The U.S. EPA’s Great Lakes Legacy Act
Ashtabula River Clean-Up

March 2008
1995 PCB Sampling Locations
Summary of Sampling Results

- 545,000 cubic yards of impacted sediments
- Maximum PCB Concentration 660 ppm
- Average PCB Concentration: 7.5 ppm (throughout entire sediment column)
- 25,000 pounds of PCBs present in sediments
Baseline Sampling Program

- **Sediment Chemistry**
  - PCBs, HCB, HCBD, TOC

- **Sediment Toxicity**
  - 20-day for *C. dilutus* Survival and Growth
  - 28-days for *H. azteca* Survival and Growth

- **Water Chemistry**
  - PCBs, TOC

- **Whole Sediment Bioaccumulation**
  - 28-day exposure of *Lumbriculus variegatus*;
  - Analyzed for: PCBs, % Lipids, % Moisture

- **Caged Fish**
  - 28-day exposure of young of the year catfish
  - Analyzed for: PCBs, % Lipids, % Moisture
PCB SWAC

Legend

Total PCB's sediment ug/kg

- 47 - 100
- 101 - 500
- 501 - 1000
- 1001 - 1500
- 1501 - 3000
- 3001 - 6000

*IDW Total PCB's SWAC = 763.97 ug/kg

Strong Brook Source

Grid cell size 2.56 x 2.56 m
SWAC = Calculated average over interpolated surface area.
*IDW = Inverse Distance Weighted
Baseline Sampling: Results and Lessons Learned

• Lessons Learned
  – Always do a baseline assessment
  – Always collect recent data to assess potential sources
  – It’s 2008 and there are still violators out there (intentional and/or unintentional)

• Results
  – Pre-Dredging PCB SWAC: 0.5 mg/kg
Project Goals

• Overarching Goals
  – Reduce contaminant levels in fish
  – Restore use of river by boats
    • 20% of boats damaged due to shallow depths in 2005
  – Reduce number of tumors in fish
  – Restore valuable habitat

• Specific Remedial Goal
  – 0.25 ppm PCBs Surface Weighted Average Concentration (SWAC) 10 years after the completion of dredging
  – 7.5 ppm PCB SWAC immediately following dredging
  – Dredge navigation channel below the federally authorized depth
Re-Sedimentation and Recovery

Depositional Scenarios

Surface Concentrations (ppm)

Years

- 1" Deposition, 3" Mix & 2" Deposition, 6" Mix
- 1" Deposition, 6" Mix
- 2" Deposition, 3" Mix & 4" Deposition, 6" Mix
- 5" Deposition, 6" Mix
Dredging
Dredging Cross Section
Summary of Dredging Process

• Required cut depths
  – Average total cut = 11 feet
  – Range of cut depths = 2-18 feet
  – Target depth: 20 feet or Bedrock
  – 545,000 cubic yards targeted for removal

• Two Hydraulic Cutterhead Dredges
  – 12” Dredge for Production
  – 8” Dredge for Clean Up Passes
    • VicVac™ Suction attachment utilized for last pass above bedrock in Upper Turning Basin
  – Operated Concurrently
Hydraulic Dredge
Dredging Equipment

Biggest Challenge: Debris

Solution: Gatling Plate and Shear Bar

Solution: Root Knife Installed in Pumps
Dredging and Debris

• Debris related shutdowns
  – 2006: 19% project downtime throughout the entire system, with the worst day averaging 4 shutdowns per hour
    • installed revised gatling plate, and root knife in dredge pump led to 7% project downtime, and 1 cleanout every 2 hours.
  – 2007: Installed wiper blade along with gatling plate, added root knives to all boosters
    • 3% project downtime.
8” Dredge for Cleanup Operations
VicVac™ Attachment
Residual Contamination and Cover Layer

Cutter Shaft
Suction Pipe
Area of Turbulence
Ladder Head
Cutter Blades
Channel Bottom
Residual Sediment
Sand Cover Layer
Dredging Operation Details

• 12” Dredge Operating Independently
  – GPM = 4,000
  – Average % Solids = 8%-10%
  – Cy/day = 1,200 to 5,000 (dependent on system uptime)
  – Average cut depth per pass = 5 ft face

• 12” Dredge and 8” Dredge in Tandem
  – GPM = 3,500 + 1,000 = 4,500
  – Average % Solids = 8%
  – Cy/day = 1,200 to 5,000 (dependent on system uptime)
Dredging Operation Details

• 8” Dredge with VicVac™ Attachment
  – GPM = 1,000
  – Average % Solids = 2% to 4%
  – Coverage = ½ acre/day
  – Average cut depth per pass = 6”-12”
Post-Dredging PCB Concentrations

Goal 1: 7.5 ppm immediately following dredging
Goal 2: 0.25 ppm 10 years after dredging
Post-Dredging PCB Concentrations

Goal 1: 7.5 ppm immediately following dredging
Goal 2: 0.25 ppm 10 years after dredging
Post Dredging SWAC

- **Goal:** 7.5 ppm PCBs
  - Max. Concentration of 40 ppm

- **Results:** 2.5 ppm PCBs
  - Max. Concentration 33 ppm
Post-Dredging PCB Concentrations
SWAC Comparison

Cleanup Dredging Areas vs. MNR Areas

• MNR Areas
  – Goal: Dredge to prescribed depth, natural sedimentation to complete remediation
  – Approximate Area = 18 acres
  – # of Samples = 50
  – Post-Dredge PCB SWAC = 3.7 ppm

• Cleanup Dredging Areas with 8” Dredge
  – Goal: Remove all sediment to bedrock
  – Approximate Area = 10 acres
  – # of Samples = 21
  – Post-Dredge PCB SWAC = 0.1 ppm
Dredging: Lessons Learned

• Innovations are improving results of environmental dredging
• “Necessity is the mother of invention”
• Use of wiper blades, gatling plate, and root knives reduced impact of debris
• Need top notch team/Listen to the dredging experts
• Prescribe objectives, not methods
• Continuous improvement
• Proper sampling leads to accurate volume estimates
• Set realistic cleanup goals
Transport, Dewatering, Disposal, Water Treatment
Double-Walled Pipeline
CF with geotube bags laid out in preparation for sediment dewatering
Summary of Dewatering & Water Treatment

• Equipment
  – Primary Treatment
    • Geotubes (primary removal)
      – Anionic and cationic polymers
  – Secondary Treatment
    • Lamella Settlers/Polishing Bag Field
      – Poly Aluminum Chloride (PAC)
  – Polishing Treatment
    • Sand Filters
    • Carbon Filters

• Capacity
  – Designed for 5,000 gpm
Summary of Water Treatment

• Discharge Limits
  – PCBs = 0.0001 ug/L (monthly average)
  – Hg = ND (at 0.16 ng/L)
    • Difficulty meeting this limit
    • Discharge concentration significantly less than river water concentrations
  – TSS = 10 mg/L (monthly average)
    • Daily maximum = 20 mg/L
Sediment Dewatering
Mountains of Bags
Polymer Quality Control
Sand and Carbon Filter Units
Clarification System
(installed winter shutdown)
Polishing Bag Field
Dewatering: Lessons Learned

- Chemistry, Chemistry, Chemistry
- Accurate chemistry = better performance
  - Not enough polymer = Poor solids removal
  - Too much polymer = Plugged bags & Unhappy WTP
  - Heterogeneity of Sediment Slurry (% solids)
  - Oil and Grease
- Minimal Breakages (9 bag failures)
  - Watch flow rates and pressures
- Adequate man power, lighting, training, and conditioning
- Safety/Managing bags for stability
Water Treatment: Lessons Learned

• Getting the Chemistry Right
  – Substantial problems if chemistry and dose of polymer not accurately matched to sediment chemistry
  – Sediments are not a homogeneous matrix

• Impacts from Oxidation of Iron
  – Before and/or after treatment plant

• Need enough flexibility to incorporate changes to WTP as required
  – Equipment
  – Size

• Oil Grease Impacts
Progress, Issues, and Modifications
2006 Progress

• Dredging Commenced on September 9, 2006
  – Average production <800 cy per day
  – 62,000 cubic yards dredged
  – Winter shutdown on November 27, 2006

• Barrier to Construction
  – Polymer chemistry/dosing
  – Water treatment plant performance
    • Exceedances of TSS limit
  – Debris
Winter 2006/2007 Modifications

- Root knives installed on dredge and at each booster pump
- Installed Wipers on Gatling Plate
- Secondary treatment component added to WTP
  - Lamella settlers
  - Polish bag field
- Modifications to dewatering/water treatment chemistry
  - Cationic polymer added prior to dewatering
  - ACH added to control soluble iron before primary treatment process
- 2nd 8” Dredge mobilized for cleanup operations
  - Articulating dredge head
  - VicVac™ Attachment
  - 12” Dredge and 8” Dredge feed into single 12” transport line
2007 Progress

• Full-scale dredging commenced April 6, 2007
  – Average production ~2,400 cy per day (including cleanup passes) at ~63% project uptime
  – 435,000 cubic yards dredged in 2007
  – Dredging end date: October 14, 2007

• Residual Cover Placement
  – 2+ acres covered in 7 days

• Remedial work complete
Lessons Learned

• Initial production ≠ Ultimate Production
• 2007 performance improvements was possible because of lessons learned during 3 month production-scale “pilot” dredging in 2006
• Adapt and improve
• Dredging and disposal is not cheap ($125 per cubic yard)
• Dredging and disposal is not easy, but it can be accomplished
Questions?