FINAL DRAFT

ASSESSMENT PLAN
for the
NATURAL RESOURCE DAMAGE ASSESSMENT
of the
SAUGET INDUSTRIAL CORRIDOR SITES
ST. CLAIR COUNTY, ILLINOIS

Prepared by:

State of Illinois

Environmental Protection Agency
and
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State of Missouri

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U.S. Department of the Interior
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LIST OF ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR §	Code of Federal Regulations
CWA	Clean Water Act
DOI	United States Department of the Interior
Eco-SSL	Ecological Soil Screening Levels
FWS	United States Fish and Wildlife Service
GIS	Geographic Information System
IEPA	Illinois Environmental Protection Agency
IDNR	Illinois Department of Natural Resources
MoDNR	Missouri Department of Natural Resources
NCP	National Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NRDA	Natural Resource Damage Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
ppm	part per million
PRPs	Potentially Responsible Party
QAPP	Quality Assurance Project Plan
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation / Feasibility Study
SIC	Sauget Industrial Corridor (Sites)
SECs	Sediment Effects Concentration
SWS	State Water Survey (Illinois)
TACO	Tiered –Approach to Corrective action Objectives
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

The United States Fish and Wildlife Service (FWS or the Federal Trustee), the Illinois Environmental Protection Agency (IEPA), the Illinois Department of Natural Resources (IDNR) (IEPA and IDNR are collectively referred to as the Illinois State Trustees) and the Missouri Department of Natural Resources (MoDNR or the Missouri State Trustee), collectively referred to as the "Trustees," have initiated a natural resource damage assessment (NRDA) to address natural resource injuries resulting from the release of oil and hazardous substances[1] in St. Clair County, Illinois (Figures 1-1 and 1-2). This Assessment Plan serves as a guiding document for NRDA activities at the Sauget Industrial Corridor Sites (SIC Sites or Corridor).

The Trustees will conduct assessments in accordance with the following:

The Illinois State Trustees will conduct assessment of Groundwater resources.

The Illinois State Trustees and the Missouri State Trustee will conduct assessment of State natural resources in the Mississippi River.

The Illinois State Trustees and the Federal Trustee will conduct assessment of State and Federal natural resources in Dead Creek.

The Illinois State Trustees and the Federal Trustee will conduct assessment of State and Federal Surface Resources (terrestrial and other aquatic, wetlands, ponds, small streams).

Authority to Conduct a Natural Resource Damage Assessment

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended (42 U.S.C. § 9601 *et seq.*), and the Federal Water Pollution Control Act (the "Clean Water Act" (CWA)), as amended (33 U.S.C. § 1251 *et seq.*), authorize Federal, State, and Tribal officials to act on behalf of the public as trustees for natural resources. The Secretary of the United States Department of the Interior (DOI) acts as a federal trustee pursuant to the National Contingency Plan (NCP) (40 CFR § 300.600) and Executive Order 12580, issued on January 23, 1987. For this NRD action, the Secretary delegated his authority as the Department's natural resource trustee to the Director of FWS (242 Departmental Manual 6). The Governor of the State of Illinois delegated trusteeship for resources in that State to IEPA and IDNR, and the Governor of the State of Missouri delegated trusteeship for resources in that State to MoDNR.

[1] USFWS' NRDA regulations provide that "natural resources trustees may assess damages to natural resources resulting from a discharge of oil or a release of a hazardous substance." 43 CFR §11.10. Oil is define in section 311(a)(1) of the Clean Water Act, 33 U.S.C. § 1251 *et seq.* Hazardous substance is defined in section 101(14) of the Comprehensive Environmental Resource, Compensation, and Liability Act, 42 U.S.C. § 9601 *et seq.*. The Assessment Plan use of the term oil and hazardous substance assumes to include both or either.

Regulations have been promulgated to guide trustees in the assessment of natural resource injuries and damages. In 1987, under the authority of CERCLA and CWA, DOI issued regulations 43 CFR § Part 11 for conducting damage assessments following the discharge of oil and/or the release of hazardous substances. The purpose of the DOI regulations is "to provide standardized and cost-effective procedures for assessing natural resource damages" [43 CFR § 11.11]. When trustees complete an assessment according to these procedures, the results "shall be accorded the evidentiary status of a rebuttable presumption" [43 CFR § 11.11]. Therefore, the damage assessment described in this Assessment Plan will follow the regulations promulgated by DOI at 43 CFR Part 11.

Justification

The DOI regulations for conducting an NRDA involve several major components. The first is the development of a Preassessment Screen (PAS), used to determine whether a discharge of oil or a release of hazardous substances warrants a NRDA. The Trustees completed a PAS in accordance with 43 CFR §§ 11.23-.25 for the SIC Sites in June 2009 (USFWS et al. 2009). The PAS determined there was a reasonable probability of making a successful claim for damages for injuries to natural resources. Specifically, the PAS concluded:

- Releases of hazardous substances have occurred;
- Natural resources for which the trustees may assert trusteeship under CERCLA and CWA have been adversely affected by the discharge or release of hazardous substances;
- The quantity and concentration of the released hazardous substances are sufficient to potentially cause injury to natural resources;
- Data sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost; and
- Response actions planned are unlikely to sufficiently restore, replace, or provide compensation for injured natural resources without further action.

Therefore, the Trustees determined that further investigation and assessment is warranted at the SIC Sites in accordance with Federal Regulations at 43 C.F.R Part 11, subparts C and E. The Trustees further determined that current information indicates that there is a reasonable probability of making a successful natural resource damage claim pursuant to section 107 of the CERCLA and section 311 of the CWA. The Trustees further concluded that the value of damages for restoration determined through an NRDA will exceed their estimate of the potential assessment costs. The existence and availability of relevant data at the SIC Sites reduces these potential assessment costs. Therefore, the Trustees intend to make use of these data to the maximum extent possible.

Figure 1-1

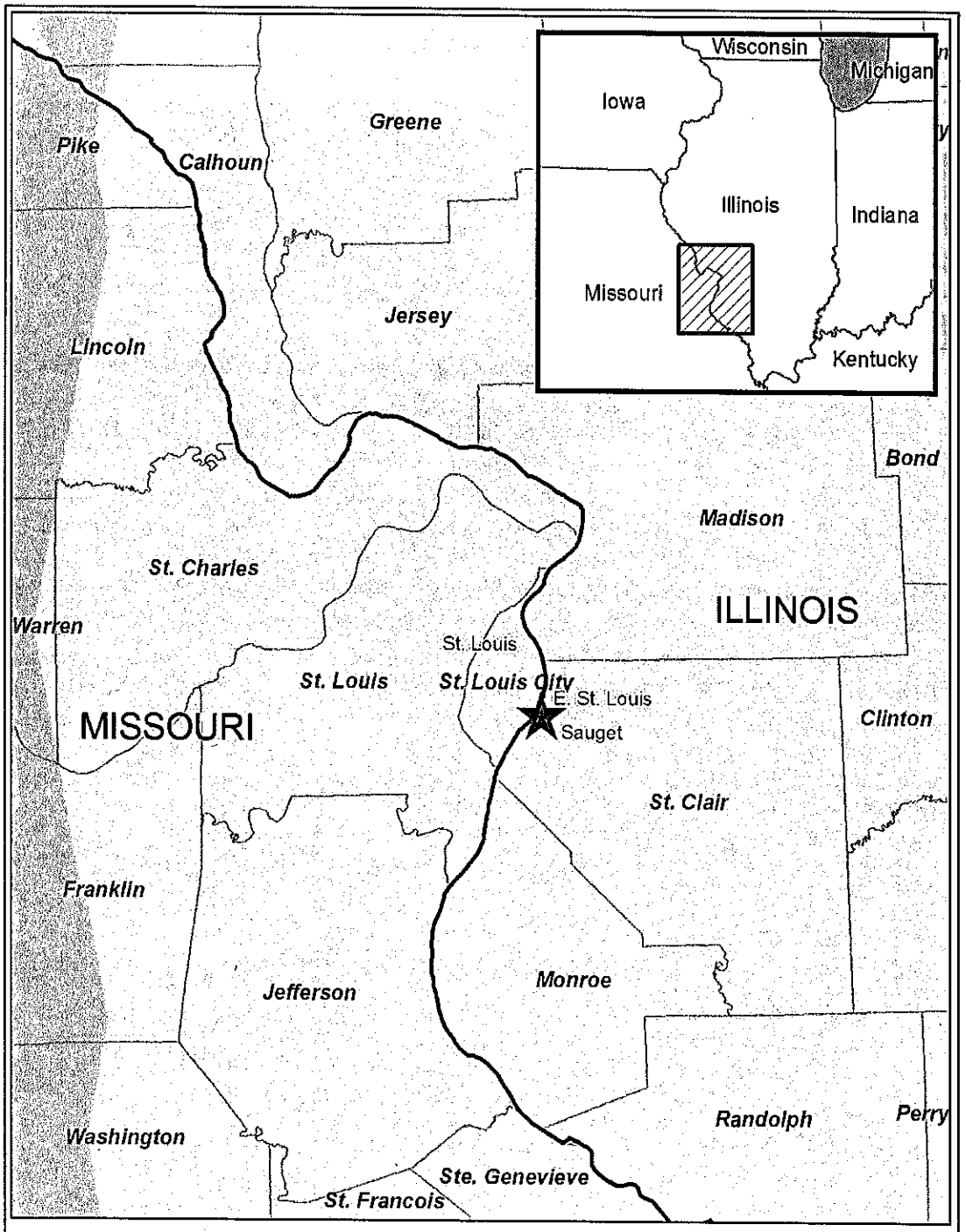

Figure 1. Sauget location map showing counties around St. Louis, MO and East St. Louis, IL area.

Figure 1-2

General Assessment Area Map

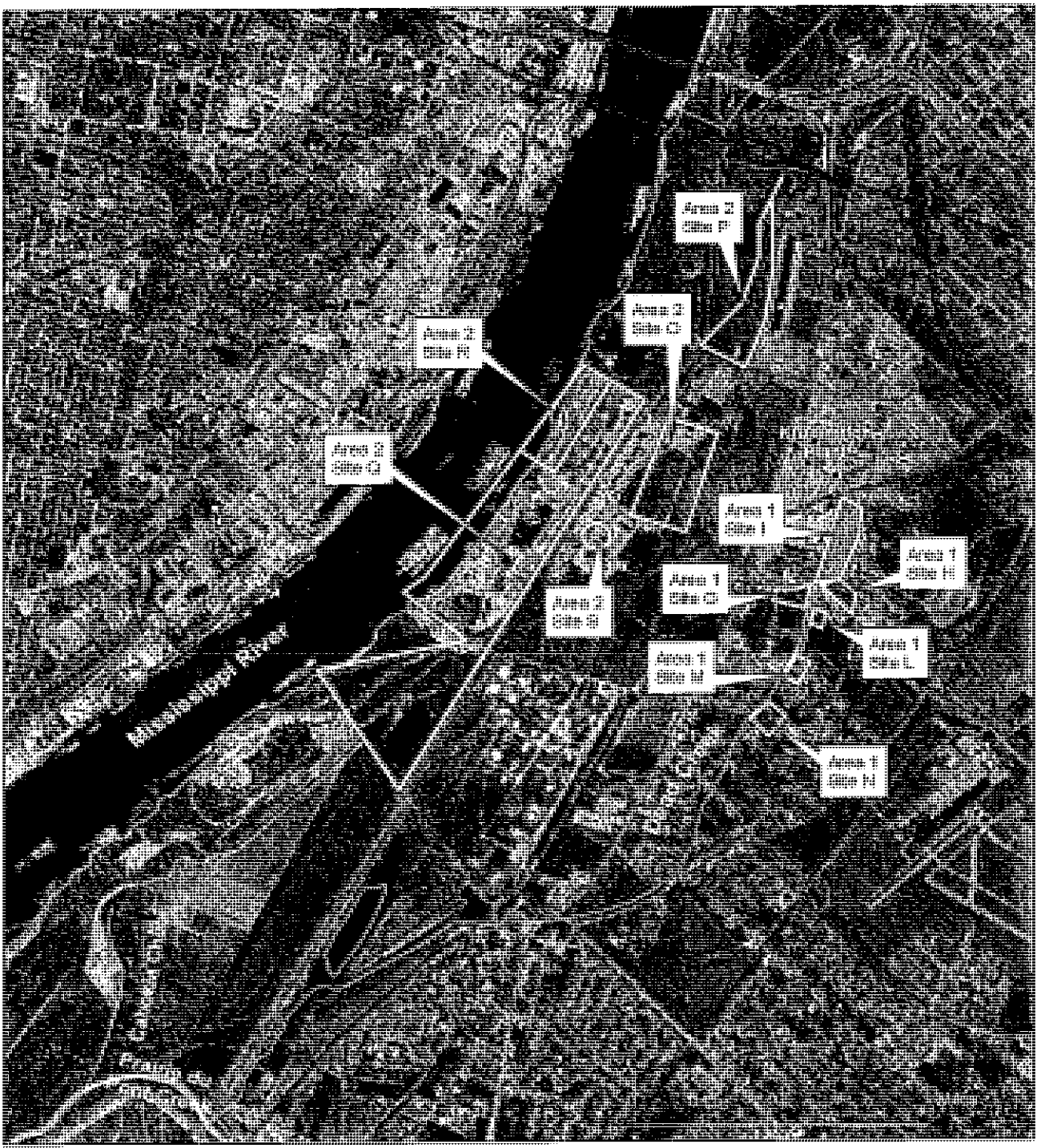

Figure 2. Map of CERCLA hazardous waste sites that are considered as operable units for the Sauget Area Sites, IL.

Map prepared by the Illinois DNR
Imagery; 2005 DOQ
March 2009

Purpose of the Assessment Plan

The Assessment Plan sets forth the manner in which the Trustees will conduct the natural resource damage assessment. The Assessment Plan documents the Trustees' basis for conducting a damage assessment and organizes the approach for quantifying natural resource injuries and calculating damages, as related to lost natural resource services associated with those injuries. By developing an Assessment Plan, the Trustees can ensure that the NRDA will be completed at a reasonable cost relative to the magnitude of damages sought. The Trustees also intend for this Plan to communicate assessment methodologies to the public, including the Potentially Responsible Parties (PRPs), in an effective manner so they can participate in the assessment process. As part of the regulations, trustees are required to provide an opportunity for public review of and comment on, the Assessment Plan.

This Assessment Plan lays out the steps the Trustees will undertake in calculating the two primary components of a damage claim: the cost to restore, rehabilitate, replace, and/or acquire equivalent resources for the injured resources; and "compensable values," or the monetary value of the natural resources and their services that were lost prior to the restoration of the injured resources to their "baseline" condition.[2] Baseline is "the condition or conditions that would have existed at the assessment area had the discharge of oil or release of hazardous substances under investigation not occurred" [43 CFR § 11.14(e)]. The concept of baseline in the context of this damage assessment is discussed in later chapters.

Decision to Perform a Type B Assessment

The DOI regulations provide for two types of assessments. The "Type A" assessment is a simplified assessment that requires minimal field observation and generates a damage claim through the application of a general computer model. The "Type B" assessment comprises a more comprehensive set of studies and analyses. Use of the Type A model is generally limited to the assessment of relatively minor, short duration discharges or releases that occur in coastal or marine environments or in the Great Lakes (other conditions, listed at 43 CFR § 11.34, may also warrant use of the Type A model). The Type B assessment is warranted when a Type A assessment is not [43 CFR § 11.24 -11.35].

A number of the conditions that would support the use of a Type A approach are not satisfied for this NRDA, including:

- The discharge or release was not of a short duration. In this case, releases of hazardous substances have occurred over a period of many years.
- The discharge or release was not minor. In this case, releases of hazardous substances have had a significant adverse effect on the natural resources within the assessment area.

[2] The third component of a damage claim is the "reasonable and necessary" costs incurred by trustees to complete the damage assessment [43 CFR § 11.15(a)(3)].

- The release was not a single event. In this case, multiple releases have occurred.

- The discharge or release did not occur into a coastal or Great Lake environment, which is a requirement of the Type A models.

Therefore, the Trustees have determined that a Type B assessment is warranted in this case.

Preliminary Estimate of Damages

As part of the planning process for a Type B assessment, the Trustees are required to prepare a preliminary estimate of natural resource damages. The purpose of this estimate is to guide the Trustees in the selection of specific technical, economic, or other methodologies for completing the assessment. The Trustees should proceed with the assessment if there is sufficient confidence that the value of calculated damages will exceed the costs of performing the proposed damage assessment activities. The Trustees are not required to make public the results of the preliminary estimate of damages until the assessment is complete.

The Trustees have completed a preliminary estimate of damages and are confident that the value of damages determined through an NRDA will exceed their estimate of the potential assessment costs. An important factor that reduces potential assessment costs is the existence, and availability, of relevant data that Federal and State agencies and PRPs have already collected. As described later in this Plan, the Trustees intend to make use of these data to the maximum extent possible.

Organization of the Assessment Plan

This Assessment Plan includes:

- A statement of the authority for asserting trusteeship, or co-trusteeship, for those natural resources considered within the Assessment Plan [43 CFR § 11.31(a)(2)];
- Explanation of the decision to proceed with a type B assessment [43 CFR § 11.31(b)];
- Information sufficient to demonstrate coordination with remedial investigation and feasibility studies (RI/FS) [43 CFR § 11.31(a)(3)];
- Descriptions of the geographic areas and natural resources involved [43 CFR § 11.31(a)(2)];
- Results of the confirmation of exposure of natural resources to hazardous substances [43 CFR § 11.31(c)(1)];
- Descriptions of the general approach for injury determination [43 CFR § 11.62] and injury quantification [43 CFR § 11.71(b)(2)];
- Descriptions of the approach for conducting the damage determination[43 CFR § 11.80] ; and,
- A Quality Assurance Plan that satisfies the requirements listed in the NCP and applicable United States Environmental Protection Agency (USEPA) guidance for quality control and quality assurance plans [43 CFR § 11.31 (c)(2)].

The Trustees will use existing data and data that are being collected as part of the RI/FS, if applicable, in assessing injuries to natural resources. The Trustees may expand upon RI/FS data collection activities to enable the most effective use of these data for injury assessment purposes.

Chapter 1 of this Assessment Plan provides an introduction to the natural resource damage assessment at the SIC Site. Chapter 2 of this Assessment Plan provides background information that establishes the framework for this damage assessment. Chapter 3 provides confirmation that natural resources have been exposed to hazardous substances. Chapter 4 describes the methods to document and evaluate the nature and degree of injuries to natural resources, and the impairment of ecological and human use services resulting from those injuries. Chapter 5 provides an introduction to the concept of damages, with an emphasis on restoration and potential methods by which the trustees will calculate compensation for injury to natural resources . While it is not feasible at this time to complete a detailed Restoration and Compensation Determination Plan, which would include the identification of a preferred restoration alternative from among a set of alternatives, Chapter 5 describes the types of restoration alternatives likely to be considered, the categories of compensable values for which the Trustees might claim damages, and the economic methodologies the Trustees would likely use to estimate these compensable values. Chapter 6 identifies the type of information to be included in a Quality Assurance Project Plan (QAPP), and provides an overview of data management procedures for this assessment.

Coordination with Other Governmental Activities

The DOI regulations require the coordination of a damage assessment, to the extent possible, with response actions or other investigations being performed pursuant to the NCP (i.e., Superfund site cleanup activities). This requirement generally reflects circumstances in which a damage assessment is being undertaken with respect to a single site. In this case, a wide range of cleanup and other investigation and response activities (pursuant to CERCLA, CWA, the Resource Conservation and Recovery Act (RCRA), and a variety of state and regional environmental initiatives) are planned or underway at the numerous "sites" located within the SIC Sites. At a minimum, the Trustees intend to take into consideration the objectives of these activities during the continued planning and implementation of this assessment. Whenever possible, the Trustees will explicitly coordinate damage assessment activities with other investigations and will ensure that appropriate consideration is given to parties undertaking or completing remediation or restoration activities that satisfy the Trustees' NRDA objectives. IEPA serves as both a Trustee and a coordinating agency for cleanup at the site. In addition, the Trustees are working closely with the Region 5 Office of the USEPA, the lead remedial agency. An USEPA Region 5 representative will serve as a main point of contact for information concerning the USEPA's activities at the SIC Sites.

Coordination among trustees is an essential component of a cost-effective damage assessment. With this in mind, the Illinois Trustees and the Federal Trustee have signed a Memorandum of Agreement, dated March 2007, and the Missouri Trustee and the Federal Trustee have signed a Memorandum of Understanding, dated September 2004, both of which provide a general framework for coordination and cooperation among the Trustees and for the implementation of the Trustees' activities in furtherance of their natural resource trustee

responsibilities. The FWS acts as lead administrative Trustee and is the central point of contact for the parties that would like to communicate with any or all of the trustee agencies. The Trustees' determination (through the PAS) that further investigation and assessment is warranted at the Sites, and the Trustees' intention to proceed with an assessment, were relayed to the PRPs via a Notice of Intent (NOI) dated June, 2009. The Trustees or their technical representatives have also met or conferred with the PRPs several times to discuss natural resource injury data and restoration issues at the SIC Sites. It is the intent of the Trustees to implement this Assessment Plan following public review.

Copies of this Plan are being made available to the public and to the identified PRPs for the SIC Sites. The Trustees intend to continue coordination and/or communication with the USEPA, the IEPA (also a Trustee), the PRPs, and the general public as this damage assessment proceeds. The Trustees note that the PRPs, IEPA, and USEPA are currently planning, conducting, and participating in activities that will better characterize environmental conditions in the assessment area and may help to address natural resource injuries.

PRPs may be involved in the assessment planning, assessment implementation, or implementation of restoration at any time, at the discretion of the Trustees. The Trustees have invited the PRPs for the SIC Sites to participate in the NRDA process. At this time, the PRPs have not responded to the invitation; therefore, the Trustees are moving forward with the assessment. The Trustees will continue to encourage the active participation of the PRPs in the implementation of this damage assessment. It is the intention of the Trustees to work cooperatively with the PRPs at each stage of the assessment and to take advantage of the expertise that the PRPs may be able to provide. As previously mentioned, the Trustees recognize that the PRPs are currently planning, conducting, and participating in activities that will better characterize environmental conditions in the assessment area and will perhaps help to address natural resource injuries. The Trustees strongly encourage the PRPs to assist them in understanding the nature and extent of natural resource injuries, both by participating in the collection of data relevant to this natural resource damage assessment and by providing them with documentation of PRP activities (e.g., work plans, results, and data analyses) as this information becomes available. Once the Trustees conduct the assessment, the DOI regulations provide that a demand be presented to the PRPs at the end of that process.

Participation in the Assessment by Non-Trustee Parties

The Trustees invite public participation in this natural resource damage assessment. Accordingly, the Trustees will solicit public comments from the PRPs, other affected Federal or State agencies or Indian tribes, and any other interested members of the public before completion of each major planning document, including:

- The Assessment Plan;
- The Restoration and Compensation Determination Plan; and
- Assessment Plan addenda that describe significant additions or changes to the approach described in this Plan.

Each public comment period will last for a period of at least 30 calendar days. The public comment period for this Assessment Plan began on Month Day/ 2012, the day the Notice of Availability was published in the Federal Register, local newspapers; therefore, the comment period will end on Month/Day, 2012. Comments may be submitted in writing to:

IL Department of Natural Resources
Attn: Tom Heavisides
One Natural Resources Way
Springfield, IL 62702email: Tom.Heavisides@Illinois.gov

In addition, the Trustees note that the public library in Cahokia is the repository for remedial documentation and provides access to documents used by the Trustees during the planning and implementation of the damage assessment. As this assessment proceeds, the Trustees will continue to seek out opportunities to inform and facilitate public engagement in the damage assessment process through the USFWS website (http://www.fws.gov/midwest/es/ec/nrda/Sauget/index.html).

Modifications to the Assessment Plan

This Assessment Plan may be modified at any stage of the assessment. Significant modifications to the Plan will be made available for review by the PRPs, any other affected natural resource trustees, other affected Federal or State agencies or Indian tribes, and any other interested members of the public for a period of at least 30 calendar days, with reasonable extensions granted as appropriate, before tasks in the modified Plan are begun. Non-significant modifications shall be made available for review by the PRPs, any other affected natural resource trustees, other affected Federal or State agencies or Indian tribes, and any other interested members of the public, but the implementation of such modifications need not be delayed as a result of the review.

Introduction

This damage assessment will address injuries to a variety of natural resources associated with the release of oil and hazardous substances from numerous sources in an area of extensive industrial activity. The complex nature of this assessment requires the Trustees to communicate effectively the proposed plan for calculating natural resource damages. As a first step toward achieving this objective, the Trustees include in this chapter preliminary background information on the geographic scope of the Assessment Area, the history of industrial activity within that area, the nature of hazardous substance releases to the environment, and the natural resources subject to injury resulting from those releases.

Geographic Scope of the Assessment Area

The SIC Sites are located within the Villages of Sauget, Cahokia, and East St. Louis, in St. Clair County, Illinois (Figure 1-2). The Assessment Area encompasses an area on the Mississippi River floodplain in Illinois that includes the SIC Sites as well as the surrounding and down-gradient natural resources and landscape including groundwater and the floodplains and downstream reaches of Dead Creek, Prairie du Pont Creek, Cahokia Chute, and the Mississippi River. Currently, the SIC Sites are comprised of various facilities, landfills, disposal areas, and other properties consisting of Sauget Area 1, Sauget Area 2, W.G. Krummrich Plant, and the Clayton Chemical Site. Sauget Area 1 is proposed for listing on the USEPA National Priorities List (NPL) [66 Fed. Reg. 47612-01 (proposed Sept. 13, 2001)]. Sauget Area 1 is located in Sauget and Cahokia and contains Sites identified as Dead Creek Segments A, B, C, D, E, and F (which includes Borrow Pit Lake), and Sites G, H, I, L, M, and N. Sauget Area 2 is also proposed for listing on the NPL [66 Fed. Reg. 47612 (proposed Sept. 13, 2001]. Sauget Area 2 is located in East St. Louis, Sauget, and Cahokia and contains Sites O, P, Q, R, and S, and a groundwater "Plume Discharge Area" of the Mississippi River, adjacent to Site R. The W.G. Krummrich Plant, located in Sauget, is the subject of a RCRA enforcement action. The Clayton Chemical Site, or RRG/Clayton Chemical Company Site, also located in Sauget, is identified by the USEPA as an Eligible Response Site and is the subject of a CERCLA enforcement action.

As mentioned above, there are three streams and one river associated with the Corridor: Dead Creek, Prairie du Pont Creek, Cahokia Chute, and the Mississippi River. Dead Creek is entirely contained within Sauget Area 1, originating in the Village of Sauget and flowing approximately 3.5 miles before emptying into Prairie du Pont Creek, which then flows approximately 0.4 miles to its confluence with Cahokia Chute. Cahokia Chute is an historic chute on the Mississippi River that once flowed around Arsenal Island, but Arsenal Island is now partially accreted to the mainland along the upstream part of the chute. Cahokia Chute flows for approximately one mile from its confluence with Prairie du Pont Creek, before joining the main channel of the Mississippi River. The Mississippi River flows alongside and constitutes the western border of the SIC Sites and includes the groundwater plume discharge area (consisting of commingled contaminated groundwater from Sauget Area 1, Sauget Area 2, the Krummrich

Plant, and the Clayton Chemical site) identified as part of Sauget Area 2 (USEPA 1999, USEPA 2002).

Land use in the SIC Sites is predominantly urban (residential) and industrial but also includes agricultural areas predominately to the south. Natural habitats include the aforementioned river or streams and their associated bottomland wetlands, emergent and seasonal wetlands, forests, and grasslands typical of the alluvial soils and ridge and swale topography that dominated the floodplain historically. Two regionally prominent ecological features associated with the SIC Sites are the remnant wetlands of the historically expansive American Bottoms wetlands complex that once occupied the local floodplain and the Mississippi River (IDNR 1998).

History of Industrial Activity and Identification of Potentially Responsible Parties (see Figure 1-2 for locations)

Sauget Area 1

Site G (5 acres) was used as a waste disposal area from 1952 to 1988 (Ecology and Environment, Inc. 1998, USEPA 1999). In 1995, the USEPA conducted a removal action at Site G. This removal action involved the excavation of polychlorinated biphenyls (PCBs), organics, metals, and dioxin-contaminated soils on and surrounding Site G, solidification of open oil pits on the Site, and covering part of the Site (including the excavated contaminated soils) with a clean soil cap approximately 18 to 24 inches thick. Approximately 60,000 cubic yards of additional contaminated wastes were consolidated into a landfill on site and covered with a soil cap. The now vegetated property is enclosed by a fence and is currently not in use (USEPA 1999, USEPA 2007).

Site H (6 acres) and Site I (19 acres) are connected and were together known as part of the "Sauget-Monsanto Landfill," which was used as a waste disposal area from 1931 to 1957 and is currently inactive. There is a building and truck parking area currently located on Site I (Ecology and Environment, Inc. 1998, USEPA 1999). Sites H and I contain approximately 110,000 and 250,000 cubic yards of contaminated waste and fill material, respectively (USEPA 1999).

Site L (0.17 acres) is inactive and the former location of two surface impoundments used for the disposal of tanker truck wash water contaminated with hazardous substances during cleaning operations of hazardous waste haulers from 1971 to 1981 (Ecology and Environment, Inc. 1998, USEPA 1999). The impoundments were subsequently filled-in, and the volume of contaminated fill material is not known (USEPA 1999).

Site M (1.35 acres) is inactive. It was a sand and gravel borrow pit in the mid to late 1940s and received overflows from Dead Creek Segment B. This pit contains approximately 3,600 cubic yards of contaminated sediments. Site M was part of a removal action for Dead Creek Segments B, C, D, E and F (see description for Dead Creek below). As part of this removal action, the pit was filled and covered with 3 feet of soil (USEPA 1999).

Site N (4-5 acres) is inactive and originally developed as a sand and gravel borrow pit in the 1940s, which was later filled with concrete rubble, scrap wood, demolition debris, and industrial waste. The depth of the fill may be as much as 30 feet (USEPA 1999).

Dead Creek (3.5 stream miles) is an urban stream that began receiving hazardous wastes from industrial sewer drainage systems following a 1928 easement agreement between local property owners and representatives of local business, municipal, and property interests. Their intent was to "improve the drainage in that District by improving Dead Creek so as to make it suitable for the disposal of wastewater, industrial waste, seepage and storm water" (USEPA 1999). As a result of this agreement, Dead Creek systematically received discharges from local businesses and the Village of Sauget. The creek served as a surcharge basin for the Village municipal sewer collection system and received direct wastewater discharges from local businesses. When the sewer system backed-up or overflowed, untreated wastes from industrial users discharged directly into Dead Creek Segment A (USEPA 1999). Dead Creek Segment B was hydrologically connected to Site M. Dead Creek Segment F is hydrologically connected to an approximately 70-acre lake and wetland named Borrow Pit Lake, which was constructed adjacent to Segment F when the Mississippi River flood control levee was constructed in the 1950s. Ongoing releases of hazardous substances into Dead Creek required dredging of Segment A multiple times over the years, with the last removal action occurring in 1990. The 1990 IEPA-led action involved removing 27,500 tons of sediment and filling-in the segment so that it no longer functioned as part of the creek (Ecology and Environment, Inc. 1998, USEPA 1999). In 2002, Solutia, Inc. began removal of approximately 75,000 tons of sediment and soil from Dead Creek Segments B, C, D, E, a portion of F, and Site M, to comply with a Unilateral Administrative Order issued by the USEPA for a time critical removal action. The Order also included installation of a high-density polyethylene liner in Dead Creek Segment B (USEPA 2001a).

Sauget Area 2

Site O (20 acres) is inactive and between 1965 and 1978 it contained four former sludge dewatering lagoons associated with the Village of Sauget wastewater treatment plant. Currently, these lagoons are covered with at least two feet of clay and vegetated (USEPA 2002).

Site P (20 acres) is mostly inactive with a newly constructed building on a corner of the Site. The Site was permitted as a general waste disposal area from approximately 1973 to 1984, but was cited repeatedly for accepting unpermitted wastes (USEPA 2000).

Site Q (90 acres) contains a barge terminal facility and several other active business operations. Historically, parts of Site Q, known as the "Sauget Landfill" and the "Old Milam Landfill," were used for waste disposal between the 1950s and 1970s. In 1995and 1999 to 2000, the USEPA and its contractors performed two removal actions at Site Q. These removals included excavating exposed drums along the Mississippi shoreline at Site Q, and more than 3,200 drums and over 17,000 tons of contaminated soil (USEPA 2000, USEPA 2002).

Site R (about 35 acres) contains a landfill known as the "Sauget Toxic Dump," "Monsanto Landfill," and the "River's Edge Landfill," which was used from 1957 to 1977 (USEPA 2000). In order to meet the conditions of the *2002 U.S. Environmental Protection Agency, Unilateral Administrative Order for Sauget Area 2 – Ground water Operable Unit*, three groundwater extraction wells have pumped groundwater flowing under and onto Site R since July 2003, and an underground barrier wall was constructed around three sides (north, west, and south) of the site in 2004. The extracted groundwater is treated by the American Bottoms Regional Wastewater Treatment Facility (USEPA 2002). Recent investigation has documented that the contaminated groundwater plume from the SIC Sites is not entirely captured by the underground barrier wall and a portion of the plume continues to reach and discharge into the Mississippi River (GSI Environmental, Inc. 2008). Also USEPA has recently required additional groundwater sampling data to better assess and define the groundwater plume as well as re-examine the Regional Groundwater Model (Personal communication with Ken Bardo, USEPA Feb. 2012).

Site S (approximately 0.9 acres) is adjacent to the Clayton Chemical Site. It is believed that Site S was used as a disposal area for still bottom waste from at least 1973 to 1975 and may have been used as a drum disposal area as well (USEPA 2002).

W.G. Krummrich Plant

The Monsanto Company (approximately 168 acres) opened the Krummrich Plant in 1917, manufacturing industrial chemicals, chemical intermediates, agricultural intermediates, and rubber chemicals. In 1997, Solutia, Inc. took over operations of the Krummrich Plant. Today, the Krummrich Plant manufactures performance materials used primarily in the automotive, architectural, transportation, and industrial markets. The Krummrich Plant is an active facility currently under a RCRA corrective action to investigate and respond to contaminated groundwater and contaminated soils (USEPA 2008a).

The $22 million RCRA corrective action remedy focuses on removing source areas of PCBs, benzene, chlorobenzenes, lead, and mercury potentially impacting workers, contaminating groundwater, and migrating to the Mississippi River. A soil vapor extraction (SVE) system was started up in January 2012 to address the benzene source area. An oxygen injection system to enhance biodegradation of the chlorobenzene source area is expected to be operational in March 2012. Subject to approval of a Remedial Action Plan (RAP) by IEPA, some 40,000 cubic yards of PCB contaminated soil will be excavated and disposed of at the Judith Lane Landfill, which was created as part of the Dead Creek removals. (Personal communication with Ken Bardo, USEPA Feb. 2012)

Clayton Chemical Site

Prior to 1961, the Clayton Chemical Site (7 acres) was used to repair and maintain railroad equipment. In 1961, the Clayton Chemical Company began recycling and recovering used solvents and waste oils on the parcel. In 1981, the Village of Sauget deeded the property to Clayton Chemical Company. In 1996, Clayton Chemical Company transferred its operations to the Resource Recovery Group. The Clayton Chemical Site is not currently operational and is

under an Administrative Order on Consent and a Unilateral Administrative Order to conduct remedial activities (USEPA 2005, USEPA 2008b).

Other Potential Sites

Based on information available at this time, and in accordance with statutory provisions in section 107(a) of CERCLA, the Trustees have relied on the USEPA's compilation of PRPs who may be liable for damages associated with injuries to natural resources occurring in the assessment area (See Appendix D of the Trustee's PAS). The Trustees may identify additional PRPs following the review of additional information. This listing may not be exhaustive or current.

Oil and Hazardous Substances Released in the Assessment Area

Information reviewed by the Trustees indicate that hundreds of hazardous substances have been emitted, emptied, discharged, allowed to escape, disposed or otherwise released directly or indirectly into the SIC Assessment Area. The PAS (SIC Natural Resource Trustees, 2009) presented a compilation of hazardous substances, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, PCBs, dioxins/furans, and metals that have been released to the environment in the Assessment Area. These contaminants are consistent with manufacturing processes operated at this location. Samples collected from surface water, ground water, soil, and sediments at the Site document these substances in natural resources within the Assessment Area. Based on the review of available data in the PAS (SIC Natural Resource Trustees, 2009), the Trustees intend to focus the assessment on natural resource injuries and damages resulting from releases of PCBs, VOCs, SVOCs, and metals. However, as more information becomes available through the remediation investigation and injury assessment, any information pertaining to other contaminants of concern listed above will also be taken into consideration.

Natural Resources and Services They Provide in the Assessment Area

Natural resources that have been, or potentially have been affected by the discharge or release of the hazardous substances, include but are not limited to: geologic resources, ground water, surface water (including sediments) and biological resources including aquatic and terrestrial plants and microorganisms; aquatic and terrestrial mammals; amphibians; fish; and migratory birds, including waterfowl, shorebirds, raptors and others. Services provided by these natural resources include fishing, and boating; provision of fish and wildlife habitat, quality food resources, and other services.

The Corridor provides important habitat for fish and wildlife species. Priority resource needs that have been identified for this area include conserving and enhancing fishery habitat, nesting and rearing habitat for migratory wildlife, migratory birds, waterfowl, wading birds and associated habitat. The overall diverse ecology of the Corridor in association with and including the American Bottoms Wetlands and the Mississippi River, supports a high diversity of resident

and migratory wildlife, including habitat supporting six species of Illinois listed endangered and threatened wetland/river associated birds and one of the largest wading bird rookeries in the state, within a five mile radius of the SIC Sites. In a broader view, within the 100-year floodplain and Mississippi River on the Illinois side from Madison County (just north of the Corridor) downstream to the confluence of the Ohio River, there are occurrences of 64 Illinois listed, including five federally listed, endangered or threatened species, 30 Illinois Natural Areas Inventory sites, which are state-registered high-quality natural communities, and four islands of the Middle Mississippi River National Wildlife Refuge. (See Appendix B, IDNR 2008, and USFWS 2009, for more details including a listing of Federal and State resources and sites).

The Mississippi River flyway is one of the four major flyways used by migratory birds on the North American continent as they migrate between their wintering ranges in the southern United States and Latin America and their breeding ranges in the northern United States, Canada and the Arctic. Millions of birds, including 40 percent of all North American waterfowl, and 60 percent of all North American bird species, use the Mississippi flyway to forage, rest and breed (McGuiness 2000, Wiener *et al.* 1998). An estimated 292 migratory bird species utilize the Upper Mississippi River (an area from the mouth of the Ohio River at Cairo, Illinois, to the beginning of the commercial shipping channel at Minneapolis, Minnesota), which includes the reach along the Corridor, during some part of their life cycle (Korschgen and Hill 1996).

Waterfowl use of the Mississippi River flyway provides significant economic benefits to the five states that border the Upper Mississippi River (Missouri, Illinois, Iowa, Minnesota, and Wisconsin) (IEc 1999). In those same states, bird watchers contributed about twice as much to the economy of these five states as waterfowl hunters (IEc 1999).

The Upper Mississippi River supports a diverse fishery of about 143 species of indigenous fish within 29 families (IEc 1999, USGS 2007). The fishery includes a variety of recreational sport and commercial fish species. This big river system contains deep channels, which also support some ancient fish species, including the paddlefish, and three sturgeon species all of which can grow to large sizes (USGS 1998). Some of the fish species live their whole life in a small area of the river while other species move around between locations or migrate over great distances along the length of the river to spawn. There are at least 12 Illinois and five Missouri listed endangered or threatened fish species, one of which is also federally listed as endangered, found in the Upper Mississippi River (USGS 1998). Recreational fishing in the Upper Mississippi River provides significant economic benefits to the five bordering states (IEc 1999).

Introduction

The DOI NRDA regulations state that before including Type B assessment methodologies in the Assessment Plan, the Plan must confirm that:

> "at least one of the natural resources identified as potentially injured in the preassessment screen has in fact been exposed to the released substance" [43 CFR § 11.37(a)].

A natural resource has been exposed to a hazardous substance if "all or part of [it] is, or has been, in physical contact with a hazardous substance, or with media containing the hazardous substance" [43 CFR § 11.14(q)]. The DOI regulations also state that "whenever possible, exposure shall be confirmed by using existing data" from previous studies of the assessment area [43 CFR § 11.37(b)(1)].

The DOI regulations define five categories of natural resources for which natural resource damages may be sought: groundwater resources, surface water resources, air resources, geologic resources, and biological resources, including aquatic and terrestrial plants and microorganisms; aquatic and terrestrial mammals; amphibians; fish; and migratory birds, including waterfowl, shorebirds, raptors, and others [43 CFR § 11.14].

The Trustees' PAS identifies resources within each of the five categories listed above as potentially injured. This part of the Plan provides confirmation of exposure, based on a review of the available data, for a number of the potentially injured resources within the Assessment Area, including:

* ground water resources
* surface water resources, including surface water and sediments
* geologic resources

The remedial investigations of Sauget Area 1 and 2 document exposure of natural resources to dozens of hazardous substances. These investigations have documented exposure of groundwater, surface water resources (sediment), and geologic resources (soil) to hazardous substances released from the SIC. The trustees are focusing primarily on PCBs, VOCs, SVOCs, and metals since the majority of the available exposure data relate to these contaminants. However, as more information becomes available through the RI/FS process information, any information pertaining to the remaining contaminants of concern will also be considered.

Groundwater

Ground water resources are defined as "water in a saturated zone or stratum beneath the surface of land or water and the rocks and sediment through which ground water moves. It includes ground water resources that meet the definition of drinking water supplies" [43 CFR § 11.14(t)].

Groundwater in the SIC area occurs in the American Bottoms aquifer. The material above the bedrock surface in the American Bottom is largely alluvial, consisting of clay, silt, sand, and gravel. During the remedial investigation phase, GSI Environmental (2008) characterized the aquifer in detail, separating the aquifer into three distinct units: shallow hydrogeologic unit (SHU), middle hydrogeologic unit (MHU), and deep hydrogeologic unit (DHU). The SHU falls within the Cahokia Alluvium, comprises mainly silty and poorly graded sands, and is approximately 15-30 feet thick. Both the MHU and the DHU are within the Henry Formation, comprising mainly poorly graded sands with hydraulic conductivities approximately two orders of magnitude higher than in the SHU.

Portions of groundwater in the approximately 175-square mile American Bottoms aquifer are potentially affected resources. The groundwater provides a variety of ecological services in addition to the human use and nonuse services. The ecological services include storage and maintenance of water levels or moist soil for floodplain wetlands. The groundwater resources also provide use, option, and bequest values related to all of the services mentioned above, and nonuse values, including existence values, related to all of the services mentioned above.

The Sauget Area 1 and Area 2 remedial investigations documented exposure of groundwater resources to benzene, (mono)chlorobenzene, and dichlorobenzene; tetrachloroethene, trichloroethene, dichloroethene, and vinyl chloride; 4-chloroanaline; the pesticide 2,4-D; and arsenic (URS, 2008; GSI Environmental, Inc., 2009). These hazardous substances are found in the shallow, middle, and deep hydrologic units of the American Bottoms aquifer. Benzene and chlorobenzene are widespread, with contaminant plumes covering several hundred acres (URS, 2008; GSI Environmental, Inc., 2009). See appendix A for a list of contaminants and corresponding concentrations detected at the SIC.

Surface Water Resources

Surface water resources are defined as the waters of the United States, including the sediments suspended in water or lying on the bank, bed, or shoreline [43 CFR § 11.14(pp)]. Services provided by these resources include fishing, boating, and swimming; provision of fish and wildlife habitat; quality food resources; and other services which will be fully described in later sections of this Assessment Plan. The following sections briefly describe each of these categories in the context of the Assessment Area.

The primary surface water resources in the Assessment Area include the water and the bed and bank sediments of Dead Creek, Prairie du Pont Creek, Cahokia Chute, and the Mississippi River; however, the Area also includes ponds, wetlands, etc., of the American Bottoms floodplain. Contamination of these resources has both direct and indirect impacts on the health of biological resources. For example, contaminated sediments can cause injury to benthic invertebrate populations, which in turn can result in injuries to resident fish populations for whom the invertebrates are a source of food. Similarly, injury to invertebrates and/or fish resulting from exposure to contaminated sediments and surface water can lead to injury in local insectivorous or piscivorous bird populations. In addition, contaminated sediments serve as a source of continuing releases of hazardous substances to the water column.

Available data on chemical concentrations in sediment document that these resources are exposed to contaminants of concern from the SIC. See appendix A for a list of contaminants and corresponding concentrations detected at the SIC.

Geologic Resources

Geologic resources are defined as "those elements of the Earth's crust such as soils, sediments, rocks, and minerals . . . that are not included in the definitions of ground and surface water resources" [43 CFR § 11.14(s)]. In this case, geologic resources include the soils and sediments located in upland and wetland areas closely associated with the Mississippi River, its tributaries, and the soils of lands within the American Bottoms.

The remedial investigations (RI) documented soil exposure to many hazardous substances released in the SIC Sites. A list of the hazardous substance exposure at each specific site is compiled in Appendix A. Briefly, within Area 1, soils were exposed to VOCs, including acetone, BTEX, 2-butanone, and dichloromethane; SVOCs, including PAHs, 4-chloroaniline, dichlorobenzene, and trichlorobenzene; pesticides, including DDT, DDE, and DDD; PCBs; and metals, including copper, lead, nickel, and zinc (GSI Environmental, Inc., 2009).

URS (2008) summarized hazardous substance exposure in the soils of each of the Area 2 sub-sites as part of the Area 2 RI. As in Area 1, contamination was widespread in each subsite. For example, in the surface soils of Site O, URS (2008) documented the presence of 11 VOCs, 24 SVOCs, 12 pesticides, 7 herbicides, 8 PCB congeners, dioxins, metals, and ammonia. Similar lists were compiled for each of the other subsites within Area 2. Multiple contaminants were detected at every Site within Area 2. The remedial investigation thus confirms widespread exposure of geologic resources to hazardous substances released in the SIC Sites. See appendix A for a list of contaminants and corresponding concentrations detected at the SIC.

The remedial agencies at this site, where applicable, have developed soil remediation goals. The IEPA has developed soil remediation goals know as Tiered-Approached to Corrective action Objectives (TACO). USEPA has published documents that describe a process used to derive risk-based ecological soil screening levels (Eco-SSLs) for many contaminants in soil (USEPA Ecological Soil Screening Levels Feb 2005).

Results from the above studies provide evidence that a variety of natural resources have been exposed to contaminants of concern in and around the SIC Site. This evidence indicates that natural resources may have been injured as a result of exposure to hazardous substances released at the Site and provides the basis for further assessment as described in Chapter 4 of this Assessment Plan.

Biological and Air Resources

In addition to the resources mentioned above, biological and air resources are categories of natural resources for which damages may be sought. Biological resources are defined in the DOI regulations as "those natural resources referred to in section 101(16) of CERCLA as fish and wildlife and other biota. Fish and wildlife include marine and freshwater aquatic and terrestrial species; game, nongame, and commercial species; and threatened, endangered, and

State sensitive species. Other biota encompass shellfish, terrestrial and aquatic plants, and other living organisms" [43 CFR § 11.14(s)]. DOI regulations define air or air resources as "those naturally occurring constituents of the atmosphere, including those gases essential for human, plant, and animal life" [(43 CFR § 11.14(b)]. The Trustees intend to review available data to determine the extent that these resources have been exposed to contaminants of concern and associated injury to the resource.

Introduction

The injury assessment, comprising both injury determination and injury quantification, is the process that informs trustees' ultimate claim for natural resource restoration and, if warranted, "compensable values," or compensation for losses incurred prior to the completion of restoration activities. The DOI regulations instruct trustees to take the following steps in completing the injury determination phase of the assessment:

- Identify and categorize each potentially injured resource;
- Select and implement injury determination methodologies and specific testing and sampling methods for each potentially injured resource, taking into consideration the DOI definitions of injury and the acceptance criteria for a determination of injury within each resource category. (The injury definitions and the acceptance criteria are provided in the DOI regulations [43 CFR § 11.62]); and
- Determine the pathway by which the potentially injured resources have been exposed to oil or hazardous substances.

The DOI regulations provide a process for collecting data on the effects of a discharge of oil or release of hazardous substances in the absence of sufficient relevant existing data. In this case, relevant data have been collected over a period of many years. Because of the DOI regulations' emphasis on conducting a cost-effective assessment, the Trustees will use existing data to the greatest extent possible consistent with generally accepted quality standards both to document injuries and to define and focus additional data collection efforts.

Injury determination is followed by quantification of the documented injuries. During the injury quantification stage, trustees evaluate the effect of the discharges or releases in terms of the reduction in the quantity and quality of natural resource services relative to the baseline level of services. The DOI regulations instruct trustees to take the following steps in completing the injury quantification phase of the assessment:

- Measure the extent of the injuries documented in the injury determination phase;
- Estimate the baseline conditions of the injured resources;
- Identify the baseline services provided by the injured resources;
- Determine the recoverability of the injured resources; and

- Estimate the reduction in services relative to baseline resulting from the discharges or releases [43 CFR §11.70(c)].

The reduction in services is the measure by which the trustees determine, in the damage determination phase, both the appropriate course of action to restore injured resources to their baseline conditions and the magnitude of compensable values.

The following sections describe activities the Trustees will undertake to determine and quantify injury to natural resources in their respective Assessment Areas. The Trustees have developed this portion of the Assessment Plan with the intention of achieving three objectives:

(1) Document the nature and extent of injuries to natural resources as "indicators" of the broader range of potential injuries, such that the development of a comprehensive restoration plan is possible;

(2) Complete the injury assessment in the most cost-effective manner possible, balancing the need for clear and convincing documentation of injuries with the need for an expeditious assessment at a reasonable cost; and

(3) Satisfy the requirements for an injury assessment provided in the DOI regulations.

Injury Assessment Approach and Data Sources

Injury is defined in the DOI regulations as a "measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a . . . release of a hazardous substance, or exposure to a product of reactions resulting from the . . . release of a hazardous substance" [43 CFR § 11.14(v)]. The definition of "injury" encompasses the concepts of "injury," "destruction," and "loss" [43 CFR § 11.14(v)]. The injury assessment will involve two basic steps, injury determination and injury quantification, as indicated below:

1. Injury determination. The Trustees will determine whether an injury to one or more natural resources has occurred as a result of releases of hazardous substances [43 CFR § 11.62]; and

2. Injury quantification. The injuries determined by the Trustees will be quantified in terms of changes from "baseline conditions" [43 CFR § 11.71(b)(2)].

Quantification will address both the spatial and temporal extent of injury, as well as evaluation of the degree of injury. Quantification will be conducted primarily to provide information that is relevant to the damage determination and to restoration planning.

Natural resources under the trusteeship of the Trustees that have been potentially injured by releases of hazardous substances at and from the facilities include, but are not necessarily limited to: groundwater resources; surface water resources including sediment and pore water; geologic resources including wetlands, floodplain, and in-stream soils and sediments; and biological resources such as freshwater fish; freshwater mussels; mammals, amphibians, reptiles; migratory birds, including waterfowl, raptors, and others; threatened and/or endangered species; aquatic and terrestrial plants; invertebrates; and microorganisms. The Assessment Plan will address all or a subset of these natural resources, depending on the availability of requisite data and information. If the evaluation of existing data indicates that additional natural resources are injured, these injuries may also be addressed in the injury assessment. Natural resources and the ecological services they provide are interdependent. For example, surface water, bed, bank, and suspended sediments, floodplain soils, and riparian vegetation together provide habitat (including lateral and longitudinal connectivity between habitats) for aquatic biota, semi-aquatic biota, and upland biota dependent on access to the river or riparian zone. Hence, injuries to individual natural resources may cause ecosystem-level service reductions. Overall, it is the entire area's ecosystem and associated ecosystem services that may be injured as a result of the releases of hazardous substances.

The Trustees will gather and analyze available data and information relevant to assessing injuries in their respective Assessment Areas (as delineated on page 1) resulting from release of hazardous substances at and from the SIC Sites. Data sources that will be evaluated in the injury assessment include:

- Articles published in the peer-reviewed literature;
- State and federal government data and reports; and
- Industry data and reports.

Pathway Determination

The injury determination analysis described below will assist with defining pathways that link sources of oil and hazardous substances and various environmental media (e.g., groundwater, surface water, and sediments and soils) to biological resources. This pathway determination will be based on an evaluation of information on past and current operating and disposal practices at the facilities located within the respective Assessment Areas. The pathway determination will identify possible additional information that may be needed to complete the determination. Any assumptions and uncertainties utilized in this determination will be specified. The Trustees' general approach to pathway determination includes the following:

1. Conduct source characterization (identification of chemicals of concern or CoCs), including summarizing CoCs' properties relative to environmental media and biota. This characterization will provide a qualitative understanding of the potential environmental fate of the CoCs in question.

2. Characterize the region's physical features in terms of environmental media, including the area's hydrology/climate, flood regimes, soils, infrastructure features, topography, and any

unique features that may influence pathways. This characterization will lead to a summary that includes a description of potential pathways (e.g., air, food chain, and other pathways).

Injury Determination

This part of the Assessment Plan describes the Trustees' methods to document and evaluate potentially injured natural resources of the SIC Sites, and the impairment of ecological and human use services resulting from those injuries.

The Trustees will conduct assessments in accordance with the following:

The Illinois State Trustees will conduct assessment of Groundwater resources.

The Illinois State Trustees and the Missouri State Trustee will conduct assessment of State natural resources in the Mississippi River.

The Illinois State Trustees and the Federal Trustee will conduct assessment of State and Federal natural resources in Dead Creek.

The Illinois State Trustees and the Federal Trustee will conduct assessment of State and Federal Surface Resources (terrestrial and other aquatic, wetlands, ponds, small streams.)

Groundwater

An injury to ground water resources has resulted from the release of a hazardous substance if:

- "Concentrations of substances are in excess of drinking water standards, as established by Sections 1411-1416 of the Safe Drinking Water Act (SDWA), or by other Federal or State laws or regulations that establish such standards for drinking water, in groundwater that was potable before the release" [43 CFR § 11.62(c)(1)(i)].

- "Concentrations of substances are sufficient to have caused injury to surface water, air, geologic, or geological resources, when exposed to groundwater" [43 CFR § 11.62(c)(1)(iv)].

Relevant injury thresholds for groundwater include concentrations in excess of Sections 1411-1416 of the SDWA and/or Illinois Class I drinking water standards for groundwater [32 Ill. Adm. Code pt. 620].

Approach

The objective for evaluating groundwater injury is to identify and characterize the spatial, volumetric, natural, and temporal extent of groundwater injury, including assessing groundwater as a pathway to surface water resources. The Illinois State Trustees intend to focus their evaluation of groundwater resources primarily on groundwater injury, and secondarily as a pathway to injure surface water resources and aquatic habitat in the Mississippi River.

The Illinois State Trustees will evaluate existing groundwater data and models, including RCRA data from W.G. Krummrich, RI data from Area 1 and Area 2, and models of groundwater transport such as the American Bottoms flow and transport model (GSI Environmental, Inc., 2008) and Illinois Department of Transportation (IDOT) groundwater flow models (TBirdie Consulting, 2009).

The Illinois State Trustees will evaluate existing data to determine where concentrations of hazardous substances exceed SDWA and/or Illinois water quality standards. They will examine the data to determine the progression of the spatial extent of groundwater injury over time. If the Illinois State Trustees identify substantial data gaps, they may estimate the extent of injury by extrapolating from existing data.

The Illinois State Trustees have been working closely with the USEPA RCRA and CERCLA program to address some existing groundwater data gaps. As a result, USEPA has required W.G. Krummrich Plant to increase the number of monitoring wells in the assessment area. The data from new wells installed under the RCRA corrective action program will be included in the Illinois State Trustees' assessment of groundwater injury.

Surface water (Including Sediment)

Surface water injury has resulted from the discharge or release of a hazardous substance if concentrations and durations of substances are (1) in excess of applicable water quality criteria established by section 304(a)(1) of the CWA, (2) in excess of applicable drinking water standards (Sections 1411-1416 of SDWA or State laws) or (3) sufficient to have caused injury to groundwater, air, geologic, or biological resources, when exposed to surface water; suspended sediments; or bed, bank, or shoreline sediments [43 CFR § 11.62(b)(1)]. Hazardous substances in sediment can cause injury to biological resources through direct toxicity to sediment-dwelling benthic macro-invertebrates or sediment-dwelling fish and through indirect effects such as food-chain bioaccumulation to higher tropic level organisms. Hazardous substances in sediment can also cause injury to surface water resources exposed to the sediment.

Approach

The Trustees intend to utilize existing Site data to document surface water and sediment injury and provide evidence that establishes surface water as a link in the exposure pathway to other potentially injured resources. The Trustees will define, organize and compile water quality data, with regard to their respective Assessment Areas (as delineated on page 1), that has been collected through investigations as part of the remedial phase. This includes reviewing RI data for Area 1 & Area 2, Administrative Orders, action memorandums (i.e., USEPA Action Memorandum Dead Creek), documents in support of those orders or memorandums, and other relevant reports. The data will be organized into the previously mentioned Assessment Areas to assess injury to surface waters for Dead Creek, the Mississippi River, and other surface waters. The Trustees will evaluate whether surface waters areas were a committed use as aquatic life habitat, recreational resource, and/or water supply, and will determine whether criteria were exceeded or impacted prior to the release(s). The Trustees will use this evaluation to assess

baseline conditions. (The issue of baseline is discussed further in later parts of the document.) A timeline of releases and subsequent interim remedies for Dead Creek, Mississippi River, and surface waters will be defined in order to assess changes in duration and degree of injury.

The Trustees will compare appropriate surface water standards to observed concentrations and identify exceedances to existing water quality criteria with regard to their respective Assessment Areas (as delineated on page 1). Water quality and safe drinking water standards for Illinois are established by the Illinois Pollution Control Board.(For Illinois Water Quality Standards see the following; http://www.ipcb.state.il.us/documents/dsweb/Get/Document-33354/ See table 4.1 for select standards for Illinois Water Standards. The IPCB adopted Water Quality Standards (35 IAC Part 302, March 1990) for waters of Illinois that are consistent with the CWA goal of water quality that provides for the protection of fish, shellfish, wildlife and recreation in and on the water. The standards, which include numerical criteria for approximately 90 pollutants, established aquatic life and recreational uses as a designated uses of warm water streams in Illinois. Illinois adopted the standards to protect and enhance the waters of Illinois and the Mississippi River. In addition, when applicable, Missouri's water quality standards will be examined for the Mississippi River to identify exceedances of Missouri's water quality standards. These standards have been established by Missouri Clean Water Commission. See the following: http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.

The analysis is expected to be conducted using a geographic information system (GIS) (or other database management system) in order to more easily manage, analyze data and illustrate spatial relationships. The GIS application will also assist with identification of data gaps and sufficiency of existing data to fully and accurately define injury. The GIS analysis will incorporate a geology (e.g.,soil types and landscapes) and hydrology (e.g., flow patterns, flood regimes, drainage, etc.) component to the Assessment Areas. (Discussed previously under Pathway Section). This effort will assist in documenting pathways and expand on the preliminary assessment. (For additional discussion on preliminary surface water/sediment pathways for exposure, see the Trustees' PAS p. 10 FWS 2009). This information will be used for the injury determination phase.

Sediment

In addition, the Trustees intend to document contaminant concentrations above levels that cause injury in the sediments of the Mississippi River, Dead Creek, streams, ponds, and associated off-river riparian and/or wetland habitats and establish the pathway link between contaminant sources in sediments and biological resources. Ecosystem services provided by sediment include habitat for benthic, epibenthic and other biological resources dependant on the aquatic habitats in the SIC area. In addition, sediment contributes to services provided by surface water, including suspended sediment transport processes, cover for fish and their supporting ecosystems, primary and secondary productivity, geochemical exchange processes, and nutrient cycling and transport.

Table 4.1

SURFACE WATER CONTAMINATION	General Water Standards	
	Acute Standards ug/L (unless otherwise noted)	Chronic Standards ug/L (unless otherwise noted)
VOC AND SVOC		
Benzene	4200*	860*
2,4-dichlorophenol	680	13
(mono)chlorobenzene	990	79
1,2-Dichlorobenzene	210	170
1,3-Dichlorobenzene	500	200
1,4-Dichlorobenzene	1.8 mg/L	0.62 mg/L
1,1-Dichloroethylene	3000	240
1,2-Trans-Dichloroethylene	--	--
Pentachlorophenol	[20] at pH ≈ 8.**	[13] at pH ≈ 7**
Tetrachloroethene	1.2 mg/L	0.15 mg/L
Trichloroethene	12 mg/L	0.94 mg/L
Vinyl Chloride	22	1.7
4-chloroaniline	2.4	0.2
PCB		
2,4-D	100	8
4,4-DDT	1.1 ng/L	0.001 ng/L
Arochlor	---	---
Dieldrin	---	---
Endosulfan II	30.8 ng/L	5.6 ng/L
METALS		
Arsenic	360*	190*
Cadmium^{D}	2.81*	0.593*
Chromium (hexavalent, total)	16*	11*
Chromium (trivalent, dissolved)	972.04*	315.32*
Copper^{D}	32.85*	20.61*
Lead^{D}	160.45*	33.65*
Mercury^{D}	2.2*	1.1*
Nickel^{D}	148.69*	9.003*
Zinc^{D}	215.88*	38.97*

D = dissolved

All values are taken from 35 IAC 02.210 unless otherwise indicated

* Values calculated/taken from 35 IAC 302.208 (Hardness = 201 mg/L)

**Values enclosed by "[ ]" are national criteria and should be used for advisory purposes only

The acceptance criterion for injury to sediments is based on application of several regulatory agencies and/or research groups that have developed sediment effects concentrations (SECs) criteria. Typically these SECs are not codified, but provide a valid means of evaluating the potential for contaminated sediment to cause toxicity to sediment-dwelling biota. SECs have been developed for direct toxicity to sediment-dwelling biota (e.g., benthic and epibenthic macro-invertebrates) by various regulatory and research groups, including: Ontario Ministry of the Environment Guidelines for the Protection and Management of Aquatic Sediment (Persaud et al. 1993); USEPA Assessment & Remediation of Contaminated Sediments Program SECs) (Ingersoll et al. 1996; EPA 1996); NOAA Effects Ranges (Long and Morgan 1991); Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (Smith et al. 1996); and MacDonald's et al. (2000a, 2000b) Consensus-Based SECs.

For injury to higher tropic level organisms via food chain, sediment quality guidelines are not readily available. However, various regulatory agencies have developed food chain multiplier models for assessing the prediction of injuries through the food chain exposure route. For additional discussion on surface water/sediment pathways for exposure see the Trustees' PAS (USFWS 2009).

Approach

The Trustees will organize and compile sediment data that has been primarily collected through remedial investigations, with regard to their respective Assessment Areas (as delineated on page 1) This includes reviewing RI data for Area 1 & Area 2, Administrative Orders, action memorandums, documents in support of those orders or memorandums, and other relevant reports (examples include documents developed in support of: Sauget Area 1 Dead Creek Sediment Removal Action Plan by Solutia, Inc.; USEPA's 2006 Mississippi River Sediment Study, Solutia-Krumrich; etc.). Data will be organized to assess injury to sediments for Dead Creek, the Mississippi River, and other aquatic environs The data will be organized into the Assessment Areas defined for the SIC Sites. The Trustees will assess baseline conditions. (Discussed further in later sections.) The Trustees will develop a timeline of releases and subsequent interim remedies for Dead Creek, Mississippi River, and sediments in aquatic environs. This step will assist with assessing changes in duration and degree of injury.

The Trustees will compile various SECs into a database in order to compare observed concentrations and identify exceedances to existing SECs with regard to their respective Assessment Areas (as delineated on page 1). The analysis is expected to be complemented by a geographic information system (GIS) (or other database management system) in order to more easily manage, analyze data, and illustrate spatial relationships. The GIS analysis will incorporate a geology and hydrology component of the Assessment Areas in order to identify those areas for which existing data do not provide adequate characterization. This information will be used for the injury determination phase. (Injury determination is discussed in following the section).

Geological Resources

An injury to a geologic resource has resulted from the release of a hazardous substance if concentrations are sufficient to injure other resources, including terrestrial organisms and vegetation (e.g., toxicity), ground water, and wildlife [43 CFR 11.62(e)]. The DOI regulations also provide ten specific measures of injury to geologic resources, including concentrations of substances sufficient to: raise soil pH above 8.5 or lower it below 4.0; impede soil microbial respiration; cause a toxic response in soil invertebrates; and/or cause a phyto-toxic response, such as retardation of plant growth [43 CFR § 11.62(e)].

Ecosystem services provided by floodplain soils include habitat for all biological resources that are dependent on riparian or the terrestrial habitats in the SIC Sites. More specifically, floodplain soils provide habitat for migratory birds (i.e., the region is part of Mississippi flyway) and mammals; habitat for soil biota; growth media and nutrients for plants; carbon storage, nitrogen fixation, decomposition, and nutrient cycling; soil organic matter and allocthonous energy to streams; hydrograph moderation; and geochemical exchange processes. An example of human use services would include recreation (e.g., hiking, picnicking, etc.) and access corridors.

Approach

The Trustees intend to document contaminant concentrations in the soils of the Mississippi River floodplains and associated off-river riparian habitats (i.e., non-sediment), and document the link in the pathway between sources of soil contaminants and biological resources.

The Illinois State Trustees and the Federal Trustee will organize and compile soil data that has been primarily collected through remedial investigations. The data will be organized to assess injury to soils for terrestrial (non-sediment, non-aquatic) areas that are part of Surface Resources. This includes reviewing RI data for Area 1 & Area 2, Administrative Orders, action memorandums and documents in support of those orders or memorandums as well as other relevant reports (examples include documents developed in support of: Ecology & Environmental Inc. 1998, Vol. 1, Area 1 Data Tables/Maps, Solutia, Inc. 2002; Dead Creek final Remedy Engineering Evaluation/Cost Analysis Sauget Area 1, Sauget Area 2 Sites Group, 2003; and RI/FS Support Sampling Plan). The Illinois State Trustees and the Federal Trustee will organize data and assess baseline conditions of Surface Resources. Included as part of the baseline assessment, the Illinois State Trustees and the Federal Trustee will develop a timeline of releases and subsequent interim remedies for the SIC Sites involving non-aquatic environs of Surface Resources. This step will assist with assessing changes in duration and degree of injury.

The Illinois State Trustees and the Federal Trustee will compile various Eco-SSLs into a database in order to compare measured concentrations and identify exceedances to existing Eco-SSLs. The analysis is expected to be complimented by a geographic information system (GIS) (or other database management system) in order to more easily manage, analyze data and illustrate spatial relationships. "This evaluation will be conducted in conjunction with the sediment pathway evaluation identified in the previous section." The Illinois State Trustees and the Federal Trustee will use this information for the injury determination phase.

Biological Resources

An injury to biological resources has occurred if concentrations of released hazardous substances are sufficient to cause species or their offspring to have undergone at least one of the following adverse changes in viability: death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations [43 CFR § 11.62(f)(1)(i)]. (See Table 4-2). Injury to biological resources has occurred if concentrations of a hazardous substance exceeds action or tolerance levels in edible portions of organisms as defined by section 402 of the Food, Drug and Cosmetic Act, 21 U.S.C. § 342 [43 CFR § 11.62 (f)(1)(ii)]. Also, injury to biological resources has occurred if concentrations of hazardous substance sufficient to exceed levels for which an appropriate State health agency has issued directive to limit or ban consumption of such organism [43 CFR § 11.62 (f)(1)(iii)].

Table 4-2
Biological Responses for Determining Injury that Satisfy the DOI Acceptance Criteria (43 CFR § 11.62(f)(4))

Injury Category	Response
Death	Brain cholinesterase (ChE) enzyme activity Fish kill investigations Wildlife kill investigations In situ bioassay Laboratory toxicity testing
Disease	Fin erosion
Behavioral abnormalities	Clinical behavioral signs of toxicity Avoidance
Cancer	Fish neoplasm
Physiological malfunctions	Eggshell thinning Reduced avian reproduction Cholinesterase (ChE) enzyme inhibition Delta-aminolevulinic acid dehydratase (ALAD) inhibition Reduced fish reproduction
Physical deformation	Overt external malformations Skeletal deformities Internal whole organ and soft tissue malformation Histopathological lesions

Eighteen different biological responses in six categories of injury have, by rule, been determined to meet the acceptance criteria [43 CFR § 11.62(f)(4)]. These responses are listed in Table 4-2. Note the list in Table 4-2 does not represent everything that satisfies the criteria, only

those identified at 43 CFR § 11.62(f)(4). The Trustees will use these responses to document injury whenever possible as well as other responses that satisfy the acceptance criteria.

Approach

Biological resources also comprise a key component of this damage assessment. The Trustees will attempt to structure the data review for the assessment of injuries to biological resources around indicator species groups that can establish broader relationships. The candidate species groups include, but may not be limited to, benthic invertebrates, fish, and birds.

The Trustees intend to determine injury to biological resources in the Assessment Areas and further document the disruption of Areas' ecosystems caused by the presence of hazardous substances. The Trustees will identify regional biological resources by species and determine their susceptibility to injury by chemicals of concern in their respective Areas (as delineated on page 1). Trustees will assemble data inventory of contaminants found in resources, water, sediments, soil, and air. This inventory will identify those contaminants whose extent and concentration are elevated such that the contaminants are likely to cause injury to biological resources. This includes reviewing RI data for Area 1 & Area 2, Administrative Orders, action memorandums, documents in support of those orders or memorandums, and other relevant reports (examples include documents developed in support of: Menzie, Cura & Associates, Baseline Ecological Risk Assessments for Sauget Area 1 and Sauget Area 2; and MacDonald Environmental Services, Critical Evaluation of the Revised Baseline Ecological Risk Assessment (BERA) for Sauget Area 2 Sites).

The Trustees will determine exposure pathways between sources of contaminants and biological resources in their respective Assessment Areas. This step will be largely qualitative and will coordinate with other tasks in terms of pathway analysis. The Trustees will analyze the timeline of releases and subsequent interim remedies for Dead Creek, the Mississippi River, and Surface Resources. This step will assist with assessing changes in duration and degree of injury.

The Trustees will summarize the biological resources results and use the results for the injury determination phase. As part of this summary effort, the Trustees will organize data into Assessment Areas; Groundwater, Mississippi River, Dead Creek, and Surface Resources.

As noted there are several lines of evidence for pursuing injury to biological resources, and some examples are discussed. State agencies conduct and prepare fish advisories and fish advisories are in effect for Mississippi River for this region. (See web site for listing of species on health advisory http://www.idph.state.il.us/envhealth/fishadv/illinois_fish_advisory.pdf). Oil and hazardous substances, including PCBs and metals, have been detected in blue herons and black-crowned night herons and their eggs in and around the assessment area (USFWS 1987). The Trustees' observations of birds in the Assessment Area lead them to believe that eggs of some species of birds have failed to hatch as a result of exposure to oil and hazardous substances during incubation. This would represent an injury in accordance with the definition of reduced avian reproduction [43 CFR § 11.62(f)(4)(v)(B)]. MacDonald prepared comments on the baseline ecological risk assessments. Those aforementioned documents and MacDonald's comments in particular will be accessed and reviewed.

Air Resources

An injury to air resource has resulted from the release of a hazardous substance if concentrations of emissions are in excess of standards for hazardous air pollutants established by section 112 of the Clean Air Act, 42 U.S.C. 7412, or by other Federal or State air standards established for the protection of public welfare or natural resources; or concentrations and duration of emissions are sufficient to have caused injury to surface water, ground water, geologic or biological resources when exposed to the emissions [43 CFR § 11.62(d)]. Emissions in excess of the National Environmental Standards for Hazardous Air Pollutants (NESHAPs) may be applicable for the determination of injury to air resources.

Approach

Air quality standards for hazardous pollutants are generally regulated by NESHAPs. NESHAPS are standards for stationary source facilities and are found in 40 CFR pt. 61. They provide standards for seven hazardous air pollutants: asbestos, beryllium, mercury, vinyl chloride, benzene, arsenic, and radon/radionuclides. The 1990 CAA Amendments, significantly expanded USEPA's authority to regulate hazardous air pollutants. Section 112 of the Clean Air Act lists 188 hazardous air pollutants to be regulated by source category. (USEPA www.epa.gov/compliance/monitoring/programs/caa/neshaps.html). Based on a preliminary review of data (i.e., the PAS development), the determination of injury is more likely to be focused on how emissions or release of contaminants to the atmosphere can injure other resources.

The Trustees have conducted preliminary assessment efforts and data review as a part of the PAS. The Trustees will conduct a more extensive review of data in their respective Assessment Areas (as delineated on page 1). In this review, the Trustees will categorize what emissions data have been collected as part of the remedial process, determine whether sufficient data has been collected to appropriately determine injury to air resources and assess the degree to which the atmosphere serves as a pathway to other resources and use this information in the injury determination phase.

Air resources are typically assessed in the context of their ability to serve as a pathway for hazardous substances to reach, and potentially injure, other resource categories. The Trustees will likely focus assessment efforts primarily on the air resource pathway. (The Trustees note that the SIC sites hazard ranking system documents did not include a score for air migration due to lack of documentation (IEPA 2001a & b). The Trustees would reevaluate this assumption upon receipt of information suggesting that the air pathway is significant in the context of injuries to corridor resources and, if appropriate, the Trustees will prepare an additional phase to the Assessment Plan.

Injury Quantification

The DOI regulations state that the specific resources or services to quantify and the methodology for doing so should be based upon the following factors:

(1) The degree to which a particular resource or service is affected by the discharge or release;

(2) The degree to which a given resource or service can be used to represent a broad range of related resources or services;

(3) Consistency of the measurement with the requirements of the economic methodology to be used in the damage determination phase;

(4) The technical feasibility of quantifying changes in a given resource or service at reasonable cost; and

(5) Preliminary estimates of services at the assessment area and control area based on resource inventory techniques [43 CFR § 11.71(d)].

The regulations list a variety of natural resource services that trustees may choose to quantify, including but not limited to: provision of habitat; food and other needs of biological resources; recreation; other products or services used by humans; flood control; groundwater recharge; waste assimilation; and other such functions that may be provided by natural resources [43 CFR § 11.71(e)].

Considering the five factors listed above, the Trustees will investigate several different methods of injury quantification, according to the Trustees' respective Assessment Areas (as delineated on page 1). For example, quantification of injury to aquatic habitat may focus on the loss or impairment of surface water and sediment (including wetland areas) as habitat for biological resources, and the loss or impairment of recreational opportunities. The latter service is one of the human uses of injured biological resources, consistent with the second factor listed above. The Trustees intend to select the most appropriate method depending on the data. The DOI regulations also describe two general approaches for quantifying injuries to natural resources. The first, which the Trustees will examine, is to quantify resource injury involving the measurement of the scale of the injury itself. As discussed, the Trustees will review documents (e.g., reports, etc.) that define the geographic area and time period over which resources have been injured with regard to their respective assessment areas. The Trustees will then document by Assessment Area (i.e., Groundwater, Mississippi River, Dead Creek, and Surface Resources) the extent to which services have been reduced from their baseline condition.

The second approach, which the Trustees may examine, is the direct quantification of services. As described at 43 CFR § 11.71(f), direct quantification of services is appropriate if the following conditions are met:

(1) The change in the services from baseline can be demonstrated to have resulted from the injury to the natural resource;

(2) The extent of the change in the services resulting from the injury can be measured without also calculating the extent of change in the resource; and

(3) The services to be measured are anticipated to provide a better indication of damages caused by the injury than would direct quantification of the injury itself.

As described above, the steps in the injury quantification process include measuring the extent of injuries, estimating baseline conditions and services, determining resource recoverability, and estimating the service reduction. The Trustees' general approach is described below for the quantification of injuries to Groundwater Resources, Mississippi River, Dead Creek, and Surface Resources. The Trustees will follow the delineation on page 1 for the assessment of these areas. Each specific Assessment Area may require variations to the general approach as dictated by the resources of the area. It should be noted that these Assessment Areas are also intended to be useful for avoiding the issue of double counting of the loss of services.

Extent of injury

The Trustees will generate detailed thematic maps for the applicable injured resources. As described in the DOI regulations, the Trustees should measure areal and temporal variation in concentrations "in sufficient detail to approximately map the boundary separating areas with concentrations above baseline from areas with concentrations equal to or less than baseline" [43 CFR § 11.71(h)(2)(i)].

Baseline services determination

As noted in Chapter 1, "baseline" is the condition or conditions that would have existed in the assessment area had discharges or releases of hazardous substances under investigation not occurred. The baseline services are those services that would have been provided by injured resources but for the discharges or releases of hazardous substances. Whenever possible, the baseline level of services should be based upon historical data. If appropriate historical data are not available, the trustees should, if possible, collect baseline data from reference (or "control") locations that are similar to the assessment area.

The DOI regulations permit the trustees to use baseline data that are not expected to represent fully the baseline conditions, subject to the trustees' ability to document that:

- Substitute baseline data shall not cause the difference between baseline and the conditions in the assessment area to exceed the difference that would be expected if the baseline were completely measured; and

- It is either not technically feasible or not cost-effective to measure the baseline conditions fully and that these baseline data are as close to the actual baseline conditions as can be obtained subject to these limitations [43 CFR § 11.72(b)(5)].

The Trustees will assess historical data, suitable reference locations, and other means to make reasonable determinations of baseline resource quantity and quality. Factors that may

affect baseline conditions include the impacts of industrialization (i.e., not related to contaminant release) that may have contributed to the loss or degradation of resources services, as well as releases of hazardous substances from other sources (natural or non-SIC related). Essentially, the Trustees will use available data to determine as accurately as possible the degree to which services would have been reduced absent the releases of hazardous substances from the SIC Sites.

Resource recoverability analysis

The Trustees will determine changes in the resources and will document remedial efforts to date in the vicinity of SIC Sites. The Trustees will assess the persistence of contaminants' ability to create situations in which it will likely take many decades or more for resources to return to their baseline conditions through natural processes.

As part of the injury quantification process, trustees are required to estimate the time needed for injured resources to recover to their baseline condition, both without restoration efforts beyond planned or ongoing response activities, and with proposed restoration alternatives. Trustees will evaluate recovery of resources, including reviewing remedial actions at the Site. If the final Record of Decision has not been developed before assessment work is completed, the Trustees may need to revisit resource recovery analysis in subsequent phases.

Service reduction

For groundwater resources, the Illinois State Trustees will quantify the reduction in services by measuring the total area and volume of groundwater that have been degraded relative to the baseline condition. If data is readily available to support loss of human services and these services can be assessed in a cost-effective manner, they will be included.

For the Mississippi River, the Illinois State Trustees and Missouri State Trustee will quantify the reduction in services as the difference between the level of services estimated to be provided by the Mississippi River with and without the release of hazardous substances. The Illinois State Trustees and Missouri State Trustee will attempt to augment data on the impairment of surface water and sediment as habitat for biological resources with human loss use data. Any double counting of lost services which result, for example, from calculating both loss of habitat and loss of recreational opportunities, will be addressed to ensure double counting is not included in the damage determination and restoration planning phase of the assessment. See 43 CFR § 11.83(a)(3)(iii).

For Dead Creek, the Illinois State Trustees and the Federal Trustee will quantify the reduction in services by measuring the total area of those habitats that have been degraded relative to their baseline condition. Further, if data are available to document service losses to Dead Creek due to releases of hazardous substances from the SIC Sites, then the measure of lost services will supplement the total acreage of sediment and aquatic habitat. Primarily, injuries to biological resources will be measured through quantification of lost habitat services. If data is readily available to support loss of human services and these services can be assessed in a cost-effective manner, they will be included.

For surface resources, the Illinois State Trustees and the Federal Trustee will quantify the reduction in services by measuring the area of those habitats that have been degraded relative to their baseline condition. Further if data are available to document service losses of surface resources due to releases of hazardous substances within the SIC Sites, then the measure of lost services will supplement the total acreage of sediment and soil habitat. Primarily, injuries to biological resources will be measured through quantification of lost habitat services. If data are readily available to support loss of human services and these services can be assessed in a cost-effective manner, they will be included.

Introduction

This chapter describes the Trustees' approach for conducting the damage determination. The first part of this chapter provides an overview of the approach to be used by the Trustees including restoration planning and costing. The chapter also describes the approach for the determination of compensable values.

Overview of Approach to Damage Determination

The purpose of a damage determination is to "establish the amount of money to be sought in compensation for injuries to natural resources resulting from a . . . release of a hazardous substance" [43 CFR § 11.80(b)]. The DOI regulations define the measure of damages as restoration costs plus, at the discretion of the authorized official, the compensable value of all or a portion of the services lost to the public for the time period from the release until the attainment of the restoration, replacement, and/or acquisition of equivalent of baseline [43 CFR § 11.80(b)]. Restoration costs are the costs of restoration actions that restore the injured resources and services to baseline, which is the condition that would have existed had the hazardous substance release(s) not occurred [43 CFR § 11.14(e)].

Natural resource services are defined as the "physical and biological functions performed by the resource, including the human uses of those functions" [43 CFR § 11.14(nn)]. Restoration actions include actions to restore, rehabilitate, replace, or acquire the equivalent of the injured resources and services they provide. Compensable values for interim losses include both past losses and losses that will occur until the injured resources and services are returned to baseline. Thus, the total amount of NRDA damages includes both the cost of restoration to baseline and the compensable values for interim losses [43 CFR § 11.80(b)]. All recovered damages will be used by the Trustees for restoration of natural resources and natural resource services.

Compensable value is the amount of money required to compensate the public for loss in services provided by injured resources between the time of the release of the hazardous substance(s) and the time that resources are restored or replaced. Compensable value can be determined as an economic value or by utilizing a restoration cost approach [43 CFR § 11.83(c)]. Where practicable, the Trustees will use existing information, potentially supplemented by new, focused, simple site-specific data collection efforts (e.g., primary interviews, discussions, and/or meetings), to assess compensable values for interim losses in their respective Assessment Areas (as delineated on page 1).

Damage Determination Methods

Currently, the Trustees are considering two general approaches to damage determination: restoration of equivalent natural resources, and economic valuation based on the value of certain natural resources on the open market. The damage determination effort will estimate damages based on one or both of these approaches.

Equivalent Restoration

The habitat equivalency analysis (HEA) is an appropriate methodology for determining the necessary scale of compensation based on the acquisition of equivalent resources and the services that they provide [43 CFR § 11.83(c)(2)(ix)]. "HEA is a method used to quantify the effects of natural resource injuries resulting from release of hazardous substance or other anthropogenic perturbations and to scale compensatory restoration. Restoration scaling using HEA involves quantifying the expected effects of a restoration action so that the benefits of the restoration are equivalent to the losses associated with the habitat degradation." (Cacela, Dave, Lipton, Joshua, Beltman, Douglas et.al. 2005. See source for more information or Dunford et.al., "The Use of Habitat Equivalency Analysis in Natural Resource Damage Assessments" Ecological Economics 2003.)

The basic premise of this approach is that the public can be compensated for interim service losses through the provision of additional services of the same or similar type in the future. The measure of compensable values is not dollars, but the diminished resource services themselves. For example, the measure of compensable values can be expressed in terms of acres of a particular type of wetland lost or injured.

The following steps describe the process the Trustees will use to complete the HEA.

1. Inventory habitats that have been injured.

2. Characterize the nature and extent of the injury, including the areal extent, type, and degree of injury.

3. Determine other inputs to the analysis, including period of loss, length and type of assumed recovery, discount rate, etc.

4. Calculate the present value loss of "habitat-acre-years," including documentation of the sensitivity of the analysis to any major assumptions.

Upon completion of the analysis, the Trustees may proceed to inventory and assess potential "compensatory" habitats and to develop options for sets of habitats that would provide services equal to those that have been lost.

Market-Based Approach

For water resources, including groundwater, that are traded in reasonably competitive

markets, one of the valuation methods available to the trustees is the market price method [43 CFR § 11.83(c)(2)(i)]. Water that could have been available from groundwater underlying the SIC Sites absent any injuries may be valued using market data that are readily available, comprehensive, and consistent. The Illinois State Trustees will evaluate the water market in the nearby American Bottoms/Mississippi River floodplain area to determine whether to use this approach for Groundwater Resources.

If adequate data are available to establish a market and the market price approach is used, damages will be estimated based on the market value for groundwater in the region (i.e., water users' willingness to pay). As with any market price valuation, the ultimate estimate of appropriate value will depend upon an analysis of variables affecting the price for each transaction. Such variables may include quality, location, reliability of supply, and quantity of water transacted.

To develop market prices for groundwater in the region, the Illinois State Trustees will use data from nearby communities that establish appropriate prices for groundwater as a community water source. The price of water would then be used to calculate the annual diminished value of injured resources. Market prices for dates after those available in the collected data would be based on statistical forecasts using projections of variables that help explain changes in water prices, such as development in the region. Values may also be based on differences in water quality and any use restrictions or other constraints not related to the injury.

Restoration Planning

As discussed above, USEPA is currently completing the RI/FS at various parts of the SIC Sites. In addition, USEPA is addressing groundwater contamination through the RCRA process at the W.G. Krummrich Plant. During these processes, data will be gathered and analyzed that will help define the type, scope, and location of contamination throughout the Assessment Area. Until those efforts – together with any additional data-gathering or studies by the Trustees in their respective Assessment Areas – have been completed and the results are applied to an injury determination, it will not be possible to develop a comprehensive strategy to restore the natural resources that have been injured. Nonetheless, this aspect of the assessment planning effort will begin to identify the types and amount of preferred restoration actions and to estimate the costs of their implementation.

Ecosystem-based restoration actions can restore resources and/or services that are similar to, but not the same as, those that are injured. General examples of such restoration actions could include habitat restoration or enhancement, stocking programs, species management programs, and improvements in the public's ability to use or enjoy resources. The DOI's NRDA regulations emphasize the restoration of natural resources to baseline (i.e., conditions that would be present absent the release of oil and hazardous substances), as measured by their services. Services are defined as:

"[T]he physical and biological functions performed by the resource. . . . These services are the result of the physical, chemical, or biological quality of the resource" [43 CFR §11.14(nn)].

The DOI regulations also state that:

"[S]ervices include provision of habitat, food and other needs of biological resources. . . flood control, ground water recharge, waste assimilation, and other such functions that may be provided by natural resources" [43 CFR §11.71(e)].

At the SIC Sites, the services provided by different components of the ecosystem are inextricably linked to each other. Because the various natural resources are so intimately linked, an ecosystem-based approach toward restoration planning will accomplish full restoration. Further, considering these interdependencies will allow restoration actions to fully compensate the Trustees for their respective lost resource services in a cost-effective manner.

NRDA regulations require an Assessment Plan to include a Quality Assurance Project Plan (QAPP) that "satisfies the requirements listed in the NCP and applicable EPA guidance for quality control and quality assurance plans" [43 CFR 11.31(c)(2)]. In performing this assessment, the Trustees will use readily available Site data and if necessary collect supplemental data. In the event additional applicable studies are conducted, those studies will have individual QAPPs tailored to that specific study. Therefore, this section of the Assessment Plan will not provide a specific QAPP, but will instead outline the type of information that should be included. Studies used in the assessment will be screened to verify that supporting documentation is available and sufficient to allow for an evaluation of the reliability and usability of the information. This chapter will also provide an overview of the types of data sources that may be used in completing this assessment.

A QAPP is a formal document describing the necessary Quality Assurance/Quality Control (QA/QC) and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. In general, a QAPP must provide sufficient detail to demonstrate that:

* The project technical and quality objectives are identified and agreed upon (USEPA, 2001b);

* The intended measurements, data generation or data acquisition methods are appropriate for achieving project objectives (USEPA, 2001b);

* Assessment procedures are sufficient for confirming that the type and quality of data required (and expected) are obtained (USEPA, 2001b); and

* Any limitations on the use of the data can be identified and documented (USEPA, 2001b).

The QAPP shall be composed of standardized, recognizable elements covering the entire project from planning, through implementation, to assessment. (USEPA, 2001b). These elements have been arranged into four general groups and their intent are summarized as described by USEPA Requirements for Quality Assurance Project Plans (2001b):

Project Management - Project management elements include the project history and objectives, roles and responsibilities of the participants, etc. These elements ensure that the project has a defined goal, that the participants understand the goal and the approach to be used, and that the planning outputs have been documented.

Data Generation and Acquisition - Data elements in this group address all aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and QC activities are employed and properly documented.

Assessment and Oversight - These elements address the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of assessment is to ensure that the QAPP is implemented as prescribed.

Data Validation and Usability - These data elements address the QA activities that occur after the data collection or generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the project objectives.

Trustee Organization and Responsibility

A Data Manager will provide oversight for supplemental studies and ensure the use of laboratories that follow QA/QC procedures that satisfies the requirements listed in the NCP and applicable EPA guidance for quality control and quality assurance plans.

Data Source

This section describes the data and information sources that will be considered for use in conducting this assessment. Readily available data and information will be used to the extent possible. However, when necessary, supplemental studies will be conducted to obtain data considered critical for providing a sound scientific basis for this assessment, but are not currently available.

Available Data

The Trustees will gather and evaluate available information relevant to this assessment for the purpose of determining exposure, evaluating pathways, and confirming injuries resulting from releases of hazardous substances at the SIC Site. Data sources that will be considered in the assessment include, but may not be limited to:

state and federal government reports and data
industry reports and data
RI/FS reports, including technical memoranda

Only information that has sufficient supporting documentation will be used in the assessment. Data sources will be screened to verify that supporting documentation is available and sufficient to allow for an evaluation of the reliability and usability of the information. Data sources should have the following types of supporting documentation available to be considered usable:

* sampling methodology, including information on sample location, environmental media samples, and measurement units;

* chemical analysis, including information on detection limits and methodology;

* raw data or data tabulations; and

* accompanying quality assurance/quality control (QA/QC) data or separate QA/QC reports

Data that are considered acceptable will be compiled into an electronic format for analysis (e.g. database or spreadsheets). Steps to ensure data quality for this procedure include: validation of all data entered and review of calculations performed on the data. Changes and modifications to the data will be tracked.

Supplemental Data Collection

If necessary, the Trustees will collect additional data not currently available but considered critical for the purpose of determining exposure, evaluating pathways, and confirming injuries resulting from releases of hazardous substances at the SIC Site. Study plans detailing sampling sites, methodology, sample analysis, and sample processing and handling procedures will be developed for each study conducted.

Procedures for Sharing Data

The NRDA regulations state that an Assessment Plan includes "procedures and schedules for sharing data, split samples, and results of analyses, when requested, with any identified potentially responsible parties and other natural resource trustees" [43 CFR 11.31 (a)(4)].

To facilitate the data-sharing process, the trustees will provide RPs and other state or federal agencies with an opportunity to obtain a copy of the data used in the assessment once the data have been validated.

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GLOSSARY OF TERMS

Avian	Of or relating to birds.
Aquifer	A water-bearing bed or layer of permeable rock, sand, or gravel capable of yielding considerable quantities of water to wells or springs.
Baseline	The condition or conditions that would have existed at the assessment area if discharges of oil or releases of hazardous substances had not occurred.
Benthic	Occurring on the bottom of a body of water.
Bioaccumulation	The process by which materials (usually contaminants) build up in an organism (e.g., through consumption of other contaminated organisms or absorption through the skin).
Biota	The animal and plant life of a region.
Committed use	A current public use or a planned public use of a resource for which there was a documented legal, administrative, budgetary, or financial commitment established before the release of the hazardous substance was detected.
Compensable value	The amount of money required to compensate the public for the loss in services provided by injured resources between the time of discharge or release and the time the resources and services provided by those resources are fully returned to their baseline conditions.
Damages	The amount of money sought by natural resource trustees as compensation for injury to, destruction of, or loss of natural resources. The measure of damages is the cost of restoration, rehabilitation, replacement and/or acquisition of the equivalent of injured natural resources and the services those resources provide. Damages may also include the compensable value of all or a portion of the services lost, as well as the cost of conducting the natural resource damage assessment.
Dewater	To remove the water from (e.g., by draining, pressing, or pumping).
Hardness	A quality of water generally measured as the concentration of calcium and magnesium in the water.
Histopathology	The study of the effects of disease on body tissues.
Injury	A measurable adverse change, either short- or long-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance.
Insectivorous	Depending on insects for food.
in situ (ex situ)	In place (not in place).
Lesion	An abnormal change in the structure of an organ due to injury or disease.
Natural resourees	Land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise

	controlled by the United States, any State or local government, foreign government, or Indian tribe.
Non-point source	Pollution from broad areas (e.g., fertilizer and pesticide application and leaking sewer systems) rather than from discrete points.
Pathway	The route or medium through which oil or a hazardous substance is or was transported from the source of discharge or release to the injured resource.
Phyto-toxic	Poisonous to plants.
Piscivorous	Depending on fish for food.
Point source	Pollution originating from any discrete source (e.g., outflow from a pipe or ditch).
Riparian	Of or relating to, or living or located on, the bank of a watercourse or lake.
Riverine	Formed by, living, or situated on the banks of a river.
Services	The physical and biological functions performed by a resource, including the human uses of those functions. A resource may provide a service to another resource (e.g., habitat for fish is a service provided by surface water).
Trustee	A designated federal or state natural resource management agency or an Indian tribe that has the authority to commence an action for natural resource damages.

APPENDIX A

Appendix A. Hazardous Substances

Sauget Area 1 Site, Sauget and Cahokia, Illinois, Site by Site Selected Media Contamination Levels

Site G Contamination	Site H Contamination	Site I Contamination	Site L Contamination	Site M Contamination
VOCs	**VOCs**	**VOCs**	**VOCs**	**VOCs**
Benzene (Soil- 45,349 ppb) (GW- 4,100 ppb)	Benzene (Soil- 61,290 ppb) (GW-4,300 ppb)	1,1,1-trichloroethane (Soil-1,692 ppb)	Chloroform (Soil- 20,253 ppb) (GW-730 ppb)	2-butanone (Soil- 14,000 ppb)
Tetrachloroethene (Soil-58,571 ppb) (GW-420ppb)	Tetrachloroethene (5,645 ppb)	Trichloroethene (Soil- 3,810 ppb) (GW- 279 ppb)	Benzene (Soil- 4,177 ppb) (GW- 150 ppb)	Chlorobenzene (Soil- 10 ppb) (GW-33 ppb)
Chlorobenzene (Soil-538,462 ppb)	Toluene (Soil- 76,450 ppb) (GW- 7,300 ppb)	Benzene (Soil- 24,130 ppb) (GW-1,400 ppb)	Toluene (Soil- 26,582 ppb)	Ethylbenzene (Soil- 0.82 ppb)
Total xylenes (Soil-41,538 ppb)	Chlorobenzene (451,613 ppb)	Tetrachloroethene (Soil-5,265 ppb) (GW- 470 ppb)	**SVOCs**	Chloroform (GW- 27 ppb)
Toluene (GW- 7,300 ppb)	Ethyl-benzene (12,788 ppb)	Toluene (Soil- 77,910 ppb) (GW- 740 ppb)	2-chlorophenol (Soil- 2,152 ppb) (GW- 130 ppb)	Toluene (GW- 19 ppb)
Ethyl benzene (GW- 840ppb)	Total xylenes (23,630 ppb)	Chlorobenzene (Soil- 126,900 ppb) (GW- 3,100 ppb)	Pentachlorophenol (Soil-58,228 ppb)	**SVOCs**
Trans-1,2 dichloroethene (GW-200ppb)	Chloroform (GW- 3,000 ppb)	Ethyl benzene (Soil- 15,070 ppb)	Di-n-butyl phthalate (Soil- 2,784 ppb)	1,4-dichlorobenzene (Soil- 40 ppm)
1,2-dichloroethane (GW- 480ppb)	**SVOCs**	Vinyl chloride (GW- 790ppb)	Phenol (GW- 150 ppb)	1,2-dichlorobenzene (Soil- 26 ppm)
Trichloroethene (GW- 800ppb)	1,4-dichlorobenzene (Soil-30,645,161 ppb)	Total xylenes (Soil- 19,180 ppb)	4-methyl phenol (GW- 75 ppb)	1,2,4-trichlorobenzene (Soil- 14 ppm)
Chloroform (Soil-11,628 ppb)	1,2-dichlorobenzene (Soil-19,354,839 ppb)	**SVOCs**	2-nitrophenol (GW- 41 ppb)	Pyrene (Soil- 27 ppm)
SVOCs	1,2,4-trichlorobenzene (Soil-7,580,645 ppb)	1,3-dichlorobenzene (Soil- 70,140 ppb)	4-chloroaniline (GW- 60 ppb)	Fluoranthene (Soil- 21 ppm)
Phenol (Soil-177,800 ppb)	4-nitroaniline (Soil-1,834,000 ppb)	1,4-dichlorobenzene (Soil- 1,837,000 ppb)	2-chlorophenol (130ppb)	Chrysene (Soil- 12 ppm)
2,4,6-trichlorophenol (Soil-49,530 ppb) (GW-350 ppb)	Phenanthrene (Soil-2,114,000 ppb)	1,2-dichlorobenzene (Soil- 324,000 ppb)	**PCBs and Pesticides**	Benzo(b)fluoranthene (Soil- 15 ppm)
Pentachlorophenol (Soil-4,769,231ppb)	Fluoranthene (Soil-1,330,000 ppb)	Naphthalene (Soil- 514,500 ppb)	Total PCBs (Soil- 500 ppm)	Phenol (GW 28 ppb)
1,2,4- trichlorobenzene (GW-1,900ppb)	Phenol (GW-950 ppb)	Hexachlorobenzene (Soil- 1,270,000 ppb)		2-chlorophenol (GW-14 ppb)
4-chloroaniline (GW- 15,00 ppb)	Pentachlorophenol (GW-650 ppb)	Phenol (GW- 1,800 ppb)	**Metals**	2,4-dimethyl phenol (GW- 13 ppb)
Naphthalene (Soil-5,428,571 ppb) (GW-21,000 ppb)	**PCBs and Pesticides**	Bis(2-chloroethoxy) methane (GW- 2,900 ppb)	Antimony (Soil- 32 ppm)	2,4-dichlorophenol (GW- 150 ppb)
PCBs and Pesticides	Arochlor 1260 (Soil-18,000,000 ppb) (GW-52 ppb)	1,2,4-trichlorobenzene (GW- 2,700 ppb)	Arsenic (Soil- 172 ppm) (GW- 14,000 ppb)	Pentachlorophenol (GW- 120 ppb)
Arochlor 1248 (Soil-174,419 ppb)	4,4-DDE (780 ppb)	4-chloroaniline (GW- 9,600 ppb)	Nickel (Soil- 2,392 ppm)	**PCBs and Pesticides**
Arochlor 1260 (Soil-5,300,000 ppb) (GW- 890 ppb)	4,4-DDD (431 ppb)	Pentachlorophenol (GW- 2,400 ppb)	Cadmium (32 ppb)	Total PBCs (Soil- 1,100 ppm) (GW-0.0044 ppb)
4,4-DDE (Soil-135,385 ppb)	4,4-DDT (923 ppb)	**PCBs and Pesticides**	Zinc (2,210 ppb)	Dieldrin (GW- 0.18 ppb)
Dioxins and Furans	**Metals**	Arochlor 1260 (Soil- 342,900 ppb)		Endosulfan II (GW- 0.06 ppb)
Dioxin (Soil-44,974 ppb)	Arsenic (Soil-388 ppm) (GW-8,490ppm)	4,4-DDD (Soil- 29,694 ppb)		4,4-DDT (GW- 0.24 ppb)
Metals	Cadmium (Soil-294 ppm)	4,4-DDT (Soil- 4,305 ppb)		2,4-D (GW- 47 ppb)
Arsenic (Soil-123 ppm) (GW- 179 ppb)	Copper (Soil-2,444 ppm) (GW- 2,410 ppm)	**Metals**		2,4,5-TP (Silvex) (GW- 3.4 ppb)
Barium (Soil- 45,949 ppm)	Lead (Soil- 4,500 ppm)	Beryllium (Soil- 1,530 ppm)		**Metals**
Copper (Soil- 2,215 ppm)	Manganese (Soil- 36,543 ppm)	Copper (Soil- 630 ppm)		Antimony (Soil- 41.2 ppm)
Lead (Soil- 3,123 ppm)	Mercury (Soil- 3.9 ppm)	Lead (Soil- 23,333 ppm)		Barium (Soil- 9,060 ppm)
Mercury (Soil-34.3 ppm) (GW-2.1 ppb)	Nickel (Soil- 15,097 ppm)(GW-17,200 ppm)	Zinc (Soil- 6,329 ppm)		Cadmium (Soil- 47.2 ppm)
Nickel (Soil- 399 ppm) (GW- 349 ppb)	Silver (Soil- 44 ppm)	Cyanide (Soil- 3,183 ppm)		Copper (Soil- 21,000 ppm)
Zinc (Soil- 4,257 ppm) (GW-1,910ppb)	Zinc (Soil- 39,516 ppm)			Nickel (Soil- 2,490 ppm)
Cyanide (GW- 350ppb)	Cyanide (GW-480ppm)			Silver (Soil- 26 ppm)
				Zinc (Soil- 31,600 ppm)
				Lead (Soil- 1,910 ppm)
				Arsenic (Soil- 94 ppm)
				Cyanide (Soil- 1.3 ppm)

Sauget Area 1 Site, Sauget and Cahokia, Illinois, Site by Site Selected Media Contamination Levels

Site N Contamination	Site CS-A Contamination	Site CS-B Contamination	Site CS-C Contamination	Site CS-D Contamination
SVOCs	**VOCs**	**VOCs**	**VOCs and SVOCs**	**VOCs and SVOCs**
Phenanthrene (Soil- 434 ppb)	1,2-dichloroethene (15,000 ppb)	Benzene (Sediment- 87 ppb)	Fluoranthene (Sediment- 4,600 ppb)	4-methyl-2-pentanone (Sediment-1,200 ppb)
Fluoranthene (Soil- 684 ppb)	Trichloroethene (Soil &Sediment- 100,000 ppb)	Toluene (Sediment- 810 ppb) (SW- 20 ppb)	Pyrene (Sediment- 4,500 ppb)	Benzo(b)fluoranthene (Sediment-500 ppb)
Pyrene (Soil- 553 ppb)	Tetrachloroethene (Soil &Sediment- 11,000 ppb)	Chlorobenzene (Sediment- 5,200 ppb) (SW- 33 ppb)	Benzo(a)anthracene (Sediment- 3,300 ppb)	Indeno(1,2,3-cd)pyrene (Sediment-310 ppb)
	Chlorobenzene (Soil &Sediment- 31,000 ppb)	Ethyl benzene (Sediment- 3,600 ppb)	Chrysene (Sediment- 4,400 ppb)	Dibenzo(a,h)anthracene (Sediment-360ppb)
Metals	Ethyl benzene (Soil &Sediment- 80,000 ppb)	Trichlorobenzene (Sediment- 3,700 ppm)	Benzo(b)fluoranthrene (Sediment- 7,500 ppb)	**PCBs**
Mercury (Soil- 9 ppm)	Xylene (Soil &Sediment- 500,000 ppb)	Dichlorobenzene (Sediment- 12,000 ppm)	Benzo(a)pyrene (Sediment- 4,500 ppb)	Total PCBs (Sediment- 12,000 ppb)
	SVOCs	Chloronitrobenzene (Sediment- 240 ppm)	Indeno(1,2,3-cd)pyrene (Sediment- 4,300ppb)	**Metals**
	1,3-dichlorobenzene (Soil &Sediment- 17,000 ppb)	Xylene (Sediment- 540 ppm)	Benzo(g,h,i)perylene (Sediment- 1,500 ppb)	Cadmium (Sediment- 42 ppm)
	4-chloroaniline (Soil &Sediment- 17,000 ppb)	Chloroform (SW- 27 ppb)	Dibenzo(a,h)anthracene (Sediment- 4,000ppb)	Copper (Sediment- 1,630 ppm)
	Acetophenone (Soil &Sediment- 24,000 ppb)	1,1-dichloroethene (SW- 3 ppb)	4-methyl-2-pentanone (Sediment- 1,200 ppb)	Lead (Sediment- 480 ppm)
	1,2,4,5-tetrachlorobenzene (Soil &Sediment- 28,000 ppb)	**SVOCs**	**PCBs**	Mercury (Sediment- 1 ppm)
	Pentachlorobenzene (Soil &Sediment- 37,000 ppb)	1,4-dichlorobenzene (Sediment- 220,000 ppb)	Total PCBs (Sediment- 27,500 ppb)	Zinc (Sediment- 6,590 ppm)
	Phenanthrene (Soil &Sediment- 14,000 ppb)	1,2-dichlorobenzene (Sediment- 17,000 ppb)	**Metals**	Cadmium (SW- 8.1 ppb)
	Pyrene (Soil &Sediment- 10,000 ppb)	Phenanthrene (Sediment- 15,000 ppb)	Copper (Sediment- 17,200 ppm)	Lead (SW- 89 ppb)
	PCBs	Fluoranthene (Sediment- 11,000 ppb)	Lead (Sediment- 1,300 ppm)	Nickel (SW- 189 ppb)
	Total PCBs (Soil &Sediment- 3,145,000 ppb)	Pyrene (Sediment- 13,000 ppb)	Nickel (Sediment- 2,300 ppm)	
	Metals	Phenol (SW- 28 ppb)	Zinc (Sediment- 21,000 ppm)	
	Arsenic (Soil &Sediment- 194 ppm)	2-chlorophenol (SW- 14 ppb)	Mercury (Sediment- 2.81 ppm)	
	Cadmium (Soil &Sediment- 532 ppm)	4-methyl phenol (SW- 35 ppb)	Lead (SW- 710 ppb)	
	Copper (Soil &Sediment- 91,800 ppm)	2,4-dichlorophenol (SW- 150 ppb)	Mercury (SW- 1.9 ppb)	
	Mercury (Soil &Sediment- 124 ppm)	Naphthalene (SW- 8 ppb)	Nickel (SW- 83 ppb)	
	Nickel (Soil &Sediment- 6,940 ppm)	3-nitroaniline (SW- 9 ppb)		
	Lead (Soil &Sediment- 32,400 ppm)	Pentachlorophenol (SW- 120 ppb)		
	Antimony (Soil &Sediment- 356 ppm)	**PCBs**		
	Selenium (Soil &Sediment- 41.6 ppm)	Total PCBs (Sediment- 10,000 ppm)		
	Zinc (Soil &Sediment- 26,800 ppm)	Arochlor 1260 (SW- 44 ppb)		
		Dieldrin (SW- 0.18 ppb)		
		4,4-DDT (SW- 0.24 ppb)		
		2,4-D (SW- 47 ppb)		
		Silvex (SW- 3.4 ppb)		
		Metals		
		Arsenic (Sediment- 6,000 ppm) (SW- 31 ppb)		
		Cadmium (Sediment- 400 ppm) (SW 25 ppb)		
		Copper (Sediment- 44,800 ppm) (SW 17,900 ppb)		
		Lead (Sediment- 24,000 ppm) (SW 1,300 ppb)		
		Mercury (Sediment- 30 ppm) (SW 8.6ppb)		
		Nickel (Sediment- 3,500 ppm) (SW 1,500 ppb)		
		Silver (Sediment- 100 ppm)		
		Zinc (Sediment- 71,000 ppm) (SW 10,300 ppb)		
		Aluminum (SW- 9,080 ppb)		
		Barium (SW- 7,130 ppb)		

Sauget Area 1 and Area 2 Site, Sauget and Cahokia, Illinois, Site by Site Selected Media Contamination Levels

Site CS-E Contamination	Site CS-F Contamination	Site O Contamination	Site P Contamination
VOCs and SVOCs	**VOCs and SVOCs**	**VOCs**	**VOCs**
Chlorobenzene (Sediment- 120 ppb)	Toluene (Sediment- 29 ppb)	1,1,1-trichloroethane (Soil- 1,410 ppb)	Toluene (Soil- 413 ppb)
Pyrene (Sediment- 5,300 ppb)	4-methyl phenol (Sediment- 1,100 ppb)	Benzene (Soil- 30,769 ppb) (GW- 190,000 ppb)	Total xylenes (Soil- 450 ppb)
Benzo(b)fluoranthene (Soil- 2,400 ppb)	Fluoranthene (Sediment- 310 ppb)	4-methyl-2-pentanone (Soil- 7,692 ppb) (GW- 38,000 ppb)	**SVOCs**
Chrysene (Sediment- 2,800 ppb)	Pyrene (Sediment- 340 ppb)	Toluene (Soil- 29,487 ppb) (GW- 15,000 ppb)	Phenol (Soil- 3,875 J ppb)
PCBs	**PCBs and Pesticides**	Chlorobenzene (Soil- 58,974 ppb) (GW- 180,000 E ppb)	1,4-dichlorobenzene (Soil- 8,875 J ppb)
Total, PCBs (Sediment- 59,926 ppb)	Total PCBs (Sediment- 5,348 ppb)	Ethylbenzene (Soil- 166,667 E ppb)	1,2-dichlorobenzene (Soil- 3,625 J ppb)
Metals	4,4-DDE (Sediment- 97 ppb)	Total xylenes (Soil- 615,385 E ppb)	Di-n-butyl phthalate (Soil- 16,250 J ppb)
Cadmium (Sediment- 23.1 ppm)	Endrin (Sediment- 66 ppb)	Methylene chloride (GW- 52,000 ppb)	**Metals**
Copper (Sediment- 8,540 ppm)	Endosulfan II (Sediment- 203 ppb)	Trans-1,2-dichloroethene (GW- 14,000 ppb)	Lead (Soil- 526 ppm)
Lead (Sediment- 1,270 ppm)	Methoxychlor (Sediment- 8 ppb)	2-butanone (GW- 62,000 ppb)	Mercury (Soil- 3.9 ppm)
Mercury (Sediment- 1.53 ppm)	**Dioxins and Furans**	Trichloroethene (GW- 83,000 ppb)	Cyanide (Soil- 15 ppm)
Nickel (Sediment- 2,130 ppm)	Total Dioxins (Sediment- 211 ppt)	Tetrachloroethene (GW- 10,000 ppb)	
Zinc (Sediment- 9,970 ppm)	**Metals**	1,1,2,2-tetrachloroethane (GW- 12,000 ppb)	
	Arsenic (Sediment- 276 ppm)	**SVOCs**	
	Lead (Sediment- 199 ppm)	1,4-dichlorobenzene (Soil- 112,821 ppb)(GW- 15,000 E ppb)	
	Mercury (Sediment- 0.55 ppm)	1,2-dichlorobenzene (Soil- 606,000 ppb) (GW- 11,000 E ppb)	
	Cadmium (Sediment- 23.5 ppm)	1,2,4-trichlorophenol (Soil- 26,923 ppb)	
	Copper (Sediment- 520 ppm)	Naphthalene (Soil- 34,615 ppb)	
	Nickel (Sediment- 772 ppm)	2-methylnapthalene (Soil- 160,256 ppn)	
	Zinc (Sediment- 4,520 ppm)	n-nitrosodiphenylamine (Soil- 50,000 J ppb)	
		Pentachlorophenol (Soil- 1,620,000 ppb)	
		Phenanthrene (Soil- 230,000 ppb)	
		Fluoranthene (Soil- 74,000 ppb)	
		Pyrene (Soil- 282,051 ppb)	
		Butyl benzyl phthalate (Soil- 3,846,154 E ppb)	
		Benzo(a)anthracene (Soil- 121,795 ppb)	
		1,2,4-trichlorobenzene (Soil- 65,300 ppb)	
		Chrysene (Soil- 282,051 ppb)	
		Acenaphthene (-)	
		Phenol (GW- 1,100 ppb)	
		4-methylphenol (GW- 1,100 ppb)	
		4-chloroaniline (GW- 780 ppb)	
		PCBs and Pesticides	
		Aroclor-1232 (Soil- 30,366 ppb)	
		Aroclor-1242 (Soil- 1,871,795 ppb)	
		Dioxins and Furans	
		Tetrachlorodibenzo-p-dioxin (Soil- 170 ng/g)	
		Metals	
		Cadmium (Soil- 31 ppm) (GW- 11ppb)	
		Copper (Soil- 341 ppb)	
		Mercury (Soil- 6.3 ppm)	
		Nickel (Soil- 136 ppm)	
		Zinc (Soil- 1,398 ppm)	
		Arsenic (GW- 133 ppb)	
		Lead (GW- 6,350 ppb)	

Sauget Area 1 Site, Sauget and Cahokia, Illinois, Site by Site Selected Media Contamination Levels

Site Q (Dog Leg) Contamination	Site R VOC Contamination	Site R SVOC Soil Contamination	Site R PCB & Pesticide Soil Contamination	Site R Metal Soil Contamination
VOCs	Methylene chloride (Soil- 27,000 J ppb)			Arsenic (147 ppm)
1,4-dichlorobenzene (Soil-1,200,000 ppb)	Acetone (Soil- 500,000 ppb)	Phenol (5,800,000 D ppb)	Beta-BHC (7,600 JN ppb)	Barium (331 ppm)
Bis(2-ethylhexyl)phthalate (Soil-1,100,000 ppb)	1,1-dichloroethene (Soil- 290 J ppb)	Phenol (GW-33,000 ppb)	Delta-BHC (330 J ppb)	Beryllium (3.1 ppm)
Di-n-butyl phthalate (Soil- 900,000 ppb)	1,2-dichloroethene (Soil- 59,000 J ppb)	Bis(2-chloroethyl)ether (31 J ppb)	Heptachlor epoxide (600 DJ ppb)	Cadmium (7 ppm)
Chlorobenzene (Soil-100,000 ppb) (GW- 6,700 J ppb)	Chloroform (Soil- 38,000 J ppb)	2-chlorophenol (6,900,000 D ppb)	Endosulfan I (3,000 JN ppb)	Calcium (31,100 ppm)
Ethylbenzene (Soil-790,000 ppb)	1,2-dichloroethane (Soil- 220,000 ppb)	1,3-dichlorobenzene (8,000 J ppb)	4,4'-DDE (22,000 J ppb)	Chromium (41 ppm)
Toluene (Soil- 2,400,000 ppb) (GW-1,600 J ppb)	2-butanone (Soil- 10,000 J ppb)	1,4-dichlorobenzene (800,000 ppb)	Endrin (4,600 J ppb)	Cobalt (83.2 ppm)
4-methyl-2-pentanone (Soil- 250,000ppb) (GW- 2,700 J ppb)	1,1,1-trichloroethane (Soil- 190 J ppb)	1,2-dichlorobenzene (2,100,000 ppb)	Endosulfan II (45,000 DJ ppb)	Copper (320 ppm)
O-xylene (Soil- 2,300,000 ppb)	Bromodichloroethane (Soil- 350 J ppb)	2-Methylphenol (o-cresol) (54,000 J ppb)	4,4'-DDD (720 ppb)	Lead (64.7 ppm)
1,2-dichloroethane (GW- 3,000 ppb)	Trichloroethene (Soil- 750,000 ppb)	4-methylphenol (p-cresol) (640,000 ppb)	4,4"-DDT (52,000 ppb)	Magnesium (7,050 ppm)
Benzene (GW- 2,000 J ppb)	Dibromochlorethane (Soil- 300 J ppb)	Nitrobenzene (650,000 ppb)	Endrin ketone (99,000 JN ppb)	Mercury (43 ppm)
2-hexanone (GW- 3,500 J ppb)	Benzene (Soil- 210,000 ppb)(GW-9980ppb)	2,4-dimethylphenol (150,000 J ppb)	Endrin aldehyde (29,000 DJ ppb)	Nickel (69.3 ppm)
SVOCs	4-methyl-2-pentanone (Soil- 2,800,000 ppb)	2,4-dichlorophenol (16,000,000 D ppb)	Alpha-Chlordane (1,700 DJ ppb)	Potassium (2,530 ppm)
Phenol (GW- 190,000 E ppb)	Tetrachlorethene (Soil- 90,000 ppb)	1,2,4-trichlorobenzene (1,800,000 ppb)	Gamma-chlordane (3,500 J ppb)	Selenium (4.2 J ppm)
2-chlorophenol (GW- 33,000 E ppb)	Toluene (Soil- 3,800,000 ppb)(GW-1400ppb)	Naphthalene (800,000 ppb)	Aroclor-1248 (4,800,000 J ppb)	Sodium (16,600 ppm)
4-methylphenol (GW- 23,000 E ppb)	Chlorobenzene (Soil-2,400,000 D ppb) (GW-60,200ppb)	4-chloroaniline (Soil- 2,000,000 J ppb)	Aroclor-1254 (1,100,000 J ppb)	Vanadium (645 ppm)
2,4-dimethylphenol (GW- 2,800 ppb)	Ethylbenzene (Soil- 970,000 ppb)	4-chloroaniline (GW-56,900 ppb)	Aroclor-1260 (100,000 ppb)	Zinc (2,620 ppm)
2,4-dichlorophenol (GW- 14,000 E ppb)	Xylenes (Soil- 4,100,000 ppb)	2-methylnapthalene (20 J ppb)		Cyanide (0.33 ppm)
4-chloroaniline (GW- 15,000 E ppb)	1,2-dichlorbenzene (GW-1,570 ppb)	2,4,6-trichlorophenol (3,900,000 D ppb)		
2,4,6-trichlorophenol (GW- 6,000 ppb)		2,4,5-trichlorophenol (1,600,000 ppb)		
2-nitroaniline (GW- 2,000 ppb)		2-nitroaniline (1,000,000 J ppb)		
Acenaphthylene (GW- 3,900 ppb)		4-nitroaniline (8,300,000 D ppb)		
Pentachlorophenol (GW- 35,000 E ppb)		Dimethylphthalate (14,000 J ppb)		
PCBs and Pesticides		Diethylphthalate (350 J ppb)		
Aroclor-1254 (Soil- 360,000 ppb)		N-nitrosodiphenylamine (10,000 J ppb)		
Aroclor-1248 (Soil- 70,000 ppb)		Pentachlorophenol (790,000 EJ ppb)		
Aroclor-1260 (Soil- 16,000,000 ppb)		Carbazole (0.3 J ppb)		
Dioxins and Furans		Di-n-butylphthalate (20 J ppb)		
2,3,7,8-TCDD (Soil- 3.31 ppb)		Butylbenzylphthalate (39,000 J ppb)		
Metals		Chrysene (360 D ppb)		
Antimony (Soil- 17,900 N ppm)		Bis(2-ethylhexyl)phthalate (960,000 ppb)		
Arsenic (Soil- 216 NS ppb) (GW-100ppb)		Di-n-octylphthalate (8,800 J ppb)		
Cadmium (Soil- 152,000 ppm)		Aniline (Soil- 1,100,000 ppb)		
Chromium (Soil- 3,650 ppm)		Aniline (GW-440,000 ppb)		
Copper (Soil- 1,630 ppm)		2-chloroaniline (Soil- 4,900,000 ppb)		
Lead (Soil- 195,000 ppm)		2-chloroaniline (GW-195,000 ppb)		
Mercury (Soil- 4.9 ppm)		3-chloroaniline (Soil- 190,000 J ppb)		
Nickel Soil- (371 N ppm)		3-chloroaniline (GW-52,400 ppb)		
Selenium (Soil- 59.9 ppm)		4-chlorophenol (GW-300 ppb)		
Silver (Soil- 30.2 N ppm)				
Thallium (Soil- 0.89 B ppm)				
Zinc (Soil- 9,520 ppm)				
Cyanide (GW-1560ppb)				

Sauget Area 1 Site and Krummrich Plant, Sauget Illinois, Site by Site Selected Media Contamination Levels

Sauget Area 2 Site S Soil Contamination	W.G. Krummrich Facility VOC Contamination	W.G. Krummrich Facility SVOC Contamination	W.G. Krummrich Facility PCB's & Pesticides Contamination
VOCs	Vinyl chloride (Soil- 10 J ppb) (GW-350ppb)	**SVOCs**	Alpha-BHC (Soil- 26 P ppb)(GW-0.16 ppb)
1,1,1-trichloroethane (12,000 ppb)	Acetone (Soil- 61 J ppb)(GW-22000ppb)	p-isopropyltoluene (Soil- 400 EJ ppb)	Beta-BHC (Soil- 1,400 DP ppb)(GW- 0.6 PE ppb)
4-methyl-2-pentanone (93,000 ppb)	Methylene chloride (Soil- 4 J ppb)(GW-680ppb)	n-butylbenzene (Soil- 190 EJ ppb)	Delta-BHC (Soil- 120 P ppb)
Toluene (990,000 ppb)	Carbon disulfide (Soil- 23 ppb)	Hexachlorobutadiene (Soil- 10 J ppb)	Gamma-BHC (Lindane) (Soil- 46 P ppb)(GW- 0.12 P ppb)
Ethylbenzene (450,000 ppb)	1,1-dichloroethene (Soil- 10 ppb)	1,2,3-trichlorobenzene (Soil- 17,000 D ppb)	Heptachlor (Soil- 59 P ppb)(GW- 3.1 P ppb)
Total xylenes (620,000 ppb)	2-butanone (Soil- 390 J ppb)	Phenol (Soil- 7,200 ppb)(GW-1,100,000ppb)	Aldrin (Soil- 230 P ppb)
SVOCs	Cis-1,2-dichloroethene (Soil- 27 ppb)	1,3-dichlorobenzene (Soil- 16,000 D ppb)(GW-150Dj ppb)	Heptachlor epoxide (Soil- 150 P ppb)
Naphthalene (200,000 ppb)	Chloroform (Soil- 5 J ppb)	1,4-dichlorobenzene (Soil- 290,000 D ppb)(GW-1600 D ppb)	Endosulfan I (Soil- 270 P ppb)
Di-n-butyl phthalate (1,500,000 J ppb)	Benzene (Soil- 2,000,000 D ppb)(GW-1,600,000ppb)	1,2-dichlorobenzene (Soil- 850,000 D ppb)(GW- n/a)	Dieldrin (Soil- 600 P ppb) (GW- 0.95 P ppb)
Din-n-octyl phthalate (310,000 ppb)	Trichloroethene (Soil- 7 ppb)	Nitrobenzene (Soil- 280 J ppb)(GW-14,000ppb)	4,4'-DDE (Soil- 430 P ppb) (GW-1.2 DP ppb)
Butyl benzyl phthalate (490,000 J ppb)	4-methyl-2-pentanone (Soil- 33 J ppb)(3100ppb)	2,4-dichlorophenol (Soil- 1,600 J ppb)(GW-340,000ppb)	Endrin (Soil- 430 P ppb) (GW- 20ppb)
Bis(2-ethylhexyl)phthalate (20,000,000 J ppb)	Toluene (Soil- 16,000 D ppb)(GW-71,000ppb)	1,2,4-trichlorobenzene (Soil- 53,000 D ppb)(GW-1400ppb)	Endosulfan II (Soil- 590 P ppb) (GW- 0.69 ppb)
PCBs and Pesticides	Tetrachloroethene (Soil- 22 ppb)	Napthalene (Soil- 1,600 J ppb)(GW-86,000ppb)	4,4'-DDD (Soil- 230 P ppb) (GW-1.1 JP ppb)
Aroclor-1248 (85,000 pc ppb)	Chlorobenzene (Soil- 28,000 D ppb)(GW-350,000ppb)	4-chloroaniline (Soil- 84,000 D ppb)(GW-25,000ppb)	Endosulfan sulfate (Soil- 74 P ppb) (GW-0.11 P ppb)
Aroclor-1254 (69,000 c ppb)	Ethylbenzene (Soil- 6,700 D ppb)(GW-29,000ppb)	2-methylnapthalene (Soil- 600 J ppb)	4,4'-DDT (Soil- 5,500 E ppb)(GW-0.48ppb)
Aroclor-1260 (41,000 pc ppb)	Xylene (Soil- 2,800 D ppb)(GW-150,000ppb)	2,4,6-trichlorophenol (Soil- 15,000 D ppb)(GW- 2,700ppb)	Methoxychlor (Soil- 410 P ppb)(GW-52ppb)
Metals	Isopropylbenzene (Soil- 1,800 EJ ppb)	2,4,5-trichlorophenol (Soil- 740 J ppb)	Endrin ketone (Soil- 74 P ppb)(GW-15 P ppb)
Copper (139 ppm)	Bromobenzene (Soil- 47 ppb)	Acenapthene (Soil- 120 J ppb)	Endrin aldehyde (Soil- 410 P ppb) (GW-0.34 P ppb)
Lead (392 ppb)	n-propylbenzene (Soil- 2,700 D ppb)	Dibenzofuran (Soil- 3,500 J ppb)	Alpha-chlordane (Soil- 190 P ppb) (GW-1.5 JP ppb)
Mercury (3.5 ppm)	2-chlorotoluene (Soil- 30,000 D ppb)	Flourene (Soil- 470 J ppb)	Gamma-chlordane (Soil- 350 D ppb) (GW- 0.098 ppb)
Zinc (327 ppm)	4-chlorotoluene (Soil- 13,000 D ppb)	Hexachlorobenzene (Soil- 690 J ppb)	Aroclor-1254 (Soil- 22,000 P ppb)
	Tert-butylbenzene (Soil- 64,000 D ppb)	Pentachlorophenol (Soil- 46,000 D ppb)(GW-18,000ppb)	Aroclor-1260 (Soil- 22,000 P ppb)
	1,2,4-trimethylbenzene (Soil- 1,500 D ppb)	Phenanthrene (Soil- 1,600 J ppb)	
	Sec-butylbenzene (Soil- 2,700 D ppb)	Anthracene (Soil- 450 J ppb)	
	1,2-Dichloroethene (GW-420 ppb)	Di-n-butylphthalate (Soil- 210 J ppb)	
	1,2-Dichloroethane (GW-14,000 ppb)	Flouranthene (Soil- 1,500 J ppb)	
	1,1,1-Trichloroethane (GW-560 ppb)	Pyrene (Soil- 1,300 J ppb)	
		Benzo(a)anthracene (Soil- 650 J ppb)	
		Chrysene (Soil- 900 J ppb)	
		Benzo(b)flouranthene (Soil- 480 J ppb)	
		Benzo(k)flouranthene (Soil- 360 J ppb)	
		Benzo(a)pyrene (Soil- 430 J ppb)	
		Indeno(1,2,3-cd)pyrine (Soil- 270 J ppb)	
		Dibenz(a,h)anthracene (Soil- 130 J ppb)	
		Benzo(g,h,i)perylene (Soil- 330 J ppb)	
		2-chlorophenol (GW- 540,000 ppb)	
		Aniline (GW- 62,000 ppb)	
		Dichlorobenzenes (GW- 23,000,000 ppb)	
		Methylphenols (GW- 280,000 ppb)	
		2-nitroaniline (GW- 1,100 ppb)	

Krummrich Plant, Sauget Illinois, Site by Site Selected Media Contamination Levels

W.G. Krummrich Facility Metals Contamination	W.G. Krummrich Mississippi River Plume Discharge VOC & SVOC Contamination	W.G. Krummrich Mississippi River Plume Discharge PCB, Pesticide, Dioxin and Furan Contamination
Arsenic (Soil- 12.4 ppm)(GW-73.1ppb)	**VOCs**	**PCB's and Pesticides**
Barium (Soil- 249 ppm)(GW-1610ppb)	1,2-dichloroethane (Sediment- 250 ppb)(SW-0.775ppb)	2,4-D (Sediment- 2,300 ppb)
Cadmium (Soil- 7.5 ppm) (GW-44.1ppb)	2-butanone (Sediment- 91 ppb)	2-(2,4-dichlorophenoxy) propionic acid Dichloroprop (Sediment- 1,100 ppb)(SW-1.85ppb)
Calcium (Soil- 74,200 ppm)	4-Methyl-2-pentanone (Sediment- 150 ppb)(SW-2.2ppb)	MCPP[2-(4-chloro-2-methylphenoxy)-propanoic acid] (Sediment- 160,000 ppb)
Chromium (Soil- 36.9 ppm)(GW-94.6ppb)	Acetone (Sediment- 3,000 ppb)	Pentachlorophenol (Sediment- 45 ppb)
		Pentachlorophenol at pH 7.8 (SW- 0.87 ppb)
Copper (Soil- 305 ppm)(GW-341ppb)	Benzene (Sediment- 460 ppb)(SW-1.8ppb)	4,4'-DDD (Sediment- 1.6 ppb)
		2,4,5-TP Silvex (SW- 0.14 ppb)
		Dicamba (SW- 0.11 ppb)
Lead (Soil- 567 ppm) (GW- 149ppb)	Carbon disulfide (Sediment- 3.3 ppb)	**Dioxins and Furans**
Magnesium (Soil- 6,770 ppm)(GW-167,000ppb)	Chlorobenzene (Sediment- 7,200 ppb)(SW-24ppb)	1,2,3,4,6,7,8,9-OCDD (Sediment- 911 ppq)(SW-169ppq)
Manganese (Soil- 388 ppm)(GW-110,000)	Chloroethane (Sediment- 1,9 ppb)	1,2,3,4,6,7,8,9-OCDF (Sediment- 74.0 ppq)(SW-5.2ppq)
Mercury (Soil- 0.96 ppm)(GW-1.5ppb)	Chloroform (Sediment- 9.7 ppb)	1,2,3,4,6,7,8-HpCDD (Sediment- 70.8 ppq)(SW-7ppq)
Nickel (Soil- 311 ppm)(GW-264ppb)	Cis-1,2-dichloroethene (Sediment- 5.8 ppb)	1,2,3,4,6,7,8-HpCDF (Sediment- 10.4 ppq)
Potassium (Soil- 3,050 ppm)	Ethylbenzene (Sediment- 82 ppb)(SW- 0.38ppb)	1,2,3,4,7,8,9-HpCDF (Sediment- 0.79 ppq)
Vanadium (Soil- 66.8 ppm)(GW-173ppb)	M&p-xylene (Sediment- 630 ppb)	1,2,3,4,7,8-HxCDF (Sediment- 0.62 ppq)(SW-2.2ppq)
Zinc (Soil- 1,260 ppm)(GW-3190ppb)	Methylene chloride (Dichloromethane) (Sediment- 17 ppb)	1,2,3,6,7,8-HxCDD (Sediment- 1.2 ppq)
Aluminum (GW- 76,700 ppb)	Tetrachloroehtene (Sediment- 24 ppb)	1,2,3,6,7,8-HxCDF (Sediment- 0.38 ppq)
Beryllium (GW- 7 ppb)	Toluene (Sediment- 7,800 ppb)(SW- 1.7ppb)	1,2,3,7,8-PeCDF (Sediment- 0.48 ppq)
Cobalt (GW- 113 ppb)	Trans-1,2-Dichloroethene (Sediment- 0.91 ppb)	2,3,4,6,7,8-HxCDF (Sediment- 0.195 ppq)
Selenium (GW- 9.2 ppb)	Trichloroethene (Sediment- 42 ppb)(SW- 0.3ppb)	2,3,4,7,8-PeCDF (Sediment- 0.18 ppq)
Sodium (GW- 1,570,000 ppb)	Vinyl chloride (Sediment- 4 ppb)	2,3,7,8-TCDF (Sediment- 0.8 ppq)
Cyanide (GW- 23.5 ppb)	Total xylenes (Sediment- 710 ppb)(SW- 2.7ppb)	Dioxin, Total HpCDD (Sediment- 146 ppq)(SW-12.9ppq)
	SVOCs	Dioxin, Total HpCDF (Sediment- 54.2 ppq)
	1,2-dichlorobenzene (Sediment- 110 ppb)(SW-13.25ppb)	Dioxin, Total HxCDD (Sediment- 11.7 ppq)
	1,4-dichlorobenzene (Sediment- 81.5 ppb)	Dioxin, Total HxCDF (Sediment- 10.1 ppq)(SW-2.2ppq)
	2,4,6-trichlorophenol (Sediment- 470 ppb)(SW-8ppb)	Dioxin, Total PeCDD (Sediment- 0.25 ppq)
	2,4-dichlorophenol (Sediment- 1,000 ppb)(SW-31ppb)	Dioxin, Total PeCDF (Sediment- 2.7 ppq)
	2,4-dimethylphenol (Sediment- 80 ppb)(SW- 3.7 ppb)	Dioxin, Total TCDD (Sediment- 42.8 ppq)
	2,4-dinitrotoluene (Sediment- 750 ppb)	Dioxin, Total TCDF (Sediment- 1.4 ppq)
	2-chlorophenol (Sediment- 360 ppb)(SW- 20ppb)	
	2-nitroaniline (Sediment- 76 ppb)	
	3-methyl phenol/4-methyl phenol (Sediment- 800 ppb)(SW- 11ppb)	
	4-bromophenylphenyl ether (Sediment- 96.5 ppb)	
	4-chloroaniline (Sediment- 4,800 ppb)(SW-45ppb)	
	Napthalene (Sediment- 190 ppb)(	
	Phenol (Sediment- 5,600 ppb)(SW- 16ppb)	
	1,2,4-trichlorobenzene (SW- 1.525 ppb)	
	Bis(2-ethylhexyl)phthalate (SW- 2.2 ppb)	
	Di-n-butyl phthalate (SW- 0.34 ppb)	
	Nitrobenzene (SW- 0.93 ppb)	

Clayton Chemical Site, Sauget Illinois, Site by Site Selected Media Contamination Levels

Clayton Chemical Facility Soil VOC Contamination	Clayton Chemical Facility Soil SVOC Contamination	Clayton Chemical Facility Soil PCB & Pesticide Contamination
Acetone (0.89 ppm)	Anthracene (3.5 ppm)	Aroclor 1242 (2,400 ppm)
Benzene (3.7 ppm)	Di-n-butyl phthalate (100 ppm)	Aroclor 1254 (680 ppm)
Benzo(g,h,i)perylene (0.63 ppm)	Flouranthene (7 ppm)	Aroclor 1260 (34 ppm)
2-Butanone (0.047 ppm)	Pyrene (37 ppm)	
Chlorobenzene (27,000 ppm)	Butyl benzyl phthalate (2.2 ppm)	
Chloroform (4 ppm)	Benzo(a)anthracene (7.6 ppm)	
1,2-Dichlorobenzene (60,000 ppm)	Chrysene (13 ppm)	
1,4-Dichlorobenzene (83,000 ppm)	Bis(2-ethylhexyl)phthalate (310 ppm)	
Cis-1,2-Dichlorethene (11 ppm)	Benzo(b)fluoranthene (2.6 ppm)	
Ethylbenzene (18 ppm)	Benzo(k)fluoranthene (1.4 ppm)	
Isopropylbenzene (2.2 ppm)	Benzo(a)pyrene (2.5 ppm)	
Methylene chloride (0.032 ppm)	Indeno(1,2,3-cd)pyrene (0.79 ppm)	
Styrene (0.35 ppm)	Dibenz(a,h)anthracene (0.11 ppm)	
1,1,2,2-Tetrachlorethane (60 ppm)	Acenapthene (0.91 ppm)	
Tetrachloroethene (44,000 ppm)	Dibenzofuran (0.48 ppm)	
Toluene (47 ppm)	Flourene (0.83 ppm)	
1,2,4-Trichlorobenzene (120 ppm)	Phenanthrene (14 ppm)	
1,1,1-Trichlorethane (57 ppm)	Napthalene (32 ppm)	
1,1,2-Trichlorethane (16 ppm)	2-methylnapthalene (3.6 ppm)	
Trichloroethene (110 ppm)	1,1'-biphenyl (1.4 ppm)	
Xylene (65 ppm)	Isophorone (48 ppm)	

Notes:
Reference for Sauget Area I = USEPA. 1999. Sauget Area 1 Site, Sauget and Cahokia, IL; Administrative Order by Consent. USEPA. Chicago, IL.
References for Sauget Area II = USEPA. 2000. Administrative Order by Consent for Sauget Area 2 Site, St. Clair County, IL. USEPA. Chicago, IL; USEPA. 2002. Unilateral Administrative Order for Remedial Design and Interim Remedial Action. USEPA. Chicago, IL; and Data collected by Monsanto pursuant to the Consent Order in People v. Monsanto 82-CH-192, *in* Geraghty and Miller, Inc., Feb. 1993.
References for Krummrich Plant = USEPA. 2002. Unilateral Administrative Order for Remedial Design and Interim Remedial Action; USEPA. 1999. Documentation of Environmental Indicator Determination. RCRA Corrective Action, Environmental Indicator (EI) RCRIS code (CA750, Migration of Contaminated Groundwater Under Control, Solutia, Inc. USEPA. Chicago, IL; and IEPA. 2000. Trip Report for Solutia / W.G. Krummrich Plant, Sauget, IL. IEPA, Bureau of Land, Federal Site Remediation Section, Site Assessment Unit. Springfield, IL.
Reference for Clayton Chemical Site = USEPA. 2008b. Unilateral Administrative Order for Performance of Work by Non-cooperating Tier 1 Potentially Responsible Parties at RRG/Clayton Chemical Company Superfund Site, 1 Mobil Avenue, Sauget, IL. USEPA. Chicago, IL.

Unless otherwise indicated;
J = estimated value.
D = concentration determined at a secondary dilution factor.
E = exceeded the instrument calibration range.
N = presumptive evidence of the compound present.
P = indicates a pesticide/aroclor target analyte when there is greater than 25% difference for the detected concentrations between the two columns, the lower of the two results is reported.
GW = Ground Water
SW = Surface Water
No Data = No contamination data listed in the Administrative Order by Consent.

Signature Page
SAUGET INDUSTRIAL CORRIDOR SITES
ASSESSMENT PLAN

Marc Miller
Director Illinois Department of Natural Resources

1-5-15
Date

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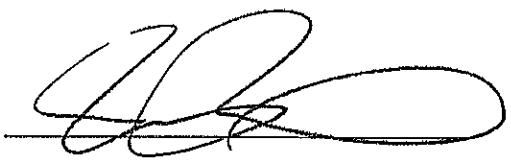
SAUGET INDUSTRIAL CORRIDOR SITES
ASSESSMENT PLAN



12/18/12

John J. Kim
Director Illinois Environmental Protection Agency

Date

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SAUGET INDUSTRIAL CORRIDOR SITES
ASSESSMENT PLAN

Sara Parker Pauley
Director of Missouri Department of Natural Resources

3/21/13
Date

Signature Page
SAUGET INDUSTRIAL CORRIDOR SITES
ASSESSMENT PLAN

Charles M. Wooley
Acting Regional Director

1/14/13
Date

Thomas O. Melius
Director Region 3, US Fish & Wildlife Service
Authorized Official