Draft Phase II Comprehensive Site Assessment and Draft Phase III Remedial Action Plan

Former Raytheon Wayland Laboratory
430 Boston Post Road, Wayland, Massachusetts
Draft Phase II Comprehensive Site Assessment

• Purpose
  • Site History
  • Site Hydrogeological Characteristics
  • Environmental Fate and Transport of OHM
  • Nature and Extent of Impact
  • Exposure Assessment
  • Risk Characterization
Site History

- 1955 - Previously undeveloped land
- 1955-97 - Raytheon leased property (never owned)
- 1957-95 - Raytheon operations
- Located in Water Supply Protection Zone II
- Wetlands located on property
  - Adjacent to Sudbury River
  - Contiguous with Great Meadows NWR
  - Outfall
Raytheon Operations History

• Research and Development facility for defense electronics
• Radar development and testing
  • Test radars on roof
  • Targets on towers
• Prototype electronic equipment
  • Antennae and transmitters
  • Design and test of manufacturing processes
• Retrofit of defense electronic field equipment
Site Regulatory History

- **1995-96 - Site closure activities**
  - RTN # 1783 CERCLIS review 1987 (C)
  - RTN # ERBn92-1340 UST Removal 1992 (C)

- **May 1995 - Initiated a Phase I Investigation**
  - Identified several areas of concern
    - RTN # 3-13302 Fuel Oil Release 1996 (C)
    - RTN # 3-13574 VOCs in groundwater 1996
    - RTN # 3-14042 PCBs in Soil 1996

- **May 1996 - Phase I submitted to MA Department of Environmental Protection (DEP)**

- **1997 - MCP Tier 1B Classification**
Site Regulatory History (cont.)

- 1998 – 2000  Continued Site Investigation
- April 2000 - Raytheon notified DEP of potential Imminent Hazard Condition (Ecological)
- May 2000  - Immediate Response Action (IRA) submitted to DEP
- September 2000 - Public Involvement Plan (PIP) submitted to DEP
- November 2000 - New Tier IB Permit issued with conditions
- September 2001 - Release Abatement Measure (RAM) Plan submitted for Groundwater Pilot Study
Site Evaluation

- **Investigation activities included:**
  - soil evaluations and removal actions
  - groundwater sampling
  - surface water sampling
  - wetland sediment sampling
  - aquifer testing
Soil Investigations

- 67 samples analyzed for metals, VOCs, PAHs, and PCBs
- 24 test pits completed in northern portion
- 4 Limited Removal Actions (“LRAs”) performed
- Two RAMs performed
  - tank removal and Activity and Use Limitation (“AUL”) by new owner, Wayland Business Center (“WBC”) RTN 3-13302
  - soil removal at TP-3 for RTN 3-14042
- Soil concentrations are below MCP standards with exception of the restricted areas (Wayland Business Center, Activity and Use Limitation)
Groundwater Evaluation

- Site located in Zone II for Baldwin Pond Wells (1/2 mile) defined by Anderson-Nichols Conceptual Zone II Study
- Groundwater flow in South/Southwest direction
- 58 GW wells installed (shallow, intermediate, deep and bedrock wells)
- Iterative process, 5 phases of drilling
- > 200 analyses of samples since 1996
- Analyzed for VOCs, metals, TPH and inorganic compounds
- VOCs exceed applicable MCP GW-1 guidelines
- Groundwater remediation is required
Groundwater Contour Map
Sediment Evaluation

• 1986-91 U.S. Fish & Wildlife (“USFW”) sampling of Great Meadows National Wildlife Refuge
  • mercury, arsenic, lead, cadmium, chromium, copper and PCBs detected throughout study area

• 1990 Raytheon identified butyl cellusolve release
  • collected sediment and surface water samples in river and wetland near outfall
  • detected metals and PAHs
  • non-detect for butyl cellusolve, VOCs, PCBs and pesticides
  • Response Action Outcome (“RAO”) filed in 1995

• 1995 - additional sediment samples collected, could not duplicate USFW data
Sediment Evaluation (cont.)

- Phase II evaluation limited by seasonal access
  - late 1998 delineated metals, petroleum, and PCBs near outfall
  - 1999 - completed 2 additional sampling rounds
  - 2000 - wetland and ecological specialists identified vegetation with stunted growth
Results of Sediment Sampling

• Majority of impact within 200 ft of Outfall (OF-1)
• Metals, PCBs and PAHs detected in Sediment at depths 0 - 12 inches
• Area of stunted growth coincides with higher concentrations of metals
Area of Stunted Growth
Concentrations of Metals in Wetland Soils

Approximate Distance from Outfall (ft)

Mean Concentration (mg/kg, dw)

- Chromium
- Copper
- Lead
Concentrations of PCBs and PAHs in Wetland Soils

Approximate Distance from Outfall (ft)

Mean Concentration (mg/kg, dw)

PCBs
PAHs
Surface Water Investigation

- 1990 - Butyl cellusolve release
  - Sampling included river surface water
- 1999 - 2000 Site Surface Sampling
  - Three rounds of sampling conducted under flooded and low flow conditions in the wetland
  - Detections of OHM in isolated surface water in wetland under low flow conditions attributed to sediment impacts
Surface Water Investigation (cont.)

- Nyanza Superfund Site Investigation (1986- present)
  - Former landfill located upstream in Ashland
  - Current EPA investigation of Sudbury River
  - Nyanza has impacted background concentrations in the Sudbury River
Risk Characterization

- Risk Methodology specified by the DEP
- Involves two components
  - Human Health
  - Ecological
- Drives extent of clean-up
Method 3 Risk Characterization

• Method 3 approach is a site specific assessment
• Human Health Risks Identified
  • Groundwater concentrations exceed drinking water standards; risk posed to future potential receptors
  • Wetland sediments pose a potential long term risk to trespassers within the area of stunted growth
Method 3 Risk Characterization

• Exposure assumptions for trespasser
  • Young adult
  • Thirty days per year for twelve years
  • Head, forearms and hands exposed
  • Daily ingestion of 50 mg of sediment and 50 ml of surface water

• GW-1 categorical definition requires clean-up to drinking water standard
Stage I and II Environmental Risk Characterization (ERC) Summary

- An area of stunted growth is present on part of the site
- Effects on wetland plants are the primary driver for ecological risk in the area of stunted growth
- No evidence of risk outside the area of concern
Conclusions of Phase II Investigations

- Extent of OHM impact limited to groundwater and wetland sediment
- Areas of site groundwater and wetland sediment to be evaluated in Phase III
- Land use controls required to mitigate risk
Draft Phase III Remedial Action Plan

• Purpose
  • Evaluate remedial technologies against performance standards established by the DEP
  • Select the preferred remedial technologies for abatement of impact in wetland sediments and in groundwater
Conclusions of Phase III

- **Wetland Sediment**
  - Excavation and off-site disposal of impacted sediments (approximately 1.5 acres)
  - Restoration of disturbed wetland area
  - Implementation of land use controls

- **Groundwater**
  - Chemical Oxidation
  - Pilot Study began October 6th
Net Environmental Benefit Analysis (NEBA)

- A conceptual framework used for evaluating remediation options
- NEBA balances the ecological benefits of planned remediation against the ecological costs in an attempt to:
  - encourage the selection of alternatives that offer the greatest potential benefit to the environment
  - *Answers: Is the cure worse than the disease?*
Area Targeted for Remediation
Wetland Permitting

- EPA TSCA Risk Based Approval
- DEP Water Quality Certification Process (401 Permit)
- Chapter 91 License Review
- Army Corps of Engineers Sec. 404 Review
  - Wild and Scenic Rivers Review
- MA Environmental Protection Act (MEPA) Review
- Wayland Conservation Commission Review
Groundwater Pilot Study Area

MW-33 Pilot Study Area

MW-43 Pilot Study Area

LEGEND
- Monitoring Well
- Injection Point
- Approximate Radius of Influence
Tentative Site Schedule
(pending regulatory approvals)

- Winter 2001 – Submit Phase II and III Reports
- Winter 2001 – IRA Completion Report
- May 2002 – Submit Phase IV Remedy Implementation Plan
- 2001-2002 – Wetland Permitting
- 2002 – Potential Implementation of Groundwater Remediation
- Summer/Fall 2002 – Implement Wetland Remediation
PIP Schedule

• 26 November - Comment period extended by 20-days. Written comments submitted to Raytheon
• A summary of the comments received and a response to those comments will be prepared
• Documents will be made available at the information repositories (Public Library and Board of Health)
• Notice of Availability of the documents will be sent to the PIP mailing list
Public Involvement Process

• Future opportunities for the public to comment on submittals:
  • Phase IV Remedy Implementation Plan
  • IRA and RAM Plans and Completion Reports
  • Response Action Outcome(s) (including AULs)
  • Other regulatory approvals
Contact Information

Ronald C. Slager, Jr.
Raytheon Company
MS -1-2-1567
1001 Boston Post Road
Marlborough, Massachusetts 01752
Cross Section

APPROXIMATE SCALE
Horizontal: 1" = 140'
Vertical: 1" = 20'

NOTE:
All elevations are approximate and are relative to mean sea level.

LEGEND

- Existing Monitoring Well
- Shallow Overburden, Groundwater Table
Location of Fence Installation
Major Steps in the ERC (based on MCP Guidance)

Stage I Screening-Level ERC

Stage II ERC
- Problem Formulation
- Analysis
- Risk Characterization

Risk Management
Goals of the Stage I Screening- Level ERC

• Identify potential exposure pathways
• Determine whether risk of harm is “readily apparent”
• Eliminate from further consideration any exposure pathways and chemicals that clearly do not pose a significant risk of harm to the environment
Results of the Stage I Screening - Level ERC

- Exposure pathways include surface water, wetland sediments, wetland soils, & biota
- Risk of harm is “readily apparent” in the area of stunted vegetation (see next slide)
Area of Readily Apparent Harm (ARAH)

Basis of ARAH in draft ERC:
- Stunted vegetation
- Exceedances of Federal and State water quality criteria
- PCBs > 50 mg/kg
- Elevated levels of copper and chromium associated with plant toxicity
Contaminants of Potential Ecological Concern (COPECs)

- **Metals:**
  - Antimony (Sb)
  - Arsenic (As)
  - Cadmium (Cd)
  - Chromium (Cr\(^{3+}\))
  - Chromium (Cr\(^{6+}\))
  - Copper (Cu)
  - Lead (Pb)
  - Manganese (Mn)
  - Mercury (hg)
  - Silver (Ag)
  - Tin (Sn)
  - Vanadium (V)
  - Zinc (Zn)

- **PCBs**
Stage II ERC
Typical “low-flow” or non-inundated condition
(photo taken on 6/28/70)

Typical “high-flow” or inundated condition
(photo taken on 3/25/68)

Air photo of Raytheon site
(removed to reduce file size)

Approximate location of wetland

Approximate location of wetland

Discharge, in CFS

Legend:  
- Discharge, in CFS
- Estimated Discharge, in CFS
- Discharge of 254 CFS corresponding to inundation at the former Raytheon site
Exposure Pathways and Potential Receptors of Concern

**Aquatic**
- Invertebrates
- Fish
- Amphibians

**Terrestrial**
- Plants
- Meadow Vole
- Muskrat
- White-tailed Deer
- Mallard
- Red-Tailed Hawk
Plan View of Cross Sections
Cross Section Locations
General Recovery Curve
General Recovery Curve

Initial injury due to digging interfering with bird foraging, lack of plant biomass, disturbance from remedial activity
Once the soil has been replaced, there is a rapid recovery as plants become established and grow, soil colonized, organic matter deposited.
The final tail of the recovery curve represents the full development of soil organic matter and invertebrate community.
Benefits and Costs of Remediation
Yellow Zone--Initial Services 80%
Benefits and Costs of Remediation
Red Zone--Initial Services 10%
Benefits and Costs of Remediation
Initial Services 10%
Benefits and Costs of Remediation
Initial Services 30%
Benefits and Costs of Remediation
Initial Services 50%
Benefits and Costs of Remediation

Initial Services 60%
Benefits and Costs of Remediation
Initial Services 70%
Benefits and Costs of Remediation Equated
Benefits and Costs of Remediation Equated

73% Initial Services