

# San Jacinto River Waste Pits Superfund Site Technical Document Review: May 2013 Baseline Ecological Risk Assessment

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## What is a Baseline Ecological Risk Assessment (BERA)?

A Baseline Ecological Risk Assessment (BERA) is used to identify both current and possible threats to the environment for a site, and to help identify cleanup levels that would protect the environment from those risks.

## Why do a BERA?

The Superfund process requires that sites are cleaned up in a way that will protect both human health and the environment. Therefore, the first step is to conduct a baseline risk assessment "characterize the current and potential threats to human health and the environment" [[40 CFR §300.430 \(d\)\(4\)](#)]. Results of the BERA provide risk managers a reference point to compare risk reduction level from the selected clean up alternatives.

## What is this BERA for?

This is for north impoundment only (the waste pits north of the interstate). The BERA for the South Impoundment will be prepared later, with information presented in the Remedial Investigation Report.

## Where did the Responsible Parties (RPs) get their data?

The baseline dataset for the Site consists of:

- Sediment, tissue, and soil data collected for the Remedial Investigation/Feasibility Study (RI/FS), including soil from the south impoundment planned for collection in February 2012.
- Sediment and surface water data collected in 2009.
- PCB *congener* (type of PCB) data for fish tissue and sediments resulting from sampling conducted by Texas Commission on Environmental Quality in 2008 and 2009.

## When they evaluated risk, what did they consider?

- *Benthic macroinvertebrates* (bottom-dwelling creatures with no backbone, like dragonfly larva or crayfish) exposed through direct contact with the river bottom (sediment, porewater, and surface water).
- Bivalve molluscs exposed through direct contact with the river bottom (sediment, porewater, and surface water).
- Fish exposed through ingestion of sediment and food, and respiration of water.
- Reptiles exposed through ingestion of sediment or soils, water, and food.
- Birds exposed through ingestion of sediment or soils, water (for seabirds only), and food.
- Mammals exposed through ingestion of sediment or soils and food.
- Contaminants (chemical of potential ecological concern or COPC<sub>E</sub>S) evaluated include the chemicals listed in the following table, but dioxins and furans are the most important ecological risk posing chemicals at the Site.

Chemical	Invertebrates	Fish and Wildlife
<b>Dioxins/Furans</b>		
Dioxins and Furans	X	X
<b>Polychlorinated Biphenyls</b>		
Polychlorinated Biphenyls		X
<b>Semivolatile Organic Compounds</b>		
Bis(2-ethylhexyl)phthalate	X	X
Carbazole	X	
Phenol	X	
<b>Metals</b>		
Aluminum	X	
Barium	X	
Cadmium		X
Cobalt	X	
Copper	X	X
Lead	X	
Manganese	X	
Mercury	X	X
Nickel		X
Thallium	X	
Vanadium	X	
Zinc	X	X

## How might these animals come in contact with the contamination?

A cap, made of an impermeable plastic membrane covered with rocks, is now in place, and additional material is not being released. However, for many years before that cap, waste material was being released. Risks result from direct contact with the wastes in the northern impoundments. This material is still in the environment. Implementation of the cap has reduced individual and population-level risks associated with dioxins and furans to negligible, but does not affect risks to some birds from zinc, suggesting that the wastes in the northern impoundments are not the primary source of exposures of birds to zinc.

Not only can plants and animals can come in contact with these released compounds, these compounds can *bioaccumulate* (see figure below). Bioaccumulation is what happens when a bottom-dwelling organism such as a worm might eat something that is contaminated (ingestion). Then, something like a fish may eat the larva, and a bird may eat the fish, passing on and sometimes concentrating the contamination (*bioaccumulation* and *biomagnification*).

However, the Bioaccumulation Memorandum prepared by the RPs concluded that the majority of dioxin and furan congeners do not consistently bioaccumulate in fish and invertebrate tissue. USEPA found that concentrations of dioxins and furans are not predicted by position in the food chain, but are accumulated more as a function of proximity to contaminated sediments. On the Site, clams and catfish were found to have the highest dioxin and furan concentrations among all tissue samples. Whether clams and catfish are at the similar levels of the food chain is unknown, but both are closely associated with the benthic environment than other species for which data are available. Since there is no specific data on the food chain on the Site, no conclusions can be drawn about the reasons for higher concentrations of dioxins/furans in catfish and clams than in other species. Therefore, there are no known “food chain implications” of dioxins and furans in the tissue of species collected at the Site.

## Bioaccumulation in Action

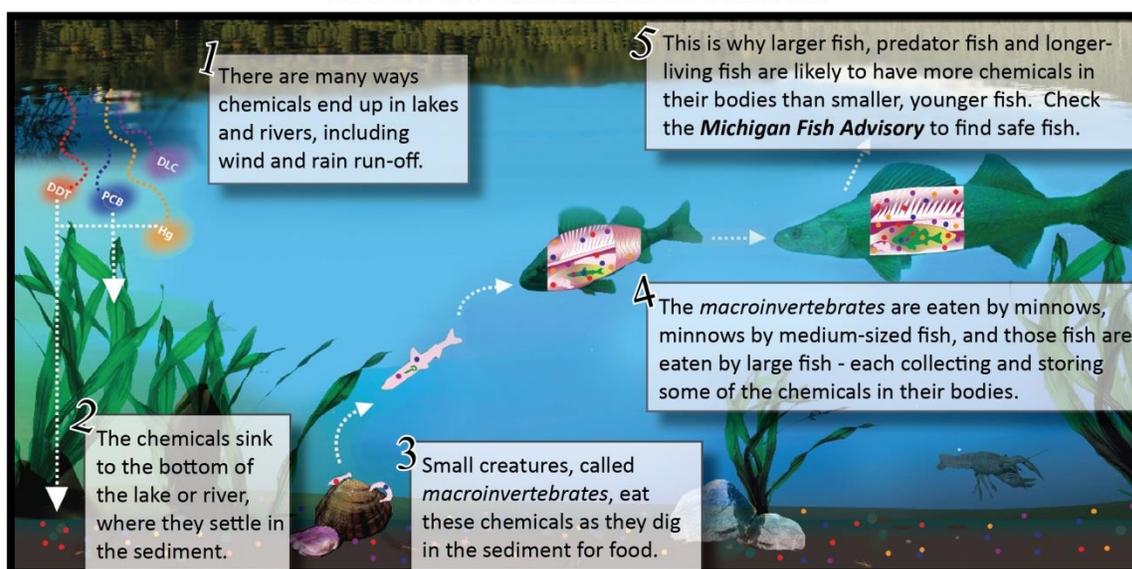


Figure is from Michigan Department of Community Health website ([http://www.michigan.gov/mdch/0,1607,7-132-54783\\_54784\\_54785\\_54800-256866--,00.html](http://www.michigan.gov/mdch/0,1607,7-132-54783_54784_54785_54800-256866--,00.html))

### How was risk evaluated?

Site specific data was collected to evaluate the contaminant concentrations in surface water, sediment, soil, benthic macroinvertebrate tissue and whole fish tissue. The RPs also estimated concentrations in bird eggs based upon the likely diet of birds. The RPs then compared the results to published information to identify the bioaccumulation potential of each chemical and describe how toxic these contaminants might be to these animals.

Ecological risk assessments rely on a very limited set of toxicity information, usually developed with very few species derived from domestic stocks. Generally, the bias resulting from the use of laboratory-based toxicity studies is considered conservative.

### Which areas potentially at risk for ecological effects?

- Upland natural habitat adjacent to the San Jacinto River in the Site vicinity occurs along narrow sections of land on either side of the river as well as small islands to the north of I-10 and east of impoundments, is vegetated by a mixture of trees and shrubs, and supports mammals (marsh rice rats, deer, passerines) and shoreline birds.
- Upland wildlife might include snakes, alligators, turtles, sparrows, starlings, pigeons and doves, corvids, killdeer, rodents, skunks, raccoons, coyotes, and possums.
- Aquatic and riparian habitats on the northern portion of the Site support a variety of marine and estuarine fish and invertebrates including clams and oysters, blue crab, black drum, southern

flounder, hardhead and blue catfish, spotted sea trout, and grass shrimp. Aquatic birds and semiaquatic mammals are also found in the vicinity of the Site.

## What risks did they identify?

### In general

Baseline risks to ecological receptors associated with the wastes in the impoundments north of I-10 are the result of exposures to dioxins and furans localized to the immediate vicinity of the impoundments. Exposure to the wastes in the northern impoundments was the primary risk at the Site, resulting from direct contact with the wastes in the northern impoundments. Installation of the cap has reduced risks associated with exposure to the waste material.

### Risks to Benthic Macroinvertebrate Communities

- The risks to the benthic macroinvertebrates from 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD; one type of dioxin), copper, lead, and zinc in sediment are negligible because concentrations of these chemicals do not approach the threshold level for any effects to be observed. Risks due to mercury are very low to negligible. Other dioxin and furan *congeners* (types) cannot be evaluated because of a lack of available toxicity data.
- Risks to benthic macroinvertebrates from Bis(2-ethylhexyl)phthalate (BEHP), phenol, cobalt, copper, magnesium, zinc, and thallium in sediment pore water are negligible.
- Molluscs directly adjacent to the impoundment north of I-10 are at risk of reproductive effects from exposure to TCDD. Risks to some of the molluscs near the upland sand separation area are low. Risks to molluscs elsewhere on the Site are negligible. There are no toxicity data available to interpret tissue concentrations of the other dioxin and furan congeners.

### Risks to Fish

- Risks to fish from BEHP and nickel in surface water are negligible.
- Risks to fish from PCBs (polycyclic aromatic hydrocarbons) in whole fish are negligible.
- Baseline risks to stable or increasing populations of fish from dioxins in whole fish samples are negligible.
- Different fish have different sensitivity to dioxins. A species sensitivity distribution could be useful for evaluating effect levels relevant for risk assessment.

## Risks to Birds

- Overall, baseline risks to birds on the Site are negligible for most chemicals, and are low for dioxins and dioxin-like compounds. There is a moderate risk to the spotted sandpiper from dioxins and furans, but that risk has been reduced since the cap was installed over the waste pits.
- Substantial exposure of killdeer to zinc occurs in background areas, that is are not solely associated with the waste material at the Site.

## Risks to Mammals

- Risks to raccoon are negligible for all COPC<sub>E</sub>S.
- Risks to marsh rice rat are negligible for all COPC<sub>E</sub>S except dioxins/furans. Marsh rice rats on the Site had been at risk of reproductive effects and reduced survival of pups because of exposure to dioxins and furans. However, the risks to this receptor have reduced to negligible since the cap has been put in place.

## Risks to Reptiles

- No information was found to interpret reptile exposures in the literature. Therefore whether the observed pollutant concentrations could not be compared to doses known to cause effects on the survival, growth, and reproduction of reptiles. However, exposure estimates for reptiles can be compared to those for other wildlife animals, such as alligator snapping turtle. Since the risks to other animals at the Site are very low, risks to reptiles are also negligible for metals, BEHP, and PCBs. However, we cannot for sure say that risks from dioxins and furans are negligible as well because of moderate risks in some areas at the Site to molluscs, birds, and mammals from these chemicals. Also because of the limited information on toxicity to reptiles, even if reptile tissue samples from the Site were collected, interpretation of these in terms of risks would not be possible.

## Data Gaps and Data Limitations

- Although a significant number of analytical samples have been collected for the remedial investigation and risk assessments, risk assessments rely on collected and available data which affect the degree of certainty associated with risk estimates.
- There are no empirical data in the baseline dataset to describe concentrations of most COPC<sub>E</sub>S in water, and there are limited water data only for dioxins, furans, and PCBs. Therefore models were used to estimate water concentrations and water chemistry needed for the exposure models.
- There are no data to describe concentrations of the COPC<sub>E</sub>S in tissue of terrestrial invertebrates and in plants.
- The spatial distribution of sediment and soil samples, combined with the definition of exposure units that encompass and emphasize the area of the former waste impoundments gives the assessments a conservative (more protective) bias.

- There isn't any relevant published information on toxicity of the various COPCs to reptiles, so it is not possible estimate exposures to reptiles. Even if reptile tissue samples from the Site had been collected, interpretation of these in terms of risks would not be possible.