STEWARDSHIP PERMIT
SECTION I
STANDARD FACILITY CONDITIONS

A. EFFECT OF PERMIT

Except as is provided in the Regulations of Connecticut State Agencies (RCSA) Section 22a-449(c)-110(a)(2) and except for any federally enforceable requirement(s), compliance with this permit during its term constitutes compliance, for purposes of enforcement, with Connecticut General Statutes (CGS) Section 22a-449(c). This permit may be modified, revoked and reissued, or terminated during its term as set forth in RCSA Section 22a-449(c)-110(a)(1), which incorporates by reference Title 40 of the Code of Federal Regulations (40 CFR) Parts 270.41, 270.42 and 270.43.

The issuance of this permit does not authorize any injury to persons or property or invasion of other private rights, or any infringement of state or local law or regulations.

Term (Duration) - The effective date of this permit is the date on which the permit is signed by the Commissioner. This permit is in effect for a term of ten (10) years and may be renewed at the end of the term, in accordance with the requirements described in Condition No. I.E.2., "Duty to Reapply."

In accordance with 40 CFR 270.73(a), upon issuance of this permit the Permittee's Interim Status granted under RCRA is hereby terminated. In addition, upon the Commissioner's determination that the Permittee has satisfied the requirements of this permit, a Certificate of Completion shall be issued to the Permittee.

B. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

C. CONFIDENTIAL INFORMATION

The Permittee may claim that any information required to be submitted by this permit contains or constitutes confidential information in accordance with CGS Section 1-210(b).

D. IMMINENT HAZARD ACTIONS

Notwithstanding any provision of this permit, enforcement actions may be brought pursuant to Section 7003 of the Resource Conservation and Recovery Act (RCRA), CGS Section 22a-6, or any other applicable law.

E. DUTIES AND REQUIREMENTS

1. Duty to Comply. The Permittee shall comply with all conditions of this permit except that the Permittee need not comply with the conditions of this permit to the extent and for the duration such noncompliance is authorized in an Emergency Permit that explicitly authorizes any such noncompliance. Noncompliance by the Permittee with the terms of this permit, except under the terms of an Emergency Permit, shall constitute a violation of this permit and any applicable laws or regulations and is grounds for enforcement action, for permit termination, revocation and reissuance or for denial of a permit renewal. Emergency Permit as used herein shall mean Emergency Permit as identified in RCSA Section 22a-449(c)-110(a)(1) incorporating 40 CFR 270.61.

   Unless superseded by a more stringent provision in this permit, the Permittee shall comply with all of the applicable requirements of RCSA Sections 22a-133k-1 et. seq. ("Remediation Standard Regulations" or "RSRs"), as amended, and 22a-449(c)-100 et. seq., including any portion of 40 CFR 260 through 279 incorporated by reference therein.

   A violation of this permit for purposes of state and federal law constitutes a violation of a RCRA permit.

2. Duty to Reapply. This permit shall expire within ten (10) years of the effective date of this permit. If the Permittee wishes to continue engaging in an activity regulated by this permit after the expiration date of this permit, the Permittee shall apply for renewal of this permit in accordance with RCSA Sections 22a-3a-5 and 22a-449(c)-104(a) incorporating 40 CFR 264.101 and any other applicable law.

3. Obligation for Corrective Action. The Permittee is required to continue this permit for any period necessary to comply with the corrective action requirements of this permit.

4. Need to Halt or Reduce Activity Not a Defense. It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce any activity authorized by this permit in order to maintain compliance with the conditions of this permit, unless otherwise required to do so by another state or federal authority.

5. Duty to Mitigate. In the event of noncompliance with this permit, the Permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent its noncompliance from having significant adverse impacts on human health or the environment. No action taken by the Permittee pursuant to this section of this permit shall affect or limit the Commissioner's authority under any other statute or regulation.

6. Permit Actions. This permit may be modified, revoked and reissued, or terminated as provided for in 40 CFR 270.41, 270.42 or 270.43, and in

accordance with all applicable law, including but not limited to, CGS Sections 22a-6g and 6h and RCSA Sections 22a-3a-5 and 22a-449(c)-110. The filing of a request by the Permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any condition of this permit.

7. Property Rights. This permit does not convey any property rights of any sort, or any exclusive privilege to the Permittee.

8. Duty to Provide Information. The Permittee shall furnish to the Commissioner, within a reasonable time, any information which the Commissioner may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee shall also furnish to the Commissioner, upon request, copies of records required to be kept by this permit.

9. Operation and Maintenance of Remedial Systems. The Permittee shall at all times properly operate and maintain all facilities and remedial systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance, at a minimum, includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of backup, auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit.

10. Inspection and Entry. The Permittee shall allow the Commissioner, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

(a) Enter at reasonable times upon the Site where a regulated activity is located or conducted, or where records must be kept under the conditions of this permit;

(b) Have access to and copy, at reasonable times, any records that shall be kept under the conditions of this permit;

(c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, operations regulated or required under this permit; and

(d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by RCRA, any substance or parameters at any location.

11. Security. Pursuant to RCSA Section 22a-449(c)-104 incorporating 40 CFR 264.14, the Permittee shall prevent the unknowing entry, and minimize the possibility for unauthorized entry, of persons or livestock onto the active portion of the Facility. The Permittee shall secure the Facility to the extent necessary to protect human health.

12. Preparedness, Prevention, Contingency Plan and Emergency Procedures.
    (a) The Permittee shall comply with the requirements of RCSA Section 22a-449(c)-104(a)(1) incorporating 40 CFR 264 Subpart C "Preparedness and Prevention" and 40 CFR 264 Subpart D "Contingency Plan and Emergency Procedures" until the termination of this permit.

    (b) The Permittee shall ensure that each entity under contract to provide emergency response services at the Facility has a permit, issued by the Commissioner pursuant to CGS Section 22a-454, authorizing such entity to provide emergency response services. The Permittee shall maintain a copy of such permit in the operating record for its Facility. The Permittee shall ensure that any action(s) taken by an entity (including such entity's officers, employees, agents and subcontractors) providing emergency response services at its Facility conforms to the requirements of this permit.

    (c) The Permittee shall ensure that each entity under contract with the Permittee to provide emergency response services visits the Site annually so that such entity is familiar with the Permittee's Site and can respond to an emergency. The Permittee shall maintain in the operating record for its Facility a certification, in accordance with the requirements of RCSA Section 22a-449(c)-110 incorporating 40 CFR 270.11, attested to by each emergency response entity under contract with the Permittee to provide emergency response services, stating that such entity has complied with the requirements specified in this paragraph.

13. Monitoring and Records.
    (a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

    (b) The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, the certification required by RCSA Section 22a-449(c)-104 incorporating 40 CFR 264.73(b)(9), and records of all data used to complete the application for this permit, for a period of at least three (3) years from the date of the sample, measurement, certification, report or application. This period may be extended by request of the Commissioner at any time. The Permittee shall maintain records from all groundwater monitoring wells and associated groundwater surface

elevations, for the active life of the Facility, and for disposal facilities for the post-closure care period as well.

(c) Records for monitoring information shall include:
- (i) The date, exact place and time of sampling or measurements;
- (ii) The individual(s) who performed the sampling or measurements;
- (iii) The date(s) analyses were performed;
- (iv) The individual(s) who performed the analyses;
- (v) The analytical techniques or methods used; and
- (vi) The results of such analyses.

14. Operating Record. The Permittee shall maintain, in writing, the following information in the Facility's operating record until termination of this permit:

(a) Summary reports and details of all incidents that require implementing the Contingency Plan pursuant to 40 CFR 264 Subpart D;

(b) Records and results of inspections as required by this permit, except this data need only be kept for three (3) years from the date of any such inspection;

(c) Monitoring, testing or analytical data, and corrective action where required by 40 CFR 264 Subpart F or any regulatory section noted in 40 CFR 264.73(b)(6);

(d) All closure, post-closure and corrective action cost estimates under RCSA Section 22a-449(c)-104 and 40 CFR 264.142 and 40 CFR 264 Subpart H; and

(e) Any other information required by this permit or by any applicable law to be maintained in the Facility Operating Record.

15. Signatory Requirements. The Permittee's application and all reports or information submitted to the Commissioner by the Permittee pursuant to this permit shall be signed by the person specified in and contain the certification prescribed in RCSA Section 22a-449(c)-110 incorporating 40 CFR 270.11.

16. Transfers. This permit is not transferable to any person without the advanced written authorization of the Commissioner, who may request whatever information the Commissioner deems necessary regarding the potential transferee. Before any such transfer, the Permittee and any proposed transferee shall fully comply with the requirements of CGS Section 22a-6o. The Commissioner may require modification or revocation and reissuance of this permit to change the name of the Permittee and as an incident to any such transfer, incorporate such other requirements, as the Commissioner deems necessary.

In advance of transferring ownership or operation of its Facility prior to the termination of this permit, the Permittee shall notify the prospective new owner or

operator in writing of the requirements of this permit, 40 CFR 264 through 270, and of the RCSA Section 22a-449(c)100 et. al. The Permittee shall provide such prospective new owner or operator with a copy of this permit.

The Permittee's failure to notify the new Permittee of the requirements of this permit in no way relieves the new Permittee of his obligations to comply with all applicable requirements.

If the transfer of the property takes place and the Permittee retains the permit, an access agreement between the Permittee and the prospective new owners of the Facility shall be approved by the Commissioner prior to the sale of the facility/site. The agreement shall include the anticipated times, locations and frequency of access needed in order for the Permittee to complete closure, post-closure care and corrective action activities and conduct inspection, operation and management activities for all remedial systems. A copy of the Operations and Management Plan, referenced in Condition No. I.E.9. of this permit, shall be provided to the prospective new owner prior to transfer of the property.

17. Reporting Requirements.

(a) Anticipated Non-Compliance. The Permittee shall give as much advance written notice as possible to the Commissioner of any planned changes in the Facility or activity, which may result in non-compliance with any requirement of this permit.

(b) Compliance Schedules. Except where otherwise provided for in this permit, reports of compliance and non-compliance with, or any progress reports on, interim and final requirements contained in any Compliance Schedule (Section III) of this permit, shall be submitted no later than fourteen (l4) calendar days following each schedule date, to the extent such reports are required herein.

(c) Twenty-four Hour Reporting.

(i) The Permittee or designee shall orally report to the Commissioner any remediation or waste related activity at its Facility, irrespective of whether such activity is in compliance with the requirements of this permit, which does or may pose an imminent and substantial endangerment to human health or the environment, immediately but not later than twenty-four (24) hours from the time the Permittee becomes aware or should be aware of the circumstances causing such endangerment.

The report to the Commissioner shall include:

(A) Name, address, and telephone number of the Permittee;
(B) Name, address, and telephone number of the Facility;
(C) Date, time and type of incident;
(D) Description of the occurrence and its cause;

(E) Name and quantity of waste(s) or constituents thereof involved;
(F) The extent of injuries, if any;
(G) An assessment of actual or potential hazards to human health and the environment;
(H) Estimated quantity and disposition of recovered waste that resulted from the incident;
(I) All information concerning the release of any waste or constituents thereof that may cause an endangerment to public drinking water supplies; and
(J) All information concerning a release or discharge of waste or constituents thereof or of a fire or explosion from the Facility, which could threaten human health or the environment

(ii) A written submission shall also be provided within five (5) calendar days of the time the Permittee becomes aware of the circumstances described in subdivision (i) above. The written submission shall contain a description of the endangerment and its cause; the period of endangerment including exact dates and times, if the endangerment has been abated, and if not, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the endangerment. The Permittee shall maintain in the operating record of its Facility a copy of all such written reports. The Commissioner may waive the five (5) day written notice requirement in favor of a written report within fifteen (15) days of the incident requiring reporting.

(iii) Nothing in this section shall effect or relieve the Permittee of its obligations under CGS Sections 22a-6u or 22a-450.

(d) Other Noncompliance. The Permittee shall report all instances of noncompliance with this permit not otherwise required to be reported by this permit to the Commissioner along with any other required monitoring report, no later than thirty (30) days of the date the Permittee is aware, or reasonably should have been aware of any such noncompliance. Any such report shall contain, at a minimum, the information listed in Condition No. I.E.17.(c)(i) of this permit.

(e) Other Information. When the Permittee becomes aware that it failed to submit any relevant facts or information in a permit application, or submitted incorrect information in a permit application, report or other document provided to the Commissioner regarding this permit, it shall submit such relevant facts or correct information to the Commissioner within thirty (30) calendar days of becoming aware of such facts or information.

18. Computation of Time.
    (a) Except as is expressly provided for in this permit, the computation of time periods set forth in this permit shall be as follows:
        (i) Any time period scheduled to begin on the occurrence of an act or event shall begin on the day after the act or event.
        (ii) Any time period scheduled to begin before the occurrence of an act or event shall be computed so that the period ends on the day before the act or event.
        (iii) If the final day of any time period falls on a Saturday, Sunday or a federally or state recognized legal holiday, the time period shall be extended to the next working day.

    (b) Submission of Reports. Where this permit requires the submission of a written report, a notification or other information or documentation to the Commissioner, the report or notification shall be deemed submitted on the date such report, notification or other information is received by the Department of Environmental Protection ("DEP").

19. Availability, Retention and Disposition of Records. The Permittee shall ensure that all records required under RCSA Sections 22a-449(c)-100 to 119, RCSA Section 22a-133k et. seq. (RSRs) or this permit, including all plans, are furnished upon request, and made available at all reasonable times for inspection, by any officer, employee, or representative of DEP or Environmental Protection Agency ("EPA").

    The retention period for all records required under RCSA Sections 22a-449(c)-100 to 119 and this permit is extended automatically during the course of any unresolved enforcement action regarding the Facility or as requested by the Commissioner or Regional Administrator of EPA.

20. Additional Requirements. Requirements not included in this permit, which become effective by statute or regulation, and not made specifically inapplicable to facilities with a permit, shall apply to the Permittee's Facility. In the event of any conflict between this permit and any such requirement, the Permittee shall comply with the more stringent requirement. If the Permittee does not fully comply with the more stringent requirement, DEP may enforce either requirement.

21. Federal and State Laws. Nothing in this permit shall be construed to prohibit any federal, state or political subdivision thereof from imposing any requirements to the extent authorized by law which are more stringent than those imposed by this permit.
    In addition, nothing in the permit shall relieve the Permittee of its obligation to comply with any other applicable federal, state, or local statute, regulation or ordinance.

22. Modification of the Compliance Schedule.

(a) The Commissioner may modify the Compliance Schedule, Section III, of this permit at any time, if it is deemed necessary.

(b) Modifications that are initiated and finalized by the Commissioner shall be in accordance with the requirements of RCSA Section 22a-449(c)-110 incorporating 40 CFR 270 and all applicable provisions. At any time, the Permittee may request to modify the Compliance Schedule of this permit in accordance with the requirements of 40 CFR 270.

(c) The Commissioner may grant extensions of submittal due dates based on the Permittee's demonstration that sufficient justification for the extension exists. Extensions to due dates, which this permit explicitly defines as being due by a certain time or during a certain time interval, may be granted by the Commissioner if sufficient justification for the extension is demonstrated by the Permittee. Extensions to permit established schedules must follow the procedures in Condition No. I.E.22.(b).

F. DEFINITIONS

Any term not otherwise defined herein shall be defined as that term is defined in RCSA 22a-449(c)-100 thru 119 incorporated 40 CFR 264 through 279.

1. "CFR" means the Code of Federal Regulations in effect on the date that this permit is issued.

2. "Commissioner" means the Commissioner of Environmental Protection as defined in the CGS Section 22a-2 or the Commissioner's designee.

3. "Facility" shall mean, pursuant to 40 CFR 260.10 all contiguous land, and structures, other appurtenances, and improvements on the land, used for treating, storing or disposing of hazardous waste and all contiguous property under control of the owner or operator. For the purposes of the permit, shall also mean the 76.70-acre parcel of land located at 550 Main Street in Stratford, CT and subject to the requirements of this permit.

4. "Final Closure" means the completion of the closure of all Hazardous Waste Management Units at the Permittee's Facility in accordance with the requirements of this permit.

5. "Hazardous Waste" or "Hazardous Wastes" shall mean hazardous waste as identified or listed as hazardous waste pursuant to 42 U.S.C. Section 6901 et. seq. and RSCA Section 22a-449(c)-101.

6. "Hazardous Waste Management Units", unless specifically limited by this permit or unless the context unequivocally indicates otherwise (e.g., that reference is being made to only one and not all areas), shall mean the following units identified in Table II-1 of this permit: 1) AOC 2 – Hazardous Waste Accumulation Tanks; 2) AOCs 12 and 53 Hazardous Waste Container Accumulation Areas; 3) AOC-13 Container Storage Area; 4) AOC-14 Container Storage Areas A and B; 5) AOC-15 Sludge Roll-off Area; and 6) NPDES Wastewater Treatment Plant.

7. "Main Parcel" means the 51.54 acres of the Site east of Main Street and north of Sniffen Lane, comprising the largest part of the Site, and containing most of the major buildings.

8. "NPDES Wastewater Treatment Plant" shall include the chemical wastewater treatment plant, collection and distribution lines, flow equalization tank, and the following areas of concern identified in Table II-1 of this permit: AOC-8 Collection Lines, AOC-9 Cyanide Destruction Facility, AOC-10 Building 18 Chemical Wastewater Treatment Plant, AOC-19 Chemical Wastewater Treatment Plant Solids Handling Area; and AOC-25 Outfall 008.

9. "Period of Active Remediation" shall mean the period prior to completion of activity conducted pursuant to Section II.B. of this permit, with the exception of that period when the only remaining activity is post-remedial monitoring or monitored natural attenuation.

10. "Permittee" shall mean the person responsible for the overall operation of the facility who has been issued a license by the Commissioner. As used herein "person" is defined in Section 22a-423, Chapter 446k, of the CGS and "license" is defined in Section 4-166, Chapter 54 of the CGS.

11. "Post-Closure Period" means thirty (30) years from the date of certification of closure of a regulated unit. This period may be extended or shortened by the Commissioner in accordance with 40 CFR 264.117(a)(2).

12. "Site" means the same or geographically contiguous property which may be divided by public and private right-of-way, provided the entrance and exit between the properties is at a cross-road intersection, and access is by crossing opposed to going along, the right-of-way. Non-contiguous properties owned by the same person but connected by a right-of-way that he controls and to which the public does not have access, is also considered part of the site property.

    For the purposes of this permit, there are three separate sites: "Main Parcel", "West Parcel", and "South Parcel" that comprise the facility. Herein after the term "site" shall refer to all three separate sites. The terms "facility" and "site" may be used interchangeably in this permit.

13. "South Parcel" means the 21.60 acres of the Site that is south of Sniffen Lane and east of Main Street, including, along with other elements, Building B6, the South Parking Lot, the industrial wastewater treatment facility, and the closed RCRA Land Disposal Units (lagoons).

14. "West Parcel" means the 3.56 acres of the Site that is west of Main Street, comprised of a parking lot.

SECTION II

Stewardship Permit
Authorized Activities

Stratford Army Engine Plant
EPA ID No. CTD001181502
Permit No. DEP/HWM/CS-134-003

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Section II – Authorized Activities

SECTION II
AUTHORIZED ACTIVITIES

A. RCRA CLOSURE AND POST-CLOSURE REQUIREMENTS

1. Closure Requirements.

(a) The Permittee shall prepare and submit a Closure Plan in accordance with the requirements of RCSA Section 22a-449(c)-104(a)(1) incorporating 40 CFR 264 Subpart G for the Commissioner's review and written approval. The Closure Plan shall:

(i) Be developed in accordance with the standards set forth in the DEP's *Draft RCRA Closure Plan Guidance – Container Storage Areas and Tank Systems and Treatment, Storage and Disposal Facilities (December 28, 2005);*

(ii) Describe the specific materials stored and activities performed for each Hazardous Waste Management Unit;

(iii) Describe the procedures to be used for the removal of any remaining waste(s), the decontamination of the Hazardous Waste Management Units, and the removal of any contaminated structures and equipment;

(iv) Include a proposed schedule for all major closure milestones such as removal of waste, implementation of decontamination and verification measures and the submission of a final report;

(v) Describe the measures to be taken to verify that closure has been completed in accordance with the Closure Plan; and

(vi) Include a description of how the proposed closure activities will interrelate with site-wide corrective action activities.

(b) The Permittee shall close the Hazardous Waste Management Units in accordance with the Closure Plan submitted and approved pursuant to Condition No. II.A.1.(a) of this permit (herein after, the "approved Closure Plan").

(c) Copy of Closure Plan. The Permittee shall ensure that a copy of the approved Closure Plan is kept at the Facility or at an alternate location acceptable to the Commissioner until Final Closure has been completed and certified in accordance with the requirements of this permit.

(d) Notification of Closure. The Permittee shall notify the Commissioner in writing at least ninety (90) calendar days prior to the date it expects to begin Final Closure of the Hazardous Waste Management Units.

(e) Schedule for Closure. The Permittee shall complete Final Closure activities, as applicable, in accordance with the approved Closure Plan. The Commissioner may approve a longer period for closure if the Permittee demonstrates to the Commissioner's satisfaction that the

activities required to comply with the approved Closure Plan will of necessity take longer than twenty-four (24) months to complete and that the Permittee has taken and will continue to take all steps needed to prevent threats to human health and the environment and will comply with any additional conditions deemed necessary by the Commissioner arising from the Final Closure.

(f) Closure Cost Estimate. The Permittee shall prepare and maintain at the Facility or at an alternate location acceptable to the Commissioner a written estimate of the cost of closing the Hazardous Waste Management Units. The Permittee shall ensure that this written estimate is prepared in accordance with the methodology specified in RCSA Section 22a-449(c)-104 incorporating 40 CFR 264.142(a).

(g) Completion of Closure. Within sixty (60) calendar days of the completion of Final Closure, the Permittee shall submit to the Commissioner by registered mail, a certification signed by both the Permittee and by an independent registered professional engineer stating that the Hazardous Waste Management Units, as applicable, have been closed in accordance with the approved Closure Plan. Documentation supporting the independent, registered professional engineer's certification shall be furnished to the Commissioner upon request.

(h) Liability Coverage. The Permittee shall establish and continuously maintain liability coverage for sudden accidental occurrences at the Facility in the amounts and in the manner specified in RCSA Section 22a-449(c)-104 incorporating 40 CFR 264.147(a). The Permittee shall ensure that the wording of the liability coverage secured for the purposes of compliance with this section of the permit is identical to the wording specified in 40 CFR 264.151, except that all references to the "Regional Administrator of EPA" shall be changed to the "Commissioner of DEP." The Permittee shall maintain such liability coverage in effect until the Commissioner notifies the Permittee in writing that maintaining such coverage is no longer required, as is provided for in Condition No. II.A.1.(i) of this permit.

(i) Release of Liability Coverage. Within sixty (60) calendar days after receiving certifications, submitted pursuant to Condition No. II.A.1.(g), from the Permittee and an independent registered professional engineer that Final Closure has been completed in accordance with the approved Closure Plan, the Commissioner will notify the Permittee in writing that it is no longer required to maintain liability coverage for the Facility, unless the Commissioner has reason to believe that Final Closure has not been performed and/or completed in accordance with the approved Closure Plan. The Commissioner shall provide the Permittee with a detailed written statement of any such reason to believe that closure has not been

performed and/or completed in accordance with the approved Closure Plan.

2. Post-Closure Requirements

(a) Post-Closure Care Plan. The Permittee shall perform post-closure care of the land disposal units as specified in an Post-Closure Plan, included in Textron Lycoming's Post-Closure Permit Application received December 17, 1991 (included in Appendix B-2 of this permit) until it is superseded by the approval of a revised Post-Closure Plan submitted pursuant to Condition No. II.A.2.(b) of this permit (herein after, the "approved Post-Closure Plan") .

(b) Revised Post-Closure Care Plan. The Permittee shall prepare and submit for the Commissioner's review and written approval a revised post-closure care plan for the closed land disposal units developed in accordance with the requirements set forth in 40 CFR 264 Subparts F, G and K. In the event that it is determined that the closure of any other Hazardous Waste Management Unit requires the designation as a land disposal unit, the Permittee shall incorporate the post-closure care for such units in the revised post-closure plan. The revised post-closure care plan shall include:

(i) A description and frequency of the planned maintenance and inspection activities that will be performed to ensure: (A) the integrity of the cap/final cover and/or other containment systems; and (B) the function of the monitoring equipment;

(ii) A compliance monitoring program developed in accordance with the requirements of RCSA Section 22a-449(c)-104 incorporating 40 CFR 264.99, and an evaluation of the existing monitoring data to determine if compliance is achievable;

If it is determined that compliance can not be achieved the Permittee shall include a description of how corrective action, required pursuant to 40 CFR 264.100, will be interrelated into site-wide corrective activities.

(iii) The name, address and phone number of the Facility contact person during the Post-Closure Care Period;

(iv) A schedule for the reporting requirements, including but not limited to, groundwater monitoring reports, scheduled and unscheduled inspection and maintenance reports, and corrective action reports resulting from inspection and maintenance activities; and

(v) A detailed estimate of the cost of performing post-closure care of the land disposal units developed in accordance with the 40 CFR 265 Subpart H.

(c) Modifications of Post-Closure Plan. The Permittee shall submit a written notification or request for a permit modification to authorize a change in the approved Post-Closure Plan in accordance with the applicable requirements of 40 CFR 124 and 40 CFR 270. The written notification or request must include a copy of the amended post-closure plan for the Commissioner's review and written approval.

(d) Copy of Post-Closure Plan. The Permittee shall ensure that a copy of the approved Post-Closure Plan is kept at the Facility or at an alternate location acceptable to the Commissioner, until the Post-Closure Care Period has been completed and certified in accordance with the requirements of this permit.

(e) Completion of Post-Closure Plan. Within sixty (60) calendar days of the completion of post-closure care, the Permittee shall submit to the Commissioner by registered mail, a certification signed by both the Permittee and by an independent registered professional engineer stating that the post-closure care period for the land disposal units, was performed in accordance with the specifications in the approved Post-Closure Plan. Documentation supporting the independent, registered professional engineer's certification shall be furnished to the Commissioner upon request.

B. RCRA CORRECTIVE ACTION REQUIREMENTS

1. Performance of Corrective Action. The Permittee shall perform corrective action in accordance with the requirements of this permit, the Remedial Action Plan(s) ("RAPs") submitted and approved pursuant to Condition Nos. II.B.2.(f), II/B.2.(g) and II.B.7. of this permit, and any other plan(s) submitted and approved pursuant to this permit.

   The Permittee shall ensure that further investigations for each SWMU and AOC are completed within two (2) years from the date of initiation of such investigation; and that remediation is initiated within three (3) years from the date of initiation of investigation of any SWMU or AOC and completed within ten (10) years of issuance of this permit or in accordance with an alternative schedule approved in writing by the Commissioner.

   The Federal Governments' obligations under this permit shall be subject to the availability of appropriated funds. Nothing in this permit shall be interpreted to require obligations or payments by the Federal Government in violation of the Anti-Deficiency Act (31. U.S.C. §1341).

   The conditions of this section apply to:

   (a) The Solid Waste Management Units ("SWMUs") and Areas of Concern ("AOCs") as identified in Table II-1;

   (b) Any additional SWMUs and AOCs discovered during the course of corrective action, characterization, groundwater monitoring, field investigations, environmental audits, or other means; and

   (As used in this permit, the terms "discover," "discovery," or "discovered" refer to the date on which the Permittee either: (i) visually observes evidence of a new SWMU or AOC, (ii) visually observes evidence of a previously unidentified release of hazardous constituents to the environment, (iii) receives information which suggests the presence of a new release of hazardous waste or hazardous constituents to the environment, or (iv) receives information which suggests the presence of a previously undocumented release of hazardous waste or hazardous waste constituents to the environment.)

   (c) Contamination that has migrated or may migrate beyond the Facility boundary, whereas necessary to protect human health and the environment.
   The Permittee shall implement corrective actions beyond the Facility boundary where necessary to protect human health and the environment

consistent with RCSA Section 22a-449(c)-104 incorporating 40 CFR 264.101(c), unless the Permittee demonstrates, to the satisfaction of the Commissioner, that despite the Permittee's best efforts, as determined by the Commissioner, the Permittee was unable to obtain the necessary permission to undertake such actions. The Permittee is not relieved of all responsibility to clean up a release that has migrated beyond the Facility boundary where off-site access is denied. On-site measures to address such releases will be determined on a case-by-case basis. Assurances of financial responsibility for completion of such off-site corrective action will be required.

2. Schedule/Scope of Work. The Permittee shall submit schedule(s)/scope(s) of work for the investigation and remediation of releases of hazardous waste and hazardous substances at or from the Facility such that the remediation will achieve compliance with RCSA Section 22a-133k-1 et seq. (Remediation Standard Regulations). Such schedule(s) and scope(s) of work shall be submitted pursuant to Condition No. III.C.6. of this permit and shall include, at a minimum, a schedule for development and implementation of the following plans and/or reports:

(a) For each SWMU and AOC listed in Table II-1:

(i) Identification of Data Gaps. The Permittee shall submit a report, for the Commissioner's review and written approval, with the rationale used for determining whether (1) no further investigation is required, or (2) additional investigation is necessary to fill any significant data gaps. If additional investigation is needed, the Permittee shall submit a plan for the implementation of such investigations and a report summarizing the findings.

(ii) Evaluation of Compliance with the RSRs. The Permittee shall submit a summary of the: 1) rationale used to determine that no remediation is needed; and 2) identification of all areas identified as exceeding any remedial criteria and the additional characterization data needed to complete the remedial design in order to achieve compliance with RSRs for polluted soil and groundwater.

(iii) Schedule for Remediation. The Permittee shall submit for the Commissioner's review and written approval a description and schedule for the development of one or more RAPs that collectively address all areas of contamination that exceed the RSR criteria.

Such description and schedule may propose activity be conducted in phases associated with the redevelopment of the Site, or focus on a particular environmental medium, reasonably deferring filling the data gap to the remedial design stage where appropriate.

(b) Quality Assurance Project Plan. The Permittee shall prepare and submit for the Commissioner's review and written approval a revised Quality Assurance Project Plan ("QAPP"), prepared in accordance with the document titled: Quality Assurance Guidance for Conducting Brownfields Site Assessments, US Environmental Protection Agency OSWER Directive No. 9230.0-83P, and incorporating Connecticut's Reasonable Confidence Protocols. The Permittee shall ensure that the data is of sufficient quality to make decisions regarding the investigation and remediation of the Site.

(c) Preconstruction Survey. The Permittee shall conduct a pre-renovation/pre-demolition survey of the Site, before building conditions deteriorate, which includes, but is not limited to, the measures to be: 1) taken to identify building components such as switches, fluorescent lamps and ballasts and asbestos that require special handling; and 2) used to identify areas of the structures that require decontamination if they are to be reused, or special handling if they are to be demolished. A summary of the finding of the survey shall be submitted for the Commissioner's review.

(d) Site Control Plan. The Permittee shall describe the plans for controlling access to any remaining contaminated area(s) of the Site until remediation activities in these areas have been completed.

(e) For the groundwater migrating off the Site to the tidal flats and other nearby surface waters, the Permittee: 1) shall develop for the Commissioner's review and written approval ecologically based and human health based remedial criteria; and 2) shall develop, in accordance with the requirements of Condition No. II.B.7. of this permit, for the Commissioner's review and written approval, and shall subsequently implement, a RAP to ensure that groundwater migrating from the Site will achieve such criteria within a reasonable timeframe.

Any RAP containing monitored natural attenuation as the selected remedy for groundwater migrating off the Site shall include: 1) an evaluation of the need for source mitigation to achieve remedial criteria; 2) a monitoring and data evaluation plan designed to evaluate the remedy performance; and 3) a contingency remedy conceptual approach in the event that monitored natural attenuation does not perform as anticipated and a schedule for implementation.

(f) For the sediments within the tidal flats and 008 outfall area the Permittee: 1) shall develop for the Commissioner's review and written approval ecologically based and human health based remedial criteria; and 2) shall develop, in accordance with the requirements of Condition No. II.B.7. of this permit, for the Commissioner's review and written approval, and shall subsequently implement, a RAP to achieve such criteria for such sediment.

3. Notification and Assessment Requirements for Newly Identified SWMUs and AOCs.

The Permittee shall notify the Commissioner in writing, within fifteen (15) calendar days of discovery, of any new suspected or confirmed AOCs or SMWUs as discovered under Condition No. II.B.1.(b). Such notification shall include, at a minimum, the following information:

(a) Location of the unit(s) on a topographic map of appropriate scale (such as required under 40 CFR 270.14(b)(19));

(b) Designation of the type and function of unit(s);

(c) General dimensions, capacities and structural description of unit(s) (supply any available plans/drawings);

(d) The date that the unit(s) was operated;

(e) Specifications of all wastes that have been managed at/in the unit(s) to the extent available. Include any available data on hazardous constituents in the wastes; and

(f) All available information (groundwater data, soil, soil gas, sediment, air, and/or surface water data) pertaining to any release of hazardous waste or hazardous constituents from such unit(s).

4. Notification Requirements for Newly Discovered Releases From SWMUs and AOCs.

(a) The Permittee shall notify the Commissioner in writing of any newly discovered release(s) of hazardous waste or hazardous constituents discovered during the course of characterization, groundwater monitoring, field investigations, environmental audits, or other means, within fifteen (15) calendar days of discovery.

Such newly discovered release(s) may be from SWMUs or AOCs identified in Condition No. II.B.1.(b) or SWMUs or AOCs previously identified for which it had been determined that further investigation was not required.

(b) If the Commissioner determines that further investigation of the SWMUs or AOCs is needed, the Permittee shall be required to prepare a plan for such investigations within sixty (60) calendar days of notification by the Commissioner.

5. Interim Measures (IM)

(a) Work Plan

(i) Upon notification by the Commissioner, the Permittee shall prepare and submit an Interim Measures ("IM") Work Plan for any SWMU or AOC that the Commissioner determines is necessary in order to minimize or prevent the further migration of contaminants, thereby limiting current and future potential for human and environmental exposure to contaminants while long-term corrective action remedies are evaluated and, if necessary, implemented.

The IM Work Plan shall be submitted within sixty (60) calendar days of such notification and shall include the elements listed in Condition No. II.B.5.(a)(iii). Such interim measures may be conducted concurrently with investigations required by this permit.

(ii) The Permittee may initiate IM at a SWMU or AOC by submitting the appropriate notification pursuant to this permit. The Commissioner will process Permittee initiated IM by either conditionally approving the IM or imposing an IM Work Plan per Condition II.B.5.(a)(i). Permittee initiated IM shall be considered conditionally approved unless the Commissioner specifically imposes an IM Work Plan within thirty (30) calendar days of receipt of notification of the Permittee initiated IM. The scope and success of Permittee initiated IM conditionally approved shall be subject to subsequent in-depth review; the Commissioner will either comment on or approve the Permittee initiated IM. Permittee initiated IM must follow the progress and final reporting requirements in Condition No. II.B.5.(c).

(iii) The IM Work Plan shall ensure that the interim measures are designed to mitigate any current or potential threat(s) to human health or the environment and is consistent with and integrated into any long-term solution at the Facility. The IM Work Plan shall include: the interim measure's objectives, procedures for implementation (including any designs, plans, or specifications), and schedules for implementation.

(b) IM Implementation

(i) The Permittee shall implement the IM under Condition No. II.B.5.(a)(i) in accordance with the approved IM Work Plan.

(ii) The Permittee shall give notice to the Commissioner as soon as possible of any planned changes, reductions or additions to the IM Work Plan imposed under Condition No. II.B.5.(a)(i) or initiated by the Permittee under Condition No. II.B.5.(a)(ii).

(c) IM Reports

(i) If the time required for completion of interim measures imposed under Condition No. II.B.5.(a)(i) or implemented under Condition No. II.B.5.(a)(ii) is greater than one year, the Permittee shall provide the Commissioner with progress reports at intervals specified in the approved Work Plan or semi-annually for Permittee initiated interim measures. The Progress Reports shall contain the following information at a minimum:

(A) A description of the portion of the interim measures completed;
(B) Summaries of the findings;
(C) Summaries of any deviations from the IM Work Plan during the reporting period;
(D) Summaries of any problems or potential problems encountered during the reporting period; and
(E) Projected work for the next reporting period.

(ii) The Permittee shall prepare and submit to the Commissioner, within ninety (90) calendar days of completion of interim measures conducted under Condition No. II.B.5. an IM Report. Such report shall contain, at a minimum, the following information:

(A) A description of the interim measures implemented;
(B) Summaries of results;
(C) Summaries of all problems encountered;
(D) Summaries of accomplishments and/or effectiveness of interim measures; and
(E) Copies of all relevant laboratory/monitoring data etc. in accordance with this permit.

6. Environmental Indicators. The Permittee shall complete the U.S. EPA Environmental Indicator, Migration of Contaminated Groundwater Under Control Worksheet (Appendix B-1) on an annual basis beginning no later than one (1) year after the issuance of this permit and continuing until the indicator (i.e., the migration of contaminated groundwater from the Site is being controlled through engineered or natural process) is achieved. When the indicator is achieved, the Permittee will complete and submit the Documentation of Environmental Indicator Determination to the DEP.

7. Remedial Action Plan ("RAP"). The Permittee shall prepare and submit for the Commissioner's review and written approval one or more RAP(s), developed in accordance with Condition No. II.B.2. of this permit and RCSA Sections 22a-449(c)-104(a)(1) and 22a-133k-1 et.seq. (Remediation Standard Regulations), incorporating 40 CFR 265 Subpart G, which details the steps to be taken to perform corrective action. The RAP(s) shall address one or more environmental media at the entire Site or area affected by or any portion thereof. The RAP(s) shall:

(a) Describe the areas at which the remediation will take place, and identify the SWMUs and AOCs addressed and the environmental media being remediated;

(b) Describe the remedial alternatives considered for performing the specified remediation, and the most expeditious schedule for performing each alternative;

(c) If the Permittee plans to adaptively re-use the buildings on-site, describe the proposed adaptive reuse of the buildings. Such description shall include at a minimum: 1) the identification of the buildings to be reused; 2) a proposed schedule for renovation; and 3) the proposed details of how environmental concerns, including but not limited to, building decontamination, provisions to limit the volatile organic compounds occurring in or migrating into the interior of the buildings, and the methodology to be used to evaluate the implementation of the proposed environmental measures.

The Permittee may propose that any adaptive reuse of the Site be conducted in phases, provided the schedule includes the provision for an initial submittal of a generic scoping document describing in detail the methodologies to be used to meet the requirements of the above condition for each phase.

(d) If the Permittee proposes any demolition on-site, describe the proposed demolition of any buildings or structures on-site. Such description shall include at a minimum: 1) the identification of such buildings and the proposed schedule for demolition; 2) the detailed measures to be taken to ensure waste minimization during demolition (including the handling of non-friable asbestos); 3) detailed measures to ensure the proper handling, segregation and disposal of contaminated building materials; 4) detailed measures to be taken to avoid impacts to human health or the environment as a result of demolition; and 5) the measures to be implemented to monitor the proposed demolition.

The Permittee may propose that the demolition of any buildings or structures be conducted in phases, provided the schedule includes provisions for an initial submittal of a generic scoping document describing in detail the methodologies to be used to meet the requirements of the above condition for each phase.

(e) List all the permits and approvals required for each alternative, including but not limited to any permits required under CGS Sections 22a-32, 22a-42a, 22a-342, 22a-361, 22a-368 or 22a-430;

(f) Propose a preferred alternative with supporting justification therefore; and

(g) Propose a detailed implementation plan and schedule to perform the preferred remedial actions, including the generation and collection of any supplemental site information needed to support completion of remedial design. Such schedule shall include a schedule for applying for and obtaining all permits and approvals required for such remedial actions and describe the establishment of financial assurance for each proposed phase of remedial activity.

8. Implementation of Remedial Activities. The Permittee shall perform all remediation activities for soil, sediment, groundwater and surface water pollution in accordance with the approved RAP(s) and any schedules contained therein; and in accordance with RCSA Sections 22a-133k-1 through 3 (Remediation Standard Regulations).

9. Completion of Active Remediation.

(a) The Permittee shall notify the Commissioner in writing at least ninety (90) calendar days prior to the date it expects to complete the active remedial activity(ies) at the Site or area affected by the Site or any portion thereof.

(b) Within sixty (60) calendar days of the completion of the active remediation, the Permittee shall submit to the Commissioner via registered mail, a certification signed by the Permittee and by an independent, registered professional engineer stating that the active remediation phase(s) at the Site or areas affected by the Site or any portion thereof has been completed in accordance with the specifications of the approved RAP(s). Documentation supporting the certification shall be furnished upon the Commissioner's request.

10. Completion of Post-Remediation Monitoring

(a) The Permittee shall notify the Commissioner in writing at least ninety (90) calendar days prior to the date it expects to complete post-remediation groundwater monitoring and monitored natural attenuation at the Site or area affected by the Site or any portion thereof.

(b) Within sixty (60) calendar days of the completion of post-remedial groundwater monitoring and monitored natural attenuation at the Site or area affected by the Site or any portion thereof, the Permittee shall submit to the Commissioner via registered mail, a certification signed by both the Permittee and by an independent registered professional engineer stating that the post-remediation groundwater monitoring, as applicable, has been completed in accordance with the specifications in the approved RAP(s). Documentation supporting the certification shall be furnished upon the Commissioner's request.

(c) Once the corrective action obligations for all media at the Site or area affected by the Site or any portion thereof, has been completed the Commissioner shall issue a Certificate of Completion.

11. Remedy Selection and Notification of Remedial Implementation.

(a) The Permittee shall propose a remedy or evaluate one or more remedial alternatives. The Commissioner may require that specific remedial alternatives be evaluated. All remedial alternatives must meet the threshold and balancing criteria specified below.

Threshold Criteria:

(i) Protect human health and the environment;
(ii) Achieve media cleanup objectives using criteria in RCSA 22a-133k-1 et seq. (Remediation Standard Regulations); and
(iii) Control sources of releases to reduce or eliminate further releases.

Balancing Criteria:

(i) Long-term effectiveness;
(ii) Toxicity, mobility and volume reduction;
(iii) Short-term effectiveness;
(iv) Implementability;
(v) Cost;
(vi) Community acceptance; and
(vii) State acceptance.

The proposed remedy may include any IM implemented to date.

(b) The Commissioner will select and approve the remedy to be implemented at the Facility. The Commissioner is not confined to these alternatives evaluated by the Permittee when selecting and approving a remedy for the Site or area affected by the Site or any portion thereof.

12. Public Participation. The Permittee shall develop and implement a Public Participation Plan. Such plan shall, at a minimum, include: 1) the provision of public notice prior to the start of or completion remediation work at the Site or area affected by the Site or any portion thereof that is consistent with Condition No. II.B.13. of this permit and the requirements of CGS Section 22a-134i; 2) a copy of such notice is submitted to the Commissioner ten (10) calendar days prior to the date of publication; and 3) within thirty (30) calendar days after the end of the public comment period submit to the Commissioner a written summary of all comments received and responses to each comment.

The Commissioner shall review the summary of the comments and the Permittee's response and shall either adopt the responses, adopt the responses with modifications, or reject the responses and prepare a response to each comment.

In the event of substantial changes in the remedial approach, the Commissioner may require an additional opportunity for public comment with respect to such changes.

13. Public Notice Requirements. At the Commissioner's direction and as stated in the Public Participation Plan, the Permittee shall provide public notice of proposed remediation and public notice of the Commissioner's tentative determination that remediation is complete. Each public notice must provide a forty-five (45) calendar day comment period.

(a) Prior to the commencement of any remedial action, the public notice shall summarize the investigations undertaken, the results of the investigations, clearly identify the proposed remedial activities, provide a public location where relevant documents can be reviewed, and include an address and telephone number for a contact person. The Permittee shall:

(i) Publish the notice in a newspaper having substantial circulation in the municipality in which the Site or the affected area is located;

(ii) Broadcast the notice on a radio station during the high volume listening times on the same day the notice is published;

(iii) Provide a copy of the notice to the Director of Health of the municipality where the Site is located;

(iv) Provide a copy of the notice to the owner or operator of the Site (if the Permittee is not the Site owner or operator) and to all persons on the Facility mailing list maintained pursuant to 40 CFR 124.10(c)(1)(ix); and

(v) Erect and maintain a sign at least six (6) feet by four (4) feet for at least thirty (30) calendar days in a legible condition at the Facility, clearly visible from the public highway and including the words "ENVIRONMENTAL CLEAN-UP IN PROGRESS AT THIS SITE. FOR FURTHER INFORMATION CONTACT:", and a telephone number at which any interested person may obtain additional information about the remediation

(b) Prior to the Commissioner's final determination that remediation is complete, the Permittee shall:

(i) Publish the notice in a newspaper having substantial circulation in the municipality in which the Site or the affected area is located;

(ii) Broadcast the notice on a radio station during the high volume listening times on the same day the notice is published;

(iii) Provide a copy of the notice to the owner or operator of the Facility (if the Permittee is not the Facility owner or operator) and to all persons on the Facility mailing list maintained pursuant to 40 CFR 124.10(c)(1)(ix); and

(iv) Include a summary of the basis for the Commissioner's determination and that the Commissioner will accept public comments on the tentative determination for at least forty-five (45) calendar days from the date of publication.

(c) Upon the completion of the public comment period the Commissioner shall make a final determination. If the final determination is that remediation is complete then the Stewardship Permit will be terminated and a Certificate of Completion will be issued.

14. **Miscellaneous.**

(a) Upon transfer of the Facility, the intended reuse of the Facility will be industrial/commercial use and an environmental land use restriction prohibiting residential use will be filed. In the event that the Permittee changes the intended reuse of the Facility to include residential use and no alternative Site-specific criterion is approved by the Commissioner, the Permittee shall use a lead remediation criterion level of 400 mg/kg for the residential direct exposure criterion as authorized by RCSA 22a-133k-2(i).

(b) The Permittee shall achieve volatilization remediation criteria, for the applicable constituents of concern, as provided in the DEP's guidance document entitled "*Proposed Revisions – Connecticut's Remediation Standard Regulations Volatilization Criteria*", dated March 2003, included in Appendix B-3 of this permit, for evaluating the volatilization exposure pathway as it applies to indoor air, until superseded by the amended RSR's, or alternative criteria are proposed in a schedule/scope of work submitted pursuant to Condition No. II.B.7.(c) of this permit and approved in writing by the Commissioner.

(c) For any substances reported at or emanating from the Site, for which no remediation criteria has been adopted, the Permittee shall, in accordance with RCSA Sections 22a-133k-1 through 3, submit for the Commissioner's review and written approval a proposal for additional remediation criteria pursuant to the schedule/scope of work as set forth in Condition No. II.B.2. of this permit.

(d) The Permittee shall not operate the Facility in any manner that stores, treats, or disposes of hazardous wastes or in any way manages hazardous wastes other than hazardous wastes that may be generated during Facility maintenance, authorized closure and/or corrective action activities. Such

waste shall be managed in accordance with all applicable regulations. The Permittee shall comply with all applicable requirements of RCSA Section 22a-449(c)-102 incorporating 40 CFR Part 262 "Standards Applicable to Generators of Hazardous Waste".

C. FINANCIAL RESPONSIBILITY

1. Pursuant to RCSA 22a-449(c)-104 incorporating 40 CFR 264.140, States and the Federal Government are exempt from all requirements of 40 CFR 264 Subpart H, including the requirement to submit cost estimates, liability coverage, and establish a financial assurance instrument. Section II.C of the permit and all other sections requiring financial assurance, liability coverage and cost estimates shall not apply to any entity of the State or Federal Government, including the Department of the Army.

2. The Permittee shall submit for the Commissioner's review and written approval a detailed RAP(s) containing detailed, written estimate(s) of the current cost to perform investigation and remediation of the Site or areas affected by the Site inclusive of closure of the Hazardous Waste Management Units and post-closure care of the land disposal units in accordance with the requirements of this permit. The Permittee shall ensure that such written estimates are prepared in accordance with the methodology specified in RCSA 22a-449(c)-104 incorporating 40 CFR 264.142(a) and 40 CFR 264.144(a), as applicable. Note a fifteen percent (15%) contingency shall be applied to the estimates for unforeseeable elements or events which may increase the cost of performing corrective action.

   The cost estimate for those obligations identified in Condition No. II.B.2.(f) for the contamination of the tidal flats and other nearby surface waters shall be reflected as a zero figure. The Federal Government is responsible for the remediation of the tidal flats pursuant to the Invitation For Bid, which became effective on April 14, 2008.

3. Within sixty (60) calendar days of receiving the Commissioner's written approval of the cost estimate(s), the Permittee shall establish and continually maintain financial assurance using one or more of the instrument formats prescribed by the Commissioner's for investigation and remediation of the Site or areas affected by the Site inclusive of closure of the Hazardous Waste Management Units and post-closure care of the land disposal units. Such assurance may be established incrementally.

   The Permittee shall ensure that the initial value of financial assurance established includes the cost(s) associated with completing the closure of the Hazardous Waste Management Units and post-closure care of the land disposal units.

   The Permittee shall submit a plan for the Commissioner's review and written approval, for incrementally establishing financial assurance. In the event that no plan is submitted, the Permittee shall establish financial assurance such that 10% of the total cost of performing corrective action is initially established and an additional 10% is established annually (e.g. the 2nd year 20%, the 3rd year 30% is established etc...) thereafter such that a total of 100% of the financial assurance is established prior to the expiration of the permit.

4. The Permittee shall adjust amounts of financial assurance to reflect inflationary costs as required by RCSA Section 22a-449(c)-104 incorporating 40 CFR 264.142, and any factors that bear on the cost of performing the work that remains to be completed under this permit. Adjustments shall be made each year, on the anniversary of the establishment of the mechanism(s) for financial assurance until the Commissioner releases the Permittee from the financial assurance requirements of this permit.

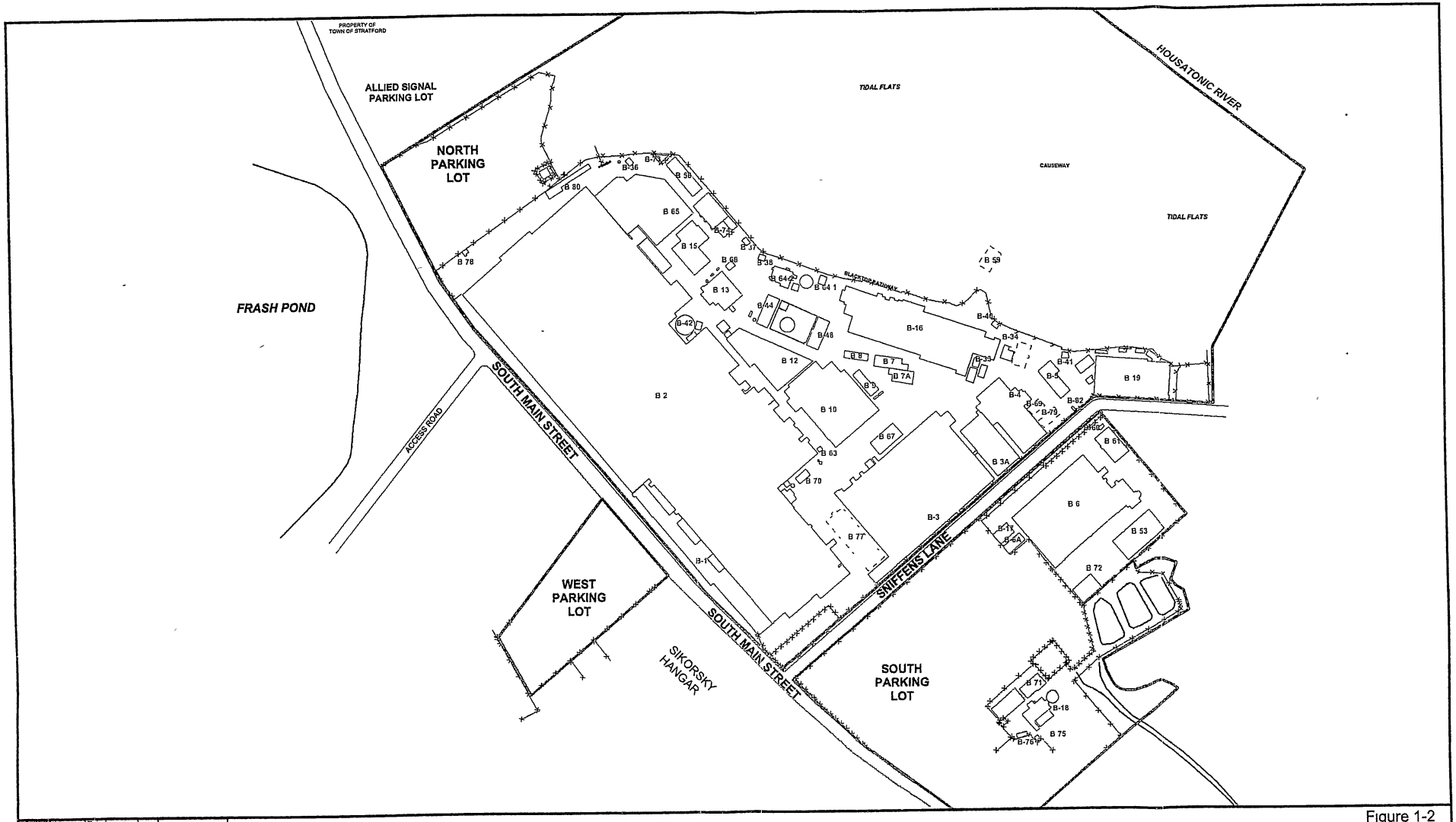
   The latest adjusted cost estimate(s) shall be kept at the Facility and a signed original shall be submitted to the Commissioner within fourteen (14) calendar days of preparation.

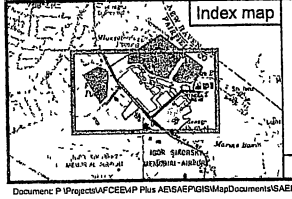
5. Upon request by the Permittee, the Commissioner may approve periodic reductions in the amount of financial assurance commensurate with the completion of corrective action activities. Such request shall include a revised cost estimate and demonstration of completed work activities which equates to at least a fifteen percent (15%) reduction in the estimate costs.

6. The Permittee shall maintain such financial assurances in effect until the Commissioner notifies the Permittee in writing that it is no longer required to maintain such a mechanism for financial assurances as provided for in Condition No II.C.7. of this permit.

7. Within sixty (60) calendar days after receiving the certification, submitted pursuant to Condition Nos. II.A.1.(g) and II.A.2.(e), that Final Closure of the Hazardous Waste Management Units and post-closure care of the land disposal units has been completed in accordance with the approved Closure Plan and Post-Closure Plan, the Commissioner will notify the Permittee in writing that it is no longer required to maintain financial assurance for closure of the Hazardous Waste Management Units or post-closure care of the land disposal units, unless the Commissioner has reason to believe that Final Closure has not been performed and/or completed in accordance with the approved Closure Plan or Post-Closure Plan. The Commissioner shall provide the Permittee with a detailed written statement of any such reason(s) to believe that closure has not been performed and/or completed in accordance with the approved Closure Plan or Post-Closure Plan.

8. If the Permittee fails to perform any of the terms or conditions of this permit, the financial assurance shall be available to the Commissioner to perform such terms or conditions of this permit provided that, prior to drawing upon any mechanism(s) for financial assurance, the Commissioner shall notify Permittee, in writing, of the alleged failure to perform and provide Permittee with a reasonable period of not less than fifteen (15) calendar days in which to remedy the alleged non-performance.





N

0 150 300 Feet

Prepared by BRP | Checked by DRP

Legend

- Riprap
- Drainage Channel, Pond
- Fence
- Road
- Boundary
- Demolished/Former Buildings
- Building
- Open Paved/Concrete Area
- Open Grassed Area
- Road/Parking Lot
- Water

Figure 1-2
Site Map

Remedial Investigation Report
Stratford Army Engine Plant
Stratford, Connecticut
MACTEC Engineering and Consulting, Inc.

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STRATFORD ARMY ENGINE PLANT, STRATFORD, CT -- AREAS OF CONCERN

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
			Hazardous Waste and Waste Oil Area		
1 & 2	Oil House Tank Farm (13 ASTs)	1,1,1-TCA; TCE; PCE; Coolants; Lubricants; Varsol; Hydraulic oils; Spent jet fuel; Waste oils	Oil House Tank Farm constructed in early 1950s. Relocated 30-50 feet west of original location between 1980 and 1982. Waste oil accumulation tanks used from 1981 to 1996. Date of release unknown.	The Waste Oil and Hazardous Waste Accumulation Tanks and aboveground piping were removed in 1998. Chlorinated and fuel-related contaminants were detected in soil within the berm, indicating a release has occurred, likely due to spills or leaks from tanks and/or piping. Concentrations of arsenic and dichloromethane in soils exceed RSR criteria. Concentrations of chloroethane, cis-1,2-DCE, TCE, and vinyl chloride in groundwater exceed RSR criteria.	Remediation required for release. [4] Requires administrative RCRA closure for HW tanks. [5]
3	Hazardous Waste and Waste Oil Transfer Systems Between Buildings 13 and 15	Waste fuel; Waste solvent/oil mixtures; Waste oil	Installed prior to 1970	The waste fuel and waste solvent and oil systems each consisted of a 500-gallon underground receiving tank. The waste oil transfer system consisted of two 400-gallon underground steel tanks. A release of fuels and chlorinated solvents to soil has occurred. Petroleum hydrocarbons were visually observed and detected in a soil boring immediately downgradient of the former USTs. Concentrations of BTEX, cVOCs, VOCs, TPH, PCBs, and inorganics in soils exceed RSR criteria. Concentrations of cVOCs and arsenic in groundwater exceed RSR criteria.	Remediation required for this location. [4]
7	Oil/Alum Tank	Cutting Oils	1976 - 1997	The Oil/Alum tank was an aboveground, 10,000-gallon welded carbon steel tank mounted on a concrete pad. One soil boring was completed beneath the former tank location. Release originating from AOC not suspected based on soil data and thickness of concrete pad. Final RI Comment Response states that no further action is necessary.	Additional evaluation of historical soil under slab may be required. Location is on edge of another AOC; remedial confirmation design must consider the potential for pollution unassociated with the Oil/Alum Tank being present under slab. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
12 & 53	Container Accumulation and Drum Staging Area Between the Former Oil House Tank Farm and Building 37	Solvents; 1,1,1-TCA; Waste oil; Fuel	Use began prior to 1980. Date of release unknown.	A release of chlorinated and fuel-related VOCs to the underlying soils has occurred. Concentrations of cis-1,2-DCE and xylenes in soil exceed RSR criteria. It is unknown if this release occurred from handling and storage of drums after designation of the area as a container storage area, or prior to that time when the area contained storage tanks.	Remediation required for this location. [4] Requires administrative RCRA closure for HW area. [5]
13	Original Container Storage Area	Hazardous waste	Used from 1980 to 1984	This area (north and northwest of Building 13) was used to accumulate 55-gallon drums of hazardous waste. Insufficient information to determine if release has occurred associated with this AOC. However, a release has occurred in this area from other activities. No samples focused on AOC; in vicinity concentrations of BTEX, cVOCs, VOCs, TPH, PCBs, and inorganics (lead) in soils exceed RSR Criteria.	Remediation required for this location. [4] Requires administrative RCRA closure. [5]
16	Metal Chips Oily Sump (Northwest corner of Building 13)	Cutting oils; Metal chips	Concrete pit for metal chips was removed in 1993.	Sample SB09B11-1 was taken from within the area of the former metal chips bin, but not adjacent to the chip sump. Detected concentrations in samples from SB09B11-1 are not greater than RSR numerical criteria. Release not known or suspected from AOC.	Insufficient information to determine no release occurred from this AOC. [6] Data indicate historical pollution or polluted fill is present in area; additional evaluation may be needed. Also, abutting AOCs require remediation, and their remedial confirmation design must consider this pollution. [4]
28	Building 15 and Associated Satellite Accumulation Areas	Solvents ; Coolants; Hydraulics; Waste oils	Constructed in 1945. Additional storeroom used as primary chemical storage area constructed between 1960 and 1970.	Solvent and fuel-related contaminants were identified in soil; however the presence of the fill from former shoreline filling and an outfall once located beneath Building 15 complicates the determination of the source of the release. Concentrations of TCE and lead in soil exceed RSR criteria.	Remediation required for location. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
--	Former Chemical Storage and Scrap Metal Reclamation (B-13)	Raw chemicals; Magnesium-thorium; Oily metal chip storage; Titanium and aluminum chips	Constructed in 1944. Date of release unknown. Metal chips concrete sump removed in 1993. Titanium and aluminum chips collection system used from early 1990s to 1996.	Oil-water separator located in Building 13. Concentrations of PAHs and TPH in soil exceed RSR criteria. Concentrations of PCE and TCE in soil vapor exceed RES and I/C VC.	Remediation required for release. [4]
--	Container Storage Pad and Collection Trench Northeast of Building 13	Solvents; Scrap metals; Oils	Drum storage began around 1943. Concrete pad and collection system built in 1993 and used for a two-year period.	Field observations interpreted to indicate no release from AOC. Concentrations of TCE, numerous PAHs, TPH, antimony, arsenic, beryllium, and lead in soil exceed RSR criteria. The source of the contaminants detected in soils is likely from historical usage of this area prior to 1993.	Remediation required for this location. [4]
--	Magnesium-Thorium Scrap Yard Between Building 13 and Building 44	Thorium chips	Scrap yard used in the 1990s. Used historically for storage of drums and debris since 1943.	Sampling from a soil boring completed in the center of the AOC detected pollutants but no pollutants exceeded RSR criteria. Release associated with scrap yard not known or suspected. BTEX, VOC and PCB detections indicate pollution is present in area, believed to be associated with historical usage of area for drum and debris storage.	Data indicate historical pollution or polluted fill is present in area; additional evaluation needed. Remediation may be required if evaluation finds criteria exceeded. Also abutting AOCs require remediation, and their remedial confirmation design must consider this pollution. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
--	Open Storage Area Between Buildings 16 and 74	Solvents; 1,1,1-TCA; Propane; Oil and grease	Storage occurred from the early 1950s until the 1980s.	The 1953 aerial photograph and a 1956 Fire Insurance Map depict three 1800-gallon propane ASTs at the future location of the OATP (Building 64-2). A 1970 aerial photograph depicts storage tanks adjacent to Building 37 and three small buildings located between Building 38 and the three 1800-gallon propane ASTs. Concentrations of BTEX, cVOCs, PAHs, TPH, PCBs, and inorganics in soils exceed RSR criteria. Concentrations of cVOCs and arsenic in groundwater exceed RSR criteria. Detected analytes in samples associated with this area may have resulted from these storage areas, ASTs historically located within this area, fill used in 1943 to extend the shoreline into the Housatonic, and/or as a result of activities associated with operation of the OATP.	Remediation required for this location. [4]
				Chemical Waste Treatment System	
8	Chemical Waste Treatment Plant (CWTP) Collection System, Pump Station (Building 63), and Associated Piping	Cyanide; Cr(VI); Chlorinated and non-chlorininated solvents; MEK; Naphtha; 1,4-dioxane; Toluene; Metals; Sulfuric acid; Sodium metabisulfite	Operated from 1950s – 1990s	Sampling results indicate releases have occurred; however, evidence suggests there are other potential sources in addition to the CWTP system. Fuel and oil storage in USTs and ASTs and the wide-spread use of solvents in cleaning procedures within Building 2 are likely contributing sources of contamination. Concentrations of antimony, arsenic, cadmium, copper, lead, and TPH in soils exceed RSR criteria. Concentrations of copper, zinc, cyanide, and cVOCs in groundwater exceed RSR criteria.	Insufficient information to determine release status of all lines included in this AOC.[6] Remedial design for site requires additional line-focused evaluations. [4]
9	Chemical Waste Treatment System Cyanide Destruction Facility (Building 70)	Copper; Cadmium; Cyanide; Sodium hypochlorite; Sulfuric acid; Sodium hydroxide	Operated from 1986 to 1997	Prior to CDF construction, this area contained an abandoned underground septic tank that reportedly received zinc chromate paint sludge and solvent from 1941 to 1949 (ESE, 1981). Cyanide was not detected in samples taken adjacent to the CDF and the upstream waste line, nor was copper or cadmium detected at elevated concentrations. Solvent and fuel-related contaminants detected in soil are likely the results of historical activities in this area, including fuel oil storage in USTs, painting and paint storage, waste paint storage and disposal, and open storage. The concentration of arsenic in soil exceeds RSR criteria at SB12B6-2.	No release suspected from AOC activity. (see also AOC 22)

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
10	CWTP in Building 18	Metals; Solvents; Acids; Cyanide; Sulfuric acid; Sodium metabisulfite; Sodium hydroxide	The CWTP was constructed in 1958, and included the Chrome Reduction Unit and clarifier. In 1986 the equalization tanks were constructed, which replaced the equalization lagoon.	The CWTP in Building 18 includes the Chrome Reduction Unit and the Metals Removal Unit. The Chrome Reduction Unit consists of six 9,725-gallon tanks. The Metals Removal Unit consists of one 240,000-gallon and two 120,000-gallon equalization tanks, and a 60,000-gallon clarifier. The concentration of dichloromethane in soil exceeds RSR criteria at EBS43-1. Release is not known or suspected.	Insufficient information to determine no release occurred from this AOC. [6]
11	CWTP Solids Handling Area in Building 71	Metal hydroxide sludge	Operation began in 1986.	This area consists of the Solids Handling Area, located in Building 71, which includes an 8,000-gallon FRP thickening tank and two 1-cubic yard filter presses. No contaminants were detected above RSR criteria in EBS11-1. Release is not known or suspected but confirming information needed.	Insufficient information to determine no release occurred from this AOC. [6]
14	Container Storage Areas A and B (South of Building 18)	Paint; Waste acetone; Waste sodium hydroxide; Waste 1,1,1-TCA; Chromium-contaminated plating wastes; Sodium hydroxide; Waste jet fuel; Waste oil	Used from 1983 to 1986	Containerized liquid and solid wastes, typically in 55-gallon drums, were collected from locations at the facility and brought to these storage areas. Container Storage Areas A and B had a combined storage capacity of 2,750 gallons. No solvent or fuel-related contamination or cyanide was detected in soil samples collected from outside the perimeter of the storage area. PCBs not known to have been handled in this area were detected at less than 1 ppm in soil. No samples were collected from beneath the concrete pad. Release is not known or suspected but confirming information needed.	Insufficient information to determine no release occurred from this AOC. [6] Requires administrative RCRA closure. [5]
15	Sludge Roll-off Container Area North of Building 71	Sludge	From 1986 until the facility ceased operation (date unknown)	No samples were taken from within this area, but the area was contained within a concrete berm and sludge material was stored in the roll-off for a period of less than 90 days.	No release suspected from AOC activity. Requires administrative RCRA closure. [5]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
18	Equalization Impoundment (Lagoon #1)	Cyanide; Cr(VI); Metal Hydroxide; Sodium hypochlorite; Sodium hydroxides	Operated from 1958 to 1986	The Equalization Lagoon had an approximate capacity of 480,000 gallons. The lagoon has been closed under RCRA Subtitle C, and a post-closure groundwater monitoring program is being conducted. LNAPL has been detected in monitoring well LW-5S, and additional investigations are planned for delineation of the extent of the LNAPL.	RCRA closed LDF under interim status, requires continued post-closure care, updated post-closure plan to meet 40 CFR 264 subparts G&H, compliance monitoring and corrective action as needed in response to monitoring data. Engineered control--requires evaluation of RSR compliance within context of DEP approved RCRA closure. Additional evaluation required for contamination detected in monitoring well LW-5S.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
19	Sludge Drying Beds (Lagoons #2, #3, and #4)	Cyanide; Cr(VI); Metal Hydroxide; Sodium hypochlorite; Sodium hydroxides	Operated from 1958 to 1986	Lagoon #2 was 8 feet deep with an approximate 547,000-gallon capacity, lagoon #3 was 6.5 feet deep with an approximate 385,000-gallon capacity, and lagoon #4 was 8 feet deep with an approximate 754,000-gallon capacity. These beds have been closed under RCRA Subtitle C, and a post-closure groundwater monitoring program is being conducted.	RCRA closed LDF under interim status, requires continued post-closure care, updated post-closure plan to meet 40CFR264 subparts G&H, compliance monitoring and corrective action as needed in response to monitoring data. Further data may be necessary to compare contaminant concentrations in soil to RSR criteria. Engineered control--requires evaluation of RSR compliance within context of DEP approved RCRA closure.
25	Outfall-008 (OF-008) and Drainage Ditch	Cyanide; Cr(VI); Metal Hydroxide; Sodium hypochlorite; Sodium hydroxides	The outfall was re-constructed in 1979.	Outfall-008 was used to discharge supernatant from the CWTP clarifier to the drainage channel immediately northeast of Building 18 and ultimately to the Housatonic River. Elevated concentrations of VOCs, PAHs, SVOCs, PCBs, and inorganics were identified in sediment impacted by discharges from OF-008. As there are no RSR criteria for sediment, no comparisons were performed.	Requires evaluation of sediment impacts and development of a remedial action plan for mitigation of these impacts to the extent necessary; additional information may be needed.
43	Former UST at Building 18	#2 Fuel Oil	1956 - 1989	A 1,000-gallon #2 Fuel Oil UST was located adjacent to Building 18. Fuel-related contaminants were not detected in SB20A1-1. No contaminants were detected above RSR criteria. No release known or suspected.	RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
			Manufacturing and Plating Areas		
22	Waste Paint Tank Located Between Buildings 2 and 3	Paints (zinc chromate primer); Solvents	1941 - 1949	Paints and solvents were piped to a septic tank. Release from AOC is not suspected. No soil borings were collected at the suspected tank location.	Insufficient data to determine if there is or is not a release from this AOC [6] (See also AOC 9)
26	Building 2 historic septic systems			Release not known or suspected. Soil borings targeting located septic tanks detected contaminants at levels less than RSR criteria.	Insufficient information to determine release status of all septic systems included in this AOC. Remedial design for site may require additional septic system-focused evaluations. [4]
37	Building 10 and Associated Satellite Accumulation Areas	Solvents	Constructed in 1929	Soil borings completed near sumps, drains, and trenches inside Building 10 do not indicate a release from this AOC, although some non-chlorinated-non-aromatic VOCs were detected in soil no contaminants associated with building uses exceed RSR criteria. Concentrations of cVOCs, chromium, and hexavalent chromium detected in groundwater exceed RSR criteria beneath Building 10; and are attributed to groundwater migrating from Building 2. The concentration of arsenic in soil at SB13G1-1 exceeds RSR criteria by several orders of magnitude (a detection of 3,550 mg/kg compared to the I/C DEC of 10.0 mg/kg).	Remediation required for this location. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
38	Building 2 Former USTs	Fuel oils; Gasoline; Oils	Oil USTs were abandoned in place in 1955. Septic tank was abandoned in place in 1969. Status of other tanks unknown. 2 fuel ASTs outside boiler room in 1940s	Former USTs at Building 2 include two 2,500-gallon oil USTs underneath Building and a 1,500-gallon sanitary UST 2. In addition, five other fuel storage tanks have been identified at Building 2: two 5,000-gallon fuel oil USTs; a 10,000-gallon and a 15,000-gallon fuel oil tank, and a 500-gallon gasoline tank. The status of these tanks is unknown. Samples from AOCs nearest the ASTs show no evidence of release. The exact location of some tanks is unknown. Furthermore, no sample locations were taken proximal to other identified fuel storage tanks at Building 2.	Additional evaluation required to determine no release occurred from this AOC. [6] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
49	Building 2 Manufacturing Areas	1,1,1-TCA; TCE; Alkaline cleaners; MEK; Acetone; Toluene; Sodium hydroxide; Chromic acid; Hydrofluoric acids	Constructed in 1929	A release has occurred. Concentrations of TPH, carbon tetrachloride, dichloromethane, TCE, PAHs, arsenic, vanadium, and cadmium in soil exceed RSR criteria. Concentrations of cVOCs in groundwater exceed RSR criteria.	Additional evaluation required. [6] Remediation required for release. [4]
50	Building 2 Plating Area	Chlorinated solvents; Xylene; Toluene; Chromium; Nickel; Copper; Cadmium; Cyanide; TCE; MEK; Carbon Tetrachloride	Operations began in 1951	A release of plating solution occurred where CR(VI) migrated to soils beneath the building floor. Chlorinated solvents used for degreasing and cleaning metal components were released in Building 2. A hexavalent chromium plume was identified in groundwater beneath the Chromium Plating Facility and extends beneath parts of Building 10 and Building 12. Concentrations of chromium and hexavalent chromium in soil exceed RSR criteria. Concentrations of TCE, cadmium, chromium, copper, cyanide, Cr(VI), and nickel in groundwater exceed RSR criteria.	Remediation required for release. [4]
51	Building 3 Plating Area	Solvents; Degreasers; Chromium	Operated from 1951 to mid-1970s	A release has occurred. Elevated concentrations of cVOCs and Cr(VI) were identified in groundwater where chromium plating was conducted. Cr(VI) was detected beneath the southeastern portion of Building 3. Concentrations of cVOCs in groundwater exceed RSR criteria.	Additional evaluation required. [6] Remediation required for release. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
--	Former Gasoline USTs near Building 10	Gasoline	Approximately 1931 to 1943	Two 1,000-gallon gasoline USTs were identified on fire maps (AFM FIC, 1931). The current status of these tanks is unknown. No release is known or suspected. No detected concentrations in soil boring SB13I1-1 are greater than RSR criteria.	Insufficient information to determine no release occurred from this AOC. RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
Research and Development					
31	Building 6 and Associated Satellite Accumulation Areas	Waste calibration fuel; Waste jet fuel; Waste oil	Constructed in 1944	Building 6 was used for engine testing, parts storage, painting, and as an experimental hangar. 55-gallon drums were used for storage within various satellite accumulation areas located throughout the building. A release has occurred from this AOC; Fuel constituents and other VOCs were detected in soil. Also, concentrations of arsenic in soil exceed RSR criteria at sample location SB24A1-1.	Additional evaluation of release needed to determine need for remediation due to release. Remediation required for arsenic at location. [4]
34	Building 3A and Associated Satellite Accumulation Areas	Waste solvents (1,1,1-TCA); Acid wastes; Waste jet fuel; Waste oil	Constructed in 1942	Building 3A was used for engineering and chemical laboratories, a machine shop, a heat treatment area, and office space. Activities conducted within Building 3A have released VOCs to underlying soil. In addition, waste solvents (1,1,1-TCA), waste jet fuel, waste oil, and acid wastes were stored in 55-gallon drums in satellite accumulation areas within the building, although there is no evidence of a release from these activities. Analytical results from soil samples collected beneath the building floor indicate fuel-related contamination. Concentrations of TPH in soil exceed RSR criteria. Results of the 2004 soil vapor survey identified that TCE and PCE concentrations were above soil vapor RES and I/C VC in Building 3A. In groundwater beneath Building 3A, concentrations of PCE exceed RES VC, and cVOC concentrations exceed both RES and I/C VC.	Remediation required for release. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
39	Building 4 Former Brine UST	Brine; Metals; Sludge	The ECM process was decommissioned in 1987, and the tank was removed in 1989.	A 20,000-gallon brine storage tank is located beneath the northernmost corner of Building 4, and used during the ECM process (cutting of parts by placing metals in a brine bath). No release is known or suspected associated with the brine tank. Although fuel and volatile constituents were detected, no concentrations of detected analytes in soil samples were greater than the RSR criteria.	Data indicate historical pollution or polluted fill is present in area; additional evaluation needed. Remediation may be required for location if evaluation finds criteria exceeded.
40	Building 6 Former USTs	Fuels; Oil; Diesel; Gasoline	Two 550-gallon tanks removed in 1989. Two 5,000-gallon tanks initially abandoned in place in 1979 and removed in 1998.	Four former USTs were used to store fuel and oil for operations conducted in Building 6. There were two 550-gallon fuel USTs, a 5,000-gallon fuel UST, and a 5,000-gallon oil UST. Other storage tanks were identified in the vicinity of Building 6. A 1986 fire map depicts two 250-gallon diesel oil tanks west of the central portion of Building 6, and a 250- gallon gasoline tank. A release has occurred, based on visual evidence: during removal of one 5,000-gallon tank in 1998, petroleum-contamination was visually identified in surrounding soil.	Additional evaluation required for release.[6] Remediation required for release if evaluation finds criteria exceeded. [4] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
55	Building 72 and Associated Petroleum Storage Tanks	Diesel; Jet fuel	1965 - 1998	Building 72 served as a pumping station for fuel storage tanks. The building serviced two 10,000 and four 20,000-gallon diesel and jet fuel ASTs. Two 20,000-gallon tanks were installed in approximately 1965; the other four tanks were installed in the early 1980s. A release has occurred from this AOC. Petroleum-contaminated soils were identified during closure of the adjacent sludge drying lagoons in 1986; the contaminated soils were not removed. Concentrations of PAHs in soil exceed RSR criteria.	Additional evaluation required for release.[6] Remediation required for release. [4] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
56	Research and Development Area in Northern Building 3, Building 3A, and Building 4	Metals; Solvents; Fuels; Oils	Constructed in 1930. A spill of cleaning solvents occurred north of Building 3A in April 1989.	According to the PAS, this area was a disposal and uncontrolled release area. A release has occurred. Fuel-related contaminants and nickel were detected in soil. Chlorinated solvent and fuel-related contaminants were detected in groundwater, and chlorinated solvents were detected in soil vapor. Concentrations of arsenic, nickel, and TPH in soil, cVOCs in groundwater, and TCE and PCE in soil vapor exceed RSR criteria.	Additional evaluation required for release.[6] Remediation required for release. [4]
59	Building 4 Drum Storage Area	Machining oil; Engine oils	Storage began in 1981.	This area was used to store 55-gallon drums of machining oil and engine oils used in engine testing and development at the facility. Release not known or suspected. Concentrations of detected contaminants do not exceed RSR criteria in samples from SB27E2-1, located at an area of staining and a crack in the floor.	Insufficient information to determine there is no release from this AOC. Data indicate historical pollution or polluted fill is present in area; additional evaluation needed. Remediation may be required for location if evaluation finds criteria exceeded.
60 & 61	Building 6A Waste Oil Rags (Satellite Accumulation Area) and Building 6A Waste TPC and Oil (Satellite Accumulation Area)	Waste Oil; TPC (aliphatic hydrocarbon)	Building 6A was built in 1966. Storage in satellite accumulation areas began in 1991.	Waste oil rags and waste TPC and oil were stored in 55-gallon drums in satellite accumulation areas located throughout the building. Fuel and solvent-related contamination were detected in soil at Building 6A. Concentrations of cVOCs in soil exceed RSR criteria.	Additional evaluation required for release.[6] Remediation required for release. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
--	Building 53 and Associated Fuel Storage Areas	Fuels	Building 53 was constructed in 1961. Open storage occurred in this area since at least 1943.	A 1962 drawing depicts two fuel USTs beneath the southern end of Building 53. A plan from 1964 shows four temporary mobile tankers immediately south of Building 53. Following the construction of Building 6 in 1944 stains and/or tanks are identified in aerial photographs. No samples taken.	Insufficient data to determine if there is or is not a release [6] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
			Testing Areas		
23	Building 19 Dry Well	Solvents; Waste fuels; Oils	Disposal to the dry well reportedly ceased in 1987; it is unknown when disposal to the dry well may have begun	The location or existence of the dry well could not be determined based on a review of records and a site inspection conducted in October 2003. No samples taken.	AOC requires resolution through holistic data evaluation using multiple lines of evidence.
30	Building 34 and Associated Satellite Accumulation Areas	Waste oil; Filters; Jet Fuel	Constructed in 1953	Building 34 served as the pumphouse for the Former Jet Fuel Tank Farm. Accumulation areas at Building 34 contained 55-gallon drums of waste oil, filters, and jet fuel. No samples taken.	Insufficient data to determine if there is or is not a release [6]
32	Building 5 and Associated Satellite Accumulation Areas	Waste jet fuel	Constructed in 1954	Reportedly, waste jet fuel was stored within 55-gallon drums in satellite accumulation areas located throughout the building. A 1986 fire insurance map identifies a 600-gallon fuel oil tank located in Building 5A. Release not known or suspected. Soil boring SB27E9-1 analyte concentrations are less than RSR criteria, and do not include fuel constituent detections.	Data indicate historical pollution or polluted fill is present in area; additional evaluation needed. Remediation may be required for location if evaluation finds criteria exceeded. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
33	Building 19 and Associated Satellite Accumulation Areas	Filters	Unknown	The satellite accumulation areas at Building 19 contained 55-gallon drums of waste filters The locations of the satellite accumulation areas are unknown and likely changed over time. Building 19 was used for jet engine testing and turbine engine research and development. Release has occurred but concentrations of analytes were less than RSR criteria.	Additional evaluation required for release. Remediation required for release if evaluation finds criteria exceeded. [4]
35	Building 43 and Associated Satellite Accumulation Areas	Fuels; Filters	Constructed in the early 1940s	Building 43 was constructed in the early 1940s to serve as a pumping station for a fire suppression tank located adjacent to the building. Building 43 was modified in approximately 1986 to serve as the fuel pumping station for two 60,000 gallon ASTs that supplied the Building 19 jet engine testing and turbine research. Waste fuel and filters were stored in 55-gallon drums located in satellite accumulation areas in the building No samples were collected from this AOC	Insufficient data to determine if there is or is not a release [6] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
44	Building 19 Former USTs	Fuels	Tanks removed in 1987	Four former fuel USTs, located in the vicinity of Building 19, were used in support of testing activities within the building. The USTs included two 550-gallon tanks, a 1,000-gallon tank, and a 2,000-gallon tank. Reportedly, all four USTs were removed in 1987 No samples were collected from this AOC	Insufficient data to determine if there is or is not a release [6] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
45	Jet Fuel Tank Farm Former USTs	Jet Fuel; Diesel; Waste Fuel; Varsol	In use from 1953 - 1989	Eighteen former USTs were located at the Former Jet Fuel Tank near Building 34, including five 20,000-gallon jet fuel tanks, and one 20,000-gallon diesel tank, a 4,000-gallon waste fuel tank, a 5,000-gallon Varsol tank, a 1,000-gallon fuel tank, and nine 300-gallon fuel tanks. During tank removal, approximately 2,000 cubic yards of fuel-contaminated soil, containing levels of toluene and xylenes up to 5,500 ppm were excavated. Soil samples taken following excavation of contaminated soil indicates residual fuel and chlorinated solvent-related contamination. Concentrations of arsenic, benzene, and TPH in soil exceed RSR criteria. Concentrations of vinyl chloride in groundwater exceed RSR criteria.	Additional remediation required for release. [4] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
48	Building 16 and Associated Satellite Accumulation Areas	Waste oil; Fuel; Filters; Oily rags	Unknown	Building 16 was used for production and development of engines in test cells, and various satellite accumulation areas that previously stored waste oil, fuel, filters, and oily rags in 55-gallons drums. Fuel-related contamination was detected in soil north of the central portion of Building 16, along the Dike. Concentrations of TPH exceed RSR criteria.	Remediation required for this location. [4]
57	Drum Storage Area East (North) of Building 19	1,1,1-TCA; PCE; Solvents	Unknown	There is documentation of a release of chlorinated solvents and fuel related to drum storage. An additional spill of diesel fuel into this area from overfilling of the adjacent ASTs resulted in the ultimate removal of approximately 120 cubic yards of soil that was sent off-site for disposal. Results of soil and groundwater samples indicate residual fuel and chlorinated solvent contamination in soil and groundwater and PCBs and cyanide in soil at the drum storage area. Concentrations of 1,1,2,2-TCA in soil exceed RSR criteria. Concentrations of cVOCs and arsenic in groundwater exceed RSR criteria.	Additional remediation required for release. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
58	Scrap Metal Yard North of Building16	Scrap metal; Oils; Greases	Unknown	This area was used to store scrap metal that was reportedly covered in oils and greases. Fuel-related contaminants and PCBs were detected in soil at concentrations of 5 mg/kg or less, and black, tar-like material was noted during soil sampling at one of the soil boring locations. Concentrations of PCBs in soil at SB17A3-4 exceed RSR criteria.	Remediation required for release. [4]
62 & --	Building 7 Waste Oil Satellite Accumulation Area and Building 7/7A Drains	Paints; Solvents; Petroleum; Fuels; Waste oil	Constructed in 1943	The drains associated with Buildings 7/7A handled waste petroleum product. Fuel and solvent-related contaminants and cyanide were detected in soil near the buildings. Concentrations of antimony, arsenic, cadmium, lead, and cVOCs in soil exceed RSR criteria.	Remediation required for release. [4]
63 & 64	Building 8 Flammable Storage Area (Paints and Solvents) and Building 8 Waste Paint Satellite Accumulation Area	Flammable paints; Solvents	Used from 1943 – 1990s	Release not known or suspected; building has concrete containment dike and no floor drains. Concentrations of detected analytes at a boring adjacent to this area are less than RSR criteria.	Release not suspected but data indicate historical pollution or polluted fill is present in area; additional evaluation needed. Also, abutting AOCs require remediation, and their remedial confirmation design must consider this pollution.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
65-67	Building 19 ASTs North of Building	Diesel; JP-5	Installed in 1953 and removed in 1998. Release in 1990.	Three ASTs, including a 2,000-gallon diesel fuel #2 tank, a 1,000-gallon diesel fuel #2 tank, and a 1,000-gallon JP-5 tank were located to the north of Building 19. The tanks were reportedly occasionally overfilled In June 1990, one of the diesel tanks was accidentally overfilled and 150 gallons of fuel was spilled to the ground surface. Approximately 100 gallons of this was collected by facility personnel and the remaining 50 gallons was removed along with contaminated soils from an open excavation west of the concrete pad, in the area of the drum storage area (AOC 57). The excavated soils were stockpiled in the bermed tank area, sampled, and sent off-site for disposal. Analytical results from samples collected underlying and south of the concrete pad indicate that no contaminants exceed RSR criteria.	Additional evaluation of adequacy of historical remediation may be needed. RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
68 & 69	Building 19 ASTs Northwest of Building	Jet-A jet fuel; JP-4 jet fuel	Installed in 1986 and removed in 1998.	Two 60,000-gallon jet fuel ASTs were located northwest of Building 19, on a concrete pad in a bermed area. Prior to installation of the fuel tanks, a 400,000 gallon fire suppression tank was located in the area. No release is known or suspected. Analytical results from boring BR-1 located approximately 10 feet northwest of these tanks did not detect fuel constituents.	RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
--	Building 9 Floor Drains	Oil; Grease; Hydraulic fluid	Constructed in 1943	Batteries, oil, grease, and hydraulic fluid were stored in 55-gallon drums in Building 9. The floor drains lead to the OATP via pump station Building 64-1. Soil boring SB13E1-1 was completed adjacent to the storm drain line from Building 9. Concentrations of detected analytes at sample location SB13E1-1 are less than RSR criteria.	Insufficient data to determine if there is or is not a release [6]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
--	ASTs Southeast of Building 16 [AKA Building 33 and associated ASTs]	Engine oil; Diesel	1953 - 1998	Four 3,000-gallon engine oil tanks were originally located in this area, likely since construction of Building 16 in 1953. These tanks were removed between 1980 and 1984, and replaced by two 40,000-gallon #2 Diesel ASTs. The diesel tanks were removed in 1998. No soil data beneath B-33.	Insufficient data to determine if there is or is not a release RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
Stormwater and Wastewater Systems					
4	Building 16 Floor Drains, Sumps, and Piping	Carbon Tetrachloride; TCE; 1,1,1-TCA; Mercury; Fuels	Used from 1953 until 1991	Documentation indicates that VOCs and fuels were released to the drainage system in Building 16. Detections of VOCs in soils collected along the drainage system and downgradient groundwater suggest that a release has occurred. Other potential contributing sources of VOCs and fuel include prior usage of this area in the 1940s for open storage of containers and documented releases from the Building 34 Jet Fuel Tank Farm. Concentrations of TPH and lead in soils at SB17A2-6 and PCBs at SB17A2-1 exceed RSR criteria. No concentrations of analytes detected in groundwater exceed RSR criteria. In soil vapor, TCE was detected slightly above RSR criteria in SG-99-32.	Insufficient information to determine release status of all lines included in this AOC.[6] Remediation required for release. [4]
5	Stormwater Collection Lines			Determination of a release not possible due to the presence of other sources of contamination.	Remedial design for site may require additional line-focused evaluations.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
6	OATP in Building 64-2	Copper; 1,1,1-TCA; Ammonia; Sodium hydroxide; Chromic acid; Zyglo ; Oil and grease	The OATP was constructed in 1976. Releases were documented in 1978 and 1981.	This area contains an oil skimmer in Building 64-2, the 200,000-gallon surge tank adjacent to B64-2 and the 10,000-gallon sodium hydroxide (NaOH)/Alum tank at B64-2. Accidental releases to the stormwater system have been documented. No samples have been collected. Following the construction of the waste transfer system and closure of the wastewater collection lines in the early- to mid-1980s, the OATP continued to receive wastewater in the form of supernatant pumped from waste oil tanks at the former Oil House Tank Farm. The continuous or intermittent presence of oil, copper, 1,1,1-TCA, and ammonia discharge to the OATP was noted in the early 1990s. No samples have been collected.	Insufficient information to evaluate releases from system into underlying soils/groundwater. Determination of a release from AOC may be problematic due to location on an area of fill. Active stormwater treatment facility.
52	Facility Outfalls-001 through -006 and associated Intertidal Flats	Solvents; Paints ; Waste oils; Fuels	Constructed in 1953	Solvent, PCBs, and fuel-related contaminants were detected in sediment samples located adjacent to the six facility outfalls associated with the stormwater system. As there are no RSR criteria for sediment, no comparisons were performed. It should be noted however, that these samples are located off the SAEP property within the tidal flats, in an area of the Housatonic River that likely has been contaminated as a result of the numerous industrial operations upstream. The current shoreline is a result of several expansions, most notably in 1943, which utilized both river sediments and fill from offsite.	Requires evaluation of sediment impacts and development of a remedial action plan for mitigation of these impacts to the extent necessary; additional information may be needed to develop RAP.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
24	Discharge to the Housatonic River and associated Intertidal Flats at Outfall-007	Chromic acid; Cr(VI); Zyglo (metal penetrant dye)		Treated stormwater from the OATP discharges through Outfall 007. Four chemical releases to the intertidal flats have been documented. These releases involved: • In May 1978, a spill of 25 to 30 pounds of chromic acid was discharged into the OATP and into the river via OF-007 (W-C, 1991). • In August 1978, CTDEP was advised that a yellow plume of Cr(VI) was extending approximately 200 yards from OF-007 (CDM FPC, 1992). This release occurred during a period when it is suspected that effluent from the CWTP was routed to the OATP for discharge via OF-007. • Approximately 75 gallons of oil sludge from the OATP bypassed clogged skimmers and discharged from OF-007 in July 1979 (W-C, 1991). • In October 1981, approximately 20 gallons of "Zyglo," a fluorescent metal penetrant dye was spilled into a storm drain and discharged from OF-007 (W-C, 1991). Sediment sample location OF-007 (SD) was taken at Outfall 007. Analytes detected in sediment included cVOCs, VOCs, PAHs, SVOCs, and PCBs. As there are no RSR criteria for sediment, no comparisons were performed.	Requires evaluation of sediment impacts and development of a remedial action plan for mitigation of these impacts to the extent necessary; additional information may be needed to develop RAP.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
			Miscellaneous AOCs		
17	Soil Pile, South Parking Lot fill area	Fuels; Metals	1989 - 1990	In September 1989, an estimated 3,000 cubic yards of contaminated soil, discovered during removal of USTs at the Jet Fuel Tank Farm were excavated and stockpiled at the South Parking Lot. Toluene and xylene were detected at levels up to 5,500 mg/kg in these soils. Additional samples collected just outside the area of removal identified soil containing TPH at concentrations up to 5,500 mg/kg. In 1990, Buildings 52 and 55 were demolished in order to construct Building 65. During excavation for the Building 65 foundation, contaminated soils contained petroleum hydrocarbons and inorganics including cadmium, chromium, lead and copper distributed throughout much of the Building 65 area (Textron 1991). An estimated 12,000 cubic yards of contaminated soil was excavated to the low-tide water level and added to the soil pile at the South Parking Lot. The soils were aerated on-site to reduce contaminant levels and then placed in the South Parking Lot. Concentrations of 1,1,2,2-TCA, PAHs, SVOCs, and cadmium exceed RSR criteria for samples from borings completed in the final placement location of this soil.	Reuse of treated soil requires evaluation of RSR compliance within context of DEP approved placement.
20	Causeway			Non time Critical Removal Action installed erosion resistant cover structure isolating soils from direct exposure.	Removal Action Completed Requires evaluation to validate as final remedy, an Environmental Land Use Restriction preventing disturbance, and appropriate O&M and Financial assurance

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
21	Building 65 Area; Previous Location of Buildings 52 and 55	Paint (zinc-chromate); Petroleum	Unknown	In 1990, Buildings 52 and 55 were demolished in order to construct Building 65. Buildings 52 and 55 had previously been used for production material warehousing. During excavation for the Building 65 foundation, contaminated soils were discovered that contained petroleum hydrocarbons and inorganics including cadmium, chromium, lead and copper distributed throughout much of the Building 65 area. This contamination was believed to partially be the result of disposal of zinc-chromate undercoat used in aircraft painting processes conducted in Building 2 in the 1940s, and/or from fill obtained from contaminated river sediments. An estimated 12,000 cubic yards of paint- and petroleum-contaminated soil was excavated to the low tide water level and placed in a soil pile in the South Parking Lot. Soil samples were collected outside the footprint of the excavated soils. The concentration of TPH in soil at SB06A2-2 exceeds RSR criteria.	Additional evaluation of AOC required.[6] Further remediation required for release if evaluation finds criteria exceeded.
27	Building 58 and Associated Satellite Accumulation Areas	Waste 1,1,1-TCA; Waste jet fuels	Constructed in 1967	Waste 1,1,1-TCA and waste jet fuels were stored in satellite accumulation areas located in the building. This area was also used for open storage in the 1950s and 1960s. It is not believed that activities within the building were associated with a release. Oil was reportedly observed in subsurface soil during pile driving for construction of the building. This area was used for open storage in the 1950s and 1960s. No samples were collected from this AOC.	Insufficient data to determine if there is or is not a release. Visual evidence reported of pollution in area, likely not associated with AOC, but requires further evaluation.
29	Building 48 and Associated Satellite Accumulation Areas	Paint cans	Constructed in 1961	Prior to construction of Building 48, aerial photographs indicated that this area was used for open storage. Paint cans and waste paint were stored in Building 48 in 55-gallon drums in satellite accumulation areas located in the building. Release determination not possible due to contamination in area. The concentration of dichloromethane in soil exceeds RSR criteria.	Remediation required for this location. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
36	Building 12 and Associated Satellite Accumulation Areas	Ammonia; Waste filters	Constructed in 1942	Waste filters were stored in accumulation areas located in this building. A 1943 fire insurance map depicts a machine oil storage area adjacent to the building. A 1956 map shows three 1,000 gallon anhydrous ammonia tanks in this area. No soil samples collected from this AOC.	Insufficient data to determine if there is or is not a release.
41	Building 9 Former USTs	Gasoline	Shown on maps as early as 1931. Four tanks removed in 1989 and two tanks removed in 1995.	Fire maps indicate gasoline USTs in the area southeast of Building 9 and north of Building 10. A total of six tanks were located in this area: two 2,500-gallon unleaded gasoline tanks, two 3,000-gallon gasoline tanks, and two 3,000-gallon unleaded gasoline tanks A release has occurred but no analytical results exceed RSR criteria.	Additional evaluation of AOC required.[6] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
42	Building 9 USTs				see AOC 41
46	Building 52 Former UST	Oil	Abandoned in place in 1969	A 1,000-gallon oil UST was located beneath Building 52 until it was sand filled and abandoned in 1969. One soil boring (SB08J1-1) adjacent to the UST found no concentrations of detected analytes greater than the RSR criteria.	RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
47	Building 73 Radioactive Waste Storage Area			Following radiological surveys of the former storage areas, the NRC released the AOC for unrestricted use. No samples for other potential pollutants at area.	NRC License terminated 29 September 2000. No further action for radiation issues. Additional evaluation of location required for pollutants other than radiation. Remediation required if evaluation finds criteria exceeded. [4]

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
54	Building 17	No 4. fuel oil	1952 – late 1980s	A 10,000-gallon aboveground storage tank that contained No. 4 fuel oil was used to supply fuel to a boiler located in this building. Petroleum stained soils observed in area in 1988 but not removed Release not known or suspected from AOC; any release would flow over slab to floor drain. No concentrations of detected analytes in soil adjacent to floor drain are greater than the RSR numerical criteria.	Visual evidence of release reported at location may indicate historical pollution or polluted fill is present in area. Additional evaluation needed. Also, abutting AOCs require remediation, and their remedial confirmation design must consider this pollution. RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
70-72	ASTs near Building 44	Oil-alum; Methanol Fuel Oil #6	Unknown	Three ASTs were located in this area: a 10,000-gallon oil-alum tank was transferred from its location near Building 13 in 1988; a 5,000-gallon methanol AST; and a 400,000-gallon Fuel Oil #6 AST. No soil samples collected from this AOC.	Insufficient data to determine if there is or is not a release. [6] RSR compliance demonstration requires representative sampling; additional data, including TPH sampling, is needed.
73	Fuel, Lubricating, and Hydraulic Oils near Building 69	Fuels; Lubricating oil; Hydraulic oil	1980 - 1991	Fuels and lubricating and hydraulic oils were stored near former Building 69. Reportedly, less than 13,750 gallons (at any given time) of these fluids were stored in 55-gallon drums in this area No soil samples collected from this AOC.	Insufficient data to determine if there is or is not a release. [6]
74 & 75	PCB Transformers in Building 2 and Building 3	PCB		Release not known or suspected, based on visual observations made during transformer removal. All PCB containing transformers were removed in 2005, after RI preparation.	Insufficient information; pending DEP receipt and review of transformer removal report of actions.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
--	Former Pits or Lagoons - North Parking Lot	Fuels	1940s	Aerial photography from 1943 indicates the presence of possible pits or small lagoons in the North Parking Lot. In 1944, Building 2 was expanded to the northwest, and during the expansion this area was likely filled. No disposal history for this area is available. Analytical results from samples collected in this area indicate fuel-related contaminants. Concentrations of arsenic and TPH in soil exceed RSR criteria.	Remediation required for release. [4]
--	Shed North of Building 12 Used to Store Cuttings	Metals cuttings; Machine oils	1990s	A shed located to the northwest of Building 12 was used to store metal cuttings in the 1990s, in a dumpster within a covered bermed area. A former building was located in this area during the 1940s, and was used as a test house and as a mould shop. Machining oils were stored in an adjacent portion of Building 12. Aerial photography from 1970 and 1980 show open storage in this area. A release is not known or suspected from the cutting storage activity. No analytes were detected in soil at a sampled location in the shed.	Insufficient information to determine if a release occurred associated with historical area usage. Remediation required if evaluation finds criteria exceeded. [4]
Additional areas identified by DEP					
--	PCB containing oil in vicinity of sump near Pump House 38			PCBs were detected in waste oil in the sump at Building B-38. Following the identification of PCB containing oil the stormwater line leading to Building B-38 sump was lined to prevent infiltration. Investigation conducted after RI preparation documents PCBs remain in soil near the stormwater line.	Remediation required for release. [4]
--	Fill Areas			Areas of fill are present on site, especially along former shoreline filled in 1940s. Baseline soil evaluation identified pollution present in soils and above screening criteria is commonly but not always associated with an AOC. Origin of this pollution (from AOCs or fill quality or general usage of area not associated with an AOC) may be indeterminate.	Remediation required for pollution in area, and may require additional samples depending on remedial approach. RSR DEC compliance evaluation required for fill soils not removed through consolidation of multiple AOCs and proximate fill soils above criteria.

AOC # [1]	Description [2]	Potential Pollutant(s) [2]	Date of Storage, Release, or Disposal [2]	Environmental Summary [2]	AOC Status [3]
--	Isolated Areas with detections of pollution			Localized areas of shallow (possibly fill) soils are above the baseline criteria/deflection point but not apparently associated with an identified AOC, notably but not limited to the following, where RSR criteria are exceeded: PAHs in location between B2 and B65, in front of B2 along Main Street, south parking lot area (including near B71), and small parking lot near corner of Main St and Sniffins Lane. Cadmium in south parking lot. Several pollutants in the general vicinity of B7-9, and north of B42 extending towards the Hazardous Waste and Waste Oil Area.	Insufficient information to determine if localized detections above criteria reflect release from an unidentified AOC or are fill-related. Further evaluation needed to determine the degree and extent of the pollution above criteria. Remediation required where pollution is above criteria. Some areas are in or near AOCs to be remediated and may be concurrently mitigated. [4]
--	Site-wide Baseline Condition	Various cVOCs, BTEX, TPH, PAHs, metals		Some site baseline concentrations are above naturally occurring levels, and some baseline screening criteria/deflection points exceed RSR criteria. These are attributed to general site usage/filling and/or assumed existence of numerous small isolated releases. TPH exceeds Residential DEC in shallow soils. Chlorinated VOCs and petroleum hydrocarbons may be present at levels above RSR criteria in groundwater and soil vapor underlying much of the Main Parcel.	Remediation/control (e.g. ELUR) required for statistical site-wide conditions above criteria.

Acronyms[2]:

1,1,1-TCA = 1,1,1-trichloroethane
AOC = Area of Concern
AST = Aboveground storage tank
Bgs = Below ground surface
BTEX = Benzene, toluene, ethylbenzene, and xylene
CDF = Cyanide Destruction Facility
cis-1,2-DCE = cis-1,2-dichloroethene
Cr(VI) = Hexavalent chromium
cVOCs = Chlorinated volatile organic compounds
CWTP = Chemical Waste Treatment Plant
DEC = Direct exposure criteria of RSR
ECM = Electrochemical machining
ELUR = Environmental Land Use Restriction
I/C = Industrial/commercial
LDF = Land disposal facility per RCRA
LNAPL = Light non-aqueous phase liquid
mg/kg = Milligrams per kilogram
NaOH = Sodium hydroxide
NPDES = National Pollutant Discharge Elimination System
NRC = Nuclear Regulatory Commission
O&M = Operations and Maintenance PlanOATP = Oil Abatement Treatment Plant
OF = Outfall
PAH = Polynuclear aromatic hydrocarbon
PCB = Polychlorinated biphenyl
PCE = Tetrachloroethene
RAP = Remedial Action Plan
RCRA = Resource Conservation and Recovery Act
RSR = Remediation Standard Regulation
SAEP = Stratford Army Engine Plant
SVOC = Semi-volatile organic compound
TCE = Trichloroethene
TPH = Total petroleum hydrocarbons
USEPA = United States Environmental Protection Agency
UST = Underground storage tank
VOC = Volatile organic compound
VC = Volatilization Criteria

Notes:

1. Not all AOCs have assigned numbers. AOC variously used to describe specifically the waste management practice and also the particular footprint at SAEP, irrespective of the waste handling.
2. Information derived from Final RI.
3. Status as determined by DEP
4. For remedial design additional site information may be needed, depending on the remedial approach selected.
5. Administrative closure under RCRA may require re-evaluation of containment integrity and potential release pathways through chip, wipe or core sampling. If pollution is present under containment, regardless of origin, location must be identified as an AOC and integrated into corrective action program.
6. See Army letter dated 30 January 2006, which identified additional evaluations to be implemented as part of remedial design. Note that with different remedial options data needs may vary and that DEP has thus deferred approval of specific data evaluations proposed in letter.

Appendix B-1

U.S. EPA Environmental Indicator.
Migration of Contaminated Groundwater Under Control Worksheet

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: _____
Facility Address: _____
Facility EPA ID #: _____

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   _____ If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ if data are not available, skip to #8 and enter"IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

_____ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and
Reference(s):_____

Footnotes:

[1]"Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

_____ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and
Reference(s):_____

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

_____ If yes - continue after identifying potentially affected surface water bodies.

_____ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and
Reference(s):_____

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

_____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

Rationale and
Reference(s):_____

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR
2) providing or referencing an interim-assessment,[5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):_____
_____
_____
_____
_____
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_____

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

_____ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

Rationale and
Reference(s):_____

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

_____ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the _____ _____facility, EPA ID # _____, located at_____. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

_____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

_____ IN - More information is needed to make a determination.

Completed by (signature)_____ Date _____
(print)_____
(title)_____

Supervisor (signature)_____ Date _____
(print)_____
(title)_____
(EPA Region or State)_____

Locations where References may be found:

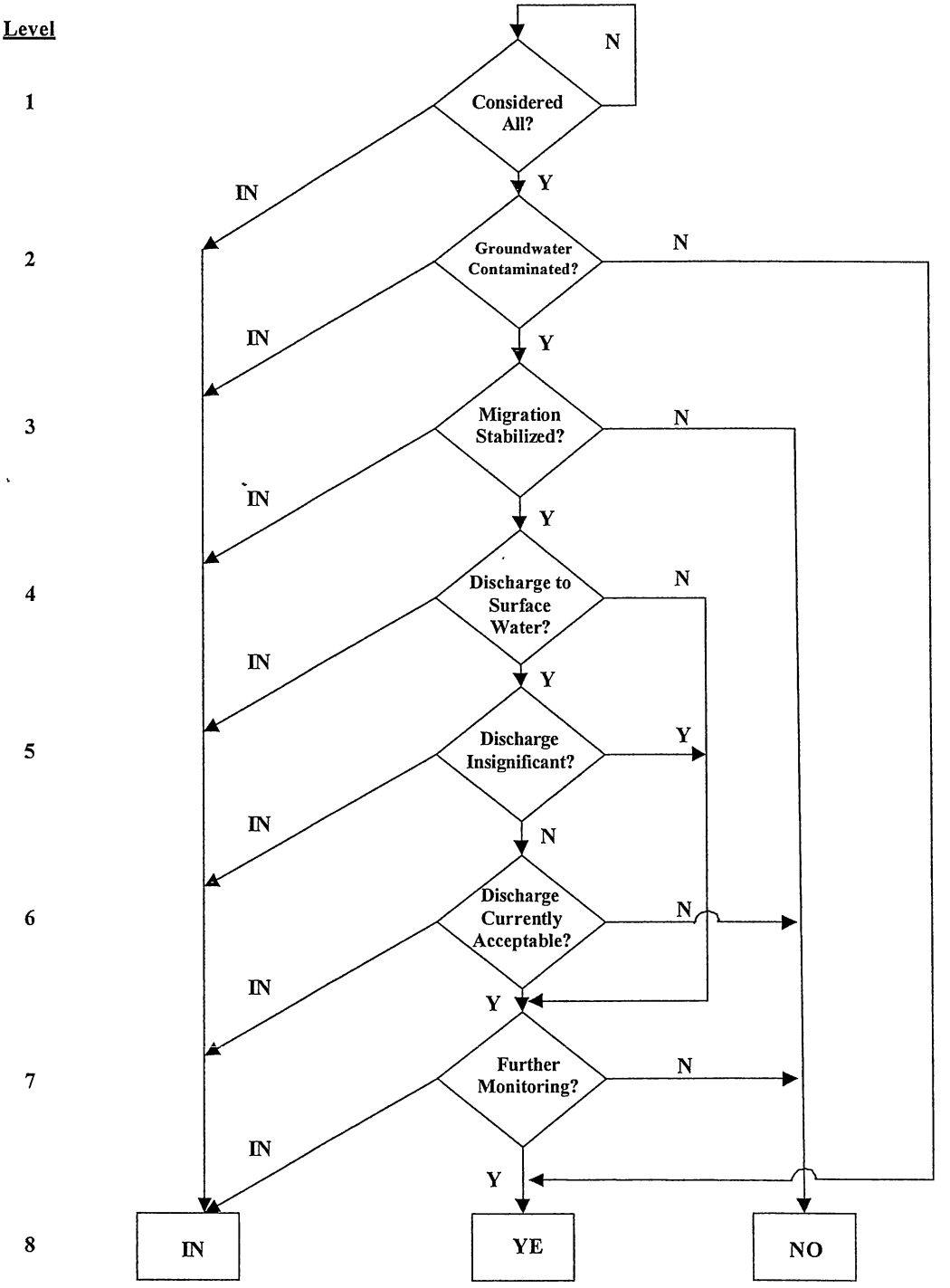
_____
_____
_____
_____
_____

Contact telephone and e-mail numbers

(name)_____
(phone #)_____
(e-mail)_____

Facility Name: _____
EPA ID#: _____
City/State: _____

MIGRATION OF CONTAMINATED GROUNDWATER UNDER CONTROL (CA 750)



Appendix B-2

Post-Closure Plan
Textron Lycoming dated December 17, 1991

Section I

Closure Plan, Post-Closure Plan, and Financial Requirement

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Section I

Closure Plan, Post-Closure Plan and Financial Requirements

This section describes the Closure Plan implemented to close the AVCO Corporation, Textron Lycoming Division (Textron Lycoming) surface impoundments in 1987 - 1989, and presents the Post-Closure Plan proposed for the post-closure care period. A description of the post-closure notices that were made and documentation of the post-closure cost estimate and exemption from financial assurance mechanism for post-closure are also presented.

I-1 Closure Plan [40 CFR 270.14(b)(13); 265.112]

A Surface Impoundment Closure Plan for the Textron Lycoming facility was submitted to the DEP and EPA in September 1987. The Closure Plan is provided in Appendix I-1. Amendments to the Surface Impoundment Closure Plan were submitted to DEP and EPA on September 30, 1987 (see Appendix I-2); January 5, 1988 (see Appendix I-3); and February 24, 1988 (see Appendix I-4).

This section presents the following background information:

- the submittal of the Closure Plan and its amendments
- DEP/EPA approval of the Closure Plan
- Closure Plan implementation
- closure certification

The Closure Plan was submitted in accordance with 40 CFR 265.112, and the Regulations of Connecticut State Agencies [Section 22a-449(c)-29(c)]. A description of the closed surface impoundments is included in Section B-1a. A description of the waste material placed in the surface impoundments is included in Section C.

Textron Lycoming's Closure Plan and closure implementation for the surface impoundments included the following activities:

- Removal of standing liquid from the equalization lagoon and processing this material through the treatment system contained in Building 18 for the removal of cyanide, chromium, and other heavy metals;
- Removal of settled solids and sludges from the four surface impoundments, pumping the materials to a holding tank, and dewatering the materials using filter presses;
- Removal of the bentonite liner beneath the equalization lagoon and soils underlying all four lagoons by excavating these materials vertically to at least the seasonal low water table elevation (generally to 1.5′ below the water table) and horizontally, as required, to remove any contaminated soils;
- Transportation of contaminated soils and dewatered sludges to a RCRA permitted hazardous waste treatment or disposal facility;
- Sampling and analyses of soils remaining after excavation to confirm that all contaminated soils had been removed from the surface impoundments;
- Removal of a pump station and associated piping and transportation to a RCRA approved facility for disposal;
- Providing site restoration, including backfilling and sloping to establish surface drainage patterns away from the locations of the closed surface impoundments;

- Designing and installing a final cover, including an impermeable bottom layer (synthetic geomembrane), middle drainage layer and vegetated top cover to minimize erosion;
- Preparation of a certificate of closure, including a survey plat and notification to the property deed; and
- Continuance of the Groundwater Assessment Monitoring Program for the waste management area during closure, as described in Section E-2.

DEP/EPA Review And Approval of the Closure Plan

Appendix I-5 contains the letter that documents the review and approval of the amended Closure/Post-Closure Plan by the DEP and EPA Region I.

Textron Lycoming's Certification of Closure

On May 22, 1990, VFL Technology Corporation certified the Textron Lycoming surface impoundments had been closed in accordance with all federal, state and local regulations. A copy of this certification is presented in Appendix I-6.

I-1a Closure Performance Standard [40 CFR 265.111]

In accordance with 40 CFR 265.111, closure activities for the surface impoundments were required to accomplish the following objectives:

- minimize the need for further maintenance;
- control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and
- comply with the closure requirements for surface impoundments [40 CFR 265.228]

To achieve the above objectives, the following Closure Performance Standards were established:

- Remove all wastes and contaminated subsoils, including liner, from the surface impoundments as described in Section I-1, in accordance with the DEP/EPA approved Closure Plan;
- Remove contaminated soil until the remaining soils, using analysis described in Table I-1, had levels that conformed to health and environmental based standards or background for all exposure pathways (the leachate extraction procedure was to be used for the groundwater pathway and mass analysis for the direct ingestion pathway);
- Provide closure as a landfill in accordance with 40 CFR 265.310 for any contaminated soil left in place;

Table I-1

Analytical Methods for Closure Soil Sampling

Analysis	Method
Aromatic Volatile Organics	Method 5030/8020[1]
Halogenated Volatile Organics	Method 5030/8010[1]
Cyanide	Method 9010[1]
Arsenic	Extraction Method 1310[1]
Barium	Extraction Method 1310[1]
Cadmium	Extraction Method 1310[1]
Chromium	Extraction Method 1310[1]
Lead	Extraction Method 1310[1]
Mercury	Extraction Method 1310[1]
Nickel	Extraction Method 1310[1]
Selenium	Extraction Method 1310[1]
Silver	Extraction Method 1310[1]
Hexavalent-Chromium	Extraction Method 1310[2]

[1] Test Methods for Evaluating Solid Waste, USEPA, DSW, SW-846, third edition, September 1986.

[2] Using EP toxicity test without acetic acid adjustment.

- Provide post-closure care for a landfill under 40 CFR 265.310 and 40 CFR 265 Subpart G, including a final cover that:
  - provides long-term minimization of migration of liquids through the closed landfill;
  - functions with minimum maintenance;
  - promotes drainage and minimizes erosion or abrasion of the cover;
  - accommodates settling and subsidence so that the cover's integrity is maintained; and
  - has a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.
- Provide additional post-closure care for the surface impoundments by:
  - maintaining the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events;
  - maintaining and monitoring the groundwater monitoring system and complying with all other applicable requirements of 40 CFR 265 Subpart F, including procedures outlined in the Groundwater Monitoring Assessment Program, March, 1987; and
  - preventing run-on and run-off from eroding or otherwise damaging the final cover.

I-1b Maximum Waste Inventory [40 CFR 265.112(b)(3)]

The maximum waste inventory was determined using base maps and surveys completed in 1985 and 1986. To estimate the material depths, a low groundwater elevation of 1.85 feet MSL, June 27, 1986, was used. As shown in Table I-2, the total estimated quantity of waste

Table I-2

Waste Inventory

Surface Impoundment	Component	Area (sq.ft.)	Depth (ft.)	Volume
Equalization (Lagoon 1)	Liquid	25,600	2	384,000 gal.
	Sludge	25,600	3	2,800 yd^3
Sludge Settling (Lagoon 2)	Sludge	9,140	3	1,020 yd^3
Sludge Settling (Lagoon 3)	Sludge	7,920	3	880 yd^3
Sludge Settling (Lagoon 4)	Sludge	12,600	4	1,870 yd^3
	Totals		Liquid	384,000 gal.
			Sludge	6,570 yd^3

inventory in the surface impoundments at the time of closure was 384,000 gallons of liquid (contained in Lagoon 1, the equalization lagoon), and 6,570 yd^3 of sludge (total for all four surface impoundments).

I-1c Inventory Removal, Disposal, and Decontamination of Equipment [40 CFR 265.114]

Waste materials and contaminated soils and liner were removed from the closed surface impoundments in accordance with the DEP/EPA approved Closure Plan and amendments contained in Appendices I-1 through I-4. Activities conducted during the closure implementation are summarized in Section I-1. Excavated contaminated soils and dewatered sludge were transported to Stablex, Quebec, Canada for disposal.

All equipment used during the closure process was decontaminated in accordance with the approved Closure Plan prior to removing the equipment from the site. This equipment included pumps, piping, dewatering equipment, backhoes, loaders, trucks, and personnel protective equipment.

I-c(1) Deviations from the Approved Closure Plan

Minor departures from the approved Closure Plan are described in a VFL Technology Corporation letter contained in Appendix I-7. This work included in-situ stabilization of the underlying soils to improve the subsurface conditions at the base of Lagoons 2, 3, and 4. This stabilization consisted of mixing on-site soils with a cement mixture that was delivered to the Textron Lycoming facility by truck. This procedure was required to provide sufficient strength to the remaining soils to adequately support the weight of the final fill material and cover, and prevent subsidence.

I-1c(2) Achievement of Closure Performance Standards

In accordance with 40 CFR 265.111, closure activities for the surface impoundments achieved the following objectives:

- the final cover was designed and installed to minimize the need for further maintenance;
- waste materials were removed from the surface impoundments and the final cover (including an impermeable liner) that was designed and installed to control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere;
- wastes and contaminated subsoils, including liner, were removed from the surface impoundments as described in Section I-1;

- closure as a landfill was accomplished in accordance with 40 CFR 265.310 and 40 CFR 265 Subpart G, including a cover that:
  - provides long-term minimization of migration of liquids through the closed surface impoundments;
  - functions with minimum maintenance;
  - promotes drainage and minimizes erosion or abrasion of the cover;
  - accommodates settling and subsidence so that the cover's integrity is maintained; and
  - has a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.
- post-closure care is continuing to be provided for the closed surface impoundments by:
  - maintaining the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct any effects of settling, subsidence, erosion, or other events (the area is currently graded, sloped and covered by vegetation, to comply with the approved Closure Plan);
  - maintaining and monitoring the groundwater monitoring system and complying with all other applicable requirements of 40 CFR 265 Subpart F, including procedures outlined in the Groundwater Assessment Monitoring Program, March, 1987; and
  - preventing run-on and run-off from eroding or otherwise damaging the final cover.

Section E-2 presents details of the Groundwater Assessment Monitoring Program and presentation of the groundwater analytical data.

I-2 Post-Closure Plan [40 CFR 270.14(b)(13)]

This Post-Closure Plan covers the closed surface impoundment area for which closure was certified in accordance with 40 CFR 265.115 on May 22, 1990. Closure activities were completed for the surface impoundments in accordance with the approved Closure Plan and are described in Section I-1. The post-closure activities proposed for the closed surface impoundment area are presented below in Sections I-2a through I-2h. All post-closure activities undertaken during the permitted portion of the post-closure care period (heretofore "post-closure care period") will be in accordance with this Post-Closure Plan. Upon receipt of a final RCRA Post-Closure Permit, this Post-Closure Plan (Section I-2) will supercede the Post-Closure Plan submitted with the original Closure Plan (see Appendix I-1).

The post-closure care period began on May 22, 1990 when Textron Lycoming certified closure of the four surface impoundments. In accordance with 40 CFR 264.117(a)(1), the 30-year post-closure care period will terminate on May 22, 2020. However, in accordance with 40 CFR 264.117(a)(2), Textron will submit an application for a permit modification to shorten the post-closure care period if it can be established that further post-closure care of the former waste management unit is not required to protect human health and the environment.

I-2a Post-Closure Care of Property [40 CFR 264.117]

The post-closure maintenance and monitoring activities specified in Sections I-2b through I-2h are proposed for the post-closure care period required by 40 CFR 264.117(a)(1). These post-closure maintenance and monitoring activities will be continued throughout the post-closure care period.

Use of the closed surface impoundment area will be restricted during the post-closure care period to protect the final cover and the monitoring system, in accordance with 40 CFR 264.117(c). Activities which may disturb the integrity of the final cover or the function of the facility's monitoring system will not be permitted. The appropriate post-closure notices have been made in accordance with 40 CFR 264.119, as described in Section I-2g.

I-2b Post-Closure Inspection and Maintenance Plan [40 CFR 264.118(b)(2)]

This section describes the elements of the Post-Closure Inspection and Maintenance Plan. In accordance with 40 CFR 264.118(b)(2), the proposed Post-Closure Inspection and Maintenance Plan describes the planned inspection and maintenance activities to be followed, and the frequencies at which these activities will be performed throughout the permitted portion of the post-closure care period to ensure the integrity of the final cover, and the proper function of the monitoring equipment. Implementation of this plan will ensure facility compliance with 40 CFR 264.117 throughout the post-closure care period.

I-2b(1) Post-Closure Inspection Plan [40 CFR 264.118(b)(1)]

Post-closure inspections will constitute an integral part of the post-closure monitoring and maintenance programs. Post-closure inspections will be performed to provide a mechanism for preventing and detecting equipment deterioration, malfunctions, erosion, vandalism, or mis-use of the property during the post-closure care period. When implemented, the post-closure inspections will prevent, or provide early detection for, any of the above events which, if allowed to continue, could result in a release of hazardous constituents, or constitute a threat to human health or the environment. Post-closure inspections will be conducted to give early warning of potential problems so that timely preventative or corrective actions can be taken.

Inspections will focus on verifying the integrity of the following items:

- site security
- final cover
- groundwater monitoring system

The Post-Closure Contact for Textron Lycoming (identified in Section I-2e) will be responsible for implementation of the inspection program. The Post-Closure Contact will have a thorough knowledge of the Post-Closure Inspection and Maintenance Plan. The Post-Closure Contact will have the responsibility to:

- implement the required inspections
- select and promptly implement appropriate maintenance or other required measures

Post-closure inspections will be conducted in accordance with the proposed schedule in Section I-2b(4). Inspections will be carried out only by personnel with a thorough knowledge of the Post-Closure Inspection and Maintenance Plan. Inspectors will work under the direction of the Post-Closure Contact and will prepare written inspection reports consisting of completed Post-Closure Inspection Checklist Report Forms. A typical Post-Closure Inspection Checklist Report Form is presented in Figure I-1. A brief description of each post-closure inspection item included in Figure I-1 is presented in Sections I-2b(1)(i) through I-2b(1)(iii).

As indicated in Figure I-1, the condition of each post-closure inspection checklist item will be assessed at the time of each post-closure inspection. For any item not found to be in acceptable condition, the inspector will indicate that maintenance is required and describe the specific type of maintenance or other measures that are necessary. After receiving each inspection report, the Post-Closure Contact will be responsible for taking prompt action to provide any maintenance or other care that may be required.

Figure I-1

Typical Post-Closure Inspection Report Form

Textron Lycoming **Post-Closure Inspection Checklist**	Date of Inspection (month/day/year) Time of inspection (hrs)

	Inspection Element	Status Acceptable (Y/N)	If Status Not Acceptable, Action Required
SECURITY	Fence line integrity		
	Gates entrances		
	Evidence of persons trespassing		
	Evidence of vandalism		
	Warning signs in place		
	Other:		
FINAL COVER	Evidence of soil erosion		
	Adequate vegetation cover		
	Stressed vegetation		
	Evidence of burrowing animals		
	Settling/Subsidence		
	Ditches/Drainage structures		
	Other:		
MONITORING	Monitoring wells locked		
	Outer casing integrity		
	Inner casing integrity		
	Concrete apron integrity		
	Other:		

Post-Closure Contact Notified: ☐ Yes ☐ No	Inspected by: *Signature*
Maintenance or Action Required: ☐ Yes ☐ No	Name and Title:
Response Timing: ☐ Urgent ☐ Routine ☐ No response required	Company:

I-2b(1)(i) Inspection of Post-Closure Security Systems

The post-closure security systems in place during the post-closure care period will include the following items:

- access to the Textron Lycoming site is limited to controlled gates, which are manned 24-hours/day by Textron Lycoming security guards; all visitors and contractors must receive authorization before entering any part of the facility
- a 6 - 10-foot high chain link fence is installed around the perimeter of the entire Textron Lycoming site except for the portion secured by Buildings #1 and #2 along Main Street
- a dedicated chain link fence with a locked gate that encloses the area of the closed surface impoundments
- signs with the legend "Danger — Unauthorized Personnel Keep Out" posted at the access gate to the enclosed location of the closed surface impoundments
- full time 24 hour/day security guards patrolling the facility on a daily basis
- outside lighting used to illuminate the facility at night

In accordance with the Post-Closure Inspection Report Form presented in Figure I-1, inspections to establish the condition of the post-closure security systems during the post-closure care period will include:

Fence Line Integrity — Establish condition of fences restricting access to the closed surface impoundment area to ensure they are sufficient to prevent unauthorized personnel and livestock from entering the area.

Gate Entrances — Establish that all gate entrances are being regularly monitored by security personnel, or are locked and secured.

Evidence of Trespassing and Vandalism — Identify any evidence of such intrusions, and evaluate the means of entry and possible measures to be taken to prevent entry.

Warning Signs in Place — Verify that warning signs reading "Danger — Unauthorized Personnel Keep Out" are posted and maintained at the entrance to the closed surface impoundment area.

Other Security Items — Any other concerns identified during inspections related to security of the closed surface impoundment area.

Inspection will be conducted at the frequencies presented in the Post-Closure Inspection and Maintenance Schedule in Section I-2b(4). Any need for maintenance to the security system

will be established via these inspections and appropriate post-closure maintenance measures will be selected and implemented as described in Section I-2b(2)(i).

I-2b(1)(ii) Inspection of Final Cover

In accordance with the Post-Closure Inspection Form presented in Figure I-1, inspections to establish the condition of the final cover during the post-closure care period will include:

Evidence of Soil Erosion — Inspect earthen cover and surrounding area to identify any evidence of soil erosion.

Adequate Vegetation Cover — Inspect vegetation over final cover to ensure that it adequately covers the closed surface impoundment area.

Stressed Vegetation — Identify any evidence of stressed vegetation.

Evidence of Burrowing Animals — Inspect cover for holes, tunneling, or other evidence of burrowing animals that could damage the impermeable cover layer or channel rain water and accelerate the migration of liquids through the final cover.

Settling/Subsidence — Identify any areas where depressions or other evidence of settling or subsidence of the final cover have developed.

Ditches/Drainage Structures — Inspect perimeter ditches and drainage structures to ensure they are in good condition.

Other Final Cover Items — Any other concerns identified during inspections related to the final cover for the closed surface impoundment area.

If any need for maintenance to the final cover that is established via the inspections, appropriate post-closure maintenance measures will be selected and implemented as described in Section I-2b(2)(ii).

I-2b(1)(iii) Inspection of Groundwater Monitoring System

The post-closure groundwater monitoring system consists of 22 groundwater monitoring wells at 13 locations and are identified in Figure E-1. In accordance with the Post-Closure Inspection Form presented in Figure I-1, inspections to establish the condition of the groundwater monitoring system during the post-closure care period will include:

Monitoring Wells Locked — Ensure that monitoring well outer casing tops are closed and locked.

Outer Casing Integrity — Inspect outer casing to identify any corrosion or deterioration that may compromise monitoring well integrity.

Inner Casing Integrity — Inspect inner casing to identify any deterioration or other evidence of malfunction that may compromise monitoring well integrity.

Concrete Apron Integrity — Inspect concrete apron around outer casing to identify any evidence of cracks or deterioration that would compromise monitoring well integrity by accelerating the migration of surface water run-off to the monitored zone.

Other Monitoring System Items — Any other concerns identified during inspections related to the groundwater monitoring system for the closed surface impoundment area.

Additional inspection and assessment of monitoring well system, particularly for the inner casing and well screen of each well, will be conducted as a routine part of the post-closure groundwater monitoring program described in Section I-2c. Any need for maintenance identified during implementation of the post-closure monitoring program will be immediately brought to the attention of the Post-Closure Contact for prompt action. A description of inspections to be conducted as a part of the post-closure monitoring program is presented in Section E-3b(1).

Any need for maintenance to the groundwater monitoring system will be identified via the routine post-closure inspection program or post-closure monitoring program and appropriate post-closure maintenance measures will be selected and implemented as described in Section I-2b(2)(iii).

I-2b(2) Post-Closure Maintenance Plan [40 CFR 264.118(b)(2)]

The closed surface impoundment area should not require any routine scheduled post-closure maintenance during the post-closure care period. Post-closure maintenance will be performed for the final cover, groundwater monitoring system, and security systems throughout the post-closure care period on an as-needed basis, as determined through the post-closure inspections described in Section I-2b(1). Typical maintenance activities to be performed based on these inspections are described in Sections I-2b(2)(i) through I-2b(2)(iii).

The Post-Closure Contact will be responsible for promptly implementing any required maintenance activities during the post-closure care period. The Post-Closure Contact will review each Post-Closure Inspection Report to determine whether any maintenance activities are required. If maintenance activities are required, the Post-Closure Contact will ensure that all necessary arrangements are made with plant personnel or subcontractors, as appropriate. The Post-Closure Contact will be responsible for following through with implementation of all maintenance activities, including ensuring the work is properly completed in a timely fashion.

The Post-Closure Contact will be responsible for completing Post-Closure Maintenance Reports for each maintenance activity completed during the post-closure care period. A Typical Post-Closure Maintenance Report Form is presented in Figure I-2. Completed Post-Closure Maintenance Reports and other supporting documentation will be maintained on file throughout the post-closure care period in the Post-Closure Inspection and Maintenance Log described in Section I-2b(3).

Figure I-2

Typical Post-Closure Maintenance Report Form

Textron Lycoming **Post-Closure Maintenance Report Form**	Date Maintenance Activity Begun: Date Maintenance Activity Completed:

Maintenance Activity

Total Cost for Maintenance

Maintenance Initiated in Response to:

- ☐ Post-Closure Inspection date: _____
- ☐ Security Guard Patrol date: _____
- ☐ Groundwater Sampling Inspection date: _____
- ☐ Other (specify) _____

Approved by:
Date:

I-2b(2)(i) Maintenance of Security

As indicated in Section I-2b(1)(i), the security system will be inspected to ensure that it is maintained in good condition throughout the post-closure care period. Based on the results of post-closure inspections, the following maintenance activities may be required for the security system during the post-closure period:

- repair to fence lines
- repair to gates, locks, or chains restricting access at entrances to the facility
- repair or replacement of warning signs
- other maintenance measures to site security systems as required

I-2b(2)(ii) Maintenence of Final Cover [40 CFR 264.118(c)(2)(i)]

The final earthen cover over the closed surface impoundment area has been stabilized with adequate vegetation (grasses and other non-woody plants) and has remained stable since certification of closure on May 22, 1990. There is no evidence that this area has been subject to settling, subsidence, or significant soil erosion during this time period. The current vegetative covering over the closed surface impoundment area is healthy, and there is no evidence of stressed vegetation.

As indicated in Section I-2b(1), the final cover will be inspected to ensure that it is maintained in good condition throughout the post-closure care period. Based on the results

of post-closure inspections, the following maintenance activities may be required for the final cover during the post-closure period:

- mowing to prevent intrusion by woody plants, and minimize the incidence of burrowing animals
- addition of topsoil and re-seeding to stabilize soil and vegetative cover to prevent erosion
- re-seeding to restore adequate density and coverage of grassy vegetation
- plugging and filling any holes or tunnels caused by burrowing animals
- addition of topsoil or other suitable fill materials where settling or subsidence has occurred, and compaction and regrading of these fill materials as required
- other maintenance measures to the final cover as required

I-2b(2)(iii) Maintenance of Groundwater Monitoring System [40 CFR 264.118(c)(2)(ii)]

The groundwater monitoring system is designed to function throughout the post-closure care period, if properly maintained. Any need for post-closure maintenance of the groundwater monitoring system will be identified by either the post-closure inspections, or by additional assessment and inspection of monitoring wells conducted regularly as a part of the post-closure groundwater monitoring program. Based on the results of these inspections, the following maintenance activities may be required for the groundwater monitoring system during the post-closure care period:

- repair or replacement of outer casing or locking cap necessary to maintain the integrity of the outer casing and adequately protect the inner casing and monitoring well integrity
- sealing of cracks or other repair of concrete apron and seal to prevent the infiltration of surface water into the monitoring well
- airlifting, overpumping, or other means as appropriate to clear any sedimentation from the screened interval of the monitoring well
- replacement of monitoring wells in cases where monitoring well integrity is permanently breached or the well is damaged beyond repair
- other maintenance measures to the groundwater monitoring system as required

I-2b(3) Post-Closure Inspection and Maintenance Log

An Inspection and Maintenance Log will be maintained to document completion of all maintenance and inspection procedures in accordance with the Post-Closure Maintenance and Monitoring Plan.

The following records will be maintained in the Post-Closure Maintenance and Inspection Log:

- copy of the Post-Closure Plan
- copies of all Post-Closure Inspection Reports

- copies of all Post-Closure Maintenance Reports
- copies of all records documenting maintenance activities, such as purchase orders and invoices for subcontractors or vendors

The Post-Closure Contact will be responsible for updating and maintaining the Post-Closure Inspection and Maintenance Log on file throughout the post-closure care period.

I-2b(4) Post-Closure Inspection and Maintenance Schedule

The closed surface impoundment area will not require any routine scheduled maintenance during the post-closure care period. Therefore, as stated in Section I-2b(2), there will not be any routine maintenance activities scheduled for the closed surface impoundment area during the post-closure care period. All post-closure maintenance activities will be initiated on an as-needed basis. The need for such maintenance will be identified during the routine post-closure inspections, and other inspection and monitoring activities described above in Section I-2(b)(1).

The post-closure inspections described in Section I-2(b)(1) will be completed on a routine scheduled basis. These inspections will be conducted and recorded quarterly throughout the post-closure care period, in accordance with the schedule presented in Table I-3. Inspections will be conducted more frequently during the post-closure care period it if is determined that maintenance is required more frequent than quarterly. Routine inspections by Textron

Lycoming security guards will be conducted on a daily basis as indicated in Section I-2b(1)(i).

Table I-3

Schedule for Conducting Post-Closure Inspections

Annual Inspection	Completed annually no latter than...
1st Quarter Inspection	March 31
2nd Quarter Inspection	June 30
3rd Quarter Inspection	September 30
4th Quarter Inspection	December 31

The additional inspection of the groundwater monitoring system described in Section I-2b(1)(iii) will be conducted at the time of each groundwater sampling event as described in Section E-3b(1).

I-2c Post-Closure Groundwater Monitoring Plan [264.118(b)(1)]

In accordance with 40 CFR 264.118(b)(1), the post-closure groundwater monitoring program will be implemented throughout the permitted portion of the post-closure care period to detect any releases to groundwater that could potentially occur from the closed surface impoundment area. The groundwater monitoring program proposed in accordance with 40 CFR 264 Subpart F for the post-closure care period is presented in Section E-3.

I-2d Updating/Amendment of Post-Closure Plan [40 CFR 264.118(d)]

Textron Lycoming will submit to the EPA Regional Administrator and the DEP Commissioner a written request for a Post-Closure Permit modification if and when any of the following circumstances occur:

- changes in operating plans or facility design affect the approved Post-Closure Plan
- events which occur during the active life of the facility, including partial and final closures, affect the approved Post-Closure Plan
- an unexpected event affects the Post-Closure Plan
- Textron Lycoming wishes to amend any provision of the Post-Closure Plan

Any written request for modification of Textron Lycoming's Post-Closure Permit will be accompanied with a copy of the amended Post-Closure Plan for approval by the EPA Regional Administrator and the DEP Commissioner. Any written request for permit modification will be submitted at least 60 days prior to the proposed change, or no later than 60 days after an unexpected event occurs that affects the Post-Closure Plan. The Post-Closure Contact will be responsible for preparing, submitting, and maintaining on file any written requests for permit modification, and amending the Post-Closure Plan accordingly.

I-2e Post-Closure Contact [40 CFR 264.118(b)(3)]

The Post-Closure Contact will be the person responsible for implementation of, and adherence to, the Post-Closure Plan during the post-closure care period. The Post-Closure Contact will have a thorough knowledge of the Post-Closure Plan. Throughout the post-closure care period, the Post-Closure Contact will have the responsibility and authority to:

- maintain post-closure records on file as described in Section I-2h
- implement the Post-Closure Inspection and Maintenance Plans as indicated in Section I-2b
- implement the post-closure groundwater monitoring activities as indicated in Section I-2c
- submit any necessary written requests to the EPA Regional Administrator and the DEP Commissioner requesting permit modifications in accordance with 40 CFR 264.118(d), as described in Section I-2d
- update the Post-Closure Cost Estimate annually in accordance with 40 CFR 264.144(b), as described in Section I-6
- prepare and submit to the EPA Regional Administrator and the DEP Commissioner the Post-Closure Certification, in accordance with 40 CFR 264.120, as described in Section I-2g
- serve as the main point of contact for Textron Lycoming on post-closure matters with the DEP and EPA Region I

In accordance with 40 CFR 118(b)(3), the designated Post-Closure Contact for Textron Lycoming will be:

Office of Legal Counsel
Textron Lycoming
Department 56
550 Main Street
Stratford, Connecticut 06497

The EPA Regional Administrator and the DEP Commissioner will be notified in writing of any change in the Post-Closure Contact during the post-closure care period.

I-2f Survey Plat [40 CFR 264.116]

The Survey Plat for the closed surface impoundment area has been prepared and submitted to the EPA Region I, the DEP, and the Town of Stratford (Stratford Zoning Commission and Stratford Environmental Conservation Office). The Survey Plat is included in Appendix I-9. The Survey Plat includes the boundaries of the closed surface impoundment area, referenced to permanent surveyed benchmarks, and was prepared and certified by a professional land surveyor. The following notes are prominently displayed on the Survey Plat:

- The closed surface impoundment area was used to manage hazardous wastes.
- The area's use is restricted under federal regulations [40 CFR 264, Subpart G] and regulations of Connecticut State Agencies [22a-449(c)-29(g)(3)].

I-2g Certification of Completion of Post-Closure Care [40 CFR 264.120]

In accordance with 40 CFR 264.120, within 60 days of completion of the post-closure care period for the closed surface impoundment area, Textron Lycoming will submit to the Regional Administrator and DEP Commissioner a certification that the post-closure care period was performed in accordance with the specifications in the approved Post-Closure Plan.

The Post-Closure Certification will be signed by a duly authorized representative of Textron Lycoming and an independent registered professional engineer. Typical Post-Closure Certifications to be submitted for the closed surface impoundments by a duly authorized representative of Textron Lycoming, and an independent registered professional engineer are presented in Figures I-3 and I-4.

The Post-Closure Contact will be responsible for contracting with the independent registered professional engineer and preparing the Post-Closure Certifications and will oversee the completion and submittal of the certifications to the EPA Regional Administrator and the DEP Commissioner.

Figure I-3

Textron Lycoming
Post-Closure Certification

The undersigned, _____(Name)_____, an officer of the Textron Lycoming, Division of AVCO Corporation, incorporated under the laws in the State of Delaware and licensed to do business in Connecticut, which formerly owned or operated surface impoundments (herein-after "Facility") at the Textron Lycoming site located at 550 Main Street, Stratford, in Fairfield County, Connecticut, has completed post-closure activities for the facility and has fully implemented all measures relating to the post-closure of the facility as set forth in the Post-Closure Plan approved by (Region or State) for said facility.

NOW, THEREFORE, I (we)_____(Name)_____ hereby swear and affirm that the post-closure activities for the above-named hazardous waste facility have been conducted in accordance with the facility's Post-Closure Plan approved in writing by (name of EPA Regional Administrator or DEP Commissioner) on _____, 19__, that all measures relating to post-closure of the facility required by the Post-Closure Plan and the rules and regulations of 40 CFR 264 Subpart G and RCSA 22a-449(c)-104 have been fully implemented, and that to the best of my knowledge, no violations exist.

_____
(Signature)

_____
(Name/Title)

_____
(Address)

Taken, sworn and subscribed before me, this____ day of
_____ A.D. 19__ _____
_____
_____
(Notary)

Figure I-4

Typical Independent Registered Professional Engineer Post-Closure Certification

I, _____(name)_____, a Professional Engineer registered in the State of Connecticut, hereby certify that I have reviewed the Post-Closure Plan for the Textron Lycoming surface impoundments located at 550 Main Street, Stratford, Connecticut, that I am familiar with the rules and regulations of 40 CFR 264 Subpart G and RCSA 22a-449(c)-104 pertaining to post-closure of such a facility, and that I personally have made visual inspection(s) of the former surface impoundment area, and that the post-closure activities for the surface impoundments have been performed in full and complete accordance with the facility's Post-Closure Plan approved in writing by (EPA Regional Administrator or DEP Commissioner) on _____ _, 19_, and the rules and regulations of 40 CFR 264 Subpart G and RCSA 22a-449(c)-104.

_____ _____

(Signature of Professional Engineer) (Date)

_____

(Name of Professional Engineer)

_____ Professional

Engineer Seal

(Professional Engineering License Number)

_____

(Business Address)

_____

(Telephone Number)

I-2h Post-Closure Recordkeeping

The Post-Closure Contact will be responsible for updating and maintaining the following records on file throughout the post-closure care period:

- a copy of the Post-Closure Plan on file in accordance with 40 CFR 264.118(c)
- the Post-Closure Inspection and Maintenance Log as indicated in Section I-2(b)(3)
- the Post-Closure Monitoring records as indicated in Section E-3e
- any necessary written requests to the EPA Regional Administrator and DEP Commissioner requesting permit modifications in accordance with 40 CFR 264.118(d), as described in Sections I-2 and I-2d
- Post-Closure Certification and supporting documentation after the post-closure care period has been completed and certification prepared
- correspondence with the DEP and EPA Region I concerning post-closure

I-3 Documentation of Notice in Deed [40 CFR 264.119]

The following post-closure notices required by 40 CFR 264.119 have been made for the closed surface impoundments:

- In accordance with Connecticut law, a notation on the deed to the facility property has been recorded and will in perpetuity notify any potential purchaser of the property that:
  - The land has been used to manage hazardous wastes.
  - Its use is restricted under 40 CFR 264 Subpart G.
  - The survey plat and a record of the type, location, and quantity of waste disposed of within the closed surface impoundments required by 40 CFR 264.116 and 40 CFR 264.119(a) have been filed with EPA Region I, the DEP, and the Town of Stratford (Stratford Zoning Commission and Stratford Environmental Conservation Office).
- A certification to the EPA Regional Administrator and the DEP Commissioner has been signed by Textron Lycoming certifying that a deed notification has been submitted in accordance with 40 CFR 264.119(b)(1), including a copy of the document in which the notation has been placed. This certification is presented in Appendix I-10.

The deed notice submitted for the Textron Lycoming closed surface impoundments is presented in Appendix I-8. The survey plat that was submitted, as described in Section I-2f, is included in Appendix I-9.

The data from the closure soil sampling described in Section I-1a is presented in Appendix I-11. This information was submitted in accordance with 40 CFR 264.119(a) to document the type, location, and quantity of waste in the closed surface impoundment area.

I-4 Closure Cost Estimate [40 CFR 270.14(b)(15)]

Due to the fact that closure of the surface impoundments has been completed and certified closed on May 22, 1990, as described in Section I-1, a cost estimate for closure is no longer applicable for the closed surface impoundments.

I-5 Financial Assurance Mechanism for Closure [40 CFR 270.14(b)(15)

Due to the fact that closure of the surface impoundments has been completed and certified closed on May 22, 1990, as described in Section I-1, financial assurance for closure is no longer applicable for the closed surface impoundments.

I-6 Post-Closure Cost Estimate [40 CFR 270.14(b)(16)]

In accordance with 40 CFR 265.140(c), Textron Lycoming's Stratford facility is exempt from the requirements of 40 CFR 265 Subpart H. Therefore, Textron Lycoming is not required to maintain a post-closure cost estimate. This exemption is applicable because it is

a government owned facility for which the U.S. Department of the Army has accepted the financial requirements of 40 CFR 265 Subpart H. The January 1988 letter submitted to EPA from Colonel Charles L. Brown of the U.S. Army documents the Army's acceptance of 40 CFR 265 Subpart H financial requirements. A copy of this letter is contained in Appendix I-12. Note that the required documentation in Appendix I-12 also exempts the facility from financial assurance requirements for post-closure care and liability requirements as described in Sections I-7 and I-8, respectively.

I-7 Financial Assurance Mechanism for Post-Closure [40 CFR 264.145(c)]

As stated in Section I-6, Textron Lycoming's Stratford facility is exempt from the requirements of 40 CFR 265 Subpart H. Therefore, Textron Lycoming is not required to maintain financial assurance for post-closure costs.

I-8 Liability Requirements [40 CFR 264.147]

As stated in Section I-6, Textron Lycoming's Stratford facility is exempt from the requirements of 40 CFR 265 Subpart H. Therefore, Textron Lycoming is not required to maintain financial assurance for both sudden and non-sudden accidental occurrences.

Appendix B-3

Remedial Criteria

Proposed
Revisions

Connecticut's
Remediation Standard Regulations
Volatilization Criteria

March 2003

Permitting, Enforcement and Remediation Division
Bureau of Water Management
Connecticut Department of Environmental Protection

Comments regarding this document may be sent to:

Ruth Lepley Parks
Permitting, Enforcement and Remediation Division
Connecticut Department of Environmental Protection
79 Elm Street
Hartford, CT 06106
ruth.lepley@po.state.ct.us

before
June 30, 2003

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INTRODUCTION

The volatilization criteria were developed to identify situations where contaminants in groundwater and soil vapor volatilize, travel into an overlying building and result in the potential risk to human health from the inhalation of the contaminants by occupants of the building. Since the development and adoption of the volatilization criteria in the Remediation Standard Regulations (RSRs) in 1996, the Department of Environmental Protection (DEP), the Department of Public Health (DPH), the U.S. Environmental Protection Agency (USEPA), other state agencies and researchers across the country have collected additional laboratory and field information regarding the volatilization of contaminants. This work has resulted in a better understanding of the vapor migration pathway and the associated risk to public health posed by volatile organic compounds present in the subsurface. Consequently, DEP, with the assistance and input of DPH, is proposing revisions to the volatilization criteria. This document describes the basis for the proposed criteria, as well as the basis for the original criteria issued in 1996 for comparison.

The proposed revisions reflect new toxicological information, a revised transport model and additional information and understanding of this potential pathway of exposure that have all become available since the RSRs were formally adopted in 1996. The proposed revised target indoor air concentrations, groundwater volatilization criteria and soil vapor volatilization criteria are presented in Tables 1, 2 and 3, respectively.

The CTDEP is proposing revisions to the volatilization criteria at this time as part of the Department's application to the USEPA for authorization of the RCRA Corrective Action Program. These proposed changes make Connecticut's criteria more consistent with the EPA Draft Guidance "Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soil" that was issued in November 2002.

BASIS FOR DEVELOPMENT OF ORIGINAL VOALTLIZATION CRITERIA

The numerical volatilization criteria adopted in 1996 are listed in Appendices E and F of the RSRs and also in Tables C1, C2 and C3 in Appendix C of this document. These numerical criteria were developed using the transport model presented in ASTM ES 38-94 "Emergency Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites" and toxicity information that was available in 1995.

Original Transport Model

The original transport model presented in the ASTM ES 38-94 was based on a model developed by Johnson and Ettinger and utilized a simplified approach for simulating the transport of volatiles from groundwater, through the soil media and building foundations, and into building structures as airborne contaminants. That model was based on the assumption that diffusion is the sole method of transport from subsurface contamination into the indoor air environment. Diffusion is the process resulting from random motion of molecules by which there is a net flow of matter from a region of high concentration to a region of low concentration. Equations used to develop the original volatilization criteria are shown in Appendix G of the RSRs and in Tables X2.1, X2.2, and X2.3 of ASTM ES 38-94.

The original transport model required the input of a variety of parameters to define the subsurface conditions, the building foundation and the interior environment of the building. Since these parameters are widely variable depending on site-specific conditions, default values were developed. Default values for the various parameters used in the model are presented in Appendix G of the RSRs and are the default values recommended in Tables X2.4 and X2.5 of ASTM ES 38-94. In general, these input parameters describe a conservative scenario in an effort to best protect human health and the environment in the generic or broad application of these criteria.

Original Target Indoor Air Concentrations

The volatilization criteria were developed by calculating a target indoor air concentration (TAC) for each chemical using risk assessment algorithms and toxicity values recommended by USEPA in 1995 and exposure assumptions recommended in ASTM ES 39-94. Background concentrations for certain chemicals were also taken into consideration when establishing the TACs. The background concentrations were described in Table 4 of ASTM ES 38-94 and in Table 3-1 of Massachusetts DEP's "Background Documentation for the Development of the MCP Numerical Standards". For some chemicals, the background concentrations were greater than the calculated risk-based concentrations. For these chemicals, the TACs were set at the background concentrations.

Ceiling Value for Groundwater Volatilization Criteria

A ceiling value of 50,000 micrograms per liter ("µg/L") was applied to all of the groundwater volatilization criteria for which the risked-based criteria were greater than 50,000 µg/L. The purpose of the ceiling value was to prevent gross contamination from being overlooked and to ensure that remediation in accordance with these criteria would address potential odor problems.

Quantification Limits

In general, if the risk-based criteria for a contaminant in soil, groundwater or soil vapor was a concentration lower than that which could be reasonably quantified, the RSR criteria was adjusted upward to a level that could be quantified by laboratories in Connecticut. In 1996, the soil vapor volatilization criteria were adjusted such that any risk-based soil vapor volatilization criteria that was determined to be less than one part per million ("ppm") was adjusted up to 1 ppm.

PROPOSED REVISIONS TO THE VOLATILIZATION CRITERIA

The proposed volatilization criteria are based on:

1) The Johnson and Ettinger (1991) model, incorporating its extensions developed in 1998 and 1999 (Johnson et al. 1998 and Johnson et al. 1999),
2) New toxicity information,
3) New exposure assumptions,
4) Ceiling values for target indoor air concentrations, and
5) Updated quantification limits.

Proposed revised target indoor air concentrations, groundwater volatilization criteria and soil vapor volatilization criteria are shown in Tables 1, 2 and 3 of this document.

Revised Transport Model

The revised Johnson and Ettinger model incorporates both diffusion and advection as the mechanisms of transport of subsurface contamination into the indoor air environment. While diffusion is a passive process, advection is an active process brought about by pressure gradients. Gases will move from areas of high pressure to areas of low pressure. Buildings, particularly under wintertime conditions, are depressurized due to warmed air constantly rising towards the roof. This allows influx of air from the soil gas, which follows the pressure gradient from soil gas into the basement. The greater the depressurization of the building, the greater the zone of influence will be. The zone of influence is the depth from which soil gas can be drawn into the building.

Since the revised model incorporates both diffusion and advection as transport mechanisms, the total amount of transport is greater than that calculated using the original model. Sampling at sites in Connecticut show that the original model under-predicted indoor air concentrations based on groundwater and soil vapor sample results. Therefore, the revised model provides a more accurate and realistic representation of volatile transport. USEPA is also currently using the revised Johnson and Ettinger model to develop their "Guidance for Evaluating the Vapor Intrusion into Indoor Air". In addition, many states including Massachusetts, Michigan, Pennsylvania, Virginia, West Virginia and California are also using this model to develop criteria for this exposure pathway. Appendix A describes the revised model in detail.

The default input values used in the revised model are the same as those used in the 1996 model with one exception, Q_{soil}/Q_B. Q_{soil}/Q_B is the ratio of soil gas intrusion rate to building ventilation rate and was not part of the original model. The default input value used for Q_{soil}/Q_B is taken from USEPA's "Guidance for Evaluating the Vapor Intrusion into Indoor Air". All variables used in the revised model are listed and defined in Tables A1 and A2. Table A3 shows the typical values or range of values for these parameters as well as the default values used to calculate the proposed volatilization criteria.

Revised and Updated Target Indoor Air Concentrations

The target indoor air concentrations (TACs) were again derived by CT DPH for each chemical using risk-based calculations recommended by USEPA, the chemical-specific reference concentrations (RfCs) and cancer unit risks currently available. Appendix B presents these risk-based equations. The following issues were addressed in the TAC revisions:

1) Updated toxicity values,
2) Revised exposure assumptions for industrial/commercial settings,
3) Increased exposure and susceptibility for children for residential settings,
4) Updated background concentrations, and
5) Ceiling value for TACs.

Toxicity Values

All of the toxicity values have been reviewed and revised to reflect up-to-date toxicity values. The most significant changes are the toxicity values for several chlorinated hydrocarbons including 1,1-dichloroethylene ("DCE"), trichloroethylene ("TCE"), and vinyl chloride. 1,1-Dichloroethylene is no longer regulated as a low dose linear carcinogen; although, there remains considerable uncertainty regarding its potential carcinogenicity, which is reflected in the new TAC. The net result of this is an increase in the 1,1-DCE TAC by 200 fold over the former value. The evidence for the carcinogenicity of trichloroethylene in humans has become strengthened with an associated increase in USEPA's estimate of its cancer potency (Cogliano, et al., 2001). This change would have led to a considerable lowering of the TCE TAC, if not for the fact that TCE is a background indoor air contaminant. Setting the TAC for TCE at its background concentration leads to a 5 fold lowering of the TAC, relative to the 1996 value. USEPA's carcinogenicity reassessment of vinyl chloride has led to a decrease in its potency estimate by 10 fold, leading to a commensurate increase in the TAC for vinyl chloride.

While USEPA's Integrated Risk Information System (IRIS) database was relied upon as the primary source of toxicity values, other federal and state risk assessment databases (USEPA's Health Effects Assessment Summary Tables – HEAST, ATSDR's Chronic Minimum Risk Levels – MRLs, California EPA's Chronic RELs) were reviewed to determine the consistency of toxicity values across agencies. These other data sources were used in derivation of TACs in cases where USEPA did not have a value listed on IRIS. Appendix B presents all of the new toxicity values and how they were used in deriving TACs for both residential and industrial/commercial scenarios.

Exposure Assumptions

Exposure assumptions for the residential scenario have not changed: 30 year residence at the affected location, daily exposure for 350 days/year, with an inhalation rate of 20 m^3/day for a 70 kg adult. The exposure assumptions for the industrial/commercial scenario are revised to better reflect likely workplace exposures. The inhalation rate per day has been reduced by one half to 10 m^3/day to reflect a shorter exposure time in the industrial/commercial exposure scenario. The other exposure assumptions for this scenario have not changed (25 years exposure, 250 days/year, 70 kg body weight).

Increased Exposure and Susceptibility of Children to Carcinogens

Increased exposure and susceptibility of children in a residential scenario to carcinogens was taken into consideration during these revisions. The residential scenario involves young children, which is a receptor group that is likely to be at elevated risk relative to adults due to several factors: 1) their greater respiratory rate per body weight and lung surface area (Child-Specific Exposure Factors Handbook, USEPA, 2000; Thurlbeck, 1982); and 2) due to the likelihood that they have increased sensitivity to carcinogens (Ginsberg, 2003; USEPA, 2003; USEPA, 2000). TACs based on adult exposure parameters and sensitivity may not be adequately protective of children.

The first factor, children's increased inhalation rate, is the basis for a 2-fold adjustment of the TAC to ensure protection of children.

The second factor, increased sensitivity to carcinogens, was the rationale for an additional 2-fold adjustment factor, but in this case it is applied only for genotoxic carcinogens. Juvenile animal studies indicate that even very brief exposures in early life can lead to substantial cancer risk (Vessinovitch, 1979; Toth, 1968). However, the standard rodent cancer bioassay upon which unit risks are derived starts dosing after this period of development. For these reasons, the development of TACs for the residential scenario incorporates a children's carcinogen sensitivity factor. This factor is applied to genotoxicants, a type of carcinogen whose effects in early life are most clearly documented at the present time. The adjustment factor is 2 fold based upon the vinyl chloride example on IRIS (USEPA, 2000). The underlying principle is that the risk from short-term early life exposure can be equal to the risk stemming from much longer exposure beginning later in life, and that risks must be additive across these age groups (Ginsberg, 2003). This approach is consistent with USEPA's IRIS file for vinyl chloride and draft Cancer Risk Assessment Guidelines (USEPA, 2000; USEPA, 2003).

Background Concentrations in Indoor Air

Since 1996, there has been an increased focus around the United States on measuring indoor air quality in impacted and non-impacted (or "background") homes, offices, schools and other environments. This had led to an enhanced database for background indoor air data (Foster, et al., 2002; Kurtz and Folkes, 2002; NYSDOH, 1997; Clayton, et al., 1999; Shields, et al., 1996; USEPA/BASE Study, 1999). These datasets, along with the pre-existing indoor air datasets (Stolwick, 1990; Vermont DOH, 1992; Brown, et al., 1994; Daisey, et al., 1994; Sheldon, et al., 1992; Shah and Singh, 1988) have been reviewed while giving particular attention to those volatile oraganic compounds (VOCs) (typically carcinogens) with risk-based TACs that approach or are below what can be considered background. VOC indoor air measurements are typically lognormally distributed; therefore, the central tendency background concentration (the median) was chosen to represent background. While higher concentrations may be found in certain background locations, the central tendency was used because of the way it would be applied: 1) to replace a risk-based TAC such that the background concentration would already be above a risk target; and 2) to back-calculate the allowable contribution from subsurface VOC contamination, such that the amount that is from background sources plus the amount allowed from subsurface sources would still be within the range of the background data distribution.

VOC background concentrations and how they are used in the derivation of TACs are shown chemical-by-chemical in Appendix B.

TAC Ceiling Value

A ceiling value of 500 ug/m^3 was applied to both the residential and industrial/commercial scenarios for those VOCs with risk-based TACs exceeding

this ceiling value. This ceiling value was derived as an upper bound concentration that signals the presence of an unusual indoor air source for an individual VOC. It is prudent to keep the concentration of individual VOCs below this level to avoid odor complaints, degraded air quality, or non-specific health complaints. VOC odor thresholds were separately considered but only in isolated cases where the odor threshold is the key factor in setting a TAC. Appendix B provides a detailed discussion of this topic.

Current Quantification Limits

Based on the use of current analytical methods, concentrations in soil vapor can be reliably quantified at a level significantly lower than 1ppm. Therefore, the soil vapor volatilization criteria were adjusted such that any risk-based soil vapor volatilization criteria that are determined to be less than 0.5 ppb, are adjusted up to 0.5 ppb. The only criteria adjusted up to 0.5 ppb, is the residential soil vapor volatilization criteria for ethylene dibromide (EDB).

Criteria for New Chemicals

Since 1996, the DEP has approved volatilization criteria for a number of compounds for which criteria had not been established in the original regulations. Based on all of the requests for additional criteria for additional chemicals submitted since 1996, the following compounds have been added to the list of volatilization criteria: trichlorofluoromethane, chloroethane, chloromethane, dichlorodiflouromethane, isopropylbenzene (cumene), cis-1,2-dichloroethene, trans-1,2-dichloroethene, bromodichloromethane, n-butylbenzene, sec-butylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene and 4-isopropyltoluene (4-cymene).

APPLICATION OF THE VOLATILIZATION CRITERIA

Under the current regulations, the groundwater volatilization criteria are applicable to "all ground water polluted with a volatile organic substance within 15 feet of the ground surface or a building". However, research since 1996 has demonstrated that volatiles in groundwater at depths much deeper than 15 feet have been the source of vapor intrusion into overlying structures at concentrations that pose a risk to public health. The USEPA in their "Guidance for Evaluating the Vapor Intrusion into Indoor Air" is recommending applying criteria up to buildings up to 100 feet from the contamination source. Other states including Michigan and Pennsylvania require that volatilization issues be addressed when polluted ground water is within 30 feet of the surface. After evaluating geology and hydrogeology in Connecticut, DEP is proposing that the volatilization criteria should be applied to groundwater within 30 feet of the ground surface or a building.

The RSRs adopted in 1996 provide baseline numeric criteria that can be used to demonstrate compliance or that can be used as a screening level. The regulations also provide the option of developing a site-specific criteria by calculating an attenuation factor using input parameters that are appropriate for the circumstances at a specific site. The site-specific option will also be retained in the proposed revisions to the regulations. However, the revised Johnson and Ettinger model should be used for such calculations. Further, the option to take measures that would prevent the migration of volatiles into indoor air rather than remediate the ground water

and the option to record a land use restriction that would prohibit the construction of a building over ground water polluted by VOCs will be retained in the revised regulations.

SUMMARY

DEP is proposing to revise the volatilization criteria to better protect human health and to remain consistent with federal programs. The revisions proposed in this document are in keeping with the following objectives:

- The proposed revised volatilization criteria are similar to those used by USEPA and other states.
- The revised transport model more accurately predicts indoor air concentrations.
- The toxicity information has been updated to current toxicity values.
- The exposure assumptions have been refined to be both protective and realistic.
- The depth to groundwater to which these criteria should be applied has been increased to 30 feet based on new research that demonstrates indoor exposures resulting from the migration of volatiles from a ground water source significantly deeper than 15 feet.

A comparison of 1996 TACs and volatilization criteria to proposed revised TACs and volatilization criteria is presented in the three tables in Appendix C.

DEP is seeking comments from the public on these revisions before proposing revised regulations in July 2003. Please send you comments to:

Ruth Lepley Parks
Permitting, Enforcement and Remediation Division
Connecticut Department of Environmental Protection
79 Elm Street
Hartford, Ct 06106

before
June 30, 2003

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Table 1

Proposed Target Indoor Air Concentrations

Compound	CAS Number	Residential TAC (ug/m^3)	Industrial/Commercial TAC (ug/m^3)
Acetone	67641	180	500[1]
Acrylonitrile	107131	NA	NA
Benzene	71432	3 3[2]	3.3[2]
Bromoform	75252	0.55	7.3
2-Butanone (MEK)	78933	500[1]	500[1]
Carbon tetrachloride	56235	0.5[2]	0.54
Chlorobenzene	108907	37	200
Chloroform	67663	0.5[2]	0.5[2]
Dibromochloromethane	124481	NA	NA
1,2-Dichlorobenzene	95501	73	410
1,3-Dichlorobenzene	541731	73	410
1,4-Dichlorobenzene	106467	24	24
1,1-Dichloroethane	75343	77	430
1,2-Dichloroethane	107062	0.07	0.31
1,1-Dichloroethylene	75354	10	20
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	See **New Criteria** below
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	See **New Criteria** below
1,2-Dichloropropane	78875	0.13	0.42
1,3-Dichloropropene	542756	0 21	2.9
Ethyl benzene	100414	53	290
Ethylene dibromide (EDB)	106934	0.0028	0.038
Methyl-tert-butyl-ether	1634044	160	190[3]
Methyl isobutyl ketone	108101	37	200
Methylene chloride	75092	3[2]	17
Styrene	100425	52	290

Table 1
(Continued)

Proposed Target Indoor Air Concentrations

Compound	CAS Number	Residential TAC (ug/m^3)	Industrial/Commercial TAC (ug/m^3)
1,1,1,2-Tetrachloroethane	630206	0.082	1.1
1,1,2,2-Tetrachloroethane	79345	0.011	0.14
Tetrachloroethylene	127184	5[2]	5[2]
Toluene	108883	210	500[1]
1,1,1 Trichloroethane	71556	500	500[1]
1,1,2-Trichloroethane	79005	2.2	12
Trichloroethylene	79016	1[2]	1[2]
Vinyl chloride	75014	0.14	1.9
Xylenes	1330207	220	500[1]
New Criteria			
Trichlorofluoromethane	75694	370	500[1]
Chloroethane	75003	500[1]	500[1]
Chloromethane	74873	14	80
Dichlorodiflouromethane	75718	91	500[1]
Isopropylbenzene (Cumene)	98828	120[3]	120[3]
cis-1,2-dichloroethene	156592	18	100
trans-1,2-dichloroethene	156605	37	200
Bromodichloromethane	75274	0.034	0.46
N-butylbenzene	104518	73	410
Sec-butylbenzene	135988	73	410
1,2,4-trimethylbenzene	95636	9.3	52
1,3,5-trimethylbenzene	108678	9.3	52
4-isopropyltoluene (4-cymene)	99876	67	370

[1] Based on a ceiling value [2] Based on a background concentration.
[3] Based on an odor threshold concentration.

Table 2

Proposed Ground Water Volatilization Criteria

Compound	CAS Number	Residential GWVC (ug/L)	Industrial/Commercial GWVC (ug/L)
Acetone	67641	50000	50000
Acrylonitrile	107131	NA	NA
Benzene	71432	130	310
Bromoform	75252	75	2300
2-Butanone (MEK)	78933	50000	50000
Carbon tetrachloride	56235	5 3	14
Chlorobenzene	108907	1800	23000
Chloroform	67663	26	62
Dibromochloromethane	124481	NA	NA
1,2-Dichlorobenzene	95501	5100	50000
1,3-Dichlorobenzene	541731	4300	50000
1,4-Dichlorobenzene	106467	1400	3400
1,1-Dichloroethane	75343	3000	41000
1,2-Dichloroethane	107062	6.5	68
1,1-Dichloroethylene	75354	190	920
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	See **New Criteria** below
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	See **New Criteria** below
1,2-Dichloropropane	78875	7.4	58
1,3-Dichloropropene	542756	11	360
Ethyl benzene	100414	2700	36000
Ethylene dibromide (EDB)	106934	0.3	11
Methyl-tert-butyl-ether	1634044	21000	50000
Methyl isobutyl ketone	108101	13000	50000
Methylene chloride	75092	160	2200
Styrene	100425	3100	42000

Table 2
(Continued)

Proposed Ground Water Volatilization Criteria

Compound	CAS Number	Residential GWVC (ug/L)	Industrial/Commercial GWVC (ug/L)
1,1,1,2-Tetrachloroethane	630206	2	64
1,1,2,2-Tetrachloroethane	79345	1.8	54
Tetrachloroethylene	127184	340	810
Toluene	108883	7100	41000
1,1,1 Trichloroethane	71556	6500	16000
1,1,2-Trichloroethane	79005	220	2900
Trichloroethylene	79016	27	67
Vinyl chloride	75014	1.6	52
Xylenes	1330207	8700	48000
New Criteria			
Trichlorofluoromethane	75694	1300	4200
Chloroethane	75003	12000	29000
Chloromethane	74873	390	5500
Dichlorodiflouromethane	75718	93	1200
Isopropylbenzene (Cumene)	98828	2800	6800
Cis-1,2-dichloroethene	156592	830	11000
trans-1,2-dichloroethene	156605	1000	13000
Bromodichloromethane	75274	2.3	73
N-butylbenzene	104518	1500	21000
Sec-butylbenzene	135988	1500	20000
1,2,4-trimethylbenzene	95636	360	4800
1,3,5-trimethylbenzene	108678	280	3900
4-isopropyltoluene (4-cymene)	99876	1600	22000

Table 3

Proposed Soil Vapor Volatilization Criteria

Compound	CAS Number	Residential SVVC (ppm)	Industrial/Commercial SVVC (ppm)
Acetone	67641	57	290
Acrylonitrile	107131	NA	NA
Benzene	71432	0.78	1.4
Bromoform	75252	0.04	0.98
2-Butanone (MEK)	78933	130	230
Carbon tetrachloride	56235	0.06	0.12
Chlorobenzene	108907	6.1	60
Chloroform	67663	0.078	0.14
Dibromochloromethane	124481	NA	NA
1,2-Dichlorobenzene	95501	9.2	95
1,3-Dichlorobenzene	541731	9.2	95
1,4-Dichlorobenzene	106467	3	5.5
1,1-Dichloroethane	75343	14	150
1,2-Dichloroethane	107062	0.013	0.11
1,1-Dichloroethylene	75354	1.9	7
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	See **New Criteria** below
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	See **New Criteria** below
1,2-Dichloropropane	78875	0.021	0.13
1,3-Dichloropropene	542756	0.035	0.89
Ethyl benzene	100414	9.3	93
Ethylene dibromide (EDB)	106934	0.0005	0.007
Methyl-tert-butyl-ether	1634044	34	73
Methyl isobutyl ketone	108101	6 8	68
Methylene chloride	75092	0.65	6.8
Styrene	100425	9.3	95

Table 3
(Continued)

Proposed Soil Vapor Volatilization Criteria

Compound	CAS Number	Residential SVVC (ppm)	Industrial/Commercial SVVC (ppm)
1,1,1,2-Tetrachloroethane	630206	0.009	0.22
1,1,2,2-Tetrachloroethane	79345	0.0012	0.028
Tetrachloroethylene	127184	0.56	1
Toluene	108883	42	180
1,1,1 Trichloroethane	71556	70	130
1,1,2-Trichloroethane	79005	0.31	3.1
Trichloroethylene	79016	0.14	0.26
Vinyl chloride	75014	0.041	1
Xylenes	1330207	38	160
New Criteria			
Trichlorofluoromethane	75694	50	120
Chloroethane	75003	140	260
Chloromethane	74873	5.1	53
Dichlorodiflouromethane	75718	14	140
Isopropylbenzene (Cumene)	98828	19	34
Cis-1,2-dichloroethene	156592	3.4	35
trans-1,2-dichloroethene	156605	7.1	70
Bromodichloromethane	75274	0.0038	0.095
N-butylbenzene	104518	10	100
Sec-butylbenzene	135988	10	100
1,2,4-trimethylbenzene	95636	1.4	15
1,3,5-trimethylbenzene	108678	1.4	15
4-isopropyltoluene (4-cymene)	99876	9.3	94

Appendix A

Johnson and Ettinger Model

APPENDIX A

JOHNSON AND ETTINGER MODEL

The revised Johnson and Ettinger model incorporates both diffusion and advection as mechanisms of transport of subsurface contamination into indoor air environment. Diffusion is the mechanism by which vapor moves from a region of higher concentration to a region of lower concentration. Diffusion is typically the vertical component of transport in this model. Advection is the transport mechanism by which vapor moves to a region where there is a difference in pressure, temperature or other factor. This Johnson and Ettinger model is the most widely used vapor transport model across the United States.

The Johnson and Ettinger model uses the conservation of mass principle and makes the following assumptions:

- Steady state conditions exist
- An infinite source of contamination exists
- The subsurface is homogeneous
- Air mixing in the building is uniform
- Preferential pathways do not exist
- Biodegradation (or any other transformation process) does not occur
- Contaminants are homogeneously distributed
- Contaminant vapors enter a building primarily through cracks and other openings in the foundation and walls
- Ventilation rates and pressure differences are assumed to remain constant

The output of the Johnson and Ettinger model is the dimensionless attenuation factor (α) that represents the ratio of the indoor air concentration to the vapor concentration at a subsurface source. Using the attenuation factor and the recommended target indoor air concentrations, allowable soil vapor and ground water concentrations were back calculated. These concentrations are the recommended volatilization criteria. The Connecticut Department of Public Health recommended appropriate target indoor air concentrations for residential and industrial/commercial scenarios.

- For ground water volatilization criteria:

  GWVC (ug/L) = Target Indoor Air Concentration ($\mu g/m^3$) / (1000 L/m^3 x α x H)

  where H = Henry's Law Constant (unitless)

- For soil vapor volatlization criteria:

  SVVC (mg/m^3) = Target Indoor Air Concentration ($\mu g/m^3$) / (1000 $\mu g/mg$ x α)

  SVVC (ppm) = SVVC (mg/m^3) x 24.45 / Molecular Weight

  where 24.45 = molar volume in liters at 760 torr barometric pressure at 25 ° C

The Johnson and Ettinger model calculates the attenuation factor as follows:

Attenuation Factor for Diffusion and Advection –

$$\alpha = (A \times e^{B}) / [e^{B} + A + (A/C)(e^{B}-1)]$$

where:

$A = (D^{eff}_{T} A_B) / (Q_B L_T)$ ***or*** $(D^{eff}_{T}) / (E_B(V_B/A_B)L_T)$

$B = (Q_{soil} L_{crack}) / (D^{eff}_{crack} \eta A_B)$ ***or*** $[(Q_{soil}/Q_b)E_B(V_B/A_B)L_{crack}] / [D^{eff}_{crack}\eta]$

$C = Q_{soil}/Q_B$

where:

$D^{eff}_{T} = L_T / [(L_{vadose}/D^{eff}_{vadose}) + (L_{cap}/D^{eff}_{cap})$

$D^{eff}_{crack} = D^{air}(\theta_{V\text{-}crack}^{3.33}/\theta_{T\text{-}crack}^{2}) + (D^{water}/H)(\theta_{m\text{-}crack}^{3.33}/\theta_{T\text{-}crack}^{2})$

where:

$D^{eff}_{vadose} = D^{air}(\theta_{V\text{-}vadose}^{3.33}/\theta_{T\text{-}vadose}^{2}) + (D^{water}/H)(\theta_{m\text{-}vadose}^{3.33}/\theta_{T\text{-}vadose}^{2})$

$D^{eff}_{cap} = D^{air}(\theta_{V\text{-}cap}^{3.33}/\theta_{T\text{-}cap}^{2}) + (D^{water}/H)(\theta_{m\text{-}cap}^{3.33}/\theta_{T\text{-}cap}^{2})$

The input values for these equations are defined in Tables A1 and A2 of this Appendix. Conservative default values for each input variable were used to calculate the generic volatilization criteria listed in Tables 2 and 3. The acceptable ranges for these default values are presented in Table A3 along with the default input values used by CTDEP to calculate the generic criteria. In addition, Table A4 presents molecular weights and Henry's Law Constants (H) used by CTDEP.

Basically the input values describe the vapor transport pathway including the

- subsurface soils and stratigraphy;
- foundation of the structure;
- interior environment of the structure; and
- transport properties of the contaminants.

The subsurface soils are assumed to be sand and the stratigraphy is assumed to be homogeneous. The default input values for the moisture content (θ_m) and vapor content (θ_V) of the soils in both the vadose zone and the capillary fringe were chosen to represent sandy soils in the subsurface. The thickness of the capillary fringe (L_{cap}) is also based on an estimated thickness of capillary fringe for a typical sand. The default input values used for the total depth (L_T) to groundwater and the total depth to a soil vapor sample are 3 meters and 1 meter, respectively.

The default values used to describe the foundation of the building are the thickness of the foundation (L_{crack}) assumed at 0.15 meters and the areal fraction of cracks in foundation (η) assumed at 0.01 (worst case value). Also, the soil properties of the soil in the cracks (θ_m and θ_V) are estimated based on a sand soil type. The default values used to describe the indoor

environment are the enclosed space air exchange rate (E_B), the volume of the building divided by the area of the building (or just the height of the building) (V_B/A_B) and the ratio of soil gas intrusion rate to the building ventilation rate (Q_{soil}/Q_B). These values differ for the residential scenario and the industrial commercial scenario.

The default values used describe the transport properties of the contaminants are Henry's Law Constants (H) listed for specific chemical on Table A4, and the diffusion in water (D^{water}) and the diffusion in air (D^{air}). Though the diffusion rates can be chemical-specific, a general diffusion rates in air (8.64×10^{-5} M^2/d) and in water (7.26×10^{-1} M^2/d) were used for all of the chemicals.

All of the default input values used in this current model were also used in the original model with the exception of the ratio Q_{soil}/Q_B This ratio was not part of the original model. The default input value used for Q_{soil}/Q_B is also the default value used in USEPA's "Guidance of revaluating the Vapor Intrusion into Indoor Air" dated November 2002. The default input values used in the original model remain unchanged. The default values are those recommended by ASTM 38-94 in Tables X2.4 and X2.5.

The article written by Johnson titled "Identification of Critical Parameters for the Johnson and Ettinger (1991) Vapor Intrusion Model" dated May 2002 provides additional information regarding the input values and the sensitivity of the final attenuation factor to various input values.

The attenuation factors used to calculate the proposed revised criteria are based on the default input values listed in Table A3 and the revised Johnson and Ettinger model. In general, the attenuation factors used to calculate the proposed revised criteria are greater than the attenuation factors used to calculate the original criteria in 1996. For the ground water scenario, the attenuation factor increased by a multiple of approximately 2.5, from about 8×10^{-5} to 2×10^{-4} for the residential scenario and from 3×10^{-5} to 7×10^{-5} for the industrial/commercial scenario. For the soil vapor scenario, the attenuation factor increased by a multiple of approximately 10, from about 1.5×10^{-4} to 1.3×10^{-3} for residential the scenario and from 6×10^{-5} to 7×10^{-4} for the industrial/commercial scenario. The revised Johnson and Ettinger model produces a more conservative attenuation factor compared to the original model.

Table A1

Definition of Variables

	Definition	Units
H	Chemical Specific Henry's Law constant	$\mu g/m^3$-vapor / $\mu g/m^3$-H_2O
$\theta_{m\text{-vadose}}$	Volumetric Moisture Content in Vadose Zone	m^3-H_2O / m^3-soil
$\theta_{T\text{-vadose}}$	Total Porosity in Vadose Zone	m^3-voids / m^3-soil
$\theta_{m\text{-crack}}$	Volumetric Moisture Content in Cracks	m^3-H_2O / m^3-soil
$\theta_{T\text{-crack}}$	Total Porosity in Cracks	m^3-voids / m^3-soil
$\theta_{m\text{-cap}}$	Volumetric Moisture Content in Cracks in Capillary Fringe	m^3-H_2O / m^3-soil
$\theta_{T\text{-cap}}$	Total Porosity in Capillary Fringe	m^3-voids / m^3-soil
D^{air}	Chemical Specific Molecular Diffusion Coefficient in Air	m^2 / d
D^{water}	Chemical Specific Molecular Diffusion Coefficient in Water	m^2 / d
K	Soil Permeability (near foundation) to Air Flow	m^2
ΔP	Indoor-Outdoor Air Pressure Difference	g / ms^2
X_{crack}	Total Length of Cracks through which Soil Gas Vapors are Flowing	m
μ	Viscosity of Air	g / ms
Z_{crack}	Crack Opening Depth Below Grade	m
η	Fraction of Enclosed Space Area Open for Vapor Intrusion	m^2 / m^2
A_B	Surface Area of the Enclosed Space in Contact with Soil	m^2
V_B	Enclosed Space Volume	m^3
E_B	Enclosed Space Air Exchange Rate	1/d
L_T	Depth from Foundation to Source	m
L_{cap}	Thickness of Capillary Fringe	m
L_{crack}	Foundation Thickness	m

Table A2

Calculated Variables

	Definition	Calculation	Units
V_B/A_B	Ratio of Enclosed Space Volume to Exposed Surface Area		m
Q_B	Enclosed Space Volumetric Air Flow Rate	$= V_B E_B$	m^3 / d
R_{crack}	Effective Crack Radius or Width	$= \eta A_B / X_{crack}$	m
$\theta_{V\text{-}vadose}$	Volumetric Vapor Content in Vadose Zone	$= \theta_{T\text{-}vadose} - \theta_{m\text{-}vadose}$	m^3-vapor / m^3-soil
$\theta_{V\text{-}crack}$	Volumetric Vapor Content in Cracks	$= \theta_{T\text{-}crack} - \theta_{m\text{-}crack}$	m^3-vapor / m^3-soil
$\theta_{V\text{-}cap}$	Volumetric Vapor Content in Capillary Fringe	$= \theta_{T\text{-}cap} - \theta_{m\text{-}cap}$	m^3-vapor / m^3-soil
Q_{soil}	Pressure Driven Soil Gas Flow Rate from the subsurface into the enclosed space	$= (2\pi k \Delta P X_{crack}) / [\mu \ln(2Z_{crack}/R_{crack})]$	m^3 / d
Q_{soil}/Q_B	Ratio of Soil Gas Intrusion Rate to Building Ventilation Rate		unitless
D^{water}/D^{air}	Ratio of Molecular Diffusion in water to air		unitless
L_{vadose}	Thickness of Vadose Zone	$= L_T - L_{cap}$	m

Table A3

Default Input Values

	Units	Typical Value Range [1]	Notes	Res GWVC	I/C GWVC	Res SVVC	I/C SVVC
H	µg/m^3-vapor / µg/m^3-H_2O	0.01 - 1.0	For most aromatic & chlorinated solvents	---	---	---	---
$\theta_{m\text{-}vadose}$	m^3-H_2O / m^3-soil		ASTM default value. Typical for sand.	0.12	0.12	0.12	0.12
$\theta_{T\text{-}vadose}$	m^3-voids / m^3-soil		ASTM default value. Typical for sand.	0.38	0.38	0.38	0.38
$\theta_{m\text{-}crack}$	m^3-H_2O / m^3-soil		ASTM default value. Typical for sand.	0.12	0.12	0.12	0 12
$\theta_{T\text{-}crack}$	m^3-voids / m^3-soil		ASTM default value. Typical for sand.	0.38	0.38	0.38	0.38
$\theta_{m\text{-}cap}$	m^3-H_2O / m^3-soil		ASTM default value. Typical for sand.	0.342	0 342	0.342	0.342
$\theta_{T\text{-}cap}$	m^3-voids / m^3-soil		ASTM default value. Typical for sand.	0.38	0.38	0.38	0.38
D^{air}	M^2 / d	0 1 - 1	For most chemicals	7 26E-01	7 26E-01	7.26E-01	7.26E-01
D^{water}	M^2 / d			8.64E-05	8.64E-05	8.64E-05	8.64E-05
k	m^2	1E-6 - 1E-12					
ΔP	g / ms^2	0 - 200	or 0 to 20 Pascals				
X_{crack}	m						
µ	g / ms						
Z_{crack}	m						
η	m^2 / m^2	0.0005 - 0.005	ASTM default value. 0.01 for worst-case scenario.	0.01	0.01	0.01	0 01
A_B	m^2						
V_B	m^3	147 - 672	Range from USDOE (1995)				
E_B	1/d	4.8 - 24	ASTM default values. 12 for Residential scenario and 19.9 for Industrial/Commercial scenario.	12	19.9	12	19.9
L_T	m	0.01 - 50	ASTM default values. 3 for Groundwater criteria and 1 for Soil Vapor criteria.	3	3	1	1
L_{cap}	m		ASTM default values. 0.05 for Groundwater criteria and 0 for Soil Vapor criteria.	0.05	0.05	0	0
L_{crack}	m	0.15 - 0 5	ASTM default value.	0.15	0.15	0.15	0.15

Table A3
(continued)

Default Input Values

	Units	Typical Value Range [1]	Notes	Res GWVC	I/C GWVC	Res SVVC	I/C SVVC
V_B/A_B	m	2 - 3	ASTM default values. 2 for Residential scenario and 3 for Industrial/Commercial scenario.	2	3	2	3
Q_B	m^3 / d						
R_{crack}	m						
$\theta_{V\text{-}vadose}$	m^3-vapor / m^3-soil		ASTM default value. Typical for sand.	0 26	0.26	0.26	0.26
$\theta_{V\text{-}crack}$	m^3-vapor / m^3-soil		ASTM default value. Typical for sand.	0.26	0 26	0.26	0.26
$\theta_{V\text{-}cap}$	m^3-vapor / m^3-soil		ASTM default value. Typical for sand.	0.038	0 038	0.038	0 038
Q_{soil}	m^3 / d						
Q_{soil}/Q_B	unitless	0.0001 – 0.05	EPA Vapor Intrusion Guidance default value.	0.003	0 003	0.003	0 003
D^{water}/D^{air}	unitless	~ 1E-4		1.19E-04	1.19E-04	1.19E-04	1.19E-04
L_{vadose}	m		ASTM default value. 2.95 for Groundwater criteria and 1 for Soil Vapor criteria.	2.95	2.95	1	1

[1] Johnson, (2002), *Identification of Critical Parameters for the Johnson and Ettinger (1991) Vapor Intrusion Model*, API Bulletin #17, May

Table A4

Henry's Law Constants and Molecular Weights

Compound	CAS Number	Henry's Law Constant (unitless)	Molecular Weight (g/mole)
Acetone	67641	1.75E-03	58
Acrylonitrile	107131		
Benzene	71432	2.26E-01	78
Bromoform	75252	2.18E-02	253
2-Butanone (MEK)	78933	1.12E-03	72
Carbon tetrachloride	56235	1.20E+00	154
Chlorobenzene	108907	1.61E-01	113
Chloroform	67663	1.39E-01	119
Dibromochloromethane	124481		
1,2-Dichlorobenzene	95501	7.95E-02	147
1,3-Dichlorobenzene	541731	1.08E-01	147
1,4-Dichlorobenzene	106467	1.12E-01	147
1,1-Dichloroethane	75343	2.23E-01	99
1,2-Dichloroethane	107062	4.51E-02	99
1,1-Dichloroethylene	75354	6.11E-01	97
cis-1,2-Dichlroethylene	156592	See listing below	See listing below
trans-1,2-Dichloroethylene	156605	See listing below	See listing below
1,2-Dichloropropane	78875	1.16E-01	113
1,3-Dichloropropene	542756	1.44E-01	111
Ethyl benzene	100414	1.41E-01	106
Ethylene dibromide (EDB)	106934	2.76E-02	188
Methyl-tert-butyl-ether	1634044	2.42E-02	88
Methyl isobutyl ketone	108101	5.66E-03	100
Methylene chloride	75092	1 31E-01	85
Styrene	100425	1.07E-01	104

Table A4
(Continued)

Henry's Law Constants and Molecular Weights

Compound	CAS Number	Henry's Law Constant (unitless)	Molecular Weight (g/mole)
1,1,1,2-Tetrachloroethane	630206	4.51E-01	168
1,1,2,2-Tetrachloroethane	79345	1.56E-02	168
Tetrachloroethylene	127184	8.36E-02	166
Toluene	108883	2.74E-01	92
1,1,1 Trichloroethane	71556	9.47E-01	133
1,1,2-Trichloroethane	79005	3.73E-02	133
Trichloroethylene	79016	3.74E-01	131
Vinyl chloride	75014	1.14E+00	63
Xylenes	1330207	2.16E-01	106
New Criteria			
Trichlorofluoromethane	75694	4.00E+00	137
Chloroethane	75003	4.50E-01	65
Chloromethane	74873	3.60E-01	51
Dichlorodiflouromethane	75718	1.40E+01	121
Isopropylbenzene (Cumene)	98828	4.70E-01	120
Cis-1,2-dichloroethene	156592	1.70E-01	97
trans-1,2-dichloroethene	156605	3.80E-01	97
Bromodichloromethane	75274	8.70E-02	164
N-butylbenzene	104518	5.24E-01	134
Sec-butylbenzene	135988	5.68E-01	134
1,2,4-trimethylbenzene	95636	2.30E-01	120
1,3,5-trimethylbenzene	108678	3.20E-01	120
4-isopropyltoluene (4-cymene)	99876	4.51E-01	134

Appendix B

Derivation of Target Indoor Air Concentrations

APPENDIX B

DERIVATION OF TARGET INDOOR AIR CONCENTRATIONS

This Appendix presents the derivation of target indoor air concentrations (TACs) for the volatile organic compounds (VOCs) listed in the existing Remediation Standard Regulations (RSR) volatilization criteria, together with TACs for 13 additional VOCs not previously listed. These additional VOCs though not originally listed, have appeared in groundwater and/or soil gas at sites in Connecticut. This Appendix includes two tables that list the TACs and the underlying toxicity values, modifying factors and background considerations. The following is a brief overview of the risk-based derivation methodology followed by the specific approaches used for the residential and industrial/commercial scenarios.

General TAC Methodology

TACs are air concentrations within homes or workplaces that are not expected to cause adverse health effects from chronic exposure. TACs rely upon chemical-specific toxicity values that describe the VOC's potency in terms of: 1) the reference concentration (RfC) - air concentration which will be free of risk for non-cancer health effects from chronic exposure; or 2) the unit risk factor – potency of VOC to produce carcinogenic effects per microgram per cubic meter (ug/m^3) of air chronically inhaled. These toxicity values are typically derived by USEPA from studies in which laboratory animals were exposed for chronic periods, with the toxic response based upon continuous exposure (24 hours per day (hr/d), every day of the year). Therefore, these targets need modification for exposure scenarios in which less than continuous exposure is likely (e.g., the industrial/commerical scenario). The TACs are set such that the lifetime cancer risk is at the de minimis risk level (one in a million or 1E-06) and the hazard index (TAC/RfC_m where RfC_m is the RfC modified for the time-weight averaged amount of exposure in the specific scenario) for non-carcinogens is equal to unity.

While USEPA's Integrated Risk Information System (IRIS) database is the primary source of toxicology information for TAC development, other toxicology databases are also recognized as having well documented and widely used toxicity values. These include the Agency for Toxic Substances and Disease Registry (ATSDR)'s chronic Minimum Risk Levels (MRLs), California EPA's chronic Reference Exposure Levels (RELs) and USEPA's Health Effects Assessment Summary Tables (HEAST). In cases where a toxicity value was not available on IRIS, the value was sought from these other data sources. If still no value could be found, CTDPH conducted its own chemical-specific risk assessment. In certain cases, USEPA has listed provisional toxicity values that rely upon the best available science currently available, but these values may be somewhat more uncertain and are not supported by USEPA to the same extent as those values on IRIS. CTDPH has examined the basis for these particular values closely and, in isolated cases, has made adjustments.

A number of VOCs in the TAC list are possible rather than proven animal carcinogens, or, if proven, their cancer mechanism has uncertain relevance to low dose exposures in humans. These types of carcinogens were labeled as Group C carcinogens in USEPA's former cancer guidelines and are considered as Class 3 agents by IARC. Their carcinogenicity database is either too uncertain or incomplete to allow an extrapolation of risk to low dose human exposures. Rather than applying the classical low dose linear approach on the one hand, or ignoring their carcinogenic potential on the other, this derivation lowers the RfC by an uncertainty factor to account for this potential hazard. This approach is consistent with that developed by USEPA's Office of Drinking Water to establish Maximum Contaminant Levels

(MCLs). The default cancer uncertainty factor is 10 fold, although 3.33 fold (one half log lower) was used in cases where the uncertainty already built into the RfC was large (1000 fold or greater); this reduction in the cancer uncertainty factor was used to keep the overall uncertainty factor to less than 10,000.

In several cases toxicity values were available for the oral but not inhalation dose route. A dose route extrapolation to convert from the reference dose (in mg/kg/d) to RfC (ug/m^3) was used as long as the target site was not local to the site of bodily entry, but rather was at a systemic location (i.e., internal organs or systems).

The following are the general equations for the derivation of TACs. These equations and most of the parameter value inputs have not changed since the setting of the 1996 RSRs

For carcinogenic effects:

$$TAC = \frac{TR \times BW \times AT_c \times 365\ d/yr \times 10^3 \mu g/mg}{Sf_i \times IR_{air} \times EF \times ED}$$

For non-carcinogenic effects:

$$TAC = \frac{THQ \times BW \times RfD_i \times AT_n \times 365\ d/yr \times 10^3 \mu g/mg}{IR_{air} \times EF \times ED}$$

where:

AT_c = averaging time for carcinogens, years
Use AT_c = 70 years

AT_n = averaging time for non-carcinogens, years
For residential use AT_n = 30 years
For commercial/industrial use AT_n = 25 years

BW = adult body weight, kg
Use BW = 70 kg

ED = exposure duration, years
For residential use ED = 30 years
For commercial/industrial use ED = 25 years

EF = exposure frequency, days/years
For residential use EF = 350 days/year
For commercial/industrial use EF = 250 days/year

IR_{air} = daily indoor inhalation rate, m^3/day
For residential use IR_{air} = 20 m^3/day
For commercial/industrial use IR_{air} = 10 m^3/day

TAC = target indoor air concentration, µg/m^3-air

RfD_i = inhalation chronic reference dose, mg/kg-day
Use numbers from IRIS and/or HEAST and/or other sources.

SF_i = inhalation cancer slope factor, kg-day/mg
Use numbers from IRIS and/or HEAST and/or other sources.

THQ = target hazard quotient for individual constituents, dimensionless
Use THQ = 1

TR = target excess individual lifetime cancer risk, dimensionless
Use TR = 1×10^{-6}

Modifications to the Residential Scenario

The exposure assumptions shown in the equations above pertain to adults (70 kg body weight, 20 m^3/d inhalation rate). However, young children inhale more air per body weight and respiratory surface area than do adults (Child-Specific Exposure Factors Handbook, USEPA, 2000; Thurlbeck, 1982). This is an especially important consideration with regards to VOCs that can cause respiratory irritation and thus have the potential to exacerbate asthma due to the local dose in the lung. However, it also applies to systemic toxicants. The child/adult dose differential from inhalation exposure is approximately 2 fold over the first six years of life (e.g., at 1 year of age: 4.5 m^3/d inhalation rate for 7.4 kg body weight for an inhalation rate/body weight ratio that is 2.1 fold larger than the adult assumption). Thus, the systemic and local respiratory tract dose to young children can be assumed to be approximately 2 fold larger than in adults for a significant portion of childhood. Since young children may be more generally sensitive to toxicants (many systems are immature and rapidly developing - Faustman, 2000), the potential importance of this exposure differential is accentuated. Thus, to be protective of children as potentially the most highly exposed and sensitive group, the residential TACs are adjusted by a 2 fold factor that corresponds with the greater inhalation exposure rate in children.

Children's increased vulnerability to toxicants has perhaps been best characterized in the area of carcinogenic risk. Standard cancer bioassays from which most unit risk values are derived, begin chemical administration when rodents are 4-6 weeks of age. At this age the animals are sexually mature and growth is not as rapid as in juvenile animals. Thus, this type of cancer study misses a potentially important vulnerability window. In fact, numerous cancer studies in which rodents were dosed beginning in early life demonstrate considerably greater potency in the neonatal period than at older ages (Vesselinovitch, et al., 1979; Toth, 1968; Maltoni, et al., 1981).

The reason for this greater susceptibility likely stems from the greater time period for expression of cancer when testing begins earlier in life, and because rapidly dividing tissues are more sensitive to genotoxicants (Laib, et al., 1985, Anderson, 2000). These issues have recently been summarized in a publication by CTDPH (Ginsberg, 2003) and by USEPA in their draft revisions to the cancer risk assessment guidelines (USEPA, 2003). The case of vinyl chloride sensitivity in early life stages has been evaluated closely by USEPA to support their recent revision to the vinyl chloride IRIS file (USEPA, 2000). That assessment showed that brief exposures in early life produced a cancer response later in life that was roughly equivalent to what would be seen from an adult-only (lifetime) exposure. On that basis, the IRIS file recommends that the unit risk factor for vinyl chloride derived for adults be doubled if there will be long-term exposure that will include children. Analysis of other juvenile animal bioassays indicates that this also appears to be true for a wide variety of chemicals, particularly those with a genotoxic mode of action (Ginsberg, 2003; USEPA, 2003). For this reason, the revised TACs for genotoxic carcinogens have an adjustment factor (2 fold lowering of TAC) to account for the greater sensitivity of early life stages (Ginsberg, 2003; USEPA, 2003).

In summary, the residential scenario includes a 2 fold adjustment factor for children's increased inhalation exposure rate relative to adults, and a 2 fold adjustment factor for children's increased sensitivity when exposed to genotoxic carcinogens. In this latter case, the combined children's adjustment factor is 4 fold. This approach is consistent with USEPA's IRIS file for vinyl chloride and draft Cancer Risk Assessment Guidelines. The Table B1 shows the use of these factors in deriving TACs.

Industrial/Commercial TAC Calculations

The industrial/commercial scenario is simpler than the residential scenario in that it only involves adults. The exposure parameters shown above for this scenario indicate that relative to the assumptions that go into RfCs and cancer unit risk values, workers will be exposed to less inhaled contaminant due to fewer hours/day of exposure (8 instead of 24 hr), fewer days per year of exposure (250 instead of 365), and fewer total years of exposure (25 instead of 70). The shorter hours per day of worker exposure is partially compensated for by the higher breathing rate workers may have compared to the general public. This leads to the assumption that 50% of the day's inhalation volume occurs while at work. In setting TACs for the workplace it is appropriate to increase the RfC by a factor of 2 for inhalation rate ($20m^3/d$ vs. 10 m^3/d) and by a factor of 1.46 for exposure days per year (365 vs. 250). This yields a combined workplace adjustment factor for RfCs of 2.92 (i.e., the workplace TAC can be 2.92 fold higher than the RfC). For carcinogens, the cumulative number of years is also part of the exposure calculation and so the 70/25 yr factor (2.8) is multiplied by 2.92 to yield a combined 8.176 adjustment factor. This factor is multiplied by the air concentration associated with de minimis risk for the general public to yield the air concentration corresponding to de minimus risk for workers. These exposure factors are in the Table B2 to show their use in deriving TACs for this scenario.

Ceiling TAC

The Tables B1 and B2 list a number of VOCs whose risk-based TAC is relatively high, a value that would allow gross contamination of indoor air. In these cases a ceiling value of 500 ug/m^3 is used. The ceiling value is based upon datasets showing that individual VOC concentrations in buildings tend to average less than 500 ug/m^3 across a broad array of building types and indoor air contaminants (Brown, et al., Indoor Air 4: 123-134, 1994). The 98^{th} percentile value for these indoor air contaminants was highly variable but most values were between 50 and 1000 ug/m^3, indicating that a level of 500 ug/m^3 represents an upper bound concentration that stems from an unusual contamination source. Such high concentrations may contribute to decreases in air quality that are noticeable to building inhabitants (Otto, et al., 1990). Therefore, this ceiling value is a prudent default value that can be replaced when more specific information becomes available (e.g., odor threshold data), as indicated for several VOCs in this derivation.

Indoor Air Background Concentrations

Since 1996, there has been an increased focus around the United States on measuring indoor air quality in impacted and non-impacted (or "background") homes, offices, schools and other environments. This had led to an enhanced database for background indoor air data (Foster, et al., 2002; Kurtz and Folkes, 2002; NYSDOH, 1997; Clayton, et al., 1999; Shields, et al., 1996; Girman, et al. report of USEPA/BASE Study, 1999). These datasets, along with the pre-existing indoor air datasets (Stolwick, 1990; Vermont DOH, 1992; Brown, et al., 1994; Daisey, et al., 1994; Sheldon, et al., 1992; Shah and Singh, 1988) have been reviewed while giving particular attention to those VOCs (typically carcinogens) with risk-based TACs that are in the range where they may approach or are below what can be considered background. VOC indoor air measurements are typically lognormally distributed; therefore, the central tendency background concentration (the median) was chosen to represent background. While higher concentrations may be found in certain background locations, the central tendency was used because of the way it would be applied: 1) to replace a risk-based TAC such that the background concentration would already be above a risk target; and 2) to back-calculate the allowable contribution from subsurface VOC contamination, such that the amount that is from

background sources plus the amount allowed from subsurface sources would still be within the range of the background data distribution.

VOC background concentrations and how they are used in the derivation of TACs are shown chemical-by-chemical in Tables B1 and B2.

Table B1

Target Air Concentrations (TACs) for Residential Scenario (Page 1)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Acetone	IRIS RfD (0.1mg-kg-d) converted to RfC (350 ug/m^3)	2x CexpF	183 ug/m^3	---[7]	180 ug/m^3
Benzene	IRIS unit risk (8.3E-6/ug/m^3)	2x CexpF, 2x CsensF	0.07 ug/m^3	3.25 ug/m^3	3.3 ug/m^3
Bromoform	IRIS unit risk (1.1E-6/ug/m^3)	2x CexpF; 2x CsensF	2.2 ug/m^3	Not available	0.55 ug/m^3
2-Butanone (MEK)	IRIS RfC (1000 ug/m^3)	2x CexpF	520 ug/m^3	---[7]	500 ug/m^3 – C[3]
Carbon Tetrachloride	IRIS unit risk (1.5E-5/ug/m^3)	2x CexpF; 2x CsensF	0.04 ug/m^3	0.5 ug/m^3	0.5 ug/m^3
Chlorobenzene	IRIS RfD (0.02 mg-kg-d) converted to RfC (70 ug/m^3)	2x CexpF	37 ug/m^3	---[7]	37 ug/m^3
Chloroform	IRIS unit risk (2.3E-5/ug/m^3)	2x CexpF	0.05 ug/m^3	0.5 ug/m^3	0.5 ug/m^3
1,2-Dichlorobenzene	HEAST RfC (140 ug/m3)	2x CexpF	73 ug/m^3	---[7]	73 ug/m^3
1,3-Dichlorobenzene	Analogy with 1,2-DCB	2x CexpF	73 ug/m^3	---[7]	73 ug/m^3
1,4-Dichlorobenzene	EPA Provisional unit risk (6.3E-06/ug/m^3)	None – since provisional unit risk	0.39 ug/m^3	24 ug/m^3	24 ug/m^3
1,1-Dichloroethane	HEAST ("A") RfC (490ug/m^3)	3.33x Cancer UF; 2x CexpF	77 ug/m^3	---[7]	77 ug/m^3
1,2-Dichloroethane	IRIS unit risk (2.6E-5/ug/m^3)	2x CexpF; 2x CsensF	0.023 ug/m^3	0.07 ug/m^3	0.07 ug/m^3
1,1-Dichloroethylene	CalEPA REL (70 ug/m^3); ATSDR MRL (80 ug/m^3)	10x Cancer UF	7 ug/m^3	<5 ug/m^3	10 ug/m^3
1,2-Dichloropropane	EPA provisional oral slope → unit risk (1.9E-05/ug/m^3)	None – since provisional unit risk	0.13 ug/m^3	Not available	0.13 ug/m^3
1,3-Dichloropropene	IRIS unit risk (2.9E-6/ug/m^3)	2x CexpF; 2x CsensF	0.21 ug/m^3	Not available	0.21 ug/m^3
Ethylbenzene	IRIS RfC (1000 ug/m^3)	10x Cancer UF; 2x CexpF	53 ug/m^3	<10 ug/m^3	53 ug/m^3
Ethylene dibromide	IRIS unit risk (2.2E-04)	2x CexpF, 2x CsensF	0.003 ug/m^3	Not available	0.0028 ug/m^3

Table B1

Target Air Concentrations (TACs) for Residential Scenario (Page 2)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Methyl-t-butyl ether	IRIS RfC (3000 ug/m^3)	10x Cancer UF; 2x CexpF	160 ug/m^3	---[7]	160 ug/m^3
Methyl isobutyl ketone	HEAST(A") RfC (70 ug/m^3)	2x CexpF	37 ug/m^3	---[7]	37 ug/m^3
Methylene chloride	IRIS unit risk (4.7E-07/ug/m^3)	2x CexpF	2.6 ug/m^3	3 ug/m^3	3 ug/m^3
Styrene	IRIS RfC (1000 ug/m^3)	10x Cancer UF; 2x CexpF	52 ug/m^3	---[7]	52 ug/m^3
1,1,1,2-Tetrachloroethane	IRIS unit risk (7.43E-06/ug/m^3)	2x CexpF; 2x CsensF	0.082 ug/m^3	Not available	0.082 ug/m^3
1,1,2,2-Tetrachloroethane	IRIS unit risk (5.7E-05/ug-m3)	2x CexpF, 2x CsensF	0.01 ug/m^3	Not available	0.01 ug/m^3
Tetrachloroethylene (PERC)	CalEPA unit risk (5.9E-06/ug/m^3)	2x CexpF	0.21 ug/m^3	5 ug/m^3	5 ug/m^3
Toluene	IRIS RfC (400 ug/m^3)	2x CexpF	208 ug/m^3	---[7]	210 ug/m^3
1,1,1-Trichloroethane	CalEPA REL (1000 ug/m^3)	2x CexpF	520 ug/m^3	---[7]	500 ug/m^3 - C[3]
1,1,2-Trichloroethane	IRIS RfD converted to RfC (14 ug/m^3)	3.33x Cancer UF; 2x CexpF	2.2 ug/m^3	0.03 ug/m^3	2.2 ug/m^3
Trichloroethylene	IRIS provisional unit risk (1.1E-04/ug/m^3)	2x CexpF, 2x CsensF	0.006 ug/m^3	1 ug/m^3	1 ug/m^3
Vinyl chloride	IRIS unit risk for early life + adult exposure (8.6E-06/ug/m^3)	2x CexpF	0.14 ug/m^3	0.01 ug/m^3	0.14 ug/m^3
Xylenes	ATSDR MRL (430 ug/m^3)	2x CexpF	220 ug/m^3	---[7]	220 ug/m^3
Trichlorofluoromethane	HEAST ("A")RfC (700 ug/m^3)	2x CexpF	365 ug/m^3	---[7]	370 ug/m^3

Table B1

Target Air Concentrations (TACs) for Residential Scenario (Page 3)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Chloroethane	IRIS RfC (10,000 ug/m^3)	10x Cancer UF; 2x CexpF	520 ug/m^3	---[7]	500 ug/m^3 - C[3]
Chloromethane	IRIS RfC (90 ug/m^3)	3.33x Cancer UF; 2x CexpF	14 ug/m^3	Not available	14 ug/m^3
Dichlorodifluoromethane	HEAST ("A")RfC (175 ug/m^3)	2x CexpF	91 ug/m^3	---[7]	91 ug/m^3
Isopropylbenzene (cumene)	IRIS RfC (385 ug/m^3)	2x CexpF	200 ug/m^3	---[7]	120 ug/m^3 (odor threshold)
cis-1,2-Dichloroethene	HEAST RfD → RfC (35 ug/m^3)	2x CexpF	18 ug/m^3	Not available	18 ug/m^3
trans-1,2-Dichloroethane	IRIS RfD → RfC (70 ug/m^3)	2x CexpF	37 ug/m^3	---[7]	37 ug/m^3
Bromodichloromethane	IRIS oral slope factor → unit risk (1.8E-05/ug/m^3)	2x CexpF; 2x CsensF	0.034 ug/m^3	Not available	0.034 ug/m^3
n-Butylbenzene	EPA provisional RfD → RfC (140 ug/m^3)	2x CexpF	73 ug/m^3	---[7]	73 ug/m^3
sec-Butylbenzene	EPA provisional RfD → RfC (140 ug/m^3)	2x CexpF	73 ug/m^3	---[7]	73 ug/m^3
1,2,4-Trimethylbenzene	EPA Provisional RfC (6 ug/m^3)	RfC ↑ed 3x[5] 2x CexpF	9 ug/m^3	Not available	9.3 ug/m^3
1,3,5Trimethylbenzene	EPA Provisional RfC (6 ug/m^3)	RfC ↑ed 3x[5] 2x CexpF	9 ug/m^3	Not available	9.3 ug/m^3
4-Isopropyltoluene	DPH risk assessment[6] yields RfC of 133 ug/m^3	2x CexpF	67 ug/m^3	---[7]	67 ug/m^3

Footnotes for Residential TAC Table B1

[1] Tox Value Notes: Values from IRIS, HEAST, CalEPA chronic RELs or ATSDR chronic MRLs; EPA provisional values have been derived by the agency but not fully documented or supported; HEAST "A" refers to values from Alternative Table within HEAST. Dose route extrapolation conducted when no inhalation tox value available and oral toxicity is to systemic sites.

[2] Modifying Factors: CexpF = children's exposure factor for increased respiratory rate per body wt and respiratory surface area;
CsensF = children's sensitivity factor for genotoxic carcinogens
Cancer UF = uncertainty factor for evidence of carcinogenicity but extrapolation to low dose uncertain.

[3] "C" designation indicates ceiling value of 500 ug/m^3.

[4] TACs based upon de minimis (1 in a million) cancer risk or a hazard index of 1 for non-cancer effects.

[5] EPA provisional RfC for 1,2,4- and 1,3,5-TMB have unnecesarily large uncertainty factors which drive very low RfC.

[6] 4-Isopropyltoluene risk assessment based upon analogy with isopropylbenzene with evidence neurotoxicity as key endpoint (4-IPT 3x > potency than IPB).

[7] Background concentration not sought since risk-based TAC is relatively high and unlikely to be in range of background.

Table B2

Target Air Concentrations (TACs) for Industrial/Commercial Scenario (Page 1)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Acetone	IRIS RfD (0.1mg-kg-d) converted to RfC (350 ug/m^3)	2.92 less worker exp.	1022 ug/m^3	---[7]	500 ug/m^3 – C[3]
Benzene	IRIS unit risk (8.3E-6/ug/m^3)	8.176 less worker exp.	0.99 ug/m^3	3.25 ug/m^3	3.3 ug/m^3
Bromoform	IRIS unit risk (1.1E-6/ug/m^3)	8.176 less worker exp.	7.34 ug/m^3	Not available	7.3 ug/m^3
2-Butanone (MEK)	IRIS RfC (1000 ug/m^3)	2.92 less worker exp.	2900 ug/m^3	---[7]	500 ug/m^3 – C[3]
Carbon Tetrachloride	IRIS unit risk (1.5E-5/ug/m^3)	8.176 less worker exp.	0.54 ug/m^3	0.5 ug/m^3	0.54 ug/m^3
Chlorobenzene	IRIS RfD (0.02 mg-kg-d) converted to RfC (70 ug/m^3)	2.92 less worker exp.	200 ug/m^3	---[7]	200 ug/m^3
Chloroform	IRIS unit risk (2.3E-5/ug/m^3)	8.176 less worker exp.	0.36 ug/m^3	0.5 ug/m^3	0.5 ug/m^3
1,2-Dichlorobenzene	HEAST RfC (140 ug/m^3)	2.92 less worker exp.	410 ug/m^3	---[7]	410 ug/m^3
1,3-Dichlorobenzene	Analogy with 1,2-DCB	2.92 less worker exp.	410 ug/m^3	---[7]	410 ug/m^3
1,4-Dichlorobenzene	EPA Provisional unit risk (6.3E-06/ug/m^3)	8.176 less worker exp.	1.3 ug/m^3	24 ug/m^3	24 ug/m^3
1,1-Dichloroethane	HEAST ("A") RfC (490 ug/m^3)	3.33x Cancer UF; 2.92 less worker exp.	430 ug/m^3	---[7]	430 ug/m^3
1,2-Dichloroethane	IRIS unit risk (2.6E-5/ug/m^3)	8.176 less worker exp.	0.31 ug/m^3	0.07 ug/m^3	0.31 ug/m^3
1,1-Dichloroethylene	CalEPA REL (70 ug/m^3); ATSDR MRL (80 ug/m^3)	10x Cancer UF	20 ug/m^3	<5 ug/m^3	20 ug/m^3
1,2-Dichloropropane	EPA provisional oral slope → unit risk (1.9E-05/ug/m^3)	8.176 less worker exp.	0.42 ug/m^3	Not available	0.42 ug/m^3
1,3-Dichloropropene	IRIS unit risk (2.9E-6/ug/m^3)	8.176 less worker exp.	2.9 ug/m^3	Not available	2.9 ug/m^3
Ethylbenzene	IRIS RfC (1000 ug/m^3)	10x Cancer UF; 2.92 less worker exp.	290 ug/m^3	<10 ug/m^3	290 ug/m^3
Ethylene dibromide	IRIS unit risk (2.2E-04)	8.176 less worker exp.	0.038 ug/m^3	Not available	0.038 ug/m^3

Table B2

Target Air Concentrations (TACs) for Industrial/Commercial Scenario (Page 2)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Methyl-t-butyl ether	IRIS RfC (3000 ug/m^3)	10x Cancer UF; 2.92 less worker exp.	876 ug/m^3	---[7]	190 ug/m^3 (odor threshold)
Methyl isobutyl ketone	HEAST(A") RfC (70 ug/m^3)	2.92 less worker exp.	200 ug/m^3	---[7]	200 ug/m^3
Methylene chloride	IRIS unit risk (4.7E-07/ug/m^3)	8.176 less worker exp.	17 ug/m^3	3 ug/m^3	17 ug/m^3
Styrene	IRIS RfC (1000 ug/m^3)	10x Cancer UF; 2.92 less worker exp.	290 ug/m^3	---[7]	290 ug/m^3
1,1,1,2-Tetrachloroethane	IRIS unit risk (7.43E-06/ug-3)	8.176 less worker exp.	1.1 ug/m^3	Not available	1.1 ug/m^3
1,1,2,2-Tetrachloroethane	IRIS unit risk (5.7E-05/ug-m3)	8.176 less worker exp.	0.14 ug/m^3	Not available	0.14 ug/m^3
Tetrachloroethylene (PERC)	CalEPA unit risk (5.9E-06/ug/m^3)	8.176 less worker exp.	1.4 ug/m^3	5 ug/m^3	5 ug/m^3
Toluene	IRIS RfC (400 ug/m^3)	2.92 less worker exp.	1165 ug/m^3	---[7]	500 ug/m^3 - C[3]
1,1,1-Trichloroethane	CalEPA REL (1000 ug/m^3)	2.92 less worker exp.	2900 ug/m^3	---[7]	500 ug/m^3 - C[3]
1,1,2-Trichloroethane	IRIS RfD converted to RfC (14 ug/m^3)	3.33x Cancer UF; 2.92 less worker exp.	12.3 ug/m^3	0.03 ug/m^3	12 ug/m^3
Trichloroethylene	IRIS provisional unit risk (1.1E-04/ug/m^3)	8.176 less worker exp.	0.074 ug/m^3	1 ug/m^3	1 ug/m^3
Vinyl chloride	IRIS unit risk for adult exposure (4.3E-6/ug/m^3)	8.176 less worker exp.	1.9 ug/m^3	0.01 ug/m^3	1.9 ug/m^3
Xylenes	ATSDR MRL (430 ug/m^3)	2.92 less worker exp.	1256 ug/m^3	---[7]	500 ug/m^3 - C[3]
Trichlorofluoromethane	HEAST ("A")RfC (700 ug/m^3)	2.92 less worker exp.	2044 ug/m^3	---[7]	500 ug/m^3– C[3]

Table B2

Target Air Concentrations (TACs) for Industrial/Commercial Scenario (Page 3)

VOC	Toxicity Value[1]	Modifying Factors[2]	Risk-Based TAC[4]	Background	TAC
Chloroethane	IRIS RfC (10,000 ug/m^3)	10x Cancer UF; 2.92 less worker exp.	2920 ug/m^3	---[7]	500 ug/m^3 - C[3]
Chloromethane	IRIS RfC (90 ug/m^3)	3.33x Cancer UF; 2.92 less worker exp.	80 ug/m^3	Not available	80 ug/m^3
Dichlorodifluoromethane	HEAST ("A")RfC (175 ug/m^3)	2.92 less worker exp.	511 ug/m^3	---[7]	500 ug/m^3 - C[3]
Isopropylbenzene (cumene)	IRIS RfC (385 ug/m^3)	2.92 less worker exp.	1168 ug/m^3	---[7]	120 ug/m^3 (odor threshold)
cis-1,2-Dichloroethene	HEAST RfD → RfC (35 ug/m^3)	2.92 less worker exp.	102 ug/m^3	Not available	100 ug/m^3
trans-1,2-Dichloroethane	IRIS RfD → RfC (70 ug/m^3)	2.92 less worker exp.	204 ug/m3	---[7]	200 ug/m^3
Bromodichloromethane	IRIS oral slope factor → unit risk (1.8E-05/ug/m^3)	8.176 fold less exp.	0.46 ug/m^3	Not available	0.46 ug/m^3
n-Butylbenzene	EPA provisional RfD → RfC (140 ug/m^3)	2.92 less worker exp.	410 ug/m^3	---[7]	410 ug/m^3
sec-Butylbenzene	EPA provisional RfD → RfC (140 ug/m^3)	2.92 less worker exp.	410 ug/m^3	---[7]	410 ug/m^3
1,2,4-Trimethylbenzene	EPA Provisional RfC (6 ug/m^3)	RfC ↑ed 3x[5] 2.92 less worker exp.	52 ug/m^3	Not available	52 ug/m^3
1,3,5-Trimethylbenzene	EPA Provisional RfC (6 ug/m^3)	RfC ↑ed 3x[5] 2.92 less worker exp.	52 ug/m^3	Not available	52 ug/m^3
4-Isopropyltoluene	DPH risk assessment[6] yields RfC of 133 ug/m^3	2.92 less worker exp.	370 ug/m^3	---[7]	370 ug/m^3

Footnotes for Industrial/Commercial TAC Table

[1] Tox Value Notes: Values from IRIS, HEAST, CalEPA chronic RELs or ATSDR chronic MRLs; EPA provisional values have been derived by the agency but not fully documented or supported; HEAST "A" refers to values from Alternative Table within HEAST. Dose route extrapolation conducted when no inhalation tox value available and oral toxicity is to systemic sites.

[2] Modifying Factors: Worker exposure assumptions for non-cancer effects: 250d/year and $10m^3$ inhaled per day leads to 2.92 fold less cumulative exposure than assumed for RfC – general public. For carcinogenic effects, this factor is increased 2.8 fold because workers exposed 25 yr instead of 70 yr leading to an overall 8.176 fold lower cumulative exposure than general public.

[3] "C" designation indicates ceiling value of 500 ug/m^3.

[4] TACs based upon de minimis (1 in a million) cancer risk or a hazard index of 1 for non-cancer effects.

[5] EPA provisional RfCs for 1,2,4- and 1,3,5-TMB have unnecessarily large uncertainty factors which drive very low RfC.

[6] 4-Isopropyltoluene risk assessment based upon analogy with isopropylbenzene with neurotoxicity as key endpoint (4-IPT 3x > potency than IPB).

[7] Background concentration not sought since risk-based TAC is relatively high and unlikely to be in range of background.

Appendix C

Comparison to
1996 Volatilization Criteria

Table C1

Comparison of Target Indoor Air Concentrations

Compound	CAS Number	Residential TAC (ug/m^3)	1995 Residential TAC (ug/m^3)	Ind/Com TAC (ug/m^3)	1995 Ind/Com TAC (ug/m^3)
Acetone	67641	▼180	834	▼500[1]	1170
Acrylonitrile	107131	NA	NA	NA	NA
Benzene	71432	►3.3[2]	3.25[2]	▼3.3[2]	21.5[2]
Bromoform	75252	▼0.55	2.21	▲7.3	3.72
2-Butanone (MEK)	78933	▼500[1]	1040	▼500[1]	1460
Carbon tetrachloride	56235	▼0.5[2]	1[2]	▼0.54	1[2]
Chlorobenzene	108907	▲37	20.9	▲200	29.2
Chloroform	67663	▼0.5[2]	3[2]	▼0.5[2]	3[2]
Dibromochloromethane	124481	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	▼73	209	▲410	292
1,3-Dichlorobenzene	541731	▼73	209	▲410	292
1,4-Dichlorobenzene	106467	▼24[2]	834	▼24[2]	1170
1,1-Dichloroethane	75343	▼77	521	▼430	730
1,2-Dichloroethane	107062	▼0.07	0.0936	▲0.31	0.157
1,1-Dichloroethylene	75354	▲10	0.0487	▲20	0.0818
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	NA	See **New Criteria** below	NA
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	NA	See **New Criteria** below	NA
1,2-Dichloropropane	78875	►0.13	0.128	▲0.42	0.215
1,3-Dichloropropene	542756	▲0.21	0.0658	▲2.9	0.11
Ethyl benzene	100414	▼53	1040	▼290	1460
Ethylene dibromide (EDB)	106934	▼0.0028	0.0111	▲0.038	0.0186
Methyl-tert-butyl-ether	1634044	▼160	521	▼190[3]	730
Methyl isobutyl ketone	108101	▼37	83.4	▲200	117
Methylene chloride	75092	▼3[2]	45[2]	▼17	45[2]
Styrene	100425	▲52	5[2]	▲290	7.17

Table C1
(Continued)

Comparison of Target Indoor Air Concentrations

Compound	CAS Number	Residential TAC (ug/m^3)	1996 Residential TAC (ug/m^3)	Ind/Com TAC (ug/m^3)	1996 Ind/Com TAC (ug/m^3)
1,1,1,2-Tetrachloroethane	630206	▼0.082	0.329	▲1.1	0.552
1,1,2,2-Tetrachloroethane	79345	▼0.011	0.042	▲0.14	0.0705
Tetrachloroethylene	127184	▼5[2]	11[2]	▼5[2]	11[2]
Toluene	108883	▼210	417	▼500[1]	584
1,1,1 Trichloroethane	71556	▼500	1040	▼500[1]	1460
1,1,2-Trichloroethane	79005	▼2.2	30[2]	▼12	30[2]
Trichloroethylene	79016	▼1[2]	5[2]	▼1[2]	5[2]
Vinyl chloride	75014	▲0.14	0.029	▲1.9	0.0487
Xylenes	1330207	▼220	313	▲500[1]	438
New Criteria					
Trichlorofluoromethane	75694	370	NA	500[1]	NA
Chloroethane	75003	500[1]	NA	500[1]	NA
Chloromethane	74873	14	NA	80	NA
Dichlorodiflouromethane	75718	91	NA	500[1]	NA
Isopropylbenzene (Cumene)	98828	120[3]	NA	120[3]	NA
cis-1,2-dichloroethene	156592	18	NA	100	NA
trans-1,2-dichloroethene	156605	37	NA	200	NA
Bromodichloromethane	75274	0.034	NA	0.46	NA
N-butylbenzene	104518	73	NA	410	NA
Sec-butylbenzene	135988	73	NA	410	NA
1,2,4-trimethylbenzene	95636	9.3	NA	52	NA
1,3,5-trimethylbenzene	108678	9.3	NA	52	NA
4-isopropyltoluene (4-cymene)	99876	67	NA	370	NA

[1] Based on a ceiling value. [2] Based on a background concentration. [3] Based on an odor threshold concentration. ▲TAC increased. ▼ TAC decreased. ► TAC stayed the same.

Table C2

Comparison of Ground Water Volatilization Criteria

Compound	CAS Number	Residential GWVC (ug/L)	1996 Residential GWVC (ug/L)	Ind/Com GWVC (ug/L)	1996 Ind/Com GWVC (ug/L)
Acetone	67641	▶50000	50000	▶50000	50000
Acrylonitrile	107131	NA	NA	NA	NA
Benzene	71432	▼130	215	▼310	3491
Bromoform	75252	▼75	920	▼2300	3800
2-Butanone (MEK)	78933	▶50000	50000	▶50000	50000
Carbon tetrachloride	56235	▼5.3	16	▼14	40
Chlorobenzene	108907	▶1800	1800	▲23000	6150
Chloroform	67663	▼26	287	▼62	710
Dibromochloromethane	124481	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	▼5100	30500	▶50000	50000
1,3-Dichlorobenzene	541731	▼4300	24200	▶50000	50000
1,4-Dichlorobenzene	106467	▼1400	50000	▼3400	50000
1,1-Dichloroethane	75343	▼3000	34600	▼41000	50000
1,2-Dichloroethane	107062	▼6 5	21	▼68	90
1,1-Dichloroethylene	75354	▲190	1	▲920	6
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	NA	See **New Criteria** below	NA
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	NA	See **New Criteria** below	NA
1,2-Dichloropropane	78875	▼7.4	14	▶58	60
1,3-Dichloropropene	542756	▲11	6	▲360	25
Ethyl benzene	100414	▼2700	50000	▼36000	50000
Ethylene dibromide (EDB)	106934	▼0.3	4	▼11	16
Methyl-tert-butyl-ether	1634044	▼21000	50000	▶50000	50000
Methyl isobutyl ketone	108101	▼13000	50000	▶50000	50000
Methylene chloride	75092	▼160	4512	▼2200	11117
Styrene	100425	▲3100	580	▲42000	2065

Table C2
(Continued)

Comparison of Ground Water Volatilization Criteria

Compound	CAS Number	Residential GWVC (ug/L)	1996 Residential GWVC (ug/L)	Ind/Com GWVC (ug/L)	1996 Ind/Com GWVC (ug/L)
1,1,1,2-Tetrachloroethane	630206	▼2	12	▲64	50
1,1,2,2-Tetrachloroethane	79345	▼1.8	23	▼54	100
Tetrachloroethylene	127184	▼340	1500	▼810	3820
Toluene	108883	▼7100	23500	▼41000	50000
1,1,1-Trichloroethane	71556	▼6500	20400	▼16000	50000
1,1,2-Trichloroethane	79005	▼220	8000	▼2900	19600
Trichloroethylene	79016	▼27	219	▼67	540
Vinyl chloride	75014	►1.6	2	▲52	2
Xylenes	1330207	▼8700	21300	▼48000	50000
New Criteria					
Trichlorofluoromethane	75694	1300	NA	4200	NA
Chloroethane	75003	12000	NA	29000	NA
Chloromethane	74873	390	NA	5500	NA
Dichlorodiflouromethane	75718	93	NA	1200	NA
Isopropylbenzene (Cumene)	98828	2800	NA	6800	NA
Cis-1,2-dichloroethene	156592	830	NA	11000	NA
trans-1,2-dichloroethene	156605	1000	NA	13000	NA
Bromodichloromethane	75274	2.3	NA	73	NA
N-butylbenzene	104518	1500	NA	21000	NA
Sec-butylbenzene	135988	1500	NA	20000	NA
1,2,4-trimethylbenzene	95636	360	NA	4800	NA
1,3,5-trimethylbenzene	108678	280	NA	3900	NA
4-isopropyltoluene (4-cymene)	99876	1600	NA	22000	NA

▲GWVC increased. ▼ GWVC decreased. ► GWVC stayed the same.

Table C3

Comparison of Soil Vapor Volatilization Criteria

Compound	CAS Number	Residential SVVC (ppm)	1996 Residential SVVC (ppm)	Ind/Com SVVC (ppm)	1996 Ind/Com SVVC (ppm)
Acetone	67641	▼57	2400	▼290	8250
Acrylonitrile	107131	NA	NA	NA	NA
Benzene	71432	▼0.78	1	▼1.4	113
Bromoform	75252	▼0.04	1.5	▼0.98	6
2-Butanone (MEK)	78933	▼130	2400	▼230	8285
Carbon tetrachloride	56235	▼0.06	1	▼0.12	2.7
Chlorobenzene	108907	▼6.1	31	▼60	106
Chloroform	67663	▼0.078	4.5	▼0.14	10.4
Dibromochloromethane	124481	NA	NA	NA	NA
1,2-Dichlorobenzene	95501	▼9.2	240	▼95	818
1,3-Dichlorobenzene	541731	▼9.2	240	▼95	818
1,4-Dichlorobenzene	106467	▼3	950	▼5.5	3270
1,1-Dichloroethane	75343	▼14	850	▼150	3037
1,2-Dichloroethane	107062	▼0 013	1	▼0.11	1
1,1-Dichloroethylene	75354	▲1.9	1	▲7	1
cis-1,2-Dichlroethylene	156592	See **New Criteria** below	NA	See **New Criteria** below	NA
trans-1,2-Dichloroethylene	156605	See **New Criteria** below	NA	See **New Criteria** below	NA
1,2-Dichloropropane	78875	▼0.021	1	▼0.13	1
1,3-Dichloropropene	542756	▼0.035	1	▼0.89	1
Ethyl benzene	100414	▼9.3	1650	▼93	5672
Ethylene dibromide (EDB)	106934	▼0.0005	1	▼0.007	1
Methyl-tert-butyl-ether	1634044	▼34	1000	▼73	3415
Methyl isobutyl ketone	108101	▼6.8	140	▼68	480
Methylene chloride	75092	▼0.65	89	▼6.8	218
Styrene	100425	▲9.3	8	▲95	28

Table C3
(Continued)

Comparison of Soil Vapor Volatilization Criteria

Compound	CAS Number	Residential SVVC (ppm)	1996 Residential SVVC (ppm)	Ind/Com SVVC (ppm)	1996 Ind/Com SVVC (ppm)
1,1,1,2-Tetrachloroethane	630206	▼0.009	1	▼0.22	1 5
1,1,2,2-Tetrachloroethane	79345	▼0.0012	1	▼0.028	1
Tetrachloroethylene	127184	▼0.56	11	▼1	27
Toluene	108883	▼42	760	▼180	2615
1,1,1 Trichloroethane	71556	▼70	1310	▼130	4520
1,1,2-Trichloroethane	79005	▼0.31	40	▼3.1	93
Trichloroethylene	79016	▼0.14	7	▼0 26	16
Vinyl chloride	75014	▼0.041	1	►1	1
Xylenes	1330207	▼38	500	▼160	1702
New Criteria					
Trichlorofluoromethane	75694	50	NA	120	NA
Chloroethane	75003	140	NA	260	NA
Chloromethane	74873	5.1	NA	53	NA
Dichlorodiflouromethane	75718	14	NA	140	NA
Isopropylbenzene (Cumene)	98828	19	NA	34	NA
Cis-1,2-dichloroethene	156592	3.4	NA	35	NA
trans-1,2-dichloroethene	156605	7.1	NA	70	NA
Bromodichloromethane	75274	0.0038	NA	0.095	NA
N-butylbenzene	104518	10	NA	100	NA
Sec-butylbenzene	135988	10	NA	100	NA
1,2,4-trimethylbenzene	95636	1.4	NA	15	NA
1,3,5-trimethylbenzene	108678	1.4	NA	15	NA
4-isopropyltoluene (4-cymene)	99876	9.3	NA	94	NA
▲SVVC increased. ▼ SVVC decreased. ► SVVC stayed the same.					

SECTION III

Stewardship Permit
Compliance Schedule

Stratford Army Engine Plant
EPA ID No. CTD001181502
Permit No. DEP/HWM/CS-134-003

SECTION III
COMPLIANCE SCHEDULE

A. All conditions set forth in Section III.A. of this permit, shall be conducted within thirty (30) calendar days of the effective date of this permit or upon transfer of the permit whichever is later. Otherwise, the Permittee may be subject to formal enforcement actions.

1. Retention of Consultant. The Permittee shall retain one or more qualified consultants acceptable to the Commissioner to prepare the documents and implement or oversee the actions required by this permit and shall, by that date, notify the Commissioner in writing of the identity of such consultant(s), and the sections of this permit for which they have been retained. The Permittee shall similarly inform the Commissioner within ten (10) calendar days of retention of any additional or replacement consultants.

   The primary consultant(s) retained to perform all investigation and remediation activities in response to this permit must be an independent, licensed environmental professional, and must provide professional services in accordance with RCSA Section 22a-133v-1 through 8 (the Licensed Environmental Professional Regulations). Nothing in this paragraph shall preclude the Commissioner from finding a previously acceptable consultant unacceptable.

B. All conditions set forth in Section III.B. of this permit, shall be conducted within sixty (60) calendar days of the effective date of this permit. Otherwise, the Permittee may be subject to formal enforcement actions.

1. Security Plan. The Permittee shall submit a Security Plan, to meet the requirements of Condition No. II.B.2.(e) of this permit. A revised plan shall be submitted within sixty (60) days prior to implementation of significant changes in site conditions as a result of site redevelopment (occupancy of buildings, demolition of buildings, major change of access routes, etc.).

2. Submittal of Schedules. The Permittee shall submit for the Commissioner's review and written approval a schedule for:

   (a) The submission of a Closure Plan for the Hazardous Waste Management Units, including an outline of a proposed closure approach and schedule in accordance with Condition No. II.A.1.(a) of this permit.

   (b) The submission of a revised Post-Closure Plan for the RCRA Land Disposal Units , in accordance with Condition No. II .A.2.(b) of this permit.

3. Liability Coverage. The Permittee shall submit for the Commissioner's review the liability coverage required pursuant to Condition No. II.A.(1)(h) of this permit.

C. All conditions set forth in Section III.C. of this permit, shall be conducted within one hundred twenty (120) calendar days of the effective date of this permit. Otherwise, the Permittee may be subject to formal enforcement actions.

1. Preparedness/Contingency Plans. The Permittee shall submit the Preparedness, Prevention, Contingency and Emergency Plans and Procedures, to meet the requirements of Condition No. I.E.12. of this permit. A revised plan shall be submitted within sixty (60) calendar days of significant changes in Site conditions.

2. O&M Plan. The Permittee shall submit a comprehensive Operations and Management Plan for all remedial systems of treatment and control, in accordance with Condition No. I.E.9. of this permit. A revised plan shall be submitted within sixty (60) calendar days of installation of any future remedial system of treatment and control.

3. Public Participation Plan. The Permittee shall submit a Public Participation Plan for the Commissioner's review and written approval in accordance with the requirements of Condition No. II.B.12. of this permit.

4. Cost Estimate for Closure. The Permittee shall submit for the Commissioner's review and written approval the cost estimate for performing closure of the Hazardous Waste Management Units in accordance with Condition No. II.C.2. of this permit.

5. Cost Estimate for Post-Closure. The Permittee shall submit for the Commissioner's review and written approval the cost estimate for performing post-closure care of the land disposal units in accordance with Condition No. II.C.2. of this permit.

6. Submittal of Schedules. The Permittee shall submit for the Commissioner's review and written approval a schedule for the submission of:

(a) The identification of data gaps in the site investigation and the evaluation of compliance with the RSRs in accordance with Condition No. II.B.2.(a) of this permit;

(b) A Quality Assurance Project plan (QAPP) in accordance with Condition No. II.B.2.(b) of this permit;

(c) The Preconstruction Survey in accordance with Condition No. II.B.2.(d) of this permit;

(d) The RAP(s) for the Site in accordance with Condition No. II.B.7. and the associated cost estimate in accordance with Condition No. II.C.2. of this permit.

D. All conditions set forth in Section III.D. of this permit, shall be conducted within one hundred and eighty (180) calendar days of the effective date of this permit. Otherwise, the Permittee may be subject to formal enforcement actions.

1. The Permittee shall develop and submit for the Commissioner's review and written approval, ecologically based and human health remedial goals for groundwater migrating off the Site to the tidal flats and other nearby surface waters in accordance with Condition No. II.B.2.(f) of this permit.

2. The Permittee shall develop and submit for the Commissioner's review and written approval, ecologically based and human health remedial goals for sediments within the tidal flats and 008 outfall area in accordance with Condition No. II.B.2.(g) of this permit.

E. All conditions set forth in Section III.E. of this permit, shall be conducted within three hundred sixty five (365) calendar days of the effective date of this permit. Otherwise, the Permittee may be subject to formal enforcement actions.

1. Progress Reports. The Permittee shall submit a progress report for the Commissioner's review describing the actions which the Permittee has taken to comply with the terms and conditions of this permit and annually thereafter until all actions required by this Permit have been completed to the Commissioner's satisfaction.