FOX RIVER OVERSIGHT – ADDING VALUE

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ABSTRACT

In 2004, the Wisconsin Department of Natural Resources (WDNR) and the Region 5 Superfund Program of the U.S. Environmental Protection Agency (USEPA) retained The Boldt Company and their subconsultants (the Oversight Team - "OT") to provide oversight on the Lower Fox River Site PCB sediment cleanup project in Wisconsin. The OT expanded the limited resources of the Agencies and significantly enhanced their technical experience with the latest trends in sediment remediation. From the beginning, it has been the Agencies' and OT's philosophy to foster a cooperative approach with the Responsible Parties (RPs) at a technical level to add value, and avoid unnecessary layers of administration or potential delays to the project. To facilitate adding value, the OT discussed many technical issues with the Agencies before they were raised in work groups with the RPs. This allowed the Agencies to proactively form opinions on these issues rather than react to what was presented by the RPs. While the goals of the project for the Agencies have been, and continue to be, aligned with the RPs, the priority of these goals may differ. These goals include:

- Meeting the cleanup objectives of the Records of Decision (RODs);
- Performing risk-based analyses to focus resources;
- Reducing the time to initiating remedy implementation and completion; and
- Controlling remedial costs.

This presentation will give several specific examples of how the Agencies-Oversight Team (A-OT) has provided input to the design and remedial action activities to more effectively realize these goals for the Lower Fox River Site sediment cleanup.

Keywords: dredging, capping, cost and schedule savings.

INTRODUCTION

This paper will highlight:

- Differences between the Fox River A-OT and typical Superfund project oversight;
- Overall philosophy of proactive participation and cooperation among the A-OT and RP/Design Team (DT); and
- Examples of value added to remedial design and implementation of Operable Unit 1 (OU1) and OU2-5.

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OVERSIGHT TEAM MEMBERS

The Fox River OT is made up of a prime contractor and consulting experts in contaminated sediment remediation. This team is unique because, unlike typical Superfund oversight contractors, the Agencies requested proposals from pre-qualified firms specifically for the Fox River project, and did not rely upon existing agency contract vehicles that may have limited the number, type, and locale of firms able to respond. This allowed for tailoring the team based on expected expertise specific to the project. The OT chosen by the Agencies is lead by The Boldt Company of Appleton, Wisconsin, with expertise in management of large civil and industrial projects (design through construction). The subconsultants, who brought the sediment remediation and other needed expertise include:

- Natural Resource Technology, Pewaukee, Wisconsin;
- Hard Hat Services (formerly Harrington Engineering & Construction), Chesterton, Indiana;
- Kern Statistical Services, Sauk Rapids, Minnesota;
- Mike Palermo Consulting, Vicksburg, Mississippi; and
- McMahon Associates, Neenah, Wisconsin.

This OT complemented several technical and management staff of WDNR and USEPA in their role as the regulatory Agencies with responsibility to the general public in ensuring the RODs and ROD Amendments (see List of References) are carried out. The December 2002 ROD for OU1-2 and the June 2003 ROD for OU3-5 selected dredging as the primary remedy to address PCB-contaminated sediments in excess of the remedial action limit (RAL) of 1 part per million (ppm). For all OUs, these RODs were to address an estimated 6.5 million cubic meters (m^3) [8.5 million cubic yards (cy)] of sediment exceeding the RAL, distributed over an area of approximately 650 hectares [1,600 acres], and cost $724 million to implement.

PROACTIVE PARTICIPATION AND COOPERATION WITH RESPONDENTS

Early on, the Agencies and RPs agreed that it was best for the A-OT to participate in the design and implementation process rather than react to it. This is key because it fosters discussion of ideas, and then concurrence before documents are written and efforts are begun in the field. Further, the Agencies directed the OT to be cooperative and proactive to provide direct feedback in meetings without delays for consultation or approval to raise specific comments or concerns.

It was important that the Agencies allowed the OT to directly participate in technical discussions with the DT. Wisconsin, like many states, has been under a severe budget crunch for many years. Professional development for WDNR staff has been significantly curtailed. The technical aspects related to remediation of contaminated sediments have evolved rapidly in the last decade as more projects have been designed and constructed. The OT has filled this need for additional technical expertise. In addition, the OT has the benefit of experience working on a variety of contaminated sediment projects in nearly every USEPA Region of the U.S.

Technical Work Groups (TWGs) were formed to focus discussion on specific technical issues. The TWGs were, and continue to be, perhaps the most import venue of the OT for adding value to this project. TWGs are composed of one or more experts from the OT and DT plus interested Agency and RP personnel. Typically, the DT would set the meeting and provide an agenda with appropriate documents stating their position prior to the meeting. When there was sufficient time to review recommended approaches, the OT provided the Agencies with a summary of the DT's proposal, and then proposed responses and recommendations. The A-OT then collaborated with the Agencies on formal responses, which were given to the DT and RPs prior to, or during, the meeting.

Many technical details were conceived, modified, and agreed to during these TWG discussions. Some examples initiated by the A-OT included bounding the conditions for where capping of sediments could be considered, analysis of potential prop wash affects on caps, the use of sand covers as a primary remedy, and development of decision tree logic for managing dredge residuals which was then embodied in the amended RODs. Examples of these and other technical topics are discussed below, along with estimated cost and schedule savings.

QUALITATIVE COST SAVINGS – OVERALL PROJECT

Some benefits resulting from the OT's involvement that are very important, but are not easily quantifiable, include:

- Recommendation to the Agencies to strongly consider not only their local contaminated sediment experience and precedence, but also the importance of more recent federal and national scientific guidance, nationwide precedence and experience of constructed projects, and effects on cost and schedule during remedial design and implementation;
- Effective communication between the RPs and Agencies;
- Setting realistic goals for project implementation, approach, and schedule;
- Encouraging the RPs to conduct early and frequent communications with the public; and
- Collaborating with the RPs to implement an early remedial action on a PCB "hot spot" found in Upper OU4.

MEASURABLE COST SAVINGS DURING OU1 REMEDIAL ACTIONS

Remedy design and implementation in OU1 (Little Lake Butte des Morts), the furthest upstream segment, is being conducted under a separate agreement between the Agencies and certain RPs. Remedial construction began in late 2004 and is on target to be finished early in this 2009 construction season. The OT had little early involvement during the remedial design of OU1 and only provided limited feedback on the design and implementation plans before the remedial action was underway. The OT did, however, actively participate in subsequent project design modifications, which resulted in a ROD Amendment, substantially reducing overall project implementation costs and schedule and significantly improving the effectiveness of the remedial action. Examples of these modifications are provided below.

High Subgrade

"High subgrade" was a condition where consolidated, native clay till stratum or "hard bottom" was encountered in OU1 below the PCB-contaminated sediment, at an elevation above the modeled target dredge cut. Through remedial investigation sampling, the native clay was confirmed to be uncontaminated with PCBs. Upon OT observations of the remedial contractor attempting to dredge into the clay layer to achieve target elevations, the OT immediately called this to the attention of the Agencies and recommended the RPs stop dredging when the clay layer was attained. A process was developed in a TWG to document high subgrade conditions when encountered, and to raise target dredge elevations accordingly.

- 62,000 in-situ m^3 at ~$170/$m^3$ [81,000 cy at ~$130/cy]. Includes cost for: dredge, dewater, water treatment, load-out, transport, and landfill disposal, but does not include infrastructure, management, overhead, or design. Estimated $10.5 million savings.
- Savings to overall schedule estimated 0.75 of a dredge season.

Unexpected TSCA

During post-dredge confirmation sampling in OU1, unexpected TSCA concentrations of PCBs (i.e., $\geq$50 ppm) were occasionally attained in generated dredge residuals. This was dealt with by considering the recommendation of the OT geostatistician, that additional samples be collected around the offending sample to verify the actual existence of such material and, if present, to better bound the extent.

- 2,300 in-situ m^3 at ~$170/$m^3$ [3,000 cy at ~$130/cy]. Estimated $0.4 million savings.
- Savings to overall schedule estimated <0.1 of a dredge season.

Hydraulically dredged material for OU1 was dewatered in geotubes. Per the RPs' contract with the local licensed landfill, these geotubes were sampled for PCBs prior to load-out and disposal. In one instance, a single sample unexpectedly measured PCBs slightly above the TSCA concentration. This was also dealt with by collecting more samples from the geotube to more accurately represent the nature of sediment in the entire geotube. As a result, the single sample was found to be an anomaly and the Agencies deemed the material non-TSCA, allowing the material to be disposed in the project's local landfill rather than having to be trucked out of state to a licensed TSCA landfill.

- 770 in-situ m^3 at ~$130/$m^3$ [1,000 cy at ~$100/cy]. Includes estimated cost differential for avoiding transportation and tipping fees associated with the TSCA landfill. Estimated $0.1 million savings.
- Savings to overall schedule estimated <0.1 of a dredge season.

Authority for Field Directives

The Agencies delegated field decision authority to the OT after a "routine" was developed.

- Savings to crews not idling while a decision is being made ~$25,000/day for 17 occurrences. Estimated $0.4 million savings
- Savings to overall schedule estimated 0.1 dredge season.

PREDICTED COST SAVINGS DURING OU2-5 DESIGN

An early response action, referred to as Phase 1, was performed in 2007-2008 to address a PCB hot spot (~3,000 ppm) at the upstream segment of OU4 while the remedial design for the balance of OU2-5 continued. Phase 2 design encompassing the rest of OU2-5 has been split into areas of OU2-3 to be implemented during this 2009 construction season, with the balance of OU3-5 design to be implemented in the period of 2010-2017. The 100% design for Phase 2 - 2009 remedial actions was approved by the Agencies in April 2009, with startup of dredging operations occurring on about May 1. Design completion, and Agency review and approval of the 100% design for the remaining Phase 2 remedial actions, are anticipated later in 2009. The following are examples of topics with predicted savings in costs and schedule associated with Phase 2 remedial actions.

High Subgrade

High subgrades are predicted in segments of OU3 where thin sediments overlie native clay till, and below the DePere dam separating OU3 and OU4 where thin sediments overlie bedrock.

- Estimated 19,000-76,000 in-situ m^3 at ~$170/$m^3$ [25,000-100,000 cy at ~$130/cy]. Includes cost for dredge, dewater, water treatment, load-out, transport, and landfill disposal, but does not include infrastructure, management, overhead or design. Predicted $3.3 - $13.0 million savings.
- Savings to overall schedule estimated <0.1-0.25 of a dredge season.

Sample Density and Model Predictions

The OT ran a geostatistical simulation to determine whether the existing design sample density was sufficient for the variance of samples for Upper OU3. The simulation showed that increasing the sample density would likely eliminate significant areas from dredging. An infill sampling program was created to collect additional samples in each of the planned 2009 dredge areas, between existing sample locations, as well as on the edges and outside the edges of the dredge areas. After results were attained, the geostatistical model was rerun and the overall 2009 dredge area was indeed reduced in size and volume, while dredging more volume of contaminated sediment and dredging less volume of non-contaminated sediment.

- Design reduction of 37,000 in-situ m^3 at ~$170/$m^3$ [49,000 cy at ~$130/cy]. Predicted $6.3 million savings.
- Savings to overall schedule predicted 0.1 of a dredge season.

Similarly, for Lower OU3, infill sampling is predicted to offer significant savings. Currently, simulations are being run to determine potential results.

- Predicted 46,000 in-situ m^3 at ~$170/$m^3$ [60,000 cy at ~$130/cy]. Predicted $7.8 million savings.
- Savings to overall schedule predicted 0.1 of a dredge season.

Authority for Field Directives

It is anticipated that, like OU1, field decision authority will be given by the Agencies to the OT. The OT will be present both on site and available at our respective offices when post-dredge confirmation samples are collected and results become available to analyze and discuss with Agency personnel.

- Savings to crews not idling while a decision is being made whether dredging is complete with no further action required, whether additional dredging or capping is necessary due to elevated PCB concentrations in dredge residuals, or whether residual concentrations and thicknesses allow the placement of sand cover. Difficult to estimate, but predict $1.0 - $5.0 million savings.
- Savings to overall schedule predicted 0.5 dredge season.

Thin Engineered Caps

The June 2003 ROD indicated a contingent remedy of insitu capping may be proposed by the RPs to supplement the primary dredging remedy if certain criteria were met. The ROD contemplated a limited area of only 27 hectares [67 acres] may be eligible for capping, and these areas excluded navigation channels and areas with PCBs $\geq$50 ppm. Further the ROD contemplated a nominal cap design thickness of 81 centimeters [32 inches], comprised of 51 centimeters [20 inches] of sand and 30 centimeters [12 inches] of overlying cobble-size armor. Through the TWG process, the OT and DT expended considerable effort during the early remedial design phase to address concerns of the Agencies regarding protectiveness and permanence of engineered caps. As a result, the June 2007 ROD Amendment significantly expanded the potential use of insitu caps to an area of 182 hectares [450 acres], including navigation channels and limited areas of TSCA sediments. Within the navigation channels, a robust 84-centimeter [33-inch] thick cap is still required. However, outside the navigation channels of OU3-4, thin engineered caps as little as 17.5 centimeters [7 inches] in thickness are allowed, including 7.5 centimeters [3 inches] of sand isolation layer and 10 centimeters [4 inches] of overlying armor gravel. The thin caps are in select areas of lower overall risk, with low surficial concentrations of PCBs ($\leq$10 ppm). OT expertise was critical to this cooperative effort as very few projects in the Great Lakes areas have included extensive capping components. Cap design analysis followed U.S. Army Corps of Engineers (USACE) and USEPA guidance, but there was additional emphasis on analyzing the effects of propellers from recreational boats in shallow water, as there was little or no precedence of extensive uses of caps in similar river environments.

- 115 hectares at ~$615,000/hectare [280 acres at ~$250,000/acre]. Includes areas outside OU3-4 navigation channels where thin caps are allowed, without the overlying cobble-size armor layer. Predicted $70.0 million savings.
- Savings to overall schedule predicted 2 construction seasons.

Sand Covers

The RPs/DT proposed natural recovery for sediments containing $\leq$2 ppm total PCBs. However, the June 2003 ROD required remediation of all areas with concentrations greater than the RAL of 1 ppm, except monitored natural recovery was approved in OU2 where limited deposits and mass of PCBs exist due to higher flow gradients, and in OU5 (outside the mouth of the river in Green Bay) where PCBs are generally only slightly above the RAL and are widely scattered, thereby lowering the risk of no active remedy while greatly increasing the cost of a remedy. The OT provided technical support to the Agencies to justify sand covering of low-risk deposits with 1-2 ppm PCB concentrations in a single, 15-centimeter [6-inch] thick sample interval. This compromise was authorized and allowed for in the June 2007 ROD Amendment.

- 85 hectares at ~$310,000/hectare [210 acres at ~$125,000/acre]. Includes the areas of thin, low-concentration sediments in OU3-4 where sand cover is allowed as the primary remedy, without the overlying gravel armor layer and long-term monitoring. Predicted $26.0 million savings.

- Savings to overall schedule predicted 1 construction season.

CONCLUSIONS

The oversight philosophy of the Agencies for the Fox River, Wisconsin remediation project has been unique with regard to procurement of the OT, and the OT's role as an active participant.

The procurement process allowed for assembling an OT with expertise focusing on specific issues related to both remedial design and remedial action for contaminated sediments in the Fox River. This also allowed for the OT to be composed of diverse firms and individuals with a high level of expertise regardless of company size and location.

Further, the Agencies also decided that the OT would proactively participate in the design and implementation of the remedy. This had the time advantage of attaining agreement before required documents were prepared, resulting in a significant reduction in review and approval times. The participatory process also allowed for synergies between technical discussions in the work groups. Many of the compromise positions highlighted in the specific cost and schedule savings items above may not have occurred if this project was conducted in a reactive mode, as is typical for Agencies.

Only a few examples of value added by the OT have been briefly described in this paper. A more complete list was provided at the request of the Agencies for their records. In aggregate for all of OU1 and OU2-5, the OT estimates they have contributed to approximately $250 million in project cost savings and a schedule reduction of more than 6 remedial construction seasons.

REFERENCES

USEPA and WDNR, 2002. Record of Decision, Operable Unit 1 and Operable Unit 2, Lower Fox River and Green Bay, Wisconsin, December 2002.

USEPA and WDNR, 2003. Record of Decision, Operable Units 3, 4, and 5, Lower Fox River and Green Bay, Wisconsin, June 2003.

USEPA and WDNR, 2007. Record of Decision Amendment, Operable Unit 2 (Deposit DD), Operable Unit 3, Operable Unit 4, and Operable Unit 5 (River Mouth), Lower Fox River and Green Bay Superfund Site, June 2007.

USEPA and WDNR, 2008. Record of Decision Amendment, Operable Unit 1, Lower Fox River and Green Bay Superfund Site, June 2008.