USACE CONTRACT NO. DACW33-94-D-0002
TASK ORDER NO. 020
TOTAL ENVIRONMENTAL RESTORATION CONTRACT

WORK PLAN
FOR THE
NON-TIME CRITICAL REMOVAL ACTION FOR
THE CAUSEWAY AND DIKE
STRATFORD ARMY ENGINE PLANT
Stratford, Connecticut

September 20, 1999

Prepared for

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts

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1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (Foster Wheeler) and Harding Lawson Associates (HLA) have been contracted through the U.S. Army Corps of Engineers – New England District (USACE) to complete a Non-time Critical Removal Action (NCRA) for the Causeway and Dike Area at the Stratford Army Engine Plant (SAEP) under Task Order No. 020 of Contract No. DACW33-94-D-0002. The objectives of this Task Order are to: 1) complete additional field activities necessary to characterize physical and chemical subsurface conditions on the Causeway and Dike, 2) summarize the results of field activities in a report, and 3) document the decision process for selection of a removal action for the Causeway and Dike area in an Engineering Evaluation/Cost Analysis (EE/CA) and a Removal Action Memorandum (RAM).

1.1 PROJECT INTRODUCTION

SAEP is located on approximately 126 acres in Stratford, Connecticut, on the Stratford Point peninsula in the southeast corner of Fairfield County (Figure 1) (see Attachment A). About 76 acres of the land are improved and 48 acres are riparian (water) rights (see Figure 1).

SAEP was formerly a government-owned, contractor-operated facility. The land and buildings are owned by the U.S. Army, and former plant equipment (removed in early 1998) was owned by both the U.S. Army and it's contractor AlliedSignal Engines. The U.S. Army-owned land, buildings, and equipment were formerly provided to AlliedSignal under a facilities contract for executing government contracts, including the manufacture and testing of turbine engines for the U.S Army. The SAEP property consists of 49 buildings, paved roadways and grounds, and five paved parking lots (Figure 2).

Responsibility for the jurisdiction, control, and accountability of SAEP was transferred from the U.S. Army Aviation and Troop command to the U.S. Army Tank-Automotive and Armament Command (TACOM) in September 1995. In October 1995, SAEP was placed on the Base Closure and Realignment (BRAC) list, known as BRAC 95. Pursuant to the Defense Base Closure and Realignment Act of 1990, the BRAC Environmental Restoration Program mandates that environmental contamination on BRAC properties be investigated and remediated, as necessary, prior to disposal and reuse. In August 1998, SAEP was transitioned from an active production facility to caretaker status.

1.2 PREVIOUS SITE ACTIVITIES

For BRAC 95 facilities, the Environmental Restoration Program begins with an Environmental Baseline Survey (EBS) to describe the environmental condition of the property. ABB Environmental Services, Inc. (subsequently HLA) published the Final EBS in December 1996. A Remedial Investigation (RI) is currently being conducted by URS Greiner-Woodward Clyde Federal Services (URSGWCFS) under a contract to the USACE to characterize the type and extent of contamination at SAEP and evaluate potential risks to human health and the environment.

1.3 PURPOSE AND SCOPE OF WORK PLAN

In order to provide a removal action recommendation for the Causeway and Dike, subsurface soil geologic and analytical data is required to characterize and evaluate subsurface conditions. Using this data, an EE/CA can be written presenting the recommended removal action alternative.

The purpose of this Work Plan is to describe the activities proposed for completion under the Causeway and Dike NCRA. Previous investigations at SAEP have characterized soil and groundwater contamination on the facility side of the dike. This NCRA includes only the dike and the causeway areas. Because Foster Wheeler/HLA completed a Work Plan for the OU 2 NCRA and URSGWCFS completed a detailed Work Plan for SAEP in support of RI activities, this document will reference those Work Plans (Foster Wheeler/HLA, 1999 and URSGWCFS, 1998) rather than duplicate information, when appropriate.

1.4 ORGANIZATION OF WORK PLAN

This Work Plan consists of eight sections, plus attachments and appendices. Section 1 contains an introduction to the SAEP site and the purpose and scope of the Work Plan; Section 2 provides information on the history of SAEP; Section 3 summarizes previous investigations completed at the site; Section 4 outlines the project objectives; Section 5 lists the data gaps identified during data review, and the subsequent data quality objectives that have been developed; Section 6 details the work approach for the Causeway and Dike NCRA; Section 7 introduces the Waste Management Plan; and Section 8 outlines the management structure for the NCRA.

Attachment A contains figures referenced in this Work Plan and Attachment B contains a copy of Section 2.0 of the URSGWC RI Work Plan. Attachment C contains the CTDEP RSR criteria and Attachment D contains the Work Scope Outline/Cost Estimate Assumptions for the Causeway and Dike NCRA. Appendix A contains the Causeway and Dike Sampling and Analysis Plan (SAP) and Appendix B contains the Causeway and Dike Site Safety and Health Plan (SSHP). This document references Appendix B of the Operable Unit (OU) 2 NCRA Work Plan, which contains the SAEP Quality Assurance Project Plan (QAPjP). A separate QAPjP will not be issued for the Causeway and Dike NCRA.

2.0 SITE DESCRIPTION AND HISTORY

Section 2.0 of the URSGWCFS RI Work Plan (URSGWCFS, 1998) provides a description of SAEP, including a land use assessment, a physical setting description, an ecological setting description, and a site history. Attachment B of this Work Plan contains a copy of Section 2.0 of the URSGWCFS RI Work Plan.

3.0 PREVIOUS INVESTIGATIONS

Several previous investigations have been completed at SAEP, including:

- Preliminary Assessment Screening
- Resource Conservation and Recovery Act (RCRA) Facility Assessment
- Phase I Investigation
- Phase II Investigation
- Environmental Baseline Survey
- Chromium Plating Facility Investigations
- VOC Groundwater Investigations
- Remedial Investigation

The first five investigations are summarized in Section 3.0 of the URSGWCFS RI Work Plan (URSGWCFS, 1998). Brief summaries of the three remaining investigations are presented in the OU 2 NCRA Work Plan (Foster Wheeler/HLA, 1999). Figure 2 presents the approximate area included in the Causeway and Dike NCRA.

3.1 CAUSEWAY

Information obtained from the EBS Report indicated the causeway was initially constructed and used as a means of launching seaplanes in the 1930s. Additional materials, of unknown origin, were deposited along the northern edge of the causeway during the 1950s and 1960s. Building B-59 was constructed to house the nose cones of missiles (without warheads), including the explosive charges used to open the nose cones. The source of the fill used to construct the causeway is unknown, but the fill is suspected to contain asbestos and construction debris. Analyses of ten surface soil samples collected from depths of 0 to 6 inches on non-vegetated areas of the causeway during the Phase I RI did not indicate the presence of asbestos (ABB Environmental Services, Inc., 1996).

It was also reported that paint solvents and wastes were burned on the causeway as part of fire training operations. Although no subsurface soil or groundwater samples have been collected in the area of the causeway, Phase I RI data from the area near Building B-16 (see Figure 2) indicates the potential for subsurface contamination.

A recent investigation conducted by WE-Manage, Inc. consisted of a radiological survey of the area containing the causeway. The May 1999 report entitled, "Radiological Assessment of the Causeway", summarizes the results of the survey. The historical assessment associated with the survey determined the following activities were reportedly conducted on the causeway:

- The residues from magnesium-thorium fires, which occurred in the production plant, were routinely dumped onto the causeway.
- Waste oil, which potentially contained thorium-232, was spread on the causeway to control dust.

- Fire control training was conducted on the causeway with magnesium-thorium alloys.

The historical assessment also indicated that:

- The area surrounding Building B-59 was found to have radiological background measurements approximately twice the background of adjacent areas; and
- Analysis of previously collected samples identified uranium; a radionuclide not identified as a manufacturing process material during the years of plant operation, but found in Building 73.

During 1997, a surface scan survey was conducted over 100 percent of the causeway and soil samples were collected from the area of the causeway and sent off-site for radiological analysis. In general, samples were collected from depths of 0 to 6 inches. The survey concluded that:

- the average concentration of suspected residual radioactive contamination is below the Nuclear Regulatory Commission (NRC) property release criteria;
- areas with potential elevated concentrations do not exceed size limitations; and
- over the next 1,000 years, the maximum hypothetical annual dose is approximately half that permitted by current NRC regulations.

Subsurface soil samples (greater than 6-inches deep) are scheduled to be collected by the NRC or CTDEP for radiological analysis during Pre-design Field Activities for this NCRA.

3.2 DIKE

Information from the EBS Report indicates that a severe flood of the Housatonic River occurred in 1948, rendering the Stratford plant's manufacturing space unusable. In 1951, the U.S. Air Force purchased the plant, repaired the water-damaged buildings, and built the dike to provide flood protection for the facility.

Information regarding the construction of the dike, including the material used to complete construction is generally unknown; however, aerial photographs indicate rip-rap material was primarily used during dike construction. Currently, an asphalt-paved road approximately 8 to 10 feet wide is placed on top of the dike. Rip-rap covers each of the sloped sides of the dike.

4.0 PROJECT OBJECTIVES

This section summarizes the project objectives for the Causeway and Dike NCRA at SAEP. Three general categories are discussed to address project objectives, including regulatory framework, project goals, and Applicable or Relevant and Appropriate Requirements (ARARs).

4.1 REGULATORY FRAMEWORK

The NCRA for the Causeway and Dike at SAEP is being performed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). In October 1995, SAEP was placed on the BRAC 95 list. The BRAC Environmental Restoration Program mandates that environmental contamination on U.S. Army BRAC properties be investigated and remediated, as necessary, prior to disposal and reuse.

Regulatory oversight is being provided by the CTDEP and the U.S. Environmental Protection Agency (USEPA). This Work Plan was prepared in accordance with CTDEP, CERCLA, and BRAC requirements.

The NRC oversees radiological activities conducted at the SAEP site. Radiological activities have been previously conducted at the Stratford site under a NRC license. AlliedSignal has submitted a request to the NRC to terminate the license for the Causeway portion of the facility.

4.2 PROJECT GOALS

The goal of the Causeway and Dike NCRA is to characterize subsurface conditions and provide a recommended removal action to address identified contamination, if necessary. Project activities will address the following goals:

- Evaluate using geophysical (electromagnetic induction [EMI] and ground-penetrating radar [GPR]) surveys, the location of subsurface features and potential drilling obstructions on the Causeway and Dike.
- Evaluate the presence or absence of contamination in the area of the Causeway and Dike and assess the potential for migration of contaminants to groundwater through surface and subsurface soil sampling and analysis.
- Determine the location and elevation of sampling locations with an elevation and location survey.
- Document the removal action alternative evaluation process in an EE/CA and the removal action selection in a RAM.

4.3 REGULATORY COMPLIANCE PLAN (ARARS)

Federal, state, and local laws and statutes have been reviewed for two purposes: 1) to determine if permits are required for the proposed field activities, and 2) to evaluate the environmental criteria against which analytical results will be compared. CTDEP RSR criteria (see Attachment C) will be followed as one of the driving considerations in the selection and implementation of any removal action(s).

As part of the EE/CA process, the applicable, relevant and appropriate federal, state and local laws, regulations and policies that might impact the various removal activities, either through cost or procedural requirements, will be identified for each of the removal alternatives detailed in the EE/CA. The ARARS for the various proposed remedies will be further researched as to the potential schedule, cost, design, construction means and methods, monitoring, and operation and maintenance impacts that they may incur. A table will be prepared that will present:

- title and citation of the law, regulation or policy;
- a brief summary of the regulatory requirements;
- a brief summary of how the project activities will comply with the spirit of the requirements. (It is assumed that written exemptions or waivers will be obtained by TACOM and/or the USACE from the appropriate agencies such that actual permits will not be required for project activities); and
- a brief summary of the impact of the ARARS on the various project aspects (including schedule, cost, design, construction means and methods, monitoring, and operation and maintenance).

Additionally, a summary of the anticipated ARARS affects upon the suggested remedy will be carried through to the RAM. A regulatory strategy will be presented in the RAM, which will identify the regulatory drivers, the anticipated affects of the regulatory issues on the removal activity aspects, and the anticipated action or actions which will be required to address the ARARS.

4.3.1 Permit Requirements

Disposal of investigation-derived waste (IDW) water is covered under an Emergency Discharge Authorization, which was issued by the CTDEP on March 18, 1999. This authorization covers discharge of wastewater from the SAEP Chemical Waste Treatment Plant (CWTP) generated during investigation and remediation activities conducted on-site. The expiration date for this authorization is March 18, 2000.

4.3.2 Criteria for Comparison to Sample Data

CTDEP has established RSR criteria for various media including target concentrations for indoor air and criteria for soil, groundwater, and surface water. The Causeway and Dike NCRA will compare detected contaminant concentrations against RSR criteria and a previously developed asbestos standard to determine if removal actions are required. The criteria to be considered include:

- Surface soil analytical data will be compared to Direct Exposure Criteria for Soil (residential);
- Subsurface soil analytical data from above the water table will be compared to the GB Pollutant Mobility Criteria; and
- Soil analytical data for asbestos will be compared to the residential standard established for another TERC project (i.e., Raymark in Stratford) of 1 percent total asbestos by the polarizing light microscope (PLM) method.

5.0 DATA GAPS AND DATA QUALITY OBJECTIVES

In order to ensure adequate data has been collected to provide the information necessary to complete the EE/CA, data gaps must be identified and data quality objectives (DQOs) must be developed. This process is summarized in the following subsections.

5.1 DATA GAPS

As part of Work Plan development, a review of existing data related to soil and groundwater sampling in the vicinity of the Causeway and Dike at SAEP was completed. The review encompassed previous data collected by HLA, URSGWCFS, and WE-Manage, Inc. at the site and identified the following data gaps:

- Information on the presence or absence of surface and subsurface soil chemical contamination in the area of the Causeway and Dike is not available;
- The location of subsurface features in the area of the Causeway and Dike is unknown; and
- Information on the horizontal location and elevation of surface and subsurface sampling points is not complete.

5.2 DATA QUALITY OBJECTIVES

DQOs have been developed to focus the Causeway and Dike NCRA investigations and ensure the necessary data are collected to support recommendation of a removal action alternative. The DQOs can be qualitative or quantitative, and identify the type and/or quality of data required to characterize a site, support an action, and satisfy ARARs.

The following list presents the DQOs for the Causeway and Dike NCRA investigations, and is the basis for the field activities identified in Section 6.0.

- Is contamination present in surface and subsurface soil in the area of the Causeway and Dike?
- What are the limits of surface and subsurface soil contamination, if identified, exceeding CTDEP RSR criteria at the site?
- What is the distribution of surface and subsurface soil contaminant concentrations in the area of the Causeway and Dike?
- Where are subsurface obstructions present on the Causeway and Dike?
- What are the horizontal locations and elevations of surface and subsurface soil sampling locations?

Quantitative DQOs such as detection limits are discussed in Section 3.0 of the SAEP QAPjP, presented in Appendix B of the OU 2 NCRA Work Plan (Foster Wheeler/HLA, 1999).

6.0 WORK APPROACH AND TASK PLAN

This section provides a brief summary of the Causeway and Dike NCRA approach. There are six tasks associated with the Causeway and Dike NCRA, including:

- Task 1 Planning (Work Plan, SAP, and SSHP)
- Task 2 Meeting Support and Data Management
- Task 3 Pre-design Field Activities
  - Subtask 3.1 Geophysical Surveys (EMI and GPR)
  - Subtask 3.2 Surface and Subsurface Soil Sampling and Analysis
  - Subtask 3.3 Location and Elevation Survey
- Task 4 Pre-Design Investigation Report
- Task 5 EE/CA Process
  - Subtask 5.1 EE/CA Report Preparation
  - Subtask 5.2 Preparation of the Action Memorandum
- Task 6 Project Management

Details on the field activities are presented in the SAP provided in Appendix A. Standard Operating Procedures (SOPs) for specific field tasks are contained in Attachment A of the SAEP QAPjP (Foster Wheeler/HLA, 1999). Table 1 of the SAP contains a summary of the analytical sampling proposed for the field investigation.

The following subsections provide a brief summary of the Causeway and Dike NCRA tasks. Attachment D of this Work Plan contains the assumptions used to generate the cost estimate for completion of each of the tasks.

6.1 PLANNING (TASK 1)

Task 1 consists of the writing of the NCRA Work Plan, the SAP, and the SSHP. Included in this task is a review of existing URSGWCFS plans to ensure coordination between the Causeway and Dike NCRA, the OU 2 NCRA, and the RI.

6.2 MEETING SUPPORT AND DATA MANAGEMENT (TASK 2)

This task includes Foster Wheeler's/HLAs participation in a post-award kick-off meeting. It is anticipated that Foster Wheeler/HLA will be responsible for development and presentation of a technical briefing regarding the status of the NCRA at this meeting.

In addition, this task includes the input and management of data produced during field investigations. Primarily this covers the input of data into the Geographic Information System (GIS) and the creation of data tables, as necessary.

6.3 PRE-DESIGN FIELD ACTIVITIES (TASK 3)

Field activities associated with Task 3 of the Causeway and Dike NCRA include:

- Geophysical surveys (EMI and GPR)
- Surface and subsurface soil sampling and analysis
- Location and elevation survey

6.3.1 Geophysical Surveys (EMI and GPR) (Subtask 3.1)

A Foster Wheeler/HLA crew will perform geophysical surveys to detect and characterize potential buried debris, buried rip-rap, voids and other potential obstructions and hazards within the survey area that may limit access to subsurface soil during investigation activities. The geophysical surveys will be completed in advance of subsurface investigations to allow time for identification of potential exploration locations. The geophysical methods best suited for this type of characterization are electromagnetic induction (EMI) and ground penetrating radar (GPR).

EMI instruments are sensitive to both ferrous and non-ferrous metals, are able to detect a buried 55-gallon drum or 10-inch pipe at depths approaching 15 feet, are fast and easy to operate over rough terrain, and can be operated near buildings, fences, and powerlines. The proposed EMI instrumentation operates using a coil to generate a pulsed (i.e., time based) primary magnetic field into the earth, which induces eddy currents in conductive media. The decay of these eddy currents produces a secondary magnetic field measured by the same coil and reported in units of millivolts (mV).

GPR equipment will be used in conjunction with EMI data to further characterize EMI anomalies. GPR data can further define geophysical anomalies adding additional information (such as rough shape) for interpretation (e.g., metal plate or buried pipe). GPR propagates short wavelength (high frequency) electromagnetic waves into the subsurface and records waves reflected back by media that posses contrasts in electrical properties. Although a GPR record is complex, its picture-like character can make it a very useful tool to delineate subsurface features. Based on the objectives of this geophysical investigation, 100 megahertz (Mhz) and/or 500 Mhz antennas will provide the necessary resolution and depth penetration for the targets and features sought, and will be used for this investigation.

Data collection will concentrate generally on the Causeway, with some data collection also occurring on the Dike area. It is anticipated that a total of approximately 2800 lineal feet of EMI data will be collected in the Causeway and Dike areas for this project. To determine the nature of selected EMI targets, GPR data will be collected along traverse lines along the top of the Dike and the length of the Causeway. It is anticipated that a total of approximately 1500 lineal feet of GPR data will be collected in the Causeway and Dike areas for this project.

Results of the geophysical surveys will be used to locate subsurface explorations and will be presented in the Pre-design Investigation Report.

6.3.2 Surface and Subsurface Soil Sampling and Analysis (Subtask 3.2)

Proposed under this Subtask is the collection of surface soil samples using hand-augering techniques and the collection of subsurface soil samples using traditional drilling methods or test-pit techniques, as necessary.

Sampling on the Causeway. Up to 32 subsurface explorations will be completed on the causeway to collect subsurface soil samples. Approximately 25 explorations will be completed

to a depth of up to 10 feet below ground surface (bgs), or refusal, using traditional hollow-stem auger (HSA) or rotary drilling techniques or test-pit techniques, as necessary to access areas containing large pieces of debris. Up to five additional exploration locations are included as a contingency to investigate areas of radiological concern or to further delineate areas of obvious contamination, if encountered.

Two soil samples will be collected from each of the boring locations, one from near the ground surface (0 to 4 feet bgs), and a second from immediately above or at the water table, using split-spoon samplers. During sample collection a Standard Penetration Test (SPT) will be completed in accordance with the American Society for Testing and Materials (ASTM) method D-1586 at approximately half of the exploration locations to provide information on physical subsurface conditions. If HSA or rotary techniques are not successful at a location, a backhoe may be used to complete test pit explorations and soil samples will be collected using stainless steel spatulas and spoons.

The two remaining borings on the causeway will be completed to the bedrock surface (estimated at 60 to 150 feet bgs), or refusal, using HSA or rotary drilling techniques to evaluate subsurface lithology and investigate the potential for dense non-aqueous phase liquids in the area of the causeway. The soil borings will be located based on results of the shallow explorations. Soil samples will be collected at 10-foot intervals using split-spoon samplers and SPTs will be completed in the borings.

Soil sample descriptions will be provided on soil boring logs in accordance with the Unified Soil Classification System (USCS), ASTM D-2488. Analytical soil samples will be sent to an off-site laboratory for analysis for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), Target Analyte List (TAL) inorganics, polychlorinated biphenyls (PCBs), inorganics using the Synthetic Precipitate Leaching Procedure (SPLP) (for samples above the water table), and asbestos. Off-site laboratory grain-size analysis may also be completed on select samples.

AlliedSignal will provide subcontractor personnel and equipment for radiological monitoring during subsurface investigations on the Causeway. NRC and/or CTDEP personnel will be on-site during the investigation to collect soil samples at some locations for radiological analysis.

Sampling on the Dike. Up to 18 subsurface explorations will be completed to a depth of up to 15 feet bgs, or refusal, on the top of the dike using HSA or rotary drilling techniques, as necessary to access areas with pieces of large debris. In addition, up to nine hand-auger borings will be completed on the facility side of the dike. Two soil samples will be collected from above and/or at the water table in soil borings using split-spoon samplers. SPTs may also be completed in selected boring locations.

Soil sample descriptions will be provided on soil boring logs in accordance with the USCS method, ASTM D-2488. Analytical soil samples will be sent to an off-site laboratory for analysis for VOCs, SVOCs, TAL inorganics, PCBs, SPLP inorganics, and asbestos. Off-site laboratory grain-size analysis may also be completed on selected samples.

Results of surface and subsurface soil sampling and analysis will be presented in the Pre-design Investigation Report. Section 4.0 of the SAP (Appendix A) details the procedures associated with surface and subsurface soil sampling and analysis.

6.3.3 Location and Elevation Survey (Subtask 3.3)

A subcontracted, registered land surveyor will perform a location and elevation survey of soil sampling locations. Horizontal and vertical control points used during previous surveys by URSGWCFS at SAEP will be used during this survey for consistency. Vertical elevation accuracy will be 0.01-foot and horizontal location accuracy will be 0.1-foot. Section 4.0 of the SAP (Appendix A) details the procedures associated with the location and elevation survey.

6.4 PRE-DESIGN INVESTIGATION REPORT (TASK 4)

Task 4 involves the development of the Pre-design Investigation Report. This report will summarize the results of this investigation and previous investigations conducted for the Causeway and Dike. The Pre-design Investigation Report will summarize the field investigation activities identified in Subsection 6.3.

6.5 EE/CA PROCESS (TASK 5)

Task 5 consists of activities conducted in support of development of the EE/CA, including EE/CA report preparation and Removal Action Memorandum (RAM) preparation.

6.5.1 EE/CA Report Preparation (Subtask 5.1)

Four documents will be prepared for the administrative record, an EE/CA, a fact sheet, a response to significant comments, and a RAM.

An EE/CA Report will be written for the causeway and dike areas to provide the rationale behind the development of removal actions alternatives and document the decision process for selection of a recommended alternative. The EE/CA will be developed in accordance with the USEPA "Guidance on Conducting Non-time Critical Removal Actions Under CERCLA" (USEPA, 1993). Prior to initiation of the required 30-day public comment period, a fact-sheet providing a brief summary of the EE/CA will be prepared for the public. Following the public comment period, a response to significant comments will be prepared for inclusion in the RAM (see Subsection 6.5.2).

6.5.2 Preparation of the Action Memorandum (Subtask 5.2)

A RAM will be written to provide documentation of the selection of a removal action for the site. The RAM will contain a summary of the EE/CA, the recommended removal action, a copy of the transcript from the public hearing, and a response to significant comments received during the 30-day public comment period.

6.6 PROJECT MANAGEMENT (TASK 6)

Activities included under Task 6 include preparation of monthly performance, schedule, and cost reports to include total labor hours, miscellaneous direct costs, and indirect costs expended by Task. Task 6 also includes Level of Effort (LOE) associated with communications between the Foster Wheeler/HLA/USACE/SAEP project team, and HLA Technical Manager. In addition, this task includes project controls to include LOE for development of periodic project estimates to complete and estimates at completions.

7.0 WASTE MANAGEMENT PLAN

This waste management section covers the disposition of IDW that is anticipated to be generated at SAEP during investigations for the Causeway and Dike NCRA. IDW will potentially include personnel protective equipment and supplies, drill cuttings and debris generated during exploration installation, groundwater generated during sampling point purging, and decontamination water generated during field decontamination of equipment. IDW will be separated (liquid and solid) and stored separately in appropriate drums inside the former Chromium Plating Facility or the locked gate surrounding the Building 63 Chemical Waste Treatment Plant (CWTP) sump. The final disposition of IDW will be determined based upon waste contents and analytical results, if necessary.

Solid IDW. Drums containing soil generated during soil boring completion will be stored briefly on-site in accordance with regulatory requirements, and then sent off-site for disposal based on analytical findings of the contents. Samples from the drums will be sent off-site for analysis using the Toxicity Characteristic Leaching Procedure (TCLP), as necessary, to determine the type of off-site disposal necessary. Personal protective equipment (PPE) and disposable sampling equipment and supplies will also be drummed for off-site disposal. Soil and PPE drums will be scanned with a pancake probe to assess potential alpha and beta radiation prior to removal from the Causeway.

Liquid IDW. Groundwater generated during subsurface investigations will be treated for possible VOCs and SVOCs using a granular activated carbon system prior to discharge to the SAEP CWTP sump at Building 63. Wastewater discharged to the CWTP must be free of VOCs, SVOCs, and surfactants (detergents) in order to meet the CWTP's National Pollutant Discharge Elimination System Permit.

The CWTP treatment process includes chromium reduction, precipitation of chromium and other heavy metals, clarification, and sand filtration. A sludge thickener and filter press dewaters sludge from the clarifier; filter cake is disposed of off-site and filtrate is returned to the CWTP for further treatment. Effluent from the CWTP sand filters is discharged to Outfall 008, which ultimately discharges to the Housatonic River. Discharge of wastewater generated during investigation activities on-site to the CWTP is permitted under the Emergency Discharge Authorization dated March 18, 1999.

Decontamination water (containing surfactants) will be stored briefly on-site (a maximum of 90 days) and will be sent off-site for disposal based on the type of contamination present in the water and suspected contaminant concentrations.

8.0 MANAGEMENT PLAN

Foster Wheeler/HLA will manage Delivery Order No. 20 in accordance with established procedures and contractual requirements for progress measurement, contract administration, and quality control.

8.1 PROJECT ORGANIZATION AND KEY PERSONNEL

As established under the Total Environmental Restoration Contract (TERC), Mr. Rick Gleason (Foster Wheeler) will be acting as the Program Manager. Mr. Jay Borkland (Foster Wheeler) will be acting as the Project Manager for the Causeway and Dike NCRA at SAEP, and will be responsible for implementing the Task Order in accordance with the established TERC guidelines and procedures. Mr. Nelson Walter (HLA) will assume the role of the Technical Manager for the Causeway and Dike work.

8.1.1 Technical Manager

The Technical Manager has primary responsibility for the implementation, and completion of Scope of Work. The Technical Manager is responsible to the Project Manager, and the USACE for day-to-day implementation of the project. The Technical Manager also supervises the timely development and delivery of the technical reports, and other project documents. The Technical Manager assigns and monitors all project personnel in planning, coordinating, and controlling all technical aspects of the tasks, and is responsible for maintaining the quality of the work product, schedule and budget control. In addition, the Technical Manager is responsible for communications with the Foster Wheeler Project Manager and USACE Project Manager, and other key staff personnel.

All personnel assigned to the project, including subcontractors, will be qualified for the task(s) to which they have been retained. Appraisal of the qualification of technical personnel assigned to the project will be made by the Technical Manager and the Project Manager. The appraisal will include comparison of the requirements of the task assignment with the relevant experience and training of the prospective personnel.

8.1.2 Project QA/QC Coordinator

The Project Quality Assurance/Quality Control; (QA/QC) Coordinator, Mr. Christian Ricardi (HLA), works directly with the Technical Manager and other project personnel. The overall responsibility of the Project QA/QC Coordinator is to implement the quality assurance program, and monitor and verify that the work is done in accordance with the SAP, and the QAPjP includes the SOPs for field activities planned for the Causeway and Dike NCRA. The Project QA/QC Coordinator also has the following responsibilities: to assess the effectiveness of the QA/QC program; to recommend modifications to the program when applicable; to verify that personnel assigned to the project are trained and indoctrinated relative to the requirements of the QA/QC program; to review and verify the disposition of nonconformance and corrective action reports; and for periodic quality

assurance. The Project QA/QC Coordinator is responsible for the coordination of QA sample collection, and the delivery.

8.1.3 Health and Safety Manager

The Health and Safety Manager (HSM), Ms. Cindy Sundquist, CIH (HLA), reports to the Technical Manager, and works with the other project personnel. The HSM has the responsibility to monitor and verify site conditions, conduct periodic audits and reports from the Site Safety and Health Officer (SSHO), and verify that the field activities are conducted in accordance with the SSHP. The HSM will advise the Technical Manager regarding health and safety issues, but will function independently of the Technical Manager. The HSM will also designate and oversee the activities of the SSHO.

8.1.4 Site Safety and Health Officer

The SSHO will monitor site activities and will be responsible for the implementation of the site-specific SSHP. The SSHO reports directly to the HSM, and works with the Technical Manager and Task Leaders to ensure overall compliance with the SSHP.

8.1.5 Technical Task Leaders

Technical Task Leaders will be chosen by the Technical Manager and the Project Manager, and will be assigned to work on various tasks as deemed necessary by the Technical Manager. Each Task Leader will be responsible to the Technical Manager for planning, scheduling, cost control, and completion of assigned project tasks. The Task Leader is responsible for implementing the QA/QC program as it relates to assigned tasks for the project.

8.1.6 Field Operations Lead

The Field Operations Lead (FOL) will be appointed by the Technical Manager and will be responsible for coordinating all field activities. The FOL will work with the Technical Task Leaders, and will schedule field activities with the project staff assigned by the Technical Manager. The FOL will also work with the SSHO and the QA/QC Coordinator to accomplish the objectives of all aspects of the work plan, including the QAPjP, as they pertain to field activities.

8.1.7 Project Staff

Project staff members are chosen by the Technical Manager. Each member of the project staff is responsible to the FOL or Technical Manager for completion of assigned project activities. Members of the project staff are responsible for understanding and implementing the QA/QC program as it applies to their project activities.

8.1.8 Data Reviewers

Data Reviewers are chosen by the Technical Manager and the Project QA/QC Coordinator. Responsibilities of the Data Reviewers include, but are not necessarily limited to:

- Verifying measurement system calibration;

- Auditing quality control activities;
- Screening data sets for outliers;
- Auditing field sample data records and chain-of-custody forms; and
- Checking calculations.

The primary task of the Data Reviewers is to quantitatively and qualitatively assess chemical data reported by the laboratory.

The quality review of non-laboratory data will be accomplished by a professional individual who is qualified for the specific task. For example, a geologist will review geologic data, and the FOL will review field calibration logs while the field activities are being performed. The appropriate Data Reviewer will review the data results and data collection procedures for compliance with established quality control criteria. Data Reviewers will report to the Technical Manager.

8.2 SUBCONTRACTORS

Implementation of the Causeway and Dike NCRA Work Plan and associated activities will require subcontractors for providing additional project support for services such as:

- Subsurface Investigations: Drilling, Off-site Laboratory, and Data Validation Subcontractors
- Location and Elevation Survey: Surveyor Subcontractor
- Off-site Waste Disposal: Waste Disposal Subcontractor

Training and qualifications of subcontractor personnel will be confirmed via certifications and licenses, which are issued by regulatory agencies. All equipment, including health and safety related items, required for field activities performed by subcontractors, will be supplied by the subcontractors. Subcontractors will be identified during the field planning activities in August 1999.

The QA/QC Coordinator and FOL will be responsible to confirm that the field subcontractors are in compliance with the Causeway and Dike NCRA Work Plan, the QAPjP, and all QA/QC requirements. Laboratory personnel, which have primary responsibility of ensuring adherence to the QA/QC of the project and the laboratory QA/QC program, will be identified in the laboratory QA/QC Manual.

Although, the Subcontractors have not been confirmed at this time, bids from prospective firms will be accepted, with the lowest, best-qualified bid to be preferred by Foster Wheeler/HLA.

8.3 MANAGEMENT INFORMATION SYSTEMS FOR REPORTING

Costs will be tracked by Foster Wheeler/HLA at the activity level. A monthly report will be submitted to the USACE with current period and job-to-date committed cost information at the task and subtask levels. This report will include a summary of technical activities and costs, a

schedule report (TACOM has requested that schedules be provided in Microsoft Project format), a cost and schedule variance analysis, and a detailed breakout of major subcontract costs.

8.4 ACQUISITION STRATEGY

A number of material, supplies, and services will need to be performed or acquired for different aspects of the Causeway and Dike NCRA field investigations and remedial design. The acquisition strategy will include a make/buy analysis on what investigation components are best self-performed by Foster Wheeler/HLA and those components best performed by outside subcontractors, the appropriate contractual terms for subcontracted work (i.e., cost reimbursable vs. fixed priced contracts), and plans to optimize use of SB/SDBs. Key to this analysis is what provides best value to the government. It is important at his state of the project to develop plans required to maximize the opportunities for SB/SDBs, historically Black Colleges and Universities/Minority Institutions (HBCU/MIs), and local businesses. The following sections provide a discussion concerning Foster Wheeler/HLAs approach for make/buy decisions and plans for maximizing opportunities for SBD/SDBs, HBCU/MIs, and local businesses.

8.4.1 Make/Buy Analysis

A key aspect of the make/buy analysis is what is the most cost effective way of performing the work. In general, Foster Wheeler/HLA opts to "buy" (subcontract the work) when:

- The project requirements are sufficiently well defined and measured, and there is minimal uncertainty or likelihood of change;
- When there is specialized training or skill beyond the capability of the Foster Wheeler Team; or
- Where specialized expertise translates into a clear advantage in terms of cost, schedule, or quality.

In these situations, the work would be performed under a fixed price or fixed unit rate arrangement with the subcontractor: the level of detail would be appropriate for the subcontractor to perform the work and Foster Wheeler/HLA to manage the work as a fixed price contract.

Conversely, Foster Wheeler/HLA prefers to self-perform ("make") the work when:

- Work requirements are highly uncertain or subject to change;
- Uniquely complex or highly hazardous work conditions exist; the task could potentially affect or significantly interfere with other project activities; or
- The task is on the critical path of the project.

In these instances, self-performance of the work allows Foster Wheeler/HLA to directly control the safety, technical quality, cost, and schedule of the work to be performed. Foster Wheeler/HLA can be more responsive and flexible when we self-perform in these situations, ultimately resulting in overall efficiency benefits for the project. It also means that the design plan and specifications can be prepared as detailed work packages that allow the Foster Wheeler Team to proceed directly to construction, as opposed to developing detailed specifications tailored for procurement and management of a subcontractor.

8.4.2 SB/SDB, HBCU/MI, and Local Business Utilization

The NE TERC has specific goals for utilization of SB/SDBs and HBCU/MIs as a percentage of total subcontracted dollar amount awarded in the contract. Meeting the established goals for the contract will require creative and innovative contracting strategies to provide opportunities for these type of businesses to participate in the project while maintaining overall project efficiency. In addition to SB/SDBs and HBCU/MIs, Foster Wheeler/HLA recognizes that USACE has a commitment to involve local businesses within the project activities. The purpose of this section is to describe the potential strategies to maximize the utilization of SB/SDBs, HBCU/MIs, and local businesses.

SB/SDBs

In order to maximize SB/SDB utilization on the project, prospective source lists for procurements will be developed using the following criteria:

- If it can be demonstrated that adequate competition (i.e., three or more SDB vendors) can be obtained on a particular procurement through the solicitation of only qualified SDB vendors, then the procurement will only include those vendors on the bidders list.
- If there is not adequate competition for a solicitation using only qualified SDB vendors, a determination will be made if adequate competition can be obtained through the solicitation of only SB vendors. In this case, the bidders list for that procurement will consist of qualified SB vendors, as many as possible of which will be SDB vendors.
- If adequate competition cannot be demonstrated through the use of SDB and/or SB vendors, then the bidders list will include a selection of the qualified vendors, as many as possible of which will be SDB or SB vendors.

Careful development of bidders lists, in accordance with this approach, will provide SB/SDBs greater opportunity to bid and win work on the project.

HBCU/MIs

The utilization of HBCU/MIs provides a separate challenge from SB/SDB subcontractors in that there is more planning and scheduling involved in obtaining services in order to conform to university schedules. Unlike SB/SDBs, it is generally not possible to subcontract an HBCU/MI student or faculty with short notice. On other NE TERC Task Orders, Foster Wheeler has been successful in obtaining and scheduling student interns on a semester-long basis, and we will continue to follow this practice for the SAEP project through the diligent scheduling of opportunities for students and faculty members.

Local Businesses

Foster Wheeler/HLA recognizes USEPA's commitment to involve local businesses and the local labor force in NE TERC projects. Foster Wheeler/HLA will make every effort to involve local businesses in subcontracted work.

ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
bgs	below ground surface
BCT	BRAC Cleanup Team
BRAC	Base Closure and Realignment
CERCLA	Comprehensive Response, Compensation, and Liability Act
CTDEP	Connecticut Department of Environmental Protection
CWTP	Chemical Waste Treatment Plant
DQO	data quality objective
EBS	Environmental Baseline Survey
EE/CA	Engineering Evaluation/Cost Analysis
EMI	electromagnetic induction
FOL	Field Operations Lead
Foster Wheeler	Foster Wheeler Environmental Corporation
GC	gas chromatograph
GIS	Geographic Information System
GPR	ground-penetrating radar
GPS	global positioning system
HLA	Harding Lawson Associates
HSA	hollow-stem augers
HSM	Health and Safety Manager
IDL	instrument detection limit
IDW	investigation-derived waste
LOE	Level of Effort
MDL	method detection limit
Mhz	megahertz
MS	matrix spike
MSD	matrix spike duplicate
mV	millivolts
NCRA	Non-time Critical Removal Action
NGVD	National Geodetic Vertical Datum
NRC	Nuclear Regulatory Commission

OU	Operable Unit
P.E.	Professional Engineer
QA/QC	Quality Assurance/Quality Control
QAPjP	Quality Assurance Project Plan
RAB	Restoration Advisory Board
RAM	Removal Action Memorandum
RCRA	Resource Conservation and Recovery Act
REDOX	oxidation-reduction
RI	Remedial Investigation
RL	reporting limit
RSR	Remediation Standard Regulation
SAEP	Stratford Army Engine Plant
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitate Leaching Procedure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SVOC	semi-volatile organic compound
TACOM	U.S. Army Tank-Automotive and Armament Command
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TERC	Total Environmental Restoration Contract
URSGWCFG	URS Greiner-Woodward Clyde Federal Services
USACE	U.S. Army Corps of Engineers – New England District
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

ABB Environmental Services, Inc., 1996. Draft Environmental Baseline Survey Report. Prepared for the U.S. Army Environmental Center, March 1996.

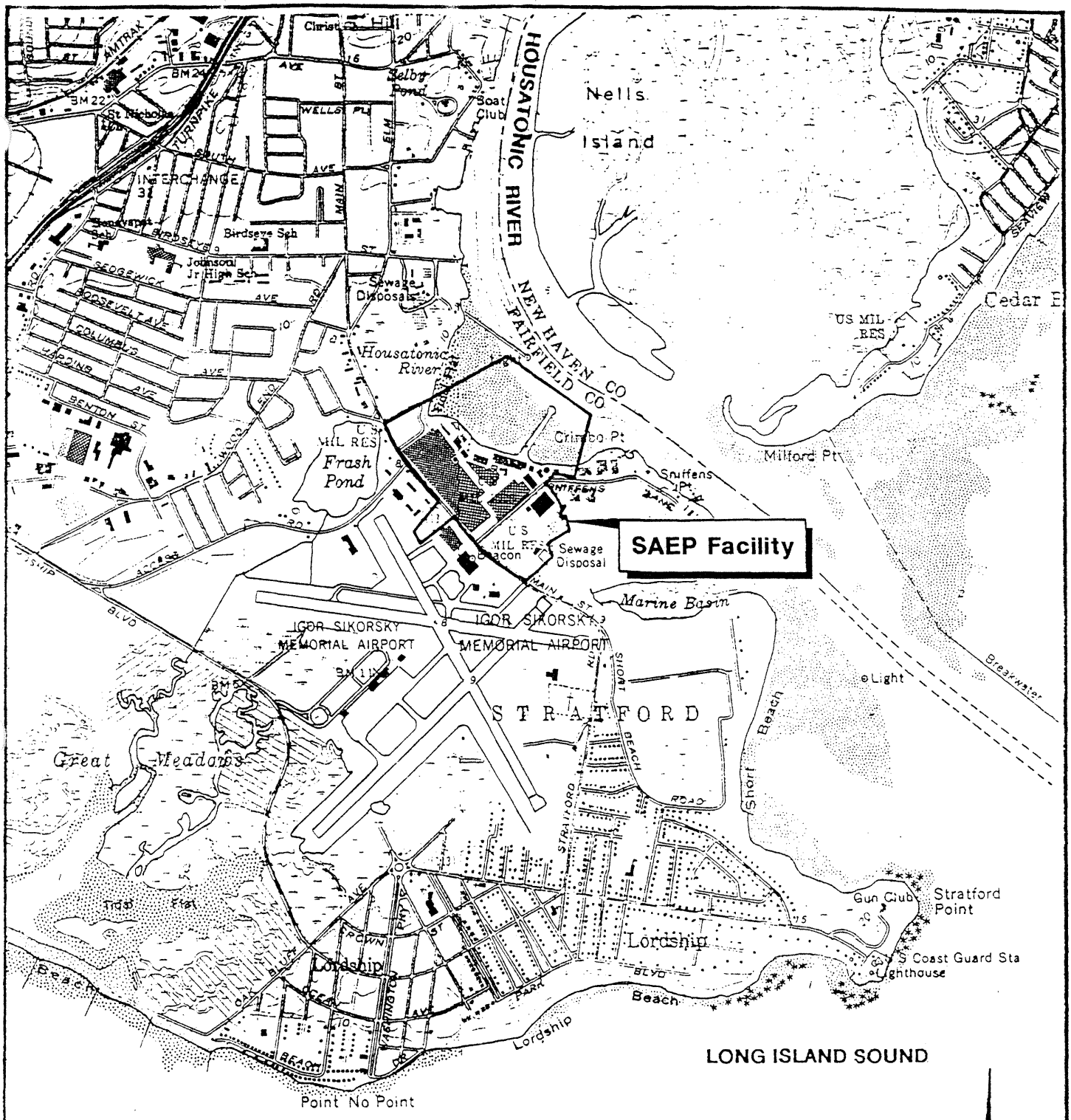
Foster Wheeler Environmental Corporation/Harding Lawson Associates (Foster Wheeler/HLA), 1999. Draft Work Plan for the Non-time Critical Removal Action for Chromium and VOC Groundwater Contamination. Prepared for the U.S. Army Corps of Engineers, June 1999.

Harding Lawson Associates (HLA), 1999. Draft Data Package for the Chromium Plating Facility Investigation. Prepared for TACOM and AlliedSignal, April 9, 1999.

URS Greiner-Woodward Clyde Federal Services (URSGWCFS), 1998. Remedial Investigation Work Plan for the Stratford Army Engine Plant. Prepared for the U.S. Department of the Army, October 26, 1998.

U.S. Environmental Protection Agency (USEPA), 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. Office of Emergency and Remedial Response. USEPA/540-R-93-057, Washington DC, August 1993.

ATTACHMENT A
FIGURES



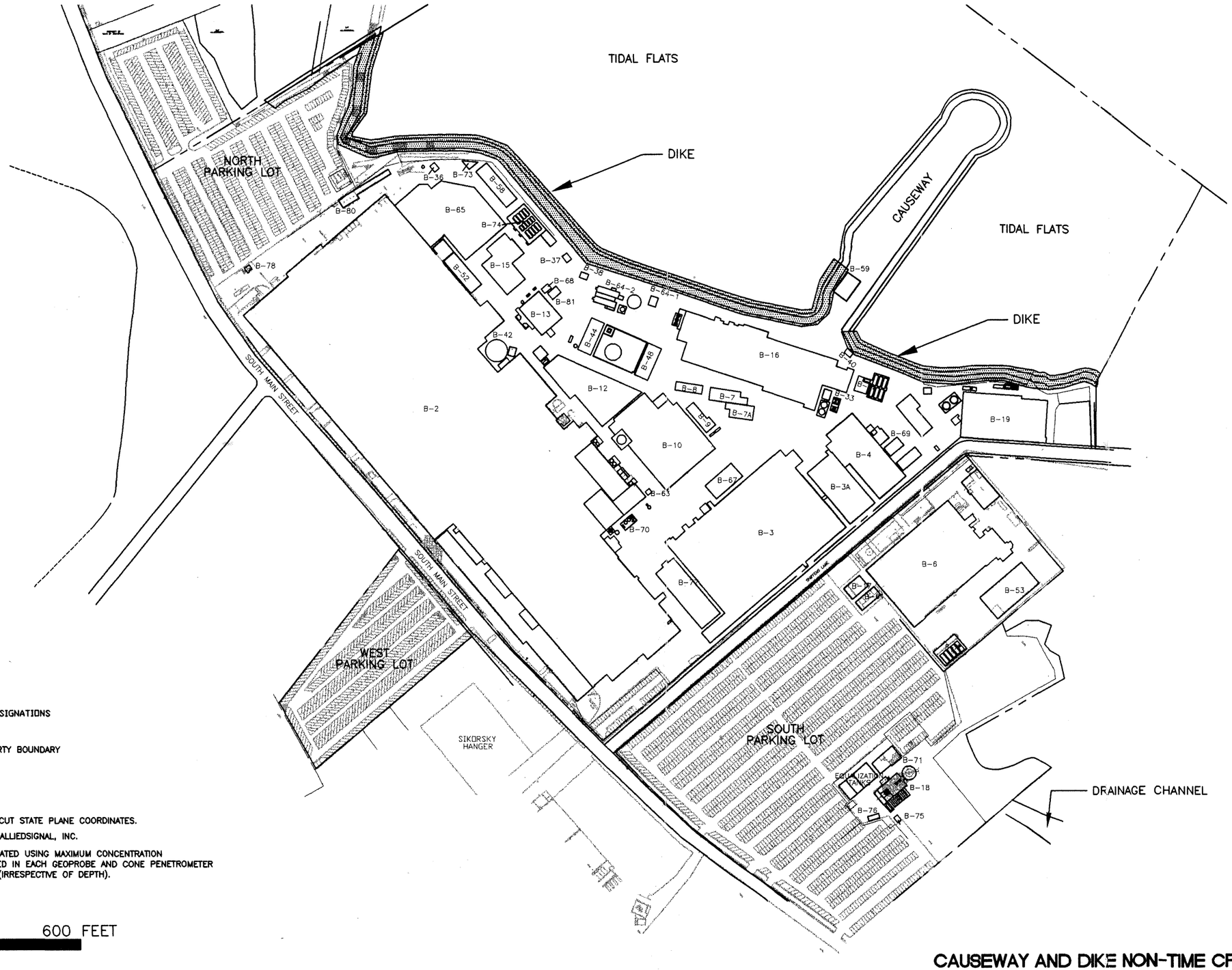
SOURCE: WOODWARD-CLYDE CONSULTANTS, 1991. FINAL PAS

0 1000 2000 FT

SCALE

CT

HLA Harding Lawson Associates Engineering and Environmental Services	SITE LOCATION MAP	
STRATFORD ARMY ENGINE PLANT STRATFORD, CONNECTICUT	Causeway and Dike NCRA	
	47254	FIGURE 1



LEGEND

B-53 BUILDING DESIGNATIONS

SEA WALL

SAEP PROPERTY BOUNDARY

NOTES:

1. MAP IS IN CONNECTICUT STATE PLANE COORDINATES.
2. BASE MAP SOURCE: ALLIEDSIGNAL, INC.
3. EXCEEDANCES DELINEATED USING MAXIMUM CONCENTRATION OF THE VOC DETECTED IN EACH GEOPROBE AND CONE PENETROMETER SAMPLING LOCATION (IRRESPECTIVE OF DEPTH).

0 150 300 600 FEET

SCALE: 1"=300'

G:\PROJECTS\ERCS\PROJECTS\D020\CAUSEWAY\FIGURES\46879003 7/30/99

FIGURE 2
SITE FEATURES
CAUSEWAY AND DIKE NON-TIME CRITICAL REMOVAL ACTION
STRATFORD ARMY ENGINE PLANT
Harding Lawson Associates

ATTACHMENT B
SECTION 2 OF THE URSGWCFS RI WORK PLAN

The description and history of the SAEP site has been divided into four categories: land use assessment; physical setting; ecological setting; and, site history. Each of these categories is described below.

2.1 LAND USE ASSESSMENT

2.1.1 SAEP Facility

SAEP is located in Stratford, Connecticut, on the Stratford Point peninsula in the southeast corner of Fairfield County (Figure 1). The plant lies on the borderline of the Bridgeport and Milford Quadrangles. Latitudinal and longitudinal coordinates of SAEP are approximately 41'-10' North and 73'-07' West.

SAEP consists of approximately 124 acres, of which about 76 acres are improved land and 48 acres are riparian rights. (A riparian right is a right of access to, or use of, the shore, bed, or water of land on the bank of a natural watercourse.) The 76 acres of improved land consist of 49 buildings, paved roadway and grounds, and five paved parking lots. Included in the improved land are an estimated 10 acres along the Housatonic River where fill was placed over tidal flats during the early development of SAEP. The 48 acres of riparian rights property consist of intertidal flats of the Housatonic River. An estimated 2 acres of this property comprise a causeway constructed in the 1930s to provide access to the river channel. A site map is provided in Figure 2.

The SAEP property is zoned light industrial. Since 1929, the SAEP site has been used for the development, manufacture, and assembly of aircraft or engines. A discussion of historical operations at SAEP is provided in Section 2.4. Access to SAEP is restricted with a perimeter fence and security guards. Boaters, fishermen, and shell fishers could potentially access unrestricted intertidal flats within SAEP property.

Future land use at the Site has been the subject of intensive study by the SAEP Local Redevelopment Authority (LRA). As reported in "SAEP Redevelopment Plan and Implementation Strategy and Homeless Assistance Submission," the preferred land use plan developed by the LRA includes the development of approximately 800,000 square feet of building space for office, research and development, and "flex space." In addition, 100,000 square feet of museum space and almost 16 acres of park land along the Housatonic River waterfront are proposed (SAEP LRA, 1997). A final decision regarding future use of the Site has not yet been attained.

2.1.2 Adjacent Land

SAEP is bounded by a paved parking lot and wetlands to the north; the Housatonic River to the east; an open field, a drainage channel, and small commercial businesses to the south; and hangar buildings, the Sikorsky Memorial Airport, several small businesses, and Frash Pond to the west.

Historically, land in the SAEP vicinity was used for agricultural and residential purposes. At present, local agricultural activities are minimal. The primary agricultural (aquaculture) activity in the area involves growing oysters in shallow waters of the Housatonic River. Oysters are

seeded in areas of the Housatonic River in the spring, collected in the fall, and placed in Long Island Sound to mature. The seed oyster beds are carefully managed by the State of Connecticut Department of Agriculture because of concerns regarding bioaccumulation of contaminants from the Housatonic River.

Land in the vicinity of SAEP is zoned light industrial, business, commercial, or residential. There are several businesses located west of Main Street, across from SAEP, including a small strip mall, several gas stations, and a restaurant.

SAEP is located about 3/4-mile southeast of Johnson Junior High School and Birdseye School.

Recreational faciliities in the area include Short Beach Park and nearby public wildlife areas, including Nells Island and the Great Meadow Salt Marsh. SAEP is located about 1/2-mile northwest of Short Beach Park, which had over 80,000 users reported for the year 1991.

2.1.3 Local Demographics

The Greater Bridgeport Regional Planning Agency's population census of Stratford was 49,389 people in 1990. Slow population growth has been a trend in Stratford for nearly two decades, and the Connecticut Office of Policy and Management anticipates a continued slow or declining growth rate for Stratford through the end of the century, with a population projection of 48,650 for the year 2000, and 45,800 for the year 2010 (W-C, 1991).

The age of the population in Stratford is older than the state average. The town's median age in 1980 was 38.2, compared to 32 for the State of Connecticut. The Connecticut Office of Policy and Management anticipates the median age of Stratford to be 45.7 by the year 2010. Nearly 23 percent of Stratford's population had reached age 60 by 1980, compared to the state average of 17 percent.

The population of Stratford represents various races and nationalities. More than 8 percent of the 1980 population in Stratford was non-white. This compares closely to a non-white population of 9.9 percent for the State of Connecticut (W-C, 1991).

2.2 PHYSICAL SETTING

2.2.1 Topography

SAEP is located in the Western Highlands of Connecticut part of the New England Physiographic Province. The local area is part of a coastal belt of dissected hilly country that extends along the coast of Connecticut. The coastal belt is characterized by uplands that range from mean sea level (MSL) to 650 feet above MSL, with an irregular, rocky coastline. Within the coastal belt, hilltops slope southward at a rate of about 50 feet per mile. Topographic features in the area mostly trend in the north-south or northeast-southwest direction, reflecting the structural trends of the local bedrock (Flint, 1968).

SAEP is situated on the Stratford Point peninsula that extends into Long Island Sound. The peninsula is relatively flat with a slight slope toward the sound. Almost all the land at SAEP is less than 10 feet above MSL. The exception to this is a dike that was constructed along the

Housatonic River in 1951 for flood protection. SAEP is within the 100-year flood plain of the Housatonic River; wetland areas surround the plant.

2.2.2 Local Climate and Rainfall

The climate of the SAEP area is strongly influenced by a land-sea breeze, which is most pronounced from spring to early autumn. The sea breeze promotes air mixing that results in slightly higher amounts of precipitation and slightly cooler temperatures at SAEP than inland. The prevailing wind is from the southwest at an average speed of about 11 miles per hour.

Precipitation averages about 44 inches per year, with about 16 inches per year of snowfall. Average monthly temperatures range from a low of about 28 degrees Fahrenheit (°F) in January to a high of about 73°F in July. Detailed information on the monthly and annual climatic averages at SAEP is listed in Table 3-8 of the EBS (ABB-ES, 1996).

2.2.3 Surface Water Drainage

Surface water bodies in the site vicinity include: Long Island Sound, the Housatonic River, Frash Pond, and the Marine Basin and drainage channel (Figure 1). The coastal and marine surface waters have been classified by CDEP Water Quality Standard regulations as SC/SB (NUS, 1990). The SC indicates that the CDEP recognizes existing water quality problems in the coastal waters; however, the SB classification indicates CDEP's goal of improving the water quality conditions. Frash Pond is not currently classified. According to CDEP, unclassified surface waters default to an A classification, which designates the following water uses: potential drinking, agricultural, or industrial water supply; fish and wildlife habitat; and recreational.

Long Island Sound receives all of the region's drainage, in large part via the Housatonic River. Water discharges from the Housatonic River range from 40 to over 100,000 cubic feet per second (cfs) and average 3,000 cfs (USGS, 1989). Reported tidal levels for the Housatonic River at Stratford are:

Low tide level	0.8 feet MSL
Mean tide level	2.9 feet MSL
High tide level	5.5 feet MSL

Most of the SAEP surface is paved or covered with buildings. Typical coefficients of runoff for paved surfaces range from 0.8 to 0.9 (i.e., 80 or 90 percent runoff), and runoff from building rooftops is expected to be equal, if not higher. Thus, runoff during storm events is heavy. Most of the precipitation that falls on SAEP is treated and drained to the Housatonic River; two exceptions are small roof areas of B-2 that drain to either Frash Pond or to the airport.

Runoff at SAEP is currently collected by one of a network of six storm drainage systems. Each of the storm drain systems is equipped with a pumping station because of the low elevation of the plant and proximity of the Housatonic River and Long Island Sound. Effluent from the storm drainage system is pumped through the Oil Abatement Treatment Plant (OATP), except in times of heavy precipitation, when some runoff is pumped directly to the Housatonic through individual outfalls.

Based on historical site photographs and plans, the Site once had a low-lying area at the head of the drainage channel that is connected to the Marine Basin (in the vicinity of B-3 and B-6). The drainage channel abuts a portion of the plant's property line (Figure 2).

SAEP is located within the 100-year flood plain of the Housatonic River (CDEP, 1979). The Site is partially protected from flooding by a dike that runs the entire length of the property abutting the Housatonic River; however, the dike is not tied into high ground, which would prevent floodwaters from going around the dike. The Site was flooded in 1951 when the Housatonic River flooded, and again in 1968.

2.2.4 Geology and Hydrogeology

2.2.4.1 Regional Geology and Hydrogeology

The bedrock geology underlying SAEP is reported to consist of lower Ordovician age metamorphic schists, phyllites, and paragneisses of the Oronoque Member of the Derby Hill Schist (Fritts, 1965). Flint (1968) identifies these rocks as the Orange Formation. Exposures of bedrock do not occur in the SAEP vicinity. Borings made along the Housatonic River (Flint, 1968) and borings completed on-site (ESE, 1991) reportedly encountered bedrock at depths ranging from about 100 to 150 feet below the land surface.

Recent deposition of alluvium, estuarine, tidal marsh, beach sediments, and man-placed artificial fill occur along the Housatonic River. The surficial unconsolidated sediments reported near SAEP are Stratford Outwash, tidal marsh peat, and artificial fill (Flint, 1968; U.S. Department of Agriculture, 1981). Lordship Outwash sediments are found south of the SAEP (Flint, 1968).

Stratified drift, consisting of sorted sediments deposited in streams formed by the meltwater of glaciers, is the main water-bearing hydrogeologic unit in the site area. The stratified drift forms two depositional facies, known as ice-contact stratified drift and outwash (Flint, 1968). Ice-contact stratified drift is defined as "sediments deposited in streams and other bodies of water against, upon, beneath, or otherwise in immediate contact with melting glacier ice", and is characteristically poorly sorted, and contains irregular beds with large and abrupt changes in grain sizes ranging from clay to boulders. Conversely, outwash is defined as "sediments deposited by streams beyond the glacier, and free of any influence of buried ice", and is generally well sorted sand to fine gravel with lenticular beds.

Borings completed near the mouth of the Housatonic River encountered post-glacial estuarine mud unconformably overlying stratified drift at depths as great as 60 feet below MSL (Flint, 1968). The estuarine sediment is described as a gray mud consisting of silt and clay with organic matter. It has a maximum reported thickness of about 60 feet.

The tidal marsh and swamp deposits in the area consist of decayed plant matter, peat, and mixtures of silt and clay with high amounts of peat. These deposits may be as thick as 15 feet. The SAEP area is influenced by tidal marsh sediments deposited at and upstream from the mouths of tidal inlets (due to rise in sea level since the last glaciation and daily tides) that discharge to the ocean (Flint, 1968). Tidal marsh sediments consist of peat and very organic silt

or clay that form wedge-shaped deposits, which become thicker towards the ocean or mouth of the streams.

Stratford Outwash is found along the fringes of the Housatonic River and consists of well sorted sand with small amounts of gravel. Borings completed for the Washington Bridge (Highway 1, about 2 miles north of SAEP) encountered outwash sand underlying more recent alluvium, tidal marsh and swamp peat, and estuarine sediments to an elevation of about 115 feet below MSL (Flint, 1968). This indicates that the outwash had filled the entire valley of the Housatonic, but after extensive erosion by the river and rise in sea level, only remnants of the deposit remain. In some exposures along the Housatonic River north of the Site, the Stratford Outwash is found overlying ice-contact stratified drift (Flint, 1968).

2.2.4.2 Site Geology and Hydrogeology

The following assessment of the geology and hydrogeology at the SAEP is summarized from the Phase II Report (W-C, 1996) in which generalized geologic cross-sections were developed from previous engineering reports as well as from boring logs prepared as part of Phase I and Phase II Investigations conducted by W-C and presented in the Phase II Report (W-C, 1996). The cross-sections show that the shallow geology is characterized by four distinct units: fill material, estuarine silt, peat, and glacial deposits. These unconsolidated deposits overlie the bedrock unconformably. A description of these units and their distribution across the SAEP follows.

Fill

Fill material is found throughout most of the SAEP. Fill was used for road construction, site grading, and as foundation material for buildings. Fill material consists of fragments of concrete, brick, asphalt, wood, cinders, copper wire, and rebar. Fill in areas along the shoreline is reported to consist of materials hydraulically dredged from the Housatonic River. The composition of the fill is variable, but most of it is described as a granular material that was placed to promote drainage.

Fill also consists of glacial material deposited on the surface from cut-and-fill operations made during facility development between 1940 and 1960. The glacial fill material generally consists of brown medium to fine sand and gravelly sand.

The thickness of the fill is generally about 5 ft, although it may reach a thickness of up to 19 ft. The fill appears to thin somewhat with distance away from the river. This may be a result of more extensive historical filling operations along the river in order to bring the shoreline up to grade with the rest of the Site.

Estuarine Silt

A thick silt deposit underlies the fill at the northern edge of the facility along the Housatonic River. This deposit consists of black organic silt containing occasional shell and sand layers. This material is an estuarine sediment deposited by the Housatonic River and subsequently topped with fill (both artificial and glacial fill) during enlargement of the facility property.

This silt stretches from piezometer PZ-7D (northeastern corner of building B-2) eastward to monitoring well MW-4 (just south of the Causeway) at a depth of approximately 1 to 9 ft below

sea level (8 to 15 feet below ground surface). The thickness of the estuarine silt layer ranges from 2 ft to 30 ft and it extends landward 150 to 250 ft. The silt layer is thickest at location piezometer PZ-5D (30 ft deep at Building B-37) and pinches out at the edges near piezometer PZ-7D (northeast corner of Building B-2) and monitoring well MW-4 (just south of the Causeway).

Peat

A deposit of brown and black peat with some organic silt was encountered in the eastern portion of the SAEP in the vicinity of the former lagoons (impoundment area). It's extent is roughly circular which indicates that it was probably formed by a marsh or swamp. Older USGS quadrangle maps show that this area was formerly a tidal marsh that was subsequently filled. In the former lagoon area, the peat forms a continuous concave layer, approximately 7 ft thick which deepens to the west - northwest. The peat lies directly beneath fill material in this area at depths ranging from 3 to 20 ft bgs. Portions of the upper peat layer may have been excavated prior to fill placement.

Peat material was also encountered at the location of monitoring well WC-8S (at Building B-8) and monitoring well WC-2D (just south of the Causeway) at depths of 5 ft bgs and 30 ft bgs and thicknesses of 2 ft and 5 ft respectively. These two peat deposits are apparently small, isolated pockets and are not a part of the continuous deposit in the lagoon area.

Glacial Sediments

A thick deposit of glacial sediments underlies the fill, estuarine silt, and peat deposits at the Site, and unconformably overlies the bedrock. The total thickness of the glacial sediments is between 148 ft and 156 ft thick, based on boring logs from monitoring wells WC-9D2, WC-20D2 and WC-21D2 (generally off-site to the west of the SAEP) installed during Phase II. The glacial deposits consist of sands, silty sands, and gravelly sands with occasional boulders and varved silt. The glacial deposits can be generally grouped into three layers: 1) a layer of gray to brown, medium to coarse sand with varying amounts of gravel, underlain by 2) light to medium-brown, medium to fine sand and silty sand with occasional clay stringers, followed by 3) another layer of brown to gray sand and gravel immediately above the bedrock.

There are variations in this general sequence, however. For example, in the eastern portion of the Site, a silty sand layer overlies the first layer of sand and gravel and a distinct gravel deposit, approximately 2 to 5 ft thick, is locally extensive in the vicinity of piezometer PZ-13D (near Building B-4), and monitoring wells WC-2D and WC-3S (both near the Causeway).

A glacial varved silt unit had been reported to occur only locally in the vicinity of Building B-65 (Haley and Aldrich, 1987). Varved silt layers were encountered at a depth of 60 ft bgs in monitoring well WC-9D2 and are described as 2 millimeter bands of red clay interlayered with orange sand layers. At other depths in monitoring well WC-9D2 (northwest corner of Building B-2) and in monitoring well WC-20D2 (off-site to the west of Building B-2) red clay stringers were observed. It is unclear as to whether the red clay stringers represent a portion of a larger varved sequence.

Bedrock

A competent amphibole-mica schist bedrock was reported at monitoring well locations LW-5D, LW-9D and LW-10D (in the vicinity of the former lagoons south of the main Plan) at depths of 163 ft, 151.5 ft, and 103 ft below grade, respectively. Bedrock was encountered at three locations during the drilling of Phase II monitoring wells WC-9D2, WC-20D2 and WC-21D2 (generally off-site the west of SAEP); at respective depths of 156 ft, 150 ft and 148 ft below grade. The bedrock is described as a black schist with greenstone.

A nineteenth century report of massive serpentinite consisting of antigorite with accessory magnetite and carbonate was reported at the SAEP (Crowley, 1968). No contemporary confirmation of this report exists.

If the locally N35oE trending trace of the Mixville Fault (Flint, 1968) is extrapolated to the southwest (Rodgers, 1985), across the Housatonic River, it would pass directly under the SAEP. However, there is no confirmation of the existence of this fault southwest of its mapped terminus.

Hydrogeology

During Phase I and Phase II investigations, shallow and intermediate wells were installed at the water table and 30 to 50 ft below the ground surface in the overburden aquifer, respectively. Deep overburden wells were screened just above the bedrock. Data from these monitoring wells, as well as from monitoring wells previously installed at SAEP, established an easterly groundwater flow direction towards the Housatonic River, a northwesterly flow towards Frash Pond, and flow toward the drainage channel in the southern portion of SAEP. There may be a groundwater divide and buried tidal inlets on SAEP, and other buried outlets from Frash Pond may pass under SAEP (Envirosphere, 1984). These types of features appear to be a factor controlling groundwater movement patterns and fate of potential contaminants. Very little flow reversal, as related to tidal influences, were measured. Groundwater contour maps are presented in the Phase II Report (W-C, 1996).

Groundwater flow at the SAEP facility is influenced by three surface water features. The primary influence is that of the intertidal flats. Groundwater flow in the northern half of the facility is in the direction of the intertidal flats at low tide. An average low tide hydraulic gradient was calculated to be 0.0012 for both the shallow and intermediate portions of the aquifer. Because the incoming tide exerts pressure on the water table aquifer, the hydraulic gradients at high tide will be lower than those at low tide.

A second surface water body influencing the groundwater flow at the facility is Frash Pond, located approximately 300 feet from the northwest corner of the facility. Frash Pond appears to be located downgradient of the northwest portion of the SAEP facility. The airport, as well as other off-site properties, are also located upgradient of Frash Pond. Water elevations measured in monitoring wells suggest that groundwater from off-site locations south and west of the SAEP are flowing toward the SAEP. Average groundwater hydraulic gradients in the direction of Frash Pond were calculated to be 0.0012 for the shallow wells and 0.0018 for the intermediate wells in the vicinity of the pond.

The third surface water body influencing the groundwater flow at the facility is the drainage channel located in the southern portion of the SAEP. The presence of groundwater mounds in the shallow portion of the aquifer in this area of the facility is due to the existence of a peat layer that causes a perched water condition above the peat. An average hydraulic gradient in the direction of the drainage channel was calculated to be 0.0073 for the shallow portion of the aquifer above the peat and 0.0018 for the intermediate portion of the aquifer below the peat layer. The area of the facility influenced by groundwater flow to the drainage channel is limited to the lagoon area in the vicinity of the channel.

Hydraulic conductivities calculated from slug tests performed in Phase II investigation monitoring wells indicate that hydraulic conductivities are generally from 12 to 15 feet per day (ft/day) for shallow wells, 0.01 to 2.7 ft/day for intermediate wells and 2.5 to 6.0 ft/day for deep wells.

2.3 ECOLOGICAL SETTING

This section of the RIWP describes the ecological resources on and in the vicinity of SAEP. For the purposes of the RI, ecological habitats are present at the following three areas:

- Intertidal Mudflats;
- Marine Basin/Outfall 008 area; and,
- Causeway.

Information on critical habitats and wetland areas in the vicinity is also summarized. Much of the information in this section is summarized from Section 2.0 of the Phase II investigation Work Plan (W-C, 1994) and the Draft Baseline Ecological Risk Assessment for the SAEP (W-C, 1996). These documents should be consulted for more detailed information and discussion of the area.

2.3.1 Surface Water Bodies

The SAEP is located on the tidal portion of the Housatonic River less than one mile upstream from the Long Island Sound (Figure 1). As such, the habitats and biota which occur in the site vicinity are largely dictated by diurnal fluctuations in water level, salinity and surface water chemistry, and are influenced by the Sound. The Housatonic River is approximately one quarter mile wide in the site vicinity and conveys most of the region's drainage to the Long Island Sound. Currents in the river proper are variable in this area due to the fluctuating tides.

In the tidal mudflat area adjacent to the Site, local currents flow toward land into the sheltered cove on a flooding tide. In the absence of current on a slack tide, suspended fine sediments settle out of the water column and contribute to the sediment accumulation in the mudflat area. The mudflat is exposed twice daily at low tide when all water recedes from the area except for flow in several rivulets near the outfalls.

Marine Basin is located about 1,000 feet southeast of SAEP on the Housatonic River (Figure 1). It is a shallow, permanently inundated, tidal embayment which receives some drainage from the drainage into which Outfall 008 feeds, but mostly from the Housatonic River.

2.3.2 Surface Water Chemistry

Characterization of surface water chemistry in the vicinity of the SAEP site is based on data collected as part of the previous investigations at the Site (W-C, 1993). Generally, surface water pH ranged from 7.4 to 8.5, and was typically approximately 8.1. Similarly, salinity ranged from 11.8 parts per thousand (ppt) to 27 ppt, typical of estuarine waters. Conductivity ranged from 14,500 umhos to 33,000 umhos.

Surface water temperatures at the time of sampling ranged from 10.5 degrees Celsius to 25.0 degrees C. Most values were in the low 20s degrees C. Temperatures were approximately five to ten degrees lower at the tidal flat and intertidal background locations than at the tidal flat outfall locations and at Outfall 008.

2.3.3 Intertidal Mudflats

The intertidal mudflats adjacent to the SAEP are a generally level to gently sloping area that is subject to alternating periods of tidal inundation and exposure. Sediments in the mudflats are primarily fine silt and mud transported from the Housatonic River and deposited here. The mudflats are nutrient enriched and support populations of macroinvertebrates which are important food sources for fish and shorebirds. The northwest portion of the mudflats support some emergent vegetation. The following paragraphs describe biota which utilize the Intertidal Mudflat for habitat and feeding.

2.3.3.1 Benthos

The intertidal mudflats adjacent to the SAEP provide a nutrient rich habitat for a variety of invertebrate forms. Information on indigenous benthic fauna in the vicinity of the SAEP site is based on extensive data collected in December 1994 as part of the Phase II effort and a field reconnaissance performed in May 1995 (W-C, 1996).

A total of 49 different macroinvertebrate taxa occur in the site vicinity. The taxa present are common to estuarine systems, with polychaetes (especially Streblospio benedicti, which was present at all stations) and oligochaetes predominating. As a group, deposit-feeding oligochaetes, and polychaetes were by far the dominant component of all samples. Individually, oligochaete densities ranged from 2 to 67 percent, and polychaetes from 26 to 97 percent of the total number of individuals at all stations sampled.

At most stations, Streblospio benedicti was the dominant polychaete. Its presence alone accounted for 12 to 89 percent of all individuals at the ten mud flat stations. At five locations, the capitellid, Mediomastus ambiseta, exceeded or equaled the Streblospio densities. Amphipods were recovered from most stations. The most common species were Leptocheirus plumulosus and Gammarus palustris. Similarly, molluscs, usually Littorina sp. juveniles (a gastropod), or Gemma gemma (a bivalve), were present in most samples.

In addition to the infaunal invertebrates described above, the site vicinity supports dense beds of oysters. Although Crassostrea virginica, the Eastern oyster, is the primary species of shellfish harvested from the area, other shellfish that are fished for include the hard clam (quahog), bay scallop, soft-shelled clam, blue mussel, and razor clam. Observations were made of benthic

macroinvertebrates inhabiting the rocky intertidal zone around the mudflats which has formed as a result of rip-rap placement. The following species were observed on the rocky intertidal zone: Ovalipes ocellatus (calico crab), Mytilus edulis (blue mussel), Modiolus demissus (ribbed mussel), Mercenaria mercenaria (hard clam), and Squilla empusa (mantis shrimp).

2.3.3.2 Fish

A number of fish species are common to the Long Island Sound and Housatonic River in the vicinity of the SAEP. The principal species include: Atlantic herring (Clupeas harengus), American shad (Alosa sapidissima), Atlantic silverside (Menidia menidia), mummichog (Fundulus heteroclitus), American eel (Anguilla rostrata), winter flounder (Pseudopleuronectes americanus), bluefish (Potamus saltatrix), and tautog (Tautoga onitis).

The mudflats adjacent to the SAEP site do not represent an important fish habitat owing largely to the hydrology in this area. At low tide, virtually all of the surface water recedes out of the area for several hours. Hence, at best, this area represents an intermittent feeding habitat for fish such as silversides and other omnivorous species feeding on small crustaceans, worms, and insects.

2.3.3.3 Avifauna

There have been approximately 220 bird species observed in the site area (W-C, 1991). Shore birds and waterfowl constitute the majority of bird life in the SAEP vicinity. The wetlands near SAEP are known breeding grounds for transitory birds such as the great egret (Casmerodius albus), snowy egret (Nyctanassa vidacea), black-crowned night heron (Nycticorax nycticorax), glossy ibis (Plegadis falcinellus), and fish crow (Corvus ossifragus).

Two bird species that nest in the general vicinity of the Site are the least tern (Sterna antillarum) and piping plover (Charadrius melodus). Both species would use tidal marshes as feeding areas during the breeding season.

During the field reconnaissance of the Site performed in May 1995 (W-C, 1996), a variety of species were observed from the Site including: great blue heron (Ardea herodias), American black ducks (Anas rubripes), sandpipers or "peeps" (Calidris sp.), herring gull (Larus argentatus), and mute swans (Cygnus olor).

The United States Fish and Wildlife Service (USF&WS) conducted bird surveys in the vicinity of the Site in 1997. Results of these recent surveys will be included in the RI report.

2.3.4 Marine Basin/Outfall 008 Area

SAEP Outfall 008 discharges into a drainageway which travels several hundred feet to its confluence with the Marine Basin. The channel of the "008 drainageway" is approximately 10 to 12 feet wide and generally less than 2 feet deep. The downstream portion is tidally influenced. The adjacent land area is generally disturbed and vegetated primarily with Phragmites. While documentation is somewhat limited, the drainageway is generally low quality habitat based on visual observation and sediment chemical and benthic community data.

Marine Basin is a tidal, permanently inundated shallow embayment surrounded primarily by stands of Phragmites. Little, if any, emergent vegetation exists. Benthic macroinvertebrates which colonize the Basin likely represent typical estuarine communities observed in the Intertidal Mudflat.

2.3.5 The Causeway

Due to the industrial nature of the SAEP site, there is no terrestrial habitat on the Site with the exception of the limited area on top of the Causeway. Where vegetated, the surface of the Causeway is primarily covered with herbaceous species, limited scrubby vegetation and several trees. Species observed include: clover, ragweed (Ambrosia sp.), jewelweed (Impatiens sp.), smartweed (Polygonum sp.), several tree of heaven (Ailanthus altissima), and willow (Salix sp.). This area is small, one to two acres in size, and does not represent valuable habitat. Since it is isolated from other nondeveloped areas and generally disturbed, it provides limited habitat, at best, to biota. Terrestrial species which may use the Causeway from time to time are likely to include some birds and small rodents which inhabit other disturbed lots in this portion of Stratford.

2.3.6 Critical Habitats and Species

Critical habitats in the vicinity of the Site include extensive tracts of salt marshes, saltwater intertidal flats and shores, and coastal sand dunes which provide habitat for a variety of biota. The intertidal mudflats in the vicinity of SAEP are located in a band along the shoreline of the Housatonic River and Long Island Sound. SAEP's riparian rights encompass the intertidal mudflats area. Plant life in the vicinity of SAEP is limited to the tidal marshes.

The tidal marsh plant life consists primarily of soft-stemmed plants such as sedges, rushes, and grasses. Cordgrass (Spartina patens) and common reed (Phragmites) are the dominant species in the marshes. A number of southeastern Piedmont and Coastal Plain plant species reach their northern native range limits in this region.

Tidal marshes provide habitat for mammals such as rodents and insectivores. The primary mammal species include muskrats (Ondatra zibethica), cottontail (Sylvilagus sp.), and raccoons (Procyon lotor). Cordgrass provides an ideal forage and building material for muskrats. Raccoons feed on crustaceans and small rodents.

A detailed description of the federal- and state-listed threatened, endangered, or special concern species that have the potential to occur in the vicinity of SAEP and the status of each is provided in the Preliminary Assessment Screening (W-C, 1991). A list of these species is provided in Table 3-3 of the Preliminary Assessment Screening (additional information from the field reconnaissance and recent U.S. Fish and Wildlife Service survey will be included in the RI report).

No federally listed threatened or endangered plant species have been reported to occur in the vicinity of the SAEP with the exception of the New England Blazing Star (Liatris borealis), which is a candidate for the list. Two federally-listed and an additional 14 state-listed threatened,

endangered or special concern birds have the potential to occur in the vicinity of the SAEP. The two federally-listed species include the piping plover and the Roseate tern.

The piping plover nests in the vicinity of the SAEP; nesting habitat is located on Short Beach, Long Beach, and Milford Point. These areas are extremely important to the continued survival of the piping plover and select areas of these beaches are closed to public activity during the nesting and rearing period. These beach areas utilized as nesting habitat by the piping plover are probably used by the least tern also, which is a state-listed threatened species.

2.4 SITE HISTORY

2.4.1 Operational History

The SAEP site has been used for development, manufacture, and assembly of aircraft or engines since 1929. The plant history has been categorized into the following periods:

1929 to 1939: Sikorsky Aero Engineering Corporation developed and manufactured sea planes at the Stratford plant.

1939 to 1948: Chance Vought Aircraft located its operations at the Stratford plant in 1939, and the company became known as Vought-Sikorsky Aircraft Division. Sikorsky developed the helicopter and left the plant in 1943 because of overcrowding. Chance Vought developed the "Corsair" for the U.S. Navy, and mass produced Corsairs during World War II. Chance Vought vacated the Stratford plant in 1948.

1948 to 1951: The Stratford plant was idle.

1951 to 1976: The U.S. Air Force procured the Stratford plant in 1951 and named it Air Force Plant No. 43. The Avco Corporation (AVCO) was contracted by the Air Force to operate the plant. AVCO manufactured radial engines for aircraft in the 1950s, and developed and manufactured turbine engines, primarily for aircraft, in the 1960s and 1970s.

1976 to Present: The plant was transferred from the U.S. Air Force to the U.S. Army in 1976. At that time, the plant was re-named the Stratford Army Engine Plant, although it continued under AVCO operations. AVCO was contracted by the Army to develop the AGT-1500 engine to power the Abrams tank. AVCO also developed and manufactured marine and industrial engines. AVCO merged with Textron in December 1985, and subsequently formed the Textron Lycoming Stratford Division. The contract for operation of SAEP was transferred from Textron Lycoming to Allied-Signal in 1994. Allied-Signal continued to develop, manufactured and test turbine engines at SAEP for both military and commercial aircraft and land vehicles until 1997. Since the cessation of Allied-Signal operations, the focus of activities at SAEP has been completion of an environmental assessment of the Site and the potential for re-development.

1986 or 1987: Historical state order issued to AVCO Lycoming regarding RCRA groundwater monitoring in the lagoon area.

2.4.2 Waste Disposal

The primary types of industrial waste generated at SAEP prior to the 1950s are reported to have been waste oils, fuels, solvents, and paints (W-C, 1991). Since 1951, most of the wastes generated at SAEP have resulted from engine production operations such as plating, metal working, and finishing, as well as cleaning operations. Wastes were also generated as a result of engine and engine component testing, research and development, raw materials testing, vehicle and other maintenance, and on-site waste treatment.

2.4.3 Environmental Regulatory Compliance

The EBS (ABB-ES, 1996) contains a review of SAEP's environmental compliance history and permit status, its current compliance status, and future compliance issues. Specifically, the EBS assesses SAEP in relation to: Resource Conservation and Recovery Act (RCRA); CERCLA; Emergency Planning and Community Right-to-Know (SARA Title III); Clean Water Act; Clean Air Act (CAA); Toxic Substances Control Act (TSCA); Safe Drinking Water Act; Federal Insecticide, Fungicide and Rodenticide Act; endangered species; radioactive materials; and, National Environmental Policy Act (NEPA). The EBS noted that SAEP has experienced some violations in the past, but, as of December 1996, was in compliance with environmental regulations (ABB-ES, 1996).

The EBS identified the following recorded deficiencies in hazardous waste management practices at SAEP.

- Manifest warning letters for deficiencies in completion of hazardous waste manifests. Deficiencies included missing analytical results, transporter name or identification (ID) number, manifest document numbers, waste ID numbers, and waste quantities; un-specified container type; incorrect USEPA generator ID number; point of departure from the United States not specified for international shipments; failure to sign and date manifest; illegible manifest; and failure to respond to manifest warning letter. To the best of SAEP's knowledge, all prior warning letters were resolved.
- Warning letters issued by CDEP for failure to submit hazardous waste biennial reports on a timely basis or submission of an unacceptable report. SAEP subsequently submitted acceptable reports.
- Several orders issued by CDEP to bring SAEP into compliance with RCRA hazardous waste management regulations. For example, updating the site contingency plan, waste analysis plan, and preparedness and prevention plan.
- Order issued by CDEP to make modifications to OATP in order to bring Outfall 007 into compliance with the National Pollutant Discharge Elimination System (NPDES) permit by "proper treatment of oily wastewaters." SAEP reportedly complied with this order.
- Records indicate that frequent and severe violations of NPDES permit limitations (i.e., effluent concentrations more than five times the permit limit) occurred prior to the mid-1980s. In a Consent Decree dated April 10, 1984, SAEP agreed to use "best reasonable efforts" to achieve compliance with the permit and to complete upgrading

of the Chemical Wastewater Treatment Plant (CWTP). Violations have occurred since that time less frequently and with less severity. Since November 1994, the only violation has been associated with the failure to meet aquatic toxicity criteria. Upon retesting of the sample, the parameter in question was found to be in compliance.

- Inspection reports indicate occasional violations of CAA requirements such as: fumes escaping from vapor degreasers; failure to notify CDEP of modifications to or additions of processes that could increase emissions; and, excess emissions of chromic acid.
- In response to findings that SAEP failed to maintain adequate inspection and maintenance records for 20 polychlorinated biphenyls (PCBs) transformers in accordance with TSCA, SAEP agreed to subsequently ensure that transformers would be inspected and that records of inspections and maintenance history of the transformers would be maintained.
- SAEP does not appear to be in compliance with the requirement of NEPA that environmental evaluations be conducted prior to beginning construction projects since 1970.

The EBS also identified several spills of hazardous materials that resulted in discharges to surface water in the SAEP site vicinity.

October 29, 1981: Approximately 20 gallons of fluorescent metal penetrant, a dye used for nondestructive inspection of metal parts, was spilled into a storm drain and discharge from Outfall 007.

July 29, 1979: Approximately 75 gallons of oil sludge from the OATP bypassed clogged skimmers and discharged from Outfall 007. SAEP was notified of the problem by the U.S. Coast Guard, which was searching for the source of an oil slick on the Housatonic River. (SAEP was apparently the sole source.)

May 8, 1978: Twenty-five to 30 pounds of chromic acid was spilled, and most flushed into a storm drain. About 50,000 gallons of diluted acid was intercepted in the drain and pumped into a holding tank. Remaining pools of the diluted acid were pumped to the CWTP. Acid that was not intercepted or contained was discharged to the Housatonic River from Outfall 007. Chromium concentrations of effluent from Outfall 007 were measured at 30 milligrams per liter (mg/l) on May 8, 1978, 2.5 mg/l on May 10, 1978, and were not detectable by May 11, 1978.

August 1978: CDEP was advised by SAEP that a yellow plume with a pH of 2.9 and 64 parts per million (ppm) of hexavalent chromium was extending approximately 200 yards from Outfall 007 into the Housatonic River (CDM, 1992).

No records of enforcement actions or fines relating to these releases were found or reported in the EBS.

ATTACHMENT C
CT DEP REMEDIAL STANDARD REGULATIONS

STATE OF CONNECTICUT

REGULATION

OF

DEPARTMENT OF ENVIRONMENTAL PROTECTION

concerning

REMEDIATION STANDARD

Section 1. The Regulations of Connecticut State Agencies are amended by adding a new section 22a-133k-1 as follows:

Section 22a-133k-1

(a) Definitions.

For the purposes of sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies, the following definitions apply:

(1) "Analytical detection limit" means the minimum concentration of a substance that can be quantified consistently and reliably using methods approved by EPA and which concentration shall be (A) for a substance in ground water, equal to or less than the ground-water protection criterion for such substance determined (i) for a sample of ground water in a GA area using analytical methods specified in subpart C of 40 CFR part 141 or (ii) for a sample of ground water in a GB area using methods established pursuant to "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods", SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460; or (B) for a substance in soil, equal to or less than the residential direct exposure criteria or the applicable pollutant mobility criteria, whichever is lower using methods established pursuant to "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods", SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460.

(2) "Aquifer protection area" means an aquifer protection area as defined in section 22a-354h of the General Statutes.

(3) "Area of influence" means as "area of influence" as defined in section 22a-354b-1(a) of the Regulations of Connecticut State Agencies.

(4) "Areal extent of a ground-water plume" means the surface area beneath which ground water has been or may be polluted by a release and in which ground water one or more substances from such release is or may be present at a concentration above the analytical detection limit.

(5) "Background concentration for ground water" with respect to a particular release means the concentration of a substance in ground water (A) at the nearest location upgradient of and unaffected by the release; or (B) if such release occurred at or created a ground-water divide, at the nearest location representative of ground water quality unaffected by any release.

(6) "Background concentration for soil" means the representative concentration of a substance in soil of similar texture and composition outside the subject release area and in the general geographic vicinity of such release area, but not within any other release area.

(7) "Carcinogenic substance" means a substance defined as a "carcinogen" by federal or state agencies and for which a quantitative health risk extrapolation is available.

(8) "CFR" means the Code of Federal Regulations.

(9) "Commissioner" means the Commissioner of Environmental Protection or his designee.

(10) "Dense non-aqueous phase liquid" means a non-aqueous phase liquid that has a density greater than water at 20 degrees Celsius.

(11) "Direct Exposure Criteria" means the concentrations identified in Appendix A to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies or any alternative direct exposure criteria approved by the Commissioner pursuant to section 22a-133k-2(d) of the Regulations of Connecticut State Agencies.

(12) "Downgradient" means in the direction of the maximum rate of decrease of hydraulic head.

(13) "Downgradient area" with respect to a release of a substance means the area bounded by (A) the width of the release area of such substance perpendicular to the direction of ground-water flow, (B) two side boundary lines parallel to the downgradient direction of ground water flow extending from the two endpoints of said width to the downgradient parcel boundary, and (C) the downgradient parcel boundary extending between the two side boundary lines; excluding any portion of such downgradient area that is (i) affected by any other release of such substance or (ii) beneath an existing permanent structure.

(14) "Environmental land use restriction" means an environmental land use restriction as defined in section 22a-133q-1 of the Regulations of Connecticut State Agencies.

(15) "Environmentally isolated soil" means polluted soil which is: (A)(i) beneath an existing building or (ii) beneath another existing and permanent structure which the Commissioner has determined in writing would prevent the migration of pollutants; (B) not a continuing source of pollution; (C) not polluted with volatile organic substances or, if it is polluted with such substances, the concentration of such substances has been reduced in concentration to the maximum extent prudent; and (D) above the seasonal high water table.

(16) "EPA" means the United States Environmental Protection Agency.

(17) "Excess lifetime cancer risk" means the estimated probability that an individual's exposure to a substance could result in cancer.

(18) "GA area" means an area where the ground-water classification is GA or GAA, respectively.

(19) "GB area" means an area where the ground-water classification is GB.

(20) "Ground water" means that portion of waters as defined in section 22a-423 of the General Statutes which portion is at or below the water table.

(21) "Ground-water classification" means the ground-water classification goal or the ground-water classification, whichever is more stringent, established in the Water Quality Standards.

(22) "Ground-water divide" means a line on the water table from which the water table slopes downward in both directions away from such line.

(23) "Ground-water protection criteria" means the concentrations identified in Appendix C to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

(24) "Ground-water plume" means ground water which has been polluted by a release and in which ground water one or more substances from such release is present at a concentration above the analytical detection limit.

(25) "Hazard index" means the calculation of the potential for non-cancer health effects as a result of exposure to one or more substances with the same or similar modes of toxic action or toxic endpoints.

(26) "Hydraulic gradient" means the change in hydraulic head per unit distance.

(27) "Hydraulic head" means the elevation to which water rises in a piezometer or a well.

(28) "Inaccessible soil" means polluted soil which is: (A) more than four feet below the ground surface; (B) more than two feet below a paved surface comprised of a minimum of three inches of bituminous concrete or concrete, which two feet may include the depth of any material used as sub-base for the pavement; or (C)(i) beneath an existing building or (ii) beneath another existing permanent structure provided written notice that such structure will be used to prevent human contact with such soil has been provided to the Commissioner.

(29) "Industrial or commercial activity" means any activity related to the commercial production, distribution, manufacture or sale of goods or services, or any other activity which is not a residential activity as defined in subdivision (53) of this subsection.

(30) "Industrial/commercial direct exposure criteria" means the concentrations identified as industrial/commercial direct exposure criteria in Appendix A to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

(31) "Industrial/commercial volatilization criteria" means the concentrations identified as industrial/commercial volatilization criteria in Appendices E and F to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

(32) "Intermittent watercourse" means "intermittent watercourse" as defined in section 22a-38 of the General Statutes.

(33) "Light non-aqueous phase liquid" means a non-aqueous phase liquid that has a density equal to or less than water at 20 degrees Celsius.

(34) "Matrix interference effect" means the inability to measure the concentration of a substance in a sample at the analytical detection limit due to chemical interferences within the sample which interferences cannot be compensated for using methods approved by EPA.

(35) "Natural attenuation" means a decrease in concentration of a substance in ground water through operation of natural physical or chemical processes, including but not limited to adsorption, absorption, dilution, phase transfer, oxidation, organic complexation, biodegradation, dispersion and diffusion.

(36) "Non-aqueous phase liquid" means a liquid that is not dissolved in water.

(37) "Organoleptic" means the capability to produce a detectable sensory stimulus such as odor or taste.

(38) "Parcel" means a piece, tract or lot of land, together with the buildings and other improvements situated thereon, a legal description of which piece, parcel, tract or lot is contained in a deed or other instrument of conveyance.

(39) "PCB" means polychlorinated biphenyls

(40) "PPB" means parts per billion

(41) "PPM" means parts per million

(42) "Person" means person as defined in section 22a-2(c) of the General Statutes.

(43) "Pollutant mobility criteria" means the concentrations identified in Appendix B to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies or any alternative pollutant mobility criteria approved by the Commissioner pursuant to subsection 22a-133k-2(d) of the Regulations of Connecticut State Agencies.

(44) "Polluted fill" means soil or sediment which contained polluting substances at the time such soil or sediment was deposited as fill material.

(45) "Polluted soil" means soil affected by a release of a substance at a concentration above the analytical detection limit for such substance.

(46) "Pollution" means pollution as defined in section 22a-423 of the General Statutes.

(47) "Potable water" means potable water as defined in section 22a-423 of the General Statutes.

(48) "Potential public water supply resource" means (A) any "potential well field" as defined in section 22a-354a of the General Statutes, or (B) any area identified by the Commissioner pursuant to section 22a-354c(b) of the General Statutes.

(49) "Prudent" means reasonable, after taking into consideration cost, in light of the social and environmental benefits.

(50) "Release" means any discharge, spillage, uncontrolled loss, seepage, filtration, leakage, injection, escape, dumping, pumping, pouring, emitting, emptying, or disposal of a substance.

(51) "Release area" means the land area at and beneath which polluted soil is located as a result of a release.

(52) "Remediation" means the containment, removal, mitigation, or abatement of pollution, a potential source of pollution, or a substance which poses a risk to human health or the environment, and includes but is not limited to the reduction of pollution by natural attenuation.

(53) "Residential activity" means any activity related to a (A) residence or dwelling, including but not limited to a house, apartment, or condominium, or (B) school, hospital, day care center, playground, or outdoor recreational area.

(54) "Residential direct exposure criteria" means the concentrations identified as residential direct exposure criteria in Appendix A to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

(55) "Residential volatilization criteria" means the concentrations identified as residential volatilization criteria in Appendices E and F to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

(56) "Seasonal high water table" means, on an annual basis, the highest plane in the ground at which plane all pore spaces are filled with water atmospheric pressure.

(57) "Seasonal low water table" means, on an annual basis, the lowest plane in the ground at which plane all pore spaces are filled with water atmospheric pressure.

(58) "Sediment" means unconsolidated material occurring in a stream channel, estuarine waters, or marine waters.

(59) "Seven day, ten year low flow" or "7Q10" means the lowest seven consecutive day mean stream discharge rate with a recurrence interval of ten (10) years.

(60) "Soil" means unconsolidated geologic material overlying bedrock, but not including sediment.

(61) "Soil water" means that portion of waters as defined in section 22a-423 of the General Statutes which portion is above the water table.

(62) "SPLP" means Synthetic Precipitation Leaching Procedure EPA Method 1312 as set forth in "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods", SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460.

(63) "Substance" means an element, compound or material which, when added to air, water, soil or sediment, may alter the physical, chemical, biological or other characteristic of such air, water, soil or sediment.

(64) "Surface-water protection criteria" means the concentrations identified in Appendix D to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies or any alternative surface-water protection criteria calculated or approved by the Commissioner in accordance with subdivision 22a-133k-3(b)(3) of the Regulations of Connecticut State Agencies.

(65) "TCLP" means Toxicity Characteristic Leaching Procedure EPA Method 1311 as set forth in "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods", SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460.

(66) "Technically practicable" means, with respect to remediation, the greatest degree of remediation that can be achieved using sound engineering and hydrogeologic practices.

(67) "Upgradient" means in the direction of maximum rate of increase of hydraulic head.

(68) "Upgradient area" with respect to a release area of a substance means the area bounded by (A) the width of the release area of such substance perpendicular to the direction of ground-water flow, (B) two side boundary lines parallel to the upgradient direction of ground-water flow extending from the two endpoints of said width to the upgradient parcel boundary, and (C) the upgradient parcel boundary extending between the two side boundary lines; excluding any portion of such upgradient area that is (i) affected by any other release of such substance or (ii) beneath an existing permanent structure.

(69) "Volatilization criteria" means the concentrations identified in Appendix E and Appendix F to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies or alternative criteria approved by the Commissioner pursuant to subdivision 22a-133k-3(c)(4) of the Regulations of Connecticut State Agencies.

(70) "Volatilization criteria for ground water" means the concentrations identified in Appendix E to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

(71) "Volatilization criteria for soil vapor" means the concentrations identified in Appendix F to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

(72) "Water table" means the plane in the ground at which plane all pore spaces are filled with water at atmospheric pressure.

(73) "Water Quality Standards" means the latest adopted Connecticut Water Quality Standards and Criteria adopted by the Commissioner pursuant to section 22a-426 of the General Statutes.

(74) "Wetland" means 'wetlands' as defined in sections 22a-38(15) and section 22a-29(2) of the General Statutes.

(75) "Zone of influence" means zone of influence as defined in section 22a-430-3(a) of the Regulations of Connecticut State Agencies.

(b) Applicability.

Sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies apply to any action taken to remediate polluted soil, surface water or a ground-water plume at or emanating from a release area which action is:

(1) required pursuant to Chapter 445 or 446k of the General Statutes, or

(2) taken pursuant to Public Act 95-183 or Public Act 95-190 including but not limited to any such action required to be taken or verified by a licensed environmental professional pursuant to such Public Acts.

Sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies do not apply within the zone of influence of a ground-water discharge permitted by the Commissioner under section 22a-430 of the General Statutes. Any person conducting a remediation in accordance with said sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies shall obtain all permits and other authorizations required by state, federal and local law and shall comply with all applicable state, federal and local laws, including without limitation the requirements of 40 CFR Part 761. In the event that any provision of sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies conflicts with any provision of any other statute or regulation, the more stringent provision shall prevail. Nothing in this subsection shall be construed as requiring any further remediation of any release which has been remediated and which remediation has been approved in writing by the Commissioner, unless the Commissioner takes action to require such remediation pursuant to any section of Chapter 446k of the General Statutes.

(c) Time frames for Issuance of Approvals by the Commissioner.

The Commissioner shall, no later than thirty days after the date of receipt of a request for his approval of any variance from or alternative criteria pursuant to sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, provide to the requester in writing estimated time frames for the Commissioner to (1) determine whether additional information is needed for him to evaluate the request; and (2) approve or deny a complete request. In addition, no later than one hundred and eighty days following adoption of said sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner shall make available general estimated written time frames for the Commissioner to approve any variance or alternative criterion pursuant to these regulations, including estimated time frames for the Commissioner to (1) determine whether additional information is needed to evaluate the request; and (2) approve or deny a complete request. In establishing estimated time frames pursuant to this subsection, the Commissioner shall take into account the complexity of the request, and the environmental and economic significance of the remediation, and shall expedite any request associated with any voluntary remediation pursuant to Public Acts 95-183 or 95-190.

(d) Public Participation.

(1) Public Hearing on Remediation. If the Commissioner determines that there is substantial public interest in any remediation proposed pursuant to section 2 of P.A. 95-190 or section 2 or 3 of P.A. 95-183, he may hold a public hearing on such proposed remediation, and he shall hold a hearing upon receipt of a petition signed by twenty-five or more persons. Notice of any such hearing shall be published in a newspaper of substantial circulation in the area of the proposed remediation at least thirty days prior to such hearing. Such hearing need not be conducted pursuant to the provisions of Chapter 54 of the General Statutes.

(2) Comment Procedures. Any public notice published or mailed pursuant to section 2 of P.A. 95-190 or section 2 or 3 of P.A. 95-183 shall provide that comments on the proposed remediation may be submitted to the Commissioner within forty-five days of the publication or mailing of such notice. The Commissioner shall forward a copy of all comments received by the date specified in the public notice and all comments made at a public hearing to the owner of the subject parcel and, if different, the person undertaking remediation at such parcel. The person undertaking remediation at the subject parcel shall, within sixty days of receiving such comments, submit to the Commissioner a written summary of all such comments and a written response to each such comment. The Commissioner shall review such summary and responses and shall adopt it as his own, adopt it with modifications, or reject it and prepare a response to each such comment. The Commissioner shall send a copy of the initial summary and responses and of his action with respect thereto to each person who submitted comments on the

remediation proposal.

(e) Periodic review.

The Commissioner shall periodically review sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies to determine whether the implementation of such regulations is successfully protecting public health and the environment from the hazards of pollution. The Commissioner shall also evaluate whether the implementation of the regulations streamlines the process of conducting remediation projects in Connecticut, based upon, among other things, his review of the number of remediation projects completed in accordance with said sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the number of such projects reviewed by the Commissioner pursuant to sections 2 or 3 of P.A. 95-183, the length of time required for the Commissioner's review of complete requests for approval of alternative criteria or variances, and the number of remediation projects conducted pursuant to P.A. 95-190 or sections 2 or 3 of P.A. 95-183 which projects were verified by a licensed environmental professional. Such reviews shall be conducted at intervals of no more than five years, provided that nothing in this subsection shall preclude the Commissioner, at his discretion, from conducting such a review at any time and further provided that the first such review shall be conducted no later than eighteen months after the effective date of sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies. As a result of such a periodic review, the Commissioner may conclude that the goals of this subsection and section 22a-133k of the General Statute are being met, or he may conclude that revisions to such regulations are necessary to ensure that the implementation of said sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies achieves such goals, in which case he may revise such Regulations as he deems necessary to achieve those goals.

Section 2. The Regulations of Connecticut State Agencies are amended by adding a new section 22a-133k-2 as follows:

22a-133k-2 Standards for Soil Remediation

(a) General.

Unless otherwise specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, polluted soil at a release area shall be remediated to a concentration which meets (1) (A) the direct exposure criteria set forth in subsection (b) of this section or alternative direct exposure criteria established in accordance with subdivision (2) or subdivision (7) of subsection (d) of this section; and (B) the pollutant mobility criteria set forth in subsection (c) of this section or alternative pollutant mobility criteria established in accordance with subdivision (3) or (5) of subsection (d) of this section; or (2) the background concentration for soil provided notice has been submitted to the Commissioner which notice shall be submitted on a form furnished by the Commissioner and shall include a brief description of the subject release area and of the general characteristics of soils in the vicinity of such release area; a map showing the location of such release area, and based on reasonable inquiry of other release areas in the vicinity thereof, and of all soil samples taken for the purpose of characterizing background concentration for soil; and the results of all laboratory analyses of such samples.

(b) Direct Exposure Criteria.

(1) Except as otherwise provided in this paragraph, polluted soil at a release area shall be remediated to at least that concentration at which the residential direct exposure criteria for each substance is met.

(2) (A) Polluted soil at a release area may be remediated to a concentration at which the industrial/commercial direct exposure criteria for each substance except PCB is met if (i) access to the parcel containing such release area is limited to individuals working at or people temporarily visiting the subject parcel; and (ii) an environmental land use restriction is in effect with respect to such parcel, or to the portion of such parcel containing such release area, which environmental land use restriction ensures that the parcel or restricted portion thereof is not used for any residential activity in the future and that any future use of such parcel or restricted portion thereof is limited to an industrial or commercial activity.

(B) Soil polluted with PCB at a release area may be remediated to a concentration at which the industrial/commercial direct exposure criteria for PCB is met if the parcel upon which such release area is located is (i) an outdoor electrical substation as defined in 40 CFR 761.123; or (ii) an other restricted access location as defined in said section 40 CFR 761.123 and an environmental land use restriction is in effect with respect to such parcel, or to the portion of such parcel containing such release area, which environmental land use restriction ensures that the parcel or restricted portion thereof is not used for any residential activity in the future and that any future use of such parcel or restricted portion thereof is limited to an industrial or commercial activity.

(3) The direct exposure criteria for substances other than PCB do not apply to inaccessible soil at a release area provided that if such inaccessible soil is less than 15 feet below the ground surface an environmental land use restriction is in effect with respect to the subject parcel or to the portion of such parcel containing such release area, which environmental land use restriction ensures that such soils will not be exposed as a result of excavation, demolition or other activities and that any pavement which is necessary to render such soil inaccessible is maintained in good condition unless and until such restriction is released in accordance with said section 22a-133q-1. Unless an alternative criterion has been approved in accordance with subsection 22a-133k-2(d)(7), inaccessible soil polluted with PCB may be remediated to a concentration of 10 ppm PCB by weight provided that (A) if such inaccessible soil is located on a parcel which is an other restricted access location as defined in said section 40 CFR 761.123, such soil may be remediated to a concentration of 25 ppm PCB by weight, or (B) if such inaccessible soil is located on a parcel which is an outdoor electrical substation as defined in 40 CFR 761.123, such soil may be remediated to a concentration of 25 ppm PCB by weight, or if a label or notice is visibly placed in the area in accordance with 40 CFR Part 761, to a concentration of 50 ppm PCB by weight.

(4) Additional Polluting Substances

(A) With respect to a substance at a release area for which a direct exposure criterion is not specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may, after consultation with the Commissioner of Public Health, approve in writing a direct exposure criterion to apply to such substance at a particular release area. Any person requesting approval of a direct exposure criterion for such substance shall submit to the commissioner (i) a proposed risk-based direct exposure concentration for such substance calculated in accordance with subparagraph (B) or (C) of this subdivision as applicable, and (ii) the analytical detection limit for such substance. Before approving a direct exposure criterion the Commissioner shall consider the proposed risk-based direct exposure concentration for such substance, the analytical detection limit for such substance, any information about the health effects such substance may cause due to exposure pathways not accounted for in the proposed risk-based direct exposure, and any other information that the Commissioner reasonably deems necessary.

(B) The proposed residential risk-based direct exposure concentration shall be calculated using the following equations:

(i) For carcinogenic substances:

$$DEC_{RB} = \left[\frac{Risk}{CSF}\right] \times \left[\frac{BW_C \times AT}{IR_C \times ED_C \times EF \times CF} + \frac{BW_A \times AT}{IR_A \times ED_A \times EF \times CF}\right]$$

(ii) For non-carcinogenic substances:

$$DEC_{RB} = \left[RFD \times HI\right] \left[\frac{BW_C \times AT_C}{IR_C \times ED_C \times EF \times CF} + \frac{BW_A \times AT}{IR_A \times ED_A \times EF \times CF}\right]$$

(iii) The abbreviations used in subparagraphs (i) and (ii) shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

Term	Description	Units	Value
DEC_{RB}	Risk-based Direct Exposure Criterion	mg/kg	calculated
Risk	Target Cancer Risk Level	unitless	1.0E-06
HI	Hazard Index	unitless	1.0
CSF	Cancer slope Factor	$(mg/kg\text{-}day)^{-1}$	substance-specific
RFD	Reference Dose	mg/kg-day	substance-specific
IR_C	Ingestion Rate, Child	mg/day	200
IR_A	Ingestion Rate, Adult	mg/day	100
EF	Exposure Frequency	days/year	365
ED_C	Exposure Duration, Child	years	6
ED_A	Exposure Duration, Adult	years	24
CF	Conversion Factor	kg/mg	0.000001
BW_C	Body Weight, Child	kg	15
BW_A	Body Weight, Adult	kg	70
AT	Averaging Time, for carcinogens	days	25550
AT_C	Averaging Time, Child for non-carcinogens	days	2190
AT_A	Averaging Time, Adult for non-carcinogens	days	8760

(C) The proposed industrial/commercial risk-based direct exposure concentration shall be calculated using the following equations:

(i) For carcinogenic substances:

$$DEC_{RB} = \left[\frac{Risk}{CSF}\right] \times \left[\frac{BW \times AT}{IR \times ED \times EF \times CF}\right]$$

(ii) For non-carcinogenic substances:

$$DEC_{RB} = \left[RFD \times HI\right] \left[\times \frac{BW \times AT}{IR \times EF \times ED \times CF}\right]$$

(iii) The abbreviations used in subparagraphs (i) and (ii) shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

Term	Description	Units	Value
DEC_{RB}	Risk-based Direct Exposure Criterion	mg/kg	calculated
Risk	Target Cancer Risk Level	unitless	1.0E-06
HI	Hazard Index	unitless	1.0
CSF	Cancer slope Factor	$(mg/kg\text{-}day)^{-1}$	substance-specific
RFD	Reference Dose	mg/kg-day	substance-specific
IR	Ingestion Rate	mg/day	50
EF	Exposure Frequency	days/year	250
ED	Exposure Duration	years	25
CF	Conversion Factor	kg/mg	0.000001
BW	Body Weight	kg	70
AT	Averaging Time, for carcinogens	days	25550
AT_A	Averaging Time, Adult for non-carcinogens	days	9125

(c) Pollutant Mobility Criteria.

(1) General.

(A) A substance, other than an inorganic substance or PCB, in soil above the seasonal low water table, or above the seasonal high water table if (i) remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution or (ii) the subject soil is located in a GB area, shall be remediated to at least that concentration at which the results of a mass analysis of such soil for such substance does not exceed the pollutant mobility criterion applicable to the ground-water classification of the area at which such soil is located, except that in the circumstances identified in subdivision (2) of this subsection, remediation to achieve compliance with the pollutant mobility criteria may be conducted in accordance with the requirements established in said subdivision (2).

(B) An inorganic substance or PCB in soil above the seasonal low water table, or above the seasonal high water table if (i) remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution or (ii) the subject soil is located in a GB area, shall be remediated to at least that concentration at which the results of a TCLP or SPLP analysis of such soil for such substance does not exceed the pollutant mobility criterion applicable to the ground-water classification of the area at which such soil is located, except that in the circumstances identified in subdivision (2) of this subsection, remediation to achieve compliance with the pollutant mobility criteria may be conducted in accordance with the requirements established in said subdivision (2).

(2) Specific Circumstances

(A) Polluted Soils in a GA Area.

A soil in a GA area and polluted with a substance, other than 1,2 dichlorobenzene, ethyl benzene, toluene, xylenes or total petroleum hydrocarbons, which soil is at or above the seasonal low water table, or at or above the seasonal high water table if remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution, may be remediated to at least that concentration at which the results of a TCLP or SPLP analysis of such soil for such substance do not exceed the ground-water protection criterion for such substance.

(B) Soils Polluted with Volatile Organic Substances in a GA area.

A soil in a GA area polluted with a volatile organic substance, other than 1,2 dichlorobenzene, ethyl benzene, toluene, or xylenes which soil is at or above the seasonal low water table, or at or above the seasonal high water table if remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution, may be remediated to at least that concentration at which the results of a TCLP or SPLP analysis of such soil for such substance do not exceed the ground-water protection criterion for such substance multiplied by ten or the results of a mass analysis of such soil for such substance do not exceed the pollutant mobility criterion for such substance multiplied by ten or by an alternative dilution or dilution and attenuation factor approved by the Commissioner in accordance with subdivision (4) of subsection (d) of this section, provided no non-aqueous phase liquids are present in the subject release area as determined in accordance with subdivision (3) of this subsection, the water table is at least fifteen feet above the surface of the bedrock and the downward vertical flow velocity is not greater than the horizontal flow velocity, and:

(i) (aa) a public water supply distribution system is available within 200 feet of the subject parcel, all adjacent parcels, and any parcel within the areal extent of the ground-water plume caused by the subject release area, (bb) the ground water within the areal extent of such ground-water plume is not used for drinking water, (cc) no public or private water supply wells exist within 500 feet of the subject release area, and (dd) the ground water affected by the subject release area is not a potential public water supply resource; or

(ii) (aa) the concentration of any volatile organic substance in a ground-water plume and within seventy-five feet of the nearest downgradient parcel boundary does not exceed the ground-water protection criterion, (bb) except for seasonal variation, the areal extent of volatile organic substances in the ground-water plume is not increasing over time and the concentration of any volatile organic substance in the ground-water plume is not increasing, except as a result of natural attenuation, at any point over time and (cc) notice of such condition is provided to the Commissioner on a form furnished by the Commissioner, which notice shall include: a brief description of the release area; a brief description of the distribution and concentration of volatile organic substances in soil and ground water; a map showing the location of the release area, and based on reasonable inquiry all other volatile organic substance release areas in the vicinity of the subject release area, all ground-water and soil monitoring points, and the areal extent of the volatile organic substance ground-water plume; and the results of all laboratory analyses conducted to determine whether the requirements of this subparagraph have been met; or

(iii) (aa) the concentration of any volatile organic substance within such ground-water plume does not exceed the ground-water protection criterion for such substance at a location downgradient of the release area, on the subject parcel, and within 25 feet of such release area, and (bb) notice of such condition is provided to the Commissioner on a form furnished by the Commissioner, which notice shall include: a brief description of the release area; a brief description of the distribution and concentration of volatile organic substances in soil and ground water; a map showing the location of the release area, and based on reasonable inquiry all other volatile organic substance

release areas in the vicinity of the subject release area, and all ground-water and soil monitoring points; and the results of all laboratory analyses conducted to determine whether the requirements of this subparagraph have been met.

(C) Inorganic, semi-volatile, PCB or pesticide contamination in a GA area.

A soil in a GA area and polluted with inorganic substances, semi-volatile substances, PCB or pesticides, which soil is at or above the seasonal low water table, or at or above the seasonal high water table if remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution, may be remediated to a level at which (i)(aa) the results of a TCLP or SPLP analysis of such soil for such substance do not exceed the ground-water protection criterion for such substance multiplied by ten or by an alternative dilution or dilution and attenuation factor approved by the Commissioner in accordance with subdivision (4) of subsection (d) of this section or (bb) the results of a mass analysis of such soil for a substance do not exceed the pollutant mobility criterion for such substance multiplied by ten or by an alternative dilution or dilution and attenuation factor approved by the Commissioner in accordance with subdivision (4) of subsection (d) of this section; provided (ii) (aa) the release area and any portion thereof is located at least twenty-five feet from the nearest legal boundary of the parcel in the downgradient direction, (bb) no non-aqueous phase liquids are present in the release area as determined in accordance with subdivision (3) of this subsection, and (cc) the water table is at least fifteen feet above the surface of the bedrock.

(D) Polluted Soils in a GB area.

A substance other than total petroleum hydrocarbons in soil above the seasonal high water table in a GB area may be remediated to a level at which the results of a TCLP or SPLP analysis of such soil does not exceed the ground-water protection criterion for any such substance (i) (aa) multiplied by 10, (bb) multiplied by the ratio of the summation of the areas downgradient and upgradient of the release area to the release area, provided that such ratio does not exceed 500, or (cc) or multiplied by an alternative dilution or dilution and attenuation factor approved by the Commissioner in accordance with subdivision (5) of subsection (d) of this section; (ii) provided non-aqueous phase liquids are not present in such soil as determined in accordance with subdivision (3) of this subsection.

(E) Site specific dilution in a GB area.

(i) A substance, other than total petroleum hydrocarbons, in a soil at or above the seasonal high water table in a GB area where the background concentration for ground water for such substance is less than the applicable ground-water protection criterion, may be remediated to a level at which the results of a mass analysis of such soil for a substance do not exceed the pollutant mobility criterion applicable to such substance in a GA area multiplied by a site-specific dilution factor calculated in accordance with clause (ii) of this subparagraph, or the results of a TCLP or SPLP analysis of such soil for a substance do not exceed the ground-water protection criterion for such substance multiplied by a site-specific dilution factor calculated in accordance with clause (ii) of this subparagraph, provided (aa) no non-aqueous phase liquids are present in such soil as determined in accordance with subdivision (3) of this subsection; (bb) notice has been submitted to the Commissioner in accordance with clause (iii) of this subparagraph; and (cc) the water table in the release area is at least fifteen feet above the surface of the bedrock and the downward ground water vertical flow velocity is not greater than the ground water horizontal flow velocity.

(ii) For the purpose of clause (i) of this subparagraph, the site-specific dilution factor shall be calculated using the following formula: $DF = (1 + (Kid/IL))(1-F_{adj})$, where:

DF = site-specific dilution factor
K = hydraulic conductivity, in feet per year, of the unconsolidated aquifer

underlying the release area

i = horizontal hydraulic gradient in feet per feet

d = 15 feet

I = infiltration rate in feet per year as specified in subparagraph (iv) of this subparagraph

L = length in feet of the release area parallel to the direction of ground-water flow

F_{adj} = background concentration for ground water divided by the ground-water protection criterion for the subject substance, or, where the background concentration for ground water can not be quantified, ½ the minimum detection limit for the subject substance divided by the ground-water protection criterion for the subject substance.

(iii) A notice submitted pursuant to clause (i) of this subparagraph shall be submitted on a form prescribed and provided by the Commissioner and shall include: a brief description of the release area and the general characteristics of soils in the vicinity of the release area; a map showing the location of the release area, and based on reasonable inquiry other release areas in the vicinity containing the substance for which the site-specific dilution factor is calculated, and all monitoring points; if applicable, justification for use of a till infiltration rate other than 0.5 feet per year, and the results of all the laboratory analyses and field analyses used to determine the (aa) parameters of the equation in clause (ii) of this subparagraph and (bb) identification of geologic material for the purposes of choosing an infiltration rate in accordance with clause (iv) of this subparagraph.

(iv)

Geologic Material	Infiltration Rate (feet/year)
Stratified Drift	2.0
Till	0.5 - 1.0
Lacustrine Deposits	0.4

(3) Determining the Presence of Non-aqueous Phase Liquids in Soil. For the purpose of this subsection, the presence of non-aqueous phase liquids in soil shall be determined using the following equation: $C_{nap} = (S/2\rho_b)(K_d \rho_b + \theta_w + H'\theta_a)$, where:

C_{nap} = the concentration of an organic substance at which or above which such substance may be present in a non-aqueous phase

S = the effective solubility

ρ_b = dry soil bulk density

K_d = soil-water partition coefficient, which may be approximated by $K_{OC} \cdot f_{OC}$

K_{OC} = soil organic carbon-water partition coefficient

f_{OC} = fraction organic carbon of soil

θ_w = water-filled soil porosity (L_{water}/L_{soil})

θ_a = air-filled soil porosity (L_{air}/L_{soil})

H' = Henry's law constant (dimensionless)

H = Henry's law constant (atm-m^3/mol)

The terms defined above shall be assigned the following values:

Term	Units	Value
C_{NAP}	mg/kg	calculated
S	mg/L	chemical-specific

ρ_b	kg/L	1.5 or the lowest value measured at the subject release area
K_d	L/kg	calculated
K_{OC}	L/kg	chemical-specific
f_{OC}	g/g	0.006 or the lowest value measured at the subject release area
θ_w	L_{water}/L_{soil}	0.15
θ_a	L_{air}/L_{soil}	0.28
H'	unitless	H x 41 where 41 is a conversion factor
H	atm-m^3/mol	chemical-specific

(4) Exceptions.

(A) If at a release area (i) the ground-water classification is GB and (ii) the elevation of the water table is below the elevation of the top of bedrock, such release area shall be remediated to a concentration which meets the pollutant mobility criteria applicable to any location at which the ground-water classification is GA or GAA.

(B) The pollutant mobility criteria do not apply to environmentally isolated soil provided an environmental land use restriction is in effect with respect to the parcel, or portion thereof, containing such soil which environmental land use restriction ensures that such soil will not be exposed to infiltration of soil water due to, among other things, demolition of the building.

(C) The pollutant mobility criteria do not apply to polluted fill on a parcel if: (aa) such fill is polluted only with coal ash, wood ash, coal fragments, asphalt paving fragments, or any combination thereof; (bb) such fill is not polluted with any volatile organic substance; (cc) the concentration of each substance in any such fill is consistent with the requirements established in subsection (b) of this section; (dd) such substance is not affecting and will not affect the quality of an existing or potential public water supply

resource or an existing private drinking water supply; (ee) a public water supply distribution system is available within 200 feet of such parcel and all parcels adjacent thereto; and (ff) the placement of the fill was not prohibited by law at the time of placement.

(5) Additional Polluting Substances.

With respect to a substance for which a pollutant mobility criterion is not specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve a pollutant mobility criterion, a dilution or dilution and attenuation factor, and a method for determining compliance with such criterion to apply to such substance at a particular release area, provided he finds that such criterion will ensure that soil water at such release area does not exceed, in a GA area, the ground-water protection criterion, or in a GB area the ground-water protection criterion multiplied by a dilution factor of 10.

(d) Alternative Soil Criteria.

(1) Requests for Approval of Alternative Soil Criteria.

(A) Any person requesting that the Commissioner approve an alternative criterion applicable to a particular release area shall submit: the name and address of the owner of the parcel at which such release area is located; the address of such release area and a brief description of its location; a detailed description of such release area; and a map at a scale of not less than 1:1200 showing the location of all release areas on such parcel, the subject release area, and describing the concentration and distribution of all substances in the soil of the subject release area, including but not limited to the substance for which an alternative criterion is sought; a detailed written report describing the justification for the proposed alternative criterion; and any other information the Commissioner reasonably deems necessary to evaluate such request.

(B) Any person requesting that the Commissioner approve an alternative pollutant mobility criterion or an alternative dilution or dilution attenuation factor shall submit, in addition to the information required by subparagraph (A) of this subdivision, a detailed description of any other release area located on the same parcel as the subject release area and which other release area (i) is affected or potentially affected by the subject release area or (ii) is affecting or potentially may affect the subject release area;

(C) Any person requesting that the Commissioner approve an alternative direct exposure criterion shall submit, in addition to the information required by subparagraph (A) of this subdivision, a detailed description of any other release area located on the same parcel as the subject release area.

(2) Alternative Direct Exposure Criteria.

With respect to a substance except PCB for which a direct exposure criterion is specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve an alternative direct exposure criterion and an alternative method for determining compliance with such criterion provided it is demonstrated to the satisfaction of the Commissioner, after consultation with the Commissioner of Public Health that the application of such alternative criterion at the subject release area will protect human health and the environment from the risks associated with direct exposure to polluted soil by ensuring that (A) the concentration of each carcinogenic substance in such soil does not exceed a 1×10^{-6} excess lifetime cancer risk level and the concentration of each non-carcinogenic substance in such soil does not exceed a hazard index of 1; or (B) for a release area polluted with multiple substances, the cumulative excess lifetime cancer risk for all carcinogenic substances in such soil does not exceed 1×10^{-5} and the cumulative hazard index does not exceed 1 for non-carcinogenic substances in such soil with the same target organ. Any person requesting approval of an alternative direct exposure criterion shall submit to the Commissioner and the Commissioner of Public Health a risk assessment prepared in accordance with the most recent EPA Risk Assessment Guidance for Superfund or other risk assessment method approved by the Commissioner

in consultation with the Commissioner of Public Health, and shall submit any additional information specified by the Commissioner or the Commissioner of Public Health.

(3) Alternative Pollutant Mobility Criteria for GA Areas.

With respect to a substance occurring at a release area located in a GA area, and for which substance a pollutant mobility criterion is specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve an alternative pollutant mobility criterion and an alternative method for determining compliance with such criterion, provided it is demonstrated to the Commissioner's satisfaction that the application of such alternative criterion at the subject release area will ensure that soil water at such release area will not exceed the ground-water protection criterion for such substance.

(4) Alternative Dilution or Dilution Attenuation Factor for GA Areas.

With respect to a substance occurring at a release area located in a GA area, and for which substance a pollutant mobility criterion is specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve an alternative dilution or dilution attenuation factor, provided that it is demonstrated to the Commissioner's satisfaction that application of such dilution factor will ensure that such release area will not degrade ground-water quality and thereby prevent the achievement of the applicable ground-water remediation standards.

(5) Alternative Pollutant Mobility Criteria for GB Areas.

With respect to a substance occurring at a release area located in a GB area, and for which substance a pollutant mobility criterion is specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve an alternative pollutant mobility criterion and an alternative method for determining compliance with such criterion at such release area, provided it is demonstrated to the Commissioner's satisfaction that the application of such criterion will ensure that soil water at the release area, after dilution with ground water derived from infiltration on the parcel, will not exceed the ground-water protection criterion for such substance.

(6) Alternative Dilution or Dilution Attenuation Factor for GB Areas.

With respect to a substance occurring at a release area located in a GB area, and for which substance a pollutant mobility criterion is specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve an alternative dilution or dilution attenuation factor, provided that it is demonstrated to the Commissioner's satisfaction that application of such alternative dilution or dilution attenuation factor will ensure that the soil water at such release area will not cause the ground water at the nearest downgradient property boundary to exceed the ground-water protection criterion for such substance.

(7) Alternative Direct Exposure Criterion for PCB.

The Commissioner may approve an alternative direct exposure criterion for PCB including an alternative direct exposure criterion for an inaccessible soil polluted with PCB, and an alternative method for determing compliance with such criterion, provided it is demonstrated to the satisfaction of the Commissioner after consultation with the Commissioner of Public Health that the application of such alternative criterion at the subject release area will protect human health and the environment from the risks associated with direct exposure to soil polluted with PCB and is consistent with 40 CFR Part 761 and with the "Guide on Remedial Actions at Superfund Sites with PCB Contamination" (EPA Directive 9355.4-01, August 1990).

(e) Applying the Direct Exposure and Pollutant Mobility Criteria

(1) Unless an alternative method for determining compliance with a direct exposure criterion has been approved by the Commissioner in writing, compliance with a direct exposure criterion is achieved when (A) the ninety-five percent upper confidence level of the arithmetic mean of all sample results of

laboratory analyses of soil from the subject release area is equal to or less than such criterion, provided that the results of no single sample exceeds two times the applicable direct exposure criterion or (B) the results of all laboratory analyses of samples from the subject release area are equal to or less than the applicable direct exposure criterion.

(2) Unless an alternative method for determining compliance with a pollutant mobility criterion for a particular substance has been approved by the Commissioner in writing, compliance with a pollutant mobility criterion for such substance is achieved when:

(A) (i) a representative sampling program consisting of not less than twenty samples of soil located above the water table has been used to characterize the distribution and concentration of such substance at the subject release area or remaining at the subject release area following remediation, (ii) the release area has not been remediated by means of excavation and removal of polluted soil, (iii) the ninety-five percent upper confidence level of the arithmetic mean of all the sample results of laboratory analyses of soil from the subject release area for such substance is equal to or less than the applicable pollutant mobility criterion or the results of all laboratory analyses of samples from the subject release area are equal to or less than the applicable direct exposure criterion, and (iv) no single sample result exceeds two times the applicable pollutant mobility criterion;

(B) (i) a representative sampling program consisting of less than twenty samples of soil located above the water table has been used to characterize the distribution and concentration of substances remaining at the subject release area following remediation, (ii) the release area has not been remediated by means of excavation and removal of polluted soil, and (iii) the results of all laboratory analysis of samples from the subject release area for such substances are equal to or less than such pollutant mobility criterion; or

(C) (i) the subject release area has been remediated by means of excavation and removal of polluted soil, (ii) a representative sampling program consisting of samples of soil located above the water table has been used to characterize the distribution and concentration of substances remaining at the subject release area following excavation and removal, and (iii) the results of all laboratory analyses of samples from the subject release area for such substances are equal to or less than such pollutant mobility criterion.

(3) Matrix interference effects.

If any applicable criterion for a substance in soil is less than the concentration for such substance that can be consistently and accurately quantified in a specific sample due to matrix interference effects, the following actions shall be taken:

(A) (i) "Test Methods for Evaluating Solid Waste : Physical/Chemical Methods," SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460 shall be consulted to determine if an analytical method sufficiently sensitive to achieve the applicable analytical detection limit was used to conduct the analysis of the subject substance. If there is available an alternative analytical method which is sufficient to achieve the required analytical detection limit, appropriate for the sample matrix, and has been approved by EPA or approved in writing by the Commissioner, the subject soil shall be re-analyzed for the subject substance using such alternative method.
(ii)If a sample has been analyzed by one or more analytical methods in accordance with subparagraph (A)(i) of this subdivision and the applicable analytical detection limit has not been achieved due to matrix interference effects, such method(s) shall be modified in order to compensate for such interferences, in accordance with analytical procedures specified by EPA within the scope of the analytical method.

(B) If, after re-analyzing the subject soil and attempting to compensate for matrix interference effects in accordance with to subparagraph (A) of this subdivision, any applicable criterion for a substance in soil is less than the concentration for such substance that can be consistently and accurately quantified in a specific sample due to matrix interference effects, compliance with

such criterion shall be achieved when such soil has been remediated to the lowest concentration for such substance which can be consistently and accurately quantified without matrix interference effects.

(C) A detailed summary of all measures taken to overcome matrix interference effects and a determination of the lowest alternative quantification level applicable to the analysis of such substance shall be prepared and, if requested by the Commissioner in writing, shall be submitted to the Commissioner for his review and approval.

(f) Variances.

(1) Widespread Polluted Fill.

The Commissioner may grant a variance from any of the requirements of subsection (c) of this section upon the written request of the owner of the subject parcel if the Commissioner determines that (A) geographically extensive polluted fill is present at such parcel and at other parcels in the vicinity of the subject parcel; (B) such fill is not polluted with volatile organic substances; (C) such fill is not affecting and will not affect the quality of an existing or potential public water supply resource or an existing private drinking water supply; (D) the concentration of each substance in such fill is consistent with subsection (b) of this section; (E) the placement of such fill was not prohibited by law at the time of placement; and (F) the person requesting the variance did not place the fill on the subject parcel. In determining whether to grant or deny such a variance, the Commissioner may consider the relative cost of compliance with subsection (c) of this section, how extensive the polluted fill is, what relative proportion of such fill occurs on the subject parcel, and whether the person requesting the variance is affiliated with any person responsible for such placement through any direct or indirect familial relationship or any contractual, corporate or financial relationship other than that by which such person's interest in such parcel is to be conveyed or financed.

(2) Engineered Control of Polluted Soils.

(A) Provided that an engineered control of polluted soils is implemented pursuant to subparagraphs (B) and (C) of this subsection, the requirements of subsections (a) through (e) of this section do not apply if:

(i) the Commissioner authorized the disposal of solid waste or polluted soil at the subject release area;

(ii) the soil at such release area is polluted with a substance for which remediation is not technically practicable;

(iii) the Commissioner, in consultation with the Commissioner of Public Health, has determined that the removal of such substance or substances from such release area would create an unacceptable risk to human health; or

(iv) the Commissioner has determined, after providing notice and an opportunity for a public hearing, that a proposal by the owner of the subject parcel to use an engineered control is acceptable because (aa) the cost of remediating the polluted soil at such release area is significantly greater than the cost of installing and maintaining an engineered control for such soil and conducting ground-water monitoring at such release area in accordance with subsection (g) of section 22a-133k-3, and (bb) that the significantly greater cost outweighs the risk to the environment and human health if the engineered control fails to prevent the mobilization of a substance in the soil or human exposure to such substance. The Commissioner may hold a public hearing pursuant to this section if in his discretion the public interest will be best served thereby, and he shall hold a hearing upon receipt of a petition signed by at least twenty-five persons. Notice of the subject proposal shall be provided by the owner of the subject parcel in two of the three following manners: (i) by publication in a newspaper of substantial circulation in the affected area; (ii) by placing and maintaining on the subject parcel, for at least thirty days, in a legible condition a sign which shall be not less than six feet by four feet which sign shall be clearly visible from the public highway; or (iii) by mailing notice to the owner of record of each property abutting the subject parcel at his address on the most recent grand tax list of the municipality or municipalities in which such properties are located. When notice is published or mailed, it shall include the name and address of owner of the subject parcel; the location address and/or a description of the location such parcel; a brief description of the nature of the pollution on the subject parcel; a brief description of the proposed engineered control; and a brief description of the procedures for requesting a hearing. When notice is provided by posting a sign, the sign shall include the words "Environmental remediation is proposed for this site. For further information contact..." and shall include the name and telephone number of an individual from whom any interested person may obtain information about the remediation. The owner of the subject parcel shall verify to the Commissioner in writing on a form furnished by him that notice has been given in accordance with this subsection.

(B) A request to use an engineered control shall be submitted to the Commissioner in writing and shall be accompanied by a detailed written report and plan which demonstrates that:

(i) (aa) the proposed engineered control is designed and will be constructed to physically isolate polluted soil and to minimize migration of liquids through soil, to function with minimum maintenance, to promote drainage and minimize erosion of or other damage to such control, and to accommodate settling and subsidence of the underlying soil so as to maintain the control's structural integrity and permeability; and (bb) with respect to an engineered cap, such cap has been designed and constructed to have a permeability of less than 10^{-6} cm/sec or, unless otherwise specified by the Commissioner in writing, to have the permeability specified in a closure plan implemented under sections 22a-209-1 et seq of the Regulations of Connecticut State Agencies for a release area which is a lawfully authorized solid waste disposal area;
(ii) plans for ground-water monitoring at the subject release area are adequate to ensure that any substance migrating therefrom will be detected;
(iii) plans for maintenance of the subject release area are adequate to ensure that the structural integrity, design permeability, and effectiveness of the engineered control will be maintained; such plans shall include without limitation measures to prevent run-on and run-off of storm water from eroding or otherwise damaging the engineered control and measures to repair such control to correct the effects of any settling, subsidence, erosion or other damaging events or conditions;
(iv) an environmental land use restriction is or will be in effect with respect to the parcel at which the subject release area is located, which restriction ensures that such parcel will not be used in a manner that could disturb the engineered control or the polluted soil;
(v) any other information that the Commissioner reasonably deems necessary; and
(vi) with respect to any release area subject to any of the requirements of section 22a-

209-4(i) or section 22a-449(c)-100 through 110 of the Regulations of Connecticut State Agencies, all such requirements are or will be satisfied. With respect to a release area which is not subject to any such regulations, the owner of the subject parcel shall demonstrate that he has posted or will post a surety in a form and amount approved in writing by the Commissioner, which surety during the first year after installation of the engineered control shall be equal to the cost of one year's maintenance and monitoring of the engineered control, and which in each subsequent year shall be increased in amount by adding an amount equal to the cost of one year's maintenance and monitoring, until the total amount of such surety is equal to the cost of five year's of maintenance and monitoring, which amount shall be maintained in effect for the next twenty-five years or for such other period as may be required by the Commissioner.

(C) When the Commissioner approves a request pursuant to this subsection to use an engineered control he may require that such control incorporate any measures which he deems necessary to protect human health and the environment. Any person implementing an engineered control under this subsection shall perform all actions specified in the approved engineered control proposal including the recordation of the environmental land use restriction and posting of the surety, and any additional measures specified by the Commissioner in his approval of such plan. Nothing in this subdivision shall preclude the Commissioner from taking any action he deems necessary to protect human health or the environment if an approved engineered control fails to prevent the migration of pollutants from the release area or human exposure to such pollutants.

(g) Removal of Non-aqueous Phase Liquids.

Removal of light non-aqueous phase liquids from soil and ground water shall be conducted in accordance with section 22a-449(d)-106(f) of the Regulations of Connecticut State Agencies. Any other non-aqueous phase liquid shall be contained or removed from soil and ground water to the maximum extent prudent.

(h) Use of Polluted Soil and Reuse of Treated Soil.

Any soil excavated from and/or treated at a release area during remediation shall be managed as follows:

(1) Hazardous Waste.

Treatment, storage, disposal and transportation of soil which is hazardous waste as defined pursuant to section 22a-449(c) of the General Statutes shall be carried out in conformance with the provisions of sections 22a-449(c)-101 through 110 of the Regulations of Connecticut State Agencies, and any other applicable law;

(2) Special Wastes.

In accordance with section 22a-209-8 of the Regulations of Connecticut State Agencies, the Commissioner may authorize polluted soil, which is not hazardous waste as defined pursuant to subsection 22a-449(c) of the General Statutes, to be disposed of as special wastes as defined in said section 22a-209-1.

(3) Polluted soil.

Polluted soil from a release area may be treated to achieve concentrations of substances that do not exceed either the applicable direct exposure criteria or pollutant mobility criteria. After such treatment, such soil may be reused on the parcel from which it was excavated or on another parcel approved by the Commissioner, provided that such reuse is consistent with all other provisions of sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies and:

(A) Prior to reuse, a map showing the location and depth of proposed placement of such soil is submitted to the Commissioner;
(B) Such soil is not placed below the water table;

(C) Such soil is not placed in an area subject to erosion; and
(D) Any such soil in which the concentration of any substance exceeds the pollutant mobility criteria applicable to a GA area is not placed over soil and ground water which have not been affected by a release at the parcel at which placement is proposed; and
(E) For soils polluted with PCB, the Commissioner has issued a written approval in accordance with by section 22a-467 of the General Statutes.

(4) Natural Soil.

Polluted soil may be used at any parcel of land if after treatment of such soil to reduce or remove substances: (A) any naturally-occurring substance is present therein in concentrations not exceeding background concentration for soil of such substance at the release area from which such soil is removed; and (B) no other substance is detectable in such soil at a concentration greater than its analytical detection limit.

(i) Additional remediation of soil.

Nothing in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies shall preclude the Commissioner from taking any action necessary to prevent or abate pollution or to prevent or abate any threat to human health or the environment, including without limitation:

(1) at any location at which, despite remediation in accordance with sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner determines that there is a potential ecological risk he may require that an ecological risk assessment be conducted in accordance with EPA/630/R-92/001, February 1992, "Framework For Ecological Risk Assessment" and that additional remediation be conducted to mitigate any risks identified in such assessment;
(2) at any location at which polluted soil has eroded into a surface-water body, the Commissioner may require that the effect of such polluted soil on aquatic life be assessed and that remediation to protect or restore aquatic life and surface water quality from the effects of such polluted soils be undertaken; or
(3) at any release area or parcel at which there is polluted soil containing multiple polluting substances, the Commissioner may require additional remediation to ensure that the risk posed by such substances does not exceed (A) a cumulative excess lifetime cancer risk of 10^{-5} for carcinogenic substances and (B) a cumulative hazard index of 1 for non-carcinogenic substances with the same target organ.

Section 3. The Regulations of Connecticut State Agencies are amended by adding a new section 22a-133k-3 as follows:

22a-133k-3 Ground-water Remediation Standards

(a) General.

(1) Remediation of a ground-water plume shall result in the attainment of: (A) the requirements concerning surface water protection set forth in subsection (b) of this section and the requirements concerning volatilization set forth in subsection (c) of this section; or (B) the background concentration for ground water for each substance in such plume.

(2) Remediation of a ground-water plume in a GA area shall also result in the reduction of each substance therein to a concentration equal to or less than the background concentration for ground water of such substance, except as provided in subsection (d) of this section.

(3) Remediation of a ground-water plume in a GB area shall also result in the reduction of each substance therein to a concentration such that such ground-water plume does not interfere with any existing use of the ground water.

(b) Surface-water protection criteria.

(1) Except as provided in subdivision (2) of this subsection, remediation of a ground-water plume which discharges to a surface water body shall result in the reduction of each substance therein to a concentration which is consistent with subdivision (2) of subsection (f) of this section and which is equal to or less than the surface-water protection criterion or an alternative surface-water protection criterion established in accordance with subdivision (3) of this subsection.

(2) If a ground-water plume (A) discharges to a wetland or an intermittent stream, or (B) the areal extent of such ground-water plume occupies more than 0.5%, or other percentage which is approved in writing by the Commissioner, of the upstream drainage basin of the stream to which such plume discharges measured from the intersection of stream and such ground-water plume, each substance therein shall be remediated to a concentration equal to or less than the applicable aquatic life criteria contained in Appendix D to the most recent Water Quality Standards, or equal to or less than an alternative water quality criterion adopted by the Commissioner in accordance with section 22a-426 of the General Statutes and paragraph 12b of the Water Quality Standards effective May 15, 1992.

(3) Alternative surface-water protection criteria.

Alternative surface-water criteria may be calculated in accordance with subparagraph (A) of this subdivision or may be approved in writing by the Commissioner in accordance with subparagraph (B) of this subdivision.

(A) An alternative surface-water protection criterion may be calculated for a substance in Appendix D of the most recent Water Quality Standards by multiplying the lower of the human health or aquatic life criterion for such substance in said Appendix D by $[(0.25 \times 7Q10)/Q_{plume}]$ where Q_{plume} is equal to the average daily discharge of polluted ground water from the subject ground-water plume.

(B) The Commissioner may approve an alternative surface-water protection criterion to be applied to a particular substance at a particular release area. Any person requesting such approval shall submit to the Commissioner: (i) a report on the flow rate, under seven day ten year low flow conditions, of the surface water body into which the subject ground water plume discharges (ii) a report on other surface water or ground water discharges to the surface water body within one-half mile upstream of the areal extent of the ground-water plume, (iii) a report on the instream water quality, (iv) a report on the flow rate of the ground-water discharge from such release area to the surface water body and the extent and degree of mixing of such

discharge in such surface water, and (v) and any other information the Commissioner reasonably deems necessary to evaluate such request. The Commissioner shall not approve an alternative surface-water protection criterion under this subparagraph unless the requester demonstrates that such criterion will protect all existing and proposed uses of such surface water.

(c) Volatilization criteria.

(1) Except as specified in subdivisions (2), (3), (4) and (5) of this subsection, all ground water polluted with a volatile organic substance within 15 feet of the ground surface or a building, shall be remediated such that the concentration of each such substance is equal to or less than the applicable residential volatilization criterion for ground water.

(2) If ground water polluted with a volatile organic substance is below a building used solely for industrial or commercial activity, such ground water shall be remediated such that the concentration of such substance is equal to or less than the applicable industrial/commercial volatilization criterion for ground water, provided that an environmental land use restriction is in effect with respect to the parcel or portion thereof upon which such building is located, which restriction ensures that the parcel or portion thereof will not be used for any residential purpose in the future and that any future use of the parcel or portion thereof is limited to industrial or commercial activity;

(3) (A) Remediation of a volatile organic substance to the volatilization criterion for ground water shall not be required if the concentration of such substance in soil vapors below a building is equal to or less than (i) the residential volatilization criterion for soil vapor or (ii) the industrial/commercial volatilization criterion for soil vapor, if such building is solely used for industrial or commercial activity and, an environmental land use restriction is in effect with respect to the parcel or portion thereof upon which such building is located, which restriction ensures that the parcel or portion thereof will not be used for any residential purpose in the future and that any future use of the parcel or portion thereof is limited to industrial or commercial activity.

(B) The requirements of subdivision (1), (2), and (3) of this subsection do not apply if: (i) measures acceptable to the Commissioner have been taken to prevent the migration of such substance into any overlying building, (ii) a program is implemented to maintain and monitor all such measures, and (iii) notice of such measures has been submitted to the Commissioner on a form furnished by him which notice includes (aa) a brief description of the areal extent of the ground-water plume and of the area which exceeds any such volatilization or soil vapor criterion; (bb) a brief description of the method of controlling the migration of such substance into any overlying building; (cc) a plan for the monitoring and maintenance of such control method; and (dd) a map showing all existing buildings, the areal extent of the ground-water plume, and the location of such control method.

(4) Site-specific and alternative volatilization criteria.

(A) Site-specific residential volatilization criteria for ground water or soil vapor may be calculated using the equations in Appendix G to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.

(B) The Commissioner may approve an alternative volatilization criterion for ground water or for soil vapor to be applied to a substance at a particular release area. The Commissioner shall not approve any alternative criterion under this subparagraph unless it has been demonstrated that such criterion will ensure that volatile organic substances from such ground water or soil do not accumulate in the air of any structure used for residential activities at a concentration which, (i) for any carcinogenic substance creates a risk to human health in excess of a 10^{-6} excess lifetime cancer risk level, and for any non-carcinogenic substance does not exceed a hazard index of 1, or (ii) for a ground-water plume polluted with multiple volatile organic substances does not exceed a cumulative excess cancer risk level of 10^{-5} for carcinogenic substances, and for non-carcinogenic substances with the same target organ, the cumulative hazard index does not exceed 1.

(5) Exemption from volatilization criteria.

(A) The volatilization criteria do not apply to ground water polluted with volatile organic substances, where the water table is less than fifteen feet below the ground surface, if no building exists over the ground water polluted with volatile organic substances at a concentration above the applicable volatilization criteria, and (i) it has been documented that best efforts have been made to ensure that each owner of any parcel of land or portion thereof overlying such polluted ground water records an environmental land use restriction which ensures that no building is constructed over such polluted ground water; or (ii) the Commissioner has approved in writing a request demonstrating that no building can reasonably be expected to be constructed over the subject ground water or that natural attenuation or other methods of remediation will, within five years, reduce the concentration of volatile organic substances in such ground water to a concentration equal to or less than the applicable volatilization criteria.

(B) The volatilization criteria for ground water underlying an existing building do not apply to ground water polluted with volatile organic substances where the Commissioner has approved in writing and there have been implemented an indoor air monitoring program and measures to control the level of any such volatile organic substances in the air of the subject building.

(i) Any person seeking the Commissioner's approval of an indoor air monitoring program shall submit to him: a detailed written plan describing the proposed indoor air monitoring program, including but not limited to a description of the distribution and concentration of volatile organic compounds beneath the building, the location of proposed monitoring points, the proposed frequency of monitoring, the parameters to be monitored, and a description of proposed actions to be taken in the event such monitoring indicates that the monitored parameters exceed proposed specified concentrations and a proposed schedule for reporting to the Commissioner on the results of such monitoring for as long as monitoring is conducted at the site.

(ii) In approving any indoor air monitoring program pursuant to this subdivision, the Commissioner may impose any additional conditions he deems necessary to ensure that the program adequately protects human health. In the event that the Commissioner approves an indoor air monitoring program pursuant to this subparagraph, any person implementing such program shall perform all actions specified in the approved plan, and any additional measures specified by the Commissioner in his approval of such plan.

(d) Applicability of Ground-water Protection Criteria.

(1) Ground water in a GA area may be remediated to a concentration for each substance therein equal to or less than the ground-water protection criterion for each such substance if, with respect to the subject ground-water plume: (A) the background concentration for ground water is equal to or less than such ground-water protection criterion; (B) a public water supply distribution system is available within 200 feet of the subject parcel, parcels adjacent thereto, and any parcel within the areal extent of such plume; (C) such ground-water plume is not located in an aquifer protection area; and (D) such ground-water plume is not located within the area of influence of any public water supply well.

(2) If prior to any ground-water remediation the maximum concentration of a substance in a ground-water plume in a GA area is equal to or less than the ground-water protection criteria, remediation of ground water to achieve background ground-water concentration is not required, provided that the extent of the ground-water plume is not increasing over time and, except for seasonal variations, the concentration of the subject substance in such ground-water plume is not increasing at any point over time.

(3) Any ground water in a GB area and which is used for drinking or other domestic purposes shall be remediated to reduce the concentration of each substance therein to a concentration equal to or less than the applicable ground-water protection criterion until such time as the use of such ground water for

drinking or other domestic purposes is permanently discontinued.

(e) Technical Impracticability of Ground-water Remediation.

(1) Exemption from Background Due to Technical Impracticability

If remediation of a ground-water plume in a GA area to achieve compliance with subdivision (2) of subsection (a) of this section has reduced the concentration of a polluting substance to less than the ground-water protection criterion, and if further reduction of such concentration is technically impracticable, no further remediation of such ground-water plume for such substance shall be required.

(2) Variance Due to Technical Impracticability of Ground-water Remediation

The Commissioner may grant a variance from any of the requirements of this section if he finds that: non-aqueous phase liquids that cannot be contained or removed in accordance with R.C.S.A. section 22a-133k-2(g) are present; remediation to the extent technically practicable has reduced the concentration of pollutants in ground water to steady-state concentrations that exceed any applicable criteria; or achieving compliance with the applicable criteria is technically impracticable as determined using Directive No. 9234.2-25 issued September 1993 by the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response.

(A) Any person requesting a variance pursuant to this subsection from any ground-water protection criterion shall submit: (i) information concerning the concentration of each substance in the ground-water plume with respect to which a variance is sought; (ii) information demonstrating that (aa) the extent of the ground-water plume which exceeds such ground-water protection criterion has been reduced to the extent technically practicable, or (bb) it is not technically practicable to reduce the extent of the ground-water plume; (iii) the results of a study conducted to determine the risks to human health posed by the polluted ground water remaining after such reduction; (iv) if such study shows a risk or a potential risk to human health, a plan to eliminate such risk or potential risk; (v) an application to change the ground-water classification of such polluted ground water to GB in accordance with section 22a-426 of the General Statutes; and (vi) any other information the Commissioner reasonably deems necessary to evaluate such request.

(B) Any person requesting a variance pursuant to this subsection from the requirement to remediate ground water to a concentration which does not exceed the applicable surface-water protection criteria shall submit information concerning the concentration of each substance in the ground-water plume with respect to which a variance is sought. If such information demonstrates that any such concentration exceeds any applicable surface-water protection criterion, such person shall also submit: (i) a map showing the areal extent of the ground-water plume that exceeds such surface-water protection criterion, and (ii) a plan for controlling the migration of such substance to the receiving surface water body.

(C) If the Commissioner grants a variance pursuant to this subsection from any ground-water protection criterion, the person receiving the variance shall, no later than thirty days after the date of granting of such variance, submit to the Commissioner on a form prescribed and provided by him: (i) certification that written notice of the extent and degree of such pollution has been provided to each owner of property overlying the subject ground-water plume at which it is not technically practicable to remediate a substance to a concentration equal to or less than the ground-water protection criterion; (ii) certification that written notice of the presence of pollution on each such parcel and a description of the extent and degree of such pollution has been sent to the Director of Health of the municipality or municipalities in which the ground-water plume is located; and (iii) certification that best efforts have been made to ensure that each owner of property overlying the subject ground-water plume records an environmental land use restriction which ensures that the subject ground-water plume is not used for drinking or other domestic purposes;

(D) If the Commissioner grants a variance pursuant to this subsection from the requirement to remediate ground water to a concentration which does not exceed the applicable surface-water

protection criteria, the person receiving the variance shall perform all actions specified in the plan submitted with the request for such variance, and any additional actions required by the Commissioner in his approval of such plan or granting of such variance.

(f) Applying the Criteria for Ground Water

(1) Compliance with the ground-water protection criterion for a substance in ground water or background concentration for ground water for such substance is achieved when the sampling locations are representative of the subject ground-water plume and (A) the analytical results for such substance at such all sampling locations are equal to or less than either the ground-water protection criterion for such substance or the background concentration for ground water therefor, whichever is applicable, for at least four consecutive quarterly sampling periods, or (B) a representative sampling program consisting of not less than twelve consecutive monthly samples from each such sampling location has been used to characterize the ground-water plume and the ninety-five percent upper confidence level of the arithmetic mean of all results of laboratory analyses of such samples for such substance are equal to or less than the criterion for such substance and that no single sample exceeds two times the applicable criterion for such substance.

(2) Compliance with a surface-water protection criterion for a substance in ground water is achieved when the sampling locations are representative of the subject ground-water plume and(A) the average concentration of such substance in such plume is equal to or less than the applicable surface-water protection criterion for at least four consecutive quarterly sampling periods, or (B) the concentration of such substance in that portion of such plume which is immediately upgradient of the point at which such ground-water discharges to the receiving surface-water body is equal to or less than the applicable surface-water protection criterion, provided that the areal extent of such ground-water plume is not increasing over time and that, except for seasonal variations, the concentration of the subject substance in such ground-water plume is not increasing, except as a result of natural attenuation, at any point over time.

(3) Compliance with a volatilization criterion for a substance in ground water or soil vapor is achieved when the sampling locations are representative of the subject ground-water plume or soil vapor and (A) the ninety-five percent upper confidence level of the arithmetic mean of all sample results from such locations is equal to or less than the applicable volatilization criterion for at least four consecutive quarterly sampling periods and that the result of no single sample exceeds two times the applicable volatilization criterion, or (B) the results of all laboratory analyses of samples for such substance are equal to or less than the volatilization criterion therefor.

(4) Matrix interference effects.

If any applicable criterion for a substance in ground water is less than the concentration for such substance that can be consistently and accurately quantified in a specific sample due to matrix interference effects, the following action shall be taken:

(A) (i)"Test Methods for Evaluating Solid Waste : Physical/Chemical Methods," SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460 shall be consulted to determine if an analytical method sufficiently sensitive to achieve the applicable analytical detection limit was used to conduct the analysis of the subject substance. If there is available an alternative analytical method which is sufficient to achieve the required analytical detection limit, appropriate for the sample matrix, and has been approved by EPA or approved in writing by the Commissioner, the subject ground water shall be re-analyzed for the subject substance using such alternative method.

(ii) If a sample has been analyzed by one or more analytical methods in accordance with subparagraph (A)(i) of this subdivision and the applicable analytical detection limit has not been achieved due to matrix interference effects, such method(s) shall be modified in order to compensate for such interferences, in accordance with analytical procedures specified by EPA within the scope of the analytical method.

(B) If, after re-analyzing the subject ground water and attempting to compensate for matrix interference effects in accordance with subparagraph (A) of this subdivision, any applicable criterion for a substance in ground water is less than the concentration for such substance that can be consistently and accurately quantified in a specific sample due to matrix interference effects, compliance with such criterion shall be achieved when such ground water has been remediated to the lowest concentration for such substance which can be consistently and accurately quantified without matrix interference effects.

(C) A detailed summary of all measures taken to overcome matrix interference effects and a determination of the lowest alternative quantification level applicable to the analysis of such substance shall be prepared and, if requested by the Commissioner in writing, shall be submitted to the Commissioner for his review and approval.

(g) Ground-water Monitoring.

For any remediation which is conducted to achieve compliance with sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, ground-water monitoring shall be conducted in accordance with this subsection.

(1) Ground-water Monitoring at GA Areas.

With respect to remediation of a release area or a ground-water plume in a GA area, a ground-water monitoring plan shall be prepared and implemented. Ground-water monitoring under such plan shall be designed to determine:

(A) the effectiveness of soil remediation in preventing the pollution of ground water by substances from the release area;

(B) the effectiveness of any remediation taken to eliminate or minimize health or safety risks identified in any risk assessment conducted in accordance with subdivision (2) of subsection (e) of this section or otherwise identified; and

(C) whether applicable requirements identified in subsection (a) of this section have been met.

(2) Ground-water Monitoring at GB Areas.

With respect to remediation of a release area or a ground-water plume in a GB area, a ground-water monitoring plan shall be prepared and implemented. Ground-water monitoring under such plan shall be designed to determine:

(A) the effectiveness of soil remediation in preventing further pollution of ground water by substances from the release area;

(B) the effectiveness of any remediation taken to eliminate or minimize identified health or safety risks associated with such release;

(C) whether applicable ground-water protection criteria, surface-water protection criteria, and volatilization criteria have been met; and

(D) whether the ground-water plume interferes with any existing use of the ground water for a drinking water supply or with any other existing use of the ground water, including but not limited to industrial, agricultural or commercial purposes.

(3) Discontinuation of Ground-water Monitoring.

(A) Unless otherwise specified in writing by the Commissioner, ground-water monitoring in a GA area may be discontinued in accordance with the following:

(i) a minimum of one year after compliance with the background concentration for ground water has been achieved in accordance with subsection (f) of this section if the background concentration for ground water of all substances in the subject ground-water plume has been maintained in all sampling events and ground-water monitoring data demonstrate that the soil remediation was effective in preventing the pollution of

ground water by any substance from the subject release area; or

(ii) a minimum of three years after compliance with the ground-water protection criteria has been achieved in accordance with subsection (f) of this section if (aa) all applicable ground-water protection criteria for all subject substances or the background concentration for ground water for all substances in the subject ground-water plume, which ever is higher, is maintained in all sampling events; (bb) ground-water monitoring data demonstrate that the soil remediation was effective in preventing the pollution of ground water by substances from the subject release area; and (cc) the volatilization and surface-water protection criteria have been met in accordance with subsection (f) of this section.

(B) Unless otherwise specified in writing by the Commissioner, ground-water monitoring in a GB area may be discontinued two years after the cessation of all remediation of such ground water or soil if the applicable surface-water protection and volatilization criteria have been met in accordance with subsection (f) of this section, and such ground water is suitable for all existing uses.

(h) Additional Polluting Substances

(1) With respect to a substance in ground water for which a ground- water protection criterion is not specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve in writing a ground-water protection criterion to apply to such substance. Any person requesting approval of a ground-water protection criterion for such substance shall submit to the commissioner (A) a risk-based ground-water protection criterion for such substance calculated in accordance with subdivision (2) of this subsection, (B) the analytical detection limit for such substance, (C) a description of the organoleptic properties of such substance. Before approving a ground-water protection criterion the Commissioner shall consider the proposed risk-based ground-water protection criterion for such substance, the analytical detection limit for such substance, the organoleptic effects of such substance, any information about the health effects such substance may cause due to exposure pathways not accounted for in the proposed risk-based ground-water protection criterion, and any other information that the Commissioner reasonably deems necessary.

(2) The risk-based ground-water protection criterion shall be calculated using the following equations:

(A) For carcinogenic substances:

$$GWPC = \left[\frac{Risk}{CSF}\right] \times \left[\frac{BW \times AT}{IR \times EF \times ED \times CF}\right]$$

(B) For non-carcinogenic substances:

$$GWPC = \left[Rfd \times HI \right]^{x} \left[\frac{BW \times AT}{IR \times EF \times ED \times CF \times SA} \right]$$

(C) The abbreviations used in subparagraphs (A) and (B) of this subdivision shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

Term	Description	Units	Value
$GWPC_{RB}$	Risk-based Ground-water protection Criterion	ug/l	calculated
Risk	Target Cancer Risk Level	unitless	1.0E-06
HI	Hazard Index	unitless	1.0
CSF	Cancer slope Factor	$(mg/kg\text{-}day)^{-1}$	substance-specific
RFD	Reference Dose	mg/kg-day	substance-specific
IR	Ingestion Rate	l/day	2
EF	Exposure Frequency	days/year	365
ED	Exposure Duration	years	70
CF	Conversion Factor	unitless	1000
BW	Body Weight	kg	70
AT	Averaging Time,	days	25550
SA	Source Allocation	unitless	0.2

(i) Additional Remediation of Ground Water.

Nothing in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies shall preclude the Commissioner from taking any action necessary to prevent or abate pollution, or to prevent or abate any threat to human health or the environment. If the presence of any substance impairs the aesthetic quality of any ground water which is or can reasonably be expected to be a source of water for drinking or other domestic use, additional remediation shall be conducted in order to reduce the concentration of such substance to a concentration appropriate for such use.

Appendix A to
Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies
Direct Exposure Criteria for Soil

Substance	Residential Criteria in mg/kg (ppm)	Industrial/ Commercial Criteria in mg/kg (ppm)
Volatile Organic Substances		
Acetone	500	1000
Acrylonitrile	1.1	11
Benzene	21	200
Bromoform	78	720
2-Butanone(MEK)	500	1000
Carbon tetrachloride	4.7	44
Chlorobenzene	500	1000
Chloroform	100	940
Dibromochloromethane	7.3	68
1,2-Dichlorobenzene	500	1000
1,3-Dichlorobenzene	500	1000
1,4-Dichlorobenzene	26	240
1,1-Dichloroethane	500	1000
1,2-Dichloroethane	6.7	63
1,1-Dichloroethylene	1	9.5
cis-1,2-Dichloroethylene	500	1000
trans-1,2-Dichloroethylene	500	1000
1,2-Dichloropropane	9	84
1,3-Dichloropropene	3.4	32
Ethylbenzene	500	1000

Substance	Residential Criteria in mg/kg (ppm)	Industrial/ Commercial Criteria in mg/kg (ppm)
Ethylene dibromide (EDB)	0.007	0.067
Methyl-tert-butyl-ether	500	1000
Methyl isobutyl ketone	500	1000
Methylene chloride	82	760
Styrene	500	1000
1,1,1,2-Tetrachloroethane	24	220
1,1,2,2-Tetrachloroethane	3.1	29
Tetrachloroethylene	12	110
Toluene	500	1000
1,1,1-Trichloroethane	500	1000
1,1,2-Trichloroethane	11	100
Trichloroethylene	56	520
Vinyl chloride	0.32	3
Xylenes	500	1000
Semivolatile Substances		
Acenaphthylene	1000	2500
Anthracene	1000	2500
Benzo(a)anthracene	1	7.8
Benzo(b)fluoranthene	1	7.8
Benzo(k)fluoranthene	8.4	78
Benzo(a)pyrene	1	1

Substance	Residential Criteria in mg/kg (ppm)	Industrial/ Commercial Criteria in mg/kg (ppm)
Bis(2-chloroethyl)ether	1	5.2
Bis(2-chloroisopropyl) ether	8.8	82
Bis(2-ethyl hexyl) phthalate	44	410
Butyl benzl phthalate	1000	2500
2-chlorophenol	340	2500
Di-n-butyl phthalate	1000	2500
Di-n-octyl phthalate	1000	2500
2,4-Dichlorophenol	200	2500
Fluoranthene	1000	2500
Fluorene	1000	2500
Hexachloroethane	44	410
Hexachlorobenzene	1	3.6
Naphthalene	1000	2500
Pentachlorophenol	5.1	48
Phenanthrene	1000	2500
Phenol	1000	2500
Pyrene	1000	2500
Inorganic Substances		
Antimony	27	8200
Arsenic	10	10
Barium	4700	140000

Substance	Residential Criteria in mg/kg (ppm)	Industrial/ Commercial in mg/kg (ppm)
Beryllium	2	2
Cadmium	34	1000
Chromium, trivalent	3900	51000
Chromium, hexavalent	100	100
Copper	2500	76000
Cyanide	1400	41000
Lead	500	1000
Mercury	20	610
Nickel	1400	7500
Selenium	340	10000
Silver	340	10000
Thallium	5.4	160
Vanadium	470	14000
Zinc	20000	610000
Pesticides, PCB's, and Total Petroleum Hydrocarbons (TPH)		
Alachlor	7.7	72
Aldicarb	14	410
Atrazine	2.8	26
Chlordane	0.49	2.2
Dieldrin	0.038	0.36
Endrin	20	610
2-4 D	680	20000

Substance	Residential Criteria in mg/kg (ppm)	Industrial/ Commercial in mg/kg (ppm)
Heptachlor epoxide	0.067	0.63
Heptachlor	0.14	1.3
Lindane	20	610
Methoxychlor	340	10000
Toxaphene	0.56	5.2
PCB's	1	10
TPH	500	2500

Appendix B to
Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies
Pollutant Mobility Criteria for Soil

Substance	GA, GAA Mobility Criteria in mg/kg (ppm)	GB Mobility Criteria in mg/kg (ppm)
Volatile Organic Substances		
Acetone	14	140
Acrylonitrile	0.01	0.1
Benzene	0.02	0.2
Bromoform	0.08	0.8
2-Butanone(MEK)	8	80
Carbon tetrachloride	0.1	1
Chlorobenzene	2	20
Chloroform	0.12	1.2
Dibromochloromethane	0.01	0.1
1,2-Dichlorobenzene	3.1	3.1
1,3-Dichlorobenzene	12	120
1,4-Dichlorobenzene	1.5	15
1,1-Dichloroethane	1.4	14
1,2-Dichloroethane	0.02	0.2
1,1-Dichloroethylene	0.14	1.4
cis-1,2-Dichloroethylene	1.4	14
trans-1,2-Dichloroethylene	2	20
1,2-Dichloropropane	0.1	1.0
1,3-Dichloropropene	0.01	0.1
Ethyl benzene	10.1	10.1
Ethylene dibromide (EDB)	0.01	0.1
Methyl-tert-butyl-ether	2	20
Methyl isobutyl ketone	7	14
Methylene chloride	0.1	1.0
Styrene	2	20
1,1,1,2-Tetrachloroethane	0.02	0.2

Substance	GA, GAA Mobility Criteria in mg/kg (ppm)	GB Mobility Criteria in mg/kg (ppm)
1,1,2,2-Tetrachloroethane	0.01	0.1
Tetrachloroethylene	0.1	1
Toluene	20	67
1,1,1-Trichloroethane	4	40
1,1,2-Trichloroethane	0.1	1
Trichloroethylene	0.1	1.0
Vinyl chloride	0.04	0.40
Xylenes	19.5	19.5
Semivolatile Substances		
Acenaphthylene	8.4	84
Anthracene	40	400
Benzo(a)anthracene	1	1
Benzo(b)fluoranthene	1	1
Benzo(k)fluoranthene	1	1
Benzo(a)pyrene	1	1
Bis(2-chloroethyl)ether	1	2.4
Bis(2-chloroisopropyl)ether	1	2.4
Bis(2-ethyl hexyl)phthalate	1	11
Butyl benzl phthalate	20	200
2-chlorophenol	1	7.2
Di-n-butyl phthalate	14	140
Di-n-octyl phthalate	2	20
2,4-Dichlorophenol	1	4
Fluoranthene	5.6	56
Fluorene	5.6	56
Hexachloroethane	1	1
Hexachlorobenzene	1	1
Naphthalene	5.6	56
Pentachlorophenol	1	1
Phenanthrene	4	40
Phenol	80	800
Pyrene	4	40

Substance	GA, GAA Mobility Criteria in mg/kg (ppm)	GB Mobility Criteria in mg/kg (ppm)
Pesticides and TPH		
Alachlor	0.230	0.4
Aldicarb	1	1
Atrazine	0.2	0.2
Chlordane	0.066	0.066
Dieldrin	0.007	0.007
2-4 D	1.4	14
Heptachlor epoxide	0.02	0.02
Heptachlor	0.013	0.013
Lindane	0.02	0.04
Methoxychlor	0.8	8
Simazine	0.8	8
Toxaphene	0.33	0.6
Total Petroleum Hydrocarbon By EPA Method 418.1 or another EPA-approved method acceptable to the Commissioner	500	2500
Inorganic Substances and PCB	**GA, GAA Mobility Criteria By TCLP or by SPLP in mg/l (ppm)**	**GB Mobility Criteria By TCLP or by SPLP in mg/l (ppm)**
Antimony	0.006	0.06
Arsenic	0.05	0.5
Barium	1	10.0
Beryllium	0.004	0.04
Cadmium	0.005	0.05
Chromium, total	0.05	0.5
Copper	1.3	13
Cyanide (by SPLP only)	0.2	2
Lead	0.015	0.15
Mercury	0.002	0.02
Nickel	0.1	1.0
Selenium	0.05	0.5

Substance	GA, GAA Mobility Criteria By TCLP or by SPLP in mg/l (ppm)	GB Mobility Criteria By TCLP or by SPLP in mg/l (ppm)
Silver	0.036	0.36
Thallium	0.005	0.05
Vanadium	0.05	0.50
Zinc	5	50
PCB	0.0005	0.005

Appendix C to
Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies
Ground-Water Protection Criteria for GA and GAA Areas

Substance	Ground-water Protection Criteria in ug/l (ppb)
Volatile Organic Substances	
Acetone	700
Acrylonitrile	0.5
Benzene	1
Bromoform	4
2-Butanone(MEK)	400
Carbon tetrachloride	5
Chlorobenzene	100
Chloroform	6
Dibromochloromethane	0.5
1,2-Dichlorobenzene	600
1,3-Dichlorobenzene	600
1,4-Dichlorobenzene	75
1,1-Dichloroethane	70
1,2-Dichloroethane	1
1,1-Dichloroethylene	7
cis-1,2-Dichloroethylene	70
trans-1,2-Dichloroethylene	100
1,2-Dichloropropane	5
1,3-Dichloropropene	0.5
Ethyl benzene	700
Ethylene dibromide (EDB)	0.05
Methyl-tert-butyl-ether	100
Methyl isobutyl ketone	350
Methylene chloride	5
Styrene	100
1,1,1,2-Tetrachloroethane	1
1,1,2,2-Tetrachloroethane	0.5
Tetrachloroethylene	5

Substance	Ground-water Protection Criteria in ug/l (ppb)
Toluene	1000
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	5
Trichloroethylene	5
Vinyl chloride	2
Xylenes	530
Semivolatile Substances	
Acenaphthylene	420
Anthracene	2000
Benzo(a)anthracene	0.06
Benzo(b)fluoranthene	0.08
Benzo(k)fluoranthene	0.5
Benzo(a)pyrene	0.2
Bis(2-chloroethyl)ether	12
Bis(2-chloroisopropyl)ether	12
Bis(2-ethyl hexyl)phthalate	2
Butyl benzl phthalate	1000
2-chlorophenol	36
Di-n-butyl phthalate	700
Di-n-octyl phthalate	100
2,4-Dichlorophenol	20
Fluoranthene	280
Fluorene	280
Hexachloroethane	3
Hexachlorobenzene	1
Naphthalene	280
Pentachlorophenol	1
Phenanthrene	200
Phenol	4000
Pyrene	200

Substance	Ground-water Protection Criteria in ug/l (ppb)
Inorganic Substances	
Antimony	6
Arsenic	50
Asbestos in mfl	7 (mfl)
Barium	1000
Beryllium	4
Cadmium	5
Chromium (total)	50
Copper	1300
Cyanide	200
Lead	15
Mercury	2
Nickel	100
Selenium	50
Silver	36
Thallium	5
Vanadium	50
Zinc	5000
Pesticides, PCB and Total Petroleum Hydrocarbons	
Alachlor	2
Aldicarb	3
Atrazine	3
Chlordane	0.3
Dieldrin	0.002
2-4 D	70
Heptachlor epoxide	0.2
Heptachlor	0.4
Lindane	0.2
Methoxychlor	40
Simazine	4
Toxaphene	3

Substance	Ground-water Protection Criteria in ug/l (ppb)
PCB's	0.5
Total Petroleum Hydrocarbon By EPA Method 418.1 or another EPA-approved method acceptable to the Commissioner	500

Appendix D to
Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies
Surface-water Protection Criteria
for Substances in Ground Water

Substance	Surface-Water Protection Criteria in ug/l (ppb)
Volatile Organic Substances	
Acrylonitrile	20
Benzene	710
Bromoform	10800
Carbon tetrachloride	132
Chlorobenzene	420000
Chloroform	14100
Dibromochloromethane	1020
1,2-Dichlorobenzene	170000
1,3-Dichlorobenzene	26000
1,4-Dichlorobenzene	26000
1,2-Dichloroethane	2970
1,1-Dichloroethylene	96
1,3-Dichloropropene	34000
Ethylbenzene	580000
Methylene chloride	48000
1,1,2,2-Tetrachloroethane	110
Tetrachloroethylene	88
Toluene	4000000
1,1,1-Trichloroethane	62000
1,1,2-Trichloroethane	1260
Trichloroethylene	2340
Vinyl chloride	15750
Semivolatile Substances	
Acenaphthylene	0.3
Anthracene	1100000
Benzo(a)anthracene	0.3
Benzo(b)fluoranthene	0.3
Benzo(k)fluoranthene	0.3

Substance	Surface-Water Protection Criteria in ug/l (ppb)
Benzo(a)pyrene	0.3
Bis(2-chloroethyl) ether	42
Bis(2-chloroisopropyl) ether	3400000
Bis(2-ethyl hexyl)phthalate	59
Di-n-butyl phthalate	120000
2,4-Dichlorophenol	15800
Fluoranthene	3700
Fluorene	140000
Hexachloroethane	89
Hexachlorobenzene	0.077
Phenanthrene	0.077
Phenol	92000000
Pyrene	110000
Inorganic Substances	
Antimony	86000
Arsenic	4
Asbestos (in mfl)	7 mfl
Beryllium	4
Cadmium	6
Chromium, trivalent	1200
Chromium, hexavalent	110
Copper	48
Cyanide	52
Lead	13
Mercury	0.4
Nickel	880
Selenium	50
Silver	12
Thallium	63
Zinc	123

Substance	Surface-Water Protection Criteria in ug/l (ppb)
Pesticides and PCB	
Chlordane	0.3
Dieldrin	0.1
Endrin	0.1
Heptachlor epoxide	0.05
Heptachlor	0.05
Toxaphene	1
PCB's	0.5

Appendix E to
Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies
Volatilization Criteria for Ground Water

Volatile Substance	Residential Volatilization Criteria for Ground water in parts per billion	Industrial/Commercial Volatilization Criteria for Ground water in parts per billion
Acetone	50000	50000
Benzene	215	530
Bromoform	920	3800
2-Butanone (MEK)	50000	50000
Carbon Tetrachloride	16	40
Chlorobenzene	1800	6150
Chloroform	287	710
1,2-Dichlorobenzene	30500	50000
1,3-Dichlorobenzene	24200	50000
1,4-Dichlorobenzene	50000	50000
1,1-Dichloroethane	34600	50000
1,2-Dichloroethane	21	90
1,1-Dichloroethylene	1	6
1,2-Dichloropropane	14	60
1,3-Dichloropropene	6	25
Ethyl benzene	50000	50000
Ethylene dibromide (EDB)	4	16
Methyl-tert-butyl-ether	50000	50000
Methyl isobutyl ketone	50000	50000
Methylene chloride	50000	50000
Styrene	580	2065
1,1,1,2-Tetrachloroethane	12	50
1,1,2,2-Tetrachloroethane	23	100
Tetrachloroethylene	1500	3820
Toluene	23500	50000
1,1,1-Trichloroethane	20400	50000
1,1,2-Trichloroethane	8000	19600
Trichloroethylene	219	540

Volatile Substance	Residential Volatilization Criteria for Ground water in parts per billion	Industrial/Commercial Volatilization Criteria for Ground water in parts per billion
Vinyl chloride	2	2
Xylenes	21300	50000

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Appendix F to
Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies
Volatilization Criteria for Soil Vapor

Volatile Substance	Residential Volatilization Criteria for Soil Vapor in parts per million	Industrial/Commercial Volatilization Criteria for Soil Vapor in parts per million
Acetone	2400	8250
Benzene	1	113
Bromoform	1.5	6
2-Butanone (MEK)	2400	8285
Carbon Tetrachloride	1	2.7
Chlorobenzene	31	106
Chloroform	4.5	10.4
1,2-Dichlorobenzene	240	818
1,3-Dichlorobenzene	240	818
1,4-Dichlorobenzene	950	3270
1,1-Dichloroethane	850	3037
1,2-Dichloroethane	1	1
1,1-Dichloroethylene	1	1
1,2-Dichloropropane	1	1
1,3-Dichloropropene	1	1
Ethyl benzene	1650	5672
Ethylene dibromide (EDB)	1	1
Methyl-tert-butyl-ether	1000	3415
Methyl isobutyl ketone	140	480
Methylene chloride	1200	2907
Styrene	8	28
1,1,1,2-Tetrachloroethane	1	1.5
1,1,2,2- Tetrachloroethane	1	1
Tetrachloroethylene	11	27
Toluene	760	2615

Volatile Substance	Residential Volatilization Criteria for Soil Vapor in parts per million	Industrial/Commercial Volatilization Criteria for Soil Vapor in parts per million
1,1,1-Trichloroethane	1310	4520
1,1,2-Trichloroethane	40	93
Trichloroethylene	7	16
Vinyl chloride	1	1
Xylenes	500	1702

Appendix G to
Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies
Equations, Terms and Values for Calculating Site-specific Volatilization Criteria
for Ground Water and Soil Vapor

Volatilization Criteria for Ground Water

Site-Specific Volatilization Criteria for Ground Water may be calculated using the following equations:

$$GWC = TAC / (1000 \cdot VF_{GW})$$

$$VF_{GW} = \frac{H\,[(D_{EFF\ WS}/L_{GW})/(ER \cdot L_B)] \cdot 1000}{1+[(D_{EFF\text{-}WS}/L_{GW})/(ER \cdot L_B)] + [(D_{EFF\text{-}WS}/L_{GW})/((D_{EFF\text{-}CRACK}/L_{CRACK})\cdot\eta)]}$$

$$D_{EFF\ WS} = (h_{cap} + h_v) / [(h_{cap} / D_{EFF\text{-}CAP}) + (h_v / D_{EFF\text{-}S})]$$

$$D_{EFF\text{-}CAP} = D_{AIR} \cdot (\bullet_{ACAP}{}^{3.33}/\theta_T{}^2) + D_{WATER}/H \cdot (\theta_{WCAP}{}^{3.33}/\theta_T{}^2)$$

$$D_{EFF\text{-}S} = D_{AIR} \cdot (\theta_{AS}{}^{3.33}/\theta_T{}^2) + D_{WATER}/H \cdot (\theta_{WS}{}^{3.33}/\theta_T{}^2)$$

$$D_{EFF\text{-}CRACK} = D_{AIR} \cdot (\theta_{ACRACK}{}^{3.33}/\theta_T{}^2) + D_{WATER}/H \cdot (\theta_{WCRACK}{}^{3.33}/\theta_T{}^2)$$

Where:

Term	Description	Units	Value
GWC	Ground Water Volatilization Criteria	ug/kg	calculated
TAC	Target Indoor Air Concentration	ug/m^3	**
VF_{GW}	Ground Water Volatilization Factor	mg/m^3	calculated
H	Henry's Law Constant	unitless	substance-specific
$D_{EFF\ WS}$	Effective Diffusion-Ground Water to Soil Surface	cm^2/s	calculated
L_{GW}	Depth to Ground Water (= $h_{CAP} + h_V$)	cm	site-specific
h_{CAP}	Thickness of Capillary Fringe	cm	site-specific
h_V	Thickness of Vadose Zone	cm	site-specific
ER_R	Residential Enclosed Space Air Exchange Rate	1/s	.00014
ER_I	Industrial Enclosed Space Air Exchange Rate	1/s	.00023

Term	Description	Units	Value
L_{BR}	Residential Enclosed Space Volume/Infiltration Area Ratio	cm	site-specific
L_{BI}	Industrial Enclosed Space Volume/Infiltration Area Ratio	cm	site-specific
$D_{EFF-CRACK}$	Effective Diffusion through Foundation Cracks	cm^2/s	calculated
L_{CRACK}	Enclosed Space Foundation or Wall Thickness	cm	site-specific
η	Areal Fraction of Cracks in Foundations / Walls	unitless	.01
$D_{EFF-CAP}$	Effective Diffusion through Capillary Fringe	cm^2/s	calculated
D_{EFF-S}	Effective Diffusion through Soil (In Vapor Phase)	cm^2/s	calculated
D_{AIR}	Diffusion Coefficient in Air	cm^2/s	8.40E-02 or chemical specific
D_{WATER}	Diffusion Coefficient in Water	cm^2/s	1.00E-05 or chemical specific
θ_{ACAP}	Volumetric Air Content in Capillary Fringe	unitless	site-specific
θ_{AS}	Volumetric Air Content in Vadose Zone	unitless	site-specific
θ_{ACRACK}	Volumetric Air Content in Foundation/Wall Cracks	unitless	site-specific
θ_{WCAP}	Volumetric Water Content in Capillary Fringe	unitless	site-specific
θ_{WS}	Volumetric Water Content in Vadose Zone	unitless	site-specific
θ_{WCRACK}	Volumetric Water Content in Foundation/Wall Cracks	unitless	site-specific
θ_T	Total Soil Porosity	unitless	site-specific

**See attached "Table of Target Air Concentrations"

Volatilization Criteria for Soil Vapor

Site-Specific Volatilization Criteria for Soil Vapor may be calculated using the following equations:

$$SSVC = TAC / (1000 \cdot VF_{SSV})$$

$$VF_{SSV} = \frac{[(D_{EFF\,S}/L_S)/(ER \cdot L_B)]}{1+[(D_{EFF\text{-}S}/L_S)/(ER \cdot L_B)] + [(D_{EFF\text{-}S}/L_S)/(D_{EFF\text{-}CRACK}/L_{CRACK})\cdot\eta]}$$

$$D_{EFF\text{-}S} = D_{AIR} \cdot (\theta_{AS}^{3.33}/\theta_T^2) + D_{WATER}/H \cdot (\theta_{WS}^{3.33}/\theta_T^2)$$

$$D_{EFF\text{-}CRACK} = D_{AIR} \cdot (\theta_{ACRACK}^{3.33}/\theta_T^2) + D_{WATER}/H \cdot (\theta_{WCRACK}^{3.33}/\theta_T^2)$$

Where:

Terms	Description	Units	Value
SSVC	Volatilization Criteria for Soil Vapor	mg/m^3-air	calculated
TAC	Target Indoor Air Concentration	ug/m^3-air	**
VF_{SSV}	Volatilization Factor for Subsurface Vapors	unitless	calculated
H	Henry's Law Constant	unitless	substance-specific
$D_{EFF\,S}$	Effective Diffusion through Soil (in Vapor Phase)	cm^2/s	calculated
L_S	Depth to Soil Vapor Sample	cm	site-specific
ER_R	Residential Enclosed Space Air Exchange Rate	1/s	.00014
ER_I	Industrial Enclosed Space Air Exchange Rate	1/s	.00023
$L_{B\,R}$	Residential Enclosed Space Volume/Infiltration Area Ratio	cm	site-specific
$L_{B\,I}$	Industrial Enclosed Space Volume/Infiltration Area Ratio	cm	site-specific
$D_{EFF\text{-}CRACK}$	Effective Diffusion through Foundation Cracks	cm^2/s	calculated
L_{CRACK}	Enclosed Space Foundation or Wall Thickness	cm	site-specific
η	Areal Fraction of Cracks in Foundations / Walls	unitless	calculated
θ_{AS}	Volumetric Air Content in Vadose Zone	unitless	site-specific
θ_{ACRACK}	Volumetric Air Content in Foundation/Wall Cracks	unitless	site-specific
θ_{WS}	Volumetric Water Content in Vadose Zone	unitless	site-specific
θ_{WCRACK}	Volumetric Water Content in Foundation/Wall Cracks	unitless	site-specific
θ_T	Total Soil Porosity	unitless	site-specific

** See attached "Table of Target Air Concentrations"

Table of Target Air Concentrations

Volatile Substance	Residential Target Indoor Air Concentration in micrograms per cubic meter	Industrial/Commercial Target Indoor Air Concentration in micrograms per cubic meter
Acetone	8.34 E02	1.17 E03
Benzene	3.25 E00	2.15 E01
Bromoform	2.21 E00	3.72 E00
2-Butanone (MEK)	1.04 E03	1.46 E03
Carbon Tetrachloride	1.00 E00	1.00 E00
Chlorobenzene	2.09 E01	2.92 E01
Chloroform	3.00 E00	3.00 E00
1,2-Dichlorobenzene	2.09 E02	2.92 E02
1,3-Dichlorobenzene	2.09 E02	2.92 E02
1,4-Dichlorobenzene	8.34 E02	1.17 E03
1,1-Dichloroethane	5.21 E02	7.30 E02
1,2-Dichloroethane	9.36 E-02	1.57 E-01
1,1-Dichloroethylene	4.87 E-02	8.18 E-02
1,2-Dichloropropane	1.28 E-01	2.15 E-01
1,3-Dichloropropene	6.58 E-02	1.10 E-01
Ethyl benzene	1.04 E03	1.46 E03
Ethylene dibromide (EDB)	1.11 E-02	1.86 E-02
Methyl-tert-butyl-ether	5.21 E02	7.30 E02
Methyl isobutyl ketone	8.34 E01	1.17 E02
Methylene chloride	6.00 E02	6.00 E02
Styrene	5.00 E00	7.17 E00
1,1,1,2-Tetrachloroethane	3.29 E-01	5.52 E-01
1,1,2,2-Tetrachloroethane	4.20 E-02	7.05 E-02
Tetrachloroethylene	1.10 E01	1.10 E01
Toluene	4.17 E02	5.84 E02

Volatile Substance	Residential Target Indoor Air Concentration in micrograms per cubic meter	Industrial/Commercial Target Indoor Air Concentration in micrograms per cubic meter
1,1,1-Trichloroethane	1.04 E03	1.46 E03
1,1,2-Trichloroethane	3.00 E01	3.00 E01
Trichloroethylene	5.00 E00	5.00 E00
Vinyl chloride	2.90 E-02	4.87 E-02
Xylenes	3.13 E02	4.38 E02

Section 4. The Regulations of Connecticut State Agencies are amended by adding a new section 22a-133q-1 as follows:

22a-133q-1 Environmental land use restrictions

(a) Definitions.

For the purpose of this section, the definitions of the terms shall be the same as the definitions of terms in section 22a-133k-1 of the Regulations of Connecticut State Agencies. In addition, the following definitions shall apply:

"Class A-2 survey" means a first survey or independent re-survey which conforms to the "Recommended Standards for Surveys and Maps in the State of Connecticut Adopted on September 24, 1992, effective January 1, 1993 by the Connecticut Association of Land Surveyors, Inc." and which has been prepared by a land surveyor licensed in the State of Connecticut; complies with the minimum detail requirements for urban land title surveys adopted by the American Land Title Association and American Congress on Surveying and Maps (such requirements shall include all optional items on Table A thereof, exclusive of Items #1 (Monumentation), #5 (Contours in Elevation), #7b-2 (Other Data), and #12; and specifically shows (1) the boundaries of the Property by course and distance, together with the metes and bounds description corresponding to such survey; (2) the location of all improvements; (3) the location and width of all easements, utility lines, rights of way and building setback lines, with references to the book and page numbers for the instruments granting the same; (4) the location of all encroachments and restrictions, if any affecting the property; (5) the location of the portion of the parcel which is the subject of the proposed environmental land use restriction and (6) the latitude and longitude of the center of the subject property.

"Environmental land use restriction" means (1) a declaration of environmental land use restriction in the form set forth in Appendix 1 to section 22a-133q-1 of the Regulations of Connecticut State Agencies, or, in the case of an environmental land use restriction approved by a licensed environmental professional pursuant to P.A. 95-190, a declaration of environmental land use restriction in the form set forth in Appendix 2 to section 22a-133q-1 of the Regulations of Connecticut State Agencies; (2) a class A-2 survey of the subject parcel or portion thereof; (3) a certificate of title demonstrating that the subordination agreement(s) required under section 22a-133o of the General Statutes as amended by P.A. 95-190 has been recorded; and (4) a copy of the decision document prepared in accordance with subsection (f) of this section.

"Licensed environmental professional" means an environmental professional licensed in accordance with section 4 of P.A. 95-183.

(b) Applicability.

This section shall govern the execution and recording of environmental land use restrictions in accordance with section 22a-133n to 22a-133s, inclusive, of the General Statutes. Except as otherwise provided by section 22a-133o of the General Statutes, no environmental land use restriction shall be effective unless and until it has (1) been submitted to the Commissioner for his review and approved by him as evidenced by his signature on the original of the instrument setting forth such restriction; and (2) been recorded on the land records in the municipality in which the subject parcel is located.

(c) Publishing Notice of an Environmental Land Use Restriction.

(1) The owner of the parcel which is the subject of a proposed environmental land use restriction shall, except as specified in subdivision (1) of this subsection, publish in at least one newspaper of general circulation in the area affected by the proposed environmental land use restriction, notice of intent to record an environmental land use restriction. Such notice shall include the name and address of such owner, the address of the parcel or a brief description of its location, a brief description of the purpose of the proposed environmental land use restriction, the name and address of an individual from whom interested persons may obtain a copy of the proposed use restriction, and a statement that public comments on the proposed environmental land use restriction may be submitted in writing to the Commissioner of Environmental

Protection, 79 Elm Street, Hartford, CT 06106 for thirty days after the date of publication of the notice.

(2) Notice of a proposed environmental land use restriction need not be published if (A) such restriction provides solely that the use of the subject parcel or portion thereof is restricted to industrial or commercial activities, and (B) the municipal zoning of such parcel limits the parcel to such use.

(d) Proposing an Environmental Land Use Restriction.

When submitting a proposed environmental land use restriction to the Commissioner for his review and approval, the owner of the affected parcel of land shall simultaneously submit:

(1) a draft declaration of environmental land use restriction in the form set forth in Appendix 1 or 2 to section 22a-133q-1 of the Regulations of Connecticut State Agencies, as applicable;
(2) a Class A-2 survey of the parcel or portion thereof which is the subject of the proposed environmental land use restriction;
(3) a proposed decision document in accordance with subsection (f) of this section; and
(4) a certified copy of the notice required by subsection (c) of this section, as such notice appeared in the newspaper or newspapers.

(e) Approval of an Environmental Land Use Restriction by the Commissioner.

After the close of the public comment period, the Commissioner shall decide whether to approve an environmental land use restriction. When making such decision the Commissioner shall consider: (1) all comments submitted; (2) whether such restriction will adequately protect human health and the environment from pollution at or emanating from the subject release area; and (3) whether such restriction conforms in all respects to the requirements of this section and sections 22a-133n through 22a-133s of the General Statutes.

(f) Decision Document.

Any environmental land use restriction approved pursuant to this section shall include a decision document prepared in accordance with this section. The decision document shall contain a detailed written description of:

(1) the type and location of pollutants present in soil or ground water on or underlying the parcel or portion thereof which is the subject of the environmental land use restriction;
(2) the provisions of the environmental land use restriction, including any limitations on the use of such parcel or portion thereof; and
(3) description of the reason for the environmental land use restriction, including an explanation why such restriction is consistent with sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies.

The decision document shall also contain a summary of all comments on the proposed environmental land use restriction received following the publication of notice in accordance with subsection (c) of this section and a brief response to each comment. The decision document shall be signed by the Commissioner or, in the case of a restriction approved pursuant to P.A. 95-190, a licensed environmental professional to indicate approval of the decision document.

(g) Approval of an Environmental Land Use Restriction by a Licensed Environmental Professional.

When an environmental land use restriction is to be approved by a licensed environmental professional in accordance with P.A. 95-190, the licensed environmental professional shall review the documents listed in subsection (e), shall prepare a written approval of such restriction, and shall retain documentation of all documents reviewed by him. A licensed environmental professional shall not approve any environmental land use restriction unless it is consistent with sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies.

(h) Subordination Agreements.

Whether the Commissioner or a licensed environmental professional approves an environmental land use restriction, prior to recording such environmental land use restriction on the municipal land records, the owner of the subject parcel shall submit to the Commissioner for his review and written approval: (1) copies of each subordination agreement, properly executed, required under section 22a-133o of the General Statutes; or (2) a certificate of title indicating that each person holding an interest in such parcel or any part thereof, including without limitation each mortgagee, lessee, lienor and encumbrancer, has irrevocably subordinated such interest to the environmental land use restriction.

(i) Recording an Environmental Land Use Restriction.

After the Commissioner or a licensed environmental professional, as applicable, has approved an environmental land use restriction in accordance with this section, the owner of the subject parcel shall record such restriction in accordance with this section and all other applicable law.

(j) Mailing Notice of an Environmental Land Use Restriction.

After an environmental land use restriction has been recorded, the owner of the subject parcel shall send, by certified mail, return receipt requested, a copy of such environmental land use restriction to (1) the chief administrative officer in the town where the parcel is located; (2) the chairman of the municipal planning, zoning or planning and zoning commission; (3) the local director of health; and (4) any person who submitted comments on such environmental use restriction.

(k) Release.

The owner of any parcel which is subject to an environmental land use restriction recorded in accordance with this section may request that the Commissioner release such parcel, in whole or in part, from the limitations of such restriction. If the Commissioner grants such request, the owner of such parcel shall, in accordance with law, record such release on the land records in the municipality where such parcel is located. No release of an environmental land use restriction shall be effective unless and until it has been submitted to the Commissioner for his review and approved by him as evidenced by his signature on the original of the instrument setting forth such release, and has been recorded on the land records of the municipality in which such parcel is located.

(l) Effect of Court Ruling on Environmental Land Use Restriction.

In the event that a court of competent jurisdiction rules that any portion of an environmental land use restriction recorded pursuant to this section is invalid, the owner of the subject parcel shall submit a copy of such restriction and such ruling to the Commissioner. The Commissioner shall review such restriction, and if he determines that such restriction would not have been approved without the invalid portion, he shall give notice that the environmental land use restriction is terminated as evidenced by his signature on in instrument setting forth such termination, and shall record such instrument on the land records of the municipality where such parcel is located. Promptly thereafter, the owner of the subject parcel shall take actions consistent with sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies to remediate the subject parcel or portion thereof. If the Commissioner determines in writing that the environmental land use restriction would have been approved without the invalid portion, the valid portion of the environmental land use restriction shall remain in full force and effect.

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Appendix 1 to
Section 22a-133q-1 of the Regulations of Connecticut State Agencies
Form of Environmental Land Use Restriction for Commissioner's Approval

Instructions: Any environmental land use restriction pursuant to R.C.S.A. section 22a-133q-1 shall be in the following form. The appropriate information shall be inserted in the blanks shown, and the appropriate language shall be selected from the choices shown in brackets, or if none of the choices addresses the specific circumstance, substitute language shall be inserted.

DECLARATION OF ENVIRONMENTAL LAND USE RESTRICTION AND GRANT OF EASEMENT

This Declaration of environmental land use restriction and Grant of Easement is made this day of , 1995 , between ("the Grantor") and the Commissioner of Environmental Protection of the State of Connecticut ("the Grantee").

W I T N E S S E T H:

WHEREAS, Grantor is the owner in fee simple of certain real property (the "Property") known as [Address/Location located in the Town of in County] [designated as Lot , Block on the tax map of the Town of in County], more particularly described on Exhibit A which is attached hereto and made a part hereof; and

WHEREAS, the Grantee has determined that the environmental land use restriction set forth below is consistent with regulations adopted by him pursuant to Section 22a-133k of the Connecticut General Statutes; and

WHEREAS, the Grantee has determined that this environmental land use restriction will effectively protect public health and the environment from the hazards of pollution; and

WHEREAS, the Grantee's written approval of this Environmental land use restriction is contained in the document attached hereto as Exhibit B (the "Decision Document") which is made a part hereof; and

WHEREAS, the property or portion thereof identified in the class A-2 survey ("the Subject Area") which survey is attached hereto as Exhibit C which is made a part hereof, contains pollutants and

WHEREAS, to prevent exposure to or migration of such pollutants and to abate hazards to human health and the environment, and in accordance with the Decision Document, the Grantor desires to impose certain restrictions upon the use, occupancy, and activities of and at the Subject Area, and to grant this environmental land use restriction to the Grantee on the terms and conditions set forth below; and

WHEREAS, Grantor intends that such restrictions shall run with the land and be binding upon and enforceable against Grantor and Grantor's successors and assigns;

NOW, THEREFORE, Grantor agrees as follows:

1. Purpose. In accordance with the Decision Document, the purpose of this Environmental land use restriction is to assure [that the Subject Area is not used for residential activities], [that ground water at the Subject Area is not utilized for drinking purposes], [that humans are not exposed to soils at the Subject Area polluted with substances in concentrations exceeding the direct exposure criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive], [that water does not infiltrate soils at the Subject Area polluted with substances in concentrations exceeding the pollutant mobility criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive] [that buildings are not constructed over soils or ground water at the Subject Area polluted with substances in concentrations exceeding the volatilization criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive], [that the engineered control described in Exhibit D attached hereto is not disturbed and is properly maintained to prevent human exposure to soils at the Subject Area polluted with substances in concentrations exceeding the direct exposure criteria

established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive, and/or that water does not infiltrate soils at the Subject Area polluted with substances in concentrations exceeding the pollutant mobility criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive.]

2. Restrictions Applicable to the Subject Area: In furtherance of the purposes of this environmental land use restriction, Grantor shall assure that use, occupancy, and activity of and at the Subject Area are restricted as follows:

[A. Use. No residential use of the Subject Area shall be permitted.

B. Ground water. Ground water at the Subject Area shall not be used for drinking or other domestic purposes.

C. Disturbances. Soil at the Subject Area shall not be disturbed in any manner, including without limitation,

D. Construction. No building shall be constructed on the Subject Area.]

3. Except as provided in Paragraph 4 below, no action shall be taken, allowed, suffered, or omitted if such action or omission is reasonably likely to:

i. Create a risk of migration of pollutants or a potential hazard to human health or the environment; or

ii. Result in a disturbance of the structural integrity of any engineering controls designed or utilized at the Property to contain pollutants or limit human exposure to pollutants.

4. Emergencies. In the event of an emergency which presents a significant risk to human health or the environment, the application of Paragraph 3 above may be suspended, provided such risk cannot be abated without suspending such Paragraph and the Grantor:

i. Immediately notifies the Grantee of the emergency;

ii. Limits both the extent and duration of the suspension to the minimum reasonably necessary to adequately respond to the emergency;

iii. Implements all measures necessary to limit actual and potential present and future risk to human health and the environment resulting from such suspension; and

iv. Implements a plan approved in writing by the Grantee, on a schedule approved by the Grantee, to ensure that the Subject Area is remediated in accordance with R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive, or restored to its condition prior to such emergency.

5. Release of Restriction; Alterations of Subject Area. Grantor shall not make, or allow or suffer to be made, any alteration of any kind in, to, or about any portion of any of the Subject Area inconsistent with this Environmental land use restriction unless the Grantor has first recorded the Grantee's written approval of such alteration upon the land records of [name of municipality where Subject Area is located]. The Grantee shall not approve any such alteration and shall not release the Property from the provisions of this environmental land use restriction unless the Grantor demonstrates to the Grantee's satisfaction that Grantor has remediated the Subject Area in accordance with R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive.

6. Grant of Easement to the Grantee. Grantor hereby grants and conveys to the Grantee, his agents, contractors, and employees, and to any person performing pollution remediation activities under the direction thereof, a non-exclusive easement (the "Easement") over the Subject Area and over such other parts of the Property as are necessary for access to the Subject Area or for carrying out any actions to abate a threat to human health or the environment associated with the Subject Area. Pursuant to this Easement, the Grantee, his agents, contractors, and employees, and any person performing pollution remediation activities under the direction thereof, may enter upon and inspect the Property and perform such investigations and actions as the Grantee deems necessary for any one or more of the following purposes:

i. Ensuring that use, occupancy, and activities of and at the Property are consistent with this environmental land use restriction;

ii. Ensuring that any remediation implemented complies with R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive;

iii. Performing any additional investigations or remediation necessary to protect human health

and the environment;

[iv. Ensuring the structural integrity of any engineering controls described in this Environmental land use restriction and Grant of Easement and their continuing effectiveness in containing pollutants and limiting human exposure to pollutants.]

7. Notice and Time of Entry onto Property. Entry onto the Property by the Grantee pursuant to this Easement shall be upon reasonable notice and at reasonable times, provided that entry shall not be subject to these limitations if the Grantee determines that immediate entry is necessary to protect human health or the environment.

8. Notice to Lessees and Other Holders of Interests in the Property. Grantor, or any future holder of any interest in the property, shall cause any lease, grant, or other transfer of any interest in the Property to include a provision expressly requiring the lessee, grantee, or transferee to comply with this environmental land use restriction and Grant of Easement. The failure to include such provision shall not affect the validity or applicability to the Property of this environmental land use restriction and Grant of Easement.

9. Persons Entitled to Enforce Restrictions. The restrictions in this environmental land use restriction on use, occupancy, and activity of and at the Property shall be enforceable in accordance with section 22a-133p of the General Statutes.

10. Severability and Termination. If any court of competent jurisdiction determines that any provision of this environmental land use restriction or Grant of Easement is invalid or unenforceable, such provision shall be deemed to have been modified automatically to conform to the requirements for validity and enforceability as determined by such court. In the event that the provision invalidated is of such nature that it cannot be so modified, the provision shall be deemed deleted from this instrument as though it had never been included herein. In either case, the remaining provisions of this instrument shall remain in full force and effect. Further, in either case, the Grantor shall submit a copy of this restriction and of the judgement of the Court to the Grantee in accordance with R.C.S. A. section 22a-133q-1(1). This environmental land use restriction shall be terminated if the Grantee provides notification pursuant to R.C.S.A. section 22a-133q-1(l).

11. Binding Effect. All of the terms, covenants and conditions of this environmental land use restriction and grant of easement shall run with the land and shall be binding on the Grantor, the Grantor's successors and assigns, and each owner and any other party entitled to possession or use of the Property during such period of ownership or possession.

12. Terms Used Herein. The definitions of terms used herein shall be the same as the definitions contained in sections 22a-133k-1 and 22a-133o-1 of the Regulations of Connecticut State Agencies as such sections existed on the date of execution of this environmental land use restriction..

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Appendix 2 to
Section 22a-133q-1 of the Regulations of Connecticut State Agencies
Form of Environmental Land Use Restriction for Licensed Environmental Professional's Approval

> **Instructions:** Any environmental land use restriction pursuant to R.C.S.A. section 22a-133q-1 shall be in the following form. The appropriate information shall be inserted in the blanks shown, and the appropriate language shall be selected from the choices shown in brackets, or if none of the choices addresses the specific circumstance, substitute language shall be inserted.

DECLARATION OF ENVIRONMENTAL LAND USE RESTRICTION AND GRANT OF EASEMENT

This Declaration of environmental land use restriction and Grant of Easement is made this day of , 1995 , between ("the Grantor") and the Commissioner of Environmental Protection of the State of Connecticut ("the Grantee").

W I T N E S S E T H:

WHEREAS, Grantor is the owner in fee simple of certain real property (the "Property") known as [Address/Location located in the Town of in County] [designated as Lot , Block on the tax map of the Town of in County], more particularly described on Exhibit A which is attached hereto and made a part hereof; and

WHEREAS, remediation of the Property has been conducted in accordance with Public Act 95-190; and

WHEREAS, the Licensed Environmental Professional whose signature appears below has determined that the environmental land use restriction set forth below is consistent with regulations adopted by the Commissioner of Environmental Protection pursuant to Section 22a-133k of the Connecticut General Statutes; and

WHEREAS, the Licensed Environmental Professional whose signature appears below has determined that this environmental land use restriction will effectively protect public health and the environment from the hazards of pollution; and

WHEREAS, the written approval of this Environmental land use restriction by the Licensed Environmental Professional whose signature appears below is contained in the document attached hereto as Exhibit B (the "Decision Document") which is made a part hereof; and

WHEREAS, the property or portion thereof identified in the class A-2 survey ("the Subject Area") which survey is attached hereto as Exhibit C which is made a part hereof, contains pollutants; and

WHEREAS, to prevent exposure to or migration of such pollutants and to abate hazards to human health and the environment, and in accordance with the Decision Document, the Grantor desires to impose certain restrictions upon the use, occupancy, and activities of and at the Subject Area, and to grant this environmental land use restriction to the Grantee on the terms and conditions set forth below; and

WHEREAS, Grantor intends that such restrictions shall run with the land and be binding upon and enforceable against Grantor and Grantor's successors and assigns;

NOW, THEREFORE, Grantor agrees as follows:

1. Purpose. In accordance with the Decision Document, the purpose of this Environmental land use restriction is to assure [that the Subject Area is not used for residential activities], [that ground water at the Subject Area is not utilized for drinking purposes], [that humans are not exposed to soils at the Subject

Area polluted with substances in concentrations exceeding the direct exposure criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive], [that water does not infiltrate soils at the Subject Area polluted with substances in concentrations exceeding the pollutant mobility criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive] [that buildings are not constructed over soils or ground water at the Subject Area polluted with substances in concentrations exceeding the volatilization criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive], [that the engineered control described in Exhibit D attached hereto is not disturbed and is properly maintained to prevent human exposure to soils at the Subject Area polluted with substances in concentrations exceeding the direct exposure criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive, and/or that water does not infiltrate soils at the Subject Area polluted with substances in concentrations exceeding the pollutant mobility criteria established in R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive].

2. Restrictions Applicable to the Subject Area: In furtherance of the purposes of this environmental land use restriction, Grantor shall assure that use, occupancy, and activity of and at the Subject Area are restricted as follows:

[A. Use. No residential use of the Subject Area shall be permitted.

B. Ground water. Ground water at the Subject Area shall not be used for drinking or other domestic purposes.

C. Disturbances. Soil at the Subject Area shall not be disturbed in any manner, including without limitation,

D. Construction. No building shall be constructed on the Subject Area.]

3. Except as provided in Paragraph 4 below, no action shall be taken, allowed, suffered, or omitted if such action or omission is reasonably likely to:

i. Cause migration of pollutants or create a potential hazard to human health or the environment; or

ii. Result in a disturbance of the structural integrity of any engineering controls or other structures designed or utilized at the Property to contain pollutants or limit human exposure to pollutants.

4. Emergencies. In the event of an emergency which presents a significant risk to human health or the environment, the application of Paragraph 3 above may be suspended, provided such risk cannot be abated without suspending such Paragraph and the Grantor:

i. Immediately notifies the Grantee of the emergency;

ii. Limits both the extent and duration of the suspension to the minimum reasonably necessary to adequately respond to the emergency;

iii. Implements all measures necessary to limit actual and potential present and future risk to human health and the environment resulting from such suspension; and

iv. Implements a plan approved in writing by the Grantee, on a schedule approved by the Grantee, to ensure that the Subject Area is remediated in accordance with R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive, or restored to its condition prior to such emergency.

5. Release of Restriction; Alterations of Subject Area. Grantor shall not make, or allow or suffer to be made, any alteration of any kind in, to, or about any portion of any of the Subject Area inconsistent with this Environmental land use restriction unless the Grantor has first recorded the Grantee's written approval of such alteration upon the land records of [name of municipality where Subject Area is located]. The Grantee shall not approve any such alteration and shall not release the Property from the provisions of this environmental land use restriction unless the Grantor demonstrates to the Grantee's satisfaction that Grantor has remediated the Subject Area in accordance with R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive.

6 Grant of Easement to the Grantee. Grantor hereby grants and conveys to the Grantee, his agents, contractors, and employees, and to any person performing pollution remediation activities under the direction thereof, a non-exclusive easement (the "Easement") over the Subject Area and over such other parts of the Property as are necessary for access to the Subject Area or for carrying out any actions to abate a threat to human health or the environment associated with the Subject Area. Pursuant to this Easement, the Grantee, his agents, contractors, and employees, and any person performing pollution remediation activities

under the direction thereof, may enter upon and inspect the Property and perform such investigations and actions as the Grantee deems necessary for any one or more of the following purposes:

I. Ensuring that use, occupancy, and activities of and at the Property are consistent with this environmental land use restriction;

ii. Ensuring that any remediation implemented complies with R.C.S.A. sections 22a-133k-1 through 22a-133k-3, inclusive;

iii. Performing any additional investigations or remediation necessary to protect human health and the environment;

[iv. Ensuring the structural integrity of any engineering controls described in this Environmental land use restriction and Grant of Easement and their continuing effectiveness in containing pollutants and limiting human exposure to pollutants.]

7. Notice and Time of Entry onto Property. Entry onto the Property by the Grantee pursuant to this Easement shall be upon reasonable notice and at reasonable times, provided that entry shall not be subject to these limitations if the Grantee determines that immediate entry is necessary to protect human health or the environment.

8. Notice to Lessees and Other Holders of Interests in the Property. Grantor, or any future holder of any interest in the property, shall cause any lease, grant, or other transfer of any interest in the Property to include a provision expressly requiring the lessee, grantee, or transferee to comply with this environmental land use restriction and Grant of Easement. The failure to include such provision shall not affect the validity or applicability to the Property of this environmental land use restriction and Grant of Easement.

9. Persons Entitled to Enforce Restrictions. The restrictions in this environmental land use restriction on use, occupancy, and activity of and at the Property shall be enforceable in accordance with section 22a-133p of the General Statutes.

10. Severability and Termination. If any court of competent jurisdiction determines that any provision of this environmental land use restriction or Grant of Easement is invalid or unenforceable, such provision shall be deemed to have been modified automatically to conform to the requirements for validity and enforceability as determined by such court. In the event that the provision invalidated is of such nature that it cannot be so modified, the provision shall be deemed deleted from this instrument as though it had never been included herein. In either case, the remaining provisions of this instrument shall remain in full force and effect. Further, in either case, the Grantor shall submit a copy of this restriction and of the judgement of the Court to the Grantee in accordance with R.C.S. A. section 22a-133q-1(1). This environmental land use restriction shall be terminated if the Grantee provides notification pursuant to R.C.S.A. section 22a-133q-1(l).

11. Binding Effect. All of the terms, covenants and conditions of this environmental land use restriction and grant of easement shall run with the land and shall be binding on the Grantor, the Grantor's successors and assigns, and each owner and any other party entitled to possession or use of the Property during such period of ownership or possession.

12. Terms Used Herein. The definitions of terms used herein shall be the same as the definitions contained in sections 22a-133k-1 and 22a-133o-1 of the Regulations of Connecticut State Agencies as such sections existed on the date of execution of this environmental land use restriction.

Section 5. Section 22a-209-1 of the Regulations of Connecticut State Agencies is repealed and the following is substituted in lieu thereof:

Sec. 22a-209-1. Definitions

"AASHTO specification" means a standard of performance for buried structures set forth in "Standard Specifications for Transportation Materials," published by the American Association of State Highway and Transportation Officials in 1989, 14TH edition.

"All weather access" means that affected roads or land surface can support operation of vehicles for the transportation of solid waste and vehicles for the maintenance of solid waste facilities under all normal climatic conditions, provided that snow is removed and flooding is precluded.

"Alter" (1) when referring to a solid waste facility which has no permit, means to change the existing configuration or method of operation of the facility in any manner, including but not limited to adding to the volume of solid waste deposited at the facility; (2) when referring to a solid waste facility which holds a permit, means to change the approved configuration or method of operation of the facility in any manner, including but not limited to adding to the approved volume of solid waste deposited at the facility.

"Asbestos" means actinolite, amosite, antnophyllite, chrysotile, crocidolite, tremolite, or any material which contains the above, all or part of which is in a friable state.

"ASTM specification" means a standard for pipes or other construction materials set forth in "Annual Book of ASTM Standards," published by the American Society of Testing Materials in 1989.

"Base flood" means a flood that has a one percent or greater chance of recurring in any year or a flood of a magnitude equaled or exceeded once in 100 years on the average over a significantly long period. If the Commissioner deems it necessary for a particular location, the base flood shall represent a less common occurrence as specified by him or her.

"Bird hazard" means an increase in the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants.

"Bulky waste" means landclearing debris and waste resulting directly from demolition activities other than clean fill.

"Cell construction method" means the spreading, compacting and daily covering of solid wastes through use of the area, ramp, or trench methods of landfilling.

"Certified operator" means the solid waste facility operator or an employee of the such operator who is present on site and oversees or carries out the daily operation of the facility, and whose qualifications are approved in accordance with Section 22a-209-6 of the Regulations of Connecticut State Agencies.

"Certified soil scientist" means a person who has been certified as a soil scientist by the Board of Directors of the Society of Soil Scientists of Southern New England.

"Clean fill" means (1) natural soil (2) rock, brick, ceramics, concrete, and asphalt paving fragments which are virtually inert and pose neither a pollution threat to ground or surface waters nor a fire hazard AND (3) POLLUTED SOIL AS DEFINED IN SUBDIVISION (45) OF SUBSECTION (a) OF SECTION 22a-133k-1 OF THE REGULATIONS OF CONNECTICUT STATE AGENCIES WHICH SOIL HAS BEEN TREATED TO REDUCE THE CONCENTRATION OF POLLUTANTS TO LEVELS WHICH DO NOT EXCEED THE APPLICABLE POLLUTANT MOBILITY CRITERIA AND DIRECT EXPOSURE CRITERIA ESTABLISHED IN SECTIONS 22a-133k-1 THROUGH 22a-133k-3 OF THE REGULATIONS OF CONNECTICUT STATE AGENCIES AND WHICH SOIL IS REUSED IN ACCORDANCE WITH R.C.S.A. SUBDIVISION (3) OF SUBSECTION (h) OF SECTION 22a-133k-2 OF SUCH REGULATIONS.

"Cover material" means soil, or other suitable material as approved by the Commissioner, which is used to cover compacted solid waste in a solid or special waste disposal area. Any soils used shall be classified as GM, silty gravels, poorly graded gravel-sand-silt mixtures; GC, clayey gravels, poorly graded gravel-sand-clay mixtures; SM, silty sands, poorly graded sand-silt mixtures; SC, clayey sands, poorly graded sand-clay mixtures, ML, inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity in accordance with the unified soil classification system.

"Dewater" means to subject material to a process that removes water.

"Dioxin sampling well" means a stainless steel ground water monitoring well installed within the area of predicted leachate plume from any portion of a solid waste facility at which residue is disposed.

"Facility plan" means the engineering studies and proposals to build, establish, alter, operate, monitor and close a solid waste facility, required by Section 22a-209-4(b)(2) of the Regulations of Connecticut State Agencies.

"Floodplain" means the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, which are inundated by the base flood.

"Friable" means readily crumbled, pulverized or reduced to powder, when dry, by hand pressure.

"Geotextile" means a woven or nonwoven fabric or film which is utilized for the engineering management of soil and water.

"Groundwater" means water present in the zone of saturation.

"Groundwater monitoring well" means a dug, driven or drilled well used to determine groundwater elevation, direction of groundwater flow, or the quality of groundwater.

"Hazardous Waste" means any waste material which may pose a present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of or otherwise managed, including hazardous waste identified in accordance with Section 3001 of the Resource Conservation and Recovery Act of 1976 (42 USC 6901 et seq.) as amended.

"Leachate" means that liquid which results from ground or surface water which has been in contact with solid waste and has extracted material, either dissolved or suspended, from the solid waste.

"Lift" means a horizontal layer of cells within a solid waste disposal area at which the cell construction method is utilized.

"Lower explosive limit" means the lowest percent by volume of gas which will propagate a flame in air at 25° C and atmospheric pressure.

"Maximum high water table" means the highest elevation reached by the upper level of the ground water as determined by an engineering evaluation conducted in accordance with test methods approved by the Commissioner.

"Monocell" means a variation of the cell construction method whereby only a single type of solid waste is disposed of in any individual cell.

"Mottling indicator" means a residual trace of reduced or oxidized iron left on soil strata as the result of fluctuations in groundwater elevation.

"Mulch" means a protective cover of organic material placed over soil to preserve soil moisture, prevent erosion, or promote the growth of plants.

"Municipal solid waste" means solid waste from residential, commercial, industrial and institutional sources, excluding solid waste consisting of significant quantities of hazardous waste as defined in Section 22a-115 of the General Statutes, landclearing debris, biomedical waste, sewage sludge and scrap metal.

"NATURAL SOIL" MEANS SOIL IN WHICH ALL SUBSTANCES NATURALLY OCCURRING THEREIN ARE PRESENT IN CONCENTRATIONS NOT EXCEEDING THE CONCENTRATIONS OF SUCH SUBSTANCE OCCURRING NATURALLY IN THE ENVIRONMENT AND IN WHICH SOIL NO OTHER SUBSTANCE IS ANALYTICALLY DETECTABLE. FOR THE PURPOSE OF THIS DEFINITION, SUBSTANCE SHALL HAVE THE SAME MEANING AS IN SECTION 22a-133k-1 OF THE REGULATIONS OF CONNECTICUT STATE AGENCIES.

"New municipal solid waste disposal area" means a solid waste facility or expansion thereof, other than a vertical expansion, for the disposal of municipal solid waste, for which facility or expansion a completed application under Sections 22a-430 and 22a-208a of the General Statutes is received by the Commissioner after the effective date of Section 22a-209-14 of the Regulations of Connecticut State Agencies.

"Open dump" means a site at which solid waste is disposed of in a manner which does not comply with Subtitle D of the Resource Conservation and Recovery Act of 1976, (42 USC 6901 et seq.), as amended, and regulations promulgated thereunder.

"Operator" means a person who is ultimately responsible for maintaining the solid waste facility in conformance with applicable statutes and regulations and the facility permits.

"Pan lysimeter" means a leachate collection device for sampling leachate from monocells within a solid waste disposal area.

"Person" means any individual, firm, partnership, association, syndicate, company, trust, corporation, municipality, agency or political or administrative subdivision of the state, or other legal entity of any kind.

"Public airport" means an airport open to the public without prior permission and without restrictions within the physical capacities of available facilities.

"Recharge" means water which enters a geologic formation.

"Regional solid waste disposal area" means a solid waste disposal area used for the disposal of solid waste generated in more than one municipality.

"Residue" means bottom ash, air pollution control residue, and other residues from the combustion process at resource recovery facilities, municipal solid waste incinerators, and biomedical waste incinerators.

"Resources recovery facility" means a volume reduction plant, as defined by Section 22a-207 of the General Statutes as amended, utilizing processes aimed at reclaiming the material or energy values from solid wastes.

"Rip-rap" means a loose assemblage of broken or whole stones utilized to dissipate the velocity and energy of moving water.

"Scarification" means the process of raking, harrowing or otherwise disturbing a soil surface to allow infiltration of water or other material.

"Solid waste boundary" means the outermost perimeter of the solid or special waste (projected in the horizontal plane) as it would exist at completion of the permitted disposal activity at a solid waste or special waste disposal area.

"Special waste disposal area" means a solid waste disposal area at which special wastes, as defined in this section, are disposed of.

"Special wastes" means the following wastes, so long as they are not hazardous waste pursuant to section 22a-115 of the General Statutes or radioactive material subject to section 22a-148 of the General Statutes: (1) water treatment, sewage treatment or industrial sludges, liquid, solids and contained gases; fly-ash and casting sands or slag; and contaminated dredge spoils; (2) scrap tires; (3) bulky waste, as defined in this section; (4) asbestos; (5) residue; and (6) biomedical waste.

"Standard proctor density" means the maximum weight per unit volume of earthen material which has been compacted by a specific weight and procedure, at an optimum soil moisture, according to a laboratory engineering test developed by Proctor.

"State Solid Waste Management Plan" means the State plan adopted pursuant to Section 22a-211 of the Connecticut General Statutes, as amended.

"Stormwater" means precipitation runoff.

"Transfer station" means a volume reduction plant, as defined by Section 22a-207 of the General Statutes, as amended, that is a central collection point for the solid waste generated within a municipality or group of municipalities, where solid wastes received are transferred to a vehicle for removal to another solid waste facility.

"Underdrainage" means a system of pipes, structures, stone, pumps, wells, or other devices utilized to lower or divert groundwater.

"Vector" means as insect or rodent or other animal (not human) which can transmit infectious diseases from one person or animal to another person or animal.

"Vertical expansion" means an expansion of an existing solid waste disposal area such that future disposal of municipal solid waste will take place only where solid waste has previously been disposed of and is still present.

"Washout" means the carrying away of solid waste by waters of the base flood.

"Water Quality Standards" means the water quality standards and water quality Classifications Map published by the Connecticut Department of Environmental Protection, February, 1987.

"Water table" means that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

"Working face" means that portion of a solid waste or special waste disposal area where the waste is deposited, spread and compacted prior to the placement of cover material.

"Zone of influence" means the area in which, assuming the absence of any means at a solid waste facility to collect or treat leachate, groundwater may be altered in quality due to discharge of leachate from any portion of such facility.

Handout from 30 Apr 99 RSR Seminar

QUESTIONS AND RESPONSE SUMMARY
DEP LIAISON MEETINGS
Environmental Professionals Organization of Connecticut
APRIL 1999

The following is a summary of questions asked at the DEP Liaison committee meetings along with DEP's response. Some of these questions have been previously distributed, and several issues raised at liaison meetings are now outdated and are not included in this summary. Questions are divided into five categories, General, Groundwater, Soil, Surface Water, and Volatilization.

A. GENERAL

1. *What is the status of DEP's research into an alternative for TPH analysis by 418.1?*

An ad hoc committee composed of personnel from DEP-UST, DPH, DPH lab, and the ERI lab researched new methods for TPH analysis. DEP will be approving an analytical method using methylene chloride extraction with gas chromatograph-flame ionization detection for TPH analysis. This method, which is one of the options available using Method 8015 GC FID will quantify the TPH with carbon numbers equivalent to diesel fuel and higher and will greatly reduce the occurrence of false positives associated with organic matter. The numerical criteria for TPH in soils will be not be changed based on the new method. However, the ground-water protection criteria will be lowered from 500 ppb to 100 ppb. Final work on the new method is being completed at the DPH lab, and DPH approval is expected by mid-May. When the DPH laboratory has approved the method a copy will be provided to EPOC for posting on the web page.

2. *Under what circumstances would remediation of an historical release from an UST be subject to the remediation standard regulations?*

The RSRs apply to the remediation of UST releases whenever that remediation is required by statute, regulation, or order from the Commissioner. However, the DEP recommends that the RSRs be used to remediate any commercial or industrial UST release. It is simply not cost-effective or efficient to partially remediate an UST release at one time, and then at a later date - perhaps in the context of a property transfer or compliance with an order - have to reassess compliance with the RSRs. DEP also recommends that, for releases of fuel oil from small residential underground storage tanks, the numeric soil criteria should be used as a guide in any excavation project.

3. *Can TPH generally be used as a surrogate for semi-volatile organic compounds when one is evaluating releases and extent of contaminants at areas where petroleum products were handled?*

With respect to SVOCs, the DEP recommends that the investigator should generally follow the guidance provided by the DEP's "Sampling and Analytical Methods for UST Closure" memo dated 5/28/96. For example, at fuel oil and diesel releases TPH analyses should be performed on all samples, but the sample with the highest TPH concentration should also be analyzed for aromatic VOCs, MTBE, and SVOCs. For most other area where petroleum products were handled it is appropriate to analyze all samples for TPH, and VOCs including MTBE with the sample having the highest level of pollution also being tested for SVOCs. Of course, the investigator should consider the nature and composition of the petroleum products used at the site and design the analytical program accordingly.

4. *If TPH is the only contaminant detected at an establishment, is a Form III filing required? Prior to passage of P.A. 95-183, such a filing would not have been required because TPH was considered a Connecticut Regulated Waste, not a hazardous waste. Please clarify DEP's position on this issue.*

Pursuant to Section 22a-134 of the Connecticut General Statutes, a Form III filing is required if hazardous wastes have been released. If only TPH has been released at a site and no hazardous wastes have otherwise been released, the filing of a form III is not required. However, the TPH release may still require remediation because of a statute, order or regulation other than the Property Transfer Act.

5. *What are the LEP's obligations for determining standards for contaminants of concern for which criteria have not been tabulated in the RSRs?*

The RSRs apply to any substance released at a site even if a numeric criteria for soil or ground water has not been established. If criteria have not been adopted, then the Commissioner must approve criteria for such additional polluting substances. The RSRs Sections 22a-133k-2(b)(4), -(2)(c)(5), and -(3)(h) describe the information that must be submitted when requesting an approval of criteria for additional substances. The DEP will share new criteria developed through this process with the public so that there is no duplication of effort.

6. *How many requests for alternative criteria have been received by the Department? How many have been reviewed, or are undergoing review by the DEP and the Department of Public Health (DPH)? How many, if any, have been approved or disapproved? How long has it taken to complete the review process from the date of receipt? Can the Department provide a list of the requests for approval of alternative*

criteria? Is the Department tracking these requests separately? How would one obtain information on these requests and how would one obtain copies of the applications for alternative criteria and the respective decision?

- Fifteen requests for alternative criterial or for additional polluting substance criteria as of March 1999.
- Seven requests have been fully reviewed and final decisions have been made.
- Two requests require additional information to be submitted.
- Six requests are currently under review by the DPH.
- On average, it has taken two to three months to complete a review and send a final determination letter. Complex requests have taken considerably longer, but the average has been about three months.
- The DEP has approved additional criteria for about sixty compounds.
- The DEP not approved alternative criteria that would apply broadly to other sites with the exception of the Massachusetts VPH/EPH method of evaluating direct exposure risk from petroleum hydrocarbons. That analytical method and the appropriate Massachesetts criteria can be used in place of the TPH direct exposure criteria, with the approval of the Commissioner.
- Information can be obtained regarding specific submittals and their respective decisions by calling Ruth Lepley at 424-3923.

B. GROUNDWATER

1. *What is DEP's position on the use of small diameter monitoring wells (less than 2-inch diameter such as those which can be installed by direct push methods) for long term monitoring, i.e.; compliance monitoring after remediation of a release?*

   The DEP considers small diameter wells acceptable for investigative or compliance monitoring purposes, so long as they yield samples that are representative and provide data that meets the objectives of the project. In particular, small-diameter wells are most compatible with low-flow sampling techniques.

2. *What is DEP's position on the use of peristaltic pumps for obtaining samples for VOC analysis?*

   DEP acknowledges that using peristaltic pumps can result in concentrations that are less than the actual concentration in ground water and does not encourage its use, particularly for compliance monitoring. However, factors such as the data objectives, the availability of alternative techniques and the overall body of data that will be generated in the course of an investigation, must be taken into consideration when designing a sampling protocol. There are circumstances for which the use of peristaltic

pumps is an acceptable sampling method provided the data generated by such sampling is interpreted appropriately.

3. *Are the GWPC for metals based on filtered or unfiltered sample analysis? What is DEP's experience and position regarding filtering for metals analysis in high silt content formations? Would the Department consider alternative filtering technologies such as the use of a 10 micron filter to remove silt, yet leave colloidal particles?*

The GWPC should be compared to results from unfiltered samples. DEP believes that unfiltered sample results is a better representation of the quality of water that might be used for drinking water purposes. Unfiltered samples are also necessary for evaluation of compliance with the SWPC and for any evaluation of ground water quality in bedrock. Low flow sampling techniques should be routinely employed and monitoring wells should be thoroughly developed prior to sampling in order to reduce the concentration of metals due to suspended solids. The DEP recognizes, however, that there may be monitoring wells installed in formations that yield samples with high turbidity despite thorough efforts to properly develop the well and despite using low flow sampling techniques. In such a circumstance, filtered samples may be more appropriate. DEP recommends contacting the Department in the event that suitable unfiltered samples cannot be obtained to discuss alternative methods, including 10 micron filtration.

4. *If a release to the soil is remediated to below direct exposure and pollutant mobility criteria in a "GB" area, and results of initial groundwater sampling indicated that no impact to groundwater is evident, is a continued groundwater monitoring program required? Is the response different for a "GA" area?*

The RSR monitoring requirements define the objectives of ground water monitoring for both GA and GB areas - Section 22a-133k-3(g)(1)and (2) - and define the circumstances under which monitoring may be discontinued - Section 22a-133k-3(g)(3). However, there are situations for which the defined objectives can be met with less data than that specified by the regulations. In that case, the Commissioner can approve a different compliance or post remediation monitoring program. Any request for such approval should document the ground water data that exists and describe why that body of data meets the objectives for monitoring.

C. SOIL

1. *What is DEP's policy on defining a polluted soil and what are the acceptable procedures for management of those soils?*

DEP's policy on defining a polluted soil is the same as the definition in the regulations. A polluted soil means soil affected by a release of a substance at a concentration above the analytical detection limit for such substance. There is a provision in the RSRs for the re-use of polluted soil on a site once it has been demonstrated to contain concentrations that do not exceed the Direct Exposure or Pollutant Mobility Criteria. Among other requirements, a map showing where these soils were placed must be submitted to DEP. In general, no prior DEP approval is needed. However, reuse of *What is DEP's experience and position regarding filtering for metals analysis in high silt content formations? Would the Department consider alternative filtering technologies such as the use of a 10 micron filter to remove silt, yet leave colloidal particles?* PCB contaminated soil or reuse of contaminated soil on another site does require DEP approval.

2. *Should weathered bedrock be considered as soil or bedrock? Should the degree of weathering be a factor in the decision?*

The definition of soil in the RSRs is that if it is unconsolidated it is considered a soil. Highly weathered bedrock is, by definition in the RSRs, a soil. In general, the RSRs use the "engineering" approach to defining soils as opposed to a geologist's or soil scientist's definition. In other words, it is the material's properties that are important rather than the processes by which it formed. Basically, if the material can be moved using standard construction equipment, such as backhoe or even a shovel, it is considered soil.

3. *The definition of inaccessible soil includes those soils beneath an "existing building." Is this also intended to include a future building to be constructed as part of site development?*

A remedial action plan which proposes to ensure that polluted soil is inaccessible after the construction of a new building and the recording of an ELUR is perfectly acceptable to the DEP. The use of the term "existing" was intended to make clear that, until the new building is constructed, the final remedial action report could not be approved by DEP and the remedial actions could not be verified by an LEP. DEP encourages LEPs to consider rendering polluted soil inaccessible or environmentally isolated when evaluating remedial options.

4. *In a GA area where you have a NAPL-impacted zone between seasonal high and seasonal low water tables, it is understood that you must remediate NAPL to the maximum extent practicable (LNAPL) or maximum extent prudent (DNAPL). When do the direct exposure criteria (DEC) and pollutant mobility criteria (PMC) apply to this zone?*

   The DEC apply to this zone if it is within 15 feet of land surface. The PMC do not apply to the zone between the high and low seasonal water table if NAPL is present because water level fluctuations will result in periodic re-contamination of the soils.

5. *DEP has indicated that the VPH/EPH method is an acceptable alternative to 418.1 for DEC. Does the use of this method still require DEP approval, or can an LEP verify based on this method?*

   DEP approval of this alternative DEC is still required; however, it is anticipated that this will become a self-implementing alternative following RSR revisions.

6. *Are there any proposed RSR exemptions for DEC failures resulting from asphalt fragments in soils?*

   No simple exemptions for DEC exceedances resulting from asphalt fragments in soils are at present contemplated. The Department is considerering a an expanded range of options for managing soil which exceeds the DEC because of asphalt. The Department remains open to considering any suggestions for dealing with this issue in a manner that is protective of human health.

7. *Does DEP have any plans to revisit any of the RSR soil criteria as a result of most laboratories difficulty in achieving the required detection limits? Some of the pesticide detection requirements are particularly troublesome for many labs.*

   The Department has not received any complaints regarding the ability to achieve the required detection limits for any soil criteria specified in the regulations including the pesticides. Achieving some of the risk-based numbers for pesticides developed for the Naval Submarine Base (which are not currently RSR criteria) is acknowledged and will be evaluated when standards are derived during the RSR revision process. The Department has in the past and will continue to take the ability to analytically quantify a compound into consideration when adopting new criteria for additional polluting substances.

8. *Is it appropriate to collect "background" TPH data similar to what would be done for background metals at a site? How many samples does DEP consider to be an adequate number to characterize background conditions at a site?*

Since DEP does not consider TPH to be a naturally occurring substance, a background determination would typically not be appropriate. However, DEP recognizes that 418.1 is subject to false positives resulting from organic matter and may be a consideration on a site-specific basis. The revised TPH method is expected to minimize this problem.

9. *Can contaminated soil be relocated within a contiguous property to an area where an engineered control is planned?*

Relocation of contaminated soil in an area with an engineered control is possible, but may be meet the threshold for creating a solid waste disposal area. In that case, the activity would be subject to the siting and permitting requirements of the Solid Waste or Hazardous Waste Statutes and the discharge permitting requirements.

D. SURFACE WATER

1. *The Surface Water Protection Criteria of phenanthrene is stated as 0.077 ug/L. However, previous versions of the regulations referenced the value as 0.3 ug/L. DEP staff have verbally indicated that 0.3 ug/L is the correct value. Please confirm the correct value.*

The Surface Water Protection Criterion of phenanthrene is 0.3 ug/L. The 0.077 was a typographical error.

2. *Page 26 - Section (f)(2)(B) states "the concentration of such substance in that portion of such plume which is immediately upgradient of the point at which such groundwater discharges to the receiving surface water body...". Is this meant to be a single point exceedance or an average of the plume concentration at the point of discharge?*

The quoted section refers to a single point exceedance. Section (f)(2)(A) refers to an "average" exceedance.

E. VOLATILIZATION

1. *When evaluating the Volatilization Criteria for Soil Vapor in Appendix F, the referenced criteria are reported in parts per million. Please confirm that the standard is actually ppmv, and not mg/m^3 (as utilized in Appendix G).*

The standard is ppmv. Note that when developing any alternative criterion using Appendix G, the value must be converted from mg/m^3 to ppmv so it can be compared to a default criterion.

2. *Please confirm that on a site where there is residual product in fractured bedrock above the water table within 15 feet of the ground surface, the volatilization criteria do not apply.*

The volatilization criteria apply to ground water. The presence of residual product in the unsaturated zone alone does not trigger the volatilization requirements. However, the situation described above was not envisioned during drafting of the RSRs. Clearly, if the residual product resulted in volatile organic compounds migrating into an overlying building at concentrations that would be a risk to human health, the Commissioner could require additional remediation. In addition, residual product must be remediated in accordance with the provisions of Section 22a-133k-2(g).

3. *Can the soil vapor volatilization criteria be applied in areas where no building exists?*

In accordance with the RSRs, the soil vapor volatilization criteria can only be used to show compliance with samples obtained from beneath a building.

Approved Criteria for Additional Polluting Substances

Pursuant to Sections 22a-133k(1) through (3) of the Regulations of Connecticut State Agencies

Pollutant	Soil (mg/kg)				Groundwater (µg/l)			
	RES DEC	I/C DEC	GAA/ GA PMC	GB PMC	GWPC	SWPC	RES VC	I/C VC
acenaphthene	1000	2500	8.4	84	420	NE	NE	NE
aldrin	0.036	0.34	In Review	In Review	In Review	NE	NE	NE
benzo(g,h,i)perylene [8]	1000	2500	4.2	42	210	NE	NE	NE
benzoic acid	1000	2500	1000	10000	50000	NE	NE	NE
BHC(alpha-)	0.097	0.91	In Review	In Review	In Review	NE	NE	NE
BHC(beta-)	0.34	3.2	In Review	In Review	In Review	NE	NE	NE
BHC(delta) [1]	0.097	0.91	In Review	In Review	In Review	NE	NE	NE
bromodichloromethane	9.9	92	0.011	0.11	0.56	NE	NE	NE
bromomethane	95	1000	0.2	2	9.8	NE	NE	NE
4-bromophenyl-phenylether	500	1000	8.2	82	410	NE	NE	NE
n-butylbenzene	500	1000	1.4	14	61[13]	NE	NE	NE
sec-butylbenzene	500	1000	1.4	14	61[13]	NE	NE	NE
tert-butylbenzene	500	1000	1.4	14	61[13]	NE	NE	NE
carbazole	31	290	1 #	1 #	10 #	NE	NE	NE

Approved Criteria for Additional Polluting Substances

Pursuant to Sections 22a-133k(1) through (3) of the Regulations of Connecticut State Agencies

Pollutant	Soil (mg/kg)				Groundwater (µg/l)			
	RES DEC	I/C DEC	GAA/ GA PMC	GB PMC	GWPC	SWPC	RES VC	I/C VC
carbon disulfide	500	1000	14	140	700	NE	NE	NE
4-chloroaniline	270	2500	1 #	5.6	28	NE	NE	NE
chloromethane	47	440	0.054	0.54	2.7	NE	NE	NE
2-chloronaphthalene	1000	2500	11	110	560	NE	NE	NE
4-chlorophenyl-phenyl ether [2]	500	1000	8.2	82	410	NE	NE	NE
chrysene	84	780	1 #	1 #	4.8	NE	NE	NE
m-cresol	1000	2500	7	70	350	NE	NE	NE
p-cresol	340	2500	0.7	7	35	NE	NE	NE
4,4'-DDD	2.6	24	In Review	In Review	0.15	NE	NE	NE
4,4'-DDE	1.8	17	In Review	In Review	0.1	NE	NE	NE
4,4'-DDT	1.8	17	In Review	In Review	0.1	NE	NE	NE
dibenzofuran	270	2500	1 #	5.6	28	NE	NE	NE
dibenz(a,h)anthracene	1 #	1 #	1 #	1 #	0.5 #	NE	NE	NE

Approved Criteria for Additional Polluting Substances

Pursuant to Sections 22a-133k(1) through (3) of the Regulations of Connecticut State Agencies

Pollutant	Soil (mg/kg)				Groundwater (µg/l)			
	RES DEC	I/C DEC	GAA/ GA PMC	GB PMC	GWPC	SWPC	RES VC	I/C VC
1,2-dibromo-3-chloropropane	0.44	4.1	In Review	In Review	In Review	NE	NE	NE
1,2-dibromoethane	0.0072	0.067	In Review	In Review	In Review	NE	NE	NE
3,3'-dichlorobenzidene	1.4	13	0.33 #	0.33 #	10 #	NE	NE	NE
1,4-dichlorobutene	0.07	0.62	In Review	In Review	In Review	NE	NE	NE
diethyl phthalate	1000	2500	110	1100	5600	NE	NE	NE
2,4-dimethylphenol	1000	2500	2.8	28	140	NE	NE	NE
dimethyl phthalate [10]	1000	2500	110	1100	5600	NE	NE	NE
2,4-dinitrophenol	140	2500	1.65 #	2.8	50 #	NE	NE	NE
2,4-dinitrotoluene	140	2500	1 #	2.8	14	NE	NE	NE
2,6-dinitrotoluene	68	2000	1 #	1.4	10 #	NE	NE	NE
endosulfan I	410	1200	0.84	8.4	42	NE	NE	NE
endosulfan II	410	1200	0.84	8.4	42	NE	NE	NE
endosulfan sulfate [3]	410	1200	0.84	8.4	42	NE	NE	NE
endrin aldehyde [4]	20	610	NE	NE	NE	NE	NE	NE

Approved Criteria for Additional Polluting Substances

Pursuant to Sections 22a-133k(1) through (3) of the Regulations of Connecticut State Agencies

Pollutant	Soil (mg/kg)				Groundwater (µg/l)			
	RES DEC	I/C DEC	GAA/ GA PMC	GB PMC	GWPC	SWPC	RES VC	I/C VC
endrin ketone [5]	20	610	NE	NE	NE	NE	NE	NE
hexachlorobutadiene	7.9	73	1 #	1 #	0.45	NE	NE	NE
hexachlorocyclopentadiene	470	2500	1 #	9.8	49	NE	NE	NE
indeno(1,2,3-cd)pyrene	1 #	7.8	1 #	1 #	0.5 #	NE	NE	NE
isophorone	640	2500	1 #	7.4	37	NE	NE	NE
isopropylbenzene (cumene)	500	1000	0.6	132 [14]	30 [15]	NE	NE	NE
4-isopropyltoluene (p-cymene)	500	1000	0.6	41.8	30 [15]	NE	NE	NE
p-isopropyltoluene [9]	NE	NE	1.4	14	70	NE	NE	NE
2-methylnaphthalene [7]	474	2500	0.98	9.8	49	NE	NE	NE
2-methylphenol	1000	2500	7	70	350	NE	NE	NE
4-methylphenol	340	2500	1 #	7	35	NE	NE	NE
2-nitroaniline	4.1	1200	1.65 #	1.65 #	50 #	NE	NE	NE
3-nitroaniline	200	2500	1.65 #	4.2	50 #	NE	NE	NE

Approved Criteria for Additional Polluting Substances

Pursuant to Sections 22a-133k(1) through (3) of the Regulations of Connecticut State Agencies

Pollutant	Soil (mg/kg)				Groundwater (µg/l)			
	RES DEC	I/C DEC	GAA/ GA PMC	GB PMC	GWPC	SWPC	RES VC	I/C VC
4-nitroaniline	200	2500	1 #	4.2	21	NE	NE	NE
nitrobenzene	34	1000	1 #	1 #	10 #	NE	NE	NE
2-nitrophenol	540	2500	1.1	11	56	NE	NE	NE
N-nitrosodiphenylamine	130	1200	1 #	1.4	10 #	NE	NE	NE
N-nitrosodi-n-propylamine	1 #	1 #	1 #	1 #	10 #	NE	NE	NE
n-propylbenzene	500	1000	1.4	14	61 [13]	NE	NE	NE
1,2,4-trichlorobenzene	680	2500	1.4	14	70	NE	NE	NE
trichloroflouroethane [11]	NE	NE	NE	NE	20000	NE	NE	NE
trichloroflouromethane	500	1000	26	260	1300	NE	NE	NE
2,4,5-trichlorophenol	1000	2500	14	140	700	NE	NE	NE
2,4,6-trichlorophenol	56	520	1 #	1 #	10 #	NE	NE	NE
1,2,4-trimethylbenzene	500	1000	7	70	350	NE	NE	NE
1,3,5-trimethylbenzene	500	1000	7	70	350	NE	NE	NE

Approved Criteria for Additional Polluting Substances

Pursuant to Sections 22a-133k(1) through (3) of the Regulations of Connecticut State Agencies

NE Not Established

\# Criteria based on detection limits.

Notes: [1] BCH(alpha) used as surrogate for BCH (delta).

[2] 4-bromophenyl-phenyl ether used as surrogate for 4-chlorophenyl-phenyl ether.

[3] Endosulfan used as surrogate for endosulfan sulfate.

[4] Endrin used as surrogate for endrin aldehyde.

[5] Endrin used as surrogate for endrin ketone.

[7] Based on an interim acceptable exposure level of 0.007 mg/kg developed by DPH. Criteria to be used for screening purposes.

[8] Pyrene used as surrogate for benzo(g,h,i)perylene.

[9] Screening level for p-isopropyltoluene is based on isopropylbenzene as a surrogate. Also known as methylisopropylbenzene.

[10] Diethyl phthalate used as surrogate for dimethyl phthalate.

[11] Based on odor threshold. Also known as Freon 113 and 1,1,2-trichloro-1,2,2-triflouroethane.

[12] Based on health based GWPC of 209 μg/l; toxicity is estimated to be three fold greater than cumene.

[13] GWPC from Region III table which incorporates inhalation and drinking exposure routes.

[14] Based on health based GWPC of 660 μg/l.

[15] GWPC based on odor detection from volatilization during showering.