

# **IMPROVEMENTS TO SEDIMENT REMEDIATION AND ZEBRA MUSSEL REMOVAL TECHNOLOGY RESULTS FROM A CONFINED SPACE PROJECT AT KNOLLS ATOMIC POWER LABORATORY (KAPL)**

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## **ABSTRACT**

Routine water withdrawals from waterways have produced sediment traps in inlet water channels leading to pump house galleys. Much of the sediment is contaminated and contains invasive species. Inlet channels pose challenges that standard dredging protocols cannot meet when dealing with confined space issues and equipment constraints. The project goal was to design a land to water project for a contaminated sediment and zebra mussel removal process that would contain contaminate resuspension and conform to NYS DEC permit regulations. The design dealt with; crane operators working blindly from behind a pump house, vacuum dredging due to zebra mussels, a 55 foot elevation change, and a 210' recovery pipeline. Confined space entry permits were required of the dive team in the channel while guiding the underwater dredging operations by radios. Two new patented process that confines sediments while using water/air injectors to agitate and suspend the sediment within the unit allowing for vacuuming out to sealed decanting dumpsters and a new air assist lift process aided the sediment slurry to overcome a vertical lift greater than the 25' physical lift that a vacuum can achieve were employed. No resuspension, releases or turbidity plumes were recorded thru out the project.

*Dredging, Contaminated Sediments, Invasive Species, Resuspension*

## **INTRODUCTION**

This report details Improvements  
ENVIRONMENTAL LUNCH BOX  
TECHNOLOGY LLC (ELBT) experienced using its  
new patented technology for sediment and zebra  
mussel removal projects in a confined space at  
KNOLLS ATOMIC POWER LABORATORY  
(KAPL) completed in 2009, 2011, 2013, 2015. The  
technical specifications called for ELBT to submit  
procedures for removing sediment and zebra  
mussels from the inlet channel which travels from  
the Mohawk River to KAPL's pump house galley  
and required approval from the Department Of  
Energy, US Navy and Bechtel Representatives. The  
submitted procedures were designed to comply with  
the NY State DEC permit and employ ELBT's most  
recent patented dredging and invasive species  
eradication technology.

## **BACKGROUND**

ENVIRONMENTAL LUNCH BOX  
TECHNOLOGY (ELBT) is a subsidiary of AIR &  
EARTH LLC (A&E), a research and development  
firm which provides new Patented Technology for  
use in the environmental and energy sectors. ELBT  
provides a system and method for SEDIMENT  
MANAGEMENT in the areas of sampling, in-place  
treatment, removing, relocating, filtering, capping,  
invasive species eradication, habitat restoration and  
artifact recovery in both fresh and salt water  
environments.

## **KNOLLS ATOMIC POWER LABORATORY**

(KAPL) based in upstate New York's Capital  
Region, is a world-class research and development  
facility dedicated to support of the United States  
NAVAL NUCLEAR PROPULSION PROGRAM.  
KAPL is operated for the DEPARTMENT OF  
ENERGY by BECHTEL MARINE PROPULSION  
CORPORATION (BMPC). Bechtel is one of the  
world's premier engineering, construction, and  
project management companies. Since its founding  
in 1898, Bechtel has worked on more than 22,000  
projects in 140 countries. Today, Bechtel's 42,500  
employees are teamed with customers, partners and  
suppliers on hundreds of projects in nearly 50  
countries. At the KAPL Site employees develop  
advanced nuclear propulsion technology, provide  
technical support for the safe and reliable operation  
of existing naval reactors and provide training to  
naval personnel who operate them. The KAPL Site  
is located on the Mohawk River which flows over  
500 miles with its extensive canal system and  
waterways. It flows largely west to east till it meets  
the Hudson River north of Albany. It flows through  
low lying lands that contribute to its high sediment  
load. In 2007 the river experienced a 100 year flood  
event that left a major impact on the amount of  
sediment loading in the river. The river has a system  
of canals with origins from the Erie Canal and a vast  
lock system thereby creating a man made sediment  
trap that impedes the natural flow and speed of the  
river. The Mohawk River provides over 63% of the

sediment loading to the Hudson River on its way south to New York City. The KAPL site relies on water drawn from the Mohawk River for their Laboratory cooling system and needs to be provided at high rates of delivery. The high level of suspended sediment and Zebra Mussels in the river poses a concern for the steady delivery of water through the inlet channel leading to their pump house due to the ongoing buildup. The second area of concern is when the river locks are raised prior to the winter season, allowing the summer high water level to drop to its natural lower flow level. This reduces the volume of water readily available for uptake to the cooling system as the water has to flow up and over the growing mounds of sediment in the inlet channel. In the past winter seasons as the river water froze, the ice thickness extended downward approaching the inlet channel bottom sediment. This lead to the water flow being squeezed for available space between the two. This situation endangered the available water to be supplied to operate the site cooling system. The DEPARTMENT OF ENERGY engineering staff prepared the technical specifications for a sediment removal project for the Mohawk River inlet channel leading to the pump house galley with the following criteria;

**UNDER SCOPE OF WORK PROVIDE;**

Provide all materials, services, labor, tools, and equipment necessary to remove all sediment, silt, leaves, twigs, zebra mussel shells from the L4 Pump

House Concrete Inlet Channel leading to the Mohawk River.

**UNDER SUBMITTALS PROVIDE;**

Inlet channel sediment removal procedure  
Diving procedure  
De-watering procedure  
Written elevated work procedure  
Confined space entry procedure  
Respirator procedure  
Written hazard analysis plan  
Written safety program including on-site safety  
representative Diver certification (NAUI or PADI)  
training  
Diver's air cylinder certificate

**SITE SPECIFIC CONDITIONS;**

Comply with the NY STATE DEC permit  
Complete as a land based project  
Provide diver's in the water start dates  
VACUUM vs PUMP sediments 55 feet  
VERTICALLY above the water line Crane operator  
"WORKING BLIND" and BEHIND the pump  
house Provide a 30 ton crane to reach OVER the  
pump house roof and down into the inlet channel  
Operate a 210 foot VACUUM PIPELINE distance  
for sediment recovery Contend with inlet channel  
overhead structural impediments  
Contend with trash rack impediments  
Entry to inlet channel by ladder only  
Diver Vision assistance required

## **PROJECT EXECUTION**

ELBT designed sediment removal procedures with a new AIR ASSIST LIFT SYSTEM that standard dredging practices do not have. Encountered hard bottoms (cement lined inlet channel ), zebra mussels, sediment re-suspension and residual regulations, large debris issues (wood/rocks), confined space issues, narrow and limited access and equipment constraints. The patented ENVIRONMENTAL LUNCH BOX (ELB) was used for this site specific application. Sediment/mussels within the ELB confines were suspended using a water/air nozzle agitating system. The confined suspended sediment was removed under a vacuum using an air assist lift system flowing to sealed decanting dumpsters. The ELB process was designed for a removal rate up to 700CF/M (5,250 gal/min) and equipped with a 6 inch diameter uptake pipeline. Work was performed from shore, sediment/mussels traveled a vertical distance 55 feet above the inlet channel and 50 feet over the pump house. A 210 foot pipeline was established running from the submerged ELB, up the river bank to the sealed decanting dumpsters alternating between them for ongoing decanting. All principle members of the project were linked thru radio communication with the project site commander for safety and operational controls. Entry into the inlet channel was by ladder access only. The ELB was crane lifted into the inlet channel, submerged and guided throughout the project by dive team members

equipped with a live cable feed to a laptop viewed by the dive coordinator. The ELB system proceeded to remove the sediment and zebra mussels within the inlet channel overcoming the 55 foot elevation while still using a vacuum recovery system. Completion of the project was diver and video verified.

## **IMPROVEMENTS**

ELB units are now controlled by both above water level operators/computers and/or by divers below the water level. ELB units are now fitted with adjustable agitator piping heights, velocities and directions. ELB units are now equipped with assorted agitator devices such as multi- directional rotating jets, whips, chains, cutters, augers, choppers, blades, drills, etc used independently and/or together. ELB units are now adjustable for the elevation of the internal uptake line and filter. ELB units are now adjustable for the air/water lift assist system. ELB units now use multi-length ends with flexible seals, plain ends or sled skid plate ends. ELB units now operate with an underwater buoy support and propulsion system.

## **PROJECT RESULTS**

The ELB removed more sediment than the forecasted 4 foot depth in the project scope while ultimately removing increasing sediment levels of 7 feet at the river's edge. All non-sediment (wood and rocks larger than 6 inches in diameter) was segregated from entering the ELB's vacuum pipeline

for sediment recovery by the adjustable filter system. Using the ELB achieved a cost savings by: reducing the 4 day work schedule to less than 1 day, reducing the non-sediment volume, handling and disposal costs, employing alternating sealed sediment dumpsters with built-in decanting features, no turbidity plumes, re-suspension or sediment releases to the water column were observed or recorded.

## **SUMMARY**

The project results demonstrated that the sediment removal improvements engineered by ELBT employed the newest and best dredging technology, controls and management practices. Efforts were made in the design by ELBT to incorporate remedial alternatives directed to CERCLA Sect.121(d),42 U.S.C. Sect 9621(b)(1), which mandates that remedial actions must be protective of human health and the environment, cost effective and utilize permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. Section121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity or mobility of the hazardous substances, pollutants and contaminants at a site. ELBT complied with the NY State DEC permit requirements and the Department of Energy project specifications with the ELBT's patented sediment

removal procedures having recorded no re-suspension, releases or turbidity plumes thru out the project while meeting the scope of work “to remove all sediment, silt, leaves, twigs and zebra mussel shells.”

## **CONCLUSIONS**

New technologies developed by ELBT aids projects that require Contaminated Sediment and Invasive Species removals without resuspension or releases to the water column. One area of mounting concern is for industries that use water from rivers, lakes, dams and waterways as a source for power generation and manufacturing processes. The Power Generation Industry is now a matter of Homeland Security and poses new security risks in addition to the current Environmental Risks we are facing today. Many processes use over 100,000 gallons a day and draw water at high flow rates compounding the accumulation of Sediments and Invasive Species in their uptake lines, supply channels and debris screens. There are processes still that require drawing additional primary source water to be added to their discharge water, so as not to create issues of Thermal Pollution or Species Kill Zones when this heated process water is returned to the waterways. A secondary water supply injection required to cool the original cooling water prior to release to the waterways also adds to the increasing accumulation rates of Sediments and Invasive Species that we are experiencing today. As we begin to deal with the

effects that Climate Change has on our environment  
we can only expect to see an increase of  
sedimentation and Invasive Species issues for power  
generation firms, industries and commerce sectors,

manufacturing, shipping, ports and harbors as well  
as issues concerning clean water and increasing  
water scarcity now being seen across all continents.