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Lower Fox River and Green Bay Site

Response to Petition to Amend Record of Decision for
Operable Unit 1 and Operable Unit 2

and

Supplement to Administrative Records for the December 2002 and June 2003
Records of Decision

The U.S. Environmental Protection Agency (EPA) and the Wisconsin Department of Natural Resources (WDNR) have issued a Remedial Investigation (RI) Report, a Final Feasibility Study (FS), and two Records of Decision (RODs) for the Lower Fox River and Green Bay Site. Among other things, the FS and both RODs considered a range of remedial alternatives for the five geographically-defined Operable Units at the Site. As part of that analysis, the FS and the RODs evaluated several options for disposal of contaminated sediment, including: (1) off-site disposal at an engineered landfill, and (2) vitrification using glass furnace technology. The Selected Remedy in both RODs requires disposal of dewatered sediments at an engineered landfill, but both RODs also note that vitrification could be substituted by a ROD Amendment, if that substitution is justified by ongoing evaluations of that technology.

In November 2003, several municipalities petitioned EPA and WDNR to amend the December 2002 ROD for Operable Units 1 and 2 (OUs 1 and 2) to change the selected OU1 remedy from off-site disposal in a landfill to vitrification.[1] As support for that request, the petition cites four reports on vitrification technology that were prepared by or for EPA and WDNR. Copies of the petition and the four referenced reports are attached to this memorandum at Tabs A-E.

[1] The December 2002 ROD requires dredging and disposal of OU1 sediment, but it only requires Monitored Natural Recovery in OU2. For that reason, the petition only requests a change to the selected remedy for OU1 (Little Lake Butte des Morts). This memorandum only addresses the OU1 evaluation.

This memorandum responds to the petition and is a formal response to a post-ROD comment. The memorandum reviews and explains the Agencies' comparative analysis of the landfill and vitrification disposal options in the FS and the RODs, and clarifies the basis for making landfill disposal part of the Selected Remedy in the ROD for OU1. The memorandum also summarizes additional information on vitrification that has become available since the December 2002 ROD, including the information presented in the four reports cited by the petition. The memorandum concludes that an Amendment to the ROD for OUs 1 and 2 to substitute vitrification for landfill disposal is not warranted because vitrification would be more costly and more difficult to implement than landfill disposal. Although the Agencies have determined that a ROD Amendment is not appropriate at this time, EPA and WDNR will continue to evaluate vitrification if additional and new information concerning the technology's cost and feasibility becomes available. However, if new information does not cause the agencies to modify the ROD by the time the final design of the selected remedy is complete, then vitrification would not be further considered.

This memorandum and its attachments are being added to the Administrative Records for the December 2002 and June 2003 RODs because the propriety of any ROD Amendments addressing vitrification was "reserve[d] to be decided a later date" as provided by the National Contingency Plan (NCP), 40 C.F.R. Section 300.825(a)(1).

The OU1 Remedy Selection

For OU1, the December 2002 ROD assessed a range of remedial options, as summarized by Table 18 in the ROD, which is reproduced below:

Table 18 Operable Unit 1. Little Lake Butte des Morts Alternatives

Yes = Fully meets criteria Partial = Partially meets criteria No = Does not meet criteria	Alternative A No Action	Alternative B Monitored Natural Recovery	Alternative C1 Dredge with off site disposal	**Selected Alternative** Alternative C2 Dredging with off site disposal	Alternative D Dredge to a Confined Disposal Facility	Alternative E Dredge and Vitrification	Alternative F In Situ Capping
1. Overall protection of human health and the environment	No	No	Yes	Yes	Yes	Yes	Yes
2. Compliance with Applicable or Relevant & Appropriate Requirements	No	Partial	Yes	Yes	Yes	Yes	Yes
3. Long-term Effectiveness and Permanence	No	No	Yes	Yes	Yes	Yes	Partial
4. Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment	No	No	Yes	Yes	Yes	Yes	Partial
5. Short-term Effectiveness	No	No	Yes	Yes	Partial	Partial	Partial
6. Implementability	Yes	Yes	Yes	Yes	Partial	Partial	Partial
7. Cost (millions of $)	$ 4.5	$ 9.9	$ 116.7	$ 66.2	$ 68.0	$ 63.6.0	$ 90.5
8. Agency Acceptance	The WDNR has been the lead agency in developing the RI/FS and the ROD. Both WDNR and EPA support the selected alternative for this OU at the 1.0 ppm action level.						
9. Community Acceptance	The level of community acceptance of the selected alternative is outlined in the Responsiveness Summary.						

More specifically, the Selected Alternative -- Alternative C2 -- requires dredging, mechanical dewatering, and off-site disposal of dredged sediments at an engineered landfill. Alternative E assumed that the same volume of sediments could be dredged, passively dewatered in lagoons, and vitrified (in lieu of landfill disposal).

As indicated by ROD Table 18, EPA and WDNR determined that the Selected Alternative (C2) would fully meet all of the nine remedy selection criteria specified by the NCP, 40 C.F.R. Section 300.430(e)(9)(iii). Alternative E, on the other hand, would fully meet seven and partially meet two of the nine criteria, namely short-term effectiveness and implementability. Table 18 also included a comparative estimate of the costs of the two alternatives. A further consideration of the nine criteria relative to Alternative C2, the selected remedy and Alternative E, as discussed in the ROD and based on additional information, is explained in greater detail below.

Protection of Human Health and the Environment
and
Compliance with Applicable or Relevant and Appropriate Requirements

Both Alternatives C2 and E are protective of Human Health and the Environment, and comply with Applicable or Relevant and Appropriate Requirements.

Long-Term Effectiveness

Alternatives C2 and E reduce residual risk through removal or containment of 800,357 cubic yards of sediments containing approximately 1715 kg (3800 pounds) of PCBs over an area of 526 acres. Alternative C2 relies on engineering controls at the disposal facility. However, properly designed and managed landfills provide proven, reliable controls for long-term disposal. Alternative E does not require long-term management of a disposal facility, as discussed below.

Reduction of Toxicity, Mobility, and Volume

Reduction in Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment and the amount of contamination present.

Alternative C2 would permanently remove large volumes of PCBs from the River (thereby reducing their mobility), but does not satisfy the statutory preference for treatment as a principal element of the remedy. Alternative E would likely reduce toxicity, mobility, and volume, and the glass aggregate product would be available for beneficial re-use, and would satisfy the statutory preference for treatment.

Short-Term Effectiveness

EPA and WDNR classified Alternative E as only partially meeting the short-term effectiveness criterion based on concern about the time that it might take to begin remedy implementation. A facility to vitrify sediments is not currently designed. As such, a full-scale vitrification facility would need to be sited and constructed, and the new facility would need appropriate air permits if it were located off-site, as noted in the

ROD. Also, it should be noted that the petition incorrectly assumes that sediment vitrification could immediately be done at an existing Minergy Corporation incineration facility located at Arrowhead Park in Neenah. The existing Neenah facility was designed and constructed to manage organic sludges, and is not sized or configured to handle PCB contaminated river sediment. For that reason, Minergy's pilot-scale technology demonstration with Fox River sediment was done at a separate, specially-constructed facility

In contrast, for alternatives requiring disposal (including Alternative C2), the FS identified multiple existing landfill locations capable of accepting OU1 sediments. However, if existing facilities were not available, new disposal facilities would also require siting, permitting and construction.

Implementability

In evaluating implementability, the NCP required EPA and WDNR to consider any "technical difficulties and unknowns associated with the construction and operation of a technology." 40 C.F.R. 300.430(e)(9)(iii)(F). The Agencies classified Alternative E as only partially meeting the implementability criterion in large part due to uncertainty about whether vitrification would be practical and cost effective on a large-scale basis. As noted in the FS and the ROD, a pilot-scale demonstration with Minergy Corporation's glass furnace technology showed that Fox River sediment could feasibly be treated by vitrification, but the technology has not yet been applied to a large-scale sediment project. Thus, the Agencies rated the vitrification alternative as only "partially" meeting the implementability criterion, but the ROD also indicated that "WDNR and EPA may utilize vitrification of dredged contaminated sediment, as an alternative to off-site disposal at a licensed facility, if this is determined to be practicable and cost effective."

Alternative C2 includes off-site disposal, a common activity at many Superfund sites. The number and location of off-site disposal facilities will be based on final determination of dredged material volume, transportation and cost considerations. This alternative is most feasible if a disposal facility(ies) is(are) located within the Fox Valley area.

Cost

On its face, ROD Table 18 above suggests that Alternative E would cost less than the Selected Alternative ($63.6 million for the vitrification alternative vs. $66.2 million for the landfill disposal alternative). The ROD's cost estimate for vitrification was based upon a number of significant assumptions set forth in the FS, including assumptions made in a January 2002 Unit Cost Study on vitrification. After re-examining several of those assumptions, the Agencies have concluded that the FS and the ROD understated the probable cost of the OU1 vitrification alternative, as explained below. That conclusion is supported by a more recent report cited by the petition, the May 2003 Revised Unit Cost

Study on vitrification. In short, EPA and WDNR estimate that a vitrification remedy for OU1 alone would cost approximately $100.8 million (rather than $63.6 million as suggested by the ROD), which is significantly more than the estimated cost of $66.2 million for the Selected Alternative. Table 1 presents a revised comparison of the costs of the Selected Alternative and ROD Alternative E.

Table 1 -- Costs for Alternative C2 and E
(costs in millions dollars)

Remedy Component	Selected Alternative (Landfill Disposal)	Alternative E (Vitrification)	
		ROD Estimate for Alternative E	Revised Estimate for Alternative E
Sediment Removal	$22.1	$22.1	$22.1
Sediment Dewatering	$16.9	$3.2	$16.9
Water Treatment	$1.4	$1.3	$1.4
Landfill Disposal	$21.3	$0	$0
Vitrification Treatment	$0	$32.5	$55.9
Institutional Controls	$4.5	$4.5	$4.5
TOTAL	$66.2	$63.6	$100.8

The discussion below describes the Agencies' re-examination of two main categories of cost savings included in their original cost estimate: (1) sediment dewatering cost and (2) vitrification cost.

Sediment Dewatering Cost

The FS and Alternative E in the ROD assumed that, before vitrification, dredged sediments would be dewatered by settling and evaporation in large passive dewatering lagoons, at a relatively low cost compared to mechanical dewatering. However, there are two reasons why passive dewatering cost savings would not be realized.

1) Passive dewatering could not achieve the solids content assumed by the cost estimate in the FS and the ROD. The FS and the ROD both used a vitrification unit cost figure derived from the January 2002 Unit Cost Study (reproduced as Appendix G of the FS). That Unit Cost Study assumed that, before vitrification, the sediment would be dewatered to 50% solids. However, the solids content could not be achieved using only passive dewatering, so mechanical dewatering would likely be required. While it might

be technically feasible for a vitrification facility to accept and process lower solids materials, costs would increase.

2) Passive dewatering would require large lagoons, but dewatering lagoons could not be located near OU1 due to space limitations. For illustrative purposes, the FS assumed two nine-acre dewatering ponds each with an operating depth of 10 feet (FS Figure 7-17). The FS also assumed that Arrowhead Park would be the staging area for OU1 (FS Figure 7-9), since much of the area around OU1 is already developed. Because Arrowhead Park is a paper mill sludge fill area, large passive dewatering lagoons could not be excavated to sufficient depth, and the fill area would not have sufficient compressive strength to support large lagoons. Since lagoons needed for passive dewatering could not be located near OU1, it is not feasible to utilize passive dewatering for OU1, as assumed by the cost estimate in the FS and the ROD.

The cost estimate used in the FS and the ROD assumed that an OU1 vitrification alternative could utilize passive dewatering, at a cost of only $3.2 million. Unlike the ROD cost estimate for Alternative E, the Selected Alternative included an estimated $16.9 million for mechanical dewatering. This method of dewatering was considered necessary, this process could be located adjacent to OU1 (requiring substantially less space) and would provide sufficient solids content. Once that estimate is used for Alternative E as well, the projected cost of the vitrification alternative increases by $13.7 million based on dewatering costs alone, as shown on Table 1.

Vitrification Cost

As noted above, the FS and the ROD both used a vitrification unit cost figure taken from the January 2002 Unit Cost Study. To derive that unit cost figure, the Unit Cost Study assumed construction of a moderately sized vitrification facility that would process a large volume of sediment taken from the entire Site (not just OU1) over an extended period of time. More specifically, the Study assumed construction of a single 250 glass ton per day facility, capable of handling approximately 3.2 million wet tons of sediment over 15 years. That set of assumptions includes savings based on an economy of scale and on the time value of money, as compared to a smaller, shorter duration project. The study also assumed that the net unit cost would be reduced by the sale of all glass aggregate produced by the vitrification process. Based on those assumptions, the vitrification cost estimate in the FS and the ROD assumed a very low unit cost of $27 per wet ton of sediment processed. That unit cost was then multiplied by a sediment tonnage value for OU1, and about $7.2 million in other costs was added for sediment loading, sediment hauling, engineering, procurement, and construction management (FS Appendix H, page 36).[2] That yielded an overall cost of $32.5 million for vitrification

[2] As indicated above, the FS assumed that passive dewatering would be used, so the tonnage subjected to vitrification would be higher than if mechanical dewatering were used. FS therefore

alone, as shown on Table 1 above.

EPA and WNDR have determined that the vitrification unit cost (and the estimated total cost of treatment by vitrification) for OU1 is significantly higher when the costs are recalculated, without considering theoretical economy of scale or time value of money savings (requiring inclusion of OU3 and OU4 sediments as part of the project), or potential savings from glass aggregate sales.[3] For OU1 alone, the project would require a 250 glass ton per day facility, capable of handling nearly 375,000 wet tons of mechanically dewatered sediment over three years. Using the most recent information from the May 2003 Revised Unit Cost Study, EPA and WDNR estimated that facility would cost approximately $43.9 million to construct and operate (equating to a vitrification unit cost of more than $117 per wet ton). The revised estimated cost for vitrification treatment alone would be $55.9 million, as reflected on Table 1, after adding approximately $6.9 million for sediment loading, sediment hauling, engineering, procurement, and construction management, consistent with the approach taken in the FS. Thus, as shown on Table 1, the projected cost of Alternative E increases by an additional $23.4 million based solely on the revised cost estimate for vitrification treatment.

The best information currently available suggests that the FS and the ROD underestimated the cost of vitrification treatment, even if sediment from the entire Site (including OU1) could somehow be treated at a single, large facility. Because most of the sediment to be removed from the Site as a whole would come from OU4, any such facility would most sensibly be sited somewhere near OU4. Managing that amount of sediment consistent with the project timeline could require a 2x375 glass ton per day facility capable of handling more than 4 million wet tons of mechanically dewatered sediment over approximately 7-8 years. The May 2003 Revised Unit Cost Study indicates that it would cost from $173-184 million to construct and operate such a facility (on a net present value basis), which equates to a vitrification unit cost of more than $40 per wet ton (assuming no net cost reduction for glass aggregate sales). (Revised Unit Cost Study page A-2.)[4] That $40 per ton unit cost is significantly higher than the $27

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assumed 935,530 wet tons from OU1 would be treated, but the tonnage would only be approximately 375,000 wet tons if OU1 sediments were mechanically dewatered.

[3] The market price for glass aggregate generated by the vitrification process currently is unknown and speculative. The Unit Cost Study and the Revised Unit Cost Study both assumed some degree of cost savings from sale of that material, and the unit cost figure used in the FS and the ROD assumed a significant cost savings. Less favorable market conditions would increase the unit cost and the total cost of vitrification.

[4] Actual vitrification costs could well exceed the estimates presented in the Revised Unit Cost Study. For example, the Revised Unit Cost Study assumes that natural gas necessary to operate a vitrification plant would cost $3.25 per million BTU, but current gas prices are $4.10 per million BTU, and are expected to increase 10 -15% over the next year. In addition, the Revised Unit Cost Study assumes that sediment would always be received in a non-frozen state, but stockpiled sediment would either need to be thawed or stored in heated areas during the winter. That would also increase costs.

per ton unit cost assumed by the FS and the ROD, and it does not account for the added cost of mechanical dewatering or the added cost of transporting all OU1 sediment to a single, large vitrification facility located near OU4. Using the information currently available, WDNR currently estimate that a Site-wide vitrification alternative would cost more than $600 million, as compared to the $400 million estimated cost of the landfill disposal approach selected by the two RODs.[5]

It should also be noted that costs for Alternative C2 and similar alternatives have been further evaluated by a "Technical Review Team," tasked to provide further evaluation of possible Fox River remedies. This additional evaluation confirmed that cost estimates for the OU 1 Alternative C2 in the Feasibility Study and ROD are generally reasonable.

Conclusion

As explained above, EPA and WDNR identified short-term effectiveness and implementability issues associated with the vitrification alternative when the ROD for OUs 1 and 2 was issued in December 2002. In light of persisting uncertainties, the ROD reflected the Agencies' intention to continue evaluating the feasibility and cost of vitrification.

The Agencies' earlier determination's regarding the vitrification alternative's short-term effectiveness and implementability has been confirmed. In addition, after re-examining potential costs of the vitrification, in light of revised cost estimated presented in the most recent reports, EPA and WNDR have concluded that the FS and the ROD underestimated the cost of the vitrification alternative.

Thus, although the Agencies have considered the issues set forth in the Petition by the Town of Vinland, after further evaluation using the criteria set forth in the NCP (discussed above), the Agencies have determined that a ROD Amendment substituting Alternative E (vitrification) for Alternative C2 (landfill disposal) is not appropriate. Nevertheless, consistent with the indications in the ROD, the Agencies will continue to evaluate the technology.

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[5] These cost estimates are stated in present value terms, and do not include certain other remedy-related costs, as emphasized by the FS and the RODs. The overall cost of a remedial alternative would also include categories such as remedial design costs, oversight costs, and a construction cost contingency. Those costs could add an additional 30-35%, bringing the total cost of a Site-wide vitrification alternative to more than $800 million and bringing the cost of the Site-wide landfill alternative to nearly $540 million, on a present value basis.

Date: 1-26-04

Richard C. Karl, Acting Director
Superfund Division
U.S. Environmental Protection Agency
Region 5

Date: 1-26-04

Bruce Baker, Deputy Administrator
Water Division
Wisconsin Department of Natural Resources

Attachments:

1) Supplemental Sediment Handling Characterization Report, Glass Furnace Technology, May 30, 2003

2) Revised Unit Cost Study, For Commercial Scale Sediment Melter Facility, Glass Furnace Technology, May 30, 2003

3) Permitting Review for Sediment Melter Facility, May 30, 2003

4) Minergy Corporation, Glass Furnace Technology Evaluation, Innovative Technology Evaluation Report, July 2003