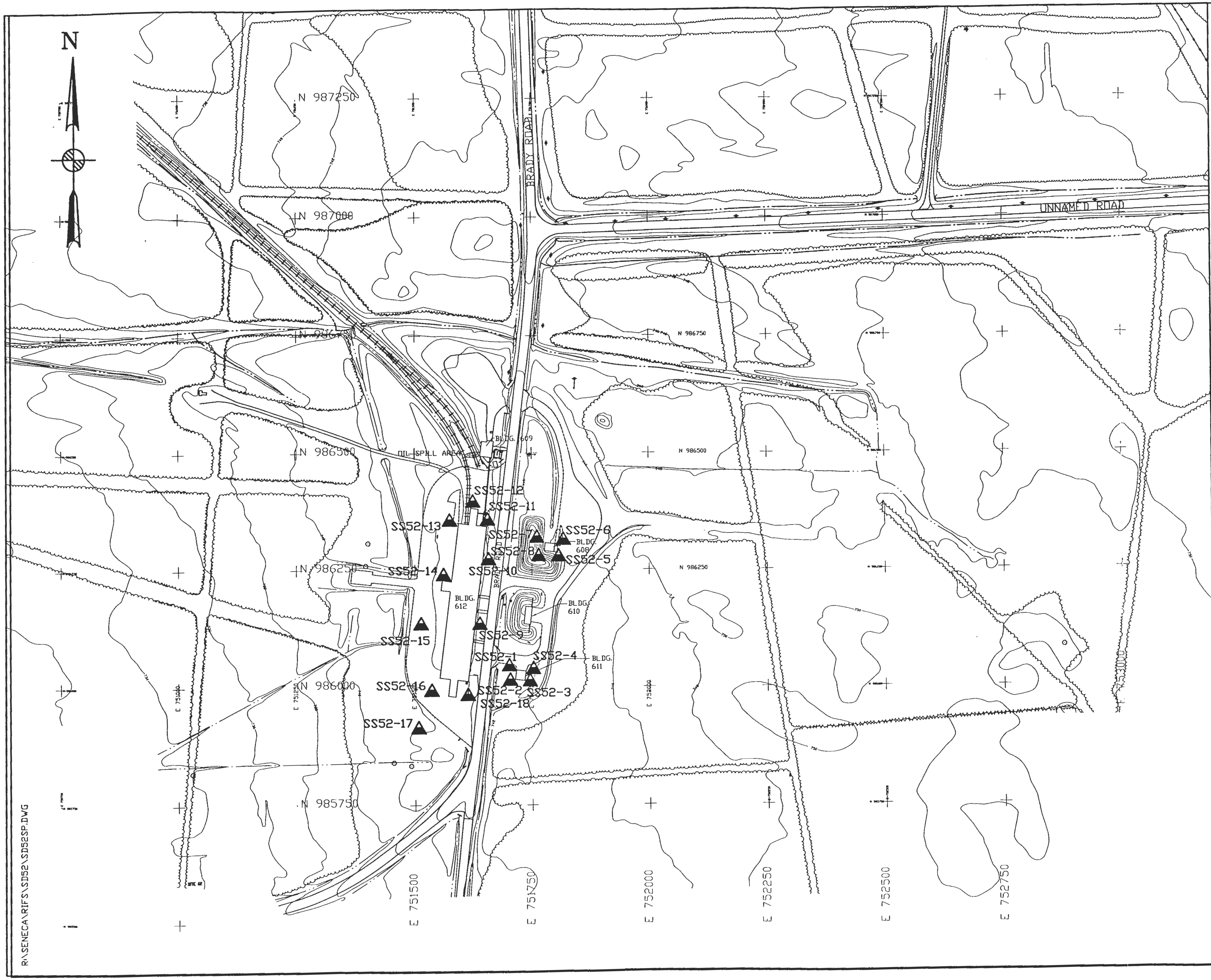
Dwg. No.

FIGURE 1-2
SITE PLAN

SCALE 1" = 200'

DATE JULY 1995

REV A



LEGEND

MINOR WATERWAY
MAJOR WATERWAY
FENCE
UNPAVED ROAD
BRUSH LINE
LANDFILL EXTENT
RAILROAD
760 GROUND SURFACE ELEVATION CONTOUR
ROAD SIGN
DECIDUOUS TREE
△ GUIDE POST
FIRE HYDRANT
⊗ MANHOLE
+ COORDINATE GRID (250' GRID)
⊙ POLE
▭ UTILITY BOX
⊡ MAILBOX/RR SIGNAL
OVERHEAD UTILITY POLE
☒ SURVEY MONUMENT
▲ SURFACE SOIL SAMPLE

100 0 100 200
(feet)

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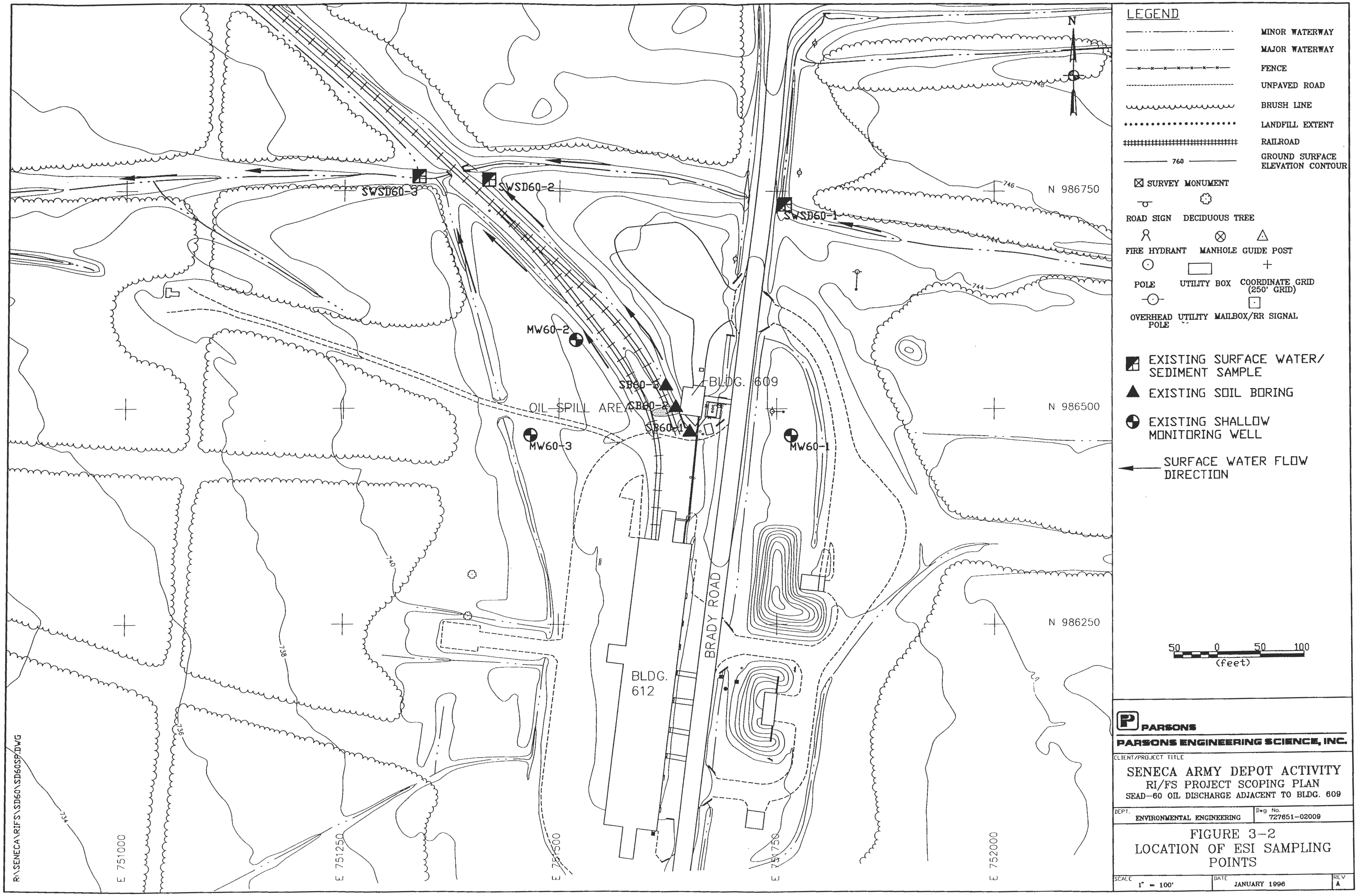
CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-52 AMMUNITION BREAKDOWN AREA

DEPT. ENVIRONMENTAL ENGINEERING
Dwg No.

FIGURE 3-1
LOCATION OF SAMPLE POINTS
FROM THE LIMITED SAMPLING PROGRAM

SCALE 1" = 200'
DATE JULY 1995
REV A



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CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-60 OIL DISCHARGE ADJACENT TO BLDG. 609

DEPT. ENVIRONMENTAL ENGINEERING

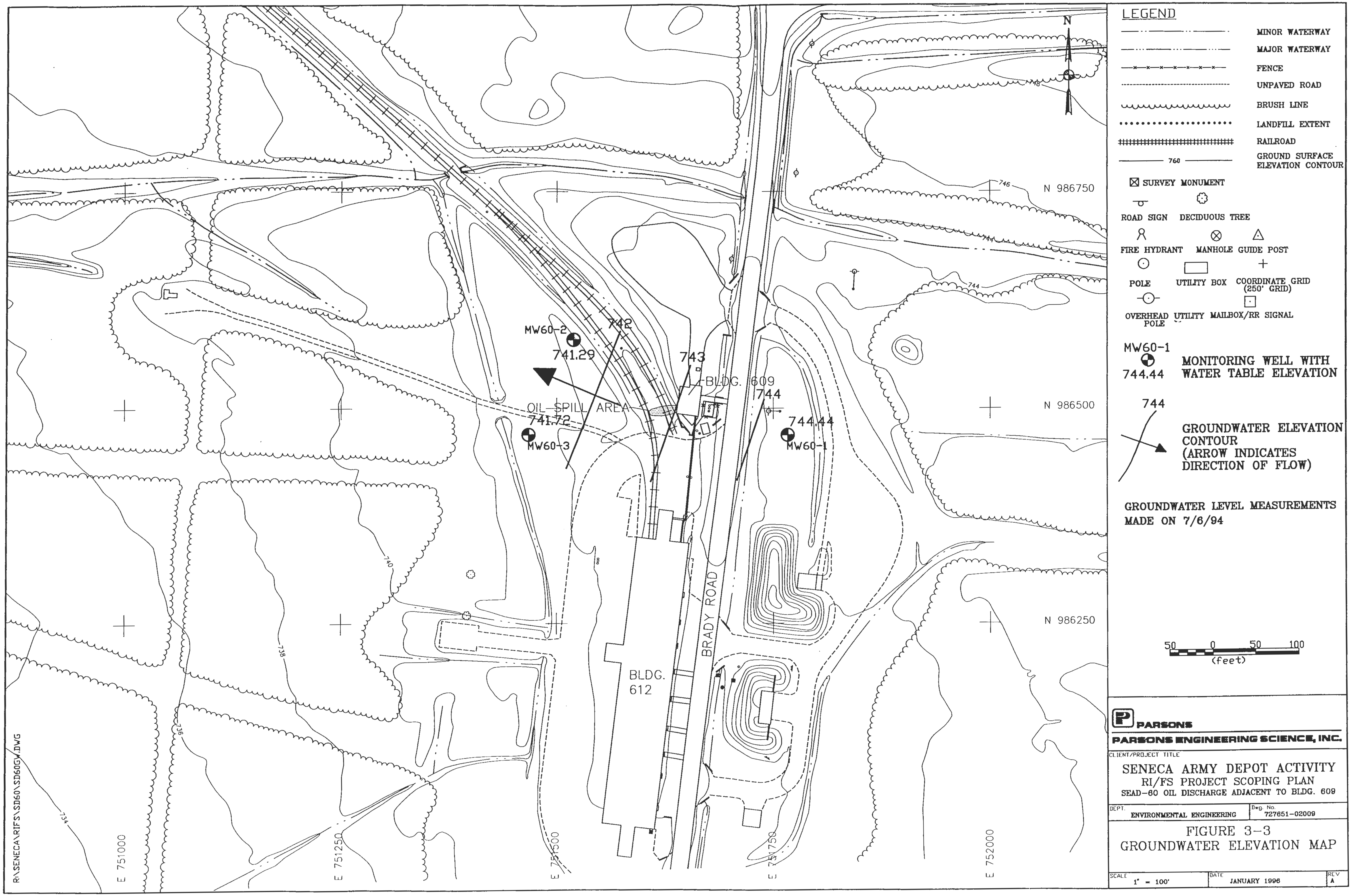
Dwg No. 727651-02009

FIGURE 3-2
LOCATION OF ESI SAMPLING POINTS

SCALE 1" = 100'

DATE JANUARY 1996

REV A



PARSONS

PARSONS ENGINEERING SCIENCE, INC.

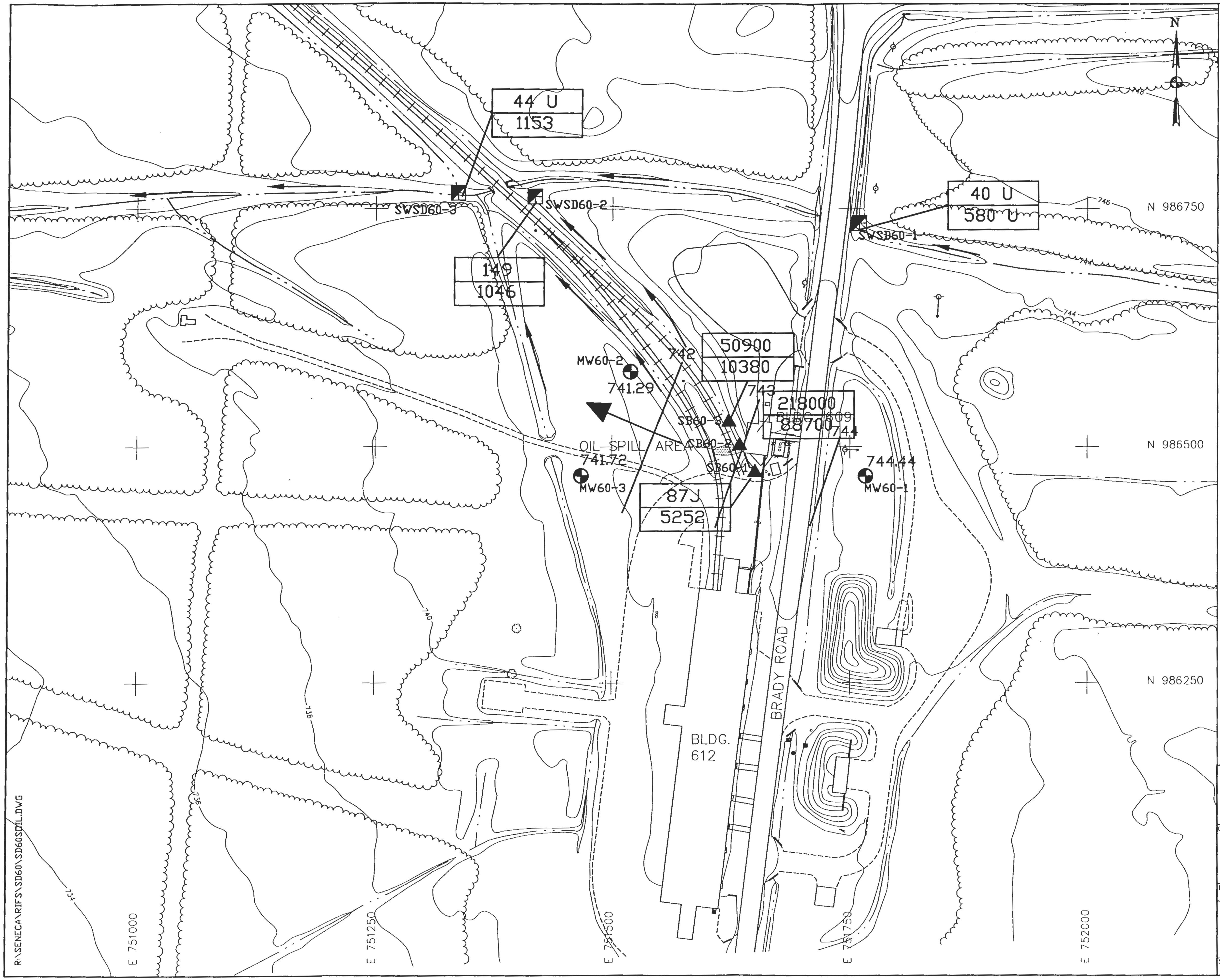
CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-60 OIL DISCHARGE ADJACENT TO BLDG. 609

DEPT.	Dwg. No.
ENVIRONMENTAL ENGINEERING	727651-02009

FIGURE 3-3
GROUNDWATER ELEVATION MAP

SCALE	DATE	REV
1" = 100'	JANUARY 1996	A



PARSONS

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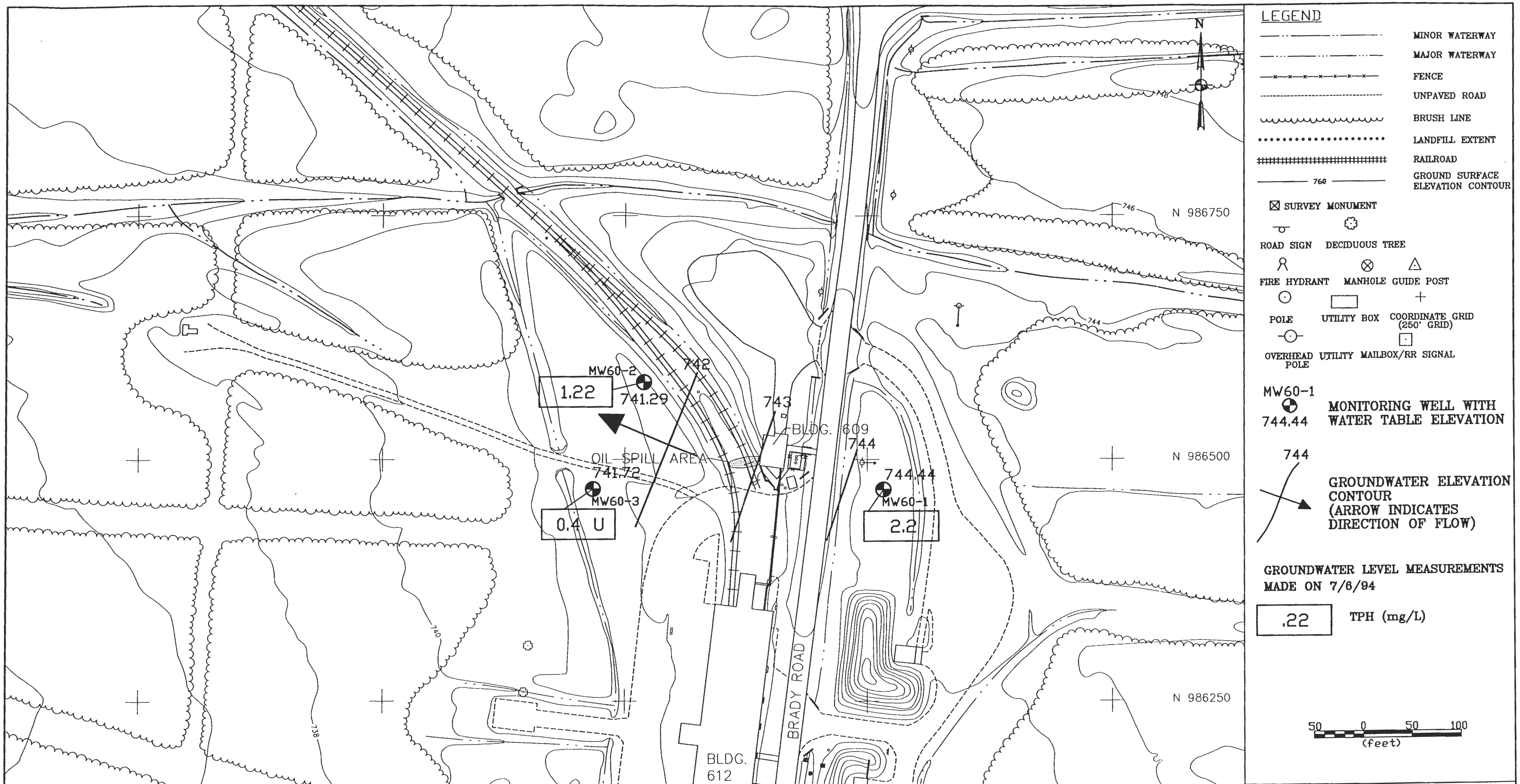
CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-60 OIL DISCHARGE ADJACENT TO BLDG. 609

DEPT. ENVIRONMENTAL ENGINEERING
Dwg. No. 727651-02009

FIGURE 3-4
TPH AND TOTAL PAHs IN SURFACE SOILS AND SEDIMENTS

SCALE 1" = 100'
DATE JANUARY 1996
REV A



PARSONS

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CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-60 OIL DISCHARGE ADJACENT TO BLDG. 609

DEPT. ENVIRONMENTAL ENGINEERING
Dwg. No. 727651-02009

FIGURE 3-5
TPH IN GROUNDWATER

SCALE 1" = 100'
DATE JANUARY 1996
REV A

SEAD-52/60

SOIL

COLLAPSED DATA TABLES

AND

SUMMARY STATISTICS TABLES

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to NYSDEC TAGM 4046

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
Volatile Organics									
1,1,1-Trichloroethane	UG/KG	12	0	0.00%	.	0	36,850,961.54	957,110.	800.
1,1,2,2-Tetrachloroethane	UG/KG	12	0	0.00%	.	0	3,439,423.077		600.
1,1,2-Trichloroethane	UG/KG	12	0	0.00%	.	0	1,206,815.115		
1,1-Dichloroethane	UG/KG	12	0	0.00%	.	0	105,288,461.5		200.
1,1-Dichloroethene	UG/KG	12	0	0.00%	.	0	114,647.436		400.
1,2-Dichloroethane	UG/KG	12	0	0.00%	.	0	755,917.16		100.
1,2-Dichloroethene (total)	UG/KG	12	0	0.00%	.	0			
1,2-Dichloropropane	UG/KG	12	0	0.00%	.	0	1,011,595.023		
Acetone	UG/KG	12	1	8.33%	160.	0	105,288,461.5	34,270.	200.
Benzene	UG/KG	12	0	0.00%	.	0	2,372,015.915	247,370.	60.
Bromodichloromethane	UG/KG	12	0	0.00%	.	0	1,109,491.315		
Bromoform	UG/KG	12	0	0.00%	.	0	8,707,400.195		
Carbon disulfide	UG/KG	12	2	16.67%	2.	0	105,288,461.5	53,000.	2,700.
Carbon tetrachloride	UG/KG	12	0	0.00%	.	0	529,142.012		600.
Chlorobenzene	UG/KG	12	0	0.00%	.	0	21,057,692.31		1,700.
Chlorodibromomethane	UG/KG	12	0	0.00%	.	0	818,910.256		
Chloroethane	UG/KG	12	0	0.00%	.	0	421,153,846.2		1,900.
Chloroform	UG/KG	12	0	0.00%	.	0	10,528,846.15	194,610.	300.
Cis-1,3-Dichloropropene	UG/KG	12	0	0.00%	.	0			
Ethyl benzene	UG/KG	12	2	16.67%	2.	0	105,288,461.5	1,720,290.	5,500.
Methyl bromide	UG/KG	12	0	0.00%	.	0	1,505,625.		
Methyl butyl ketone	UG/KG	12	1	8.33%	1.	0			
Methyl chloride	UG/KG	12	0	0.00%	.	0	5,291,420.118		
Methyl ethyl ketone	UG/KG	12	1	8.33%	20.	0		421,380.	300.
Methyl isobutyl ketone	UG/KG	12	0	0.00%	.	0	84,230,769.23		1,000.
Methylene chloride	UG/KG	12	5	41.67%	54.	0	9,171,794.872	132,030.	100.
Styrene	UG/KG	12	0	0.00%	.	0			
Tetrachloroethene	UG/KG	12	1	8.33%	3.	0	1,322,855.03	6,454,550.	1,400.
Toluene	UG/KG	12	4	33.33%	13.	0	210,576,923.1	1,552,560.	1,500.
Total Xylenes	UG/KG	12	1	8.33%	5.	0	2,105,769,231.	5,642,680.	1,200.
Trans-1,3-Dichloropropene	UG/KG	12	0	0.00%	.	0			
Trichloroethene	UG/KG	12	0	0.00%	.	0	6,253,496.503		700.
Vinyl chloride	UG/KG	12	0	0.00%	.	0	36,204.453		200.
Nitroaromatics									
HMX	UG/KG	19	0	0.00%	.	0			
RDX	UG/KG	19	0	0.00%	.	0			
1,3,5-Trinitrobenzene	UG/KG	19	0	0.00%	.	0	53,000.		
1,3-Dinitrobenzene	UG/KG	19	0	0.00%	.	0	105,000.		
Tetryl	UG/KG	19	1	5.26%	150,000.	0			
2,4,6-Trinitrotoluene	UG/KG	19	2	10.53%	410,000.	0	2,293,000.		
4-amino-2,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0			
2-amino-4,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0			
2,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0	1,053,000.		1,000.
2,4-Dinitrotoluene	UG/KG	19	10	52.63%	2,100,000.	0	2,106,000.	5,060.	
Semivolatile Organics									
1,2,4-Trichlorobenzene	UG/KG	12	0	0.00%	.	0	10,528,846.15	1,132,060.	3,400.
1,2-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	94,759,615.38		7,900.
1,3-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	93,706,730.77		1,600.
1,4-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	2,866,185.897		8,500.
2,2'-oxybis(1-Chloropropan	UG/KG	12	0	0.00%	.	0			
2,4,5-Trichlorophenol	UG/KG	12	0	0.00%	.	0	105,288,461.5		100.
2,4,6-Trichlorophenol	UG/KG	12	0	0.00%	.	0	6,253,496.503		
2,4-Dichlorophenol	UG/KG	12	0	0.00%	.	0	3,158,653.846		400.
2,4-Dimethylphenol	UG/KG	12	0	0.00%	.	0	21,057,692.31		
2,4-Dinitrophenol	UG/KG	12	0	0.00%	.	0	2,105,769.231		200.
2,4-Dinitrotoluene	UG/KG	12	0	0.00%	.	0	2,105,769.231	5,060.	
2,6-Dinitrotoluene	UG/KG	12	0	0.00%	.	0	1,052,884.615		1,000.
2-Chloronaphthalene	UG/KG	12	0	0.00%	.	0			
2-Chlorophenol	UG/KG	12	0	0.00%	.	0	5,264,423.077	83,200.	800.
2-Methylnaphthalene	UG/KG	12	1	8.33%	1,100.	0		962,620.	36,400.
2-Methylphenol	UG/KG	12	0	0.00%	.	0	52,644,230.77		100.
2-Nitroaniline	UG/KG	12	0	0.00%	.	0	63,173.077		430.
2-Nitrophenol	UG/KG	12	0	0.00%	.	0			330.
3,3`-Dichlorobenzidine	UG/KG	12	0	0.00%	.	0	152,863.248		
3-Nitroaniline	UG/KG	12	0	0.00%	.	0	3,158,653.846		500.
4,6-Dinitro-2-methylphenol	UG/KG	12	0	0.00%	.	0			
4-Bromophenyl phenyl ethe	UG/KG	12	0	0.00%	.	0	61,067,307.69		
4-Chloro-3-methylphenol	UG/KG	12	0	0.00%	.	0			240.
4-Chloroaniline	UG/KG	12	0	0.00%	.	0	4,211,538.462		220.
4-Chlorophenyl phenyl ethe	UG/KG	12	0	0.00%	.	0			
4-Methylphenol	UG/KG	12	0	0.00%	.	0			900.

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to NYSDEC TAGM 4046

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
4-Nitroaniline	UG/KG	12	0	0.00%	.	0	3,158,653.846		
4-Nitrophenol	UG/KG	12	0	0.00%	.	0	63,173,076.92	18,680.	100.
Acenaphthene	UG/KG	12	2	16.67%	1,400.	0		2,268,070.	50,000.
Acenaphthylene	UG/KG	12	0	0.00%	.	0		33,460.	41,000.
Anthracene	UG/KG	12	3	25.00%	2,000.	0	315,865,384.6	1,269,040.	50,000.
Benzo[a]anthracene	UG/KG	12	2	16.67%	340.	1	94,230.769	1,476,040.	224.
Benzo[a]pyrene	UG/KG	12	2	16.67%	350.	2	9,423.077	562,720.	61.
Benzo[b]fluoranthene	UG/KG	12	4	33.33%	16,000.	2	94,230.769	59,750.	1,100.
Benzo[ghi]perylene	UG/KG	12	3	25.00%	1,600.	0		76,250.	50,000.
Benzo[k]fluoranthene	UG/KG	12	1	8.33%	190.	0	942,307.692	72,640.	1,100.
Bis(2-Chloroethoxy)methan	UG/KG	12	0	0.00%	.	0			
Bis(2-Chloroethyl)ether	UG/KG	12	0	0.00%	.	0	62,534.965		
Bis(2-Ethylhexyl)phthalate	UG/KG	12	5	41.67%	380.	0	4,913,461.538	39,350.	50,000.
Butylbenzylphthalate	UG/KG	12	0	0.00%	.	0	210,576,923.1		50,000.
Carbazole	UG/KG	12	1	8.33%	79.	0	3,439,423.077		
Chrysene	UG/KG	12	5	41.67%	17,000.	2	9,423,076.923	93,300.	400.
Di-n-butylphthalate	UG/KG	12	3	25.00%	1,500.	0		94,697,730.	8,100.
Di-n-octylphthalate	UG/KG	12	0	0.00%	.	0	21,057,692.31		50,000.
Dibenz[a,h]anthracene	UG/KG	12	3	25.00%	1,100.	3	9,423.077	53,680.	14.
Dibenzofuran	UG/KG	12	1	8.33%	29.	0	4,211,538.462		6,200.
Diethyl phthalate	UG/KG	12	0	0.00%	.	0	842,307,692.3	7,665,910.	7,100.
Dimethylphthalate	UG/KG	12	0	0.00%	.	0	10,528,846,150.		2,000.
Fluoranthene	UG/KG	12	8	66.67%	14,000.	0	42,115,384.62	7,849,900.	50,000.
Fluorene	UG/KG	12	2	16.67%	1,300.	0	42,115,384.62	1,755,510.	50,000.
Hexachlorobenzene	UG/KG	12	0	0.00%	.	0	42,992.788		410.
Hexachlorobutadiene	UG/KG	12	0	0.00%	.	0	210,576.923		
Hexachlorocyclopentadiene	UG/KG	12	0	0.00%	.	0	7,370,192.308		
Hexachloroethane	UG/KG	12	0	0.00%	.	0	1,052,884.615		
Indeno[1,2,3-cd]pyrene	UG/KG	12	3	25.00%	1,100.	0	94,230.769	47,630.	3,200.
Isophorone	UG/KG	12	0	0.00%	.	0			4,400.
N-Nitrosodiphenylamine	UG/KG	12	0	0.00%	.	0	14,038,461.54		
N-Nitrosodipropylamine	UG/KG	12	0	0.00%	.	0	9,826.923	1,454,550.	
Naphthalene	UG/KG	12	1	8.33%	38.	0	42,115,384.62	149,740.	13,000.
Nitrobenzene	UG/KG	12	0	0.00%	.	0	526,442.308		200.
Pentachlorophenol	UG/KG	12	0	0.00%	.	0	573,237.18	1,415,560.	1,000.
Phenanthrene	UG/KG	12	6	50.00%	8,900.	0		325,820.	50,000.
Phenol	UG/KG	12	0	0.00%	.	0	631,730,769.2	79,520.	30.
Pyrene	UG/KG	12	10	83.33%	27,000.	0	31,586,538.46	2,420,460.	50,000.
Pesticides/PCBs									
4,4`-DDD	UG/KG	12	3	25.00%	100.	0	286,618.59	874,990.	2,900.
4,4`-DDE	UG/KG	12	6	50.00%	110.	0	202,319.005	86,590.	2,100.
4,4`-DDT	UG/KG	12	4	33.33%	130.	0	202,319.005	8,870.	2,100.
Aldrin	UG/KG	12	2	16.67%	16.	0	4,046.38	2,750.	41.
Alpha-BHC	UG/KG	12	1	8.33%	5.	0			110.
Alpha-Chlordane	UG/KG	12	3	25.00%	27.	0		142,090.	
Aroclor-1016	UG/KG	12	0	0.00%	.	0	73,701.923		
Aroclor-1221	UG/KG	12	0	0.00%	.	0			
Aroclor-1232	UG/KG	12	0	0.00%	.	0			
Aroclor-1242	UG/KG	12	1	8.33%	970.	0		12,879,550.	
Aroclor-1248	UG/KG	12	1	8.33%	2,100.	0			
Aroclor-1254	UG/KG	12	0	0.00%	.	0	21,057.692	3,925,000.	10,000.
Aroclor-1260	UG/KG	12	3	25.00%	4,400.	0		2,272,730.	10,000.
Beta-BHC	UG/KG	12	0	0.00%	.	0		11,060.	200.
Delta-BHC	UG/KG	12	0	0.00%	.	0			300.
Dieldrin	UG/KG	12	0	0.00%	.	0	4,299.279		44.
Endosulfan I	UG/KG	12	5	41.67%	34.	0	6,317,307.692	131,820.	900.
Endosulfan II	UG/KG	12	0	0.00%	.	0	6,317,307.692		900.
Endosulfan sulfate	UG/KG	12	0	0.00%	.	0		15,820.	1,000.
Endrin	UG/KG	12	0	0.00%	.	0	315,865.385	240,910.	100.
Endrin aldehyde	UG/KG	12	0	0.00%	.	0	315,865.385	6,350.	
Endrin ketone	UG/KG	12	2	16.67%	14.	0	315,865.385	6,350.	
Gamma-BHC/Lindane	UG/KG	12	0	0.00%	.	0	52,914.201		60.
Gamma-Chlordane	UG/KG	12	2	16.67%	10.	0		47,360.	540.
Heptachlor	UG/KG	12	0	0.00%	.	0	15,286.325	28,620.	100.
Heptachlor epoxide	UG/KG	12	0	0.00%	.	0	7,559.172	10.	20.
Methoxychlor	UG/KG	12	0	0.00%	.	0	5,264,423.077		
Toxaphene	UG/KG	12	0	0.00%	.	0			
Metals									
Aluminum	UG/KG	12	12	100.00%	14,100,000.	0	1,052,884,615.		19,520,000.
Antimony	UG/KG	12	8	66.67%	1,800.	0	421,153.846	18,437,230.	6,000.
Arsenic	UG/KG	12	12	100.00%	8,100.	0	45,858.974	223,670.	8,900.
Barium	UG/KG	12	12	100.00%	679,000.	3	73,701,923.08	91,840.	300,000.

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to NYSDEC TAGM 4046

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
Beryllium	UG/KG	12	12	100.00%	670.	0	15,997.317	6,570.	1,130.
Cadmium	UG/KG	12	12	100.00%	2,000.	0	526,442.308	737,770.	2,460.
Calcium	UG/KG	12	12	100.00%	102,000,000.	0			125,300,000.
Chromium	UG/KG	12	12	100.00%	23,300.	0	1,052,884,615.	850,430.	30,000.
Cobalt	UG/KG	12	12	100.00%	13,100.	0	63,173,076.92		30,000.
Copper	UG/KG	12	12	100.00%	190,000.	3	42,115,384.62	827,810.	33,000.
Cyanide	UG/KG	12	0	0.00%	.	0		13,636,360.	350.
Iron	UG/KG	12	12	100.00%	32,100,000.	0	315,865,384.6		37,410,000.
Lead	UG/KG	12	12	100.00%	66,700.	4		181,460.	24,400.
Magnesium	UG/KG	12	12	100.00%	25,400,000.	1			21,700,000.
Manganese	UG/KG	12	12	100.00%	536,000.	0	24,216,346.15	8,821,860.	1,100,000.
Mercury	UG/KG	12	10	83.33%	80.	0	315,865.385	1,710.	100.
Nickel	UG/KG	12	12	100.00%	44,300.	0	21,057,692.31	2,833,820.	50,000.
Potassium	UG/KG	12	12	100.00%	1,920,000.	0			2,623,000.
Selenium	UG/KG	12	4	33.33%	1,500.	0	5,264,423.077	193,140.	2,000.
Silver	UG/KG	12	0	0.00%	.	0	5,264,423.077		800.
Sodium	UG/KG	12	12	100.00%	140,000.	0			188,000.
Thallium	UG/KG	12	0	0.00%	.	0	84,230.769		855.
Vanadium	UG/KG	12	12	100.00%	26,200.	0	7,370,192.308		150,000.
Zinc	UG/KG	12	12	100.00%	569,000.	4	315,865,384.6		115,000.
Other Analyses									
Total Petroleum Hydrocarb	UG/KG	12	9	75.00%	218,000,000.	0			

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to NYSDEC TAGM 4046

STUDY ID:	ESI	ESI	ESI	ESI
SITE:	SEAD-60	SEAD-60	SEAD-60	SEAD-60
LOC ID:	SB60-1	SB60-1	SB60-1	SB60-1
LOC TYPE:	SITE	SITE	SITE	SITE
SAMP_ID:	SB60-1-20	SB60-1-00	SB60-1-01	SB60-1-21
QC CODE:	DU	SA	SA	DU
SAMP. DETH TOP:	0	0	0	2
SAMP. DEPTH BOT:	0.2	0.2	2	4
MATRIX:	SOIL	SOIL	SOIL	SOIL
SAMP. DATE:	27-May-94	27-May-94	28-Feb-94	28-Feb-94

ETER	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
acene	UG/KG	1	94,230.769	1,476,040.	224.	300.	J	200.	J	370.	U	390.	U
e	UG/KG	2	9,423.077	562,720.	61.	360.	J	[illegible]	J	370.	U	390.	U
nthene	UG/KG	2	94,230.769	59,750.	1,100.	730.	J	310.	J	370.	U	390.	U
	UG/KG	2	9,423,076.923	93,300.	400.	400.		250.	J	370.	U	390.	U
hracene	UG/KG	3	9,423.077	53,680.	14.	[illegible]	J	[illegible]	J	370.	U	390.	U
	UG/KG	3	73,701,923.08	91,840.	300,000.	77,600.		71,500.		98,300.		68,600.	
	UG/KG	3	42,115,384.62	827,810.	33,000.	23,000.		24,900.		21,300.		20,800.	
	UG/KG	4		181,460.	24,400.	14,200.		17,100.		[illegible]	J	9,400.	J
	UG/KG	1			21,700,000.	12,200,000.		13,300,000.		11,300,000.		17,200,000.	
	UG/KG	4	315,865,384.6		115,000.	79,700.		85,000.		58,600.		101,000.	

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to NYSDEC TAGM 4046

					STUDY ID:	ESI		ESI		ESI		ESI	
					SITE:	SEAD-60		SEAD-60		SEAD-60		SEAD-60	
					LOC ID:	SB60-1		SB60-2		SB60-2		SB60-2	
					LOC TYPE:	SITE		SITE		SITE		SITE	
					SAMP_ID:	SB60-1-02		SB60-2-20		SB60-2-00		SB60-2-02	
					QC CODE:	SA		DU		SA		SA	
					SAMP. DETH TOP:	2		0		0		2	
					SAMP. DEPTH BOT:	4		0.2		0.2		4	
					MATRIX:	SOIL		SOIL		SOIL		SOIL	
					SAMP. DATE:	28-Feb-94		07-Jun-94		07-Jun-94		08-Jun-94	
TER	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
cene	UG/KG	1	94,230.769	1,476,040.	224.	370.	U	14,000.	U	18,000.	U	360.	U
e	UG/KG	2	9,423.077	562,720.	61.	370.	U	14,000.	U	18,000.	U	360.	U
nthena	UG/KG	2	94,230.769	59,750.	1,100.	370.	U	16,000.	J	18,000.	U	360.	U
	UG/KG	2	9,423,076.923	93,300.	400.	370.	U	17,000.	J	18,000.	U	18.	J
nracene	UG/KG	3	9,423.077	53,680.	14.	370.	U	14,000.	U	18,000.	U	360.	U
	UG/KG	3	73,701,923.08	91,840.	300,000.	85,800.		575,000.		679,000.		71,700.	J
	UG/KG	3	42,115,384.62	827,810.	33,000.	21,700.		112,000.		190,000.		16,600.	J
	UG/KG	4		181,460.	24,400.	12,600.	J	36,300.		66,700.		7,200.	
	UG/KG	1			21,700,000.	10,400,000.		12,200,000.		9,150,000.		[redacted]	J
	UG/KG	4	315,865,384.6		115,000.	80,700.		415,000.		569,000.		43,700.	J

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to NYSDEC TAGM 4046

					STUDY ID:	ESI		ESI		ESI		ESI	
					SITE:	SEAD-60		SEAD-60		SEAD-60		SEAD-60	
					LOC ID:	SB60-2		SB60-3		SB60-3		SB60-3	
					LOC TYPE:	SITE		SITE		SITE		SITE	
					SAMP_ID:	SB60-2-04		SB60-3-00		SB60-3-03		SB60-3-04	
					QC CODE:	SA		SA		SA		SA	
					SAMP. DETH TOP:	6		0		4		6	
					SAMP. DEPTH BOT:	8		0.2		6		8	
					MATRIX:	SOIL		SOIL		SOIL		SOIL	
					SAMP. DATE:	07-Jun-94		08-Jun-94		08-Jun-94		08-Jun-94	
ER	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
ene	UG/KG	1	94,230.769	1,476,040.	224.	350.	U	2,200.	U	350.	U	350.	U
	UG/KG	2	9,423.077	562,720.	61.	350.	U	2,200.	U	350.	U	350.	U
hene	UG/KG	2	94,230.769	59,750.	1,100.	350.	U	1,500.	J	350.	U	350.	U
	UG/KG	2	9,423,076.923	93,300.	400.	350.	U	1,100.	J	350.	U	350.	U
acene	UG/KG	3	9,423.077	53,680.	14.	350.	U	1,100.	J	350.	U	350.	U
	UG/KG	3	73,701,923.08	91,840.	300,000.	90,100.		416,000.		64,000.		50,100.	
	UG/KG	3	42,115,384.62	827,810.	33,000.	20,500.		74,100.		19,800.		30,600.	
	UG/KG	4		181,460.	24,400.	9,500.		50,600.		8,200.		15,300.	
	UG/KG	1			21,700,000.	19,000,000.		8,570,000.		18,000,000.		11,400,000.	
	UG/KG	4	315,865,384.6		115,000.	64,400.		314,000.		56,300.		[illegible]	

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to NYSDEC TAGM 4046

STUDY ID:	ESI	ESI	ESI	ESI
SITE:	SEAD-52	SEAD-52	SEAD-52	SEAD-52
LOC ID:	SS52-1	SS52-1	SS52-2	SS52-3
LOC TYPE:	SITE	SITE	SITE	SITE
SAMP_ID:	SS52-1	SS52-19	SS52-2	SS52-3
QC CODE:	SA	DU	SA	SA
SAMP. DETH TOP:	0.000	0.000	0.000	0.000
SAMP. DEPTH BOT:	0.200	0.200	0.200	0.200
MATRIX:	SOIL	SOIL	SOIL	SOIL
SAMP. DATE:	16-Dec-93	16-Dec-93	16-Dec-93	16-Dec-93

ER	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	'NYSDEC TAGM 4046	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
ene	UG/KG	1	94,230.769	1,476,040.	224.								
	UG/KG	2	9,423.077	562,720.	61.								
hene	UG/KG	2	94,230.769	59,750.	1,100.								
	UG/KG	2	9,423,076.923	93,300.	400.								
acene	UG/KG	3	9,423.077	53,680.	14.								
	UG/KG	3	73,701,923.08	91,840.	300,000.								
	UG/KG	3	42,115,384.62	827,810.	33,000.								
	UG/KG	4		181,460.	24,400.								
	UG/KG	1			21,700,000.								
	UG/KG	4	315,865,384.6		115,000.								

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to Ecological PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
Volatile Organics									
1,1,1-Trichloroethane	UG/KG	12	0	0.00%	.	0	36,850,961.54	957,110.	800.
1,1,2,2-Tetrachloroethane	UG/KG	12	0	0.00%	.	0	3,439,423.077		600.
1,1,2-Trichloroethane	UG/KG	12	0	0.00%	.	0	1,206,815.115		
1,1-Dichloroethane	UG/KG	12	0	0.00%	.	0	105,288,461.5		200.
1,1-Dichloroethene	UG/KG	12	0	0.00%	.	0	114,647.436		400.
1,2-Dichloroethane	UG/KG	12	0	0.00%	.	0	755,917.16		100.
1,2-Dichloroethene (total)	UG/KG	12	0	0.00%	.	0			
1,2-Dichloropropane	UG/KG	12	0	0.00%	.	0	1,011,595.023		
Acetone	UG/KG	12	1	8.33%	160.	0	105,288,461.5	34,270.	200.
Benzene	UG/KG	12	0	0.00%	.	0	2,372,015.915	247,370.	60.
Bromodichloromethane	UG/KG	12	0	0.00%	.	0	1,109,491.315		
Bromoform	UG/KG	12	0	0.00%	.	0	8,707,400.195		
Carbon disulfide	UG/KG	12	2	16.67%	2.	0	105,288,461.5	53,000.	2,700.
Carbon tetrachloride	UG/KG	12	0	0.00%	.	0	529,142.012		600.
Chlorobenzene	UG/KG	12	0	0.00%	.	0	21,057,692.31		1,700.
Chlorodibromomethane	UG/KG	12	0	0.00%	.	0	818,910.256		
Chloroethane	UG/KG	12	0	0.00%	.	0	421,153,846.2		1,900.
Chloroform	UG/KG	12	0	0.00%	.	0	10,528,846.15	194,610.	300.
Cis-1,3-Dichloropropene	UG/KG	12	0	0.00%	.	0			
Ethyl benzene	UG/KG	12	2	16.67%	2.	0	105,288,461.5	1,720,290.	5,500.
Methyl bromide	UG/KG	12	0	0.00%	.	0	1,505,625.		
Methyl butyl ketone	UG/KG	12	1	8.33%	1.	0			
Methyl chloride	UG/KG	12	0	0.00%	.	0	5,291,420.118		
Methyl ethyl ketone	UG/KG	12	1	8.33%	20.	0		421,380.	300.
Methyl isobutyl ketone	UG/KG	12	0	0.00%	.	0	84,230,769.23		1,000.
Methylene chloride	UG/KG	12	5	41.67%	54.	0	9,171,794.872	132,030.	100.
Styrene	UG/KG	12	0	0.00%	.	0			
Tetrachloroethene	UG/KG	12	1	8.33%	3.	0	1,322,855.03	6,454,550.	1,400.
Toluene	UG/KG	12	4	33.33%	13.	0	210,576,923.1	1,552,560.	1,500.
Total Xylenes	UG/KG	12	1	8.33%	5.	0	2,105,769,231.	5,642,680.	1,200.
Trans-1,3-Dichloropropene	UG/KG	12	0	0.00%	.	0			
Trichloroethene	UG/KG	12	0	0.00%	.	0	6,253,496.503		700.
Vinyl chloride	UG/KG	12	0	0.00%	.	0	36,204.453		200.
Nitroaromatics									
HMX	UG/KG	19	0	0.00%	.	0			
RDX	UG/KG	19	0	0.00%	.	0			
1,3,5-Trinitrobenzene	UG/KG	19	0	0.00%	.	0	53,000.		
1,3-Dinitrobenzene	UG/KG	19	0	0.00%	.	0	105,000.		
Tetryl	UG/KG	19	1	5.26%	150,000.	0			
2,4,6-Trinitrotoluene	UG/KG	19	2	10.53%	410,000.	0	2,293,000.		
4-amino-2,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0			
2-amino-4,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0			
2,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0	1,053,000.		1,000.
2,4-Dinitrotoluene	UG/KG	19	10	52.63%	2,100,000.	10	2,106,000.	5,060.	
Semivolatile Organics									
1,2,4-Trichlorobenzene	UG/KG	12	0	0.00%	.	0	10,528,846.15	1,132,060.	3,400.
1,2-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	94,759,615.38		7,900.
1,3-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	93,706,730.77		1,600.
1,4-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	2,866,185.897		8,500.
2,2'-oxybis(1-Chloropropane	UG/KG	12	0	0.00%	.	0			
2,4,5-Trichlorophenol	UG/KG	12	0	0.00%	.	0	105,288,461.5		100.
2,4,6-Trichlorophenol	UG/KG	12	0	0.00%	.	0	6,253,496.503		
2,4-Dichlorophenol	UG/KG	12	0	0.00%	.	0	3,158,653.846		400.
2,4-Dimethylphenol	UG/KG	12	0	0.00%	.	0	21,057,692.31		
2,4-Dinitrophenol	UG/KG	12	0	0.00%	.	0	2,105,769.231		200.
2,4-Dinitrotoluene	UG/KG	12	0	0.00%	.	0	2,105,769.231	5,060.	
2,6-Dinitrotoluene	UG/KG	12	0	0.00%	.	0	1,052,884.615		1,000.
2-Chloronaphthalene	UG/KG	12	0	0.00%	.	0			
2-Chlorophenol	UG/KG	12	0	0.00%	.	0	5,264,423.077	83,200.	800.
2-Methylnaphthalene	UG/KG	12	1	8.33%	1,100.	0		962,620.	36,400.
2-Methylphenol	UG/KG	12	0	0.00%	.	0	52,644,230.77		100.
2-Nitroaniline	UG/KG	12	0	0.00%	.	0	63,173.077		430.
2-Nitrophenol	UG/KG	12	0	0.00%	.	0			330.
3,3`-Dichlorobenzidine	UG/KG	12	0	0.00%	.	0	152,863.248		
3-Nitroaniline	UG/KG	12	0	0.00%	.	0	3,158,653.846		500.
4,6-Dinitro-2-methylphenol	UG/KG	12	0	0.00%	.	0			
4-Bromophenyl phenyl ether	UG/KG	12	0	0.00%	.	0	61,067,307.69		
4-Chloro-3-methylphenol	UG/KG	12	0	0.00%	.	0			240.
4-Chloroaniline	UG/KG	12	0	0.00%	.	0	4,211,538.462		220.
4-Chlorophenyl phenyl ether	UG/KG	12	0	0.00%	.	0			

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to Ecological PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
4-Methylphenol	UG/KG	12	0	0.00%	.	0			900.
4-Nitroaniline	UG/KG	12	0	0.00%	.	0	3,158,653.846		
4-Nitrophenol	UG/KG	12	0	0.00%	.	0	63,173,076.92	18,680.	100.
Acenaphthene	UG/KG	12	2	16.67%	1,400.	0		2,268,070.	50,000.
Acenaphthylene	UG/KG	12	0	0.00%	.	0		33,460.	41,000.
Anthracene	UG/KG	12	3	25.00%	2,000.	0	315,865,384.6	1,269,040.	50,000.
Benzo[a]anthracene	UG/KG	12	2	16.67%	340.	0	94,230.769	1,476,040.	224.
Benzo[a]pyrene	UG/KG	12	2	16.67%	350.	0	9,423.077	562,720.	61.
Benzo[b]fluoranthene	UG/KG	12	4	33.33%	16,000.	0	94,230.769	59,750.	1,100.
Benzo[ghi]perylene	UG/KG	12	3	25.00%	1,600.	0		76,250.	50,000.
Benzo[k]fluoranthene	UG/KG	12	1	8.33%	190.	0	942,307.692	72,640.	1,100.
Bis(2-Chloroethoxy)methan	UG/KG	12	0	0.00%	.	0			
Bis(2-Chloroethyl)ether	UG/KG	12	0	0.00%	.	0	62,534.965		
Bis(2-Ethylhexyl)phthalate	UG/KG	12	5	41.67%	380.	0	4,913,461.538	39,350.	50,000.
Butylbenzylphthalate	UG/KG	12	0	0.00%	.	0	210,576,923.1		50,000.
Carbazole	UG/KG	12	1	8.33%	79.	0	3,439,423.077		
Chrysene	UG/KG	12	5	41.67%	17,000.	0	9,423,076.923	93,300.	400.
Di-n-butylphthalate	UG/KG	12	3	25.00%	1,500.	0		94,697,730.	8,100.
Di-n-octylphthalate	UG/KG	12	0	0.00%	.	0	21,057,692.31		50,000.
Dibenz[a,h]anthracene	UG/KG	12	3	25.00%	1,100.	0	9,423.077	53,680.	14.
Dibenzofuran	UG/KG	12	1	8.33%	29.	0	4,211,538.462		6,200.
Diethyl phthalate	UG/KG	12	0	0.00%	.	0	842,307,692.3	7,665,910.	7,100.
Dimethylphthalate	UG/KG	12	0	0.00%	.	0	10,528,846,150.		2,000.
Fluoranthene	UG/KG	12	8	66.67%	14,000.	0	42,115,384.62	7,849,900.	50,000.
Fluorene	UG/KG	12	2	16.67%	1,300.	0	42,115,384.62	1,755,510.	50,000.
Hexachlorobenzene	UG/KG	12	0	0.00%	.	0	42,992.788		410.
Hexachlorobutadiene	UG/KG	12	0	0.00%	.	0	210,576.923		
Hexachlorocyclopentadiene	UG/KG	12	0	0.00%	.	0	7,370,192.308		
Hexachloroethane	UG/KG	12	0	0.00%	.	0	1,052,884.615		
Indeno[1,2,3-cd]pyrene	UG/KG	12	3	25.00%	1,100.	0	94,230.769	47,630.	3,200.
Isophorone	UG/KG	12	0	0.00%	.	0			4,400.
N-Nitrosodiphenylamine	UG/KG	12	0	0.00%	.	0	14,038,461.54		
N-Nitrosodipropylamine	UG/KG	12	0	0.00%	.	0	9,826.923	1,454,550.	
Naphthalene	UG/KG	12	1	8.33%	38.	0	42,115,384.62	149,740.	13,000.
Nitrobenzene	UG/KG	12	0	0.00%	.	0	526,442.308		200.
Pentachlorophenol	UG/KG	12	0	0.00%	.	0	573,237.18	1,415,560.	1,000.
Phenanthrene	UG/KG	12	6	50.00%	8,900.	0		325,820.	50,000.
Phenol	UG/KG	12	0	0.00%	.	0	631,730,769.2	79,520.	30.
Pyrene	UG/KG	12	10	83.33%	27,000.	0	31,586,538.46	2,420,460.	50,000.
Pesticides/PCBs									
4,4`-DDD	UG/KG	12	3	25.00%	100.	0	286,618.59	874,990.	2,900.
4,4`-DDE	UG/KG	12	6	50.00%	110.	0	202,319.005	86,590.	2,100.
4,4`-DDT	UG/KG	12	4	33.33%	130.	0	202,319.005	8,870.	2,100.
Aldrin	UG/KG	12	2	16.67%	16.	0	4,046.38	2,750.	41.
Alpha-BHC	UG/KG	12	1	8.33%	5.	0			110.
Alpha-Chlordane	UG/KG	12	3	25.00%	27.	0		142,090.	
Aroclor-1016	UG/KG	12	0	0.00%	.	0	73,701.923		
Aroclor-1221	UG/KG	12	0	0.00%	.	0			
Aroclor-1232	UG/KG	12	0	0.00%	.	0			
Aroclor-1242	UG/KG	12	1	8.33%	970.	0		12,879,550.	
Aroclor-1248	UG/KG	12	1	8.33%	2,100.	0			
Aroclor-1254	UG/KG	12	0	0.00%	.	0	21,057.692	3,925,000.	10,000.
Aroclor-1260	UG/KG	12	3	25.00%	4,400.	0		2,272,730.	10,000.
Beta-BHC	UG/KG	12	0	0.00%	.	0		11,060.	200.
Delta-BHC	UG/KG	12	0	0.00%	.	0			300.
Dieldrin	UG/KG	12	0	0.00%	.	0	4,299.279		44.
Endosulfan I	UG/KG	12	5	41.67%	34.	0	6,317,307.692	131,820.	900.
Endosulfan II	UG/KG	12	0	0.00%	.	0	6,317,307.692		900.
Endosulfan sulfate	UG/KG	12	0	0.00%	.	0		15,820.	1,000.
Endrin	UG/KG	12	0	0.00%	.	0	315,865.385	240,910.	100.
Endrin aldehyde	UG/KG	12	0	0.00%	.	0	315,865.385	6,350.	
Endrin ketone	UG/KG	12	2	16.67%	14.	0	315,865.385	6,350.	
Gamma-BHC/Lindane	UG/KG	12	0	0.00%	.	0	52,914.201		60.
Gamma-Chlordane	UG/KG	12	2	16.67%	10.	0		47,360.	540.
Heptachlor	UG/KG	12	0	0.00%	.	0	15,286.325	28,620.	100.
Heptachlor epoxide	UG/KG	12	0	0.00%	.	0	7,559.172	10.	20.
Methoxychlor	UG/KG	12	0	0.00%	.	0	5,264,423.077		
Toxaphene	UG/KG	12	0	0.00%	.	0			
Metals									
Aluminum	UG/KG	12	12	100.00%	14,100,000.	0	1,052,884,615.		19,520,000.
Antimony	UG/KG	12	8	66.67%	1,800.	0	421,153.846	18,437,230.	6,000.

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to Ecological PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
Arsenic	UG/KG	12	12	100.00%	8,100.	0	45,858.974	223,670.	8,900.
Barium	UG/KG	12	12	100.00%	679,000.	4	73,701,923.08	91,840.	300,000.
Beryllium	UG/KG	12	12	100.00%	670.	0	15,997.317	6,570.	1,130.
Cadmium	UG/KG	12	12	100.00%	2,000.	0	526,442.308	737,770.	2,460.
Calcium	UG/KG	12	12	100.00%	102,000,000.	0			125,300,000.
Chromium	UG/KG	12	12	100.00%	23,300.	0	1,052,884,615.	850,430.	30,000.
Cobalt	UG/KG	12	12	100.00%	13,100.	0	63,173,076.92		30,000.
Copper	UG/KG	12	12	100.00%	190,000.	0	42,115,384.62	827,810.	33,000.
Cyanide	UG/KG	12	0	0.00%	.	0		13,636,360.	350.
Iron	UG/KG	12	12	100.00%	32,100,000.	0	315,865,384.6		37,410,000.
Lead	UG/KG	12	12	100.00%	66,700.	0		181,460.	24,400.
Magnesium	UG/KG	12	12	100.00%	25,400,000.	0			21,700,000.
Manganese	UG/KG	12	12	100.00%	536,000.	0	24,216,346.15	8,821,860.	1,100,000.
Mercury	UG/KG	12	10	83.33%	80.	0	315,865.385	1,710.	100.
Nickel	UG/KG	12	12	100.00%	44,300.	0	21,057,692.31	2,833,820.	50,000.
Potassium	UG/KG	12	12	100.00%	1,920,000.	0			2,623,000.
Selenium	UG/KG	12	4	33.33%	1,500.	0	5,264,423.077	193,140.	2,000.
Silver	UG/KG	12	0	0.00%	.	0	5,264,423.077		800.
Sodium	UG/KG	12	12	100.00%	140,000.	0			188,000.
Thallium	UG/KG	12	0	0.00%	.	0	84,230.769		855.
Vanadium	UG/KG	12	12	100.00%	26,200.	0	7,370,192.308		150,000.
Zinc	UG/KG	12	12	100.00%	569,000.	0	315,865,384.6		115,000.
Other Analyses									
Total Petroleum Hydrocarbons	UG/KG	12	9	75.00%	218,000,000.	0			

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to Ecological PRG

					STUDY ID:	ESI	ESI	ESI	ESI
					SITE:	SEAD-60	SEAD-60	SEAD-60	SEAD-60
					LOC ID:	SB60-1	SB60-1	SB60-1	SB60-1
					LOC TYPE:	SITE	SITE	SITE	SITE
					SAMP_ID:	SB60-1-20	SB60-1-00	SB60-1-01	SB60-1-21
					QC CODE:	DU	SA	SA	DU
					SAMP. DETH TOP:	0	0	0	2
					SAMP. DEPTH BOT:	0.2	0.2	2	4
					MATRIX:	SOIL	SOIL	SOIL	SOIL
					SAMP. DATE:	27-May-94	27-May-94	28-Feb-94	28-Feb-94
	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE Q	VALUE Q	VALUE Q	VALUE Q
ne	UG/KG	10	2,106,000.	5,060.					
	UG/KG	4	73,701,923.08	91,840.	300,000.	77,600.	71,500.	98,300.	68,600.

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Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to Ecological PRG

					STUDY ID:	ESI	ESI	ESI	ESI
					SITE:	SEAD-60	SEAD-60	SEAD-60	SEAD-60
					LOC ID:	SB60-1	SB60-2	SB60-2	SB60-2
					LOC TYPE:	SITE	SITE	SITE	SITE
					SAMP_ID:	SB60-1-02	SB60-2-20	SB60-2-00	SB60-2-02
					QC CODE:	SA	DU	SA	SA
					SAMP. DETH TOP:	2	0	0	2
					SAMP. DEPTH BOT:	4	0.2	0.2	4
					MATRIX:	SOIL	SOIL	SOIL	SOIL
					SAMP. DATE:	28-Feb-94	07-Jun-94	07-Jun-94	08-Jun-94
	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE Q	VALUE Q	VALUE Q	VALUE Q
ene	UG/KG	10	2,106,000.	5,060.					
	UG/KG	4	73,701,923.08	91,840.	300,000.	85,800.	575,000.	679,000.	71,700. J

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to Ecological PRG

						VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
					STUDY ID:	ESI		ESI		ESI		ESI	
					SITE:	SEAD-60		SEAD-60		SEAD-60		SEAD-60	
					LOC ID:	SB60-2		SB60-3		SB60-3		SB60-3	
					LOC TYPE:	SITE		SITE		SITE		SITE	
					SAMP_ID:	SB60-2-04		SB60-3-00		SB60-3-03		SB60-3-04	
					QC CODE:	SA		SA		SA		SA	
					SAMP. DETH TOP:	6		0		4		6	
					SAMP. DEPTH BOT:	8		0.2		6		8	
					MATRIX:	SOIL		SOIL		SOIL		SOIL	
					SAMP. DATE:	07-Jun-94		08-Jun-94		08-Jun-94		08-Jun-94	
	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE	Q	VALUE	Q	VALUE	Q	VALUE	Q
ene	UG/KG	10	2,106,000.	5,060.									
	UG/KG	4	73,701,923.08	91,840.	300,000.	90,100.		416,000.		64,000.		50,100.	

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Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to Ecological PRG

					STUDY ID:	ESI	ESI	ESI	ESI
					SITE:	SEAD-52	SEAD-52	SEAD-52	SEAD-52
					LOC ID:	SS52-1	SS52-1	SS52-2	SS52-3
					LOC TYPE:	SITE	SITE	SITE	SITE
					SAMP_ID:	SS52-1	SS52-19	SS52-2	SS52-3
					QC CODE:	SA	DU	SA	SA
					SAMP. DETH TOP:	0.000	0.000	0.000	0.000
					SAMP. DEPTH BOT:	0.200	0.200	0.200	0.200
					MATRIX:	SOIL	SOIL	SOIL	SOIL
					SAMP. DATE:	16-Dec-93	16-Dec-93	16-Dec-93	16-Dec-93
	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE Q	VALUE Q	VALUE Q	VALUE Q
ene	UG/KG	10	2,106,000.	5,060.		110,000. J	120,000. J	130,000. UJ	130,000. UJ
	UG/KG	4	73,701,923.08	91,840.	300,000.				

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to Ecological PRG

				STUDY ID:	ESI	ESI	ESI	ESI
				SITE:	SEAD-52	SEAD-52	SEAD-52	SEAD-52
				LOC ID:	SS52-4	SS52-5	SS52-6	SS52-7
				LOC TYPE:	SITE	SITE	SITE	SITE
				SAMP_ID:	SS52-4	SS52-5	SS52-6	SS52-7
				QC CODE:	SA	SA	SA	SA
				SAMP. DETH TOP:	0.000	0.000	0.000	0.000
				SAMP. DEPTH BOT:	0.200	0.200	0.200	0.200
				MATRIX:	SOIL	SOIL	SOIL	SOIL
				SAMP. DATE:	16-Dec-93	16-Dec-93	16-Dec-93	16-Dec-93
	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE Q	VALUE Q	VALUE Q	VALUE Q
ne	UG/KG	10	2,106,000.	5,060.		130,000. UJ	130,000. UJ	280,000. J	130,000. UJ
	UG/KG	4	73,701,923.08	91,840.	300,000.				

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to Ecological PRG

					STUDY ID:	ESI	ESI	ESI	ESI
					SITE:	SEAD-52	SEAD-52	SEAD-52	SEAD-52
					LOC ID:	SS52-8	SS52-9	SS52-10	SS52-11
					LOC TYPE:	SITE	SITE	SITE	SITE
					SAMP_ID:	SS52-8	SS52-9	SS52-10	SS52-11
					QC CODE:	SA	SA	SA	SA
					SAMP. DETH TOP:	0.000	0.000	0.000	0.000
					SAMP. DEPTH BOT:	0.200	0.200	0.200	0.200
					MATRIX:	SOIL	SOIL	SOIL	SOIL
					SAMP. DATE:	16-Dec-93	16-Dec-93	16-Dec-93	16-Dec-93
	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE Q	VALUE Q	VALUE Q	VALUE Q
ene	UG/KG	10	2,106,000.	5,060.		130,000. UJ	490,000. J	99,000. J	130,000. UJ
	UG/KG	4	73,701,923.08	91,840.	300,000.				

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to Ecological PRG

					STUDY ID:	ESI	ESI	ESI	ESI
					SITE:	SEAD-52	SEAD-52	SEAD-52	SEAD-52
					LOC ID:	SS52-12	SS52-13	SS52-14	SS52-15
					LOC TYPE:	SITE	SITE	SITE	SITE
					SAMP_ID:	SS52-12	SS52-13	SS52-14	SS52-15
					QC CODE:	SA	SA	SA	SA
					SAMP. DETH TOP:	0.000	0.000	0.000	0.000
					SAMP. DEPTH BOT:	0.200	0.200	0.200	0.200
					MATRIX:	SOIL	SOIL	SOIL	SOIL
					SAMP. DATE:	16-Dec-93	16-Dec-93	16-Dec-93	16-Dec-93
	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE Q	VALUE Q	VALUE Q	VALUE Q
ene	UG/KG	10	2,106,000.	5,060.		91,000. J	200,000. J	1,500,000. J	130,000. UJ
	UG/KG	4	73,701,923.08	91,840.	300,000.				

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Collapsed Data Summary
Comparison to Ecological PRG

					STUDY ID:	ESI		ESI		ESI	
					SITE:	SEAD-52		SEAD-52		SEAD-52	
					LOC ID:	SS52-16		SS52-17		SS52-18	
					LOC TYPE:	SITE		SITE		SITE	
					SAMP_ID:	SS52-16		SS52-17		SS52-18	
					QC CODE:	SA		SA		SA	
					SAMP. DETH TOP:	0.000		0.000		0.000	
					SAMP. DEPTH BOT:	0.200		0.200		0.200	
					MATRIX:	SOIL		SOIL		SOIL	
					SAMP. DATE:	16-Dec-93		16-Dec-93		16-Dec-93	
	UNIT	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046	VALUE	Q	VALUE	Q	VALUE	Q
ene	UG/KG	10	2,106,000.	5,060.		130,000.	UJ	1,800,000.	J	2,100,000.	J
	UG/KG	4	73,701,923.08	91,840.	300,000.						

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to Recreational PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
Volatile Organics									
1,1,1-Trichloroethane	UG/KG	12	0	0.00%	.	0	36,850,961.54	957,110.	800.
1,1,2,2-Tetrachloroethane	UG/KG	12	0	0.00%	.	0	3,439,423.077		600.
1,1,2-Trichloroethane	UG/KG	12	0	0.00%	.	0	1,206,815.115		
1,1-Dichloroethane	UG/KG	12	0	0.00%	.	0	105,288,461.5		200.
1,1-Dichloroethene	UG/KG	12	0	0.00%	.	0	114,647.436		400.
1,2-Dichloroethane	UG/KG	12	0	0.00%	.	0	755,917.16		100.
1,2-Dichloroethene (total)	UG/KG	12	0	0.00%	.	0			
1,2-Dichloropropane	UG/KG	12	0	0.00%	.	0	1,011,595.023		
Acetone	UG/KG	12	1	8.33%	160.	0	105,288,461.5	34,270.	200.
Benzene	UG/KG	12	0	0.00%	.	0	2,372,015.915	247,370.	60.
Bromodichloromethane	UG/KG	12	0	0.00%	.	0	1,109,491.315		
Bromoform	UG/KG	12	0	0.00%	.	0	8,707,400.195		
Carbon disulfide	UG/KG	12	2	16.67%	2.	0	105,288,461.5	53,000.	2,700.
Carbon tetrachloride	UG/KG	12	0	0.00%	.	0	529,142.012		600.
Chlorobenzene	UG/KG	12	0	0.00%	.	0	21,057,692.31		1,700.
Chlorodibromomethane	UG/KG	12	0	0.00%	.	0	818,910.256		
Chloroethane	UG/KG	12	0	0.00%	.	0	421,153,846.2		1,900.
Chloroform	UG/KG	12	0	0.00%	.	0	10,528,846.15	194,610.	300.
Cis-1,3-Dichloropropene	UG/KG	12	0	0.00%	.	0			
Ethyl benzene	UG/KG	12	2	16.67%	2.	0	105,288,461.5	1,720,290.	5,500.
Methyl bromide	UG/KG	12	0	0.00%	.	0	1,505,625.		
Methyl butyl ketone	UG/KG	12	1	8.33%	1.	0			
Methyl chloride	UG/KG	12	0	0.00%	.	0	5,291,420.118		
Methyl ethyl ketone	UG/KG	12	1	8.33%	20.	0		421,380.	300.
Methyl isobutyl ketone	UG/KG	12	0	0.00%	.	0	84,230,769.23		1,000.
Methylene chloride	UG/KG	12	5	41.67%	54.	0	9,171,794.872	132,030.	100.
Styrene	UG/KG	12	0	0.00%	.	0			
Tetrachloroethene	UG/KG	12	1	8.33%	3.	0	1,322,855.03	6,454,550.	1,400.
Toluene	UG/KG	12	4	33.33%	13.	0	210,576,923.1	1,552,560.	1,500.
Total Xylenes	UG/KG	12	1	8.33%	5.	0	2,105,769,231.	5,642,680.	1,200.
Trans-1,3-Dichloropropene	UG/KG	12	0	0.00%	.	0			
Trichloroethene	UG/KG	12	0	0.00%	.	0	6,253,496.503		700.
Vinyl chloride	UG/KG	12	0	0.00%	.	0	36,204.453		200.
Nitroaromatics									
HMX	UG/KG	19	0	0.00%	.	0			
RDX	UG/KG	19	0	0.00%	.	0			
1,3,5-Trinitrobenzene	UG/KG	19	0	0.00%	.	0	53,000.		
1,3-Dinitrobenzene	UG/KG	19	0	0.00%	.	0	105,000.		
Tetryl	UG/KG	19	1	5.26%	150,000.	0			
2,4,6-Trinitrotoluene	UG/KG	19	2	10.53%	410,000.	0	2,293,000.		
4-amino-2,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0			
2-amino-4,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0			
2,6-Dinitrotoluene	UG/KG	19	0	0.00%	.	0	1,053,000.		1,000.
2,4-Dinitrotoluene	UG/KG	19	10	52.63%	2,100,000.	0	2,106,000.	5,060.	
Semivolatile Organics									
1,2,4-Trichlorobenzene	UG/KG	12	0	0.00%	.	0	10,528,846.15	1,132,060.	3,400.
1,2-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	94,759,615.38		7,900.
1,3-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	93,706,730.77		1,600.
1,4-Dichlorobenzene	UG/KG	12	0	0.00%	.	0	2,866,185.897		8,500.
2,2'-oxybis(1-Chloropropane)	UG/KG	12	0	0.00%	.	0			
2,4,5-Trichlorophenol	UG/KG	12	0	0.00%	.	0	105,288,461.5		100.
2,4,6-Trichlorophenol	UG/KG	12	0	0.00%	.	0	6,253,496.503		
2,4-Dichlorophenol	UG/KG	12	0	0.00%	.	0	3,158,653.846		400.
2,4-Dimethylphenol	UG/KG	12	0	0.00%	.	0	21,057,692.31		
2,4-Dinitrophenol	UG/KG	12	0	0.00%	.	0	2,105,769.231		200.
2,4-Dinitrotoluene	UG/KG	12	0	0.00%	.	0	2,105,769.231	5,060.	
2,6-Dinitrotoluene	UG/KG	12	0	0.00%	.	0	1,052,884.615		1,000.
2-Chloronaphthalene	UG/KG	12	0	0.00%	.	0			
2-Chlorophenol	UG/KG	12	0	0.00%	.	0	5,264,423.077	83,200.	800.
2-Methylnaphthalene	UG/KG	12	1	8.33%	1,100.	0		962,620.	36,400.
2-Methylphenol	UG/KG	12	0	0.00%	.	0	52,644,230.77		100.
2-Nitroaniline	UG/KG	12	0	0.00%	.	0	63,173.077		430.
2-Nitrophenol	UG/KG	12	0	0.00%	.	0			330.
3,3`-Dichlorobenzidine	UG/KG	12	0	0.00%	.	0	152,863.248		
3-Nitroaniline	UG/KG	12	0	0.00%	.	0	3,158,653.846		500.
4,6-Dinitro-2-methylphenol	UG/KG	12	0	0.00%	.	0			
4-Bromophenyl phenyl ether	UG/KG	12	0	0.00%	.	0	61,067,307.69		
4-Chloro-3-methylphenol	UG/KG	12	0	0.00%	.	0			240.
4-Chloroaniline	UG/KG	12	0	0.00%	.	0	4,211,538.462		220.

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to Recreational PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
4-Chlorophenyl phenyl ether	UG/KG	12	0	0.00%	.	0			
4-Methylphenol	UG/KG	12	0	0.00%	.	0			900.
4-Nitroaniline	UG/KG	12	0	0.00%	.	0	3,158,653.846		
4-Nitrophenol	UG/KG	12	0	0.00%	.	0	63,173,076.92	18,680.	100.
Acenaphthene	UG/KG	12	2	16.67%	1,400.	0		2,268,070.	50,000.
Acenaphthylene	UG/KG	12	0	0.00%	.	0		33,460.	41,000.
Anthracene	UG/KG	12	3	25.00%	2,000.	0	315,865,384.6	1,269,040.	50,000.
Benzo[a]anthracene	UG/KG	12	2	16.67%	340.	0	94,230.769	1,476,040.	224.
Benzo[a]pyrene	UG/KG	12	2	16.67%	350.	0	9,423.077	562,720.	61.
Benzo[b]fluoranthene	UG/KG	12	4	33.33%	16,000.	0	94,230.769	59,750.	1,100.
Benzo[ghi]perylene	UG/KG	12	3	25.00%	1,600.	0		76,250.	50,000.
Benzo[k]fluoranthene	UG/KG	12	1	8.33%	190.	0	942,307.692	72,640.	1,100.
Bis(2-Chloroethoxy)methane	UG/KG	12	0	0.00%	.	0			
Bis(2-Chloroethyl)ether	UG/KG	12	0	0.00%	.	0	62,534.965		
Bis(2-Ethylhexyl)phthalate	UG/KG	12	5	41.67%	380.	0	4,913,461.538	39,350.	50,000.
Butylbenzylphthalate	UG/KG	12	0	0.00%	.	0	210,576,923.1		50,000.
Carbazole	UG/KG	12	1	8.33%	79.	0	3,439,423.077		
Chrysene	UG/KG	12	5	41.67%	17,000.	0	9,423,076.923	93,300.	400.
Di-n-butylphthalate	UG/KG	12	3	25.00%	1,500.	0		94,697,730.	8,100.
Di-n-octylphthalate	UG/KG	12	0	0.00%	.	0	21,057,692.31		50,000.
Dibenz[a,h]anthracene	UG/KG	12	3	25.00%	1,100.	0	9,423.077	53,680.	14.
Dibenzofuran	UG/KG	12	1	8.33%	29.	0	4,211,538.462		6,200.
Diethyl phthalate	UG/KG	12	0	0.00%	.	0	842,307,692.3	7,665,910.	7,100.
Dimethylphthalate	UG/KG	12	0	0.00%	.	0	10,528,846,150.		2,000.
Fluoranthene	UG/KG	12	8	66.67%	14,000.	0	42,115,384.62	7,849,900.	50,000.
Fluorene	UG/KG	12	2	16.67%	1,300.	0	42,115,384.62	1,755,510.	50,000.
Hexachlorobenzene	UG/KG	12	0	0.00%	.	0	42,992.788		410.
Hexachlorobutadiene	UG/KG	12	0	0.00%	.	0	210,576.923		
Hexachlorocyclopentadiene	UG/KG	12	0	0.00%	.	0	7,370,192.308		
Hexachloroethane	UG/KG	12	0	0.00%	.	0	1,052,884.615		
Indeno[1,2,3-cd]pyrene	UG/KG	12	3	25.00%	1,100.	0	94,230.769	47,630.	3,200.
Isophorone	UG/KG	12	0	0.00%	.	0			4,400.
N-Nitrosodiphenylamine	UG/KG	12	0	0.00%	.	0	14,038,461.54		
N-Nitrosodipropylamine	UG/KG	12	0	0.00%	.	0	9,826.923	1,454,550.	
Naphthalene	UG/KG	12	1	8.33%	38.	0	42,115,384.62	149,740.	13,000.
Nitrobenzene	UG/KG	12	0	0.00%	.	0	526,442.308		200.
Pentachlorophenol	UG/KG	12	0	0.00%	.	0	573,237.18	1,415,560.	1,000.
Phenanthrene	UG/KG	12	6	50.00%	8,900.	0		325,820.	50,000.
Phenol	UG/KG	12	0	0.00%	.	0	631,730,769.2	79,520.	30.
Pyrene	UG/KG	12	10	83.33%	27,000.	0	31,586,538.46	2,420,460.	50,000.
Pesticides/PCBs									
4,4`-DDD	UG/KG	12	3	25.00%	100.	0	286,618.59	874,990.	2,900.
4,4`-DDE	UG/KG	12	6	50.00%	110.	0	202,319.005	86,590.	2,100.
4,4`-DDT	UG/KG	12	4	33.33%	130.	0	202,319.005	8,870.	2,100.
Aldrin	UG/KG	12	2	16.67%	16.	0	4,046.38	2,750.	41.
Alpha-BHC	UG/KG	12	1	8.33%	5.	0			110.
Alpha-Chlordane	UG/KG	12	3	25.00%	27.	0		142,090.	
Aroclor-1016	UG/KG	12	0	0.00%	.	0	73,701.923		
Aroclor-1221	UG/KG	12	0	0.00%	.	0			
Aroclor-1232	UG/KG	12	0	0.00%	.	0			
Aroclor-1242	UG/KG	12	1	8.33%	970.	0		12,879,550.	
Aroclor-1248	UG/KG	12	1	8.33%	2,100.	0			
Aroclor-1254	UG/KG	12	0	0.00%	.	0	21,057.692	3,925,000.	10,000.
Aroclor-1260	UG/KG	12	3	25.00%	4,400.	0		2,272,730.	10,000.
Beta-BHC	UG/KG	12	0	0.00%	.	0		11,060.	200.
Delta-BHC	UG/KG	12	0	0.00%	.	0			300.
Dieldrin	UG/KG	12	0	0.00%	.	0	4,299.279		44.
Endosulfan I	UG/KG	12	5	41.67%	34.	0	6,317,307.692	131,820.	900.
Endosulfan II	UG/KG	12	0	0.00%	.	0	6,317,307.692		900.
Endosulfan sulfate	UG/KG	12	0	0.00%	.	0		15,820.	1,000.
Endrin	UG/KG	12	0	0.00%	.	0	315,865.385	240,910.	100.
Endrin aldehyde	UG/KG	12	0	0.00%	.	0	315,865.385	6,350.	
Endrin ketone	UG/KG	12	2	16.67%	14.	0	315,865.385	6,350.	
Gamma-BHC/Lindane	UG/KG	12	0	0.00%	.	0	52,914.201		60.
Gamma-Chlordane	UG/KG	12	2	16.67%	10.	0		47,360.	540.
Heptachlor	UG/KG	12	0	0.00%	.	0	15,286.325	28,620.	100.
Heptachlor epoxide	UG/KG	12	0	0.00%	.	0	7,559.172	10.	20.
Methoxychlor	UG/KG	12	0	0.00%	.	0	5,264,423.077		
Toxaphene	UG/KG	12	0	0.00%	.	0			
Metals									

Seneca Army Depot Activity
SEAD-60 and 52 SOILS
Summary Statistics
Comparison to Recreational PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Recreational PRG	Ecological PRG	NYSDEC TAGM 4046
Aluminum	UG/KG	12	12	100.00%	14,100,000.	0	1,052,884,615.		19,520,000.
Antimony	UG/KG	12	8	66.67%	1,800.	0	421,153.846	18,437,230.	6,000.
Arsenic	UG/KG	12	12	100.00%	8,100.	0	45,858.974	223,670.	8,900.
Barium	UG/KG	12	12	100.00%	679,000.	0	73,701,923.08	91,840.	300,000.
Beryllium	UG/KG	12	12	100.00%	670.	0	15,997.317	6,570.	1,130.
Cadmium	UG/KG	12	12	100.00%	2,000.	0	526,442.308	737,770.	2,460.
Calcium	UG/KG	12	12	100.00%	102,000,000.	0			125,300,000.
Chromium	UG/KG	12	12	100.00%	23,300.	0	1,052,884,615.	850,430.	30,000.
Cobalt	UG/KG	12	12	100.00%	13,100.	0	63,173,076.92		30,000.
Copper	UG/KG	12	12	100.00%	190,000.	0	42,115,384.62	827,810.	33,000.
Cyanide	UG/KG	12	0	0.00%	.	0		13,636,360.	350.
Iron	UG/KG	12	12	100.00%	32,100,000.	0	315,865,384.6		37,410,000.
Lead	UG/KG	12	12	100.00%	66,700.	0		181,460.	24,400.
Magnesium	UG/KG	12	12	100.00%	25,400,000.	0			21,700,000.
Manganese	UG/KG	12	12	100.00%	536,000.	0	24,216,346.15	8,821,860.	1,100,000.
Mercury	UG/KG	12	10	83.33%	80.	0	315,865.385	1,710.	100.
Nickel	UG/KG	12	12	100.00%	44,300.	0	21,057,692.31	2,833,820.	50,000.
Potassium	UG/KG	12	12	100.00%	1,920,000.	0			2,623,000.
Selenium	UG/KG	12	4	33.33%	1,500.	0	5,264,423.077	193,140.	2,000.
Silver	UG/KG	12	0	0.00%	.	0	5,264,423.077		800.
Sodium	UG/KG	12	12	100.00%	140,000.	0			188,000.
Thallium	UG/KG	12	0	0.00%	.	0	84,230.769		855.
Vanadium	UG/KG	12	12	100.00%	26,200.	0	7,370,192.308		150,000.
Zinc	UG/KG	12	12	100.00%	569,000.	0	315,865,384.6		115,000.
Other Analyses									
Total Petroleum Hydrocarbons	UG/KG	12	9	75.00%	218,000,000.	0			

SEAD-52/60

GROUNDWATER

COLLAPSED DATA TABLES

AND

SUMMARY STATISTICS TABLES

4/30/98

Seneca Army Depot Activity
SEAD-60
Summary Statistics - Groundwater
NYS Class GA Standard

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Drinking Water PRG	NYS Class GA Standard
Volatiles								
1,1,1-Trichloroethane	UG/L	4	0	0.00%	.	0	792.549	5.
1,1,2,2-Tetrachloroethane	UG/L	4	0	0.00%	.	0	.521	5.
1,1,2-Trichloroethane	UG/L	4	0	0.00%	.	0	.188	
1,1-Dichloroethane	UG/L	4	0	0.00%	.	0	811.742	5.
1,1-Dichloroethene	UG/L	4	0	0.00%	.	0	.044	5.
1,2-Dichloroethane	UG/L	4	0	0.00%	.	0	.116	5.
1,2-Dichloroethene (total)	UG/L	4	0	0.00%	.	0		5.
1,2-Dichloropropane	UG/L	4	0	0.00%	.	0	.989	5.
Acetone	UG/L	4	3	75.00%	77.	0	3,650.	
Benzene	UG/L	4	1	25.00%	1.	1	.364	.7
Bromodichloromethane	UG/L	4	0	0.00%	.	0	1.084	
Bromoform	UG/L	4	0	0.00%	.	0	2.354	
Carbon disulfide	UG/L	4	0	0.00%	.	0	1,042.857	
Carbon tetrachloride	UG/L	4	0	0.00%	.	0	.163	5.
Chlorobenzene	UG/L	4	0	0.00%	.	0	39.431	5.
Chlorodibromomethane	UG/L	4	0	0.00%	.	0	.8	
Chloroethane	UG/L	4	0	0.00%	.	0	8,591.77	5.
Chloroform	UG/L	4	0	0.00%	.	0	.153	7.
Cis-1,3-Dichloropropene	UG/L	4	0	0.00%	.	0		5.
Ethyl benzene	UG/L	4	0	0.00%	.	0	1,328.117	5.
Methyl bromide	UG/L	4	0	0.00%	.	0	8.699	
Methyl butyl ketone	UG/L	4	0	0.00%	.	0		
Methyl chloride	UG/L	4	0	0.00%	.	0	1.436	5.
Methyl ethyl ketone	UG/L	4	0	0.00%	.	0		50.
Methyl isobutyl ketone	UG/L	4	0	0.00%	.	0	158.118	
Methylene chloride	UG/L	4	0	0.00%	.	0	4.124	5.
Styrene	UG/L	4	0	0.00%	.	0		
Tetrachloroethene	UG/L	4	0	0.00%	.	0	1.069	5.
Toluene	UG/L	4	0	0.00%	.	0	747.038	5.
Total Xylenes	UG/L	4	0	0.00%	.	0	73,000.	5.
Trans-1,3-Dichloropropene	UG/L	4	0	0.00%	.	0		5.
Trichloroethene	UG/L	4	0	0.00%	.	0	1.556	5.
Vinyl chloride	UG/L	4	0	0.00%	.	0	.019	2.
Semivolatile Organics								
1,2,4-Trichlorobenzene	UG/L	4	0	0.00%	.	0	194.599	5.
1,2-Dichlorobenzene	UG/L	4	0	0.00%	.	0	268.163	4.7
1,3-Dichlorobenzene	UG/L	4	0	0.00%	.	0	3,248.5	5.
1,4-Dichlorobenzene	UG/L	4	0	0.00%	.	0	2.802	4.7
2,2'-oxybis(1-Chloropropane)	UG/L	4	0	0.00%	.	0		
2,4,5-Trichlorophenol	UG/L	4	0	0.00%	.	0	3,650.	
2,4,6-Trichlorophenol	UG/L	4	0	0.00%	.	0	.967	
2,4-Dichlorophenol	UG/L	4	0	0.00%	.	0	109.5	
2,4-Dimethylphenol	UG/L	4	0	0.00%	.	0	730.	5.
2,4-Dinitrophenol	UG/L	4	0	0.00%	.	0	73.	
2,4-Dinitrotoluene	UG/L	4	0	0.00%	.	0	73.	5.
2,6-Dinitrotoluene	UG/L	4	0	0.00%	.	0	36.5	5.
2-Chloronaphthalene	UG/L	4	0	0.00%	.	0		
2-Chlorophenol	UG/L	4	0	0.00%	.	0	182.5	
2-Methylnaphthalene	UG/L	4	0	0.00%	.	0		
2-Methylphenol	UG/L	4	0	0.00%	.	0	1,825.	5.
2-Nitroaniline	UG/L	4	0	0.00%	.	0	.35	
2-Nitrophenol	UG/L	4	0	0.00%	.	0		
3,3`-Dichlorobenzidine	UG/L	4	0	0.00%	.	0	.149	
3-Nitroaniline	UG/L	4	0	0.00%	.	0	109.5	
4,6-Dinitro-2-methylphenol	UG/L	4	0	0.00%	.	0		5.
4-Bromophenyl phenyl ether	UG/L	4	0	0.00%	.	0	2,117.	
4-Chloro-3-methylphenol	UG/L	4	0	0.00%	.	0		
4-Chloroaniline	UG/L	4	0	0.00%	.	0	146.	5.
4-Chlorophenyl phenyl ether	UG/L	4	0	0.00%	.	0		
4-Methylphenol	UG/L	4	0	0.00%	.	0		5.
4-Nitroaniline	UG/L	4	0	0.00%	.	0	109.5	5.
4-Nitrophenol	UG/L	4	0	0.00%	.	0	2,190.	
Acenaphthene	UG/L	4	0	0.00%	.	0		
Acenaphthylene	UG/L	4	0	0.00%	.	0		
Anthracene	UG/L	4	0	0.00%	.	0	10,950.	
Benzo[a]anthracene	UG/L	4	0	0.00%	.	0	.017	
Benzo[a]pyrene	UG/L	4	0	0.00%	.	0	.002	10.
Benzo[b]fluoranthene	UG/L	4	0	0.00%	.	0	.017	
Benzo[ghi]perylene	UG/L	4	0	0.00%	.	0		

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Drinking Water PRG	NYS Class GA Standard
Benzo[k]fluoranthene	UG/L	4	0	0.00%	.	0	.168	
Bis(2-Chloroethoxy)methane	UG/L	4	0	0.00%	.	0		
Bis(2-Chloroethyl)ether	UG/L	4	0	0.00%	.	0	.009	
Bis(2-Ethylhexyl)phthalate	UG/L	4	0	0.00%	.	0	4.803	50.
Butylbenzylphthalate	UG/L	4	0	0.00%	.	0	7,300.	
Carbazole	UG/L	4	0	0.00%	.	0	3.362	
Chrysene	UG/L	4	0	0.00%	.	0	1.679	
Di-n-butylphthalate	UG/L	4	0	0.00%	.	0		50.
Di-n-octylphthalate	UG/L	4	0	0.00%	.	0	730.	
Dibenz[a,h]anthracene	UG/L	4	0	0.00%	.	0	.002	
Dibenzofuran	UG/L	4	0	0.00%	.	0	146.	
Diethyl phthalate	UG/L	4	0	0.00%	.	0	29,200.	
Dimethylphthalate	UG/L	4	0	0.00%	.	0	365,000.	
Fluoranthene	UG/L	4	0	0.00%	.	0	1,460.	
Fluorene	UG/L	4	0	0.00%	.	0	1,460.	
Hexachlorobenzene	UG/L	4	0	0.00%	.	0	.007	.35
Hexachlorobutadiene	UG/L	4	0	0.00%	.	0	.137	
Hexachlorocyclopentadiene	UG/L	4	0	0.00%	.	0	.146	
Hexachloroethane	UG/L	4	0	0.00%	.	0	.754	
Indeno[1,2,3-cd]pyrene	UG/L	4	0	0.00%	.	0	.017	
Isophorone	UG/L	4	0	0.00%	.	0		
N-Nitrosodiphenylamine	UG/L	4	0	0.00%	.	0	13.722	
N-Nitrosodipropylamine	UG/L	4	0	0.00%	.	0	.01	
Naphthalene	UG/L	4	0	0.00%	.	0	1,460.	
Nitrobenzene	UG/L	4	0	0.00%	.	0	3.393	
Pentachlorophenol	UG/L	4	0	0.00%	.	0	.56	1.
Phenanthrene	UG/L	4	0	0.00%	.	0		
Phenol	UG/L	4	0	0.00%	.	0	21,900.	1.
Pyrene	UG/L	4	0	0.00%	.	0	1,095.	
Pesticides/PCBs								
4,4`-DDD	UG/L	4	0	0.00%	.	0	.28	.1
4,4`-DDE	UG/L	4	0	0.00%	.	0	.198	.1
4,4`-DDT	UG/L	4	0	0.00%	.	0	.031	.1
Aldrin	UG/L	4	0	0.00%	.	0	.001	.055
Alpha-BHC	UG/L	4	0	0.00%	.	0		
Alpha-Chlordane	UG/L	4	0	0.00%	.	0		5.
Aroclor-1016	UG/L	4	0	0.00%	.	0	2.555	
Aroclor-1221	UG/L	4	0	0.00%	.	0		
Aroclor-1232	UG/L	4	0	0.00%	.	0		
Aroclor-1242	UG/L	4	0	0.00%	.	0		
Aroclor-1248	UG/L	4	0	0.00%	.	0		
Aroclor-1254	UG/L	4	0	0.00%	.	0	.73	.1
Aroclor-1260	UG/L	4	0	0.00%	.	0		.1
Beta-BHC	UG/L	4	1	25.00%	.049	0		5.
Delta-BHC	UG/L	4	0	0.00%	.	0		
Dieldrin	UG/L	4	0	0.00%	.	0	.001	.1
Endosulfan I	UG/L	4	0	0.00%	.	0	219.	
Endosulfan II	UG/L	4	0	0.00%	.	0	219.	
Endosulfan sulfate	UG/L	4	0	0.00%	.	0		
Endrin	UG/L	4	0	0.00%	.	0	10.95	.1
Endrin aldehyde	UG/L	4	0	0.00%	.	0	10.95	5.
Endrin ketone	UG/L	4	0	0.00%	.	0	10.95	5.
Gamma-BHC/Lindane	UG/L	4	0	0.00%	.	0	.052	5.
Gamma-Chlordane	UG/L	4	0	0.00%	.	0		
Heptachlor	UG/L	4	0	0.00%	.	0	.002	.05
Heptachlor epoxide	UG/L	4	0	0.00%	.	0	.001	.05
Methoxychlor	UG/L	4	0	0.00%	.	0	182.5	35.
Toxaphene	UG/L	4	0	0.00%	.	0		
Metals								
Aluminum	UG/L	4	4	100.00%	376.	0	36,500.	
Antimony	UG/L	4	0	0.00%	.	0	14.6	
Arsenic	UG/L	4	0	0.00%	.	0	.007	25.
Barium	UG/L	4	4	100.00%	88.7	0	1.043	1,000.
Beryllium	UG/L	4	0	0.00%	.	0	.001	
Cadmium	UG/L	4	0	0.00%	.	0	.002	10.
Calcium	UG/L	4	4	100.00%	113,000.	0		
Chromium	UG/L	4	2	50.00%	.56	0	.004	50.
Cobalt	UG/L	4	1	25.00%	.72	0	2,190.	
Copper	UG/L	4	1	25.00%	.99	0	1,460.	200.
Cyanide	UG/L	4	0	0.00%	.	0		100.

Seneca Army Depot Activity
SEAD-60
Summary Statistics - Groundwater
NYS Class GA Standard

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Drinking Water PRG	NYS Class GA Standard
Iron	UG/L	4	4	100.00%	1,440.	4	10,950.	300.
Lead	UG/L	4	0	0.00%	.	0		25.
Magnesium	UG/L	4	4	100.00%	55,100.	0		
Manganese	UG/L	4	4	100.00%	377.	1	.104	300.
Mercury	UG/L	4	2	50.00%	.05	0	.592	2.
Nickel	UG/L	4	1	25.00%	1.6	0	730.	
Potassium	UG/L	4	4	100.00%	8,760.	0		
Selenium	UG/L	4	0	0.00%	.	0	182.5	10.
Silver	UG/L	4	0	0.00%	.	0	182.5	50.
Sodium	UG/L	4	4	100.00%	59,400.	1		20,000.
Thallium	UG/L	4	1	25.00%	1.8	0	2.92	
Vanadium	UG/L	4	2	50.00%	1.5	0	255.5	
Zinc	UG/L	4	3	75.00%	6.9	0	10,950.	300.
Other Analyses								
Total Petroleum Hydrocarbons	UG/L	4	3	75.00%	2,200.	0		

Seneca Army Depot Activity
SEAD-60
Collapsed Data Summary - Groundwater
Comparison to NYS Class GA Standard

STUDY ID:	ESI	ESI	ESI	ESI
SITE:	SEAD-60	SEAD-60	SEAD-60	SEAD-60
LOC ID:	MW60-1	MW60-2	MW60-2	MW60-3
LOC TYPE:	BACKGROUND	SITE	SITE	SITE
SAMP_ID:	MW60-1	MW60-5	MW60-2	MW60-3
QC CODE:	SA	DU	SA	SA
SAMP. DETH TOP:	5.4	4.4	4.4	4
SAMP. DEPTH BOT:	17.2	18.4	18.4	22.95
MATRIX:	GROUNDWATER	GROUNDWATER	GROUNDWATER	GROUNDWATER
SAMP. DATE:	07-Jul-94	07-Jul-94	07-Jul-94	29-Mar-94

ER	UNIT	Number of Exceedances	Drinking Water PRG	NYS Class GA Standard	VALUE Q	VALUE Q	VALUE Q	VALUE Q
	UG/L	1	.364	.7	1. J	10. U	10. U	10. U
	UG/L	4	10,950.	300.	1,290.	[illegible]	[illegible]	[illegible]
	UG/L	1	.104	300.	377.	116.	125.	166.
	UG/L	1		20,000.	59,400.	10,900.	12,300.	11,400.

4/30/98

Seneca Army Depot Activity
SEAD-60
Summary Statistics - Groundwater
Comparison to Drinking Water PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Drinking Water PRG	NYS Class GA Standard
Volatiles								
1,1,1-Trichloroethane	UG/L	4	0	0.00%	.	0	792.549	5.
1,1,2,2-Tetrachloroethane	UG/L	4	0	0.00%	.	0	.521	5.
1,1,2-Trichloroethane	UG/L	4	0	0.00%	.	0	.188	
1,1-Dichloroethane	UG/L	4	0	0.00%	.	0	811.742	5.
1,1-Dichloroethene	UG/L	4	0	0.00%	.	0	.044	5.
1,2-Dichloroethane	UG/L	4	0	0.00%	.	0	.116	5.
1,2-Dichloroethene (total)	UG/L	4	0	0.00%	.	0		5.
1,2-Dichloropropane	UG/L	4	0	0.00%	.	0	.989	5.
Acetone	UG/L	4	3	75.00%	77.	0	3,650.	
Benzene	UG/L	4	1	25.00%	1.	1	.364	.7
Bromodichloromethane	UG/L	4	0	0.00%	.	0	1.084	
Bromoform	UG/L	4	0	0.00%	.	0	2.354	
Carbon disulfide	UG/L	4	0	0.00%	.	0	1,042.857	
Carbon tetrachloride	UG/L	4	0	0.00%	.	0	.163	5.
Chlorobenzene	UG/L	4	0	0.00%	.	0	39.431	5.
Chlorodibromomethane	UG/L	4	0	0.00%	.	0	.8	
Chloroethane	UG/L	4	0	0.00%	.	0	8,591.77	5.
Chloroform	UG/L	4	0	0.00%	.	0	.153	7.
Cis-1,3-Dichloropropene	UG/L	4	0	0.00%	.	0		5.
Ethyl benzene	UG/L	4	0	0.00%	.	0	1,328.117	5.
Methyl bromide	UG/L	4	0	0.00%	.	0	8.699	
Methyl butyl ketone	UG/L	4	0	0.00%	.	0		
Methyl chloride	UG/L	4	0	0.00%	.	0	1.436	5.
Methyl ethyl ketone	UG/L	4	0	0.00%	.	0		50.
Methyl isobutyl ketone	UG/L	4	0	0.00%	.	0	158.118	
Methylene chloride	UG/L	4	0	0.00%	.	0	4.124	5.
Styrene	UG/L	4	0	0.00%	.	0		
Tetrachloroethene	UG/L	4	0	0.00%	.	0	1.069	5.
Toluene	UG/L	4	0	0.00%	.	0	747.038	5.
Total Xylenes	UG/L	4	0	0.00%	.	0	73,000.	5.
Trans-1,3-Dichloropropene	UG/L	4	0	0.00%	.	0		5.
Trichloroethene	UG/L	4	0	0.00%	.	0	1.556	5.
Vinyl chloride	UG/L	4	0	0.00%	.	0	.019	2.
Semivolatile Organics								
1,2,4-Trichlorobenzene	UG/L	4	0	0.00%	.	0	194.599	5.
1,2-Dichlorobenzene	UG/L	4	0	0.00%	.	0	268.163	4.7
1,3-Dichlorobenzene	UG/L	4	0	0.00%	.	0	3,248.5	5.
1,4-Dichlorobenzene	UG/L	4	0	0.00%	.	0	2.802	4.7
2,2'-oxybis(1-Chloropropane)	UG/L	4	0	0.00%	.	0		
2,4,5-Trichlorophenol	UG/L	4	0	0.00%	.	0	3,650.	
2,4,6-Trichlorophenol	UG/L	4	0	0.00%	.	0	.967	
2,4-Dichlorophenol	UG/L	4	0	0.00%	.	0	109.5	
2,4-Dimethylphenol	UG/L	4	0	0.00%	.	0	730.	5.
2,4-Dinitrophenol	UG/L	4	0	0.00%	.	0	73.	
2,4-Dinitrotoluene	UG/L	4	0	0.00%	.	0	73.	5.
2,6-Dinitrotoluene	UG/L	4	0	0.00%	.	0	36.5	5.
2-Chloronaphthalene	UG/L	4	0	0.00%	.	0		
2-Chlorophenol	UG/L	4	0	0.00%	.	0	182.5	
2-Methylnaphthalene	UG/L	4	0	0.00%	.	0		
2-Methylphenol	UG/L	4	0	0.00%	.	0	1,825.	5.
2-Nitroaniline	UG/L	4	0	0.00%	.	0	.35	
2-Nitrophenol	UG/L	4	0	0.00%	.	0		
3,3`-Dichlorobenzidine	UG/L	4	0	0.00%	.	0	.149	
3-Nitroaniline	UG/L	4	0	0.00%	.	0	109.5	
4,6-Dinitro-2-methylphenol	UG/L	4	0	0.00%	.	0		5.
4-Bromophenyl phenyl ether	UG/L	4	0	0.00%	.	0	2,117.	
4-Chloro-3-methylphenol	UG/L	4	0	0.00%	.	0		
4-Chloroaniline	UG/L	4	0	0.00%	.	0	146.	5.
4-Chlorophenyl phenyl ether	UG/L	4	0	0.00%	.	0		
4-Methylphenol	UG/L	4	0	0.00%	.	0		5.
4-Nitroaniline	UG/L	4	0	0.00%	.	0	109.5	5.
4-Nitrophenol	UG/L	4	0	0.00%	.	0	2,190.	
Acenaphthene	UG/L	4	0	0.00%	.	0		
Acenaphthylene	UG/L	4	0	0.00%	.	0		
Anthracene	UG/L	4	0	0.00%	.	0	10,950.	
Benzo[a]anthracene	UG/L	4	0	0.00%	.	0	.017	
Benzo[a]pyrene	UG/L	4	0	0.00%	.	0	.002	10.

Seneca Army Depot Activity
SEAD-60
Summary Statistics - Groundwater
Comparison to Drinking Water PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Drinking Water PRG	NYS Class GA Standard
Benzo[b]fluoranthene	UG/L	4	0	0.00%	.	0	.017	
Benzo[ghi]perylene	UG/L	4	0	0.00%	.	0		
Benzo[k]fluoranthene	UG/L	4	0	0.00%	.	0	.168	
Bis(2-Chloroethoxy)methane	UG/L	4	0	0.00%	.	0		
Bis(2-Chloroethyl)ether	UG/L	4	0	0.00%	.	0	.009	
Bis(2-Ethylhexyl)phthalate	UG/L	4	0	0.00%	.	0	4.803	50.
Butylbenzylphthalate	UG/L	4	0	0.00%	.	0	7,300.	
Carbazole	UG/L	4	0	0.00%	.	0	3.362	
Chrysene	UG/L	4	0	0.00%	.	0	1.679	
Di-n-butylphthalate	UG/L	4	0	0.00%	.	0		50.
Di-n-octylphthalate	UG/L	4	0	0.00%	.	0	730.	
Dibenz[a,h]anthracene	UG/L	4	0	0.00%	.	0	.002	
Dibenzofuran	UG/L	4	0	0.00%	.	0	146.	
Diethyl phthalate	UG/L	4	0	0.00%	.	0	29,200.	
Dimethylphthalate	UG/L	4	0	0.00%	.	0	365,000.	
Fluoranthene	UG/L	4	0	0.00%	.	0	1,460.	
Fluorene	UG/L	4	0	0.00%	.	0	1,460.	
Hexachlorobenzene	UG/L	4	0	0.00%	.	0	.007	.35
Hexachlorobutadiene	UG/L	4	0	0.00%	.	0	.137	
Hexachlorocyclopentadiene	UG/L	4	0	0.00%	.	0	.146	
Hexachloroethane	UG/L	4	0	0.00%	.	0	.754	
Indeno[1,2,3-cd]pyrene	UG/L	4	0	0.00%	.	0	.017	
Isophorone	UG/L	4	0	0.00%	.	0		
N-Nitrosodiphenylamine	UG/L	4	0	0.00%	.	0	13.722	
N-Nitrosodipropylamine	UG/L	4	0	0.00%	.	0	.01	
Naphthalene	UG/L	4	0	0.00%	.	0	1,460.	
Nitrobenzene	UG/L	4	0	0.00%	.	0	3.393	
Pentachlorophenol	UG/L	4	0	0.00%	.	0	.56	1.
Phenanthrene	UG/L	4	0	0.00%	.	0		
Phenol	UG/L	4	0	0.00%	.	0	21,900.	1.
Pyrene	UG/L	4	0	0.00%	.	0	1,095.	
Pesticides/PCBs								
4,4`-DDD	UG/L	4	0	0.00%	.	0	.28	.1
4,4`-DDE	UG/L	4	0	0.00%	.	0	.198	.1
4,4`-DDT	UG/L	4	0	0.00%	.	0	.031	.1
Aldrin	UG/L	4	0	0.00%	.	0	.001	.055
Alpha-BHC	UG/L	4	0	0.00%	.	0		
Alpha-Chlordane	UG/L	4	0	0.00%	.	0		5.
Aroclor-1016	UG/L	4	0	0.00%	.	0	2.555	
Aroclor-1221	UG/L	4	0	0.00%	.	0		
Aroclor-1232	UG/L	4	0	0.00%	.	0		
Aroclor-1242	UG/L	4	0	0.00%	.	0		
Aroclor-1248	UG/L	4	0	0.00%	.	0		
Aroclor-1254	UG/L	4	0	0.00%	.	0	.73	.1
Aroclor-1260	UG/L	4	0	0.00%	.	0		.1
Beta-BHC	UG/L	4	1	25.00%	.049	0		5.
Delta-BHC	UG/L	4	0	0.00%	.	0		
Dieldrin	UG/L	4	0	0.00%	.	0	.001	.1
Endosulfan I	UG/L	4	0	0.00%	.	0	219.	
Endosulfan II	UG/L	4	0	0.00%	.	0	219.	
Endosulfan sulfate	UG/L	4	0	0.00%	.	0		
Endrin	UG/L	4	0	0.00%	.	0	10.95	.1
Endrin aldehyde	UG/L	4	0	0.00%	.	0	10.95	5.
Endrin ketone	UG/L	4	0	0.00%	.	0	10.95	5.
Gamma-BHC/Lindane	UG/L	4	0	0.00%	.	0	.052	5.
Gamma-Chlordane	UG/L	4	0	0.00%	.	0		
Heptachlor	UG/L	4	0	0.00%	.	0	.002	.05
Heptachlor epoxide	UG/L	4	0	0.00%	.	0	.001	.05
Methoxychlor	UG/L	4	0	0.00%	.	0	182.5	35.
Toxaphene	UG/L	4	0	0.00%	.	0		
Metals								
Aluminum	UG/L	4	4	100.00%	376.	0	36,500.	
Antimony	UG/L	4	0	0.00%	.	0	14.6	
Arsenic	UG/L	4	0	0.00%	.	0	.007	25.
Barium	UG/L	4	4	100.00%	88.7	4	1.043	1,000.
Beryllium	UG/L	4	0	0.00%	.	0	.001	
Cadmium	UG/L	4	0	0.00%	.	0	.002	10.
Calcium	UG/L	4	4	100.00%	113,000.	0		

Seneca Army Depot Activity
SEAD-60
Summary Statistics - Groundwater
Comparison to Drinking Water PRG

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	Drinking Water PRG	NYS Class GA Standard
Chromium	UG/L	4	2	50.00%	.56	2	.004	50.
Cobalt	UG/L	4	1	25.00%	.72	0	2,190.	
Copper	UG/L	4	1	25.00%	.99	0	1,460.	200.
Cyanide	UG/L	4	0	0.00%	.	0		100.
Iron	UG/L	4	4	100.00%	1,440.	0	10,950.	300.
Lead	UG/L	4	0	0.00%	.	0		25.
Magnesium	UG/L	4	4	100.00%	55,100.	0		
Manganese	UG/L	4	4	100.00%	377.	4	.104	300.
Mercury	UG/L	4	2	50.00%	.05	0	.592	2.
Nickel	UG/L	4	1	25.00%	1.6	0	730.	
Potassium	UG/L	4	4	100.00%	8,760.	0		
Selenium	UG/L	4	0	0.00%	.	0	182.5	10.
Silver	UG/L	4	0	0.00%	.	0	182.5	50.
Sodium	UG/L	4	4	100.00%	59,400.	0		20,000.
Thallium	UG/L	4	1	25.00%	1.8	0	2.92	
Vanadium	UG/L	4	2	50.00%	1.5	0	255.5	
Zinc	UG/L	4	3	75.00%	6.9	0	10,950.	300.
Other Analyses								
Total Petroleum Hydrocarbons	UG/L	4	3	75.00%	2,200.	0		

Seneca Army Depot Activity
SEAD-60
Collapsed Data Summary - Groundwater
Comparison to Drinking Water PRG

STUDY ID:	ESI	ESI	ESI	ESI
SITE:	SEAD-60	SEAD-60	SEAD-60	SEAD-60
LOC ID:	MW60-1	MW60-2	MW60-2	MW60-3
LOC TYPE:	BACKGROUND	SITE	SITE	SITE
SAMP_ID:	MW60-1	MW60-5	MW60-2	MW60-3
QC CODE:	SA	DU	SA	SA
SAMP. DETH TOP:	5.4	4.4	4.4	4
SAMP. DEPTH BOT:	17.2	18.4	18.4	22.95
MATRIX:	GROUNDWATER	GROUNDWATER	GROUNDWATER	GROUNDWATER
SAMP. DATE:	07-Jul-94	07-Jul-94	07-Jul-94	29-Mar-94

ER	UNIT	Number of Exceedances	Drinking Water PRG	NYS Class GA Standard	VALUE Q	VALUE Q	VALUE Q	VALUE
	UG/L	1	.364	.7	1. J	10. U	10. U	10.
	UG/L	4	1.043	1,000.	88.7 J	[illegible] J	[illegible] J	34.
	UG/L	2	.004	50.	.56 J	.4 U	.4 U	.51
e	UG/L	4	.104	300.	377.	116.	125.	166.

SEAD-52/60

SURFACE WATER

COLLAPSED DATA TABLES

AND

SUMMARY STATISTICS TABLES

Seneca Army Depot Activity
SEAD-60 - Surface Water/Sediment
Summary Stastics
Comparison to NYS Class C Standard

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	CRITERIA	CRITERIA VALUE
Volatiles								
1,1,1-Trichloroethane	UG/L	4	0	0	0	0		
1,1,2,2-Tetrachloroethane	UG/L	4	0	0	0	0		
1,1,2-Trichloroethane	UG/L	4	0	0	0	0		
1,1-Dichloroethane	UG/L	4	0	0	0	0		
1,1-Dichloroethene	UG/L	4	0	0	0	0		
1,2-Dichloroethane	UG/L	4	0	0	0	0		
1,2-Dichloroethene (total)	UG/L	4	0	0	0	0		
1,2-Dichloropropane	UG/L	4	0	0	0	0		
Acetone	UG/L	4	0	0	0	0		
Benzene	UG/L	4	0	0	0	0		
Bromodichloromethane	UG/L	4	0	0	0	0		
Bromoform	UG/L	4	0	0	0	0		
Carbon disulfide	UG/L	4	0	0	0	0		
Carbon tetrachloride	UG/L	4	0	0	0	0		
Chlorobenzene	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	5.
Chlorodibromomethane	UG/L	4	0	0	0	0		
Chloroethane	UG/L	4	0	0	0	0		
Chloroform	UG/L	4	0	0	0	0		
Cis-1,3-Dichloropropene	UG/L	4	0	0	0	0		
Ethyl benzene	UG/L	4	0	0	0	0		
Methyl bromide	UG/L	4	0	0	0	0		
Methyl butyl ketone	UG/L	4	0	0	0	0		
Methyl chloride	UG/L	4	0	0	0	0		
Methyl ethyl ketone	UG/L	4	0	0	0	0		
Methyl isobutyl ketone	UG/L	4	0	0	0	0		
Methylene chloride	UG/L	4	0	0	0	0		
Styrene	UG/L	4	0	0	0	0		
Tetrachloroethene	UG/L	4	0	0	0	0		
Toluene	UG/L	4	0	0	0	0		
Total Xylenes	UG/L	4	0	0	0	0		
Trans-1,3-Dichloropropene	UG/L	4	0	0	0	0		
Trichloroethene	UG/L	4	0	0	0	0		
Vinyl chloride	UG/L	4	0	0	0	0		
Semivolatile Organics								
1,2,4-Trichlorobenzene	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	5.
1,2-Dichlorobenzene	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	5.
1,3-Dichlorobenzene	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	5.
1,4-Dichlorobenzene	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	5.
2,2'-oxybis(1-Chloropropane)	UG/L	4	0	0	0	0		
2,4,5-Trichlorophenol	UG/L	4	0	0	0	0		
2,4,6-Trichlorophenol	UG/L	4	0	0	0	0		
2,4-Dichlorophenol	UG/L	4	0	0	0	0		
2,4-Dimethylphenol	UG/L	4	0	0	0	0		
2,4-Dinitrophenol	UG/L	4	0	0	0	0		
2,4-Dinitrotoluene	UG/L	4	0	0	0	0		
2,6-Dinitrotoluene	UG/L	4	0	0	0	0		
2-Chloronaphthalene	UG/L	4	0	0	0	0		
2-Chlorophenol	UG/L	4	0	0	0	0		
2-Methylnaphthalene	UG/L	4	0	0	0	0		
2-Methylphenol	UG/L	4	0	0	0	0		
2-Nitroaniline	UG/L	4	0	0	0	0		
2-Nitrophenol	UG/L	4	0	0	0	0		
3,3`-Dichlorobenzidine	UG/L	4	0	0	0	0		
3-Nitroaniline	UG/L	4	0	0	0	0		
4,6-Dinitro-2-methylphenol	UG/L	4	0	0	0	0		
4-Bromophenyl phenyl ether	UG/L	4	0	0	0	0		
4-Chloro-3-methylphenol	UG/L	4	0	0	0	0		
4-Chloroaniline	UG/L	4	0	0	0	0		
4-Chlorophenyl phenyl ether	UG/L	4	0	0	0	0		
4-Methylphenol	UG/L	4	0	0	0	0		
4-Nitroaniline	UG/L	4	0	0	0	0		
4-Nitrophenol	UG/L	4	0	0	0	0		
Acenaphthene	UG/L	4	0	0	0	0		
Acenaphthylene	UG/L	4	0	0	0	0		
Anthracene	UG/L	4	0	0	0	0		
Benzo[a]anthracene	UG/L	4	0	0	0	0		

Seneca Army Depot Activity
SEAD-60 - Surface Water/Sediment
Summary Stastics
Comparison to NYS Class C Standard

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	CRITERIA	CRITERIA VALUE
Volatiles								
Benzo[a]pyrene	UG/L	4	0	0	0	0		
Benzo[b]fluoranthene	UG/L	4	0	0	0	0		
Benzo[ghi]perylene	UG/L	4	0	0	0	0		
Benzo[k]fluoranthene	UG/L	4	0	0	0	0		
Bis(2-Chloroethoxy)methane	UG/L	4	0	0	0	0		
Bis(2-Chloroethyl)ether	UG/L	4	0	0	0	0		
Bis(2-Ethylhexyl)phthalate	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.6
Butylbenzylphthalate	UG/L	4	0	0	0	0		
Carbazole	UG/L	4	0	0	0	0		
Chrysene	UG/L	4	0	0	0	0		
Di-n-butylphthalate	UG/L	4	0	0	0	0		
Di-n-octylphthalate	UG/L	4	0	0	0	0		
Dibenz[a,h]anthracene	UG/L	4	0	0	0	0		
Dibenzofuran	UG/L	4	0	0	0	0		
Diethyl phthalate	UG/L	4	0	0	0	0		
Dimethylphthalate	UG/L	4	0	0	0	0		
Fluoranthene	UG/L	4	0	0	0	0		
Fluorene	UG/L	4	0	0	0	0		
Hexachlorobenzene	UG/L	4	0	0	0	0		
Hexachlorobutadiene	UG/L	4	0	0	0	0		
Hexachlorocyclopentadiene	UG/L	4	0	0	0	0		
Hexachloroethane	UG/L	4	0	0	0	0		
Indeno[1,2,3-cd]pyrene	UG/L	4	0	0	0	0		
Isophorone	UG/L	4	0	0	0	0		
N-Nitrosodiphenylamine	UG/L	4	0	0	0	0		
N-Nitrosodipropylamine	UG/L	4	0	0	0	0		
Naphthalene	UG/L	4	0	0	0	0		
Nitrobenzene	UG/L	4	0	0	0	0		
Pentachlorophenol	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.4
Phenanthrene	UG/L	4	0	0	0	0		
Phenol	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	5.
Pyrene	UG/L	4	0	0	0	0		
Pesticides/PCBs								
4,4`-DDD	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.001
4,4`-DDE	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.001
4,4`-DDT	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.001
Aldrin	UG/L	4	0	0	0	0		
Alpha-BHC	UG/L	4	0	0	0	0		
Alpha-Chlordane	UG/L	4	0	0	0	0		
Aroclor-1016	UG/L	4	0	0	0	0		
Aroclor-1221	UG/L	4	0	0	0	0		
Aroclor-1232	UG/L	4	0	0	0	0		
Aroclor-1242	UG/L	4	0	0	0	0		
Aroclor-1248	UG/L	4	0	0	0	0		
Aroclor-1254	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.001
Aroclor-1260	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.001
Beta-BHC	UG/L	4	0	0	0	0		
Delta-BHC	UG/L	4	0	0	0	0		
Dieldrin	UG/L	4	0	0	0	0		
Endosulfan I	UG/L	4	0	0	0	0		
Endosulfan II	UG/L	4	0	0	0	0		
Endosulfan sulfate	UG/L	4	0	0	0	0		
Endrin	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.002
Endrin aldehyde	UG/L	4	0	0	0	0		
Endrin ketone	UG/L	4	0	0	0	0		
Gamma-BHC/Lindane	UG/L	4	0	0	0	0		
Gamma-Chlordane	UG/L	4	0	0	0	0		
Heptachlor	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.001
Heptachlor epoxide	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.001
Methoxychlor	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.03
Toxaphene	UG/L	4	0	0	0	0		
Metals								
Aluminum	UG/L	4	4	1	259	1	NYS AWQS CLASS C (AQUATIC)	100.
Antimony	UG/L	4	0	0	0	0		
Arsenic	UG/L	4	1	0.25	1.6	0	NYS AWQS CLASS C (AQUATIC)	190.
Barium	UG/L	4	4	1	49.4	0		

Seneca Army Depot Activity
SEAD-60 - Surface Water/Sediment
Summary Stastics
Comparison to NYS Class C Standard

PARAMETER **Volatiles**	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	CRITERIA	CRITERIA VALUE
Beryllium	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	1.111
Cadmium	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	1.863
Calcium	UG/L	4	4	1	89000	0		
Chromium	UG/L	4	2	0.5	0.68	0	NYS AWQS CLASS C (AQUATIC)	347.27
Cobalt	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	5.
Copper	UG/L	4	4	1	2	0	NYS AWQS CLASS C (AQUATIC)	20.288
Cyanide	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	5.2
Iron	UG/L	4	4	1	453	1	NYS AWQS CLASS C (AQUATIC)	300.
Lead	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	7.164
Magnesium	UG/L	4	4	1	22000	0		
Manganese	UG/L	4	4	1	28.5	0		
Mercury	UG/L	4	0	0	0	0		
Nickel	UG/L	4	3	0.75	1.8	0	NYS AWQS CLASS C (AQUATIC)	154.489
Potassium	UG/L	4	4	1	1430	0		
Selenium	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	1.
Silver	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	.1
Sodium	UG/L	4	4	1	53800	0		
Thallium	UG/L	4	0	0	0	0	NYS AWQS CLASS C (AQUATIC)	8.
Vanadium	UG/L	4	1	0.25	0.85	0	NYS AWQS CLASS C (AQUATIC)	14.
Zinc	UG/L	4	4	1	9.6	0	NYS AWQS CLASS C (AQUATIC)	141.38

Seneca Army Depot Activity
SEAD-60
Collapsed Data Summary
Comparison to NYS Class C Standard

								STUDY ID:	ESI	ESI	ESI	
								SITE:	SEAD-60	SEAD-60	SEAD-60	SEA
								LOC ID:	SWSD60-1	SWSD60-2	SWSD60-3	SWS
								LOC TYPE:	SITE	SITE	SITE	
								SAMP_ID:	SW60-1	SW60-2	SW60-5	SV
								QC CODE:	SA	SA	DU	
								SAMP. DETH TOP:	0	0	0	
								SAMP. DEPTH BOT:	0.1	0.1	0.1	
								MATRIX:	SURFACE WATER	SURFACE WATER	SURFACE WATER	SURFACE WA
								SAMP. DATE:	27-Apr-94	20-Apr-94	20-Apr-94	20-A
ER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	CRITERIA	CRITERIA VALUE	VALUE Q	VALUE Q	VALUE Q	V
um	UG/L	4	4	100.00%	259	1	NYS AWQS CLASS C (AQUATIC)	100.	35.7 J	259.	93.5 J	
on	UG/L	4	4	100.00%	453	1	NYS AWQS CLASS C (AQUATIC)	300.	78. J	453.	121.	

SEAD-52/60

SEDIMENT

COLLAPSED DATA TABLES

AND

SUMMARY STATISTICS TABLES

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Seneca Army Depot Activity
SEAD-60 - Surface Water/Sediment
Collapsed Data Summary
Comparison to Minimum Sediment Criteria

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	CRITERIA	CRITERIA VALUE
Volatiles								
1,1,1-Trichloroethane	UG/KG	4	0	0.00%	0	0		
1,1,2,2-Tetrachloroethane	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	300.
1,1,2-Trichloroethane	UG/KG	4	0	0.00%	0	0		
1,1-Dichloroethane	UG/KG	4	0	0.00%	0	0		
1,1-Dichloroethene	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	20.
1,2-Dichloroethane	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	700.
1,2-Dichloroethene (total)	UG/KG	4	0	0.00%	0	0		
1,2-Dichloropropane	UG/KG	4	0	0.00%	0	0		
Acetone	UG/KG	4	0	0.00%	0	0		
Benzene	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	600.
Bromodichloromethane	UG/KG	4	0	0.00%	0	0		
Bromoform	UG/KG	4	0	0.00%	0	0		
Carbon disulfide	UG/KG	4	0	0.00%	0	0		
Carbon tetrachloride	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	600.
Chlorobenzene	UG/KG	4	0	0.00%	0	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	3,500.
Chlorodibromomethane	UG/KG	4	0	0.00%	0	0		
Chloroethane	UG/KG	4	0	0.00%	0	0		
Chloroform	UG/KG	4	1	25.00%	3	0		
Cis-1,3-Dichloropropene	UG/KG	4	0	0.00%	0	0		
Ethyl benzene	UG/KG	4	0	0.00%	0	0		
Methyl bromide	UG/KG	4	0	0.00%	0	0		
Methyl butyl ketone	UG/KG	4	0	0.00%	0	0		
Methyl chloride	UG/KG	4	0	0.00%	0	0		
Methyl ethyl ketone	UG/KG	4	0	0.00%	0	0		
Methyl isobutyl ketone	UG/KG	4	0	0.00%	0	0		
Methylene chloride	UG/KG	4	0	0.00%	0	0		
Styrene	UG/KG	4	0	0.00%	0	0		
Tetrachloroethene	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	800.
Toluene	UG/KG	4	0	0.00%	0	0		
Total Xylenes	UG/KG	4	0	0.00%	0	0		
Trans-1,3-Dichloropropene	UG/KG	4	0	0.00%	0	0		
Trichloroethene	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	2,000.
Vinyl chloride	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	70.
Semivolatile Organics								
1,2,4-Trichlorobenzene	UG/KG	4	0	0.00%	0	0		
1,2-Dichlorobenzene	UG/KG	4	0	0.00%	0	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	12,000.
1,3-Dichlorobenzene	UG/KG	4	0	0.00%	0	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	12,000.
1,4-Dichlorobenzene	UG/KG	4	0	0.00%	0	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	12,000.
2,2'-oxybis(1-Chloropropane)	UG/KG	4	0	0.00%	0	0		
2,4,5-Trichlorophenol	UG/KG	4	0	0.00%	0	0		
2,4,6-Trichlorophenol	UG/KG	4	0	0.00%	0	0		
2,4-Dichlorophenol	UG/KG	4	0	0.00%	0	0		
2,4-Dimethylphenol	UG/KG	4	0	0.00%	0	0		
2,4-Dinitrophenol	UG/KG	4	0	0.00%	0	0		
2,4-Dinitrotoluene	UG/KG	4	0	0.00%	0	0		
2,6-Dinitrotoluene	UG/KG	4	0	0.00%	0	0		
2-Chloronaphthalene	UG/KG	4	0	0.00%	0	0		
2-Chlorophenol	UG/KG	4	0	0.00%	0	0		
2-Methylnaphthalene	UG/KG	4	0	0.00%	0	0		
2-Methylphenol	UG/KG	4	0	0.00%	0	0		
2-Nitroaniline	UG/KG	4	0	0.00%	0	0		
2-Nitrophenol	UG/KG	4	0	0.00%	0	0		
3,3'-Dichlorobenzidine	UG/KG	4	0	0.00%	0	0		
3-Nitroaniline	UG/KG	4	0	0.00%	0	0		
4,6-Dinitro-2-methylphenol	UG/KG	4	0	0.00%	0	0		
4-Bromophenyl phenyl ether	UG/KG	4	0	0.00%	0	0		
4-Chloro-3-methylphenol	UG/KG	4	0	0.00%	0	0		
4-Chloroaniline	UG/KG	4	0	0.00%	0	0		
4-Chlorophenyl phenyl ether	UG/KG	4	0	0.00%	0	0		
4-Methylphenol	UG/KG	4	0	0.00%	0	0		
4-Nitroaniline	UG/KG	4	0	0.00%	0	0		
4-Nitrophenol	UG/KG	4	0	0.00%	0	0		
Acenaphthene	UG/KG	4	0	0.00%	0	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	140,000.
Acenaphthylene	UG/KG	4	0	0.00%	0	0		
Anthracene	UG/KG	4	0	0.00%	0	0		
Benzo[a]anthracene	UG/KG	4	3	75.00%	68	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	1,300.
Benzo[a]pyrene	UG/KG	4	3	75.00%	79	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	1,300.
Benzo[b]fluoranthene	UG/KG	4	3	75.00%	120	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	1,300.
Benzo[ghi]perylene	UG/KG	4	3	75.00%	93	0		
Benzo[k]fluoranthene	UG/KG	4	3	75.00%	97	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	1,300.
Bis(2-Chloroethoxy)methane	UG/KG	4	0	0.00%	0	0		
Bis(2-Chloroethyl)ether	UG/KG	4	0	0.00%	0	0		
Bis(2-Ethylhexyl)phthalate	UG/KG	4	4	100.00%	1100	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	200,000.
Butylbenzylphthalate	UG/KG	4	0	0.00%	0	0		
Carbazole	UG/KG	4	0	0.00%	0	0		
Chrysene	UG/KG	4	3	75.00%	160	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	1,300.
Di-n-butylphthalate	UG/KG	4	0	0.00%	0	0		
Di-n-octylphthalate	UG/KG	4	0	0.00%	0	0		
Dibenz[a,h]anthracene	UG/KG	4	0	0.00%	0	0		
Dibenzofuran	UG/KG	4	0	0.00%	0	0		
Diethyl phthalate	UG/KG	4	0	0.00%	0	0		
Dimethylphthalate	UG/KG	4	0	0.00%	0	0		
Fluoranthene	UG/KG	4	3	75.00%	200	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	1,020,000.
Fluorene	UG/KG	4	0	0.00%	0	0		
Hexachlorobenzene	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	150.
Hexachlorobutadiene	UG/KG	4	0	0.00%	0	0		

Seneca Army Depot Activity
SEAD-60 - Surface Water/Sediment
Collapsed Data Summary
Comparison to Minimum Sediment Criteria

5/1/98

PARAMETER	UNIT	Number of Analyses	Number of Detections	Frequency of Detection	Maximum Value	Number of Exceedances	CRITERIA	CRITERIA VALUE
Volatiles								
Hexachlorocyclopentadiene	UG/KG	4	0	0.00%	0	0		
Hexachloroethane	UG/KG	4	0	0.00%	0	0		
Indeno[1,2,3-cd]pyrene	UG/KG	4	3	75.00%	68	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	1,300.
Isophorone	UG/KG	4	0	0.00%	0	0		
N-Nitrosodiphenylamine	UG/KG	4	0	0.00%	0	0		
N-Nitrosodipropylamine	UG/KG	4	0	0.00%	0	0		
Naphthalene	UG/KG	4	0	0.00%	0	0		
Nitrobenzene	UG/KG	4	0	0.00%	0	0		
Pentachlorophenol	UG/KG	4	0	0.00%	0	0		
Phenanthrene	UG/KG	4	3	75.00%	70	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	120,000.
Phenol	UG/KG	4	0	0.00%	0	0		
Pyrene	UG/KG	4	3	75.00%	250	0		
Pesticides/PCBs								
4,4'-DDD	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	10.
4,4'-DDE	UG/KG	4	2	50.00%	5.4	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	10.
4,4'-DDT	UG/KG	4	2	50.00%	3.4	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	10.
Aldrin	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	100.
Alpha-BHC	UG/KG	4	0	0.00%	0	0		
Alpha-Chlordane	UG/KG	4	1	25.00%	1.9	0		
Aroclor-1016	UG/KG	4	0	0.00%	0	0		
Aroclor-1221	UG/KG	4	0	0.00%	0	0		
Aroclor-1232	UG/KG	4	0	0.00%	0	0		
Aroclor-1242	UG/KG	4	0	0.00%	0	0		
Aroclor-1248	UG/KG	4	0	0.00%	0	0		
Aroclor-1254	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	.8
Aroclor-1260	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	.8
Beta-BHC	UG/KG	4	0	0.00%	0	0		
Delta-BHC	UG/KG	4	0	0.00%	0	0		
Dieldrin	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	100.
Endosulfan I	UG/KG	4	2	50.00%	2.1	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	30.
Endosulfan II	UG/KG	4	0	0.00%	0	0	NYS BENTHIC AQUATIC LIFE CHRONIC TOXICITY CRITERIA	30.
Endosulfan sulfate	UG/KG	4	0	0.00%	0	0		
Endrin	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	800.
Endrin aldehyde	UG/KG	4	0	0.00%	0	0		
Endrin ketone	UG/KG	4	0	0.00%	0	0		
Gamma-BHC/Lindane	UG/KG	4	0	0.00%	0	0		
Gamma-Chlordane	UG/KG	4	0	0.00%	0	0		
Heptachlor	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	.8
Heptachlor epoxide	UG/KG	4	0	0.00%	0	0	NYS HUMAN HEALTH BIOACCUMULATION CRITERIA	.8
Methoxychlor	UG/KG	4	0	0.00%	0	0		
Toxaphene	UG/KG	4	0	0.00%	0	0		
Metals								
Aluminum	UG/KG	4	4	100.00%	12700000	0		
Antimony	UG/KG	4	0	0.00%	0	0	NYS LOWEST EFFECT LEVEL	2,000.
Arsenic	UG/KG	4	4	100.00%	4800	0	NYS LOWEST EFFECT LEVEL	6,000.
Barium	UG/KG	4	4	100.00%	97600	0		
Beryllium	UG/KG	4	4	100.00%	620	0		
Cadmium	UG/KG	4	4	100.00%	440	0	NYS LOWEST EFFECT LEVEL	600.
Calcium	UG/KG	4	4	100.00%	2.27E+08	0		
Chromium	UG/KG	4	4	100.00%	19500	0	NYS LOWEST EFFECT LEVEL	26,000.
Cobalt	UG/KG	4	4	100.00%	9600	0		
Copper	UG/KG	4	4	100.00%	21100	1	NYS LOWEST EFFECT LEVEL	16,000.
Cyanide	UG/KG	4	2	50.00%	3300	0		
Iron	UG/KG	4	4	100.00%	25000000	2	NYS LOWEST EFFECT LEVEL	20,000,000.
Lead	UG/KG	4	4	100.00%	24600	0	NYS LOWEST EFFECT LEVEL	31,000.
Magnesium	UG/KG	4	4	100.00%	8380000	0		
Manganese	UG/KG	4	4	100.00%	509000	2	NYS LOWEST EFFECT LEVEL	460,000.
Mercury	UG/KG	4	3	75.00%	50	0	NYS LOWEST EFFECT LEVEL	150.
Nickel	UG/KG	4	4	100.00%	27200	3	NYS LOWEST EFFECT LEVEL	16,000.
Potassium	UG/KG	4	4	100.00%	1610000	0		
Selenium	UG/KG	4	0	0.00%	0	0		
Silver	UG/KG	4	0	0.00%	0	0	NYS LOWEST EFFECT LEVEL	1,000.
Sodium	UG/KG	4	3	75.00%	134000	0		
Thallium	UG/KG	4	1	25.00%	550	0		
Vanadium	UG/KG	4	4	100.00%	23900	0		
Zinc	UG/KG	4	4	100.00%	101000	0	NYS LOWEST EFFECT LEVEL	120,000.
Other Analyses								
Total Petroleum Hydrocarbons	UG/KG	4	1	25.00%	149000	0		

Seneca Army Depot Activity
SEAD-60 - Surface Water/Sediment
Collapsed Data Summary
Comparison to Minimum Sediment Criteria

				STUDY ID:	ESI	ESI	ESI	
				SITE:	SEAD-60	SEAD-60	SEAD-60	SEAD
				LOC ID:	SWSD60-1	SWSD60-2	SWSD60-3	SWSD6
				LOC TYPE:	SITE	SITE	SITE	S
				SAMP_ID:	SD60-1	SD60-2	SD60-5	SD6
				QC CODE:	SA	SA	DU	
				SAMP. DETH TOP:	0	0	0	
				SAMP. DEPTH BOT:	0.2	0.2	0.2	
				MATRIX:	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMI
				SAMP. DATE:	27-Apr-94	20-Apr-94	20-Apr-94	20-Ap
METER	UNIT	Number of Exceedances	CRITERIA	CRITERIA VALUE	VALUE Q	VALUE Q	VALUE Q	VA
Copper	UG/KG	1	NYS LOWEST EFFECT LEVEL	16,000.	14,200.	**21,100.**	7,700. J	12,
Iron	UG/KG	2	NYS LOWEST EFFECT LEVEL	20,000,000.	**25,000,000.**	**22,000,000.**	6,580,000.	12,700,
ganese	UG/KG	2	NYS LOWEST EFFECT LEVEL	460,000.	**467,000.** J	282,000. J	292,000. J	**509**
Nickel	UG/KG	3	NYS LOWEST EFFECT LEVEL	16,000.	**27,200.**	**26,700.**	9,200. J	**16**

SEAD-52/60

NYSDEC TAGM HWR-94-4046

NYSDEC CORRESPONDANCE

NYSDEC TECHNICAL GUIDANCE FOR SCREENING CONTAMINATED SEDIMENTS

HWR-94-4046
January 24, 1994
(REVISED)

New York State Department of Environmental Conservation

MEMORANDUM

TO: Regional Haz. Waste Remediation Engineers, Bureau Dirs. & Section Chiefs
FROM: Michael J. O'Toole, Jr., Director, Div. of Hazardous Waste Remediation
SUBJECT: DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM: DETERMINATION OF SOIL CLEANUP OBJECTIVES AND CLEANUP LEVELS
DATE: JAN 24 1994 - Current as of June 16, 1995

Michael J O'Toole Jr

The cleanup goal of the Department is to restore inactive hazardous waste sites to predisposal conditions, to the extent feasible and authorized by law. However, it is recognized that restoration to predisposal conditions will not always be feasible.

1. INTRODUCTION:

This TAGM provides a basis and procedure to determine soil cleanup levels at individual Federal Superfund, State Superfund, 1986 EQBA Title 3 and Responsible Party (RP) sites, when the Director of the DHWR determines that cleanup of a site to predisposal conditions is not possible or feasible.

The process starts with development of soil cleanup objectives by the Technology Section for the contaminants identified by the Project Managers. The Technology Section uses the procedure described in this TAGM to develop soil cleanup objectives. Attainment of these generic soil cleanup objectives will, at a minimum, eliminate all significant threats to human health and/or the environment posed by the inactive hazardous waste site. Project Managers should use these cleanup objectives in selecting alternatives in the Feasibility Study (FS). Based on the proposed selected remedial technology (outcome of FS), final site specific soil cleanup levels are established in the Record of Decision (ROD) for these sites.

It should be noted that even after soil cleanup levels are established in the ROD, these levels may prove to be unattainable when remedial construction begins. In that event, alternative remedial actions or institutional controls may be necessary to protect the environment.

2. BASIS FOR SOIL CLEANUP OBJECTIVES:

The following alternative bases are used to determine soil cleanup objectives:

(a) Human health based levels that correspond to excess lifetime

cancer risks of one in a million for Class A[1] and B[2] carcinogens, or one in 100,000 for Class C[3] carcinogens. These levels are contained in USEPA's Health Effects Assessment Summary Tables (HEASTs) which are compiled and updated quarterly by the NYSDEC's Division of Hazardous Substances Regulation;

(b) Human health based levels for systemic toxicants, calculated from Reference Doses (RfDs). RfDs are an estimate of the daily exposure an individual (including sensitive individuals) can experience without appreciable risk of health effects during a lifetime. An average scenario of exposure in which children ages one to six (who exhibit the greatest tendency to ingest soil) is assumed. An intake rate of 0.2 gram/day for a five-year exposure period for a 16-kg child is assumed. These levels are contained in USEPA's Health Effects Assessment Summary Tables (HEASTs) which are compiled and updated quarterly by the NYSDEC's Division of Hazardous Substances Regulation;

(c) Environmental concentrations which are protective of groundwater/drinking water quality; based on promulgated or proposed New York State Standards;

(d) Background values for contaminants; and

(e) Detection limits.

A recommendation on the appropriate cleanup objective is based on the criterion that produces the most stringent cleanup level using criteria a, b, and c for organic chemicals, and criteria a, b, and d for heavy metals. If criteria a and/or b are below criterion d for a contaminant, its background value should be used as the cleanup objective. However, cleanup objectives developed using this approach must be, at a minimum, above the method detection limit (MDL) and it is preferable to have the soil cleanup objectives above the Contract Required Quantitation Limit (CRQL) as defined by NYSDEC. If the cleanup objective of a compound is "non-detectable", it should mean that it is not detected at the MDL. Efforts should be made to obtain the best MDL detection possible when selecting a laboratory and analytical protocol.

The water/soil partitioning theory is used to determine soil cleanup objectives which would be protective of groundwater/drinking water quality for its best use. This theory is conservative in nature and assumes that contaminated soil and groundwater are in direct contact. This theory is based upon the ability of organic matter in soil to adsorb organic chemicals. The approach predicts the maximum amount of contamination that may remain in soil so that leachate from the contaminated soil will not violate groundwater and/or drinking water

standards.

(1) Class A are proved human carcinogens
(2) Class B are probable human carcinogens
(3) Class C are possible human carcinogens

This approach is not used for heavy metals, which do not partition appreciably into soil organic matter. For heavy metals, eastern USA or New York State soil background values may be used as soil cleanup objectives. A list of values that have been tabulated is attached. Soil background data near the site, if available, is preferable and should be used as the cleanup objective for such metals. Background samples should be free from the influences of this site and any other source of contaminants. Ideal background samples may be obtained from uncontaminated upgradient and upwind locations.

3. DETERMINATION OF SOIL CLEANUP GOALS FOR ORGANICS IN SOIL FOR PROTECTION OF WATER QUALITY

Protection of water quality from contaminated soil is a two-part problem. The first is predicting the amount of contamination that will leave the contaminated media as leachate. The second part of the problem is to determine how much of that contamination will actually contribute to a violation of groundwater standards upon reaching and dispersing into groundwater. Some of the contamination which initially leaches out of soil will be absorbed by other soil before it reaches groundwater. Some portion will be reduced through natural attenuation or other mechanism.

PART A: PARTITION THEORY MODEL

There are many test and theoretical models which are used to predict leachate quality given a known value of soil contamination. The Water-Soil Equilibrium Partition Theory is used as a basis to determine soil standard or contamination limit for protection of water quality by most of the models currently in use. It is based on the ability of organic carbon in soil to adsorb contamination. Using a water quality value which may not be exceeded in leachate and the partition coefficient method, the equilibrium concentration (Cs) will be expressed in the same units as the water standards. The following expression is used:

Allowable Soil Concentration $Cs = f \times Koc \times Cw$ . . . . (1)

Where: f = fraction of organic carbon of the natural soil medium.

Koc = partition coefficient between water and soil media. Koc can be estimated by the following equation:

$\log Koc = 3.64 - 0.55 \log S$

S = water solubility in ppm
Cw = appropriate water quality value from TOGS 1.1.1

Most Koc and S values are listed in the Exhibit A-1 of the USEPA Superfund Public Health Evaluation Manual (EPA/540/1-86/060). The Koc values listed in this manual should be used for the purpose. If the Koc value for a contaminant is not listed, it should be estimated using the above ~~mentioned~~ equation.

PART B: PROCEDURE FOR DETERMINATION OF SOIL CLEANUP OBJECTIVES

When the contaminated soil is in the unsaturated zone above the water table, many mechanisms are at work that prevent all of the contamination that would leave the contaminated soil from impacting groundwater. These mechanisms occur during transport and may work simultaneously. They include the following: (1) volatility, (2) sorption and desorption, (3) leaching and diffusion, (4) transformation and degradation, and (5) change in concentration of contaminants after reaching and/or mixing with the groundwater surface. To account for these mechanisms, a correction factor of 100 is used to establish soil cleanup objectives. This value of 100 for the correction is consistent with the logic used by EPA in its Dilution Attenuation Factor (DAF) approach for EP Toxicity and TCLP. (Federal Register/Vol. 55, No. 61, March 29, 1990/Pages 11826-27). Soil cleanup objectives are calculated by multiplying the allowable soil concentration by the correction factor. If the contaminated soil is very close (<3' - 5') to the groundwater table or in the groundwater, extreme caution should be exercised when using the correction factor of 100 (one hundred) as this may not give conservative cleanup objectives. For such situations the Technology Section should be consulted for site-specific cleanup objectives.

Soil cleanup objectives are limited to the following maximum values. These values are consistent with the approach promulgated by the States of Washington and Michigan.

1) Total VOCs $\leq$ 10 ppm.
2) Total Semi VOCs $\leq$ 500 ppm.
3) Individual Semi VOCs $\leq$ 50 ppm.
4) Total Pesticides $\leq$ 10 ppm.

One concern regarding the semi-volatile compounds is that some of these compounds are so insoluble that their Cs values are fairly large. Experience (Draft TOGS on Petroleum

Contaminated Soil Guidance) has shown that soil containing some of these insoluble substances at high concentrations can exhibit a distinct odor even though the substance will not leach from the soil. Hence any time a soil exhibits a discernible odor nuisance, it shall not be considered clean even if it has met the numerical criteria.

4. DETERMINATION OF FINAL CLEANUP LEVELS:

Recommended soil cleanup objectives should be utilized in the development of final cleanup levels through the Feasibility Study (FS) process. During the FS, various alternative remedial actions developed during the Remedial Investigation (RI) are initially screened and narrowed down to the list of potential alternative remedial actions that will be evaluated in detail. These alternative remedial actions are evaluated using the criteria discussed in TAGM 4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites, revised May 15, 1990, and the preferred remedial action will be selected. After the detailed evaluation of the preferred remedial action, the final cleanup levels which can be actually achieved using the preferred remedial action must be established. Remedy selection, which will include final cleanup levels, is the subject of TAGM 4030.

Recommended soil cleanup objectives that have been calculated by the Technology Section are presented in Appendix A. These objectives are based on a soil organic carbon content of 1% (0.01) and should be adjusted for the actual organic carbon content if it is known. For determining soil organic carbon content, use attached USEPA method (Appendix B). Please contact the Technology Section, Bureau of Program Management for soil cleanup objectives not included in Appendix A.

Attachments

cc:
T. Jorling
J. Lacey
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Regional Directors
Regional Engineers
Regional Solid and Haz. Waste Engrs.
Regional Citizen Participation Spec.

APPENDIX A
TABLE 1
Recommended soil cleanup objectives (mg/kg or ppm)
Volatile Organic Contaminants

Contaminant	Partition coefficient Koc	Groundwater Standards/ Criteria Cw ug/l or ppb.	a Allowable Soil conc. ppm. Cs	b ** Soil Cleanup objectives to Protect GW Quality (ppm)	USEPA Health Based (ppm)		CRQL (ppb)	*** Rec.soil Clnup Ob (ppm
					Carcinogens	Systemic Toxicants		
Acetone	2.2	50	0.0011	0.11	N/A	8,000	10	0.
Benzene	83	0.7	0.0006	0.06	24	N/A	5	0.
Benzoic Acid	54*	50	0.027	2.7	N/A	300,000	5	2.
2-Butanone	4.5*	50	0.003	0.3	N/A	4,000	10	0.
Carbon Disulfide	54*	50	0.027	2.7	N/A	8,000	5	2.
Carbon Tetrachloride	110*	5	0.006	0.6	5.4	60	5	0.
Chlorobenzene	330	5	0.017	1.7	N/A	2,000	5	1.
Chloroethane	37*	50	0.019	1.9	N/A	N/A	10	1.
Chloroform	31	7	0.003	0.30	114	800	5	0.
Dibromochloromethane	N/A	50	N/A	N/A	N/A	N/A	5	N/
1,2-Dichlorobenzene	1,700	4.7	0.079	7.9	N/A	N/A	330	7.
1,3-Dichlorobenzene	310 *	5	0.0155	1.55	N/A	N/A	330	1.
1,4-Dichlorobenzene	1,700	5	0.085	8.5	N/A	N/A	330	8.
1,1-Dichloroethane	30	5	0.002	0.2	N/A	N/A	5	0.
1,2-Dichloroethane	14	5	0.001	0.1	7.7	N/A	5	0.
1,1-Dichloroethene	65	5	0.004	0.4	12	700	5	0.
1,2-Dichloroethene(trans)	59	5	0.003	0.3	N/A	2,000	5	0.
1,3-dichloropropane	51	5	0.003	0.3	N/A	N/A	5	0.
Ethylbenzene	1,100	5	0.055	5.5	N/A	8,000	5	5.
113 Freon(1,1,2 Trichloro-1,2,2 Trifluoroethane)	1,230*	5	0.060	6.0	N/A	200,000	5	6.
Methylene chloride	21	5	0.001	0.1	93	5,000	5	0
4-Methyl-2-Pentanone	19*	50	0.01	1.0	N/A	N/A	10	1
Tetrachloroethene	277	5	0.014	1.4	14	800	5	1
1,1,1-Trichloroethane	152	5	0.0076	0.76	N/A	7,000	5	0
1,1,2,2-Tetrachloroethane	118	5	0.006	0.6	35	N/A	5	0
1,2,3-trichloropropane	68	5	0.0034	0.34	N/A	80	5	0
1,2,4-Trichlorobenzene	670 *	5	0.034	3.4	N/A	N/A	330	3
Toluene	300	5	0.015	1.5	N/A	20,000	5	1
Trichloroethene	126	5	0.007	0.70	64	N/A	5	0
Vinyl chloride	57	2	0.0012	0.12	N/A	N/A	10	0
Xylenes	240	5	0.012	1.2	N/A	200,000	—	1

a. Allowable Soil Concentration Cs = f x Cw x Koc
b. Soil cleanup objective = Cs x Correction Factor (CF)
N/A is not available

* Partition coefficient is calculated by using the following equation: log Koc = -0.55 log S + 3.64, where S is solubility in water in ppm. All other Koc values are experimental values.

** Correction Factor (CF) of 100 is used as per TAGM #4046

*** As per TAGM #4046, Total VOCs < 10 ppm.

Note: Soil cleanup objectives are developed for soil organic carbon content (f) of 1% , and should be adjusted for the actual soil organic carbon content if it is known.

APPENDIX A (cont.)

TABLE 2

Recommended Soil Cleanup Objectives (mg/kg or ppm)

Semi-Volatile Organic Contaminants

Contaminant	Partition coefficient Koc	Groundwater Standards/ Criteria Cw ug/l or ppb.	a Allowable Soil conc. ppm. Cs	b ** Soil Cleanup objectives to Protect GW Quality (ppm)	USEPA Health Based (ppm)		CRQL (ppb)	Rec.soil Clnup.Objc (ppm)
					Carcinogens	Systemic Toxicants		
Acenaphthene	4,600	20	0.9	90.0	N/A	5,000	330	50.0**
Acenaphthylene	2,056*	20	0.41	41.0	N/A	N/A	330	41.0
Aniline	13.8	5	0.001	0.1	123	N/A	330	0.1
Anthracene	14,000	50	7.00	700.0	N/A	20,000	330	50.0**
Benzo(a)anthracene	1,380,000	0.002	0.03	3.0	0.224	N/A	330	0.224 or
Benzo(a)pyrene	5,500,000	0.002(ND)	0.110	11.0	0.0609	N/A	330	0.061 or
Benzo(b)fluoranthene	550,000	0.002	0.011	1.1	N/A	N/A	330	1.1
Benzo(g,h,i)perylene	1,600,000	5	8.0	800	N/A	N/A	330	50.0**
Benzo(k)fluoranthene	550,000	0.002	0.011	1.1	N/A	N/A	330	1.1
bis(2-ethylhexyl)phthalate	8,706*	50	4.35	435.0	50	2,000	330	50.0*
Butylbenzylphthlate	2,430	50	1.215	122.0	N/A	20,000	330	50.0*
Chrysene	200,000	0.002	0.004	0.4	N/A	N/A	330	0.4
4-Chloroaniline	43 ****	5	0.0022	0.22	200	300	330	0.220 or
4-Chloro-3-methylphenol	47	5	0.0024	0.24	N/A	N/A	330	0.240 or
2-Chlorophenol	15*	50	0.008	0.8	N/A	400	330	0.8
Dibenzofuran	1,230*	5	0.062	6.2	N/A	N/A	330	6.2
Dibenzo(a,h)anthracene	33,000,000	50	1,650	165,000	0.0143	N/A	330	0.014 or
3,3'-Dichlorobenzidine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dichlorophenol	380	1	0.004	0.4	N/A	200	330	0.4
2,4-Dinitrophenol	38	5	0.002	0.2	N/A	200	1,600	0.200 or
2,6 Dinitrotoluene	198*	5	0.01	1.0	1.03	N/A	330	1.0
Diethylphthlate	142	50	0.071	7.1	N/A	60,000	330	7.1
Dimethylphthlate	40	50	0.020	2.0	N/A	80,000	330	2.0
Di-n-butyl phthalate	162*	50	0.081	8.1	N/A	8,000	330	8.1
Di-n-octyl phthlate	2,346*	50	1.2	120.0	N/A	2,000	330	50.0*
Fluoranthene	38,000	50	19	1900.0	N/A	3,000	330	50.0*
Fluorene	7,300	50	3.5	350.0	N/A	3,000	330	50.0*
Hexachlorobenzene	3,900	0.35	0.014	1.4	0.41	60	330	0.41
Indeno(1,2,3-cd)pyrene	1,600,000	0.002	0.032	3.2	N/A	N/A	330	3.2
Isophorone	88.31*	50	0.044	4.40	1,707	20,000	330	4.4
2-methylnaphthalene	727*	50	0.364	36.4	N/A	N/A	330	36.4
2-Methylphenol	15	5	0.001	0.1	N/A	N/A	330	0.100 or
4-Methylphenol	17	50	0.009	0.9	N/A	4,000	330	0.9
Naphthalene	1,300	10	0.130	13.0	N/A	300	330	13.0
Nitrobenzene	36	5	0.002	0.2	N/A	40	330	0.200 or
2-Nitroaniline	86	5	0.0043	0.43	N/A	N/A	1,600	0.430 or
2-Nitrophenol	65	5	0.0033	0.33	N/A	N/A	330	0.330 or
4-Nitrophenol	21	5	0.001	0.1	N/A	N/A	1,600	0.100 or
3-Nitroaniline	93	5	0.005	0.5	N/A	N/A	1,600	0.500 or
Pentachlorophenol	1,022	1	0.01	1.0	N/A	2,000	1,600	1.0 or
Phenanthrene	4,365*	50	2.20	220.0	N/A	N/A	330	50.0
Phenol	27	1	0.0003	0.03	N/A	50,000	330	0.03 or
Pyrene	13,295*	50	6.65	665.0	N/A	2,000	330	50.0
2,4,5-Trichlorophenol	89*	1	0.001	0.1	N/A	8,000	330	0.1

a. Allowable Soil Concentration Cs = f x Cw x Koc
b. Soil cleanup objective = Cs x Correction Factor (CF)

N/A is not available
MDL is Method Detection Limit

* Partition coefficient is calculated by using the following equation:
log Koc = -0.55 log S + 3.64, where S is solubility in water in ppm. Other Koc values are experimental values.

** Correction Factor (CF) of 100 is used as per TAGM #4046

*** As per TAGM #4046, Total VOCs < 10 ppm., Total Semi-VOCs < 500 ppm. and Individual Semi-VOCs < 50 ppm.

**** Koc is derived from the correlation Koc = 0.63 Kow (Determining Soil Response Action Levels..... EPA/540/2-89/057). Kow is obtained from the USEPA computer database 'MAIN'.

Note: Soil cleanup objectives are developed for soil organic carbon content (f) of 1%, and should be adjusted for the actual soil organic carbon content if it is known.

APPENDIX A (cont.)

TABLE 3

Recommended soil cleanup objectives (mg/kg or ppm)

Organic Pesticides / Herbicides and PCBs

Contaminant	Partition coefficient Koc	Groundwater Standards/ Criteria Cw ug/l or ppb.	a Allowable Soil conc. ppm. Cs	b ** Soil Cleanup objectives to Protect GW Quality (ppm)	USEPA Health Based (ppm)		CRQL (ppb)	*** Rec.soil Clnup Ob (ppm
					Carcinogens	Systemic Toxicants		
Aldrin	96,000	ND(<0.01)	0.005	0.5	0.041	2	8	0.0
alpha - BHC	3,800	ND(<0.05)	0.002	0.2	0.111	N/A	8	0.1
beta - BHC	3,800	ND(<0.05)	0.002	0.2	3.89	N/A	8	0.2
delta - BHC	6,600	ND(<0.05)	0.003	0.3	N/A	N/A	8	0.3
Chlordane	21,305*	0.1	0.02	2.0	0.54	50	80	0.5
2,4-D	104*	4.4	0.005	0.5	N/A	800	800	0.5
4,4'-DDD	770,000*	ND(<0.01)	0.077	7.7	2.9	N/A	16	2.9
4,4'-DDE	440,000*	ND(<0.01)	0.0440	4.4	2.1	N/A	16	2.1
4,4'-DDT	243,000*	ND(<0.01)	0.025	2.5	2.1	40	16	2.1
Dibenzo-P-dioxins(PCDD)								
2,3,7,8 TCDD	1709800	0.000035	0.0006	0.06	N/A	N/A	N/A	N/
Dieldrin	10,700*	ND(<0.01)	0.0010	0.1	0.044	4	16	0.
Endosulfan I	8,168*	0.1	0.009	0.9	N/A	N/A	16	0.
Endosulfan II	8,031*	0.1	0.009	0.9	N/A	N/A	16	0.
Endosulfan Sulfate	10,038*	0.1	0.01	1.0	N/A	N/A	16	1.
Endrin	9,157*	ND(<0.01)	0.001	0.1	N/A	20	8	0.
Endrin keytone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/
gamma - BHC (Lindane)	1,080	ND(<0.05)	0.0006	0.06	5.4	20	8	0.
gamma - chlordane	140,000	0.1	0.14	14.0	0.54	5	80	0.
Heptachlor	12,000	ND(<0.01)	0.0010	0.1	0.16	40	8	0.
Heptachlor epoxide	220	ND(<0.01)	0.0002	0.02	0.077	0.8	8	0.
Methoxychlor	25,637	35.0	9.0	900	N/A	400	80	**
Mitotane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/
Parathion	760	1.5	0.012	1.2	N/A	500	8	1.
PCBs	17,510*	0.1	0.1	10.0	1.0	N/A	160	1.0(Sur 10(sub-
Polychlorinated dibenzo-furans(PCDF)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/
Silvex	2,600	0.26	0.007	0.7	N/A	600	330	0.
2,4,5-T	53	35	0.019	1.9	N/A	200	330	1.

a. Allowable Soil Concentration Cs = f x Cw x Koc

b. Soil cleanup objective = Cs x Correction Factor (CF)

N/A is not available

* Partition coefficient is calculated by using the following equation: log Koc = -0.55 log S + 3.64, where S is solubility in water in ppm. All other Koc values are experimental values.

** Correction Factor (CF) of 100 is used as per TAGM #4046

*** As per TAGM #4046, Total Pesticides < 10 ppm.

Note: Soil cleanup objectives are developed for soil organic carbon content (f) of 1% (5% for PCBs as per PCB guidance document), and should be adjusted for the actual soil organic Carbon content if it is known.

APPENDIX A Rev. 12/93

TABLE 4

Recommended Soil Cleanup Objectives (mg/kg or ppm) for Heavy Metals

Contaminants	Protect Water Quality ppm	Eastern USA Background ppm	* CRDL mg/kg or ppm	***** Rec.soil Clnup Objct. (ppm)
Aluminum	N/A	33,000	2.0	SB
Antimony	N/A	N/A	0.6	SB
Arsenic	N/A	3-12 **	0.1	7.5 or SB
Barium	N/A	15-600	2.0	300 or SB
Beryllium	N/A	0-1.75	0.05	0.16(HEAST) or SB
Cadmium	N/A	0.1-1	0.05	1 or SB
Calcium	N/A	130 - 35,000 **	50.0	SB
Chromium	N/A	1.5-40 **	0.1	10 or SB
Cobalt	N/A	2.5-60 **	0.5	30 or SB
Copper	N/A	1-50	0.25	25 or SB
Cyanide	N/A	N/A	0.1	***
Iron	N/A	2,000 - 550,000	1.0	2,000 or SB
Lead	N/A	****	0.03	SB****
Magnesium	N/A	100 - 5,000	50.0	SB
Manganese	N/A	50 - 5,000	0.15	SB
Mercury	N/A	0.001-0.2	0.002	0.1
Nickel	N/A	0.5-25	0.4	13 or SB
Potassium	N/A	8,500 - 43,000 **	50.0	SB
Selenium	N/A	0.1-3.9	0.05	2 or SB
Silver	N/A	N/A	0.1	SB
Sodium	N/A	6,000 - 8,000	50.0	SB
Thallium	N/A	N/A	0.1	SB
Vanadium	N/A	1-300	0.5	150 or SB
Zinc	N/A	9-50	0.2	20 or SB

Note: Some forms of metal salts such as Aluminum Phosphide, Calcium Cyanide, Potassium Cyanide, Copper cyanide, Silver cyanide, Sodium cyanide, Zinc phosphide, Thallium salts, Vanadium pentoxide, and Chromium (VI) compounds are more toxic in nature. Please refer to the USEPA HEASTs database to find cleanup objectives if such metal salts are present in soil.

SB is site background

N/A is not available

* CRDL is contract required detection limit which is approx. 10 times the CRDL for water.

** New York State backgrond

*** Some forms of Cyanide are complex and very stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objective.

**** Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 ppm. Average background levels in metropolitan or suburban areas or near highways are much higher and typically range from 200-500 ppm.

*****Recommended soil cleanup objectives are average background concentrations as reported in a 1984 survey of reference material by E. Carol McGovern, NYSDEC.

New York State Department of Environmental Conservation
Division of Fish and Wildlife
Division of Marine Resources

Technical Guidance for Screening Contaminated Sediment

22 November 1993

This document describes the methodology used by the Division of Fish and Wildlife and the Division of Marine Resources for establishing sediment criteria for the purposes of identifying contaminated sediments. Sediments with contaminant concentrations that exceed the criteria listed in this document are considered to be contaminated, and potentially causing harmful impacts to marine and aquatic ecosystems. These criteria do not <u>necessarily</u> represent the final concentrations that must be achieved through sediment remediation. Comprehensive sediment testing and risk management are necessary to establish when remediation is appropriate and what final contaminant concentrations the sediment remediation efforts should achieve.

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I. Executive Summary

The Department of Environmental Conservation originally proposed sediment criteria in 1989, as an appendix of a Cleanup Standards Task Force Report. These criteria were controversial because the proposed methodology, equilibrium partitioning, had not yet been endorsed by the U.S. Environmental Protection Agency (EPA) Science Advisory Board, and because the criteria themselves were perceived as remediation target concentrations. This revised sediment criteria document was prepared to incorporate scientific literature published since 1989, and to establish the purpose of sediment criteria for screening; that is, to identify areas of sediment contamination and to make a preliminary assessment of the risk posed by the contamination to human health and the environment. Criteria are developed for two classes of contaminants - non-polar organic contaminants and metals. Non-polar organic contaminant criteria are derived using the equilibrium partitioning approach, which has now been endorsed by the EPA Science Advisory Board. This approach estimates the biological impacts that a contaminant may cause based on it's affinity to sorb to organic carbon in the sediment. The concentration of biologically available contaminant is predicted and related to potential toxicity and bioaccumulation by using existing criteria established for the water column. New York State water quality standards and guidance values are used to derive sediment criteria. EPA water quality criteria are used only when New York State has not published a standard or guidance value for a particular compound. Water quality criteria for bioaccumulation proposed by the Divisions of Fish and Wildlife and Marine Resources are used when no New York State water quality standard or guidance value for bioaccumulation has been developed. Metals criteria are derived from Ministry of Ontario guidelines and NOAA data that make use of the screening level approach. This methodology measures the concentration of contaminants present in areas where ecological impacts have been noted, and correlates the contaminant concentration with the severity of the impact. Toxicity mitigating conditions such as acid volatile sulfides are not considered because with the screening level approach, the metal concentrations present are correlated directly to a measurable ecological impact. Finally, this document discusses risk management for contaminated sediment, and makes recommendations for implementing sediment criteria. Table 1 lists sediment criteria for 52 non-polar organic compounds or classes of compounds, and Table 2 lists sediment criteria for 12 metals.

II. Background and Objectives

The Department of Environmental Conservation originally proposed draft sediment criteria in December 1989 as Appendix D to the Draft Clean Up Standards Task Force Report (DEC 1991). These criteria were based on the EPA equilibrium partitioning (EP) model, which had at that time just been submitted to the EPA Science Advisory Board for review. Two problems developed relative to these criteria. The first was that the equilibrium partitioning model did not receive a complete endorsement by the EPA Science Advisory Board (EPA SAB 1990). The SAB raised questions about the degree of uncertainty, sources of variability, and applicability of EP-based sediment criteria. Secondly, the New York State sediment criteria were published in the context of a clean-up standards report for contaminated sediment remediation. The perception of the reviewers and potential users was that the criteria represented mandatory clean-up levels that must be achieved by remediation methodologies. Appendix D of the Draft Clean-up Standards Task Force Report did state that risk management decisions were necessary and appropriate in the application of the sediment criteria, but the perception remained that the low concentrations described therein were in fact the primary target levels for sediment remediation. This issue was further clouded by real-world environmental problems such as dioxin in the New York-New Jersey Harbor area. Dredging and dredge spoil disposal is necessary for continued harbor operation, but attainment of the dioxin sediment criterion described in Appendix D could be economically unachievable.

There were three objectives for revising the sediment criteria document. The first objective was simply to clarify the document, make it easier to read, and provide greater scientific documentation to support the information presented.

The second objective was to incorporate scientific literature that has been published since 1989. This revision will be based primarily upon an EPA Proposed Technical Support Document (TSD) for the Development of Sediment Quality Criteria (EPA 1991). The EPA TSD was also published verbatim in peer-reviewed scientific literature (DiToro et al., 1991). The revised sediment criteria document will also incorporate a new EPA Science Advisory Board Report that endorses the equilibrium partitioning methodology and commends the EPA for satisfactorily addressing many of the concerns noted in the original SAB review (EPA SAB 1992). Also, this revision incorporates the 1992 Ministry of Ontario Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, for metals concentrations in sediment (Persaud et al., 1992). These guidelines were only draft in 1989, when the first sediment criteria document was produced.

The final objective of the revised document was to establish the role of EP-based sediment criteria as screening criteria; that is, for identifying areas of sediment contamination, and providing an initial assessment of potential adverse

impacts. While attainment of the EP-based sediment criteria will provide the maximum assurance of environmental protection, it is not necessary in all cases and at all times to achieve these criteria through remediation efforts. Risk assessment, risk management, and the results of further biological and chemical tests and analyses are vital tools for managing sediment contamination. To view sediment criteria in a one-dimensional, go/no go context is to miss potential opportunities for resource utilization through appropriately identified and managed risk.

III. Need, Basis, and Concept of Sediment Criteria

Sediments can be loosely defined as a collection of fine-, medium-, and course- grain minerals and organic particles that are found at the bottom of lakes [and ponds], rivers [and streams], bays, estuaries, and oceans (Adams et al., 1992). Sediments are essential components of aquatic [and marine] ecosystems. They provide habitat for a wide variety of benthic organisms as well as juvenile forms of pelagic organisms. The organisms in sediments are in constant contact with the sediments, and therefore, constant contact with any contaminants that may be adsorbed to the sediment particles. Potential impacts to benthic organisms include both acute and chronic toxicity with individual-, population-, and community- level affects, bioaccumulation of contaminants, and the potential to pass contaminants along to predators of benthic species (Adams, et al, 1992; Marcus, 1991; Milleman and Kinney, 1992).

Potential to harm benthic organisms is not the only adverse impact of contaminated sediments. They serve as diffuse sources of contamination to the overlying waterbody; slowly releasing the contaminant back into the water column (Marcus, 1991; DEC, 1989).

Contamination is a concept that is not always clearly defined relative to sediments. The mere presence of a foreign substance in a sediment could be construed as contamination. However, the presence of a foreign substance does not necessarily mean it is harmful. Metals can be present in naturally occurring concentrations (background levels) in species, or forms, that are not harmful to aquatic life. While there are no naturally occurring background concentrations for synthetic organic compounds, the presence of a synthetic organic compound does not necessarily imply harm. Some evaluation must be made to estimate the potential risk to aquatic life or human health that the compound will have.

The EPA has defined a contaminant as: "Any solid, liquid, semisolid, dissolved solid, gaseous material, or disease-causing agent which upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, may . . . pose a risk of or cause death, disease, behavioral abnormalities, cancer, genetic mutations,

physiological malfunctions . . . or physical deformations, in the organism or their offspring" (EPA, 1992). This definition clearly explains that a contaminant is not simply the presence of a foreign substance, but an element of harm to some organism, species, population, or community must be involved.

The EPA defines sediment criteria in the following manner: A sediment criterion is a specific level of protection from the adverse effects of sediment associated pollutants, for beneficial uses of the environment, for biota, or for human health . . . (EPA, 1992). A sediment criterion, then, must relate to the element of harm that the contaminant possesses by specifying an appropriate level of protection. To develop sediment criteria, it is necessary to identify the potential elements of harm to the various organisms, populations, and communities that could be affected. The criterion must then specify the level of protection necessary to balance each identified element of harm.

A corollary of the EPA definition is that if the specified level of protection is not attained, then a certain level of risk exists. The concentration of a contaminant in sediment can be compared to a number of criteria and their associated levels of protection, to determine the overall potential risk posed by that particular contaminant concentration to various exposed organisms. Only if the contaminant concentration is less than all of the available criteria can exposure to the sediment, or to organisms that inhabit the sediment, be considered to be without significant risk from those contaminants (risk could still result from other sources, such as contaminants for which criteria have not yet been derived). This is the concept of screening criteria. By comparing the contaminant concentration to various criteria and their associated levels of protection, the resource manager can begin to identify the appropriate tests, studies, and procedures to quantify and refine the level of risk; set remediation goals; prioritize remediation actions; and select risk management and communications options.

EP-based sediment criteria are tied to water quality standards, guidance values, (DEC, 1991) and criteria (EPA, 1991)[1]. Within the framework of New York State water quality regulations, five primary levels of protection are identified (6NYCRR, 1991) from which sediment criteria can be derived. These are:

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[1] Water quality standards and guidance values are New York State regulatory terms that are essentially synonymous with the EPA term criterion. A standard is a water quality criterion that has been adopted into regulation. A guidance value is a water quality criterion that has been derived in the same manner as a standard, but has not yet been adopted into regulation, or subjected to public review and comment. When referring to water quality in this document, the use of the general term criteria will mean either a New York standard or guidance value.

A. Protection of human health from acute or chronic toxicity;

B. Protection of human health from toxic effects of bioaccumulation;

C. Protection of aquatic life from acute toxicity;

D. Protection of aquatic life from chronic toxicity;

E. Protection of wildlife from toxic effects of bioaccumulation.

Other levels of protection include fish flesh tainting, and aesthetics (taste, odor, or appearance). Human health-based criteria can be further subdivided into oncogenic (cancer causing) effects and non-oncogenic effects (6NYCRR, 1991). Unfortunately, water quality standards or guidance values do not usually exist for all five levels of protection simultaneously.

This document will identify a series of screening criteria concentrations for a number of contaminants that can be used to identify areas of sediment contamination, and evaluate the potential risk that the contaminated sediment may pose to human health or the environment. A contaminated sediment can be identified as one in which the concentration of a contaminant in the sediment exceeds any of the sediment criteria for that contaminant. Once a sediment has been identified as contaminated, a site-specific evaluation procedure must be employed to quantify the level of risk, establish remediation goals, and determine the appropriate risk management actions. The site-specific evaluation might include for example: additional chemical testing; sediment toxicity testing; or sediment bioaccumulation tests.

Sediment contaminants primarily consist of heavy metals and persistent organic compounds (EPA, 1990). Sediment criteria for non-polar organic compounds are derived using equilibrium partitioning methodology (EPA, 1991, DiToro, et al., 1991). This document will derive sediment criteria for non-polar organic contaminants listed in the TOGS 1.1.1. (DoW, 1991), using the water quality standards and guidance values listed there. If a water quality criterion for a particular contaminant is not identified in TOGS 1.1.1., an EPA water quality criterion is used. These criteria are annotated with the suffix (E). Proposed water quality criteria for the protection of human health and piscivorous wildlife from bioaccumulative affects are derived using procedures identified in Appendix 1; Newell et al. (1987); and 6NYCRR Parts 702.8 and 702.13. These criteria are annotated with the suffix (P). With the exception of PCBs, these water quality guidance values are not yet listed in TOGS 1.1.1.

Sediment criteria for metals are based upon procedures and data developed by the Ministry of Ontario (Persaud et al., 1992), and the National Oceanic and

Atmospheric Agency (NOAA) (Long and Morgan, 1990). Sediment criteria for polar organic compounds are not derived. Instead, contaminant concentrations in pore water should be compared directly to surface water quality criteria; see section V. Some polar organics such as phenolic compounds behave as non-polar compounds under conditions of neutral pH. For these compounds, EP-based sediment criteria can be derived. Both the equilibrium partitioning methodology and the Ministry of Ontario procedures are discussed below.

IV. Derivation of Sediment Quality Criteria for Non-polar Organic Compounds using Equilibrium Partitioning.

A. Characteristics of Non-polar Organics

Non-polar organic compounds are substances that contain carbon, and do not exhibit a net electrical (ionic) charge (Nebergall, et al. 1968). Non-polar organic contaminants tend to be of low solubility in water. Otherwise they would dissolve and not accumulate in sediments (Manahan, 1991). Many non-polar contaminants are highly soluble in lipids, and thus can be bioaccumulated. They are persistent, meaning they do not break down or degrade rapidly, and can remain in sediments for long periods of time. The International Joint Commission defines persistent compounds as compounds with a half life greater than 56 days (IJC, 1978). Some contaminants such as pesticides can cause direct, acute toxicity to exposed benthic organisms in low concentrations. Others such as DDT, PCB, and dioxin are more insidious, and bioaccumulate over time to cause chronic toxicity affects such as reproductive failure, either in populations exposed directly to the contaminated sediment or to organisms further up the food chain (Rand and Petrocelli, 1985).

B. Fundamentals of Equilibrium Partitioning (EP)

The basis for the EP methodology for deriving sediment criteria is that the toxicity of a contaminant in a sediment is attributable to the fraction of the contaminant that dissolves in the interstitial pore water, and is considered to be freely biologically available. The EP methodology predicts the concentration of contaminant that will dissolve in the interstitial pore water from three factors: 1) the concentration of contaminant in the sediment; 2) the concentration of organic carbon in the sediment; and 3) the affinity of the contaminant for organic carbon in the sediment.

The affinity of a contaminant for sediment organic carbon can be directly measured. The sediment/water partition coefficient, or K_p is a measure of the concentration of a contaminant sorbed to the sediment divided by the concentration dissolved in water (measured in l/kg), after mixing. The K_p is only useful as a site specific measure because the K_p will vary with different sediment

samples. The EPA (1991) reported that the organic carbon content of a sediment accounts for most of the variation in the uptake of the contaminant by the sediment. The K_{oc}, or sediment organic carbon/water partition coefficient is a measure of the concentration of contaminant that adsorbs to the organic carbon content of the sediment divided by the concentration dissolved in water, after mixing (measured in l/kg). When normalized for organic carbon, concentrations of a contaminant in different sediment samples are comparable. Another partition coefficient that is closely correlated with K_{oc} and is useful for predicting soil adsorption is the octanol/water partition coefficient, or K_{ow} (Kenaga, 1980). Voice, et al. (1983) citing Karickhoff (1979), reports that the relationship between the three coefficients can be described in two equations:

$$K_{oc} = K_p/f_{oc}$$

and

$$\log_{10}K_{oc} = \log_{10}K_{ow} - 0.21 \quad \text{(also in Kenaga, 1980)}$$

where f_{oc} is the fraction of solids by weight that is comprised of organic carbon.

The EPA (1991) refers to DiToro (1985) to define the relationship between K_{oc} and K_{ow} as:

$$\log_{10}K_{oc} = 0.00028 + 0.983\log_{10}K_{ow}$$

Using the DiToro (1985) relationship, the K_{oc} very nearly equals the K_{ow}. Using either relationship, it can be readily seen that the K_{oc} and K_{ow} for a given non-polar organic compound are very similar, and vary in direct proportion. In their initial review of the equilibrium partitioning methodology, the EPA SAB considered the equating of K_{oc} and K_{ow} to be a source of uncertainty (EPA SAB 1990). In their 1992 review, the EPA SAB states that uncertainties have diminished largely as a result of more accurate determination's of K_{ow}s, and that occasionally the K_{ow} may not be a good predictor of the K_{oc} (EPA SAB 1992).

When a non-polar organic contaminant enters the sediment, it will partition between the sediment and pore water in three compartments: a fraction will adsorb to the organic carbon in the sediment; another fraction will adsorb to dissolved organic carbon in the interstitial pore water; and a third fraction will dissolve in the pore water. An equilibrium will be established so that any change in the contaminant concentration in one compartment will result in a corresponding change in the contaminant concentration in other compartments. For example, if some of the contaminant dissolved in the pore water is removed, some of the contaminant adsorbed to the sediments will desorb to balance the loss from the pore water. If dissolved contaminant is added to the pore water, it will not all

remain in the pore water, but some will adsorb to dissolved organic carbon and sediment organic carbon, re-establishing the equilibrium. Interestingly, the EPA (1991) noted that an increase in the volume of dissolved organic carbon in the pore water causes contaminant sorbed to the sediment to desorb and in turn sorb to the dissolved organic carbon. The freely dissolved fraction of the contaminant remains practically unchanged.

Equilibrium partitioning methodology contends that sediment toxicity is attributable to the concentration of contaminant dissolved in the interstitial pore water and considered to be biologically available (EPA 1989, EPA 1991). It can be inferred, then, that a water quality criterion developed to protect aquatic life from contaminants dissolved in the water column should also protect benthic aquatic life from contaminant concentrations dissolved in pore water. The EPA (1991) compared the sensitivity of benthic organisms to the sensitivity of water column organisms to toxicity from the same chemicals, and found that they were very similar. Therefore the prediction that exceeding a water column-based criterion in sediment pore water would harm benthic organisms was considered valid.

C. Derivation of Sediment Criteria using Equilibrium Partitioning

To derive an organic carbon normalized sediment criterion, two items of information are required:

A. An ambient water quality criterion for a particular contaminant;

B. the K_{ow} partition coefficient for the contaminant;

For example, the PCB water quality criterion (see footnote 1 on page 4) for the protection of piscivorous wildlife from bioaccumulation is 0.001 µg/l. The K_{ow} for PCB is $10^{6.14}$, or 1,380,384.3 l/kg. The organic carbon normalized PCB sediment criterion (SC_{oc}) would be:

$$SC_{oc} = WQC * K_{ow}$$

$$\text{PCB } SC_{oc} = 0.001\ \mu g/l * 1{,}380{,}384.3\ l/kg * 1\ kg/1{,}000\ gOC =$$

$$1.38\ (\approx 1.4)\ \mu g/gOC$$

1 kg/1,000 gOC is a conversion factor.

The meaning of the criterion is: based on the equilibrium partitioning characteristic of PCBs, in order not to exceed the water quality criterion of 0.001 µg/l in the pore water, the concentration of PCB in the sediment must not exceed 1.4 µg for each gram of organic carbon in the sediment.

To apply this SC_{oc} on a site specific basis, the concentration of organic carbon in the sediment at the site must be known. If a sediment sample was known to contain 3% organic carbon, the site specific sediment criterion (SC) for PCB could be derived:

$$SC = SC_{oc} * f_{oc}$$

$$f_{oc} = 3\%\ OC/kg\ sediment = 30\ gOC/kg$$

$$PCB\ SC = 1.4\ \mu g/gOC * 30\ gOC/kg = 42\ \mu g\ PCB/kg\ sediment$$

This criterion states that: if there are less than 42 µg PCB/kg of sediment in a sediment containing ≥ 3% organic carbon, there is no appreciable risk to piscivorous wildlife from consuming fish or other aquatic life from the waterbody over the contaminated sediment.

D. Limitations of Equilibrium Partitioning Derived Sediment Criteria

There are several limitations to the application of EP-based criteria:

1. EP-based criteria are only applicable to non-polar organic compounds, or other substances that behave as non-polar organic compounds in the sediment and prevailing environmental conditions, such as pH.

2. EP-based criteria apply only to the specific level of protection identified in the criterion. In the example above, the 42 µg/kg PCB concentration in the 3% sediment sample does not pose appreciable risk to wildlife, however, it may or may not pose a risk to human beings. A sediment criterion derived from a human health-based water quality criterion must be compared to make that determination.

3. EP-based criteria should only be derived for sediments with organic carbon fractions between approximately 0.2 - 12% (EPA SAB, 1992). Outside of this range, other factors that the EP methodology does not account for may influence contaminant partitioning.

4. The equilibrium partitioning method should not be applied to broad classes of compounds or mixtures if one K_{ow} value is used to represent the entire class or the mixture (EPA SAB, 1992). In this respect, PCB congeners would not be considered a broad class of compounds; they are a narrow class of quite similar compounds.

5. For compounds with a K_{ow} less than 100 ($\log_{10}K_{ow} \leq 2$), the water quality criterion can be greater than the site specific sediment quality

criterion. This implies that virtually all of the contaminant is biologically available. Since the water quality criterion delineates the concentration that is harmful to aquatic life, it is not reasonable that a smaller concentration in the sediments would be harmful to benthic organisms, especially considering that some fraction of the contaminant will be sorbed to the sediment and not biologically available. For these compounds, the organic carbon normalized sediment criterion should be derived in the manner described above. However, when determining the site specific criterion, compare the product of the $SC_{oc} * f_{oc}$ with the water quality criterion, converted from a volumetric to mass units ($\mu g/l * l/kg = \mu g/kg$). If the water criterion is greater than the site specific sediment quality criterion, use the water quality criterion as the sediment criterion. For example, the $\log_{10}K_{ow}$ of benzidine is 1.4. The SC_{oc} for the protection of benthic life (chronic toxicity), based on a TOGS 1.1.1. water quality criterion of 0.1 μg/l is 0.003 μg/gOC. If the sediment contained 3% organic carbon, the site specific SC would be 0.09 μg/kg. The water quality criterion (converted from a volumetric measure to a mass measure) of 0.1 μg/kg is greater, so the site specific sediment criterion should be 0.1 μg/kg. If the site contained 5% organic carbon the site specific sediment criterion would be 0.15 μg/kg, which is greater than the water quality criterion of 0.1 μg/l. In this instance, the 0.15 μg/kg would be the appropriate criterion to use.

6. Derivation of EP-based criteria assumes that an equilibrium between the sediment/pore water compartments has been achieved. Rand and Petrocelli (1985) indicate that the sorption-desorption equilibria are achieved rapidly, usually in a few minutes to several hours. Voice et al. (1983) found that in laboratory studies, equilibria were generally achieved in about 4 hours. In investigating contamination of stable sediments with long term exposure to a contaminant, it is likely that equilibrium has been achieved. However for spill sites, and areas with unstable sediments, attainment of the equilibrium condition may be questionable. The EPA SAB (1992) recommends that EP-based criteria not be used in areas of rapid deposition or erosion (e.g. > 10 cm/yr), such as active dredge disposal areas, areas of heavy boat and barge traffic, and some river channels.

7. The EP methodology is not a highly accurate procedure in and of itself. Several related sampling and analysis procedures could introduce additional variation and uncertainty into the results. Some of these factors include: the value of the K_{ow} used and how it was derived; how the sediment sample was taken and analyzed for contaminant content; and how the organic content of the sediment sample (f_{oc}) was determined. For consistent application of sediment criteria, these factors must be considered systematically and consistently. ASTM (1993) recommendations should be followed for the proper collection, storage, and analysis techniques when

applying EP-based sediment criteria. The analysis method is particularly important for determination of sediment total organic carbon, because there are several methods available that may give variable results. The authors and EPA (1992b) recommend the use of catalytic combustion with nondispersive infrared carbon dioxide detection (Leonard, 1991) when developing total organic carbon-normalized criteria for non-polar organic compounds. However, unless the "true" K_{ow} differs by a factor of 10, or the "true" f_{oc} differs by 50 - 100% from the K_{ow} and f_{oc} values used to derive the sediment criteria, the level of imprecision introduced into the criteria calculation will be minor. An EP-based criterion applies to a single sediment sample. Results obtained from composite samples may be misleading in that the contaminant concentration at a single point or depth might be diluted with uncontaminated samples. Conversely, a contaminated sample mixed with uncontaminated samples from other points or depths might cause a greater area appear to be contaminated than actually is.

8. There are still a number of uncertainties related to equilibrium partitioning-derived sediment criteria. These include such factors as particle size, particle density, organic carbon content, K_{ow}/K_{oc} relationship, route of exposure, the impact of dissolved organic carbon, and the uncertainty of extrapolating laboratory data to field conditions (EPA, 1991; EPA SAB, 1992). Despite these uncertainties, the EPA has found that sediment toxicity from laboratory experiments generally falls within a factor of 5 of the toxicity predicted by equilibrium partitioning. EP-based criteria are considered to be valid for screening and assessment. These preliminary assessments can be followed up with further testing if necessary to more accurately quantify risk.

Table 1 lists 52 non-polar organic compounds or classes of compounds for which sediment criteria have been derived using the equilibrium partitioning methodology. The derivation procedure is the same as that recommended by the EPA (1991). The only difference is that New York State water quality standards and guidance values are used instead of EPA ambient water quality criteria. EPA criteria have been used to derive a sediment quality criterion only when a New York standard or guidance value is not available. Four criteria, corresponding to four of the five levels of protection, are listed for each contaminant whenever possible. Sediment criteria are not derived for the protection of human health from toxicity, because that type of exposure would constitute human consumption of the interstitial pore water within the contaminated area, which is an unreasonable assumption. A sediment is considered to be contaminated if the contaminant concentration exceeds <u>any</u> of the criteria listed. The table also identifies the K_{ow} and the water quality criterion used to derive the sediment criterion. Water quality criteria are from DoW TOGS 1.1.1., unless suffixed with an (E), which indicates an EPA water quality criterion. Proposed water quality criteria for the protection of

human health and piscivorous wildlife from bioaccumulative effects are used when no TOGS 1.1.1. criterion for bioaccumulation has been developed. These criterion are annotated with the suffix (P), and are derived according to the method described in Appendix 1 and Newell et al. (1987).

V. Polar Organics - Application of Water Quality Criteria to Pore Water via Direct Measurement of Pore Water

For polar organics (except for phenols) no algorithms have been developed yet for sediment criteria that account for sediment characteristics which may affect substance toxicity. However, in order to screen sediments for potential impacts from polar organic compounds, interstitial (pore) water from sediment samples should not exceed existing water quality standards and guidance values for polar organics in TOGS 1.1.1.

The application of these criteria to pore water is complicated by dissolved organic carbon (DOC) in pore water that is generally much higher than DOC in the water column. DOC tends to reduce toxicity and bioaccumulation of chemicals by reducing their availability for uptake by the organism. However, even though water column DOC is usually low, water quality criteria are not modified to account for the effects of DOC. If the partitioning coeficient between DOC and water for a contaminant is known, that coefficient could be used to account for the effect of DOC on toxicity or bioaccumulation in the application of water quality criteria to pore water. The bioaccumulation of contaminants with low K_{ow} is generally not suppressed by water column DOC, indicating that the effects of DOC can probably be ignored. In any case, a conservative risk assessment is assured if the effects of DOC in pore water are ignored during a preliminary screening. In follow-on assessments, DOC affects should be evaluated. As a consequence, the water quality criteria becomes the pore water criteria, and sediment criteria per se are not derived for these compounds.

VI. Derivation of Sediment Quality Criteria for Metals

A. Characteristics of Metals as Sediment Contaminants

A wide variety of metals in a wide variety of forms can be found in marine and aquatic sediments. Some concentrations occur naturally, while others have been introduced through man's activities. Very low concentrations of most metals are required nutrients for living organisms, but in excess concentrations, metals can be harmful (Rand and Petrocelli, 1985). The properties that metals exhibit in water depend largely on the form in which the metal occurs (Manahan, 1991). In waterbodies, metals are typically found (Demayo et. al, 1978):

1. Dissolved as free ions and complexes;

2. As particulates:

    a. inorganic precipitates such as hydroxides, sulphides, carbonates, and sulphates;

    b. sorbed onto or complexed with high molecular weight organic compounds or clay particles;

3. Mixed or sorbed to bottom sediments;

4. Incorporated into the tissues of biota.

The toxicity and bioavailability of metals in water [and sediment] vary with the form of the metals (EPA 1992a). The form of the metal, and thereby the toxicity of a metal, are highly influenced by environmental conditions such as pH, alkalinity, REDOX potential, and the availability of complexing ions or ligands. Very generally, it can be said that the dissolved fraction of metals seems to account for most toxicity, however, some particulate forms of some metals also exhibit toxicity (EPA 1992a).

Metals in water can generally be measured as total (total recoverable) dissolved metal. Currently, the EPA recommends using water effects ratios for evaluating the impact of metals on surface water quality (EPA 1993). Conduct toxicity tests using water from a specified site, and compare the toxicity with reference toxicity tests in relatively pure water. The resulting "water effects ratio" can then be used to adjust either a total recoverable metal criterion or effluent limitation, or dissolved metals water quality criterion (preferred in areas of highly variable suspended solids concentrations) to account for local conditions.

In sediments, metals exhibit the same variety of forms as in water; they can dissolve as ions or soluble complexes in the interstitial pore water, precipitate as organic or inorganic compounds, or sorb to binding sites in the sediment. The complexity of metals behavior in water and sediments makes it impossible to accurately predict the levels at which toxic effects will occur. For metals, the primary concern in sediments is toxicity to benthic organisms. Metals can bioaccumulate in organisms. Bioaccumulation of metals is highly variable and dependent on the form of the metal and how it enters the organism (Doull et al., 1980). Different organs and tissues will have different affinities for different metals and species of metals. Metals can be absorbed by an organism but be bound by protiens known as metallothioneins into relatively harmless forms. Toxicity of metals are dependent on many environmental conditions and are difficult at best to predict consistantly.

B. Establishing Screening Level Concentrations

Because of the inability to predict biological affects from metals concentrations in sediment, the best alternative is to identify adverse ecological effects that are attributable to sediment-borne metals concentrations, and measure what concentration caused the adverse effect. The Ontario Ministry of the Environment issued metals guidelines derived by the "Screening Level Concentration" approach. This is an effects-based approach which uses field data on co-occurrence of benthic animals and contaminants (Persaud et al., 1992). The Ontario guidelines span background, lowest effect levels and severe effect levels. The methods used to derive these guidelines do not account for the effects of organic content, acid volatile sulfide concentration, particle size distribution or iron and manganese oxide content, or other toxicity-mitigating factors on the bioavailability of metals within the sediments, because the total metals concentration is related directly to an observed, measureable ecological effect. It is possible that this methodology might not discern toxicity from other compounds besides metals.

Long and Morgan (1990) reviewed and categorized chemical effects data in sediments according to low and median toxic effects ["Effects Range-Low (ER-L)"and "Effects Range-Median (ER-M)" concentrations] and "Overall Apparent Effects Thresholds" for benthic organisms observed in field studies across the nation. Effects levels reported were associated with bulk sediment concentrations without normalizing for any toxicity mitigating factors. For metals, effects levels in Long and Morgan (1990) may be compared with effects levels taken from Persaud et al. (1992). Both are based on a selection of observed effects from field studies, although Persaud et al. (1992) is restricted to Great Lakes data while Long and Morgan (1990) used both fresh and salt water data. For six metals (arsenic, cadmium, chromium, copper, lead and nickel), the lowest effects levels described by Persaud et al. (1992) are lower than the ER-L (effects range-low) from Long and Morgan (1990). This could be because in the relatively pure waters of Lake Ontario, fewer ligands were available to complex metal ions, so biological affects were noted at lower metals concentrations. The Long and Morgan (1990) study included more eutrophic waters, wherein, metals could be complexed to a greater extent into biologically unavailable forms. Exposed organisms were able to tolerate higher total metals concentrations because the greater fraction of metal present was biologically unavailable.

To establish screening criteria for sediments in New York State, two levels of protection as a basis sediment quality screening criteria were established, following the Ministry of Ontario Guidlines definitions. These are the Lowest Effect Level and the Severe Effect Level. The Lowest Effect Level indicates a level of sediment contamination that can be tolerated by the majority of benthic organisms, but still causes toxicity to a few species. The Severe Effect Level indicates the concentration at which pronounced disturbance of the sediment

dwelling community can be expected (Persaud et al. 1992). The ER-L and ER-M from Long and Morgan (1990) were compared with the Lowest Effect Level and Severe Effect Level from Persaud et al. (1990). The lowest concentration in each of the two effect levels was selected as the New York sediment screening criteria. These sediment criteria for metals are listed in Table 2. If a total metals concentration in a sediment sample is less than the Lowest Effect Level listed in Table 2, the effects of the metal in the sediment are considered to be acceptable. If the concentration is greater than the lowest effect level but less than the severe effect level concentration, the sediment is considered to be contaminated, with moderate impacts to benthic life. If the concentration is greater than the severe effect level, the sediment is contaminated and significant harm to benthic aquatic life is anticipated.

Background concentrations described in Persaud et al. (1992) were not used to establish criteria. For some metals, cadmium and copper for example, Persaud lists a Lowest Effect Level that exceeds the typical background concentration. Because a metal concentration in sediment is considered to be naturally occurring, or background, does not mean that the concentration is not causing an adverse ecological effect.

As noted above, metals guidelines from Persaud et al. (1992) are based on freshwater sediments only, and effects levels in Long and Morgan (1990) reflect data from both fresh and salt water. Although differences in the bioavailability of metals in fresh and salt water sediments may be elucidated in the future, at this time, the sediment criteria identified in Table 2 are considered suitable for identifying areas of metal contaminated sediment, assessing potential risk, and identifying suitable follow-up tests, studies, and risk management options in both fresh and salt water sediments.

C. Limitations to Sediment Criteria for Metals

There are limitations to the application of the metals sediment quality criteria listed in Table 2:

1. Persaud et al. (1992) values are based on oligotrophic waters with low concentrations of metals-complexing ligands. These criteria are possibly over-protective when applied to more eutrophic waters. However, many streams and ponds in New York are oligotrophic, and the low effects concentrations are justified. These criteria are intended to be used for screening; that is, to identify potentially contaminated sites and provide a qualitative estimate of risk. Once a site is found to be contaminated with metals, further studies are necessary to quantify risk and determine if remediation actions are necessary. Remediation should not be based solely on exceedances of these criteria.

2. These criteria have limited applicability to mixtures of metals. Metals criteria are most clearly applicable to sediments with high concentrations of a single metal, or situations where one metal has a disproportionatly greater abundance in a sediment sample than any other metal. The presence of one metal can significantly affect the impact that another metal has on an organism. The effect can be synergistic, additive, or antagonistic (Eisler, 1993). A reasonable level of protection can be expected if none of the criteria are exceeded for metals that are present, however, effects <u>may</u> be present if the sum of the fractions of criteria over sediment concentrations exceed one, for all of the metals present. For example, in a sediment sample, four metals are detected. The concentration of each metal in the sediment sample is 0.3 of its corresponding sediment criterion. The sum of the fractions would be 1.2. In this case, further testing is warranted.

3. Total metals, or the bulk metals concentration should be measured in sediment samples.

VII. Use of Sediment Criteria in Risk Management Decisions

Once it has been determined that a sediment criterion is exceeded, more information is required to determine if remediation is necessary and what actual risks to the environment are present. The volume and location of sediment exceeding a criterion, which levels of protection are exceeded, the persistence of the contaminant, the uncertainty about the criteria, and the results of more detailed, site specific sediment tests all play a role in making decisions about how, and how much sediment to clean up in order to eliminate or minimize adverse effects. If the volume of sediment that exceeds sediment criteria is small and the sediment is fairly accessible, the remediation of all contaminated sediment may be the most expedient action. If volumes of sediment are large and/or difficult to remediate either because of accessibility, sensitivity of the impaired habitat, or lack of efficacious technology, further risk management evaluations are warranted. In general the areal extent of the contaminated sediments should be a factor in considering the need for, and method of remediation.

Once the source of contaminants to sediments is terminated, the length of time a particular area of sediments remain contaminated will depend on the persistence of the chemicals, and the site-specific characteristics of the sediment such as: rate of sedimentation; resuspension; and biological and chemical degradation. If a contaminant is not persistent (e.g. contaminant concentrations would be expected to fall to acceptable levels within six months to a year), and the effect of the contaminant is not severe, then sediment remediation may not be necessary. Even for a persistent contaminant, it may not be necessary to remediate the sediments if the contaminated area is a deposition zone, and the natural burying of the contaminated sediments beneath the zone of biological

activity and availability would be expected to occur within a short time, and resuspension of the contaminants was unlikely.

EPA SAB (1992) examined a number of factors relating to the uncertainty of EP based sediment criteria, including sediment composition variability, measurement variation and K_{ow} - K_{oc} correlations and measurements. They report that all these variabilities amount to an estimated uncertainty factor of five. This suggests with good confidence that sediment criteria exceeded by a factor of five will result in the onset of toxicity. Toxicity could also result from sediment contaminant concentrations just below the sediment criterion. The EPA SAB (1992) identifies the range of concentrations from 1/5 - 5 times an EP-derived sediment criterion as a "grey" area, where observable impacts may or may not occur. Based on the statistical analysis of EP-derived sediment criteria, there is a high degree of confidence that contaminant concentrations $\leq$ 1/5 of a sediment criterion pose little or no risk. Similarly, if a contaminant concentration in sediment exceeds an EP-derived sediment criterion by a factor of 5, there is little or no doubt that adverse ecological impacts are occurring. Within the range in-between, the actual occurrence of effects is unknown. However, to avoid making the criteria excessively overprotective or underprotective, the best use of the factor of 5 is in interpreting the results of sediment screening, not to modify the criteria.

The onset of chronic toxicity may be difficult to detect in natural systems. Water quality criteria designed to prevent acute toxicity are generally about ten times greater than comparable chronic criteria. Therefore, in general, sediments with contaminants at 50 times chronic toxicity sediment criteria concentrations (a factor of five for uncertainty and a factor of ten based on acute to chronic toxicity ratios), will result in the onset of acute toxicity to benthic animals with a high degree of confidence.

It must also be noted that with this uncertainty the possibility exists that the sediment criteria may be somewhat underprotective as well as than overprotective.

Sediment criteria for metals are based on empirical evidence from both lab and field studies without an attempt to normalize for any toxicity mitigating factors in the sediment. Variability of toxicity from metals in any given sediment is evident (Appendix 2). Many of the Lowest Effect Levels from Persaud et al. (1992) are lower than the mean background concentrations in Great Lake sediments. This suggests that in some sediments relatively low levels of metals, even below mean background, are toxic, whereas in other sediments fairly high levels, up to and possibly even above background, may not be toxic. For all metals, the Severe Effect Level criteria exceeds mean background considerably; consequently, significant and noticeable toxicity is expected in all sediments that exceed that level of protection.

VIII. Implementation of Sediment Criteria for Screening

Implementation guidance can be outlined in a strategy to apply sediment criteria for screening areas suspected of sediment contamination and recommending actions to take if they are exceeded.

1. Compare sediment contaminant concentrations with sediment criteria

    a. Quantify the area and volume of sediment wherein the criteria is exceeded; determine whether biota are exposed to contaminated sediment, e.g. deeply buried sediments may be below active biological zones.

    b. Describe the significance of exceedances in terms of the predicted effects. For example, would bioaccumulation or toxicity be the predominant impact. Based on the levels of protection exceeded, evaluate whether impacts are expected to be isolated or widespread through the ecosystem of concern. Consider the potential for transport of contaminants by natural processes to other areas.

2. For naturally occurring substances such as metals, compare sediment concentrations in the area of interest with local background concentrations in areas known to be unaffected by anthropogenic sources of contamination. Evaluate sediments relative to sediment criteria to identify contaminated sites. Compare suspected contaminated sites with uncontaminated sites, looking for adverse ecological impacts.

3. If sediment concentrations of a compound are less than all of the sediment criteria for that substance, aquatic resources can be considered to be not at risk (from that compound). However, additional testing would be warranted if the concentration of numerous contaminants were just below the criteria thresholds.

4. If sediment contaminant concentrations exceed criteria, and especially if widespread in the area of interest, steps may be taken to verify the need for remediation:

    a. For sediments with non-persistent, non-polar organic contaminants that are not causing observable acute or significant chronic toxicity, further remedial investigation or sediment remediation is not necessary if the source of contamination will be eliminated and the sediment will cleanse itself. Many chemicals with $\log_{10}K_{ow} < 3$ can be expected to be non-persistent in sediments. If it is decided not to remediate sediments contaminated with non-persistent chemicals, then,

assurance must be made that water quality standards in offsite waters will not be contravened, and the public is informed of risks related to the contamination.

b. For sediments exceeding criteria based on aquatic life toxicity, including metals Lowest Effect Levels:

1. Assess the degree of impairment to the benthic community; compare site specific impairment with sediment contaminant concentrations; correlate site specific level of impairment with other known level of impairments and contaminant concentrations.

2. Collect sediment samples and conduct acute and chronic toxicity tests with fish and benthic invertebrates; correlate toxicity test results with sediment contaminant concentrations. It is important to follow established toxicity identification evaluation (TIE) techniques to ensure correct identification of the cause of toxicity, e.g. ammonia is a common cause of toxicity to benthic animals that can be mistakenly attributed to other toxics. Similarly, dissolved oxygem depletion in organically enriched sites such as wetlands could be confused with acute toxicity from contaminants.

3. For non-polar organic contaminants, exceedance of sediment criteria based on aquatic life chronic toxicity by a factor of 50 in a significantly large area indicates that biota are probably impaired and to achieve restoration of the ecosystem will require remediation of organic contaminants present.

4. For metals, if Severe Effect Levels are exceeded in significant portions of the ecosystem of concern, biota are most likely impaired and to achieve restoration of the ecosystem would likely require remediation of metals present.

c. For sediments exceeding criteria based on human health concerns:

1. Collect data on residues in edible, resident biota from the areas of concern and compare with tolerances, action levels, guidance values, or 1×10^{-6} cancer risk levels, or

2. Collect sediment samples, expose representative edible biota to sediments, measure residue in biota.

d. For sediment contaminant concentrations exceeding sediment criteria for the protection of piscivorous wildlife:

1. Collect data on residues in resident prey of piscivorous wildlife and compare with fish flesh criteria for protection of wildlife.

2. Expose wildlife food supply to contaminated sediment and measure residues in the food supply; compare with food supply residue levels known to be toxic to wildlife.

If sediment concentrations and criteria are less than analytical detection limits, ecological assessments are necessary to measure toxicity of sediments or residues in organisms exposed to sediments suspected of contamination. Generally, it is reasonable to predict that some, possibly high, levels of toxicity or bioaccumulation may associated with contaminants in sediments below analytical detection.

ment criteria for non-polar organic contaminants. Water quality criteria used are taken from Togs 1.1.1. If a water quality criterion
OGS 1.1.1., then an EPA criterion was used. These are annotated with the suffix (E). EPA criteria were extracted from the "Water
ary" chart (EPA, 1991). EPA water quality criteria for the protection of human health (bioaccumulation) were taken from the "Reca
nisms Only" column. Wildlife (bioaccumulation) and Human Health (bioaccumulation) protection criteria were derived in Appendix 1
bioaccumulation) criteria already existed. Although these criteria are only proposed, they are useful as guidance for estimating pote
risks. These criteria are annotated with a suffix (P), for "Proposed criteria values".

			Levels of Protection							
			Human Health Bioaccumulation		Benthic Aquatic Life Acute Toxicity		Benthic Aquatic Life Chronic Toxicity		Wildlife Bioaccumula	
	LogK$_{ow}$	Fresh-FW Salt -SW Both -FS	TOGS Water Qual Criteria µg/l	Sediment Criteria µg/gOC TOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Se Cri µg
	4.33	FW SW						140(E)[1] 240(E)[1]		
drin	5.0	FS	0.001	0.1					0.0077 (P)	0
nyl	2.4	FW SW					0.005 0.01	0.001 0.003		
	3.82	FS	0.16 (P)	1.0						
	2:0	FS	6.0	0.6						
ne[2]	6.04	FW SW	0.0012 0.0006	1.3 0.7						

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[1] EPA proposed sediment quality criterion for the protection of benthic organisms.

[2] These values also apply to benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and benz(a)anthracene.

			Levels of Protection							
			Human Health Bioaccumulation		Benthic Aquatic Life Acute Toxicity		Benthic Aquatic Life Chronic Toxicity		Wildlif Bioaccumu	
t	LogK_{ow}	Fresh-FW Salt -SW Both -FS	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	S C µ
	1.4	FW			0.1	0.003	0.1	0.003		
ethyl) ether	1.73	FS	0.5 (P)	0.03						
exyl) phthalate	5.3	FW					0.6	199.5		
	2.26	FW			10.0	1.82	1.0	0.2		
achloride	2.64	FS	1.3 (P)	0.6						
	2.78	FW SW	0.002 0.002	0.001 0.001	2.4 (E) 0.09 (E)	1.4 0.05	0.043 (E) 0.004 (E)	0.03 0.002	0.01 (P) 0.01 (P)	0 0
ene	2.84	FS			50.0	34.6	5.0	3.5		
uidine	≈2.0	FS	6.5 (P)	0.65						
s	5.11	FW SW			0.083 (E) 0.011 (E)	10.7 1.4	0.041 (E) 0.0056 (E)	5.3 0.72		
& DDE[1]	6.0	FW SW	0.00001 (P) 0.00001 (P)	0.01 0.01	1.1 (E) 0.13 (E)	1100 130	0.001 (E) 0.001 (E)	1.0 1.0	0.001 0.001	1 1
	1.92	FW					0.08	0.007		
zenes	3.38	FS			50.0	120.0	5.0	12.0		
ethane	1.48	FS	24.0 (P)	0.7						
ethylene	1.48	FS	0.8 (P)	0.02						

Criteria for acute and chronic benthic toxicity apply to DDT only.

			Levels of Protection							
			Human Health Bioaccumulation		Benthic Aquatic Life Acute Toxicity		Benthic Aquatic Life Chronic Toxicity		Wildlife Bioaccumul	
	$LogK_{ow}$	Fresh-FW Salt -SW Both -FS	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	S Cr µ
	5.0	FW SW	0.001 0.001	0.1 0.1				9.0 (E)[1] 17.0 (E)		
azine	3.03	FS	0.54 (E)	0.58						
	3.55	FW SW			0.22 0.034	0.78 0.12	0.009 0.001	0.03 0.004		
	5.6	FW SW	0.002	0.8				4.0 (E)[1] 0.73 (E)[1]	0.0019 (P)	
	5.19	FW SW						1020 (E)[1] 1340 (E)[1]		
& Epoxide	4.4	FW SW	0.00003 (P) 0.00003 (P)	0.0008 0.0008	0.52 (E) 0.053 (E)	13.1 1.3	0.0038(E) 0.0036(E)	0.1 0.09	0.001	
enzene	6.18	FW	0.0001 (P)	0.15	6.0 (E)	9081	3.68 (E)	5570	0.008 (P)	
utadiene	3.74	FW SW	0.06 (P) 0.06 (P)	0.3 0.3	10.0 3.0	55.0 16.4	1.0 0.3	5.5 1.6	0.7 (P) 0.7 (P)	

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osed sediment quality criteria for the protection of benthic organisms.

			Levels of Protection							
			Human Health Bioaccumulation		Benthic Aquatic Life Acute Toxicity		Benthic Aquatic Life Chronic Toxicity		Wildlif Bioaccumu	
t	$LogK_{ow}$	Fresh-FW Salt -SW Both -FS	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	S C µ
yclohexanes	3.8	FW SW	0.009 (P) 0.009 (P)	0.06 0.06	2.0 0.16	12.6 1.0	0.01 0.004	0.06 0.03	0.23 (P) 0.23 (P)	
yclopentadiene	3.99	FW SW			4.5 0.7	44.0 6.8	0.45 0.07	4.4 0.7		
enyl phosphate	5.4	FW			22	5526	1.7	427		
Benzene	3.97	FW					40	373		
	2.2	FS					0.1	0.02		
or	4.3	FS					0.03	0.6		
	5.83	FS	0.0001 (P)	0.07			0.001	0.7	0.0055 (P)	
tyrene	≈6.0	FS							0.0005 (P)	
nd thion	2.5	FW			0.065 (E)	0.02	0.008	0.003		
phenol	5.0	FW			1.0	100	0.4	40		
e	4.45	FW SW						120 (E)[1] 160 (E)[1]		
al chlorinated	2.75	FW					1.0	0.6		

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osed sediment quality criteria for the protection of benthic organisms.

			Levels of Protection						
			Human Health Bioaccumulation		Benthic Aquatic Life Acute Toxicity		Benthic Aquatic Life Chronic Toxicity		Wildlif Bioaccumu
t	LogK_{ow}	Fresh-FW Salt -SW Both -FS	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l	Sediment Criteria µg/gOC	Water Qual Criteria µg/l
al unchlorinated	2.0	FW					5.0	0.5	
	6.14	FW SW	0.0000006 0.0000006	0.0008 0.0008	2.0 (E) 10.0 (E)	2760.8 13803.8	0.014 (E) 0.03 (E)	19.3 41.4	0.001 0.001
DD	7.0	FS	0.000001	0.01					2x10^{-8} (P)
rachloroethane	2.56	FS	0.7 (P)	0.3					
ethylene	2.88	FS	1.0	0.8					
	1.4	FS	18.0 (P)	0.5					
	3.3	FW SW	0.009 (P) 0.009 (P)	0.02 0.02	1.6 0.07	3.2 0.14	0.005 0.005	0.01 0.01	
nzenes	4.26	FS			50	910	5	91	
oroethane	2.17	FS	4.0 (P)	0.6					
ylene	2.29	FS	11.0	2.0					
hosphate	4.59	FW			40	1556	4	156	
de	0.6	FS	18.0 (P)	0.07					

Table 2. Sediment Criteria for Metals. Two levels of risk have been established for metals contamination in sediments. These are the Lowest Effect Level and the Severe Effect Level. The Lowest Effect Level for each metal is the lowest of either the Persaud et al. (1992) Lowest Effect Level or the Long and Morgan (1990) Effect Range-Low. Similarly, the Severe Effect Level for each metal is the lowest of either the Persaud et al. (1992) Severe Effect Level or the Long and Morgan (1990) Effect Range-Moderate. A sediment is considered contaminated if either criterion is exceeded. If both criteria are exceeded, the sediment is considered to be severely impacted. If only the Lowest Effect Level criterion is exceeded, the impact is considered moderate. The units are μg/g, or ppm, except for iron, which is listed as a percentage. An "L" following a criterion means that it was taken from Long and Morgan (1990); a "P" following a criterion indicates that it is from Persaud et al. (1992). Complete tables from both sources can be found in appendix 2.

Metal	**Lowest Effect Level μg/g (ppm)**	**Severe Effect Level μg/g (ppm)**
Antimony	2.0 (L)	25.0 (L)
Arsenic	6.0 (P)	33.0 (P)
Cadmium	0.6 (P)	9.0 (L)
Chromium	26.0 (P)	110.0 (P)
Copper	16.0 (P)	110.0 (P)
Iron (%)	2.0% (P)	4.0% (P)
Lead	31.0 (P)	110.0 (L)
Manganese	460.0 (P)	1100.0 (L)
Mercury	0.15 (L)	1.3 (L)
Nickel	16.0 (P)	50.0 (L)
Silver	1.0 (L)	2.2 (L)
Zinc	120.0 (P/L)	270.0 (L)

Appendix 1. Basis for the Water Quality Criteria Used for Deriving Sediment Criteria for the Protection of Human and Health and Piscivorous Wildlife from Bioaccumulation Effects.

This appendix provides the basis and calculations for ambient water quality criteria in Table 1 with the suffix (P), which were developed by the Divisions of Fish and Wildlife and Marine Resources for use in calculation of sediment criteria.

Human health (bioaccumulation) based criteria in Table 1 with the (P) suffix are derived according to the method in 6NYCRR 702.8.

$$\text{Water Quality Criterion, ug/l} = \frac{\text{ADI, ug/d}}{0.033 \text{ kg/d} \times \text{BF}}$$

where

ADI, ug/d = acceptable daily intake for humans taken from fact sheets supporting drinking water standards and guidance values in TOGS 1.1.1

0.033 kg/d = the human daily intake from fish consumption cited in Part 702.8 and

BF = bioaccumulation factor

Wildlife residue based criteria in Table 1 with the (P) suffix are derived according to the method in 6NYCRR 702.13.

$$\text{Water Quality Criterion, ug/l} = \frac{\text{A, mg/kg}}{\text{BF}}$$

where

A is a fish flesh criterion for protection of piscivorous wildlife taken from Newell et al (1987), and BF = Bioaccumulation Factor

BFs for human health based criteria are about 3% lipid based, whereas the BCF's for wildlife based criteria are about 10% lipid based. BFs were determined as a best judgement from review of available information in EPA water quality criteria documents, EPA (1979), and other scientific literature.

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-7010

John P. Cahill
Commissioner

October 21, 1997

Mr. Stephen Absolom
Chief, Engineering and Environmental Division
Seneca Army Depot Activity (SEADA)
5786 State Route 96
Romulus, NY 14541-5001

Dear Mr. Absolom:

Re: Use of Preliminary Remediation Goals

We have discussed the use of preliminary remediation goals (a.k.a. risk based criteria) for setting remedial or cleanup levels for contaminated CERCLA sites at the Seneca Army Depot. This was in response to the SEAD's proposal for using factors similar to the USEPA's Region 3 RBC's.

The NYSDEC, under the CERCLA program, does not recognize the use of RBC's in setting remedial goals for contaminated areas, neither on NPL nor non-NPL sites. The use of the USEPA's Region 3 RBC's has been proposed by other USDOD facilities in New York, but the NYSDEC has rejected this notion.

The USEPA went to great pains in its RBC document to state: "To summarize, the table should generally not be used to (1) set cleanup or no-action levels at CERCLA sites or RCRA Corrective Action sites, (2) substitute for EPA guidelines for preparing baseline risk assessments, or (3) determine if a waste is hazardous under RCRA." You will also note on page 1 of the NYSDEC TAGM 4046, that the goal of the Department is to restore hazardous waste sites to predisposal conditions, and that the TAGM provides a basis and procedure to determine soil cleanup levels *"... when the Director determines that cleanup of a site to predisposal conditions is not possible or feasible."*

These are the general arguments against the use of the RBC's and we could discuss further, if there is a need.

Sincerely,

Marsden Chen

Marsden Chen
Bureau of Eastern Remedial Action
Division of Environmental Remediation

c: R. Wing/C. Struble, USEPA-Region II

SEADRBC.WPD

DEPARTMENT OF THE ARMY
SENECA ARMY DEPOT ACTIVITY
5786 STATE RTE 96
ROMULUS, NEW YORK 14541-5001

July 23, 1997

REPLY TO
ATTENTION OF

Engineering and
Environmental Office

Mr. Marsden Chen
NYS Department of Environmental Conservation
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
50 Wolf Road, Room 208
Albany, New York 12233-7010

Dear Mr. Chen:

At the July 15, 1997 BRAC Cleanup Team meeting, the proper use of NYSDEC technical administrative guidance memorandum (TAGM) values was discussed.

In order to adequately address the Peer Review comment regarding the application of TAGMs, request that you clarify their use. Specifically, are they to be compared to individual samples, arithmetic mean, geometric mean, or upper 90th or 95th percentile of the distribution? Also, is it necessary for you to address whether they are to be absolute precipitators for further investigation, cleanup standards, or considered preliminary remediation goals?

The proper understanding of the use of TAGMs is important as new sites are considered for action, existing sites reconsidered, and all sites compete for limited BRAC funding.

Should you have any questions regarding this request, please contact Stephen Absolom at (607) 869-1309.

Sincerely,

Donald C. Olson
LTC, U.S. Army
Commanding Officer

Copies Furnished:

Ms. Carla M. Struble, P.E., U.S. Environmental Protection Agency, Emergency and Remedial Response Division, 290 Broadway, 18th Floor, E-3, New York, New York 10007-1866

Mr. Michael Duchesneau, Parsons Engineering Science, Inc., Prudential Center, 101 Huntington Avenue, Boston, Massachusetts 02199-7697

Mr. Dan Geraghty, New York State Department of Health, Bureau of Environmental Exposure Investigation, Division of Health Assessment, 2 University Place, Room 205, Albany, New York, New York 12203-3399

Commander, U.S. Army Industrial Operations Command, ATTN: AMSIO-EQE (Ed Agy), Rock Island, Illinois 61299-6000

Commander, U.S. Army Environmental Center, ATTN: SFIM-AEC-IRP (Jeff Waugh), Aberdeen Proving Ground, Maryland 21010-5410

Commander, U.S. Army Corps of Engineers, Huntsville Division, ATTN: CEHND-ED-CS (Kevin Healy), PO Box 1600, Huntsville, Alabama 35807

Commander, U.S. Army Corps of Engineers, Seneca Army Depot Activity, ATTN: CENAN-PP-E, SEDA Resident Office, Romulus, New York 14541-5001

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-7010

John P. Cahill
Commissioner

July 28, 1997

Donald C. Olson
LTC, U.S. Army
Commanding Officer
Seneca Army Depot Activity
5786 State Rte. 96
Romulus, NY 14541-5001

Dear Col. Olson:

I am responding to your July 23, 1997 query on the NYSDEC's TAGM 4046 and specifically on the use of the cleanup values contained therein. The answer to the question is: TAGM 4046 soil cleanup numbers represent the concentrations to which the contaminants in the soils at a Superfund site should be reduced during the remedial action. The TAGM 4046 values do not represent the arithmetic or geometric mean nor any other statistical calculation as the standard deviations or 90th or 95th percentile value of a distribution.

You will note that the DEC's goal is to restore Superfund sites to predisposal conditions (see TAGM, page 1); but in exercising flexibility (TAGM's Introduction, paragraphs 1 and 3), DEC has calculated the TAGM values, and applies them in instances where achievement of predisposal conditions is not possible.

Sincerely,

Marsden Chen.

Marsden Chen
Bureau of Eastern Remedial Action
Division of Environmental Remediation

c: S. Absolom, SEDA
C. Struble, USEPA-Region II
M. Duchesneau, Parsons Eng. Sci.
D. Geraghty, NYSDOH
E. Agy, U.S. Army
J. Waugh, U.S. Army
K. Healy, USACOE
SEDA Resident Office