PHYTOREMEDIATION AT PORTS GASEOUS DIFFUSION PLANT

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The Plant Site
PORTS looking southwest
History

- **August 1952** U.S. government selects Pike County site for new Portsmouth uranium enrichment plant.
- **September 1952** U.S. officials select Goodyear Tire & Rubber Corp. as plant operator. Goodyear creates Goodyear Atomic Corp. to operate plant.
- **March 1956** Plant complete six months ahead of schedule. **Full production begins.**
History (cont’d)

■ **July 1993**
  ■ USEC takes over Pad and Ports UE plants.
  ■ DOE retains legacy responsibilities for ER and WM.
  ■ USEC contracts with MMUS, for O&M of UE plants.

■ **May 2001**
  ■ USEC ceases enrichment activities at Ports.
Regulatory Issues

- The **ER Program at PORTS** - 2 enforcement actions.

I. A **Consent Decree** issued by the State of Ohio on August 31, 1989

II. An **Administrative Order by Consent (AOC)** issued by the U.S. EPA Region V on September 27, 1989 (amended twice since) under the authority of Section 3008(h) of the RCRA of 1976.
Regulatory Issues (cont’d)

- The **Consent Decree** requires a Cleanup Alternatives Study (**CAS**).

- The **AOC** requires a Corrective Measures Study (**CMS**).

- Ohio EPA and U.S. EPA agreed to a **CAS/CMS** report.

- The 2nd amendment to the AOC (August 11, 1997) relinquished day-to-day oversight of response action activities to the Ohio EPA.
The Problem
LEGEND
TCE Concentrations in Gallia Groundwater in ug/L
- 5 - 100
- 100 - 1,000
- 1,000 - 10,000
- 10,000 - 100,000

SCALE IN FEET

0 2000
0 2000
Based on 1997 and 1998 data

Non-Detected
TCE Concentration (ug/L) in red

TCE Concentrations 1000 ug/L
TCE Concentrations 100 ug/L
TCE Concentrations 10 ug/L
TCE Concentrations 5 ug/L

TCE Concentrations 1000 ug/L
TCE Concentrations 100 ug/L
TCE Concentrations 10 ug/L
TCE Concentrations 5 ug/L

Non-Detected
TCE Concentration (ug/L) in red
“Stratigraphy”
PORTS STRATIGRAPHY

MINFORD MEMBER

Lacustrian Silts and Clays
K = 0.75 ft/d

Semi-confined Fluvial Sands & Gravels
K = 1.7 to 60 ft/d

CUYAHOGA SHALE
Sandy Shale

SUNBURY SHALE
Carbonaceous Shale
K = 0.002 ft/d

BEREA SANDSTONE
Thick Bedded Fine-grained Sandstone
K = 2 ft/d

BEDFORD SHALE
Shale with Interbedded Sandstone

GEOLOGIC SETTING
Why Phytoremediation?
The Decision Process

- **Quad III RFI**
  - Occurred in 2 phases
    - Phase I: April to August 1992
    - Phase II: April to July 1994
  - OEPA final approval received September 5, 1997.

- **A Baseline Ecological Risk Assessment (BERA)**
  - Approved by OEPA February 7, 1997
The Decision Process (cont’d)

- A Background Sampling Investigation (BSI) of Soil and Groundwater
  - Approved by the OEPA May 16, 1996.

- Data from RFI, BERA, and BSI used to support the CAS/CMS Document
Alternatives Considered

- Option 1- Do Nothing
- Option 2- I.C. & Monitoring
- **Option 3- I.C. & Phytoremediation**
- Option 4- I.C. & Pump & Treat
- Option 5- I.C. & VER
Alternative Costs

- Option 1 - $0
- Option 2 - $603 Thousand
- **Option 3** - $638 Thousand
- Option 4 - $1.12 - $1.51 Million
- Option 5 - $2.53 - $3.53 Million
Project Design
Sand-filled borings allow contaminated Gallia groundwater to flow into bottom of trenches. Trees planted between trenches compete for surface infiltration.
Block diagram of the phytoremediation system showing Poplar tree plantings in a shallow trench to the water table with sand-filled borings to the Gallia.
Tree planting design with trenches and wells at X-740
Project Construction
X-740
X-740 Project Details

- **Species Used:**
  - P. deltoides x P. nigra (DN-34)
  - P. nigra x P. maximowiczi (NM-6)
  - P. nigra x P. nigra (NE-19)

- **Acreage:** 4.3
- **Total No Trees planted:** 765
- **Trenches (10ft Deep):** 2,060 ft. (0.39 mi)
- **Sand Stacks:** 107
- **24” Borings:** 559
The First Trench
X-740 Looking N.E.
June 6, 2001
Mary, Mary,........
How does your garden grow?.........
June 3, 1999
1 week after planting
August 3, 1999
9 weeks after planting
September 10, 1999
15 weeks after planting
Project Construction
X-749/120
X-749/120 Project Details

- **Species Used:**
  - P. nigra x P. maximowiczi (NM-6)

- **Acreage:**
  - Phase 1: 2.3
  - Phase 2: 41

- **Total No Trees planted:**
  - Phase 1: 709
  - Phase 2: 2,774

- **Trenches (12ft Deep):**
  - Phase 1: 4,986 ft* (1.34 mi)
  - Phase 2: 14,040 ft (2.66 mi)

- **Trenches (15ft Deep):**
  - Phase 1: 0
  - Phase 2: 13,700 ft (2.59 mi)

- **Sand Stacks:**
  - Phase 1: 354
  - Phase 2: 1,387

- **24” Borings:**
  - Phase 1: 0
  - Phase 2: 0

*10ft deep trenches in Phase I
PORTSMOUTH SUMMARY
(SO FAR)

- **Acreage:** 45+ acres
- **Total No Trees planted:** 4,214
- **Trenches (Total):** 34,786 ft. (6.6 miles)
- **Sand Stacks:** 1,848
- **24” Borings:** 559