Joint Base McGuire-Dix-Lakehurst
Restoration Advisory Board (RAB) Draft Meeting Minutes
Meeting No. 29 – 24 February 2010

SUBJECT: Restoration Advisory Board (RAB) Meeting No. 29 – Meeting Minutes

1. Place: Edward Holloway Senior Citizen Community Center, Cookstown, New Jersey

2. Date/Time: Wednesday, February 24, 2010; 6:30 PM

3. Co-Chairs: Col Joseph Poth, Deputy Joint Base Commander, Joint Base McGuire-Dix-Lakehurst
Mr. Michael Tamn, Resident, Pemberton Township, New Jersey

4. Attendees:

Ms. Alida Karas	US Environmental Protection Agency, Region II, RAB Member
Ms. Susan Anton-Switka	Jackson Twp. / RAB Member
Ms. Theresa Lettman	Pinelands Preservation Alliance, RAB Member
Dr. William Walker	Wrightstown Borough resident, RAB Member
Mr. Chris Archer	JB MDL 87 CES, Deputy Civil Engineer
Mr. Ken Smith	JB MDL, Chief, 87 CES/CEAN
Mr. Curt Frye	JB MDL, 87 CES/CEAN, Environmental Restoration Program Chief
Mr. King Mak	JB MDL, 87 CES/CEAN, Environmental Restoration Program
Mr. Michael Figura	JB MDL, 87 CES/CEAN, Environmental Restoration Program
Mr. Michael Brown	JB MDL, 87 CES/CEAN, Environmental Restoration Program
Ms. Nicole York	JB MDL, 87 CES/CEAN, Environmental Restoration Program
Mr. Michael Slade	JB MDL, 87 CES/CEAN, Environmental Restoration Program
Ms. Patty Odoardo	JB MDL, 87 ABW/PA
Mr. John Malleck	US Environmental Protection Agency, Region 2
Ms. L. Tamn	Mt Holly
Mr. Matthew Csik	Ocean County Health Dept.
Mr. Jeff Sagnip	Representative for Congressman Chris Smith
Ms. Jennifer Azzarano	Burlington County College
Mr. Frederick Poli	Shaw Environmental & Infrastructure, Inc.
Mr. Graig Lavorgna	Shaw Environmental & Infrastructure, Inc.
Mr. Peter Naumoff	URS
Mr. Greg Kendall	Plexus Scientific

5. Call to Order:

The meeting was called to order at 1830 by Col Joseph Poth.

6. Minutes of Previous Meeting and Review of Agenda Items:

Mr. Tamn called for approval of the minutes from the 17 November 2009 RAB meeting. A motion was made, seconded and the minutes were approved.

7. Outstanding Action Items/Questions from Previous November 2009 RAB Meeting:

Mr. Curtis Frye-Chief, Environmental Restoration Program

A. Provide update on Bioaugmentation Pilot Study at Dix Mag- 1 site

- Mr. Frye noted that a detailed update of this project was scheduled for later in the meeting.

B. Provide information on potential solar panel "farm" at Dix National Priority List (NPL) landfill

- Mr Frye stated that several entities have expressed interest in installing a solar array at the site; and that a feasibility study would be the next step to evaluate engineering, environmental and financial considerations, including maintaining the integrity of the cap. The RAB will be briefed on any future developments.

C. Impact of Dix NPL landfill on nearby marshy area and Budds Run

- Mr. Frye noted that a detailed update of this project was scheduled for later in the meeting.

D. Provide copy of latest long term monitoring (LTM) report on Dix NPL Landfill

- Mr. Frye stated that a copy of the LTM Report was mailed to Mr. Tamn on 12 February 2010 and a summary of the report will be provided at this meeting (Item 8).

E. Administrative Order and Federal Facilities Agreement (FFA) Status

- Mr. Frye stated that the FFA was finalized and became effective 01 December 2009; the EPA rescinded the Administrative Order, which was documented by EPA Region 2 letter dated 25 January 2010. The Site Management Plan was finalized was finalized in early February 2010.

8. Dix NPL Landfill Long Term Monitoring Update:

Mr. Gregory Kendall, Project Manager, Plexus Scientific

- Mr. Kendall presented information describing current surface water and sediment conditions at the NPL Landfill and described regulatory exceedance of metals and DDT. Surface water exceedances at the site boundary included nutrient metals and manganese. Mr. Kendall pointed out the naturally acidic pH condition of the aquifer which results in metals leaching out of the soils into the aquifer. There is ample evidence documenting this naturally occurring condition in the Pinelands.
- There was also mercury detections which are believed to be associated with an upgradient site – the PDO Landfill - and will therefore being addressed as part of the CERCLA process for that site.
- Mr. Kendall pointed out that a Mann- Kendall Statistical Analysis has demonstrated that contaminant levels are not increasing.
- An Ecological Risk Assessment (ERA) was completed in 2009 and will be re-evaluated in the upcoming 5-Year Review for 2010. Findings show that some site related compounds exceed benchmark criteria; however, the recent trend analysis shows no increasing concentrations.

- In summary, recent data shows no site-related surface water contaminants extending beyond the site boundary; exceedance of DDT in sediment is ubiquitous to the area; and non-nutrient metal exceedances are localized and not migrating to the site boundary.
- Mr. Tamn inquired as to whether these 'naturally occurring' contaminant levels compared with previous background levels?
    - Mr. Kendall suggested that they were comparable.
    - These values line up with the Kirkwood-Cohansey formation.
- Mr. Tamn questioned in the long term how does the settling not get into the ground as the landfills are not lined.
    - Mr. Kendall stated that there is a monitoring well network around the infiltrations; the landfill is probably clay lined; if there was an influence it would be observed in the shallow surface water.
- Mr. Tamn also questioned whether the infiltration basins affected the groundwater or nearby surface water.
    - Mr. Kendall pointed out that the basins were designed to be protective of groundwater and surface water; it was also pointed out that the affect of the infiltration basins will be examined as a part of the upcoming 5-Year Review.
    - Mr. Kendall stated that he would look into the existence of an aquitard for confirmation of the deep well depths and investigate the existence of well data from the infiltration pond area.
    - Michael Slade stated that he will forward information regarding the infiltration basins to Mr. Tamn.
- Ms. Lettman and Ms. Switka also questioned why there was variation in background metal concentrations and was there a confining layer in the aquifer, respectively.
    - It was suggested that MDL give an update on on-going background studies; and provide more information on well depths and the existence of a confining layer.
- Ms. Lettman inquired as to why the analytical are higher than the monitoring wells closer to the landfill and what the sentinel well depths are.
    - The shallow wells are 25' and 35', respectively. The deep wells are 40' and 45' respectively.
    - The lithology for all wells is basically sand (one water body). There is a confining layer underneath the Kirkwood-Cohansey foundation.
- Ms. Lettman questioned the benzene concentrations in LTM-20 and LT-32; is benzene present due to groundwater mounding?
    - Mr. Kendall stated that mounding is not likely.

9. <u>Dix NPL Landfill Five-Year Review</u>:

Mr. Michael Slade, Restoration Program Manager, Fort Dix Environmental Division

- Mr. Slade gave a presentation on the upcoming 3rd CERCLA Five-Year Review at the Dix Sanitary (NPL) Landfill.
- Under CERCLA, Five-Year Reviews are required for all remedies that do not allow for unrestricted use or unlimited exposure to ensure the remedy continues to be protective of human health and the environment.

- Mr. Slade presented slides describing the Five Year Review process and also pointed out that interviews will be performed with any interested RAB Member of local officials to review any public concerns/comments associated with the remedy. A Questionnaire is available for anyone interested in providing input (Attachment). The Draft 5-Year Review Report is scheduled for completion in April 2010 and the Final Report is expected in September 2010.

10. Update on Bioaugmentation Pilot Study at Dix Mag-1 Site:

Mr. Graig Lavorgna, Project Engineer, Shaw E&I

- Mr. Lavorgna gave a presentation on the history of Mag-1, Bioaugmentation Pilot Study results, on-going Pre-Design activities and future plans for the Mag-1 groundwater remediation site.
- Mr. Lavorgna pointed out that Mag-1 Area was used as an ammunition and weapons storage and vapor-degreasing area at Dix. TCE was used as a degreaser and groundwater was impacted by TCE at concentrations up to approximately 2000ug/L after being disposed at a rock rubble pile. Bench Scale Treatability Studies of groundwater showed bioaugmentation with pH buffering to be a cost effective and feasible technology to remediate saturated soil and groundwater impacted by TCE at the site. A Bioaugmentation Pilot Scale Test was implemented at the site for one year, completed in December 2008. The Pilot Scale test demonstrated the complete dechlorination of TCE to ethene and shows that Bioaugmentation is an effective remedial alternative for TCE-impacted groundwater at the site. Mr. Lavorgna pointed out that on-going pre-design activities will continue, the Decision Document will need to be amended and full scale operation are currently expected to start in late 2011.
- Mr. Tamn stated that he had always thought the plume was much bigger than what is depicted on the figures shown this evening.
    - Mr. Poli and Mr. Lavorgna indicated that the current extent of the plume has been determined through significant investigations with the concurrence of NJDEP. Due to the fact that the releases occurred many years ago, it is very likely that a significant amount of the solvents have dissipated/biodegraded over time.
    - Mr. Lavorgna stated that there was a soil removal action at the site in 2005. The post excavation samples taken confirmed that the excavation area was clean.
    - Mr. Lavorgna also stated that monitoring wells were added downgradient to confirm the extent of the plume.

11. Action Items for next RAB meeting:

- Provide update on Dix Basewide Background Report

- Provide a hand-out to all RAB Members on the status of the Dix restoration sites including MMRP sites (fact sheets).

- Provide Mr. Tamn with a copy of the No Further Action Decision Document for the Dix Mag-2 Site.

- Mr. Tamn would like a list of all Dix sites that are in the IRP program (this list should be sent to all RAB members).

- For the Dix NPL Landfill, provide information on well depths and the existence of a confining layer

- For the 17 November 2009 RAB Minutes, ensure that the final version of the minutes included in the Information Repository shows the correct size of the Dix NPL Landfill (113 acres).

12. Meeting Adjourned:

Mr. Michael Tamn, RAB Co-Chair

- The meeting was adjourned at 2015.

JOINT BASE MCGUIRE-DIX-LAKEHURST, N.J.
RESTORATION ADVISORY BOARD (RAB)

Document Availability
Wednesday, Feb. 24, 2010

Document Control Point of Contact: Nicole York 609.754.0068

Background: The documents below have been made available since the last RAB meeting.

The following documents are currently available through Mr. Tam, the RAB Co-Chair, and will be available at the Burlington County Library by Monday, March 8, 2010.

- April through September 2009 Semi-Annual Progress Report for Areas A&B at the Naval Air Engineering Station, Lakehurst
- April through September 2009 Semi Annual Progress Report for Area C at the Naval Air Engineering Station, Lakehurst
- April through September 2009 Semi-Annual Progress Report for Area H at the Naval Air Engineering Station, Lakehurst
- Workplan for Vapor Intrusion Investigation at Areas B and K at the Naval Air Engineering Station, Lakehurst

The following document is currently available through Mr. Tam, the RAB Co-Chair and at the Burlington County Library.

- Sanitary Landfill, FTDX-10, 2009 Draft Sampling and Analysis Report for Groundwater, Surface Water, and Sediment at Ft. Dix, NJ

The following documents will soon be available through Mr. Tam, the RAB Co-Chair and at the Burlington County Library.

- McGuire AFB and EPA Final Federal Facilities Agreement (FFA) with the Site Management Plan (SMP) included as an appendix.

RAB QUESTIONNAIRE
FORT DIX SANITARY LANDFILL (FTDX-10)
3rd FIVE-YEAR REVIEW

1. What is your overall impression of the remedial actions and long-term monitoring activities at this site?

   _____
   _____
   _____

2. Are you aware of any community concerns regarding this site? Please provide details.

   _____
   _____
   _____

3. Are you aware of any problems or concerns associated with on-going monitoring and maintenance activities?

   _____
   _____
   _____

4. Do you feel that the land-use controls at this site is adequately communicated to the public?

   _____
   _____
   _____

5. Do you feel well informed about the long-term monitoring activities?

   _____
   _____
   _____

6. Do you have any comments, suggestions, or recommendations regarding the management of this site?

   _____
   _____
   _____

Name: _____

Title: _____

Organization/Community: _____

87th Air Base Wing

Joint Base McGuire-Dix-Lakehurst Restoration Advisory Board

Meeting No. 29
24 February 2010

87th Air Base Wing

Outstanding Action Items/Questions
from 17 November 2009 RAB Meeting

Mr. Curtis Frye
Chief, Environmental Restoration Program
87 CES/CEAN

Outstanding Action Items/Questions

- Bioaugmentation Pilot Study at Dix Mag - 1 Site
  - Action Item: Provide an update
    - ✓Response: An update will be provided at this meeting
- Dix NPL Landfill
  - Action Item: Provide information on future potential of the solar panel "farm" on the landfill
    - ✓Response: Information will be provided at this meeting

Outstanding Action Items/Questions Solar Array for Dix NPL Landfill

- **Several entities have expressed interest in evaluating the feasibility of installing a solar array at the Dix NPL Landfill site**
- **A feasibility evaluation would be a necessary next step - addressing engineering, environmental, and financial considerations, including maintaining the integrity of the landfill cap**

Outstanding Action Items/Question

- Administrative Order and FFA Status
  - Federal Facilities Agreement (FFA) was finalized and became effective 01 December 2009
  - Administrative Order rescinded (EPA Region 2 letter of 25 January 2010)
  - Site Management Plan (SMP) finalized February 2010

Outstanding Action Items/Question

- Dix NPL Landfill (Continued)
  - Action Item: Provide information on the impact of the landfill on the nearby marshy area and Budds Run
    - ✓Response: Information will be provided at this meeting
  - Action Item: Provided a copy of the latest long term monitoring report on the landfill
    - ✓Response: A copy of the LTM report was mailed to Mr. Tamn on 12 February 2010. Also, a summary of the report will be provided at this meeting

Questions?

87th Air Base Wing

Mr. Michael Slade
Restoration Program Manager-Dix
87 CES/CEAN

Mr. Greg Kendall
Project Manager
Plexus Scientific Corporation

Dix Sanitary (NPL) Landfill (FTDX-10)

Chemical Findings
and Current Conditions

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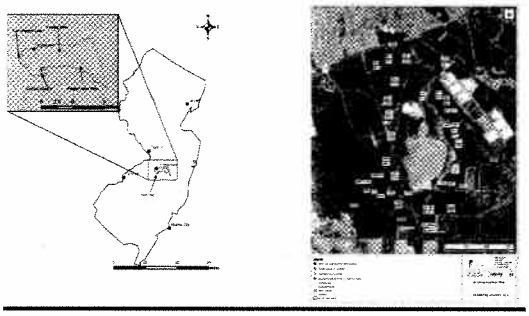
Dix Sanitary (NPL) Landfill (FTDX-10)



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Dix Sanitary (NPL) Landfill (FTDX-10)
Current Surface Water and Sediment Conditions

- Last round of sampling was conducted in October 2009 and occurs semi-annually
- Regulatory exceedances of metals, acetone and the pesticide dichlorodiphenyltrichloroethane (DDT), which is ubiquitous to the area
- Surface water exceedances at the site boundary include nutrient metals and manganese
- Acetone is a laboratory contaminant
- Mercury detections are related to a different site upgradient of the Sanitary Landfill

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Dix Sanitary (NPL) Landfill (FTDX-10)
Current Condition – Metals Exceedance

- Nutrient metals and manganese are natural occurring analytes at the sanitary landfill and across the Pinelands
- Naturally occurring acidic conditions in groundwater leach out metals from the aquifer sediments
- This phenomenon is documented by the USEPA and has been concurred with by the regulators as a naturally occurring condition. Therefore, these constituents are no longer considered site related contaminants.

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Dix Sanitary (NPL) Landfill (FTDX-10)
Current Condition – Ecological Risk Assessment

- An Ecological Risk Assessment (ERA) was completed in 2009 and will be re-evaluated for the upcoming Five-Year Review
- Chemical detections are compared to regulatory bench marks for risk to ecological receptors such as wildlife
- While findings show that some site related compounds exceed benchmark criteria, the most recent trend analysis show no increasing concentrations

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13

Dix Sanitary (NPL) Landfill (FTDX-10)
Conclusions

- Recent data shows no site-related contaminants extending beyond the site boundary in surface water
- Exceedances of DDT in sediment is ubiquitous to the area and is not detected in surface water
- Non-nutrient metal exceedances such as lead are localized and are not migrating to the site boundary
- Mercury exceedances are being addressed under a different site program

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14

Questions?

15

87th Air Base Wing

Mr. Michael Slade
Restoration Program Manager – Dix
87 CES/CEAN

Mr. Greg Kendall
Project Manager
Plexus Scientific Corporation

3rd CERCLA Five-Year Review Summary for the Dix Sanitary (NPL) Landfill

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17

Statutory Requirement for Five-Year Reviews

- Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) section 121 (c) Five-Year Reviews are required on remedial actions when hazardous substances, pollutants, or contaminants will remain on site above levels that allow for "unlimited use and unrestricted exposure"
- The Five-Year Review is used to ensure that the remedy continues to be protective of human health and the environment
- The United States Environmental Protection Agency (EPA) will be involved during the five year review process

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18

CERCLA Remedial Actions at the Dix Sanitary (NPL) Landfill

- Placed on the NPL 1987
- RI/FS completed 1987
- ROD signed in September 1991
- Phase I construction completed 1992
- Phase II construction completed 1996
- Construction consisted of a 53 acre landfill cap, landfill venting system, 6 ft perimeter chain link fence and a sediment and erosion control system

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19

CERCLA Remedial Actions at the Dix Sanitary (NPL) Landfill (cont.)

- Long-term (30 years) groundwater, surface water and sediment monitoring
- Long-term operation and maintenance
- Institutional controls in the form of deed and water restrictions on future uses of the landfill, groundwater and surface water in the immediate vicinity of the landfill

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20

Dix Sanitary (NPL) Landfill Site Layout and Sample Location Map

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21

Purpose of the Five-Year Review

- The purpose of a Five-Year Review is to determine whether the remedy implemented at a site continues to be protective of human health and the environment. This is done by answering the following three questions:
  1. Is the remedy functioning as intended?
  2. Are the assumptions used when the remedy was selected still valid?
  3. Has any other information come to light that could call into question the protectiveness of the remedy?

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22

Components of the Five-Year Review Process

- Document progress since last review
- Document and data review and evaluation
- Community notification
- Site inspection
- Site Interviews
- Perform a technical re-assessment of the remedial action objectives and reassess risk to human health and the environment
- Provide recommendations

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23

Five-Year Review Report Contents

- Site history and background
- Summary of CERCLA Remedial Actions
- Five-Year Review process
- Technical Assessment
- Issues identified during the Five-Year Review process
- Recommendations and follow-up items
- Protectiveness Statement
- Planned date for the next Five-Year Review

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24

Five-Year Review Interview

- Those interviewed may include the site manager; site personnel; Federal, and State, regulatory authorities; local officials; community action groups or associations
- Interview results will be outlined in the Five-Year Report
- Example Questions

1. What is your overall impression of the project? (general sentiment)
2. What effects have site operations had on the surrounding community?
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
5. Do you feel well informed about the site's activities and progress?
6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

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25

2010 Five-Year Review Schedule

- Interviews - March 2010
- Draft Five-Year Review Report - April 2010
- EPA Review - Summer 2010
- Address EPA comments - August 2010
- Final Report Submitted to EPA - September 2010
- Present Findings to RAB - Winter 2010

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26

Questions?

27

87th Air Base Wing

Bioaugmentation Pilot Study Update

Magazine-1 Area, Site FTDX-07

Mr. Michael Slade
Restoration Program Manager – Dix
87 CES/CEAN

Mr. Graig Lavorgna
Remediation Engineer
Shaw Environmental & Infrastructure, Inc.

Outline

I. Site History / CERCLA Process
II. Bioaugmentation Pilot Study Planning / Results
III. Ongoing Pre-Design Activities
IV. Future Plans

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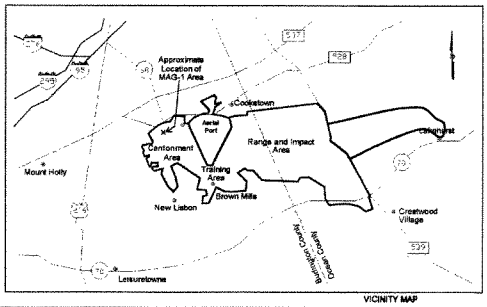
29

Site History / CERCLA Process



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30

Site History / CERCLA Process

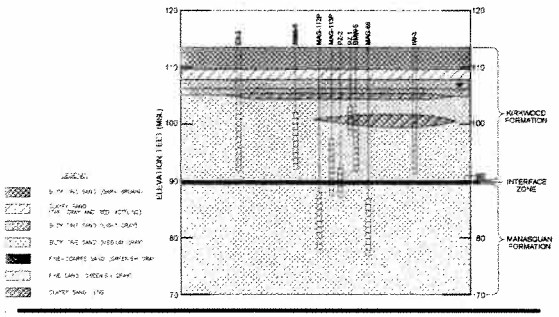
- MAG-1 area was used as an ammunition and weapons storage and vapor-degreasing area at Dix
- Virtually all contaminants impacting groundwater were discharged at a rock rubble pile
- Groundwater impacted with TCE at concentrations up to approximately 2,000 µg/L
- Aquifer soils mainly fine silty sands of the Kirkwood and Manasquan formations, with a thin interface zone of medium sands between the formations

"WIN AS ONE" 31

Site History / CERCLA Process

"WIN AS ONE" 32

Site History / CERCLA Process



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Site History / CERCLA Process

- Preliminary Assessment/Site Inspection – 1986
- Remedial Investigation/Feasibility Study – 1988 to 2001
- Decision Document for "Biostimulation" remedy – 2002
- Initial Lab Treatability Study (TS) Report – March 2005
- Revised Lab TS Report – December 2005
- Final Remedial Action Work Plan (RAWP) – May 2004
- RAWP Addendum for Groundwater– June 2005
- Revised RAWP Addendum for Groundwater– July 2006
- Draft Field Demonstration Summary Report – May 2009

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Site History / CERCLA Process

- 2002 "Biostimulation" remedy, concurred with by NJDEP, NJ Pinelands Commission, and Dix Stakeholders
- Biostimulation - Stimulate growth of native groundwater microbial populations to enhance the dechlorination of chlorinated VOCs in groundwater using Hydrogen Releasing Compound (HRC) or equivalent

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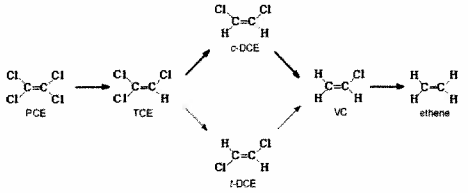
Site History / CERCLA Process

- Complete dechlorination of PCE/TCE to ethene requires the presence of *Dehalococcoides* sp. (DHC)



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Site History / CERCLA Process

- March 2005 Treatability Study (TS) report concluded stimulation of indigenous microbes using HRC was not adequate to fully degrade contaminants
- Per NJDEP recommendation, Army decided to perform a second TS, testing other *in-situ* technologies:
  - Bioaugmentation
  - Zero Valent Iron (ZVI)
  - In-situ Chemical Oxidation (ISCO) using Potassium Permanganate

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Site History / CERCLA Process

- *Bioaugmentation* – differs from biostimulation in that a TCE-degrading bacteria consortium containing DHC is also injected
  - Result: TCE was fully degraded to ethene within 11 days
- *Zero Valent Iron (ZVI)* – Acts as an electron donor to facilitate reductive dechlorination of organic compounds via iron oxidation
  - Result: Need high ZVI dosage (2% ZVI to soil mass) to reduce cis-DCE
- *In-situ chemical oxidation (ISCO) using Potassium Permanganate* – reacts with organic compounds to create non-toxic compounds
  - Result: High soil oxidant demand (119 g $KMnO_4$ / kg soil)

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Bioaugmentation Pilot Study Planning / Results

- Results show bioaugmentation to be a cost effective and feasible technology to remediate saturated soil and groundwater TCE-impacts at the site
- Implement Bioaugmentation Pilot Scale Test
- Pilot Scale System designed to:
  - create recirculation cells within the subsurface aquifer using an engineered groundwater extraction-injection system
  - ensure the proper mixing and delivery of exogenous bacteria (Shaw's SDC-9 culture), lactate, nutrients and buffering solution at required concentrations to affectively bioremediate the subsurface aquifer and provide hydraulic control in the central zone of the affected area
- Revised RAW Addendum completed July 2006

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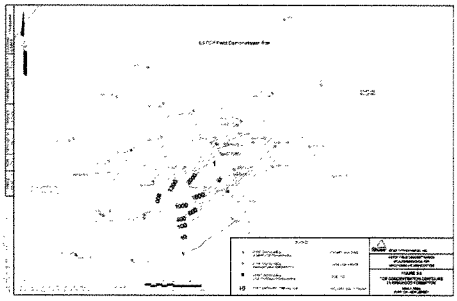
Bioaugmentation Pilot Study Planning / Results



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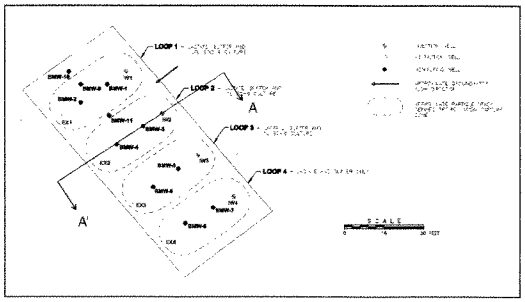
Bioaugmentation Pilot Study Planning / Results



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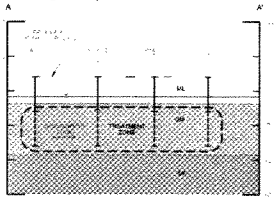
Bioaugmentation Pilot Study Planning / Results

Aquifer Conditions

- Relatively low permeability and heterogeneity
- TCE: 30 to 1,600 µg/L
- cis-1,2-DCE: 50 to 1,300 µg/L
- Low pH (~4.5 std. units)
- Aerobic conditions
  - DO: 0.5 to 5 mg/L
  - ORP: +50 to +150 mV
- Sulfate: 25 to 75 mg/L
- Dissolved iron: 1.5 to 7.5 mg/L
- Nutrient limited: no ortho-phosphate or nitrate



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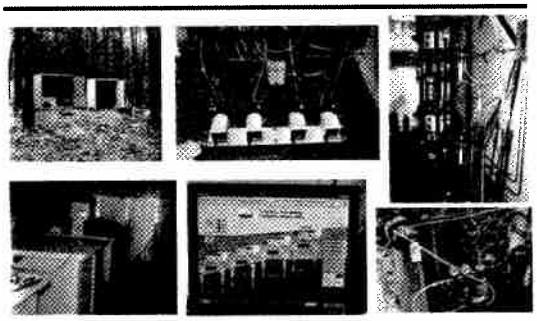
Bioaugmentation Pilot Study Planning / Results



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Bioaugmentation Pilot Study Planning / Results

- **Operation of recirculation loops began 15 November 2007**
- **pH buffer and amendment injected first, to achieve and sustain optimal conditions for anaerobic bacterial growth**
- **SDC-9 bacteria and nutrients then injected**
- **12 performance monitoring sampling events conducted**
- **88,000 gallons of groundwater recirculated in each loop**
- **Pilot study system shut-down 05 November 2008 after approximately 1 year of operation**
- **Final groundwater sampling event 05 January 2009**

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Bioaugmentation Pilot Study Planning / Results

Challenges

- Maintaining proper pH levels
  - Raising and maintaining pH above 6.5 required significant buffer
    - ✓ 7,000 lbs of sodium bicarbonate
    - ✓ 9,600 lbs of sodium carbonate
  - pH>10 required at injection wells to increase downgradient pH>6
  - Localized high pH near injection wells was lethal to SDC-9 and other organisms
- Fouling of injection wells
  - Carbonate precipitation
  - Metals precipitation
  - Biomass from bioaugmentation and electron donor addition
  - Redevelopment required / performance dropped

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Bioaugmentation Pilot Study Planning / Results

- Successfully demonstrated the complete dechlorination of TCE to ethene
- Significant growth of DHC occurred in the aquifer, particularly in areas with the greatest target compound concentrations
- Stronger buffer required initially (e.g., potassium hydroxide)
  - Reduce volume of buffer required
  - Eliminate heavy carbonate precipitation during initial buffering
- Inject bacteria away from the buffer injection well
  - Avoid exposing bacteria to high pH environment
  - Reduce bio-fouling potential in injection wells
- Results show Bioaugmentation to be an effective remedial alternative for TCE-impacted groundwater at the site

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Ongoing Pre-Design Activities

- August 2009 – Geoprobe investigation to assess contaminant distribution versus lithologic formation (Kirkwood, Interface, Manasquan) in preparation for remedial system well placement
  - Kirkwood: TCE to 500 µg/L, upgradient plume
  - Interface: TCE to 1,000 µg/L, upgradient & center plume
  - Manasquan: TCE to 400 µg/L, downgradient plume

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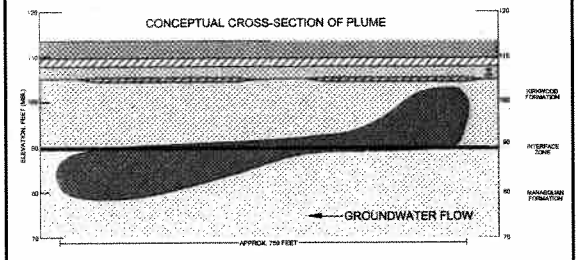
Ongoing Pre-Design Activities



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Future Plans

- **March 2010:**
  - Respond to December 28, 2009 NJDEP comment letter on the Draft Field Demonstration Summary Report
- **Calendar Year 2010:**
  - Monitoring well installation and site-wide groundwater sampling to confirm full scale remedial extent
  - Amend Decision Document to include bioaugmentation as the remedy
  - Remedial system design and Draft Remedial Action Work Plan Addendum for Groundwater submittal
- **Calendar Year 2011:**
  - Final Remedial Action Work Plan Addendum for Groundwater submittal
  - Remedial system installation, operation, and monitoring

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49

Questions?

50