Summary: project description: goals, objectives, accomplishments

The Lower Fox River Cleanup Project is designed to reduce risk to human health and the environment due to the presence of PCBs in the river sediment. It is a multi-year cleanup effort that includes dredging, capping with coarse sand, gravel and quarry stone, the separation of clean sand and dewatering of the fine sediments with membrane filter presses. The client is the Lower Fox River Remediation LLC. The regulatory agencies consist of a consortium representing the U.S. Environmental Protection Agency, the Wisconsin Department of Natural Resources, prominent members from private industry, collectively the Agencies/Oversight Team (A/OT).

The objective of the Lower Fox River sediment processing facility is to minimize the volume and weight of contaminated material disposed of at the landfill by using a three-stage separation approach. The process facility screens, conditions, and dewater the hydraulically dredged slurry. During this process the volume of the slurry is reduced and portions are prepared for beneficial use (e.g., separated sand) or recycle to the river (treated water), significantly reducing transportation and disposal costs. This is particularly important with regard to the hazardous in-situ classified TSCA material dredged, must be transported and disposed of at substantially higher cost than the non-TSCA material.

The project approach is unique due to the single stream process where dredged sediments from three hydraulic dredges are directly piped to the land-based processing facility. Dewatering with eight membrane filter presses had been identified as the most economical and efficient means of dewatering the sediment prior to off-site disposal. The design of the sediment desanding and dewatering system required careful estimation of the expected sand content and balancing of the flow of solids and water through the entire system, from the point of dredging through final production of sand, filter cake and water treatment.

The Lower Fox River cleanup was initially started as a fast track design-build project to complete construction of the building and all enclosed processing equipment in time to begin the remediation. Tetra Tech EC, Inc. is the prime contractor, with Stuyvesant Environmental Contracting (an affiliate of the Dutch based company Boskalis Dolman) and J.F. Brennan Company as key subcontractors. Sediment sampling and bench-scale testing were performed in November 2007. The objectives of the testing included developing a proper characterization of the sediment properties as well as selection and sizing of the appropriate sediment processing approach and equipment. Perhaps the most critical pieces of equipment that needed to be specified and purchased early, considering delivery lead-time, were the eight large membrane filter presses manufactured in Europe. Design of the processing facility began in March 2008. Process site clearing and earthwork activities were initiated in July of that year. Mechanical construction was complete by April 2009, followed by several weeks of pre-operational testing and start-up. Since its start, this project has exceeded all technical performance goals while delivering more than 800,000 hours of safe operation without a lost time incident. The project team is very proud of these accomplishments.
Complete list of project team members and their affiliations, including the project owner, the role of the team members, WEDA membership status, and the nominating entity

The team of contractors on this complex project are part of the Fox River Cleanup Group. Tetra Tech EC (TtEC) is the general contractor. There are two primary subcontractors working with TtEC. J.F. Brennan is responsible for the dredging, capping and sand covering scope of this project. Stuyvesant Environmental Contracting (Stuyvesant) obtained the contract for the sediment desanding and dewatering services. For this project Stuyvesant worked with its Netherlands-based affiliate company Boskalis Dolman bv, which is responsible for the design, engineering, operation and maintenance of the sediment desanding and dewatering equipment.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Name</th>
<th>WEDA Member?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stuyvesant Environmental Contracting</td>
<td>Harry van Dam</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Neil Geevers</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Bart Hiemstra</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Rudy Driessen</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Martijn Luth</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Ron Dielhof</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Bastiaan Lammers</td>
<td>Yes</td>
</tr>
<tr>
<td>JF Brennan</td>
<td>Greg Smith</td>
<td>Yes?</td>
</tr>
<tr>
<td></td>
<td>Glenn Green</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Others?</td>
<td></td>
</tr>
<tr>
<td>Tetra Tech</td>
<td>Terry Blackmar</td>
<td>Yes?</td>
</tr>
<tr>
<td></td>
<td>Richard Feeney</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Gary Braun</td>
<td>Yes?</td>
</tr>
<tr>
<td></td>
<td>Tom Kivett</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Bill Coleman</td>
<td>No</td>
</tr>
</tbody>
</table>

Environmental benefits

The Lower Fox River Cleanup Project aims to remediate PCB impacted sediments from a 13.3 mile stretch of the Lower Fox River between the Little Rapids Dam and the mouth of the Fox River at Green Bay, Wisconsin. The cleanup project is designed to reduce risk to human health and the environment due to the presence of PCBs in the river sediment.

Monitoring efforts to date have determined that there is minimal re-suspension of contaminated sediment associated with the hydraulic dredging process since this is a suction operation.

Since the sand is separated from the sediment slurry for process optimization, it was decided to reduce the small amounts of PCB impacted silt and finer material from the sand to trace levels to facilitate its reuse. Reduction of the contaminated material produces sand with a typical PCB concentration of less than 0.3 ppm. The sand is suitable for use in local construction projects and landfill capacity is preserved for the filter cake fraction which contains the PCBs.

The project Construction Quality Assurance Project Plan (CQAPP) requires rigorous sampling and analytical testing of the sand to determine PCB concentrations. Participation by the Lower Fox River
Remediation LLC QA Contractor and the Agency/Oversight Team (A/OT) ensures compliance with the CQAPP protocols and procedures.

**Innovation**

1. The initial layers of the engineered cap consist of sand and gravel. These layers are placed with a patented broadcast system to reduce mixing and over-placement in terms of area or thickness.
2. The project approach is unique due to the single stream process where hydraulically dredged sediments from three hydraulic dredges are directly piped to the land-based processing facility.
3. The Sediment Desanding and Dewatering Process (SDDP) and Water Treatment Plant (WTP) are installed within a 250,000 square foot building that was erected for the purpose of this project. The building includes a large area for indoor storage and handling of the filter cake and houses administrative office space for project staff. Boskalis Dolman designed, mobilized and constructed the SDDP within a short 8-month period to meet the overall project schedule. TiEC procured and constructed the filter cake storage and handling systems and the WTP during the same time period.
4. In order to ensure a safe working environment within the building and minimize operator exposure to airborne PCBs, the interior volume of the building is exchanged eight times per day. The air drawn from the building is treated using many vapor phase filters containing activated carbon so that PCBs will not be discharged to the surrounding environment.
5. The filter presses designed for the Fox River are sized to process approximately 14 cubic yards of solids per hour per press, with a compression factor of 1.3 and a cycle time of 75 minutes. The number of presses needed was calculated based on the anticipated range of flow rates through the dewatering system, an assumed uptime for the presses ranging from 75 to 100 percent, a range of 20 percent to 40 percent sand removal, and the hourly production rate for each press. It was determined that eight presses were needed; however, space was allocated and foundations installed for two additional presses.
6. Process water is re-used in the operation. Surplus water from the SDDP is treated and analyzed before being discharged to the river or re-used in the processing facility. Some of the treated water is used for dust control purposes on the large sand storage piles outdoors.
7. The water treatment plant consists of three treatment trains each capable of handling 3,000 GPM. Treatment includes sand filtration, carbon filtration and bag filtration. After treatment the water is returned to the river under regulations set by the State of Wisconsin. These include treatment goals or goal ranges for PCBs, TSS, pH, mercury, ammonia and biochemical oxygen demand (BOD). The treated water is returned to the river through a multi-port diffuser, which was modeled to assure acceptable dilution characteristics based on the expected flow rate range and concentration goal for ammonia in the effluent.

**Economic benefits**

This long term project has provided many local jobs, particularly during the fast-track construction and installation phase when as many as 300 craft labor personnel were on-site daily. Local vendors and
subcontractors have been utilized throughout and the project continues to contribute to the local economy.

In terms of implementing cost-effective methods and procedures, this project has implemented many efficiency enhancements and cost saving measures, here are two examples:

- Operational efficiency improvements to the sediment dewatering process that produced a dryer filter cake with less moisture, resulting in significant T&D cost savings.
- Sand separation process that recovered more than 70,000 tons of sand which reduced equipment wear and tear, reduced dewatering cycle time, avoided unnecessary expense for T&D as waste, and enabled beneficially reuse of this sand on a local highway project.

**Transferability**

The technical lessons learned on this innovative project have widespread application and it is being used as a model by various agencies and other companies as an example of how to cleanup rivers with similar conditions. A few specific examples of such lessons learned that are readily transferable to others addressing similar environmental issues include:

- Construction of the building and installation of all enclosed processing equipment using a fast track design-build approach which significantly reduced the overall construction time.
- Implementation of a comprehensive safety program where all project participants are directly involved and committed to safe working conditions.
- Sand recovery as presented under economic benefits section above.

**Outreach and education**

From the start of the project the client hired a local public relations firm to guide our team’s outreach and education activities including establishing and maintaining a project website: [http://www.foxrivercleanup.com](http://www.foxrivercleanup.com) This website provides updates of the project’s progress along with relevant documents and photos. Our team also continues to conduct many informational meetings and open-house tours of the project site to enable local stakeholders and interested parties to visit the processing facility. Project videos were made and numerous magazine and newspaper articles featured details about the success of this complex project.

**Other**

The project approach emphasizes the “integration” of all of the performing parties. This includes the client, the regulatory agencies, local stakeholders and the contractors performing various aspects of the work. The client is the Lower Fox River Remediation LLC. The regulatory agencies consist of a consortium representing the Environmental Protection Agency, the Wisconsin Department of Natural Resources and prominent members from private industry, collectively the A/OT.
Local stakeholders include municipalities nearby the project operations and haul route, local Native American tribes and numerous private and commercial property owners along the river. In a sediment project such as this, communication and cooperation with the client is paramount; communication and cooperation among the A/OT, general contractor, the marine contractor and the sediment processing contractor are critical in achieving the success which has been reached on the Lower Fox River project. The basis for this success, amongst other things, is the mutual understanding of the need for an integrated approach. To demonstrate their commitment to a cooperative approach the contractor team signed a Memorandum of Understanding (MOU) to formally establish this cooperative approach.

The first operations season exceeded the 2009 targets for dredging and processing. In addition, despite the extremely aggressive construction period and nearly two years of operations, there have been no lost time incidents on the project with more than 800,000 hours worked. This extremely important project is being used as a model by various agencies and other companies as an example of how technically the cleanup of rivers with similar conditions can be achieved.

Remediation work continued very well during the 2010 season, and in April 2011 our team began the third dredging and processing season.

Project photos: