INDIANA HARBOR & CANAL AIR & WATER QUALITY MONITORING GUIDANCE DOCUMENT

Prepared For:

USACE Chicago District

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List of Acronyms

µg/hr	Micrograms per Hour
µg/m^3	Micrograms per Cubic Meter
ACGIH	American Conference of Governmental Industrial Hygienists
ArSLID	Aromatic Specific Laser Ionization Detectors
BACT	Best Available Control Technology
BMPs	Best Management Practices
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAA	Clean Air Act
CDF	Confined Disposal Facility
CDP	Cooperative Dredging Plan
CMP	Comprehensive Management Plan
COIs	Compounds of Interest
CWA	Clean Water Act
CWCCIS	Civil Works Construction Cost Index System
DDAA	Dredging and Disposal Alternatives Analysis
DDR	Design Documentation Report
DIAL	Differential Absorption Light Detection and Ranging
DOAS	Differential Optical Absorption Spectroscopy
ECI	Energy Cooperative, Inc.
ECWMD	East Chicago Waterway Management District
EDDs	Electronic Data Deliverables
EPP	Environmental Protection Plan
FAQs	Frequently Asked Questions
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
GCR	Grand Calumet River
HAPs	Hazardous Air Pollutants
IAC	Indiana Administrative Code
IAW	In Accordance With
IDEM	Indiana Department of Environmental Management
IHC	Indiana Harbor and Canal
IR	Infrared
L/min	Liters per Minute
LIDAR	Light Detection And Ranging
m/s	Meters per Second
m^2	Square Meters
m^3	Cubic Meters
m^3/min	Cubic Meters per Minute
MDLs	Minimum Detection Limits
MOU	Memorandum of Understanding
MWH	MWH Americas, Inc.
NAAQS	National Ambient Air Quality Standard

List of Acronyms (cont.)	
NAPL	Non-Aqueous Phase Liquids
NPDES	National Pollution Discharge Elimination System
NTUs	Nephelometric Turbidity Units
OAQ	Office of Air Quality
OMB	Office of Management and Budget
OP-FTIR	Open Path Fourier Transform IR
OSHA	Occupational Safety and Health Administration
PAC	Powdered Activated Carbon
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PM	Particulate Matter
ppb	Parts Per Billion
PUF	Polyurethane Foam
QA	Quality Assurance
QAM	Quality Assurance Manual
QC	Quality Control
RCOS	Registered Construction and Operation Status
RCRA	Resource Conservation and Recovery Act
REMPI	Resonance Enhanced Multi Photon Ionization
SIM	Selective Ion Monitoring
SIP	State Implementation Plan
SOPs	Standard Operating Procedures
SRA	Supplemental Risk Assessment
STAL	Short Term Action Level
TEEL	Temporary Emergency Exposure Limit
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act
TSP	Total Suspended Particulates
USACE	United Stated Army Corps of Engineers
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
VOCs	Volatile Organic Compounds
WWTP	Waste Water Treatment Plant

1.0 INTRODUCTION

1.1 Purpose

Barr Engineering Co., as a subcontractor to MWH Americas Inc. (MWH), was contracted to develop an Air and Water Quality Monitoring Guidance Document for future dredging and disposal operations at the Indiana Harbor and Canal (IHC) Confined Disposal Facility (CDF) under development by the US Army Corps of Engineers (USACE) Chicago District. This work was authorized under Contract W912P6-04-D-0004, TO #0008.

As stated in the scope of work, the objectives of the guidance document are:

- To provide an in-stream water-monitoring program that will monitor and verify that the dredging operation is not negatively impacting water quality downstream, consistent with NEPA regulations and guidance.
- To provide an air monitoring program for the dredging operation and for the CDF operation that monitors, notifies, and verifies the air quality at the CDF fenceline so that work is conducted in a safe and effective manner that minimizes impacts on the community, consistent with USEPA guidance for air quality impacts for remediation type projects and consistent with IDEM regulations for air quality.

The guidance document will be used by USACE as an aid for developing future budgets, specifications, and plans for dredging and facility operations. The guidance document will not be incorporated directly into any specifications or contracts. Monitoring plan implementation will be by USACE and their contractor(s). Prior to the beginning of any fieldwork, USACE will require each contractor to submit and implement an Environmental Protection Plan (EPP) consistent with applicable regulatory and permit requirements, and applicable portions of this Air and Water Quality Monitoring Guidance Document.

A summary of the monitoring identified herein, including the parameters to be monitored, frequency of sampling, action levels, reporting requirements and select details of the recommended equipment is given in **Table S-1**. This monitoring program will be reviewed periodically, minimum of annually, to determine if the requirements may be adjusted. This review could result in, for example, narrowing the scope of this plan, reducing the number and frequency of the contaminants monitored, or the elimination of sampling altogether.

1.2 Background Information

Indiana Harbor and Canal Site Location

Indiana Harbor is located in East Chicago, Lake County, Indiana as shown in **Figure 1-1**. It is on the southwest shore of Lake Michigan, 4.5 miles east of the Indiana-Illinois State line and 17 miles from downtown Chicago, Illinois. Indiana Harbor has an entrance channel and outer harbor protected by breakwaters, and an inner harbor. The inner harbor consists of the Indiana Harbor Canal and its two branches. The main channel extends from the lakeward E.J.&E. Railway Bridge to The Forks, a distance of 7,400 feet. Near The Forks, there is a small turning basin located on the southeast side of the canal about 600 feet lakeward of Canal Street. From The Forks, the Lake George Branch extends west for a distance of 6,800 feet and the Calumet River Branch extends south for about 2 miles where it joins the Grand Calumet River (GCR).

Confined Disposal Facility (CDF) Site Location

The CDF is located at the property known as the former Energy Cooperative, Inc (ECI) site approximately 2,000 feet west of The Forks on the Lake George Branch of the Indiana Harbor Canal. The ECI property is located within the City of East Chicago in Lake County, Indiana approximately 20 miles southeast of downtown Chicago, Illinois. A location map is provided as **Figure 1-1**. The project site is bordered by the Lake George Canal to the south, Cline Avenue to the north, Indianapolis Boulevard to the east, and the Amoco Oil Company Refinery to the west.

Previous Industrial Activity

Upstream of the E.J.&E. Railway bridge there are major terminal and transfer facilities located all along the main canal and the Calumet River and Lake George Branches. Most of the facilities were used in the past for handling cargoes via deep-draft vessels and barges serving Inland Steel and petroleum companies, such as Amoco, Citgo, Mobil, and Phillips. However, many of the petroleum company dock facilities are not being used at the present time.

The ECI property was the location of a petroleum products refinery from 1918 to 1981. The refinery operations included the production of mineral spirits, propane, leaded and unleaded gasoline, fuel oil, kerosene, asphalt and asphalt products, liquefied petroleum gas, grease, lubricating oils, paraffin wax, phenols, and sulfur.

In 1981, ECI filed for bankruptcy, and in the late 1980s, all the buildings and aboveground structures were razed in response to a court order. Several inches of clean topsoil were graded to cover the site. In 1989, the City of East Chicago became the owner of the site as payment for back taxes owed by ECI. In 1994, the East Chicago Waterway Management District (ECWMD) was formed and has been the property owner since.

Current Industrial Activity

There are three major sources that account for the sediment entering the IHC and GCR. They are municipal and industrial discharges, combined sewer overflows, and urban runoff.

The principal terminal and transfer facilities located along the IHC lakeward of the E.J.&E. Railway Bridge consists of five docks and related structures owned by MITTAL Steel. MITTAL Steel operates extensive iron ore docks along the canal immediately west of the E.J.&E. Railway Bridge. A wallboard manufacturer and a recycling company located in the Calumet Branch, as well as BP/Amoco also operate barge shipping in the IHC.

Current industrial activity within close proximity to the CDF site include the BP Products North America, Inc oil refinery to the north and tank farm to the west, and the Safety Kleen Oil Recovery Co. facility to the east.

Past Dredging Activity

Official Federal work began on the IHC in June of 1910 with selected authorized work listed in **Table 1-1**. Navigational dredging to maintain adequate depth has not been conducted in IHC since 1972 due to the lack of an approved economically feasible and environmentally acceptable disposal facility for the dredged material.

1.3 Indiana Harbor and Canal Dredging Program

In 1975, the Chicago District of USACE began to formulate an economically feasible and environmentally acceptable plan for disposal of dredged sediments from the IHC. The results of environmental studies and technical evaluations conducted in the course of developing a management plan for Indiana Harbor sediments are summarized in the Comprehensive Management Plan (CMP), the Design Documentation Report (DDR), the Disposal Alternatives for PCB-Contaminated Sediments from Indiana Harbor, Indiana, and the Indiana Harbor Canal (IHC) Dredging and Disposal Alternatives Analysis (DDAA). The sediments in the IHC are contaminated and not suitable for open water disposal in Lake Michigan, nor are they suitable for unconfined upland disposal or beneficial use. The DDR (USACE, 2000) was prepared to describe the design selected in the CMP (USACE and USEPA, 1999). A summary of these documents as well as additional historical documents are located in **Appendix A,** with the previous air monitoring reports located in **Appendix D**.

The selected plan is called the Cooperative Dredging Plan (CDP). The plan includes the construction of a CDF on a portion of the ECI property. The plan further provides for maintenance dredging of contaminated channel sediments by closed-bucket or environmental bucket mechanical dredging equipment with disposal of the dredged material in the CDF. Use of the proposed CDF will be limited to disposal of dredged materials from the IHC and other USACE-approved material. The details of the CDP are given in the DDR.

Implementing the CDP will result in emissions of particulate matter and volatile organic compounds (VOCs). The IDEM issued an air registration document that includes emission limits for particulate matter (PM) and VOCs, including hazardous air pollutants (HAPs). The USEPA prepared a risk assessment and a supplemental risk assessment for the CDF evaluating the emission limits in the IDEM air registration permit and found the "cancer health risk…is relatively low and below USEPA's established risk level" for nearby residents from the planned CDF (USEPA, 2006). Therefore, if the CDF is in compliance with the IDEM registration, the USEPA determined that the long term health risk to receptors will be below USEPA's established risk level. The primary objectives of this air-monitoring guidance document are to establish monitoring procedures and viable emission controls so that dredging/disposal operations are conducted within the limits stated by IDEM and USEPA, and that the CDF is being operated efficiently and in a safe manner for the surrounding community.

1.4 Regulatory Requirements and Permits

1.4.1 General

The ECWMD, the local project sponsor, presently owns the ECI site and provides the USACE, Chicago District, with authority to perform all activities necessary for the construction, operation, maintenance, or management of the CDF.

The ECI site is a Resource Conservation and Recovery Act (RCRA) facility. The site requires RCRA corrective action because soil and groundwater on site were contaminated from past industrial activities. A slurry wall has been constructed along the western, northern, and eastern boundaries of the site, and a sealed steel sheet pile wall will be constructed along the southern boundary of the site. A ground water gradient control system consisting of 88 extraction wells will be employed to maintain at least a two foot inward hydraulic gradient to prevent any adverse impacts to the surrounding groundwater. The site will be capped with an approved cap to complete the RCRA Corrective Action.

A portion of the CDF will be used for the disposal of Toxic Substances Control Act (TSCA)-regulated PCB contaminated sediments (greater than 50 ppm PCBs). The design and/or operational elements for the TSCA cell will require either a “coordinated approval” or a “risk-based approval” from the USEPA and will be completed during the TSCA permitting process.

The City of East Chicago regulates air emissions from sources within the city limits. Title 8.52.130 of the East Chicago Municipal Code regulates agitation or exposure of substances that could potentially scatter in the wind. The City of East Chicago also has specific requirements regarding control and reporting of emissions from the site. Regulations concerning air pollution are listed in Title 18 of the municipal code.

A Memorandum of Understanding (MOU) was developed and signed in 1999 and 2000. Partners include USEPA, USACE, ECWMD, and IDEM. In lieu of a RCRA Closure Plan, this MOU will serve to delineate the aspects of RCRA closure/corrective action requirements.

Additionally, TSCA, Section 402 of the Clean Water Act (CWA), and Facility Construction permits will be required.

Conformity provisions first appeared in the Clean Air Act (CAA) of 1977 and stated that no Federal agency could engage in, support in any way, or provide financial assistance for, license or permit, or approve any activity that did not conform to a State Implementation Plan (SIP) after its approval or promulgation. Section 176(c) [42 USC 7506c] of the CAA Amendments of 1990 expanded the scope and content. Specifically, the language requires that a Federal agency cannot approve or support an action that:

1. Causes or contributes to new violations of any National Ambient Air Quality Standard (NAAQS);
2. Increases the frequency or severity of existing violations of any NAAQS; or
3. Delays the timely attainment of any NAAQS or any required interim emission reductions or milestones.

The IDEM reviewed Appendix V of the CMP (General Conformity) for the air quality impacts during the development of the Air Registration. The IDEM Air Registration sets the limits on VOC and PM emissions, and the requirements for the monitoring and reporting of those emissions. Air emissions modeling has been done and will be used to estimate the emissions for a given year and to demonstrate compliance with the IDEM Air Registration. If the modeling indicates the potential to exceed the annual thresholds, modifications will be made to the operations plan(s). The Air Registration and modeling are discussed in greater detail in the following sections.

1.4.2 IDEM Air Registration

This Air Quality Monitoring Guidance Document is not specifically required under any law, regulation, or permit. However, operations at the site are subject to specific requirements regarding fugitive dust and VOC emission controls as specified in Title 326 of the Indiana Administrative Code (IAC). This section of the Indiana statutes requires any entity producing waste gasses or emitting particles into the air to obtain an air permit. The level of permit required depends on the "potential to emit" the various regulated pollutants. The hierarchy (from lowest to highest) of operating permits is:

- Exemption
- Registration
- Minor Source Operating Permit
- Federally Enforceable State Operating Permit
- Title V (major source) Operating Permit.

Due to the potential for the site to emit more than 5 tons per year of fugitive particulate matter, the IHC site falls into the "Registration" category and a permit application is required and was submitted to IDEM in accordance with 326 IAC 6 and 326 IAC 2 on February 22, 2002. A copy of the application is included in **Appendix B**.

Activities at the site will conform to the applicable terms and conditions of the finalized Registered Construction and Operation Status (RCOS), 089-15320-00471. The RCOS details requirements regarding fugitive dust controls and opacity limits for sources at the site, and regulates VOC emissions. The requirements for the IHC site are:

- Emissions of PM or VOC must not exceed twenty-five (25) tons per year, and
- Emissions of a single HAP must not exceed ten (10) tons per year, and
- Combined HAPs must not exceed twenty-five (25) tons per year.
- PM Emissions for paved and unpaved roads and parking lots, the average instantaneous opacity of fugitive particulate emissions shall not exceed ten percent (10%).
- In addition, for wind erosion from storage piles and exposed areas, the opacity of fugitive particulate emissions from storage piles or exposed areas shall not exceed ten percent (10%) on a six (6) minute average.
- In accordance with 326 IAC 8, VOC emissions at the site will be reduced using Best Available Control Technology (BACT). The IDEM Air Registration is included as **Appendix B**.

1.4.3 Air Emission Modeling

The IDEM registration requires annual emissions modeling of VOCs prior to commencement of dredging activities. The sediment characterization data for a given year, along with the dredging and CDF operational parameters, will be used in conjunction with the air emissions model described in the following sections to calculate the amount of emissions anticipated to be generated during each year of dredging, placement, and CDF operations.

The air emission modeling will involve the volatile compounds of interest, which will also be monitored and controlled.

The sediment dredging and handling will be performed while the sediment is wet, so particulate emissions from these operations will be negligible. Particulate emissions are probable at the CDF, where they have already been modeled (Hagen, L.J., 2005). Thus, the particulate emission focus is on monitoring and the effective use of emissions control measures.

1.4.3.1 Model Selection

The model selected by USACE for estimating VOC emissions is based on the theoretical algorithms developed by Dr. Louis J. Thibodeaux for application to dredging and dredged material placement. The USACE will review the air emissions model periodically to ensure that emissions are estimated using the best available methods.

The model consists of three individual modules that estimate emissions from the dredge, ponded sediment, and exposed sediment. The emissions estimates obtained from each of the three locations will be added to determine the total projected annual mass emissions for the site.

A discussion of the model development as well as a detailed description of the model can be found in the "Investigations on the Controlling Factors for Air Emissions Associated with Dredging of the Indiana Harbor Canal and CDF Operations" report (ERDC/EL TR-08-17), L.J. Thibodeaux, K.T. Valsaraj, R. Ravikrishna, K. Fountain, C. Price, U.S. Army Engineer Research and Development Center, Vicksburg, MS, 2008 report (USACE, 2008). At this time, the CDF modeling is undergoing further development with the most current draft released on March 19, 2007. The draft report and model are included in **Appendix C**.

1.4.3.2 Modeling Results and Discussion

Detailed emissions estimates will be submitted to the IDEM for review and will include:

- On an annual basis, predictive emissions estimates based on sediment sampling and the expected dredging and disposal volumes. These estimates will be reported at least 6 months prior to commencement of dredging.
- The actual in-situ dredged volumes of sediments placed in the CDF will be reported within thirty (30) days of the end of each calendar quarter in which dredging and placement took place.

If estimates of emissions indicate an exceedance of the annual emission thresholds is likely, then modifications to the dredging/placement operations will be incorporated to reduce the projected emissions to limits allowed by the RCOS. **Section 5.0** discusses possible air emission control measures. If during operation, the potential to emit VOCs is equal to or greater than ten (10) tons per year, an emission statement for the source must be submitted annually. Also, all contaminant related activities that result in air emissions shall cease if the Office of Air Quality (OAQ) determines that (a) During operation, emissions of PM or VOCs exceed 25 tons per year or more or (b) During operation, emissions of a single HAP exceed 10 tons per year or combined HAPs exceed 25 tons per year, or (c) During construction or operation, emissions pose an unacceptable risk to public health.

1.4.4 Water Quality

A Section 402 permit will be required and will be a combined Stormwater and National Pollution Discharge Elimination System (NPDES) permit. The NPDES permit will address discharge of all contaminated water from within the CDF and a separate storm water permit will be obtained for non-contaminated runoff from outside the CDF. Monitoring of surface water in the IHC for turbidity, and oil and grease will ensure that the water quality is not negatively impacted during dredging operations.

1.5 Monitoring Implementation and Plan Review

This guidance document will be used by USACE as an aid for developing future budgets, specifications, and plans for dredging and facility operations. Implementation will be by USACE and their contractor(s), who will develop necessary details including equipment installations; systems for data logging, management, and reporting; standard operating procedures; response actions and mitigation measures.

The monitoring program, in combination with the air monitoring data collected, will be reviewed by the operator and USACE on a regular basis to determine if any adjustments to the program need or can be made. A significant number of non-detects could result in, for example, the elimination of specific compounds monitored and a reduction in the frequency of sampling.

2.0 AIR MONITORING – SHORT TERM

The primary objectives of the air-monitoring guidance document are to establish monitoring procedures and viable emission controls to ensure that dredging/disposal operations are conducted within the framework developed by IDEM and USEPA, and that the CDF is being operated efficiently and in a safe manner for the surrounding community.

The purpose of short-term monitoring is to have data available so that site management can manage the daily operation of the CDF to avoid negative short term impacts to the surrounding area. The following sections will describe the means by which this objective will be accomplished. This monitoring program and the data collected will be reviewed periodically, minimum annually, to determine if the plan requirements can or should be adjusted. This review could result, for example, in the reduction of the list of contaminants and frequency of monitoring, or the complete cessation of monitoring activities.

2.1 Development of Short-Term Action Levels (STALs)

2.1.1 Particulate Emissions

The USEPA conducted a Supplemental Risk Assessment (SRA) in which the risk of exposure to particulate emissions from the CDF was evaluated. The SRA concluded that the estimated cancer risk evaluated for particulate matter emissions of 25 tons per year for adult and child exposure are below the level of 1.4 x 10-5 (1.4E-05; 1.4 in 100,000) that USEPA generally regards as a level with "no further concern.". This was the starting point to develop an STAL for site operations. The level of 25 tons per year was converted to the amount of particulate matter that could be allowed to emit continuously from the site per hour in micrograms. This calculation is as follows;

$$\frac{25\ tons}{year} \times \frac{year}{365\ days} \times \frac{day}{24\ hours\ (hr)} \times \frac{2000\ pounds\ (lb)}{ton} \times \frac{4.54 \times 10^{8}\ micrograms\ (ug)}{lb} = 2.59 \times 10^{9}\ ug/hr$$

The volume of air blowing across the CDF that would be carrying the particulate matter was then calculated. The cross-sectional area of the CDF was determined by taking the predominant wind direction (SSW) and the diagonal cross-sectional length of the CDF in meters and multiplying that by a height of 2 meters, the potential height of the air monitoring equipment, the height where the concentrations would be available to potentially impact the nearest receptors where less mixing is occurring (particulate emissions are inversely related to height) and approximate height of the human breathing zone, to determine an area that could be used to determine the concentration of particulate matter per cubic meter of air blowing from the site (2,090 m^2). A wind rose plot for five years (1987-1991) of on-site meteorological data, AMOCO TOWER Monitoring Site, IN obtained from Figure 5-1 of the USEPA SRA was used for the wind speed and directional information. The average wind speed of 3.89 m/s was used in the calculations. The volume of air crossing the site in one hour was calculated using the predominant wind direction (SSW), cross-sectional area, and the average wind speed. The concentration of particulate matter was obtained by dividing the mass of particulates emitted on hourly basis (2.59 x 10^9 µg/hr) by the volume of air crossing the CDF site. The airborne concentration is calculated to be 88.5 micrograms per cubic meter of air (µg/m^3).

$$\frac{2.59 \text{ x } 10^9 \ ug/hr}{2{,}090 \ m^2 \ \text{ x } \ 3.89 \ m/s \ \text{ x } \ \frac{3600 \ s}{hr}} = 88.5 \ ug/m^3$$

The calculated particulate concentration is greater than the particulate limit in the IDEM Air Registration Permit (Condition 3b) requiring property line emissions to be less than 50 µg/m^3 for total particulate above background for 60 minutes for CDF operations. The IDEM level of 50 µg/m^3 is an appropriate level to use as a real-time monitoring to demonstrate compliance with the IDEM air registration and is more stringent than the particulate concentration evaluated in the USEPA SRA. Therefore, the particulate matter STAL provides for the CDF operator to respond to conditions that may result in levels exceeding 50 µg/m^3 above background in 60 minutes if left unabated.

The continuous monitors are capable of averaging particulate measurements over user-specified intervals. The monitors will be set to record 15 minute averages with an alarm at 50 µg /m^3. A summary of CDF operator response actions for particulate matter is as follows:

- An initial 15-minute exceedance will trigger a heightened awareness of the air monitoring and an investigation into the source of the particulate emissions causing the exceedance; and
- The second 15-minute exceedance will activate emissions control measures as described in **Section 5.4.4**.

CDF operators therefore would have 30 minutes to respond to site conditions and apply appropriate particulate matter emissions controls (should background not be the source of the elevated measurements as determined by the method described in **Section 2.2**). The IDEM Air Registration has a limit of 50 micrograms/cubic meter for one hour and the proposed response times give the operator ample warning to employ control measures. No action would be required if the exceptions given in 326 IAC 6-4-6 (i.e. adverse meteorological conditions 326 IAC 6-4-6 (6)) are met.

2.1.2 Naphthalene Emissions

The USEPA SRA assumed that the CDF would emit 25 tons per year of total HAPs. The SRA conservatively assumed that all 25 tons of HAPs would be naphthalene, which is the most significant HAP to be emitted, rather than the IDEM regulatory limit of 10 tons per year of an individual HAP (i.e. naphthalene). Additionally the SRA assumed that the 25 tons of Naphthalene would be emitted over a seven-month period from May 1st to November 30th for 30 years. As a result, the SRA evaluated chronic exposure for off-site receptors and acute exposures for the inhalation pathway.

The SRA deemed the risk to be acceptable as long as the facility remained in compliance with the air registration at the 25 tons per year emissions rate. Twenty-five tons of Naphthalene emitted uniformly over the course of 7 months would average 150 µg/m^3 per 24-hour period (above background) at the top of the dike surrounding the CDF, based on a 5-year average site wind speed of 3.89 m/sec. No action is required for the CDF operator if the average naphthalene concentration is less than 150 µg/m^3 per 24-hour period at the top of the dike.

USACE performed air dispersion modeling to estimate concentrations in the surrounding community associated with this action level. The latest version of USEPA's SCREEN3 model was used to screen single sources for potential worst case pollutant levels. Results of this modeling, under multiple different scenarios, indicated concentrations in the surrounding community that are less than those determined to be acceptable in the SRA. The conclusion is that the STAL of 150 $\mu g/m^3$ per 24-hour period at the top of the dike is appropriate for use during the CDF operation monitoring.

Two additional action levels were developed for naphthalene to allow for a "tiered" operator response to ambient concentrations: a 5-day STAL and a maximum "cease disposal activities" STAL.

A maximum Naphthalene action level was developed for the CDF operator to immediately cease CDF disposal activities. The SRA based the acute inhalation exposure for naphthalene on the Temporary Emergency Exposure Limit (TEEL), mild, transient health effects threshold (TEEL-1, 15 parts per million (ppm), 78,645 $\mu g/m^3$). The TEEL was developed by the United States Department of Energy (USDOE) and is an assessment of risk to the general population including people more susceptible to chemical exposures. However, this value is for emergencies (15 minute exposure) and is similar to the American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Value (TLV) for workers exposed to Naphthalene; Therefore, a more conservative threshold was selected, TEEL-0, no adverse health effects threshold (10 ppm, 52,430 $\mu g/m^3$). An additional safety factor of 10 was applied to the TEEL-0 to obtain a "1-hour maximum" Naphthalene action level of 5,000 $\mu g/m^3$.

In addition, the SRA evaluated acute inhalation risks using a hazard quotient. The hazard quotient is the highest predicted 1-hour air concentration divided by the TEEL-1 concentration. The SRA states that a hazard quotient less than or equal to 1 is considered health protective. The hazard quotient for the maximum Naphthalene action level is:

$$\frac{5{,}000}{78{,}645} = 0.06$$

The hazard quotient for the maximum Naphthalene action level is below 1. The general interpretation of a hazard quotient is that a value of less than or equal to 1 is considered health protective.

In order to provide adequate CDF operator response time, a 5-day STAL was also developed incorporating the hazard quotient obtained from the maximum Naphthalene limit:

$$(5000)(0.06) = 300$$

For development of the 5-day action level, the maximum Naphthalene limit was applied in place of the TEEL-1 since the site will cease CDF disposal activities if a 1-hour concentration of 5,000 µg/m^3 is detected on the CDF air monitors. In keeping the hazard quotient at 0.06, the 5-day action level is 300 µg/m^3. The CDF operator is required to take action if the average 24-hour real-time air monitor Naphthalene concentration is greater than or equal to 300 µg/m^3 (above background) for 5 consecutive days.

A summary of CDF operator response actions for Naphthalene action levels is as follows:

- <u>24-hour Action Level</u> = 150 µg/m^3 (24-hour average) - If the project emissions are less than 150 µg/m^3 above background over a 24-hour period, no action is required. If the emissions are greater than 150 µg/m^3 above background, the CDF operator is required to monitor emissions over the next 5 days to confirm the emissions do not approach or exceed 300 µg/m^3 above background.
- <u>5-day Action Level</u> = 300 µg/m^3 (24-hour average) - If the project emissions are 300 µg/m^3 above background for 5 consecutive days, the CDF operator is required to implement emissions control measures as described in **Section 5.0**.
- <u>1-Hour Maximum Action Level</u> = 5,000 µg/m^3 (1-hour maximum) - if the CDF emissions reach 5,000 µg/m^3 above background, the operator is required to cease CDF disposal activities, provided all other control measures have been implemented.

2.2 Response Action Levels

To identify site-generated emissions, wind direction data will be used to determine the appropriate upwind and downwind real-time monitors for comparison. Because short-term equipment cannot be easily started and stopped, they will run continuously, while the meteorological wind direction data will indicate which samplers are upwind and downwind at any given time, allowing for the subtraction of upwind concentrations from downwind values. This upwind/downwind designation will only be used qualitatively to determine if an action level is being approached or reached due to site emissions or by off-site sources. The action level of an operator's response should be applied in proportion to the concentration and duration of the observed emission, and may include, but are not limited to:

- Notification of USACE
- Increasing air sampling,
- Recalibrating equipment,
- Adjusting the slurry sediment/water ratio (to decrease the suspension and dissolution of contaminants, and minimize their mass transfer to the air),
- Increasing emission control measures at the CDF (i.e. physical or chemical covers),
- Deploying contingency controls like activated carbon slurries or temporary covers over high emitting areas, or
- Temporarily ceasing dredging and disposal activities.

Possible emissions control measures are further described in **Section 5.0**. The operator shall prepare contingency response action plans for USACE review prior to beginning operations and the plans shall be updated annually or as necessary thereafter.

2.3 Locations of the Sampling Stations

The primary goals in establishing the sampling locations are to position the stations to obtain accurate upwind and downwind emissions, and to position the stations between the emission sources and potential receptors. In establishing locations for the network of sampling stations, the following elements were considered:

- Public exposure points were used to identify locations near the CDF where residential, commercial, or other sensitive receptors could be expected;
- Potential sources of emissions that need to be monitored will be bracketed upwind and downwind;
- Existing site-specific meteorological data collected from 2002 through 2007 were reviewed to identify prevailing wind directions at different times of the year; and
- The availability of the utilities and ease of access were considered for practical reasons.

Receptors that could be possibly affected by air emissions from the dredging activities in the IHC include workers at the MITTAL Steel USA, Inc, the BP/Amoco Refinery, and the Safety Kleen Oil Recovery Company. Each of these facilities is believed to operate under Occupational Safety and Health Administration (OSHA) and Right-to-know environments where they are trained for and monitored for exposure to the same air pollutants expected from the CDF.

Selected residential areas were identified as possible receptors based on their distance and direction from the CDF site. The residential areas are identified, along with approximate distances and directions, and the municipalities where they are located are given in **Table 1-2**. These areas are also illustrated in **Figure 1-2**. Since the site will be secured, the potential pathways that apply to individuals living within these areas include:

- Inhalation of volatile contaminants and particulate contaminants,
- Incidental ingestion of soil containing deposited contaminants,
- Incidental dermal contact with contaminants in off-site soil, and
- Ingestion of contaminants incorporated into produce from a home vegetable garden that contains particulates from the site.

In addition to the residential areas, two schools were identified as possible receptors:

- West Side Junior High, and
- East Chicago Central High School.

Both schools are located approximately the same distance and direction from the CDF (0.25 mile south of the CDF at the intersection of Indianapolis Blvd. and Columbus Dr.), and are illustrated in **Figure 1-2**. Due to the proximity of the two schools, they are combined into a single location for the purpose of this monitoring plan.

Three locations were identified that could potentially cause elevated emissions: the CDF, including the TSCA cell, the barge offloading berth, and the area immediately surrounding the active dredge.

Meteorological data collected from an on-site station from May 2002 through April 2007 was evaluated to determine prevailing wind conditions at the CDF. When viewing the data on an annual basis, there appears to be a slight prevailing wind from the south-southwest. Analyzing the data on a monthly basis gave the following:

- January – Prevailing wind from the WSW,
- February – Prevailing wind from the WSW,
- March – Prevailing wind from the SW and, to a lesser extent, the NNE,
- April – Prevailing wind from the NNE,
- May – No Prevailing wind,
- June – Prevailing wind from the SSW and, to a lesser extent, the NNE,
- July – Prevailing wind from the SSW and the NNE,
- August – Prevailing wind from the NNE and the SSW, and
- September – Prevailing wind from the South,
- October – Prevailing wind from the SW,
- November – Prevailing wind from the SW, and
- December – Prevailing wind from the SW.

The wind roses and meteorological data are given in **Appendix E**.

The availability of utilities and ease of access was not a limiting factor in the selection of the location of the monitoring stations. Four sampling locations, in addition to the existing location at the East Chicago Central High School, will be established to evaluate and document short-term emissions from the CDF. The locations of the sampling stations are shown in **Figure 4-1**.

2.4 Pre-Dredge Baseline Monitoring

Background monitoring was and is being performed by USACE. Continuous short-term baseline monitoring for Compounds of Interest (COIs) and PM will be conducted for at least 14 days prior to the start of any on-site dredging or CDF operating activities. The method for the continuous monitoring is described in **Section 2.5**.

2.5 Real-Time Air Monitoring of COI Emissions

Based on the results of the Draft CDF Volatile Emissions Modeling (March 19, 2007), which identified naphthalene as the VOC with the highest emissions (>70% of the total VOCs), the selection of naphthalene for risk modeling in the USEPA SRA, the relatively high volatility of naphthalene, and availability of naphthalene monitoring equipment, naphthalene was selected as the most appropriate indicator compound for real-time monitoring. Technologies considered for continuous monitoring of COIs are described below.

There are several characteristics that the "ideal" monitor would have primary of which are detection limit, robustness, and ease of data interpretation. The selected monitor would have to have a detection limit low enough to be useful for the action levels developed, ability to work in the sometimes harsh environment of the location, and produce results that are easy enough to read in order to respond quickly enough to eliminate or reduce impacts of elevated emissions. The advantages and disadvantages of each system are summarized in **Table 5-1** with budgetary costs discussed in **Section 2.7** and shown in **Table 5-2** and **Table 9-1**. If technically and economically feasible, a mobile monitor may also be included to assist in identifying sources of emissions, or to investigate off-site questions raised by neighbors.

2.5.1 Differential Optical Absorption Spectroscopy (DOAS)

DOAS is a method to determine concentrations of trace gases by measuring their specific narrow band absorption structures in the infrared (IR), ultraviolet (UV), and visible spectral ranges. A typical DOAS instrument consists of a continuous light source and an optical setup to send and receive the light through the atmosphere. The typical length of the light path in the atmosphere ranges from several meters to many kilometers.

A UV-DOAS system uses a broad-band light source, i.e. Xenon, which projects a narrow beam of light across a monitoring path ranging from 1 to 1000 meters in length. The receiver telescope focuses the light into a quartz fiber optic cable that connects to the DOAS analyzer. The system can provide path-averaged measurements from the light source to the receiver. In most systems, two temperature signals are logged through the signal unit: the temperature of the calibration cell and the ambient air temperature. The temperature values are used to normalize the data, which are stored in the analyzer and can be extracted directly or are available on a separate computer that connects to the system.

IR-DOAS systems use a high-frequency IR flash source to detect hydrocarbons. The flash source projects a wavelength (specific for the type of gas to be measured) to the detector over an unobstructed line of sight. The beam is attenuated when the target gas traverses it at any point along its path. The detector measures the amount of attenuation by means of two narrowband sensors and compares this information to a third reference sensor that is not affected by the subject gas or environmental factors.

The UV- and IR-DOAS systems can be factory calibrated to any of the compounds in their library.

2.5.2 Open Path Fourier Transform IR (OP-FTIR)

OP-FTIR spectroscopy can be used with on-site meteorological data to provide on-going assessment of action-level compliance, in real-time, over a virtually unlimited line of sight. OP-FTIR is able to provide simultaneous analysis of up to several dozen gaseous contaminants. The technology is identical in principle to classical laboratory FTIR spectroscopy, except the cell into which a sample would be injected is extended to the open atmosphere. A beam of light spanning a range of wavelengths in the near IR portion of the electromagnetic spectrum is propagated from the transmitter portion of the instrument. In the most common configuration, a "retroreflector", comprised of an array of corner-cubed mirrors, is positioned to intercept this radiation and redirect it back upon itself to the receiver portion of the instrument. Contaminants of concern are identified and quantified via a computer-based spectral search involving sequential, compound specific analysis and comparison to the system's internal reference spectra library.

This observed contaminant burden is normalized to a pathlength of one meter. One-way pathlength can range from less than 10 meters to several hundred meters or more. Path-averaged minimum detection limits (MDLs) are generally in the single digit ppb range based on a pathlength of 100 meters.

No calibration is required as the instrument is intrinsically calibrated. Only daily precision and accuracy assessments need to be made in accordance with procedures set forth in Toxic Compendium Method TO-16.

2.5.3 Differential Absorption Light Detection and Ranging (DIAL)

The operating principle of all uses of Light Detection And Ranging (LIDAR) is a laser operated in the UV, visible, or IR wavelength range that is transmitted towards a target. The light interacts with the target where it is either absorbed or reflected/scattered back to a measuring device.

DIAL is used to measure chemical concentrations in the atmosphere. A DIAL uses a laser wavelength that is strongly absorbed by the target compound and a second nearby wavelength that is not absorbed. The difference in the intensity of the two return signals can be used to calculate the concentration of the compound being investigated. The laser can be transmitted as a continuous wave or pulsed source. Tunable laser systems are available that allow for quickly changing wavelengths of interest to measure a wider range of contaminants.

Unlike FTIR or UV-DOAS, DIAL produces a measure of discrete concentrations versus distance along the line of the shot. This allows for the shot values to be superimposed on a map or other visual aid to show where low and high point concentrations are occurring. A series of closely placed shots over a sight can be plotted as an isopleth map that will clearly indicate hotspot emission areas. In addition to more specific chemical detection, a DIAL system can be used in a more “open” mode much like a point source organic vapor analyzer. In this mode, a chemical family such as alkanes is measured by picking a band that is common to many and interpreting the results as an “average”.

2.5.4 Raman Spectroscopy

An open path Raman spectroscopy-based sensor uses an intense monochromatic light source and detectors to measure a portion of the light that is scattered inelastically from the analyte molecule. The instrument can provide an average concentration over the distance measured or in LIDAR configuration, the concentrations at specified distances.

Raman spectroscopy is a form of vibrational spectroscopy that relies upon the change in polarization of a molecular bond that occurs when electromagnetic energy interacts with the bond. The incoming photon interacts with the molecule and induces a dipole moment that in turn radiates a photon when it decays. Raman spectroscopy usually measures the Stokes shifted photons since they constitute the strongest signal.

Unlike infrared spectroscopy, the Raman technique is not affected by chemical species that can “swamp-out” infrared systems, such as water, water vapor, and carbon dioxide. Raman spectroscopy can have problems with interference from fluorescent molecules that are often present in the environment. There are, however, methods that will overcome fluorescent interference while maintaining a strong Raman signal.

2.5.5 Aromatic Specific Laser Ionization Detectors (ArSLID)

The ArSLID is based on the spectroscopic technique referred to as resonance enhanced multi photon ionization (REMPI). In the REMPI process, molecules with one or more aromatic rings can absorb ultraviolet photons to become electronically excited. This excitation is caused by a laser and then detected in the ArSLID. It is very sensitive to naphthalene and much less so to the always present toluene, and benzene.

Field and laboratory tests show that it is reliable, conservative (consistently reported higher total ArSLID values than polyurethane foam samples taken at the same time and analyzed in the lab for naphthalene), insensitive to humidity, and functional in cold weather. The ArSLID demonstrated its reliability at the St. Louis River/Interlake/Duluth Tar Superfund site in Duluth, MN with a 95% uptime during a capping event in the Fall of 2004 and a greater than 90% uptime during remediation activities in the Summer of 2006. Its detection limit is in the low ppbv range on an average hourly basis. The output can be hour-averaged and transmitted in real time via the on-site telemetry system to a computer and uploaded to the project website. The ArSLID unit can be combined with a field gas chromatograph (GC) to speciate the aromatics and isolate naphthalene. This lowers the detection limit to about one ppbv, but makes it more difficult to operate continuously. A mobile ArSLID GC combination could be included to assess the portion of the total aromatics that is truly naphthalene.

2.5.6 Recommendation

It is recommended that an UV-DOAS system, such as the UVSentry Gas Analyzer supplied by Cerex Monitoring Solutions, LLC., be selected for the IHC project based on capital and operating costs, detection limits, path length, and ability to operate in the expected environment. This system is solely for the continuous monitoring of one VOC, naphthalene, which is an indicator compound for volatile emissions. The concentration of naphthalene measured by the UV-DOAS will be compared to the action levels described in **Section 2.1** to ensure that volatile emissions will not cause an acute inhalation risk to the surrounding environment and community.

2.6 Real-Time Air Monitoring of Particulate Emissions

A comparison of each system is presented in **Table 5-3** with budgetary costs discussed in **Section 2.7** and shown in **Table 9-2**. If technically and economically feasible, a mobile monitor may also be included.

2.6.1 Thermo Scientific Model 5030

The Model 5030 SHARP Monitor implements the fast response of light scattering photometry and the accuracy of beta attenuation allowing for a measurement of particulates that is fast, accurate, and sensitive. The Model 5030 provides continuous, real time readings by reporting data in one-minute averages. It is reported to have greater than 99% data availability. The Model 5030 provides an hourly detection limit of 0.5 $\mu g/m^3$.

Other features of the Model 5030 are automatic filter changes that occur every three hours, with filter rolls that require replacement only twice per year. The Model 5030 also controls the humidity of the sample air, which can affect the quality of data. A moisture control system regulates internal humidity through a heating system linked to a relative humidity sensor. By measuring the relative humidity of incoming air, the system heats only when necessary to eliminate moisture effects.

2.6.2 Thermo Scientific Model FH 62 C14 Series

The FH 62 C14 Continuous Ambient Particulate Monitor measures the mass concentration of suspended particulate matter by use of beta attenuation. In addition, the ambient influence of natural Radon gas is measured as a refinement step toward better sensitivity at lower ambient particulate concentrations.

The FH 62 C14 has the capability of storing half-hour averages for up to a year with user-selected reporting of mass concentration based on the standard or actual flow rate. The FH 62 C14 is insensitive to vibration and diurnal temperature fluctuations. The FH 62 C14 has a detection limit of < 1 μg/m^3 for a 24-hour average and < 4 μg/m^3 for a one-hour average.

2.6.3 Thermo Scientific TEOM Series 1400ab

The Series 1400ab monitor measures the ambient particulate mass concentration by using a tapered element oscillating microbalance, which is a patented inertial mass measurement technique for making a direct measurement of the particle mass collected on a filter in real time.

The instrument has the USEPA equivalency designation for PM-10 as EQPM-1090-079, and is used extensively by the USEPA and state air monitoring organizations for continuous PM-2.5 monitoring as a correlated acceptable continuous monitor.

The time resolution of the Series 1400ab Monitor allows users to identify episodes and determine trends in real time with concentrations reported in μg/m^3 at standard averaging times of 10 min., 30 min., 1, 8, and 24 hours. Exposed collection filters can be analyzed for heavy metals using standard laboratory techniques.

2.6.4 Thermo Scientific Model ADR-1200S

The Model ADR-1200S is a particulate monitoring system designed for outdoor, continuous, unattended monitoring providing real-time data transmission to a central location and/or internal data logging.

The ADR-1200S incorporates light scattering photometry sensing technology giving long-term, precise, and driftless measurements of airborne particulate matter concentrations down to 1 μg/m^3.

2.6.5 Environmental Devices Corp. HAZ-DUST EPAM-5000

The EPAM-5000 is a portable microprocessor-based particulate monitor suitable for ambient, environmental, and indoor air quality investigations. Highly sensitive, this monitor uses light scattering to measure particulate concentration and provide immediate real-time determinations and data recordings of airborne particle concentration in mg/m^3. Sample for up to 24 hours on one battery or continuously using a supplied AC power transformer and store up to 15 months of monitoring data. Data can be downloaded to and stored on a PC for further analysis using DustComm Professional Software with generation of management-ready reports capability. The EPAM-5000 has a sensing range of 1 – 20,000 μg/m^3 with a precision of 3 μg/m^3.

2.6.6 Met One Instruments, Inc., E-BAM Mass Monitor

E-BAM automates particulate measurement by continuously sampling and reporting particulate concentration, data is updated every second, and data records updated every minute. The E-BAM may be supplied with TSP, PM-10, PM-2.5, or PM-1 inlets for size selectivity. E-BAM is a lightweight portable instrument that operates directly in hostile environments without exterior enclosure and is easily installed in less than 15 minutes.

The E-BAM has sensing range of 0 – 10,000 μg/m^3 with an accuracy of 2.5 μg/m^3 in a 24-hour period. Advanced communication options include cellular phone, line-of-sight radio, and satellite. The E-BAM can be powered by AC, battery, or solar panels.

2.6.7 Met One Instruments, Inc., BAM-1020 Mass Monitor

The BAM-1020 is a beta attenuation mass monitor that may be equipped with a sharp cut cyclone PM-2.5 or a WINS PM-2.5 sampling inlet for monitoring of finer particulate matter. The BAM-1020 can also be configured for the monitoring of TSP. The mass density is measured with a small beta source coupled to a sensitive detector that counts the emitted beta particles. As the mass deposited on a filter increases, the measured beta count is reduced according to a known equation.

Reliable, accurate measurements are assured with automatic zero and span calibration conducted each cycle. The BAM-1020 can be configured for various sensing ranges from 0 – 10,000 $\mu g/m^3$ with detection limits of 1 $\mu g/m^3$ on 24 hours and 5 $\mu g/m^3$ on one hour.

2.6.8 Met One Instruments, Inc., E-SAMPLER

The E-SAMPLER is a dual technology instrument that combines the real-time measurement of light scatter with the accuracy of standard filter methods. The E-SAMPLER provides real time particulate measurement through near-forward light scattering and filters can be removed for laboratory analysis. The E-SAMPLER is rugged, portable and easy to use. The unit can be fastened to any structure.

The E-SAMPLER has auto-zero and auto-span functions to ensure that the data collected will be of the highest quality. Both functions can be operated manually or individually programmed at varying time bases. The E-SAMPLER has auto-ranging capabilities with a sensing range of 0 – 100,000 $\mu g/m^3$, a sensitivity of 0.1 $\mu g/m^3$, and a precision of 0.003 $\mu g/m^3$.

2.6.9 Turnkey Instruments Ltd TOPAS

The TOPAS fixed station monitor is intended for long term installation. Several sites can be networked together to form a site-wide monitoring system. Sites can be connected by radio, modems, or fixed wiring and are controlled by a central PC with optional alarm annunciators.

The measurement range of the TOPAS is 0 – 6000 $\mu g/m^3$ with a detection limit of 0.01 $\mu g/m^3$.

2.6.10 Turnkey Instruments Ltd OSIRIS

The OSIRIS fixed station monitor is designed to study short or long term hotspots. The OSIRIS can be powered either by mains or 24 hour plus battery pack. The instrument can be used effectively to determine exceedance areas.

The measurement range of the OSIRIS is 0 – 6000 $\mu g/m^3$ with a detection limit of 0.01 $\mu g/m^3$.

2.6.11 Recommendation

Based on its detection limit of 0.5 μg/m^3, selectable alarm level, capital and operating cost, and ability to operate in the temperature range to which it will be exposed; it is recommended that the Thermo-Scientific Model 5030 be selected as the real-time PM monitor. Monitoring data collected will be reviewed periodically, minimum annually, to determine if the plan requirements can or should be adjusted. This review could result, for example, in changes to the monitoring equipment and technologies and in the list of contaminants, reductions in the frequency of monitoring, or the elimination of monitoring altogether.

2.7 Short Term Air Monitoring Cost Analysis

Planning-level cost estimates were prepared to provide an economic basis for comparison of the real-time monitoring alternatives for VOCs and PM. These cost estimates include:

- The capital costs for the purchase of the required number of monitors,
- Any required software,
- An estimate of the annual operating costs, and
- An estimate of any annual factory maintenance and calibration.

These cost estimates do not represent complete project cost estimates, only a Benefit/Cost Ratio for the selection of equipment. It should be noted that the costs do not include all the labor costs for maintaining and operating equipment, data processing and data evaluation labor, etc. The actual costs for a complete monitoring operation will be higher than this. A comparison is given in **Table 5-2** and **Table 9-1** for COI monitors and in **Table 5-3** and **Table 9-2** for PM monitors. Capital costs were estimated for the following items for which significant differences were anticipated between the alternatives under consideration:

- COI Emissions
  - Differential Optical Absorption Spectroscopy (DOAS)
  - Open Path FTIR (OP-FTIR)
  - Differential Absorption Light Detection and Ranging (DIAL)
  - Raman Spectroscopy
  - Aromatic Specific Laser Ionization Detectors (ArSLID)

- Particulate Emissions
  - Thermo Scientific Model 5030
  - Thermo Scientific Model FH 62 C14 Series
  - Thermo Scientific TEOM Series 1400ab
  - Thermo Scientific Model ADR-1200S
  - Environmental Devices Corp. HAZ-DUST EPAM-5000
  - Met One Instruments, Inc., E-BAM Mass Monitor
  - Met One Instruments, Inc., BAM-1020 Mass Monitor
  - Met One Instruments, Inc., E-SAMPLER
  - Turnkey Instruments Ltd TOPAS
  - Turnkey Instruments Ltd OSIRIS.

Costs were then converted to present value, taking into account the year in which expenditures will occur and the applicable federal discount rate. The discount rate is established by the Office of Management and Budget (OMB) for federal projects and is presently 4.78%. The present value formula is:

$$PV = \frac{V1}{(1+i)^\wedge 1} + \frac{V2}{(1+i)^\wedge 2} + \frac{V3}{(1+i)^\wedge 3} + \ldots\ldots + \frac{Vn}{(1+i)^\wedge n}$$

All costs developed in this section will be escalated to the year of execution using USACE Channels and Canals escalation values from the Civil Works Construction Cost Index System (CWCCIS) dated 30 March 2007, USEPA 540-R-00-002 guide, and OMB Circular A-94. Budgetary costs for the real-time COI and PM monitoring were developed to aid in the selection of monitoring equipment. Costs for the first ten years of long-term ambient air monitoring were also calculated, including sample analysis costs. These estimates are discussed in the following sections and are shown in **Tables 9-1** through **9-2**.

2.7.1 Initial (First Year) Cost

The estimations for the initial costs for real-time COI monitoring ranges from $197,500 for the SafEye 227 monitor to $2,570,000 for the LIDAR system. The cost estimates include equipment purchase and setup, and the O&M for each system. The cost analysis for the COI monitoring is presented in **Table 9-1**.

Estimates were developed for the PM monitors in the same manner as for the COI monitoring and are shown in **Table 9-2**. The costs for the PM monitors range from $105,000 for the EDC HAZ-DUST EPAM5000 to $201,000 for the ThermoScientific TEOM 1400ab.

2.7.2 Projected Annual Cost for Years 2 – 10

Annual O&M costs for each of the monitoring systems were projected out for the first ten years of the project life. These are budgetary estimates only and more detailed and accurate costs will be developed for the selected system. As a rule of thumb, costs should be reviewed every two or three years to ensure accuracy.

The Present Value, including the initial costs, of the COI monitoring systems for the first ten years of operation range from $1,071,000 for the UVSentry system to $5,791,000 for the LIDAR system. A detailed year-to-year breakdown for each system is shown in **Table 9-1**.

The Present Value, including the initial costs, of the PM monitoring systems for the first ten years of operation range from $718,000 for the ThermoScientific Model 5030 and Met One Instruments BAM1020 systems to $1,070,000 for the ThermoScientific TEOM 1400ab system. A detailed year-to-year breakdown for each system is shown in **Table 9-2**.

3.0 AIR MONITORING – LONG-TERM

The purpose of long-term monitoring is to provide a continual database of air monitoring data during the dredge disposal phase. To date, the air quality via long-term monitoring has been generated for background (both pre-site construction activities and between site construction activities) and during construction of the CDF. After a 2 to 3 year initial CDF operational period, the air monitoring will be re-evaluated. Compounds that are not detected could be eliminated from the monitoring list. After sufficient data are collected for statistically meaningful analysis, the air program requirements will be fully re-evaluated to determine the need for and goals of continued air monitoring. Long-term monitoring will be used to show that the surrounding community is not adversely impacted from the CDF emissions, and to confirm that the CDF is being operated efficiently to minimize emissions. Emissions modeling (as discussed in **Section 1.4**) will be used to demonstrate compliance with the IDEM Air Registration. Based on the results of the USEPA SRA, which identified naphthalene as the VOC with the greatest risk, the relatively high volatility of naphthalene (>70% of the total VOCs), and availability of naphthalene monitoring equipment, naphthalene was selected as the most appropriate indicator compound for real-time monitoring.

Due to the transient nature of dredging, the relatively short dredging season, and the wet environment of the dredged material; long-term monitoring for VOC and fugitive PM emissions is not appropriate for dredging operations. Long-term monitoring will be conducted for CDF operations only.

The IDEM Air Registration has established annual standards of 25 tons per year for Total VOCs and 10 tons per year for any individual hazardous air pollutant (HAP). Monitoring for every conceivable VOC is extremely difficult and cost prohibitive. Therefore, USACE provided a list of COIs that will be monitored and tracked. The COI list includes the parameters currently monitored by USACE. These compounds were selected by USACE based on concentration in the Indiana Harbor and Canal sediment, relative toxicity of the compounds, and on the relative contribution to health impacts to the local community if emitted. The following is a list of those COIs:

<u>PAHs</u>

Acenaphthene

Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Benzo(e)pyrene
Benzo(ghi)perylene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-c,d)pyrene
Naphthalene
Phenanthrene
Pyrene

VOCs
Benzene
Ethylbenzene
Toluene
Xylenes, Total
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene

PCBs
Total PCBs

Metals

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Nickel
Selenium
Silver
Thallium
Vanadium

Zinc

3.1 Long-Term Action Levels

The IDEM Air Registration has set ambient air emission standards of 25 tons per year for PM, and 25 tons per year for total VOCs, and 10 tons per year for individual HAPs. If modeling results indicate an exceedance of one or more annual emission threshold is likely, modifications to the dredging and placement operations will be incorporated to reduce the projected emissions to allowable levels. **Section 5.0** discusses possible air emission control measures. Operational procedures incorporated into the modeling to control emissions will be implemented during field operations.

The long term monitoring data will be used to evaluate trends to make adjustments / revisions to the monitoring plan (if necessary). Compliance with the IDEM registration limits will be demonstrated with the Thibodeaux emissions model; however the short-term particulate monitoring will demonstrate compliance with the 50 $\mu g/m^3$ hourly particulate matter limit.

3.2 Locations of the Sampling Stations

Locations of sampling stations for long-term monitoring were selected on the same basis as was used for locating short-term monitoring stations.

The primary goals in establishing the sampling locations are to position the stations to obtain accurate upwind and downwind emissions, and to position the stations between the emission sources and potential receptors. In establishing locations for the network of sampling stations, the following elements were considered:

- Public exposure points were used to identify locations near the CDF where residential, commercial, or other sensitive receptors could be expected;
- Potential sources of emissions that need to be monitored will be bracketed upwind and downwind;
- Existing site-specific meteorological data collected from 2002 through 2007 were reviewed to identify prevailing wind directions at different times of the year; and

- The availability of the utilities and ease of access were considered for practical reasons.

Receptors that could be possibly affected by air emissions from the dredging activities in the IHC include workers at the MITTAL Steel USA, Inc. and the Safety Kleen Oil Recovery Company. Each of these facilities is believed to operate under OSHA and Right-to-know environments where they are trained for and monitored for exposure to the same air pollutants expected from the CDF.

Selected residential areas were identified as possible receptors based on their distance and direction from the CDF site. The residential areas are identified, along with approximate distances and directions, and the municipalities where they are located are given in **Table 1-2**. These areas are also illustrated in **Figure 1-2**. Since the site will be secured, the potential pathways that apply to individuals living within these areas include:

- Inhalation of volatile contaminants and particulate contaminants,
- Incidental ingestion of soil containing deposited contaminants,
- Incidental dermal contact with contaminants in off-site soil, and
- Ingestion of contaminants incorporated into produce from a home vegetable garden that contains particulates from the site.

In addition to the residential areas, two schools were identified as possible receptors:

- West Side Junior High, and
- East Chicago Central High School.

Both schools are located approximately the same distance and direction from the CDF (0.25 mile south of the CDF at the intersection of Indianapolis Blvd. and Columbus Dr.), and are illustrated in **Figure 1-2**. Due to the proximity of the two schools, they are combined into a single location for the purpose of this monitoring plan.

Three locations were identified that could potentially cause elevated emissions: the CDF, including the TSCA cell, the barge offloading berth, and the area immediately surrounding the active dredge.

Meteorological data collected from an on-site station from May 2002 through April 2007 was evaluated to determine prevailing wind conditions at the CDF. When viewing the data on an annual basis, there appears to be a slight prevailing wind from the south-southwest. Analyzing the data on a monthly basis gave the following:

- January – Prevailing wind from the WSW,
- February – Prevailing wind from the WSW,
- March – Prevailing wind from the SW and, to a lesser extent, the NNE,
- April – Prevailing wind from the NNE,
- May – No Prevailing wind,
- June – Prevailing wind from the SSW and, to a lesser extent, the NNE,
- July – Prevailing wind from the SSW and the NNE,
- August – Prevailing wind from the NNE and the SSW, and
- September – Prevailing wind from the South,
- October – Prevailing wind from the SW,
- November – Prevailing wind from the SW, and
- December – Prevailing wind from the SW.

The wind roses and meteorological data are given in **Appendix E**.

The availability of utilities and ease of access was not a limiting factor in the selection of the location of the monitoring stations. Four sampling locations, in addition to the existing location at the East Chicago Central High School, will be established to evaluate and document long-term emissions from the CDF. The locations of the sampling stations are shown if **Figure 4-1**.

3.3 Pre-Dredge Baseline Monitoring

Background monitoring was and is being performed by USACE. Two 24-hour, long-term samples each for PAHs, VOCs, PCBs, PM, and metals will be collected from each monitoring location during the 14-day period prior to the start of every dredging season. The method for the collection of the long-term samples is described in **Sections 3.4 and 3.5**.

3.4 Long-Term Air Monitoring of COI Emissions

3.4.1 Sampling of PAHs

Sampling of PAHs will be performed in accordance with (IAW) EPA Compendium Method TO-13A, **Appendix G**. This method will utilize a high-volume sampler capable of pulling ambient air through the filter/sorbent cartridge at a flow rate of approximately 200 – 280 L/min to obtain a total sample volume of greater than 300 m^3 over a 24-hour period. Samples will be collected at each of the five (including the High School) long-term monitoring stations (**Figure 4-1**) using the standard 1 in 6 day calendar. Major manufacturers of the high volume sampling equipment are:

- Tisch Environmental, Village of Cleves, OH,
- Anderson Instruments, Inc., Smyrna, GA, and
- Thermo Environmental Instruments, Inc., Franklin, MA.

This method will use polyurethane foam (PUF) samplers that have sandwiched XAD resin. The PUF/XAD samples will be removed after 24 hours of use, iced, and shipped to the laboratory for analysis within the recommended seven day holding time.

Laboratory analysts will utilize GC/MS selective ion monitoring (SIM) as the procedure for analysis. With a typical reporting limit of 0.1 µg and based on a 300 liter air sample, this method will have a reporting limit of 0.33 $\mu g/m^3$. A log will be kept for the recording of the date, time, flow rate, sample number, and calibration data.

3.4.2 Sampling of VOCs

Sampling of VOCs (BTEX and Trimethylbenzenes) will be performed IAW USEPA Compendium Method TO-15 (See **Appendix J**). This method will use pressurized sampling with a summa canister. Pressurized sampling is used when longer-term integrated samples or higher volume samples are required. The sample is collected in a canister using a pump and flow control arrangement to achieve a typical 101-202 kPa (15-30 psig) final canister pressure. A flow control device is chosen to maintain a constant flow into the canister over the desired sample period. This flow rate is determined so the canister is filled to about one atmosphere above ambient pressure over the desired sample period.

Laboratory analysts will utilize GC/MS SIM as the procedure for analysis. The limit of detection will depend on the nature of the analyte and range from 0.65 $\mu g/m^3$ for benzene to 1.76 $\mu g/m^3$ for m,p-xylenes. A log will be kept for the recording of the date, time, flow rate, sample number, and calibration data.

3.4.3 Sampling of PCBs

Sampling of PCBs will be performed IAW USEPA Compendium Method TO-4A (See **Appendix H**, **Table 1**). This method will be identical to the method used for PAHs as described in **Section 3.4** with the following differences:

PCBs will be collected on a sorbent cartridge containing PUF. The limit of detection will depend on the nature of the analyte and the length of the sampling period.

3.5 Long-Term Air Monitoring of Particulate Emissions and Metals

The long-term particulate emissions will be monitored with conventional high-volume samplers IAW USEPA Compendium Method IO-2.1 for PM_{10} (**Appendix I**) and USEPA Compendium Method IO-3 (**Appendix F**) for metals. The long-term particulate emissions will be monitored and analyzed for total particulates only. A large volume of ambient air, typically at a rate of 1.13 – 1.70 m^3/min will be drawn through a glass fiber or quartz filter by means of a blower. The upper limit of mass loading is determined by plugging the filter medium with sample material, which causes a significant decrease in flow rate. For very dusty atmospheres, shorter sampling periods will be necessary. Samples will be collected at each of the five (including the High School) long-term monitoring stations (**Figure 4-1**) using the standard 1 in 6 day calendar.

Airborne particulate matter retained on the filter will be examined in accordance with USEPA Compendium Method IO-3.1 and/or analyzed chemically as delineated in Inorganic Compendium Methods IO-3.2 through IO-3.7 for the metals listed in **Section 3.0**.

3.6 Long-Term Air Monitoring Cost Analysis

Planning-level cost estimates were prepared to provide an economic basis for comparison of the real-time monitoring alternatives for VOCs and Particulate Matter. These cost estimates include:

- The capital costs for the purchase of the required number of monitors,
- Any required software,
- An estimate of the annual operating costs, and
- An estimate of any annual factory maintenance and calibration.

These cost estimates do not represent complete project cost estimates and do not include all the labor costs for maintaining and operating equipment, data processing and data evaluation labor, etc. The actual costs for a complete monitoring operation will be higher than this. Capital and operating costs as well as analytical costs for the long-term, high volume monitoring is given in **Table 9-3**. Costs were converted to present value, taking into account the year in which expenditures will occur and the applicable federal discount rate. The discount rate is established by the OMB for federal projects and is presently 4.78%. The present value formula is:

$$PV = \frac{V1}{(1+i)^\wedge 1} + \frac{V2}{(1+i)^\wedge 2} + \frac{V3}{(1+i)^\wedge 3} + \ldots\ldots + \frac{Vn}{(1+i)^\wedge n}$$

All costs developed in this section will be escalated to the year of expenditure using USACE Channels and Canals escalation values from the CWCCIS dated 30 March 2007, USEPA 540-R-00-002 guide, and OMB Circular A-94.

Costs for the first ten years of long-term ambient air monitoring were also calculated, including sample analysis costs. These estimates are discussed in the following sections and are shown in **Table 9-3**.

3.6.1 Initial (First Year) Cost

Projected costs for the first year of long-term VOC and PM monitoring are approximately $174,988 and are given in **Table 9-3**.

3.6.2 Projected Annual Cost for Years 2 – 10

Annual O&M costs for each of the monitoring systems were projected out for the first ten years of the project life. These are budgetary estimates only and more detailed and accurate costs will be developed for the selected system. As a rule of thumb, costs should be reviewed every two or three years to ensure accuracy. It is estimated that the Present Value of the long-term VOC and PM monitoring is approximately $1,431,044 for the first ten years of operation, including initial costs. A detailed year-to-year breakdown for each system is shown in **Table 9-3**.

4.0 METEOROLOGICAL DATA

Meteorological data will be collected continuously at the existing ten-meter tower located on-site. Variables collected at the weather station include wind speed and direction, temperature, barometric pressure, rainfall, and solar radiation. Current conditions will be available on the web. Data will be accumulated as before. To identify site-generated emissions, wind direction data will be used to determine the appropriate upwind and downwind high volume samplers for comparison. An alternative means to determine if action levels have been exceeded is to take the difference between the lowest and the highest readings at any time. If the difference is greater than the action level, check the wind direction to determine if the higher one is upwind or downwind. Because short-term equipment cannot be easily started and stopped, they will run continuously, while the meteorological wind direction data will indicate which samplers are upwind and downwind at any given time, allowing for the subtraction of upwind concentrations from downwind values. This upwind/downwind designation will only be used qualitatively to determine if an action level is being approached or reached due to site emissions or by off-site sources.

5.0 POSSIBLE AIR EMISSIONS CONTROL MEASURES

In the event that air emission modeling results indicate an exceedance of the annual emission threshold or the real-time air monitoring indicates that the STALs are exceeded, contingency measures will be implemented by the operator. The following sections provide a general description of **possible** chemical and particulate emission control measures for USACE and operator consideration. Selection of specific measures, whether these or alternatives, and development of implementation methods and details, will depend on site-specific conditions at the time as determined by the operator. The potential emission locations include the dredging site, barge transport, sediment off-loading and placement into the CDF, the wastewater treatment plant, and the CDF itself.

Emission modeling and field experience both indicate that emissions from the dredging site would be very small relative to the other locations, and that the dredging site would not require control measures, since the dredging activity (including dredging, barge transport, and sediment off-loading) emissions are less than 1% of the IDEM air registration limit of 25 tons per year. If these dredging activities were determined to be an issue during operations, appropriate control measures would be implemented at that time. The most effective controls for dredging operations are generally Best Management Practices (BMPs) that require the operator to dredge in a controlled and careful manner.

The following discussion of controls is meant to provide guidance and suggestions. The implementation of controls will occur in the field, and many factors will influence the actual use of individual control measures, including the relative effectiveness of the measure, the feasibility of implementation under actual work conditions, cost, equipment availability, and other factors. The sources discussed below are not equal in terms of impacts, and it will always be the goal to address the largest sources of emissions first. The controls discussed below represent possible actions or methods, but not all of these may actually be used. In addition, the implementation of any control must be tied to a decision point (i.e., there must be some defined time at which it is determined that a control is needed.) The decision points for the CDF operation are tied to the air monitoring action levels for particulates and volatile compounds which are developed and discussed earlier in this report. If the dredging activities indicate an issue, then decision points would be incorporated into the controls and implemented at that time.

5.1 Barge Transport Controls

Wet sediments will be mechanically dredged, transported by barge to the CDF, and hydraulically offloaded and placed into the CDF. The transport distance will vary depending on the dredging location, but will generally be within a couple of miles of the CDF site. The time of transport will be relatively short, less than one hour. Because the time is short, the barges themselves will be a minor source of emissions. Additionally, it is not anticipated that the sediments will be allowed to thoroughly dry during transport; thereby eliminating any possibility of particulate emissions during these phases of operation. The only possible time that transport could be a potential emission source requiring control is if the barges remain full of sediment for an extended period of time. This is unlikely, since most dredging operations rely on continuous use of the barges. As a contingency, any loaded barge that is delayed for more than 24 hours before offloading would be covered to control emissions.

Covers used for emissions control can be either mechanical or chemical in nature. Mechanical covers are constructed of various membranes and can be tailored to fit almost any size area. If properly designed and deployed, membrane covers can provide virtually complete emission suppression. A drawback of membrane covers is that the cover interferes with equipment access through the cover for maintenance or operations activities. Rainwater collected on top of the cover must be drained. Chemical covers are generally designed for temporary use, such as overnight, and can provide emissions control for up to six months with the right weather conditions. Most chemical covers are semi-permeable to water therefore rainwater will not tend to collect on them. Chemical covers may have the disadvantages of contributing to the load placed on the waste water treatment plant (WWTP) and their fibers may clog the WWTP filtering system. Water covers are also effective, especially for particulate control. Adequate freeboard would need to be maintained in the barge for a water cover. Overall, covers on idled barges could be effective and practical, although it is unlikely that they would be needed. This contingency can be required in the dredging Contractor's work plan, to ensure that action is taken in case of unforeseen circumstances.

5.2 Controls During Sediment Off-loading and Placement in the CDF

Once at the CDF site, barges will be emptied by a hydraulic off-loading operation. The hydraulic off-loading operation will consist of piping the slurried sediment and water mixture from the barge and pumping it into the CDF. Because the piping is closed, there are no emissions from the pipe itself. The only possible location for emissions to occur would be at the end of the pipeline, during placement of the material into the CDF. Three methods of deposition of the sediment slurry into the CDF were considered:

- Above water surface hydraulic discharge;
- Submerged hydraulic discharge; and
- Placement through the use of a Tremie/Diffuser combination.

The above water surface discharge option has the advantage of being technically simple and relatively low cost. However, above water discharge will allow direct volatilization of VOCs at the discharge point, maximize mixing of the sediment slurry with the overlying water column thereby increasing the suspension and dissolution of contaminants, and maximizing their mass transfer to the air.

While an improvement over above water discharge, a submerged discharge system, such as that used at USS, still has the potential for significant mixing with the water column, as well as slurry acceleration, air suction into the line which creates bubbles that would strip VOCs. Depending on the feed material and the depth of the pond, this method could be adequate to meet site emission goals.

Another effective means of placing the sediment slurry into a CDF is by a tremie/diffuser combination. This system is designed to minimize mixing with the overlying water by controlling the:

1. Acceleration in the vertical section of the system, and
2. Horizontal radial flow velocity.

These processes are defined by the internal Froude number, the rheological properties of the fines slurry (<45µm), and the gradient Richardson number.

This system has been implemented as the primary means of emissions control for the St. Louis River/Interlake/Duluth Tar site in Duluth, MN, which began construction in Spring 2007. It is being used with average 6% solids slurry, recirculating carry water to a mechanical dredging operation. Performance data was not yet available at the preparation of this guide.

For volatiles to be emitted to the atmosphere, they must dissolve from the soil particles or NAPL into the water. From the dissolved phase, the VOC can emit to the air. An effective means to reduce emissions is to adjust the sediment/water ratio in the slurry. Lowering the solids content will reduce the amount of volatiles available for the mass transfer from sediment to water to air. However, reducing solids content could also effect production and other operations, such as increasing the water that would need to be treated by the WWTP. A final decision on the placement method for sediment at the IHC CDF has not been made; placement methods are being evaluated based on effectiveness, emissions impacts, CDF capacity considerations, cost, and equipment considerations.

5.3 Waste Water Treatment Plant (WWTP)

Although the WWTP is not considered to be a likely source for VOC emissions, contingencies were investigated in case it was demonstrated otherwise. An effective means to control most emissions from the WWTP would be to use enclosure(s) to capture the air and treat it with a carbon canister.

5.4 Confined Disposal Facility (CDF) Emissions Controls

Two types of emissions are possible from the CDF, particulate and volatile compounds. Volatile compound emission control methods identified for use at the CDF can be classified in three categories, discussed below. Particulate emission control methods are discussed separately, although there may be some overlap between control methods.

5.4.1 Covers

Either physical or chemical covers, as discussed in **Section 5.1** for idled barges, could theoretically be effective for a CDF. However, in practical terms, a physical cover, in particular, would be difficult to implement due to the size of the CDF cells at the IHC facility. It would not be possible to unroll a 40 acre cover by hand due to the weight of the cover, and the use of a crane or other equipment to place a flexible cover would be equally difficult and would likely lead to tearing of the cover. A chemical cover, such as a foam or surfactant, could also theoretically be placed on the quiescent water surface. However, a key factor in the use of foams or surfactants would be to avoid impacts to the wastewater treatment plant. The treatability of these chemicals is not known, which makes the idea unattractive. For these practical reasons, it is not likely that a cover would be used at the CDF.

5.4.2 Emission Control Sprays

The variety of sprays available is virtually endless. Sprays come in powdered form, as liquids, and as foams. The sprays can work through peroxidation, neutralization, as surfactants, or emulsification. Their primary efficacy comes from washing the contaminants out of the air like rain does. Some of the products also act as oxygen releasing agents and work as a catalyst for the bioremediation of the contaminants, thereby potentially reducing the load on the WWTP. The main disadvantage of sprays is that the effect of the additional chemicals on water treatment is not fully understood. However, most are biodegradable and should not significantly interfere with the WWTP. They may be feasible as a contingency. Testing effort would be needed to determine which of the sprays are the most effective in controlling emissions and the least detrimental to water treatment. Further investigation or information would be needed before emission control sprays could be used at the CDF.

5.4.3 Powdered Activated Carbon (PAC)

PAC can be used for emissions control by either injecting it into the pipeline or mixing it into slurry and spraying it onto the emitting water surface within the CDF. PAC addition is very efficient in reducing the emissions and can reduce the loading on the WWTP by adsorbing the contaminants. PAC disadvantages are that the PAC will absorb water reducing its effectiveness and it increases the volume of solids within the CDF. It is flexible and feasible as a contingency. PAC was also used by U.S. Steel for their sediment containment facility, with good results. PAC may also be effective for controlling emissions during sediment placement.

5.4.4 Particulate Emission Controls

Particulate emissions will only occur from dry, exposed sediments within the CDF. One effective method for controlling particulate emissions, and possibly volatile emissions, is to keep the sediment wet or ponded. Ponding may not always be possible because it also can prevent the consolidation of sediment, so additional control methods have also been considered.

Particulate emissions can be minimized with the use of controls such as physical barriers, chemical stabilizers, or vegetation (Francingues et al. 1985, USACE 1983). Physical barriers may include fibers, mulches or geotextiles, as discussed in **Section 5.4.1**. Chemical suppressants are also commercially available, but suitability for this application has not been determined, as discussed in **Section 5.4.1**.

Surface vegetation and windscreens can reduce particulate transport. Dewatering may be somewhat facilitated by plant transpiration, although this may be offset by surface shading. Since vegetation typically volunteers in idle cells of CDFs where salinity of the material is not high, it is expected that an effective surface vegetative cover could be established for particulate control. Floating equipment could be used for seeding operations if necessary, as soon as the surface water content is conducive to germination. High concentrations of zinc in the sediment may also inhibit seed germination without chemical additives.

Because there are many variables in the operation of a CDF, and because conditions in the CDF will tend to change over time, it is likely that more than one control method will be used over the life of the CDF. To provide efficient controls while still allowing maximum operational flexibility, the operating contractor will propose control methods for the CDF in his workplan. Implementation details for control methods will be part of the workplan.

6.0 AIR MONITORING DATA MANAGEMENT AND EVALUATION

This section defines which records are necessary to document the air monitoring activities and what information needs to be included in the records. In addition, the data reporting format and the document retention procedures to be used are described.

Data generated during all monitoring activities will be managed by the database manager, under the direction of the Quality Assurance (QA) officer. Electronic data will be stored in a secured database maintained on a computer server, under the direction of the database manager. Hard copy paper data, including field logs and notebooks, will be submitted on a daily basis to the field team leader, or designee. Hard copy paper data will then be maintained at the operator's or USACE office(s) by the database manager, or designee.

As a part of the EPP, the contractor/operator is required to submit a data flowchart detailing how the data will be managed and by whom. The data collected will be subject to the same data management and evaluation as all other data collected.

All data recorded on log forms or in notebooks will provide as much detail as possible, to avoid the reliance on memory. Entries will be written in ink, with errors crossed out with a single strike. Erasures are not permitted.

Electronic data will be stored on a secure computer server, which is to be backed up regularly. The backup server tapes will be stored in a fireproof safe at an off-site location.

6.1 Records Retention

These and other records for the site will be maintained at the selected operator's office for a minimum of seven years from the completion of the project or until authorized for disposal by the IDEM in writing, whichever is longer.

6.2 Field Operation Records

6.2.1 COI Emissions

The selected operator shall maintain the records of all required air monitoring data and support information in accordance with **Section 8) a)** and **b)** of the IDEM Air Registration: 089-15320-00471, including, but not limited to:

- The date, place, and time of sampling or measurements;
- The dates analyses were performed;
- The company or entity performing the analyses;
- The analytical techniques or methods used;
- The results of such analyses;
- The field activities in the vicinity of the monitoring; and
- All calibration and maintenance records.

6.2.2 Particulate Matter Emissions

The information contained in the records of the monitoring described in **Section 4) g)** of the IDEM Air Registration: 089-15320-00471, including, but not limited to:

- A map or diagram showing the location of all controlled emission sources,
- Details pertaining to the application of water or chemical solutions,
- A log recording incidents when control measures were not used and a statement of explanation, and
- All field monitoring forms, survey or notes, and calculations will be maintained at the location shown above.

6.3 Laboratory Records

Each laboratory will maintain in its files, documentation necessary to demonstrate that the results reported were gathered in accordance with the methods approved. Relevant QA audit reports and corrective action reports covering the period when these tests were conducted will also be maintained until authorized for disposal by the IDEM or USACE in writing. The laboratory analytical report will contain the following information as appropriate to the type of test conducted:

- Laboratory name

- Contact person
- Matrix type
- Field sample identification number
- Laboratory sample identification number
- Sample date
- Receipt date
- Extraction date
- Analysis date
- Batch number
- Extraction number
- Analytical number
- Method Detection Limit
- Quantitation and Reporting Limits
- Analyte and reported concentration
- Units of measure
- Surrogate recovery percentages
- Data qualifiers using the CLP standard notation or an approved equivalent

Additionally, Method Blanks, Matrix Spikes, Matrix Spike Duplicates, Laboratory Control Samples and Laboratory Control Sample Duplicates shall be reported on a similar format for each batch tested. Matrix spike tests shall be on samples from the Site as designated on the chain-of-custody unless otherwise approved by the QA Officer. Finally, with the transmission of each batch, the laboratory cover letter or narrative must affirmatively indicate that laboratory Quality Control (QC) data have been reviewed and that they comply with the method specifications. Where there are exceptions to the QC performance requirements, the cover letter or narrative must identify each exception and indicate if the laboratory accepts the data or must qualify it. Where data is to be qualified regarding quality, it shall be so designated in the laboratory report. Where corrective action is necessary, the laboratory will also indicate what actions have been taken. The QA Manager at each laboratory must perform a final review of the report to determine whether it meets project requirements.

Electronic data will be transferred from the laboratories using a USACE approved Electronic Data Deliverables (EDD) format. Reports of system audits or other audits conducted in accordance with the laboratory's QA plan that affect the results reported for this project will also be provided by the laboratory as soon as possible, with an explanation of the impact the result is believed to have had on the data or its quality.

The selected analytical laboratory's internal data management, including document control, data handling and reporting, and record keeping will be approved by USACE before beginning any dredging or CDF activities. The selected laboratory's Quality Assurance Manual (QAM) and Standard Operating Procedures (SOPs) will be attached to this monitoring plan.

6.4 Electronic Data Deliverable Requirements

All subcontracted laboratories will report analytical results to the operator in accordance with the approved EDD SOP. It will be the responsibility of the laboratory to ensure that all data entry, transposition and/or manipulation are completed prior to submitting the data electronically. If a code or data entry error is discovered in an EDD, it will be the responsibility of the subcontract laboratory to remedy the error(s) in a timely manner.

In addition to the EDD submitted, the laboratory reports will include a QA/QC narrative summary detailing any problems or inconsistencies.

7.0 AIR MONITORING INFORMATION DISSEMINATION

Requirements for agency notification and reporting of COI and PM emissions have been established by the IDEM Air Registration. These requirements are discussed in **Sections 6.1 – 6.3**. A Public Outreach program has been developed by USACE to keep the surrounding community and other interested parties informed regarding activities and emissions at the site. This program is discussed in **Section 7.4**.

7.1 Agency Notification/Communication

This section describes the reporting requirements set forth in the IDEM Air Registration: 089-15320-00471 **Sections 4) and Sections 8) – 17)**. The Quarterly Reports described below will be submitted within 30 days of the end of each calendar quarter. All reports shall be submitted to:

Compliance Data Section
Office of Air Quality
100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015

Unless otherwise specified in the IDEM Air Registration: 089-15320-00471, any notice, report, or other submission required will be considered timely if the date postmarked on the envelope or certified mail receipt, or affixed by the shipper on the private shipping receipt is on or before the date it is due. If the document is submitted by any other means, it will be considered timely if received by IDEM on or before the date it is due. Copies of all reports and correspondences shall be sent to USACE.

7.2 COI Emissions Reporting

The operator will submit copies of all records required to the IDEM within 20 working days of a written request of the IDEM and shall make these records available for inspection and copying during working hours.

Detailed emissions reports will be submitted to the IDEM for review. Emissions estimate reports will include the following:

- On an annual basis, predictive emissions estimates based on the sediment sampling conducted in accordance with the IDEM Air Registration 089-15320-00471 **Section 11)** and the modeling results obtained in accordance with **Section 12)** and the expected dredging and disposal volumes will be reported at least six months prior to the commencement of dredging.
- On an annual basis, if during operation, the potential to emit VOCs is equal to or greater than ten tons per year an emission statement for the source will be submitted to the IDEM by the operator. The annual statement must be received by the IDEM by April 15th of each year and contain the minimum requirements as specified in 326 IAC 2-6-4.
- On an annual basis, an authorized representative of the operator will provide annual notice to the IDEM that the site is in operation and compliance with the air registration.
- On a quarterly basis, the actual in-situ dredged volumes of sediments placed in the CDF will be reported within 30 days of the end of each calendar quarter in which the dredging and placement take place.
- On a quarterly basis, a Quarterly Air Monitoring Report covering the requirements of **Sections 6) – 8)** of the Air Registration will be submitted that includes the following:
    - Any failure to perform monitoring or obtain valid results in accordance with the Air Monitoring Program;
    - All instances of monitoring results demonstrating that the action levels were exceeded for the period of time that called for corrective action; and
    - Any corrective actions taken in response to the monitoring results reported above.

If the emissions estimates indicate the likely exceedance of the annual emissions thresholds, modifications to the dredging/placement plans will be submitted to the IDEM in a timely manner.

The monitoring results for each calendar quarter will be made available on the World Wide Web within 60 days of the end of the quarter.

7.3 Particulate Matter Emissions Reporting

The operator will submit copies of all records required to the IDEM within 20 working days of a written request of the IDEM and shall make these records available for inspection and copying during working hours.

A quarterly report will be submitted to the IDEM stating the following:

- The dates any required control measures were implemented;
- A listing of those control measures;
- The reasons the control measures were not implemented; and
- Any corrective action taken.

An annual report, including COI and PM emissions results, will be submitted to the IDEM no later than March 1st of each year demonstrating that the dredging and CDF activities are in compliance with the air registration.

7.4 Public Outreach and Notification

The community relations plan during dredging and CDF placement activities will include the following components:

- Participation in periodic public informational meetings,
- Updating of information on an IHC Web site including:
    - Monthly project progress updates;
    - Most recent air monitor readings;
    - Current schedule;
    - Listing of upcoming events;
    - Latest happenings;
    - Site News;
    - FAQs;
    - Overview; and
    - Contact Information

- An identified telephone number for interested parties to call with comments, questions and concerns, and
- A printed document containing information for the public who do not have access to the community meetings or Internet.

The project team will also assist and coordinate with USACE and IDEM regarding other areas of community outreach.

USACE is developing a separate Emergency Response Plan in coordination with local emergency response organizations. Emergency communications will be discussed in that document.

8.0 SURFACE WATER MONITORING

The primary purpose of the surface water monitoring guidance document is to establish monitoring procedures and control measures to minimize adverse impacts on water quality in the vicinity of the dredging operations. The following sections will describe the means by which this objective will be accomplished. This monitoring program and the data collected will be reviewed periodically, minimum annually, to determine if the requirements can or should be adjusted. This review could result, for example, in the reduction of the list of contaminants and frequency of monitoring, or the complete cessation of monitoring activities.

8.1 Locations of Sampling Stations

Review of the existing documents has shown that there are no water quality standards or requirements that apply specifically to this site. However, surface water in the IHC will be monitored to proactively manage oil and grease, and to document that turbidity from navigational dredging operations is not adversely impacting water quality. In order to collect background data, turbidity monitoring will be conducted at least one day prior to the start of any in water work. Water sampling will be conducted daily during dredging operations. Water samples will be taken at two locations, described below and shown in **Figure 6-1**:

- Site 1 – A variable station site, located approximately 600 feet up current of the dredge as it moves through each Reach.
- Site 2 – A variable station site, located approximately 600 feet down current of the dredge as it moves through each Reach.

To determine which sampling locations are designated as the up current locations, the current and direction, or the water level in the canal will be monitored for flow-reversal. The up current sampling location will be used to verify if elevated concentrations found within the IHC are possibly resulting from the dredging operations or possibly from contaminants entering the canal from other sources. Logging of ship passage near the dredge will be conducted to document possible causes for intermittent spikes in water quality.

8.2 Pre-Dredge Baseline Monitoring

Two samples each for turbidity will be collected from each monitoring location at least one day prior to the beginning of any in water work. The method for the collection of the samples is described in **Section 8.3**.

8.3 Turbidity Monitoring

There is no turbidity standard that applies to this site. A literature search was conducted and showed that turbidity requirements varied widely and typically fell in the range of 10 – 50 NTUs above background. Examples of turbidity requirements are:

State	**Turbidity Restriction**
Alabama	• not to exceed 50 NTU above background levels
Florida	• not to exceed 29 NTUs • not to exceed 29 NTUs outside the 2642 ft (800 m) downstream mixing zone. Within the mixing zone, turbidity not to exceed 1000 NTUs for 12 consecutive hours, 3000 NTUs for 3 consecutive hours.
Georgia	• post-construction levels of turbidity are not to exceed 20 NTUs
Idaho	• not to instantaneously exceed 50 NTUs, or 25 NTU averaged over 10 days.
New Hampshire	• for watercourses greater than 10 ft, water quality not to exceed greater than 10 NTU above background at the end of a 1000 ft mixing zone; • for watercourses less than 10 ft wide, water quality not to exceed greater than 10 NTU above background at the end of a 500 ft mixing zone.
New York	• not to exceed 10 NTUs outside a 300 ft mixing zone.
Tennessee	• not to exceed 50 NTUs above background.
Vermont	• not to exceed a 10 NTU allowable increase.

Two site-specific restrictions were found that had a two times or higher than background standard: the Fox River project in Green Bay, WI and the Manistique River in Michigan. The stated intent of attached numerical conditions in some states was to ensure the proper application of BMPs and control technologies rather than to maintain defined turbidity levels. Therefore, the following, self-imposed standards are proposed:

- Monitor 600 ft upstream & downstream of dredge site, at 50% and 80% depths,
- Monitor once/shift unless readings are observed > 50 NTU above background,
- If readings are > 50 NTU above background, increase frequency to once every 4 hrs for 24 hr,
- If readings remain > 50 NTU above background, take additional actions to reduce turbidity, up to and including (if necessary) shutdown of dredge operations.

If the readings remain > 50 NTU above background for more than 24 hours, response actions will be taken to reduce or eliminate the impact. Response actions may include changing or reducing dredging operations, or temporarily ceasing dredging operations until the turbidity has reduced to background levels.

Sampling will not be conducted unless the dredge has been in operation for a minimum of three hours. All turbidity readings will be obtained from 50% of water depth, and 80% of water depth at each of the sampling locations. Turbidity monitoring at all locations will be performed using a turbidity meter with a minimum range of 0 – 250 NTUs and an accuracy of ± 5% of full scale or by deployment of data sondes with nephelometers to record the turbidity continuously.

8.4 Oil and Grease Monitoring

As a part of BMPs during active dredging, an oil boom will be deployed in the immediate area surrounding the dredge. Monitoring of oil and grease will be primarily by visual observation to determine when the boom needs replacement or if additional oil booms are required. Visual observations will be conducted by the operator, at a minimum, once every two hours. A log will be kept of the date, location, and visual observations. The operator shall deploy an oil boom around the dredge in such a manner as to contain floating oil or grease generated as a result of the dredging operation while not interfering with shipping activity in the IHC. Operator will use sorbants or other means to collect, remove and dispose of the oil and grease contained by the oil boom. All saturated sorbent materials will be collected, stored, and disposed of within an approved facility. It is not anticipated that the concentration of PCBs in the sorbent material will approach 50 ppm; however, if the sorbent materials exceed 50 ppm PCBs, then the operator will dispose of these materials at an approved facility.

8.5 Surface Water Monitoring Cost Analysis

Projected costs for the monitoring of the surface water during dredging were developed for the first ten years of the project life. The estimates include the purchase of equipment (including backup), and labor. It was assumed that sampling would require three hours of work per 8-hour shift each for two people (buddy system required while on water). It was also assumed that dredging would take place 24/7 from May 1 through August 31 each year.

8.5.1 Initial (First Year) Cost

Projected costs for the first year of Surface Water monitoring are approximately $87,500 and are given in **Table 9-4**.

8.5.2 Projected Annual Cost for Years 2 – 10

It is estimated that the Present Value of the monitoring is approximately $836,100 for the first ten years of operation, including initial costs. A detailed year-to-year breakdown for each system is shown in **Table 9-4**.

9.0 SURFACE WATER MONITORING DATA MANAGEMENT AND EVALUATION

This section defines which records are necessary to document the surface water monitoring activities and what information needs to be included in the records. In addition, the data reporting format and the document retention procedures to be used are described.

Data generated during all monitoring activities will be managed by the database manager, under the direction of the QA officer. Electronic data will be stored in a secured database maintained on a computer server, under the direction of the database manager. Hard copy paper data, including field logs and notebooks, will be submitted on a daily basis to the field team leader, or designee. Hard copy paper data will then be maintained at the operator's or USACE office(s) by the database manager, or designee.

As a part of the EPP, the contractor/operator is required to submit a data flowchart detailing how the data will be managed and by whom. The data collected will be subject to the same data management and evaluation as all other data collected.

All data recorded on log forms or in notebooks will provide as much detail as possible, to avoid the reliance on memory. Entries will be written in ink, with errors crossed out with a single strike. Erasures are not permitted.

Electronic data will be stored on a secure computer server, which is to be backed up regularly. The backup server tapes will be stored in a fireproof safe at an off-site location.

9.1 Records Retention

These and other records for the site will be maintained at the selected operator's office for a minimum of seven years from the completion of the project or until authorized for disposal by the IDEM in writing, whichever is longer.

9.2 Field Operation Records

The IDEM has not set any requirements for water quality monitoring records retention. However, water monitoring records will be maintained in a manner consistent with **Sections 6.2.1 and 6.2.2.**

10.0 SURFACE WATER MONITORING INFORMATION DISSEMINATION

10.1 Agency Notification/Communication

Requirements for agency notification and reporting of surface water monitoring results have not been established. However, USACE will be notified within 24 hours of an exceedance of the >50 NTU limit set in **Section 8.3**. The monitoring results for each calendar quarter will be made available on the World Wide Web within 60 days of the end of the quarter.

10.2 Public Outreach and Notification

The community relations plan during dredging and CDF placement activities will include the following components:

- Participation in periodic public informational meetings,
- Updating of information on an IHC Web site including:
  - Monthly project progress updates;
  - Most recent air monitor readings;
  - Current schedule;
  - Listing of upcoming events;
  - Latest happenings;
  - Site News;
  - FAQs;
  - Overview; and
  - Contact Information
  - An identified telephone number for interested parties to call with comments, and
  - A printed document containing information for the public who do not have access to the community meetings or Internet.

The project team will also assist and coordinate with USACE and IDEM regarding other areas of community outreach. USACE is developing a separate Emergency Response Plan in coordination with local emergency response organizations. Emergency communications will be discussed in that document.

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