

**Environmental
Resources
Management**

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<http://www.erm.com>

22 October 2002
Reference: 143.66

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup
Northeast Regional Office
205 A Lowell Street
Wilmington, MA 01887



Re: Release Abatement Measure Plan - Modification #1
Former Raytheon Facility
430 Boston Post Road
Wayland, Massachusetts
Permit No. 133939/RTN 3-13574

Dear Sir or Madam:

On behalf of Raytheon Company (Raytheon), Environmental Resources Management (ERM) is submitting this Release Abatement Measure (RAM) Plan Modification for the above-referenced Site in Wayland, Massachusetts. This proposed RAM Modification includes a continuation of pilot treatment of chlorinated hydrocarbons in groundwater using in-situ chemical oxidation (ISCO). This modification to the RAM Plan was prepared in accordance with the requirements of 310 CMR 40.0444 of the Massachusetts Contingency Plan (MCP). The RAM Transmittal Form BWSC-106 is included as Appendix A.

Since the Site is classified as a Tier 1B site, Department approval of this RAM Plan is not required pursuant to 310 CMR 40.0443(3).

ERM previously submitted a RAM Plan, dated 11 September 2001, for groundwater pilot studies involving ISCO of chlorinated hydrocarbons (primarily trichloroethylene (TCE)) in groundwater in two pilot areas, referred to as the MW-33 and MW-43 pilot areas. Implementation of this RAM was initiated during October 2001, and the results of the injection and subsequent monitoring are detailed in the 120-Day and Six-Month RAM Status Reports, dated 31 January 2002 and 25 July 2002, respectively.

This RAM proposes continuation of ISCO activities in the MW-43 pilot area using the hydraulic fracturing and liquid atomized injection (HFLAI) technique, additional oxidant (sodium permanganate), and

multiple injection points and intervals. The activities included were selected to provide additional treatment of the subsurface materials while building upon the results from the previous RAM activities. Relevant site information and technology discussion as provided in the original RAM is also provided herein for completeness.

BACKGROUND

The Site is an approximately 83-acre facility located at 430 Boston Post Road in Wayland, Massachusetts (Figure 1). Raytheon operated the facility from 1955 to 1995. Operations included electronic testing and research to support Raytheon's in-house prototype manufacturing. Raytheon operations have been terminated, and the facility decommissioned. The facility has since been sold and is currently utilized as commercial office space.

ERM submitted a Phase I-Initial Site Investigation (Phase I) report for the Site to the Massachusetts Department of Environmental Protection (MA DEP or Department) in July 1996 and a Tier Classification filing in January 1997. The Department issued Raytheon a Tier IB Permit, effective 21 May 1997. Results of previous Phase II assessment activities identified a potential imminent hazard condition in Site wetlands. Based on this condition, a reclassification permit application was submitted to the MA DEP. A new Tier IB Permit was issued by MA DEP, effective 15 December 2000.

A Phase II-Comprehensive Site Assessment (Phase II) report was submitted to the Department in November 2001. The Phase II report indicated impacts to groundwater consisting primarily of trichloroethene (TCE), with limited tetrachloroethene (PCE) and TCE degradation by-products. The source of release is suspect to have been a former manhole connected to the former printed circuit board shop (Figure 2). Since the Site is located within the Zone II for the Baldwin Pond Well Field, impacts to groundwater at levels in excess of Massachusetts Maximum Contaminant Levels (MMCLs) pose a condition of "Significant Risk" to potential future receptors, requiring abatement.

ERM completed a review of remedial alternatives as part of Phase III – Identification, Evaluation and Selection of Comprehensive Response Action Alternatives, which was submitted to the Department in November 2001, and determined that ISCO is the preferred remedial

alternative to abate chlorinated ethenes in groundwater at the Site. ERM conducted two ISCO pilot tests under the ongoing RAM. This RAM Modification includes continuation of the ISCO pilot study in the MW-43 pilot area (Figure 3).

PURPOSE & SCOPE

The purpose of the proposed RAM Modification is to conduct an expanded pilot in the MW-43 area to evaluate the ability to reduce the concentration of chlorinated hydrocarbons in groundwater to levels that will enable achievement of a Permanent Solution, if feasible. The previous pilot test conducted in this area added a small volume of oxidant under gravity addition. This pilot was successful in reducing concentrations of TCE an average of 84%. This percentage was calculated using the two wells directly affected by the permanganate injection (i.e., MW-43S and MW-104 based on presence of visible permanganate) and the downgradient well MW-106, which appears to have been indirectly affected by the injection (i.e., the TCE concentration decreased significantly, likely due to advective mixing of treated and untreated groundwater several months after the injection). The upgradient well (MW-105) was not included in the calculation since it had not been affected by the injection (i.e., as evidenced by lack of color change or decrease in VOC concentration) and therefore, represented background or a control sample.

This RAM Modification is therefore proposing additional treatment of this area using the HFLAI technique, which is similar to the technique previously used in the MW-33 pilot area (pneumatic fracturing and liquid atomized injection (PFLAI)), and greater oxidant mass. An advantage of the HFLAI technique is the larger radius of influence versus the gravity addition (i.e., 20 feet using HFLAI versus 5 to 10 feet under gravity alone). This RAM outlines responsibilities and procedures for conducting the continued pilot study. The remainder of this RAM Plan is formatted consistent with the requirements of 310 CMR 40.0444 (1).

a) Name, address, telephone number and relationship of the person assuming responsibility for the RAM;

Mr. Ronald C. Slager, Jr.
Manager, Environmental Restoration Program
Raytheon Systems Company

1001 Boston Post Road, MS-1-2-1567
Marlborough, MA 01752-3789
TEL: (508) 490-1707

Additional information is contained in Appendix A, Form BWSC-106, RAM Transmittal Form.

b) *Description of the historical release, Site conditions and surrounding receptors;*

Historical Release Description

A former manhole, W-4, located in the courtyard between Buildings 3 and 4, was inspected by Raytheon in July 1996 and found to contain a heavy oily sediment and hard silt material. Raytheon retained Clean Harbors, Inc. (CHI) on 24 July 1996 to sample the material, which was found to contain elevated levels of chlorinated hydrocarbons including TCE at 598 micrograms per liter ($\mu\text{g}/\text{L}$), associated degradation products and semi-volatile organic compounds (SVOCs).

On 1 August 1996, CHI removed three drums of solid waste and found the bottom of the manhole to have a solid concrete bottom. The manhole was cleaned and 15 drums of fluids were containerized and disposed off-Site. Inspection of the interior of Building 4 revealed a drain labeled "sanitary" that was found to be connected to the manhole. A wipe sample collected from the drain indicated the presence of 613 μg of TCE per 100 square centimeters (cm^2) within the discharge pipe. As indicated in the Phase I Report, this portion of Building 4 had been formerly utilized as a Printed Circuit Board Shop from the 1960s until 1991.

Following cleaning of the drain line and manhole, two holes approximately four inches in diameter were observed in the bottom of the manhole. Water was also observed slowly seeping into the manhole. The water was sampled and found to contain 120,000 $\mu\text{g}/\text{L}$ of TCE, 1,100 $\mu\text{g}/\text{L}$ of cis-1,2-dichloroethene (cis-1,2-DCE) and 8.2 $\mu\text{g}/\text{L}$ of butyl cellusolve. The bottom of the manhole was subsequently sealed by Raytheon as part of facility decommissioning.

To evaluate the potential for impacts to soil and groundwater from manhole W-4, a soil boring was advanced immediately adjacent to the manhole and soil samples were collected for visual inspection, field screening and laboratory analysis. Field screening indicated no elevated VOCs in soil. Laboratory analysis of soil collected from six to eight feet in depth (targeting the bottom of the manhole) for VOCs and PCBs also indicated no impact to soil. The boring (MW-31) was advanced to a depth of 21 feet and a monitoring well was installed with a ten-foot long screen straddling the water table. Analysis of groundwater samples from this monitoring well (MW-31) indicated TCE at 190 µg/L. MW-31 was subsequently destroyed during facility decommissioning activities. The MW-43S/43D well couplet was later installed in proximity to the former MW-31 location (Figure 2).

Site Conditions

As part of on-going Site characterization activities being conducted at the Site, ERM advanced and logged a borehole (B-210) in the MW-43 pilot area using a Modified Waterloo Profiler. This technique provides a detailed record of the index of hydraulic conductivity (I_k), which was compared with the MW-43S/D boring logs to develop a detailed geologic log in this portion of the Site. VOC concentrations were measured in groundwater at five vertical horizons within the MW-210 borehole. No VOCs were detected in a soil sample collected from this borehole at a depth of approximately 25 feet below ground surface (bgs). The I_k and VOC data for MW-210 are shown on Figure 4. The proposed pilot study will be conducted in the following geologic units:

- Sand – Brown, fine- to coarse-grained sand fill. This layer is approximately 13 feet thick (0 - 13 feet depth).
- Silt – Brown, interbedded, fine-grained sand and silt, with some clay lenses. This layer is approximately 16 feet thick (13 - 29 feet depth).
- Sand – Brown, bedded, fine- to medium-grained sand. This layer extends to the bottom of the borehole at 35 feet (29 - greater than 35 feet depth).

Groundwater was encountered at a depth of approximately 15 feet bgs. Migration of dissolved-phase impacted groundwater is primarily controlled by groundwater flow. The predominant flow direction in the MW-43 pilot area is from northeast to southwest (Figure 5). Dissolved phase TCE appears to be limited to wells in the vicinity of the potential source area (i.e., MW-43S) at depths ranging from 13 feet to 30 feet bgs. This RAM will focus on treatment of this potential source area from 13 feet to 30 feet bgs.

Surrounding Receptors

The Site is located in a portion of Wayland that is zoned for Limited Commercial/Residential use. Currently, the Site is being used for commercial office space.

Surrounding land use and zoning is residential and roadside commercial. Properties adjacent to the Site include:

- North – forest and upland wetlands designated as Protected Open Space and owned by the Town of Wayland.
- East – wooded area and residential properties.
- West – wetlands and the Sudbury River.
- South – Route 20 (Boston Post Road), commercial and residential properties.

As shown in Figure 1, the Sudbury River abuts the Site to the west. An unnamed brook abuts the Site to the east-southeast, and flows into the Sudbury River approximately ¼ mile south of the Site. Wetlands are located along the banks of the Sudbury River.

The MA DEP Geographical Information System (GIS) Site Scoring Map (Figure 6), indicates that the Site is located within the MA DEP-approved Zone II Wellhead Protection Area for the Baldwin Pond Well Field, located approximately 0.5-mile to the north of the Site.

c) *Objectives, specific plans, and proposed implementation schedule for the RAM*

Objectives

The objective of the RAM Modification is to incorporate data gathered from the previous pilots to affect additional treatment in the MW-43 pilot area. Specifically, this RAM will be used to evaluate if ISCO is an applicable technology to achieve a Permanent Solution for the Site.

Specific Plans

ISCO is a remedial technology that, through a series of chemical reactions, completely mineralizes contaminant mass into neutral by-products such as manganese dioxide, salt and carbon dioxide. A variety of chemical oxidants exist, including hydrogen peroxide, permanganate, persulfate and ozone, each of which can be used to destroy TCE. Permanganate (sodium or potassium) has been selected as the appropriate oxidant for the Site based upon the Site conditions, contaminants present (i.e., chlorinated ethenes) and the amount and strength of oxidant needed. In addition, there are fewer health and safety issues associated with the use of permanganate versus hydrogen peroxide or ozone, since vapors (VOCs or oxygen) are not generated using this oxidant. Use of permanganate addresses DEP's concern regarding the need to monitor subsurface vapors, since permanganate does not generate such vapors. Therefore, ERM does not propose to monitor for VOCs, oxygen or lower explosive limit (LEL) during implementation of the ISCO pilot.

Based on our experience at similar sites, an ISCO system will involve injection of oxidant at discrete locations throughout the pilot area. Successful treatment is a function of the effectiveness of delivering oxidants to the impacted groundwater (i.e., contact) and transport of the oxidants within the aquifer. This RAM will be implemented as a grid injection across the strata impacted by TCE, defined using the Modified Waterloo Profiler at boring B-210 (approximately 15 to 30 feet depth; Figure 4). Based on the nature and extent of groundwater impacts and hydrogeologic characteristics of the Site, we anticipate that the reduction of VOCs in this pilot area may be achieved using the direct injection

program proposed to provide an initial oxidant dispersion through hydraulic fracturing, followed by further distribution via the passive, natural groundwater flow gradient. The method of injection proposed in this RAM, direct push injection using HFLAI, is directly comparable with the method previously used in the MW-33 area (PFLAI), which was found to provide a larger lateral distribution resulting in better dispersion as compared to the single well injection method.

The pilot will include six direct push injection points to provide overlapping areas of treatment both up-gradient, cross-gradient and down-gradient of the MW-43 well cluster and the existing monitoring wells located up-gradient, cross-gradient and down-gradient of the injection wells (Figure 3). The oxidant will be injected under pressure and allowed to migrate via natural advective and diffusive flow between injection points and throughout the study area. Groundwater samples will be collected to evaluate the distribution of oxidants throughout the aquifer and the rate of mass reduction achieved using this technology.

The ISCO pilot study will consist of the following tasks:

1. Install Additional Monitoring Points

The purpose of this task is to install an adequate monitoring well network to monitor the effects of the ISCO injection. Currently, seven monitoring wells exist within the proposed pilot area. Of these wells, five are set at a depth of 20 feet (MW-43S, MW-104, MW-105, MW-106 and MW-212), one well is set at a depth of 28 feet (MW-210) and one well is set at a depth of 55 feet (MW-43D). Three additional wells will be installed at a depth of 30 feet adjacent to existing wells MW-105, MW-106 and MW-212 (labeled as P-105M, P-106M and P-212M on Figure 3). These wells will be used to evaluate the effectiveness of the pilot study across the entire vertical injection interval (i.e., 13 to 30 feet bgs).

ERM will attempt to install at least two additional wells to a depth of 20 feet bgs beneath the building to evaluate the downgradient effects of the ISCO pilot (labeled as P-1 and P-2 on Figure 2). The final number of wells and their locations will be determined based on accessibility and drilling conditions.

All borings will be advanced using direct-push drilling methods (hand-held or truck-mounted). Monitoring wells will be constructed in each boring using one-inch inside diameter, Schedule 40, polyvinyl chloride (PVC) riser pipe and 10-foot long well screens.

2. Establish Baseline Hydrogeochemistry

The purpose of this task is to establish baseline groundwater flow and groundwater quality within the pilot area prior to beginning the oxidant injection. One round of groundwater monitoring will be conducted to establish baseline aquifer geochemistry. The baseline monitoring program will consist of the following field measurements and laboratory analyses:

Table 1

Analysis	Method of Analysis	Rationale	Frequency
Groundwater Elevation	Field Probe	Evaluate groundwater table elevation	Note 1
pH	Field Flow-Through Cell	Evaluate aquifer conditions	Note 1
Electrical Conductivity	Field Flow-Through Cell	Evaluate aquifer conditions and oxidant	Note 1
Temperature	Field Flow-Through Cell	Evaluate aquifer conditions	Note 1
Eh	Field Flow-Through Cell	Indicator of oxidant	Note 1
Dissolved Oxygen	Field Flow-Through Cell	Evaluate aquifer conditions	Note 1
Color	Field Visual Assessment	Indicator of permanganate	Note 1
Permanganate	Field Colorimetry	Quantify concentration of permanganate in groundwater	Note 1
VOCs	Lab - EPA Method 8021C	Contaminant concentrations	Note 2
Chloride	Lab - EPA Method 300.0	Degradation by-product	Note 2
Sodium	Lab - EPA Method 200.7	Evaluate aquifer conditions and potential tracer	Note 2
Manganese	Lab - EPA Method 200.7	Degradation product of MnO ₄	Note 2
Chromium & Hexavalent Chromium	Lab - EPA Method 200.7 Lab - SM 3500Cr-D/EPA 7196A	Oxidation can convert Cr ³ to Cr ⁶	Note 2

Table 1 Notes:

1. These parameters will be monitored daily during oxidant addition and weekly thereafter until unreacted permanganate is no longer present or stabilizes
2. These parameters will be monitored during the baseline round and after unreacted permanganate is no longer present or stabilizes. VOCs will be monitored at a minimum of quarterly.

ERM will conduct surveying, gauging and groundwater sampling activities in accordance with accepted practices outlined in the DEP's Standard References for Monitoring Wells, WSC-310-91, dated April 1991 and updated July 1994. Groundwater samples will be preserved on ice and will be documented consistent with chain-of-custody protocols. For Quality Assurance/Quality Control (QA/QC) purposes, ERM will collect and submit the following samples :

- one duplicate sample per monitoring round;
- one matrix spike per monitoring round; and,
- one matrix spike duplicate per monitoring round.

The laboratory will provide one trip blank per monitoring round. Monitoring will be conducted in the following wells.

Table 2

Location	Rationale
MW-43S, MW-43D, MW-104, MW-105, MW-106, MW-210, MW-212, and three proposed wells	Wells within and beneath the pilot area (10)
MW-44S, MW-44M, MW-44D	Wells up-gradient of the pilot area (3)
MW-101, MW-102, MW-103, MW-107, MW-108, MW-213, MW-214, P-1 and P-2	Wells down-gradient of the pilot area (9)
MW-209, MW-211	Wells cross-gradient of the pilot area (2)

3. Apply Reagent

The purpose of this task is to conduct an oxidant injection in the MW-43 pilot area. Once baseline conditions have been

established, a solution of sodium permanganate will be prepared. The oxidant solution will be prepared by mixing concentrated oxidant with potable water to the appropriate concentration, and delivered to the site in bulk containers.

Oxidant solution will be injected using HFLAI into the six injection locations shown on Figure 3. HFLAI was selected for this pilot application to provide increased radius of influence for each injection point, homogenize the overburden (i.e., lessening the potential degree of channelization that can occur during injection) and provide direct fracturing of the silty materials to provide better oxidant distribution within this layer.

The same procedure will be used at each injection point. A two-foot long injection tip will be advanced to the bottom of the target treatment zone (approximately 30 feet). A calculated volume of oxidant will be injected under high pressure using HFLAI. The injection tip will then be withdrawn approximately two feet to the next interval and oxidant will be injected into this interval. This sequential injection will be repeated from an approximate depth of 30 to 15 feet at each location.

Approximately 10,000 gallons of liquid (approximately 5% of available pore volume in a 80 feet by 80 feet by 15 foot thick treatment area) will be injected into six injection points, delivering approximately 17,250 pounds of oxidant. The injections will be conducted from the outside in to minimize the potential for displacing VOC impacted groundwater from the treatment area. During the injection process, ERM will conduct daily monitoring for groundwater elevation and field parameters prior to the start of each day's additions (Table 1). The exact amount of permanganate will be documented in future RAM Status Reports.

The presence of oxidant in the wells will be determined based on:

- Increases in electrical conductivity, which indicates the presence of sodium and/or unreacted oxidant;
- Eh value greater than 600 millivolts (mV), which indicates the presence of oxidant; and,

- Visual indication of permanganate, which is visibly pink at a concentration of approximately 0.25 to 0.5 parts per million (ppm) and purple at concentrations greater than 1 ppm.

Based upon ERM's past additions in this area, we anticipate that the oxidant addition will be completed in approximately two to three days using one rig and a dedicated field crew.

4. Install Confirmatory Soil Borings

The purpose of this task is to collect soil cores to evaluate the efficacy of the HFLAI injection technique at distributing permanganate within the subsurface. Within approximately one week after oxidant injection, ERM will advance four soil borings within the pilot study area and collect continuous soil samples (labeled B-1 through B-4 on Figure 3). These borings will be used to evaluate the lateral and vertical distribution of the oxidant across the targeted treatment area. Each boring will be continuously logged and photographed to evaluate the presence of permanganate. Soil samples will be screened for total VOCs using a photoionization detector (PID) and the jar headspace method. One soil sample from each boring will be collected and submitted for laboratory analysis of VOCs by EPA Method 8260/5035. The soil VOC results can be compared with soil VOC data collected as part of the ongoing Phase II/III Addendum assessment.

5. Post-Injection Groundwater Monitoring

The purpose of this task is to monitor the progress of the ISCO pilot study over time. Weekly measurements of field parameters will be conducted initially following oxidant injection. As monitoring continues, this schedule may be compressed or expanded based upon the results to provide sufficient information to document the changes in groundwater geochemistry over time.

Two rounds of laboratory analysis of VOCs using EPA Method 8021C and selected metals (sodium, manganese, chromium using EPA Method 200.7 and hexavalent chromium by SM 3500Cr-D/EPA 7196A) will be completed after all the permanganate has been consumed. Depending on the length of the pilot, groundwater samples will be analyzed for VOCs by EPA Method

8021C on a quarterly basis until completion of the pilot. Groundwater samples collected for VOC analysis will be immediately quenched using sodium thiosulfate to react with excess permanganate present in the groundwater sample.

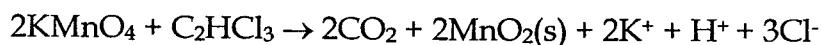
These data will allow for evaluation of oxidant diffusion, dispersion and degradation rates, and VOC destruction rates, and will be used to optimize well spacing and frequency of injections for potential treatment of other portions of the Site.

Schedule

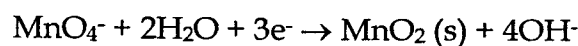
The proposed schedule includes baseline sampling and application of oxidants during Fall 2002, with monitoring for approximately six to nine months after injection.

d) Management of Remediation Waste

An estimated 17,250 pounds of sodium permanganate will be added to the subsurface as an oxidizing treatment of VOCs. This oxidant will be added as a liquid solution (approximately 18% weight basis concentration). The permanganate solution is observed as a dark purple solution (specific gravity 1.16). All permanganate containers will be rinsed, with rinseate solutions added to injection wells, and recycled. No remedial waste or remedial wastewater will be generated. The TCE oxidation reaction does not generate any toxic by-products, as demonstrated by the following reaction (Siegrist et al., 2001):



Similarly, the permanganate degradation reaction does not generate any toxic by-products, as demonstrated by the following example reaction (Siegrist et al., 2001):



Remedial Additives will be injected at the Site as discussed previously.

e) Proposed monitoring during and after the RAM

Monitoring will be performed in accordance with 310 CMR 40.0046(4) and as discussed above.

If the concentrations of Remedial Additives applied are above the applicable standards set forth in 310 CMR 40.0046(1)(b), ERM will monitor these wells for such additives for a reasonable period of time after the final application of the additives to demonstrate compliance.

f) Listing of all federal, state and local permits likely to be needed for the RAM;

In accordance with 310 CMR 40.0041(17), a permit pursuant to 314 CMR 5.00, the Massachusetts Ground Water Discharge Permit Program, is not needed, since Remedial Additives shall be applied in accordance with the requirements of 310 CMR 40.0000.

Pursuant to 310 CMR 40.0046(3), remedial additives are not being applied within 100 feet of any private water supply well, within 800 feet of any public water supply well or within 50 feet of any other surface water body, or any tributary. Therefore, Department approval is not required prior to conducting the RAM.

Pursuant to 310 CMR 40.0443(3), Department approval is not required prior to conducting the RAM because the Site has been Tier Classified and is not a Tier IA site. Therefore, Department approval is not required prior to conducting the RAM.

Public involvement will be performed in accordance with 310 CMR 40.1400 (Appendix B).

g) Seal and signature of the LSP who prepared the RAM Plan;

Refer to BWSC Form 106; Section J (Appendix A).

h) Certification for Remediation Waste in excess of 1,500 cubic yards;

Not Applicable.

i) Department required information.

To be submitted at the Department's request.

(2) RAM Fees

Since the Site has been Tier Classified as a Tier IB Site conducting response actions in compliance with the provisions of 310 CMR 40.0640, no RAM fee is required for this RAM pursuant to 310 CMR 40.0444(2).

(3) RAM Transmittal Form BWSC-106

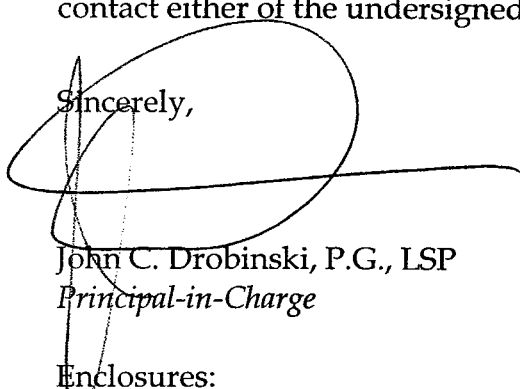
Original RAM Transmittal Form BWSC-106 is attached (Appendix A).

Reference

Siegrist, R.L., M.A. Urynowicz, O.R. West, M.L. Crimi and K.S. Lowe, 2001, Principles and Practices of In Situ Chemical Oxidation Using Permanganate, Battelle Press, Columbus, OH, 348 pp.

If the Department requires additional information or clarification, please contact either of the undersigned at (617) 267-8377.

Sincerely,



John C. Drobinski, P.G., LSP
Principal-in-Charge



R. Joseph Fiacco, Jr., P.G.
Project Manager

Enclosures:

Figures: Figure 1 Site Locus Map
Figure 2 Site Plan
Figure 3 Site Plan Showing the MW-43 Pilot Area with Six Injection Points
Figure 4 B-210 I_K Record, VOC Data and Geologic Interpretation
Figure 5 Groundwater Elevation Contour Map - March 2002
Figure 6 Resource Area Map

Appendices: Appendix A: RAM Transmittal Form BWSC-106
Appendix B: Copy of Notice to Public Officials

cc: Mr. Ron Slager, Manager, Environmental Restoration Program,
Raytheon Systems Company, 1001 Boston Post Rd., MS-1-2-1567,
Marlborough, MA 01752-3789

Public Repository (Primary Location), Former Raytheon Facility,
Wayland Public Library, Louise Brown, 5 Concord Road,
Wayland, MA 01778

Public Repository (Secondary Location), Former Raytheon
Facility, Wayland Town Hall, 41 Cochituate Road, Wayland, MA
01778

Karen Stromberg, PIP Coordinator, MA Department of
Environmental Protection, Northeast Regional Office, 205A
Lowell Street, Wilmington, MA 01887

Appendix A
RAM Transmittal Form BWSC-106



RELEASE & UTILITY-RELATED ABATEMENT
MEASURE (RAM & URAM) TRANSMITTAL FORM

Release Tracking Number

3 - 13574

Pursuant to 310 CMR 40.0444 - 0446 and 310 CMR 40.0462 - 0465 (Subpart D)

A. SITE LOCATION:

Site Name: Former Raytheon Facility

Street: 430 Boston Post Road

Location Aid: Route 20

City/Town: Wayland

ZIP Code: 01778-0000

Check here if a Tier Classification Submittal has been provided to DEP for this Release Tracking Number.

Related Release Tracking Numbers That This RAM or URAM Addresses:

B. THIS FORM IS BEING USED TO: (check all that apply)

Submit a RAM Plan (complete Sections A, B, C, D, E, F, J, K, L and M).

Check here if this RAM Plan is an update or modification of a previously approved written RAM Plan. Date Submitted:

Submit a RAM Status Report (complete Sections A, B, C, E, J, K, L and M).

Submit a RAM Completion Statement (complete Sections A, B, C, D, E, G, J, K, L and M).

Confirm or Provide URAM Notification (complete Sections A, B, H, K, L and M).

Submit a URAM Status Report (complete Sections A, B, C, E, J, K, L and M).

Submit a URAM Completion Statement (complete Sections A, B, C, D, E, I, J, K, L and M).

You must attach all supporting documentation required for each use of form indicated, including copies of any Legal Notices and Notices to Public Officials required by 310 CMR 40.1400.

C. SITE CONDITIONS:

Check here if the source of the Release or Threat of Release is known.

If yes, check all sources that apply: UST Pipe/Hose/Line AST Drums Transformer Boat

Tanker Truck Vehicle Other Specify: Former manhole

Identify Media and Receptors Affected: (check all that apply) Air Groundwater Surface Water Sediments Soil

Wetlands Storm Drain Paved Surface Private Well Public Water Supply Zone 2 Residence

School Unknown Other Specify:

Identify Release and/or Threat of Release Conditions at Site: (check all that apply)

2 and 72 Hour Reporting Condition(s) 120 Day Reporting Condition(s) Other Condition(s)

Describe: Groundwater concentrations above applicable reportable concentrations

RAMs may be conducted concurrently with an IRA only with written DEP approval
URAMs may not be conducted if any 2 or 72 Hour conditions exist at the site.

Identify Oils and Hazardous Materials Released: (check all that apply) Oils Chlorinated Solvents Heavy Metals

Others Specify:

D. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply)

Assessment and/or Monitoring Only

Deployment of Absorbant or Containment Materials

Excavation of Contaminated Soils

Temporary Covers or Caps

Re-use, Recycling or Treatment

Bioremediation

On Site Off Site Est. Vol.: cubic yards

Soil Vapor Extraction

Describe:

Structure Venting System

Store On Site Off Site Est. Vol.: cubic yards

Product or NAPL Recovery

SECTION D IS CONTINUED ON THE NEXT PAGE.



**RELEASE & UTILITY-RELATED ABATEMENT
MEASURE (RAM & URAM) TRANSMITTAL FORM**

Release Tracking Number

Pursuant to 310 CMR 40.0444 - 0446 and 310 CMR 40.0462 - 0465 (Subpart D)

3 - 13574

D. DESCRIPTION OF RESPONSE ACTIONS (continued):

- Landfill Cover Disposal Est. Vol.: _____ cubic yards Groundwater Treatment Systems
- Removal of Drums, Tanks or Containers Air Sparging
- Describe: _____ Temporary Water Supplies
- Removal of Other Contaminated Media Temporary Evacuation or Relocation of Residents
- Specify Type and Volume: _____ Fencing and Sign Posting

Other Response Actions Describe: Remedial Additives - Chemical Oxidation

**See 310 CMR 40.0442 for limitations on the scope and type of RAMs.
See 310 CMR 40.0464 for performance standards for URAMs.**

Check here if this RAM or URAM involves the use of Innovative Technologies. DEP is interested in using this information to aid in creating an Innovative Technologies Clearinghouse.
Describe Technologies: Chemical Oxidation

E. TRANSPORT OF REMEDIATION WASTE: (if Remediation Waste has been sent to an off-site facility, answer the following questions)

Name of Facility: N/A
Town and State: N/A
Quantity of Remediation Waste Transported to Date: N/A

F. RAM PLAN:

- Check here if this RAM Plan received previous oral approval from DEP as a continuation of a Limited Removal Action (LRA).
Date of Oral Approval: _____
- If a RAM Compliance Fee is required, check here to certify that the fee has been submitted. You **MUST** attach a photocopy of the payment. See 310 CMR 40.0444(2) to learn when a fee is not required.
- Check here if the RAM Plan is proposed for a Transition Site. If this is the case, you may need to attach an LSP Evaluation Opinion prior to undertaking the RAM, if not previously provided. See 310 CMR 40.0600 for further information about Transition Sites.

G. RAM COMPLETION STATEMENT:

If a RAM Compliance Fee is required in connection with submission of the RAM Completion Statement, check here to certify that the fee has been submitted. You **MUST** attach a photocopy of the payment. You owe this fee when submitting a RAM Completion Statement if you received oral approval of a RAM that continued an LRA, and have NOT previously submitted a RAM Plan and accompanying fee.
If any Remediation Waste will be stored, treated, managed, recycled or reused at the site following submission of the RAM Completion Statement, you must submit a Phase IV Remedy Implementation Plan, along with the appropriate transmittal form, as an attachment to the RAM Completion Statement.

H. URAM NOTIFICATION:

Identify Location Type: (check all that apply) Public Right of Way Utility Easement Private Property
Identify Utility Type: (check all that apply) Sanitary/Combined Sewerage Water Drainage Natural Gas
 Telephone Steam Lines Telecommunications Electric Other Specify: _____

- Check here if you provided DEP with previous oral notification of this URAM. Date of Oral Notice: _____
- Check here if the property owner was NOT contacted prior to initiation of the URAM. If this is the case, you must attach an explanation of why the owner was not contacted, including the date and time when contact ultimately occurred.
- Check here if this URAM will occur in connection with the construction of new public utilities. If this is the case, document the nature and extent of encountered contamination, the scope and expense of necessary mitigation and the benefits and limitations of project alternatives.

With the exception stated below, the person undertaking the URAM must provide the name and license number of an LSP engaged or employed in connection with the URAM:

LSP Name: _____ LSP License Number: _____

LSP information is not required if the URAM is limited to the excavation and/or handling of not more than 100 cubic yards of soil contaminated by Oil, or not more than 20 cubic yards of soil contaminated either by a Hazardous Material or a mixture of a Hazardous Material and Oil.



RELEASE & UTILITY-RELATED ABATEMENT MEASURE (RAM & URAM) TRANSMITTAL FORM

Release Tracking Number

Pursuant to 310 CMR 40.0444 - 0446 and 310 CMR 40.0462 - 0465 (Subpart D)

3 - 13574

I. URAM COMPLETION STATEMENT:

Check here if this URAM was limited to the excavation and/or handling of not more than 100 cubic yards of soil contaminated by Oil, or not more than 20 cubic yards of soil contaminated by either a Hazardous Material or a mixture of a Hazardous Material and Oil.

If any Remediation Waste will be stored, treated, managed, recycled or reused at the site following submission of the URAM Completion Statement, you must submit either a Release Abatement Measure (RAM) Plan or a Phase IV Remedy Implementation Plan, along with the appropriate transmittal form, as an attachment to the URAM Completion Statement.

J. LSP OPINION:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and (iii) the provisions of 309 CMR 4.03(5), to the best of my knowledge, information and belief,

> if Section B of this form indicates that a Release Abatement Measure Plan is being submitted, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> if Section B of this form indicates that a Release Abatement Measure Status Report or a Utility-Related Abatement Measure Status Report is being submitted, the response action(s) that is (are) the subject of this submittal (i) is (are) being implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> if Section B of this form indicates that a Release Abatement Measure Completion Statement or a Utility-Related Abatement Measure Completion Statement is being submitted, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

LSP Name: John C. Drobinski LSP #: 2196 Stamp:

Telephone: 617-267-8377 Ext.: 7850

FAX: (optional) 617-267-6447

Signature:

Date: 18 December 2002



An LSP Opinion is not required for a Utility-Related Abatement Measure Notification.

An LSP Opinion is not required for a URAM Completion Statement if the URAM is limited to the excavation and/or handling of not more than 100 cubic yards of soil contaminated by Oil, or not more than 20 cubic yards of soil contaminated either by Hazardous Material or a mixture of Hazardous Material and Oil.

K. PERSON UNDERTAKING RAM OR URAM:

Name of Organization: Raytheon Systems Company

Name of Contact: Ronald C. Slager, Jr. Title: Manager, Env. Rest. Program

Street: 1001 Boston Post Road, MS 1-2-1567

City/Town: Marlborough State: MA ZIP Code: 01752-3789

Telephone: 508-490-1707 Ext.: FAX: 508-490-1744

Check here if there has been a change in person undertaking the RAM or URAM.



RELEASE & UTILITY-RELATED ABATEMENT MEASURE (RAM & URAM) TRANSMITTAL FORM

Release Tracking Number

3 - 13574

Pursuant to 310 CMR 40.0444 - 0446 and 310 CMR 40.0462 - 0465 (Subpart D)

L. RELATIONSHIP TO SITE OF PERSON UNDERTAKING RAM or URAM: (check one)

- RP or PRP Specify: Owner Operator Generator Transporter Other RP or PRP: Former Operator
Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)
Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))
Any Other Person Undertaking a RAM or URAM Specify Relationship:

M. CERTIFICATION OF PERSON UNDERTAKING RAM OR URAM:

I, Ronald C. Slager, Jr., attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal.

By: [Signature] Title: Manager, Env. Rest. Program

For: Ronald C. Slager, Jr. Date: 18 September 2002

Enter address of person providing certification, if different from address recorded in Section
Street
City/Town: State: ZIP Code:
Telephone: Ext.: FAX: (optional)

YOU MUST COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.

Appendix B
Copy of Notice to Public Officials

**Environmental
Resources
Management**

399 Boylston Street, 6th Floor
Boston, MA 02116
(617) 267-8377
(617) 267-6447 (fax)

<http://www.erm.com>

18 September 2002
Reference: 143.66

Steven Calichman
Director of Public Health
Town of Wayland
14 Cochituate Road
Wayland, MA 01778



RE: Notification of Modification to Release Abatement Measure
Former Raytheon Facility
430 Boston Post Road
Wayland, Massachusetts
Permit No. 133939/RTN 3-13574

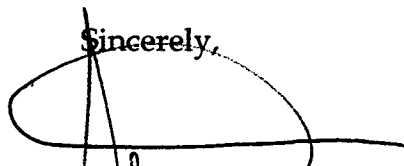
Dear Mr. Calichman:

On behalf of Raytheon Company, Environmental Resources Management (ERM), is submitting this letter to inform you that we will be implementing a modification to the ongoing Release Abatement Measure (RAM) at the above-referenced site in accordance with 310 CMR 40.0444 of the Massachusetts Contingency Plan (MCP).

The purpose of the RAM Modification is to evaluate the efficacy of reducing the concentration of chlorinated hydrocarbons in groundwater at the site by conducting an in situ chemical oxidation pilot study. The duration of the pilot study is expected to be approximately six months.

Please direct any questions to Ronald Slager, Jr., Raytheon Company at (508) 490-1707 or the undersigned at (617) 267-8377.

Sincerely,



John C. Drobinski, P.G., LSP
Principal-in-Charge



R. Joseph Fiacco, Jr., P.G.
Project Manager

cc: Ronald Slager, Jr., Raytheon Company

**Environmental
Resources
Management**

399 Boylston Street, 6th Floor
Boston, MA 02116
(617) 267-8377
(617) 267-6447 (fax)

<http://www.erm.com>

18 September 2002
Reference: 143.66

Jeff Ritter
Executive Secretary
Town of Wayland
14 Cochituate Road
Wayland, MA 01778



RE: Notification of Modification to Release Abatement Measure
Former Raytheon Facility
430 Boston Post Road
Wayland, Massachusetts
Permit No. 133939/RTN 3-13574

Dear Mr. Ritter:

On behalf of Raytheon Company, Environmental Resources Management (ERM), is submitting this letter to inform you that we will be implementing a modification to the ongoing Release Abatement Measure (RAM) at the above-referenced site in accordance with 310 CMR 40.0444 of the Massachusetts Contingency Plan (MCP).

The purpose of the RAM Modification is to evaluate the efficacy of reducing the concentration of chlorinated hydrocarbons in groundwater at the site by conducting an in situ chemical oxidation pilot study. The duration of the pilot study is expected to be approximately six months.

Please direct any questions to Ronald Slager, Jr., Raytheon Company at (508) 490-1707 or the undersigned at (617) 267-8377.

Sincerely,

John C. Drobinski, P.G., LSP
Principal-in-Charge

R. Joseph Fiacco, Jr., P.G.
Project Manager

cc: Ronald Slager, Jr., Raytheon Company