

# TOSC Review of *Indiana Harbor and Canal Dredging and Disposal Alternatives Analysis*

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## SUMMARY

Residents of northwest Indiana have asked Technical Outreach Services for Communities (TOSC) to comment on plans to dredge sediments from the Indiana Harbor and Canal. This report reviews the dredging technology chosen by the Corps in the *Dredging Alternatives Analysis* and their plan to handle the dredged materials. To complete this report, TOSC solicited the help of Dr. Danny Reible, Professor of Chemical Engineering at Louisiana State University and Director of the South and Southwest Hazardous Substance Research Center. Other university faculty were also consulted, as shown in the report.

After reviewing the Corps's analysis and plans, we offer the following conclusions:

- To do nothing, not to dredge, would leave in place a dynamic system that is contaminating Lake Michigan. The contaminated sediments are moving into the lake and therefore must be removed from the harbor and canal.
- To characterize the project as navigational or environmental is less important than to monitor how the Corps and the dredging contractor do their jobs. *If done properly*, even a navigational dredging operation can have environmental benefits and must meet environmental standards. Therefore, the key is to ensure that adequate quality control and assurance are built into the project—regardless of how it is characterized.
- No clear difference between mechanical and hydraulic dredging operations has been observed in practice. If the appropriate mechanical technologies are used, and if the dredge operator follows procedures, the total amounts of sediments resuspended in the waterway during mechanical dredging are likely to be small—on the order of three-tenths percent (3/10%) of the total volume that is dredged. In fact, mechanical dredging is the preferred method for reducing *total airborne emissions* (i.e., particulate and volatile emissions).
- Because the Corps's plans are based on historical data (over ten years old) and preliminary assessments carried out in 2003-2004, their assessments may have missed “hotspots” in the canal and harbor. Given the uncertainty over the location and concentrations of contaminants, and given the complexity of the project, it is important that the Corps create a contingency plan and then monitor the dredging to ensure adequate protection.
- Traditionally, a risk assessment for a cleanup project (whether a Superfund site or a dredging project) is conducted after the contamination problem has been investigated but before remedies are chosen. In the Indiana Harbor case, the remedy (mechanical dredging) has been chosen by the Corps prior to the completion of the risk assessment. Therefore, we strongly support the Corps's efforts to gather more data to support that decision.

## **Analysis of Dredging and Disposal Alternatives**

TOSC's conclusion is that, while the selection of mechanical dredging is appropriate given the constraints of cost and CDF size, many decisions remain to be made that may affect public health. Therefore, TOSC recommends that the Corps remain flexible and allow the findings of the risk assessment, and unanticipated contingencies during the dredging itself, to be incorporated into the Corps's Operations Plan.

## INTRODUCTION

Residents of northwest Indiana have asked Technical Outreach Services for Communities (TOSC) to comment on plans (1) to dredge sediments from the Indiana Harbor and Canal and (2) to construct a confined disposal facility in East Chicago, Indiana. As a result, TOSC will produce a series of reports that comment on various aspects of the plans proposed by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. This report reviews the dredging technology chosen by the Corps in the *Dredging Alternatives Analysis* and their plan to handle the dredged materials. To complete this report, TOSC solicited the help of Dr. Danny Reible, Professor of Chemical Engineering at Louisiana State University and Director of the South and Southwest Hazardous Substance Research Center. Other university faculty were also consulted, as shown in the report.

The report is organized according to three sets of questions raised by the community:

- Should the project be characterized as an environmental or navigational dredging?
- Which dredging alternative would be more appropriate for the Indiana Harbor and Canal project—mechanical or hydraulic?
- Has the Corps gathered adequate data to support its plans?

Answers to these questions are addressed below, followed by a summary of the *Dredging Alternatives Analysis*, which can be found in Appendix A. Additional information regarding TOSC and its work appears in Appendix B.

## ENVIRONMENTAL VERSUS NAVIGATIONAL DREDGING

The U.S. Army Corps of Engineers has characterized the Indiana Harbor and Canal (IHC) dredging project as a navigational project. Residents have asked about the difference between navigational and environmental dredging projects and have asked if the IHC should be characterized as an environmental dredging project. In particular, residents have asked us two questions: what are the differences between navigational and environmental dredging, and should the IHC project be considered an environmental dredging project?

### **What are the differences between navigational and environmental dredging?**

Navigational and environmental dredging have different but complementary goals. Whereas the primary goal of navigational dredging is to open a river or harbor to vessel traffic, the primary goal of environmental dredging is to remove contaminants and reduce risk to human health and the ecosystem. The goals of each type of dredging can overlap. Dredging to improve navigation certainly can remove contaminants from a body of water, while environmental dredging can improve navigation. In addition, commercial traffic in an inadequately dredged harbor may resuspend significant quantities of contaminated sediment during docking and maneuvering. Adequate dredging may eliminate this problem and result in improved water quality. Therefore, even a navigational dredge can benefit the environment.

### **Should the Indiana Harbor and Canal Project be considered an environmental dredging project?**

The Indiana Harbor and Canal project is designed as a navigational dredging project. This makes the driving force economic. The Corps's *Dredging Alternatives Analysis* states that by law the Corps has to take cost as the primary consideration while ensuring that it meets good engineering standards and is environmentally sound. As a result, the Corps has not put the environmental aspects of this project at the forefront. In TOSC's judgment, the IHC project should be considered as having characteristics of both environmental and navigational dredging projects. Therefore, while characterized as a navigational project, it is still appropriate to examine what steps the Corps has taken to address areas of contamination and how those areas will be dredged. In fact, that is TOSC's goal in reviewing the Corps's dredging plan.

## Analysis of Dredging and Disposal Alternatives

TOSC suggests that instead of strictly examining the question of environmental vs. navigational dredging, the community might ask the following questions:

- 1) Has the Corps **adequately characterized the sediments** so we know where the hotspots are, what contaminants are where, their concentrations and whether the contaminants are moving, **regardless of whether the project is labeled navigational or environmental?**
- 2) Has the Corps **done an adequate risk assessment** (two separate studies, one an ecological risk assessment, the other a human health risk assessment) so that we can anticipate and minimize the risks associated with the project, both the dredging operation and the CDF construction/operation, **regardless of whether the project is labeled navigational or environmental?**
- 3) Finally, **will the *dredging aspects* of the project be carried out in an environmentally sound manner**, as reflected in the *Dredging Alternatives Analysis*?

Over the course of this document, TOSC will address each of these questions.

## ANALYSIS OF DREDGING ALTERNATIVES

With any dredging project, the risks may be large if sediment resuspension, returned water, volatiles, or residual sediment contamination cause a significant increase in the contaminants introduced to the water column.<sup>1</sup> (Volatiles are chemicals that evaporate readily, such as benzene, a constituent of gasoline.) However, the dynamics of sediment transport in the Indiana Harbor and Canal pose ongoing risks.

The sediment moving into Lake Michigan under current conditions is similar in magnitude to the 150,000 cubic yards per year that were required to maintain dredging depth in the years immediately prior to dredging cessation. Although the quality of the sediment in the harbor and canal is uncertain, it is reasonable to suggest that it is similar to the average concentrations of contaminants in the harbor sediments. Therefore, *not dredging* leaves in place a dynamic system that is contaminating Lake Michigan.

### Common problems associated with any dredging alternative

Regardless of the dredging alternative chosen, three problems may arise when dealing with contaminated sediments: excess water, residual contamination, and resuspension.

- **Excess water** – Dredges generate significant quantities of contaminated water that must be returned to the river or harbor. Excess water is always associated with dredged materials, although some types of dredges produce more excess water than others. The water collected with the dredged sediments must be treated and/or returned to the waterway. It is often infeasible, technically or economically, to treat this water to the point that it has no impact on the body of water to which it is returned.

#### What are “resuspension” and “residual contamination”?

“Resuspension” involves reintroducing sediment particles into the water. Resuspension occurs when particles lying on a riverbed or harbor floor get “kicked up” into the water. This may occur in the wake of water traffic as well as during a dredging project.

“Residual” (or left behind) contamination occurs when deeply buried contaminated sediment is exposed but not removed during a dredging project. “Residuals” also refers to situations where dredged particles and contaminants are resuspended and then land again—this time on previously uncontaminated soil.

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<sup>1</sup> Water Column – A hypothetical “cylinder” of water from the surface of a water body to the bottom and within which physical and chemical properties can be measured.

- **Residual contamination** – “Residual contamination” refers to contaminated sediment left in place following a dredging operation. Significant levels of “residuals” (contaminated sediments left behind) may result at projects where highly contaminated sediments are found deeper in the contaminated sediment layers. These layers may be difficult to reach and therefore dredge successfully. The nature of the sediments at the floor of the body of water can also lead to increased residuals. For example, very soft, high-water-content sediments and sediments underlain with bedrock or hard clay layers may make it difficult to dredge to a clean sediment layer. Residual contamination may also result if contaminated sediments (particles) become suspended in the water during the dredging project and then resettle on the bottom of the waterway.
- **Resuspension** – Resuspension refers to the remixing of sediment particles and pollutants back into the water. Resuspension can happen in a number of ways: storms, currents, organisms, and human activities, such as dredging. With any type of dredging, contaminants may also be resuspended if the excess water produced during dredging is allowed to overflow from the barge. This is now usually prohibited, however, if sediments are significantly contaminated.

### What problems are associated with mechanical dredging technologies?

There are two primary concerns with mechanical dredging: the amount of contaminated sediments left in place (residuals) and resuspension of contaminants into the water. Although mechanical dredging may create higher rates of resuspension than hydraulic dredging (because mechanical dredges “kick up” slightly more sediment into the water body), this can be managed in a carefully designed dredging operation, including the selection of an experienced dredging firm and use of experienced dredge operators. In fact, on the issue of resuspension, a clear difference between mechanical and hydraulic dredging operations has not been observed in practice.

Resuspension during mechanical dredging occurs primarily through the physical disturbance of sediments. That is, sediments can be disturbed as a dredge digs into the bed of a river, canal or harbor. However, resuspension is a problem even if nothing were done to a body of water. Resuspension can also occur naturally during storms and through wave action, and also when sediments are disturbed by ship traffic. If the appropriate mechanical technologies are used, and if the dredge operator follows procedures, the total amounts resuspended in the waterway during mechanical

#### What are the differences between contaminants and volatiles?

A **contaminant** is any physical, chemical, biological or radiological substance that appears in soil, water, air, or human bodies. A **volatile** is a substance that converts easily to a gas and evaporates. Therefore, a volatile is a kind of contaminant.

**Volatilization** occurs when a contaminant converts from liquid to a gaseous form.

dredging are likely to be small—on the order of three-tenths percent (3/10%) of the total volume that is dredged.<sup>2</sup>

### What problems are associated with hydraulic dredging technologies?

The primary problem with the hydraulic dredge is the large amount of water captured by the vacuum device used for dredging. Although this method may reduce the amount of contaminated sediments left behind and slightly reduce the resuspension of sediments, those benefits may be completely offset when the excess water is returned to the river or harbor. Unless that excess water is treated completely, it will contain contaminants. It may be technologically or economically infeasible to treat the water sufficiently to ensure a minimal impact on the water body.

More volatilization can occur during hydraulic dredging than during mechanical because contaminants can evaporate from contaminated water more easily than from sediment. (Volatile chemicals, as described previously, are chemicals that evaporate quickly in the atmosphere.) Exposed sediment from mechanical dredging can initially release volatiles at a high rate, but, once the surface dries, it becomes depleted of contaminants and the rate slows dramatically. With hydraulic dredging, however, the surface of the dredged material stays wet and thus

volatilization can continue much longer. This volatilization can occur during three phases of the project: during transport to the CDF, when the sediments are placed into the CDF (whether placed by mechanical means or vacuum means, the

#### How do mechanical and hydraulic dredges function?

**Mechanical dredges** scoop or grab the material from the bottom and are capable of removing hard-packed materials and debris. They have difficulty retaining fine materials in their buckets and do not dredge continuously. Mechanical dredges place the material into barges for transport to the placement site.

**Hydraulic dredges** remove the material from the bottom by suction. The resulting slurry (material and water) is either pumped directly to the disposal site, or in the case of a hopper dredge, pumped into its own hopper for later placement.

A common type of mechanical dredge is a clamshell dredge. Hydraulic dredges include cutterhead pipeline dredges and self-propelled hopper dredges. Cutterhead pipeline dredges can excavate most materials and can dredge almost continuously. Hopper dredges are used primarily in deep water and can operate in rough weather.

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<sup>2</sup> Source: Donald Hayes, Professor of Civil Engineering, University of Utah: TOSC personal communication, January 2004.

## Analysis of Dredging and Disposal Alternatives

sediment-water mixture in the CDF will be stirred up, releasing volatile chemicals), and during the dewatering (drying) and settling of the material in the CDF.

The mechanism for higher volatile emissions during hydraulic dredging is as follows. The contaminated sediments dredged hydraulically would be transported and placed into the CDF while suspended/mixed in the water. Contaminants that are “stuck to” (or adsorbed to)<sup>3</sup> the sediment will become “unstuck” (or desorb). The desorption would occur through physical disturbance or natural volatilization/desorption processes. During that process, some of the contaminants that had desorbed will then volatilize—or convert from the liquid to a gas. Because the sediment/water system tends to remain in equilibrium, the sorbed contaminants (those that are still stuck to the sediment) will desorb to “fill the space” previously occupied by the now-volatilized contaminants. Those contaminants will themselves volatilize, and the process will continue in a cyclical fashion, thus leaving an increased volatilization potential.

Hydraulic dredging typically introduces about four times the volume of water per volume of in-place sediments. Therefore, hydraulically dredged slurries may be about 10-15% solids, 85-90% water. Dewatering of the slurry is a critical factor and would normally be accomplished by first providing adequate retention time for the solids to settle. Estimates in the Corps’ design reports suggest that the dredged slurry would have a “holding time” (the time for solids to settle out) of five hours. This is a typical length of time for settling of solids from hydraulically dredged sediments.<sup>4</sup>

The speed of any dredging project is constrained by the “rate-limiting” step, the bottleneck that represents the slowest point in the process. With most dredging projects, *dewatering* is the rate-limiting step. So, by mechanically dredging the IHC sediments, the Corps has eliminated the need to conduct substantial dewatering and therefore the need to allocate space (and time) to dewatering. Given that the Corps conducted its analysis with the CDF site already selected, allowing time for settling of all dredged materials would require a much larger portion of the site be allocated to dewatering, and thus would reduce the “production rate” (the rate at which the waterway could be dredged). Therefore, dredging using hydraulic means would increase costs.

In addition, the larger water settling area would have negative environmental and public health effects, because of the greater volatile emissions (as described above).

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<sup>3</sup> Adsorption is a chemical process where a molecule attaches loosely to the surface of another phase, without becoming incorporated into that phase. For example, benzene may be adsorbed to sediment particles without becoming chemically incorporated into the sediment particle.

<sup>4</sup> In a March 2004 phone conversation with TOSC reviewers, Bill White, the Corps Project Manager indicated that the Corps is considering the use of hydraulic (vacuum) methods for *transporting* the sediments to the CDF from the point of dredging, after they are dredged *mechanically*. TOSC is uncertain as to what the Corps’s final decision may be on this issue.

In weighing mechanical vs. hydraulic, the question for TOSC is this: In selecting mechanical dredging as the preferred option (in part because a site for the CDF has already been chosen, thus limiting the feasibility of adequate dewatering space for hydraulically dredged sediments), will the Corps potentially imperil public health and the environment? TOSC's response is that a properly designed and executed mechanical dredging project, in this location, will safeguard public health and the environment, but also that the Corps and U.S. EPA have work to do still to ensure adequate safeguards, including completing the supplemental risk assessment, publishing an Operations Plan (including contingency planning), hiring contractors, and, perhaps most important, conducting the dredging operation in a safe manner.

### **What is the relative resuspension potential of mechanical vs. hydraulic dredging?**

Sediment and contaminants may be resuspended into the water with either method. But dredging would resuspend fewer sediments and contaminants, and in a smaller area, than is currently resuspended due to commercial shipping or storm events. In general, because mechanical dredging generates less wastewater than hydraulic dredging, it decreases the likelihood that contaminants will be reintroduced to the water body when wastewater effluent is discharged or that chemicals will volatilize at the point of disposal. Mechanical dredging also offers increased flexibility to manage debris encountered during the dredging—rocks and other objects. Resuspension of contaminants *is* slightly greater with mechanical dredging than with hydraulic dredging, but the differences are minimal.

The levels of resuspension and residual contamination can be affected by the operating conditions of the dredge (operator experience, care and level of control). Residuals, for example, can be minimized by overdredging beyond depths of expected contamination<sup>5</sup> and by maintaining good control of dredging location and depth. Again, in both cases, operating conditions can be more important than type of dredge employed in controlling emissions.

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<sup>5</sup> On this issue, the Corps has stated that its authorization will permit dredging to **one foot deeper** than the anticipated depth of dredging to permit use of the waterway for navigation. Given the potential for high levels of contamination, it is TOSC's opinion that if high levels of contaminants are found at deeper levels (and potentially exposed by the dredging operation), the Corps should seek authorization to dredge to deeper levels.

TOSC confirmed the lack of difference between suspension rates for mechanical and hydraulic dredging by contacting Dr. Donald Hayes, Associate Professor of Civil Engineering at the University of Utah.<sup>6</sup> Given good quality control of dredging operations (e.g., barges are not allowed to overflow; operators are skilled and consistent), Dr. Hayes says there is little difference in the resuspension rates between mechanical and hydraulic dredges at the point of dredging. He notes that on a conventional cutter suction hydraulic dredging operation, available data suggests that resuspended sediment typically amounts to about one-tenth of a percent of the total dredged volume (Hayes, 2000).<sup>7</sup> Other types of hydraulic dredges may actually resuspend significantly more sediment. For conventional bucket (mechanical) dredging operations, data show resuspended sediment typically amounts to three-tenths to seven-tenths of a percent of the dredged sediments by volume, excluding barge overflow. In either case, physical sediment characteristics and dredge operation (quality control) can influence the resuspension rate significantly.

**Should the community be concerned about exposure to contaminated particulates?**

Yes. Particulate emissions in the air (effectively, wind blown dust) can increase risks to human health from sediment dredging operations. Particulate emissions may occur both during the transport of sediments to the CDF and at the site of the CDF. In the *Dredging Alternatives Analysis*, the Corps addresses which method (hydraulic or mechanical) is best for managing particulates.

The Corps approaches the problem of emissions in terms of *total airborne emissions*, or the combination of particulate emissions and volatile emissions. On one hand, mechanical dredges tend to produce more particulate emissions. The

**Why are quality assurance and control so important?**

First, good quality control practically eliminates any difference between mechanical and hydraulic dredging. As long as barges are not allowed to overflow and operators are skilled and consistent, there is little difference in the resuspension rates between mechanical and hydraulic dredges at the point of dredging.

Second, operators must be prepared to respond to unexpected “hot spots” in the harbor and canal. The data available to the Corps make identifying the sediments as they exist today difficult. It is also impossible to predict precise migration patterns for these contaminants or future movement. Therefore, dredging operations must be designed to react quickly to changing conditions.

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<sup>6</sup> Dr. Hayes was consulted at the suggestion of Dr. Reible on January 22, 2004.

<sup>7</sup> Hayes, D.F., Crockett, T.R., Ward, T.J., and Averett, D. (2000b). “Sediment Resuspension During Cutterhead Dredging Operations.” *Journal of Waterway, Port, Coastal, and Ocean Engineering*, 126(3), May/June 2000, ASCE.

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Corps states: “Particulate (dust) emissions were determined to be less under both hydraulic alternatives than with mechanical dredging.” On the other hand, hydraulic dredges produce more volatile emissions. Of the two types of airborne emissions, the Corps argues that particulate emissions are easier to control: “Particulate emissions are more easily controlled than volatile emissions through the use of such measures as vegetation cover and windscreens. These controls can reduce particulate emissions significantly.” As a result, the Corps views mechanical dredging as the preferred method for reducing *total airborne emissions*.

TOSC agrees with the Corps’s conclusion in this area. The CDF itself is designed to accept wet sediments and then dewater the sediment. As long as the sediment is still wet, blowing dust will not be a major problem. If the sediment dries before being covered, however, dust could be a problem. As described above, the Corps has two options to control blowing dust: it can keep the sediments wet, or it can place a cover or vegetation on the surface. Since dewatering is the goal, adding moisture is somewhat counterproductive, so ultimately ground cover or vegetation is needed. (*The Dredging Alternatives Analysis* also proposes using an erosion control fence, although TOSC is unsure how effective that approach might be.) Adding clean material in order to cap dried areas would effectively eliminate wind blown dust, just as capping can reduce airborne migration of contaminants from sanitary landfills

The *transport* of the sediments to the CDF also presents another time when particulate releases might occur, but the sediments should still be wet during this phase and particulate emissions should not be a significant problem. Particulate releases are more likely to occur during the dewatering (drying) phase *in the CDF* than during the transport phase.

The Corps should clearly state in the Operations Plan how volatile and particulate emissions will be managed during the execution of the dredging project. One indicator of volatile releases that TOSC recommends the Corps use is simply the *presence of strong odors*. Such odors should trigger further air monitoring by the Corps to determine the chemical constituents causing the odors and their concentrations—and whether action should be taken to reduce volatile releases.

In addition, at a future date TOSC will provide a separate review of the *confined disposal facility design and operations plan*, including additional comments on the steps planned by the Corps and its contractors for a) monitoring particulate and volatile emissions and b) controlling those emissions during the operation of the CDF. That review will be conducted by Dr. Milind Khire, Assistant Professor of Environmental Engineering at Michigan State University.

**Has the correct dredging alternative been chosen?**

With the information provided by the *Dredging Alternatives Analysis*, it is the opinion of TOSC that the right dredging equipment has been chosen for the project. Given the current cost and CDF size constraints, mechanical dredging technology is the preferred choice.

A comparison of mechanical versus hydraulic dredging could be thought of as a trade off between potentially increased residual concentrations (under mechanical dredging) for increased emissions to the air (volatilization) and effluent discharges into the water body (under hydraulic dredging). If returned water or volatile release is likely to be the primary source of environmental concern, mechanical dredging should be preferred due to the lower water production. If speed of dredging is of primary concern and adequate dewatering and water treatment facilities exist, hydraulic dredging is likely to be preferred. If residual contamination is of primary concern, the type of dredge most appropriate depends upon the environmental setting and the ability of the dredge to effectively remove sediments in that setting.

Once again, however, the costs and CDF size are driving the choice of dredging alternative. Given a CDF with sufficient dewatering space or the ability to treat large volumes of water, other technologies may be more feasible—but also potentially more prone to volatilization and more expensive.<sup>8</sup>

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<sup>8</sup> The data collected from the dredging of the Grand Calumet River at the U.S. Steel Gary Works site may be used by the Corps as a point of reference for the IHC dredging project. Monitoring data from the GCR project could be used to provide an indication of the potential for volatilization and other airborne emissions from the IHC project.

## COMMENTS ON CORPS METHODS

Several questions have been raised regarding whether the Corps has considered all issues adequately. The purpose of this section is to address those questions.

### **Has the Corps adequately characterized the sediments?**

The answer to this question is both “yes” and “no.” There certainly is enough information to do a preliminary design for the project. Based on the historical data, the Corps can also answer questions about what the sediments looked like at specific times. The key point is this, however: our understanding of the sediments is incomplete, and so their characterization should be subject to review as more current information becomes available during the implementation phases of the project—as the dredging begins and as it continues to take place over the coming years.

There were two distinct phases to sample collection. Over 300 sediment samples have been collected and analyzed since the end of regular dredging of the harbor in 1972. These samples were collected between 1977 and 1993 and provide a good indication of the sediment distribution and spatial trends over this period. Data collected since 1993 have focused in specific areas. This data should provide a good indication of the location of any “hotspots” at the time it was collected.

However, both the data collected between 1977 and 1993 and the data collected since 1993 make identifying the sediments as they exist today difficult given the spatial distribution of the sampling, and the different methods, objectives, and quality of the collected data. It is also impossible to predict precise migration patterns for these contaminants or future movement.

The complexity of characterizing sediments emphasizes the importance of ongoing monitoring and contingency planning. Because the Corps has only preliminary assessments and historical data, equipment should be in place during construction and dredging operations that reliably measure emissions, measurements that will allow the Corps to know when field observations deviate from lab estimates. Those estimates come from modeling work on volatiles and particulates conducted by the Corps during 2003-2004. (The results have not been released to the public, and therefore TOSC has not reviewed them.) Furthermore, criteria must be developed for evaluating exposures, based on both emissions levels from monitoring and the proximity of people who live near the dredge area or the CDF site. In other words, the criteria should be tied to risks posed to nearby residents. These criteria would then be used to trigger other elements of a contingency plan, such as cessation of operations or adjustments to operations.

## Analysis of Dredging and Disposal Alternatives

Given the uncertainty over the location and concentrations of contaminants (on the part of both TOSC and the Corps) and given the complexity of the project, it is important that monitoring be in place that will trigger protections delineated in a contingency plan. **TOSC would like to emphasize that writing an adequate contingency plan is relatively easy; knowing that a *triggering event* has occurred is much more difficult.**

In its Operations Plan, the Corps should carefully delineate possible anomalies that might occur during the dredging operation, particularly if:

- Higher than anticipated resuspension of contaminated sediments occurs in the waterway.
- Areas being dredged (throughout the course of the project) are found (through sampling and analysis of *the sediment material* during the project) to have sediments with high levels of contaminants (so-called Toxic Substance Control Act or TSCA sediments). The Corps's plan requires that TSCA sediments be disposed of in a cell (area) of the CDF designated for such sediments. However, unidentified TSCA sediments pose a greater risk as air emissions from the sediments, either as volatiles or contaminant-laden particulates.
- Air monitoring during the course of the project detects unacceptable levels of contaminants that may be released during the transport of the sediments or their placement into the CDF.

### **Has the Corps/EPA conducted an adequate risk assessment?**

The EPA has stated that the earlier human health risk assessment did not address public concerns completely. Therefore, the agency is conducting an additional risk assessment to examine more thoroughly the potential human health effects of the dredging, transport, and placement of the sediments into the confined disposal facility. TOSC supports this work by the EPA and encourages the agency to utilize the information arising from the risk assessment to modify the Corps's dredging plans accordingly. TOSC will review those studies, once they are released to the public, under the guidance of Peter Orris, M.D., Professor of Occupation and Environmental Medicine, University of Illinois-Chicago.

Given the strong public concern over health impacts, particularly concerns over potential airborne exposures during the time that the dredged materials are transported to the CDF, during the placement of materials into the CDF, and during the ongoing, 30-year planned operation of the CDF, **TOSC encourages the EPA and the Corps to hold a public meeting to explain the findings of the risk assessment.** TOSC also encourages the EPA and the Corps to provide work plan documents to the public as early in the process as possible, so that the public may have every opportunity to participate in the process.

Because work is ongoing, TOSC cannot yet answer the question of the adequacy of the risk assessments. However, TOSC is in the process of discussing with the EPA the feasibility of having a member of Dr. Orris's staff added to the EPA's risk assessment team. TOSC plans to meet with EPA to discuss this participation further, and a representative of the community with which TOSC is working will also be invited to the meeting.

**Did the Corps adequately consider public health and environmental effects?**

Not completely, but work is ongoing. Here we address some of the components of this issue.

Traditionally, a risk assessment for a cleanup project (whether a Superfund site or a dredging project) is conducted after the contamination problem has been investigated but before remedies are chosen. In the Indiana Harbor case, the remedy (mechanical dredging) has been chosen by the Corps prior to the completion of the risk assessment. (In fact, the remedy has been chosen absent a thorough characterization of the contamination—which is commonly the case with navigational dredging projects.)

Given that the risk assessment has not been completed, TOSC recommends that the Corps remain flexible and incorporate the findings of the risk assessment into the Operations Plan. For example, the EPA may call for additional air monitoring, or the EPA or the Corps may decide that the only way to reduce risk of airborne exposures is to *transport* the sediments through hydraulic means, once they are dredged mechanically. Given the incomplete characterization and the ongoing risk assessment, TOSC's conclusion is that, while the selection of mechanical dredging is appropriate given the constraints of cost and CDF size, many decisions remain to be made that may affect public health. Just as importantly, the quality of the dredging operation itself must remain an issue of critical concern.

**What else should the Corps and the EPA do?**

Among other things, TOSC recommends the following:

- The Corps should develop appropriate contingency plans.
- The EPA is conducting an additional risk assessment to examine more thoroughly the potential human health effects of the Harbor and Canal project. The EPA should utilize the information arising from the risk assessment to modify the Corps's dredging plans accordingly.
- Given the strong public concern over health impacts, the EPA and the Corps should hold a public meeting to explain the findings of the risk assessment.
- Criteria must be developed for evaluating exposures, based on both emissions levels from monitoring and the proximity of people who live near the dredge area or the CDF site. In other words, the criteria should be tied to risks posed to nearby residents.

## Analysis of Dredging and Disposal Alternatives

As indicated above, TOSC believes that the *Dredging Alternatives Analysis* provides partial justification for the selection of mechanical dredging; therefore, we strongly support the Corps's efforts to gather more data to support that decision. The Corps has begun such efforts by requesting an additional examination of airborne particulates (dust) that the dredging may create. That work is now being carried out by Kansas State University. The Corps has also requested an additional examination of volatile chemical emissions by the Corps Engineer Research and Development Center and by Louisiana State University. TOSC will review both studies and provide comment to residents on their findings.

The US EPA is conducting a supplemental risk assessment (as mentioned above) to further assess potential risks associated with the project, particularly to children. The results of these studies should be used to further evaluate the Corp's plans, but also to identify areas of concern where special caution should be taken during operations. We have also discussed, above, the importance of *contingency planning*, as a means of assuring the project safeguards the health of community members. These are steps the Corps should take if unforeseen circumstances arise, such as greater than anticipated resuspension, volatilization or airborne particulates.

## APPENDIX A: EXECUTIVE SUMMARY OF THE *DREDGING ALTERNATIVES ANALYSIS*

(This summary is taken directly from the U.S. Army Corps of Engineers Executive Summary of the *Dredging Alternatives Analysis*)

### EXECUTIVE SUMMARY

#### Purpose of WES Alternatives Analysis

Indiana Harbor and Canal (IHC) is an authorized Federal navigation project located in East Chicago, Indiana. Contaminated sediments in the IHC have been determined to be unsuitable for open water disposal, unconfined upland disposal, or beneficial use. Dredging of the IHC and safe remediation of the sediments are important to the health and economic prosperity of the surrounding community. IHC dredging has been deferred since 1972 while a technically and economically feasible and environmentally acceptable management plan was developed.

During the course of developing a sediment management plan for Indiana Harbor sediments, a number of dredging technologies were considered. As summarized in the Comprehensive Management Plan, these technologies included mechanical, hydraulic, and special purpose dredges. Based on detailed evaluations of feasible alternatives, it was determined that dredging would be performed using a closed-bucket clamshell dredge.

This current study was conducted in response to the public's desire to re-evaluate the use of hydraulic dredging for the disposal for the IHC project. The Environmental Laboratory of the U.S. Army Research and Development Center, Waterways Experiment Station conducted the analysis on behalf of the U.S. Army Corps of Engineers, Chicago District. The primary objective of this study was to compare dredging and placement alternatives for the IHC Confined Disposal Facility (CDF), including costs and environmental impacts. The study recommendations have led to selection of the National Economic Development (the Federal standard) alternative.

Three dredging and rehandling alternatives were considered in the analysis:

- Alternative 1 – Mechanical dredging and placement. This alternative was based on the selected plan from the Comprehensive Management Plan, using a mechanical dredge. A projected dredging rate was established based on documented sediment depths and projected accumulation over a period of 30 years.
- Alternative 2 – Hydraulic dredging and placement at an annual rate comparable with mechanical dredging. This alternative assumes that hydraulic dredging would be utilized throughout the life of the project that would be performed at the same rates and schedules as the plan for mechanical dredging.
- Alternative 3 – Hydraulic dredging and placement at an accelerated annual rate to remove the backlog in a compressed timeframe. This alternative would restore navigation depths in the shortest period of time using hydraulic dredging, maintain at the same rates and schedules as mechanical dredging and provide for the CDF cap at an earlier date.

## Analysis of Dredging and Disposal Alternatives

- Alternative 4- Accelerated hydraulic dredging except for the TSCA materials, which would be dredged utilizing a mechanical dredge. This alternative was eliminated because the reduction in storage requirements was small as compared to the Alternatives 2 & 3, and a barge offloading facility would be required for offloading the mechanically dredged materials. The additional cost of the offloading facility was expected to make this alternative cost prohibitive as compared to the other alternatives.

### Alternatives Evaluation

To provide a technical, environmental, and economic basis for comparison of the alternatives, the following factors were considered in the evaluation:

- CDF height and area to contain the dredged material for the proposed methods and rates;
- Average and peak effluent flow rates for wastewater treatment;
- Storage volume requirements for flow equalization and storm water management;
- Relative volatile and particulate emissions from the CDF without emission controls; and
- Cost comparisons based on present worth.

### Major Findings

- Evaluation of volatile emission rates favored selection of Alternative 1. Volatile flux rates for 20% of the chemical constituents are significantly greater (more than 10%) under Alternative 3 than under Alternative 1, mechanical dredging. Volatile flux rates for the standard hydraulic dredging scenario would be expected to exceed the mechanical dredging alternative to a lesser extent. We will be performing volatilization studies to determine the magnitude of volatilization and evaluate any need for controls. Controls will be implemented if necessary.
- Evaluation of particulate emissions favored the selection of Alternative 3. The tendency for fugitive dust production (particulate emissions) during the dredging season may be about 1.5 times as large as fugitive dust production for accelerated hydraulic dredging. During the off season, the mechanical dredging alternative may generate about 1.6 times as much fugitive dust as accelerated hydraulic dredging because the sediment will be dry and exposed to the air. We will be performing particulate emission experiments and modeling to further refine this analysis and evaluate any need for controls. Controls will be implemented if necessary.
- Evaluation of the height of the CDF favored the selection of Alternative 1. Dikes would need to be 2 1/2 feet higher for Alternate 2 and 3 feet higher for Alternative 3 than for mechanical dredging.
- Evaluation of wastewater treatment plant capacity favored the selection of Alternative 1. Wastewater treatment plant capacity would need to increase from 200 gallons per minute for Alternative 1 to 2700 gallons per minute for Alternatives 2 and 3.
- Evaluation of costs favored the selection of Alternative 1. The present value of Alternative 1 is \$16,000,000 less than Alternative 2 and \$27,000,000 less than Alternative 3.
- Accelerated hydraulic dredging of backlog would shorten the project life by 6 years.

## **Analysis of Dredging and Disposal Alternatives**

- Acceleration is not possible for maintenance dredging since it would only be performed on the basis of sedimentation rates.
- Particulate emissions are more easily controlled than volatiles through use of such measures as vegetation cover and windscreens. A reduction of 90% or more in particulate emissions can be expected by utilizing an effective windscreen system or surface vegetative cover.

## **Selection of the Federal Standard (National Economic Development Plan) Alternative**

Corps of Engineers regulations require the selection of the alternative that provides the highest net benefits, meets good engineering standards and is environmentally sound. This alternative is referred to as the National Economic Development (NED) plan. The Project Delivery Team has recommended Alternative 1 of the Waterway Experimentation Station report as the NED alternative. The recommendation was made based on the following factors:

- Simple control measures will be used to ensure that particulate emissions fall below IDEM' Air Registration thresholds to control dust migration that was higher during both mechanical dredging activities and inactive periods. The level of reduction in particulate emissions would depend on several factors, among which are the type and height of screens and vegetations, and the percent coverage (i.e., depending on how seeds are distributed, on how well a selected plant will grow, etc.) We will be conducting planting studies to identify the most appropriate plant(s) to vegetate the CDF. A 90% or more reduction can be realistically expected for an effective windscreen system or surface vegetative cover.
- The recommended Alternative, mechanical dredging, results in lower volatilization than hydraulic dredging. Volatiles are more difficult to provide controls for.
- The Risk Analysis contained in the Environmental Impact Statement indicated that there was no significant environmental impact based on preliminary design contained in the Comprehensive Management Plan.
- Based on the above factors, Alternative 2 was eliminated because the additional cost of \$16,000,000 was not justifiable and no additional environmental benefit could be ascertained. Alternative 3 was preferred because it shortened the sediment exposure period.
- As between Alternatives 1 and 3, the determination was that Alternative 3 did not sufficiently minimize the exposure to particulate emissions to warrant an additional \$27, 000,000.

## APPENDIX B: WHAT IS TOSC?

The Technical Outreach Services for Communities (TOSC) program promotes community involvement in environmental decision-making through educational and technical assistance services, and is funded under a grant from the U.S. Environmental Protection Agency. TOSC is a national program (see [www.toscprogram.org](http://www.toscprogram.org)). This review has been conducted by the Michigan State University TOSC office, part of the Midwest Hazardous Substance Research Center. Participating universities include Purdue University, Michigan State University, Kansas State University, and the Virginia Polytechnic Institute and State University.

TOSC program services seek to build community understanding of site contamination problems and empower citizens and local government to participate more effectively in the decision-making process. TOSC faculty, working collaboratively with citizens, design educational workshops that address key questions and concerns. Additionally, TOSC reviews documents and provides professional guidance on site cleanup work. TOSC faculty members generally teach and conduct research in environmental engineering and sciences, hydrogeology, and toxicology.

TOSC is providing assistance in East Chicago pursuant to a request from the Grand Calumet Task Force and Citizens for a Clean Environment. For additional information on the IHC TOSC Project, please visit [www.tosc.msu.edu/grandcal](http://www.tosc.msu.edu/grandcal).

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