Department of Navy
Risk-Informed Remedy Selection

Federal Remediation Technologies Roundtable

Mr. Richard G. Mach Jr., P.E.

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Department of Navy Decades of Optimization Policy

Subj: POLICY FOR OPTIMIZING REMEDIAL AND REMOVAL ACTIONS AT ALL Department of Navy (DON) ENVIRONMENTAL RESTORATION PROGRAM SITES

Ref: (a) DOD Manual (DODM) 4715.20, Defense Environmental Restoration Program (DERP) Management, March 2012
(b) DON Environmental Restoration Program (NERP) Manual, August 2006
(c) OUSD Memorandum: Consideration of Green and Sustainable Remediation (GSR) Practices in the Defense Environmental Restoration Program, August 2009
(d) DON Guidance for Planning and Optimizing Monitoring Strategies, November 2010
(e) DON Guidance on GSR, April 2012
(f) DON Tiered Approach for Developing Sampling and Analysis Plans, June 2011
(g) DON Guidance for Optimizing Remedy Evaluation, Selection, and Design, March 2010
(h) DON Guidance for Preparing a Remedial Alternatives Analysis (RAA) Document, August, 2010
(i) DON Management and Monitoring Approach for DON ER Program Post ROD Sites, April 2012
(j) DON Monitoring Report Template, May 2011
(k)DON Guidance for Optimizing Remedial Action Operation (RAO), April 2001
(l) DON Guidance to Documenting the Milestones throughout the Site Closeout Process, March 2006

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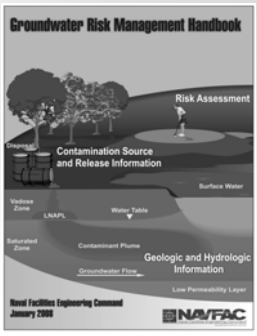
Key References

- Groundwater Risk Management Handbook, NAVFAC 2008
- Guidance for Optimizing Remedy Evaluation, Selection, and Design, NAVFAC, 2010
- Navy Optimization Policy, NAVFAC 2012

Use internet search or:
http://www.navfac.navy.mil/navfac_worldwide/specialty_centers/exwc/products_and_services/ev/er/erb/gpr.html



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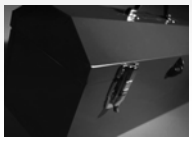
Navy's Toolbox Approach

- Site Evaluation / CSM
  - Focus on GW useability and complete exposure pathways
- Risk Management
  - Plume Management Zones, Point of Compliance
- Remediation Strategies
  - Treatment Trains, Active vs. Passive, Containment , MNA as polishing technology
- Optimization / Sustainability
- New Tools
  - Mass flux
  - Plume stability/MNA software



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Typical Alternative Approaches to Groundwater Remediation

- Groundwater plume management
  - Some states allow for plume management zones, alternate groundwater classification, alternate concentration limits (risk-based)
  - Containment systems (focus on plume migration control through pumping or permeable barriers)
- Treatment + MNA over long time frames
  - Treat source/hot spots to extent practicable followed by MNA (often with extend timeframes) and/or other passive remediation technologies
  - Land-use controls to manage potential exposure during remediation

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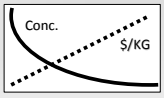
Performance Objectives and Exit Strategies

- Goals
  - Select remediation approach to achieve objectives
  - Define clear end-point



- Performance Objectives
  - Need to be developed and clearly defined
  - Functional objectives should be specific, measurable, attainable, relevant, and time-bound (SMART)
- Exit Strategies
  - When time to stop, modify, or change technology
  - "Asymptote" and "$/kg removed" important
  - Identify appropriate times to transition to other components of the treatment train

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Example Navy Project- Bethpage, NY

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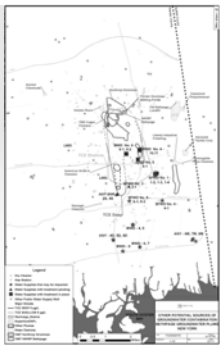
Background

- Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage government-owned contractor-operated (GOCO) facility was established in the 1940's to build Navy aircraft (originally 109 acres)
- Northrop Grumman (NG) operated the NWIRP as contractor; also owned and operated its own facility adjacent to NWIRP (500 +/-acres)
- Releases occurred over 50 years, and site is complicated by number of other PRPs
- South Oyster Bay (Atlantic Ocean) is the ultimate receptor
- Zones of sand and gravel promote non-uniform migration of chlorinated VOCs
- Plume is over 3 miles long, 750 feet deep, and fragmented near southern extent



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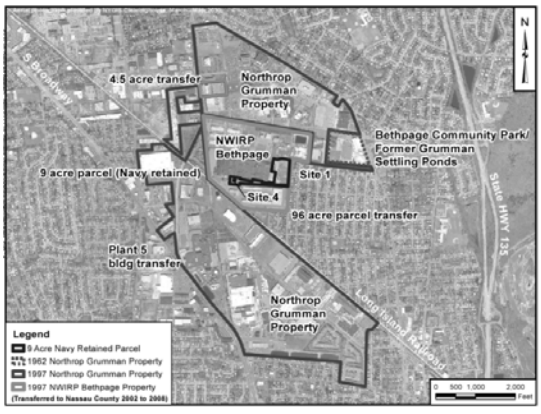

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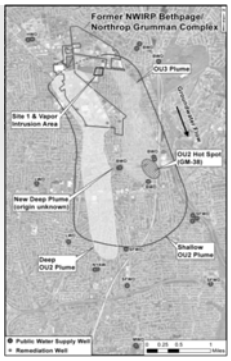
Remedy Overview

Remedial Actions have consisted of:

- Early treatment of concentrated source area via in-situ treatment (OU1)
- Early implementation of plume containment at the facility boundary (IRM and OU2)
- Off-property installation of hotspot system for mass removal (VOCs > 1 ppm) (OU2)
- Extensive monitoring system and provisions for well head treatment at impacted public water supply (PWS) systems (OU1 and OU2)



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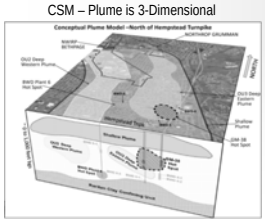
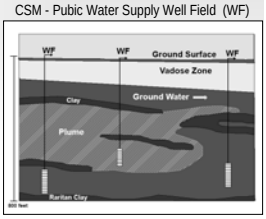
Groundwater Conceptual Site Model

- Plumes are relatively well defined, concentrated, and continuous near NWIRP Bethpage/NGC
- Plume becomes discontinuous in downgradient areas and moves as separate fingers

CSM – Plume is 3-Dimensional



CSM - Pubic Water Supply Well Field (WF)



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Hot Spot Treatment System

- Constructed in an off-property residential area, on property leased from Town of Oyster Bay
- Design, easements, construction required 6 years and $14M.
- System anticipated to run for 5 to 10 years
- System started in 2009 and has removed 3.5 tons of VOCs
- In 2010, OMM was approximately $700K/yr (3,000 pounds of VOCs or $230/lb)
- In 2013, OMM was approximately $600K/yr (1,300 pounds of VOCs or $460/lb)
- 2013 Optimization Study prepared to:
  - Improve performance and reliability
  - Continue to reduce operating costs
  - Define metrics for system shutdown, not well defined in ROD

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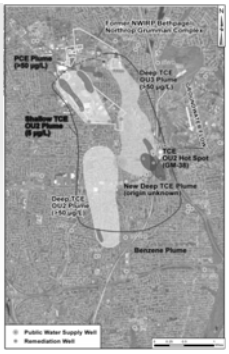
Off-Property Groundwater Monitoring

- Consists of plume monitoring and PWS sentry wells
- Plume is very complex, with multiple semi-confining units and fragmenting of plume from multiple releases over 50 years and seasonal pumping by PWS'
- Plume encompasses over 3000 acres and to depths of 750 feet.
- Delineation of plume is complicated by several non-Navy sources in the area and similarity of VOCs used
- Drilling in residential areas involves significant community interaction



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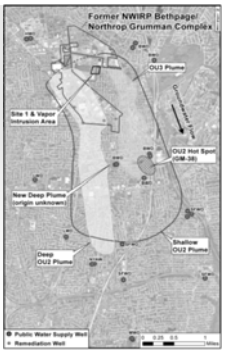
PWS Well Head Treatment

- Navy is negotiating and/or has implemented well treatment for three public water suppliers
  - Bethpage Water District (BWD) – 2 plants
  - South Farmingdale Water District (SFWD) – 2 plants
  - New York American Water (NYAW) – 1 plant
  - Total of 14 well fields may be impacted
- Dealing with water districts can be challenging, involves:
  - Legal agreements
  - Extensive community involvement
  - Political pressure



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Off-Property Optimization

- 2011, Navy assembled team of third-party experts to evaluate effectiveness of offsite OU2 GW remedy
- One of the findings presented in Optimization Report (June 2011) recommended an evaluation of alternatives for managing impacted groundwater. Alternatives report completed in Jan 2012
- 2012, independent review of Alternatives Report was conducted by Battelle, USGS, and USACE, all concluded the Alternative Report was "technically sound" (May 2012)

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Off-Property Optimization

- Based on these evaluations, the Navy concluded that the overall approach presented in the OU2 ROD:
  - Remains protective of human health and the environmental through monitoring and well head treatment
  - Complies with Federal and State regulations
  - Is cost effective, at least among the options available
  - Uses permanent solutions to the maximum extent practical
  - Utilizes treatment to the maximum extent practical

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Off-Property Optimization

- As a result of the evaluations and based on ten years of implementation experience, specific technical details of the program were modified to optimize performance, including:
  - Increased plume monitoring to better develop CSM and allow accurate predictions of potential plume migration
  - Enhanced sentry well network around potentially impact PWS'
  - Use of existing infrastructure, where reasonable, to achieve mass removal and thereby reduce or delay potential impacts to PWS'
  - Use of MNA for portions of the plume that will bypass PWS' and not effect human health or the environment

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