

San Jacinto River Waste Pits Superfund Site Technical Document Review: Preliminary Site Characterization Report

by Jennifer Ronk and Birnur Guven, Houston Advanced Research Center

What is the Preliminary Site Characterization Report (PSCR)?

The Preliminary Site Characterization Report provides an overview of existing information. While the report includes summaries of all of the information collected through the end of 2011, including sampling done as part of the remedial investigation (RI), it only includes preliminary data analyses. It does not include data collected after that date, or a detailed analysis of the type and extent of the contamination. That information will be presented in the Remedial Investigation (RI) report that is scheduled for completion in March of 2013.

What were the Objectives of the PSCR?

The specific objectives were to:

- Summarize potential remedial technologies (further discussed in the Remedial Alternatives Memorandum that will be finalized in 2012)
- Update information on the surrounding land uses
- Provide a comprehensive resource of Site information developed to date
- Provide a preliminary assessment of the physical Site setting and of the nature and extent of contamination
- Present preliminary data analyses
- Identify remaining data gaps.

In order to meet these objectives, the PSCR presented information on:

- The time critical removal action (TCRA)
- Potential clean up technologies
- Physical setting and surrounding land uses
- Existing data
- Results for North of I-10 and the Aquatic Environment
- Results for South of I-10

Each of these sections is summarized below.

What was the Time Critical Removal Action (TCRA)?

There was no waste removed as part of the TCRA; it is just the name of this phase of the Superfund process. Instead of removal, the TCRA was designed to prevent direct contact with waste material by covering the waste material with a cap designed to withstand a 100-year storm until the nature and extent of contamination for the Site is determined and the final remedy is implemented. A security fence and danger signs were also installed as part of the TCRA. The TCRA construction was completed in July 2011.

What are the Potential Remedial Activities?

USEPA guidance for contaminated sediment remediation identifies “three major approaches: Monitored Natural Recovery (MNR), in-situ capping, and sediment removal by dredging or excavation” for addressing sediment sites. The technologies considered in the Feasibility Study will therefore focus on the following (or a combination of the following):

- MNR or Enhanced MNR
- In situ capping
- Dredging or excavation combined with the following auxiliary technologies:
 - Transport
 - Materials handling (i.e., treatment)
 - Disposal.

The responsible parties are preparing a Remedial Alternatives Memorandum that will be finalized in 2012. This memorandum will provide details on all of these options.

What are Applicable or Relevant and Appropriate Requirements (ARARs)?

The remedial activities are often discussed in relation to ARARs. The term ARARs stands for “Applicable or Relevant and Appropriate Requirements,” in other words; ARARs are the list of all of the rules and regulations that could apply to investigating and cleaning up the Site. The PSCR contains a table that summarizes the potential ARARs.

What Information was Presented on Habitats and Surrounding Land Use?

The report describes the natural areas around the Site, including identifying some wetland areas that had not been previously identified. The document also listed species known to occur in the vicinity of the Site: clams and oysters, blue crab (*Callinectes sapidus*), black drum (*Pogonius cromis*), southern flounder (*Paralichthys lethostigma*), hardhead (*Ariopsis afelis*) and blue catfish (*Ictalurus furcatus*), spotted sea trout (*Cynoscion nebulosis*), and grass shrimp (*Palaemonetes pugio*).

The report also discusses surrounding land uses, noting that there is a combination of residential, commercial, industrial, and other land uses occurs adjacent to the site, in the surrounding areas, and upstream.

Could the Surrounding Land Use Result in the Release of Chemical of Potential Concern (COPCs)?

The PCSR noted that land uses upstream of the Site include industrial and municipal activities that may result in releases of dioxins and furans into San Jacinto River upstream of the Site. There are 7 permitted wastewater outfalls and at least one stormwater conveyance system draining to the river. Both can be sources of COPCs. Soils in upland areas throughout the site may be affected by atmospheric deposition of COPCs and north of I-10, by sand mining and sorting. South of I-10, industrial and commercial use, towing company, a shipbuilding company and a shipyard. As part of the investigation, the Responsible Parties should make sure to collect sufficient upstream samples to document background conditions.

What Existing Data was Discussed in the PCSR?

The PCSR lists data that will be used in the RI/FS in order to better identify possible gaps in the data that need to be filled before the RI can be completed. These are discussed further below:

Physical Datasets

Within the aquatic portion of the Site, three data collection efforts have been performed since the beginning of 2009.

- Two bathymetry surveys for a portion of the Site (2009 and 2010). Bathymetry is the measurement of the depth to sediment from the water surface. It describes the “topography” of the river bottom.
- Depth-averaged current velocity and stage height information in northern impoundment in June and July 2010 to measure the speed and direction of flow.

Other physical data included sediment physical data collected at stations in and around the 1966 northern impoundment perimeter and data from a light detection and ranging (LiDAR) survey of the Houston area that was performed in February and March 2008. The LiDAR information can help with creating accurate surface maps.

The PCSR also noted additional physical data analysis will be collected for the RI, including gathering more information about the river bed, sediment loading, current speed and direction, erosion potential of sediments, sedimentation rates, and additional bathymetry.

Chemical Datasets

There are numerous historical chemical datasets for sediment, water and tissue samples (2006 -2010) that were collected by various parties. In addition, there was data collected for the RI for sediment, groundwater, tissue, and soil. Surface water samples were not collected for the RI, however because dioxins and furans are not very soluble in water, this does not represent a significant data gap.

How will These Datasets be Used?

The quality and reliability of each dataset was evaluated to identify how the data can best be used. The following subsections describe how the various dataset will be used.

Baseline Risk Assessments

There were differences between the 2005 and the 2010 data on dioxin and furan concentrations in surface sediment surrounding north impoundment. The cause of the difference is unknown, but 2005 data will not be used as baseline data because it is not representative of the current conditions. Data to be used in the baseline risk assessments include:

- Soil, sediment and tissue data collected for the RI/FS
- Sediment and water data collected by URS (2010) for TCEQ in 2009.

The document also noted that additional sediment, water, and tissue data for polychlorinated biphenyls (PCBs) are available and may be used for the baseline risk assessments if the required laboratory quality assurance information can be obtained.

Description of the Type and Extent of Contamination

The same data that are used for the baseline risk assessment will be used for presentation and evaluation of nature and extent because it is high quality data representative of current conditions:

- Soil, sediment, and tissue data collected for the RI/FS
- Sediment and water data collected by URS (2010) for TCEQ in 2009.

The report did note that data might also be used if it provides information that is not available elsewhere or is otherwise unique, including data from:

- Sediment collected by Weston in 2006 for the Texas Department of Transportation's dolphin project
- PCB data for sediment, water, and tissue collected in 2008 and 2009 by the TCEQ's Total Maximum Daily Load program for PCBs.

Those datasets will not be used in portraying contaminant nature and extent in figures or tables, but may be discussed in relation to both cleanup alternatives risks associated with the Site.

Description of Past Conditions

Much of the data that is not useful for describing current conditions is still useful for describing past conditions and may be used for this purpose.

What are the Preliminary Results for the Area North of I-10 and the Aquatic Environment?

The PSCR provided a description of the physical characteristics of the site, including topography, surface water properties (elevation, salinity, flow in the river, etc), regional groundwater flow, soil, and shape of the river channel.

Detailed site characterization included site topography, surface water flow, groundwater characteristics and flow (southeast), soil and sediment types, and other physical information will be presented in the RI. The PSCR also presented a preliminary assessment of the contamination, the results of which are presented in the following subsections:

Surface Sediments

The report presented dioxin/furan concentrations using a *toxicity equivalent for dioxins and furans* (TEQ_{df}). This TEQ_{df} relates the toxicity of all the detected dioxin and furans to the toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), the most toxic form of dioxin. Surface sediment samples were taken from 0 to 6 inches below ground surface (bgs) at 120 locations. Upstream (background) samples had the lowest reported concentrations of TEQ_{df}. Concentrations are highest within the 1966 perimeter of northern impoundments, the highest in the western cell. Outside the perimeter, elevated concentrations of TEQ_{df} (between 120 and 160 ng/kg) were reported on the peninsula northwest of the waste pits, referred to as the “upland sand separation area,” an area where sand and sediment was processed. South of I-10, on the southern tip of the peninsula near the south impoundment area, elevated concentrations were also reported (~50ng/kg).

The lowest concentrations are reported in the upstream (background) sampling locations. Concentrations similar to background were also reported in several downstream samples, indicating that the extent of contamination has been determined, except in the area off the southern tip of the peninsula near the south impoundment where there were reported concentrations of ~50ng/kg TEQ_{df} without a corresponding sample from further downstream with a concentration more typical of background.

Subsurface Sediments

Subsurface samples were taken from intervals greater than 6 inches bgs. Subsurface sediment samples were collected from various depths for chemical analysis from 22 locations, for a total of 124 subsurface sediment samples. The highest reported TEQ_{df} concentration in subsurface sediment samples was 31,600 ng/kg, in the upper 2-ft interval of the boring located in the north central portion of the northern impoundment. Samples from within the western cell also have high reported TEQ_{df} concentrations. The highest reported subsurface sediment TEQ_{df} concentration from a sample outside the 1966 impoundment perimeter, are from a sample collected from the eastern side of the “upland sand separation area,” in the 3- to 4-foot bgs (349 ng/kg) and 5- to 6-foot bgs (339 ng/kg) intervals (Figure 6-15). The highest TEQ_{df} concentration south of I-10, was reported in the sample collected from Station SJNE007, at the 3- to 4-foot depth interval (51.1 ng/kg).

The horizontal extent of subsurface sediment contamination appears to be delineated. The vertical extent of contamination (depth of contamination), appears to be delineated for all of the samples

outside the former waste impoundment, but has not been determined for parts of the area under the impoundment.

Soil

For both the surface and subsurface soil, the highest contaminant concentrations are reported in the northern impoundments. Elevated contaminant concentrations are also apparent in the “upland sand separation area.” Dioxin does not move through soil well, it is much more likely to be found in sediments.

Groundwater

Monitoring well sampling was conducted in three locations within the 1966 perimeter of the northern impoundments in December 2010 through January 2011. A shallow and deep groundwater sample were collected at each of the three locations, In addition, a water sample was collected from a location inside waste materials in the western cell of northern impoundment. This highest contaminant concentrations in water were reported in the sample collected from the well in the waste material. The sample collected from shallow well SJMWS02 (location at the northern tip of the peninsula) had low reported concentrations of two dioxin and furan *congeners* (single, unique well-defined chemical compounds in the “dioxin/furan” category). Dioxins and furans were not reported in any of the deep water samples.

The water sample in the waste was unfiltered. Given the low solubility of dioxins and furans, and their high affinity for organic carbon, it is likely that the detected *congeners* were actually related to particles suspended in the water sample. Additional data would be helpful to understand the possible transport of these compounds.

Tissue chemistry

Tissue samples were collected from within the Site at locations where people or animals receptors may be exposed to tissue, and also at background locations. Tissue collections for clams were collocated with sediment collection sites in nearshore locations where people or animals may be exposed. Forage fish (Gulf killifish) were collected at the nearshore locations where ecological receptors are expected to be exposed and where sediment chemistry data will be available. The PSCR did not evaluate risk related to the tissue samples, it simply presented the data collected to date for summary purposes. The Baseline Ecological Risk Assessment and the Baseline Human Health Risk Assessments will provide an evaluation of the risks posed by contamination related to the San Jacinto Waste Pits Site.

Four types of animals were sampled:

- Hardhead catfish. Both edible tissue and whole bodies were collected, to support human health and ecological risk assessments, respectively.
- Rangia cuneata clams. Soft tissue (everything internal to the shell) was analyzed both to evaluate risk to molluscs as well as to support human health risk assessment.
- Gulf killifish. Whole bodies were analyzed and will be used to evaluate risk to the fish themselves and to wildlife.

- Blue crabs. Both edible tissue and whole bodies of crabs were analyzed, to support human health and ecological risk assessments, respectively.

Overall, TEQ_{DF} was detected in tissue samples collected from each type of animal, with whole animal concentrations typically higher than edible-only portions. Of the edible tissue samples, the samples collected from the clams had the highest reported average and maximum TEQ_{DF} concentrations. In general, killifish had the lowest reported concentrations.

What are some of the Conclusions from the PSCR?

The north and south impoundments received pulp mill wastes in the mid-1960s, and these wastes are considered to be a major source of dioxins and furans at the Site. In many cases, the reported TEQ_{DF} concentrations within the 1966 impoundment perimeter are 3-4 orders of magnitude greater than those directly adjacent to the impoundments. A specific dioxin and furan mixture, or fingerprint, characteristic of the wastes north of I-10 exists and can be used to identify Site-related dioxin and furan contamination. Some of the conclusions presented in the report include:

- Wastes deposited in the impoundments north of I-10 have been released to the aquatic environment.
- Handling of sediment potentially contaminated with paper mill wastes from the northern impoundments occurred on the “upland sand separation area,” and therefore soils in that area may be contaminated with wastes from the impoundments north of I-10.
- The wastes from the northern impoundments are the primary source of waste-related dioxins and furans to sediments. Groundwater is not contaminated by paper mill waste-related dioxins and furans.
- Proportions of the total dioxin and furan concentrations consisting of TCDD and TCDF in tissue are much greater than their proportions in adjacent sediments.
- For TCDD and TCDF, concentrations in clam tissue showed the strongest correlations to date with sediment concentrations, in spite of the relatively small dataset.

What are some Conclusions Specific to the North Impoundment

- The sharp decline in concentration towards the bottom of cores suggests that the waste is mainly in the northern impoundments, and not spreading through the natural sediment below the waste.
- The concentration of wastes at depth, and with a limited eastern extent is consistent with the Site history, which described the eastern cell as an area used to hold liquid wastes drained from the western cell, which was used for consolidation of solid wastes.
- Material from within the impoundment was subject to mobilization and redistributed by erosion resulting from tidal and river currents. Dredging activities in the area may have affected the Site. Mobilization of materials by dredging may have released sediment-associated contaminants to the water column that would have settled to the bottom.
- The sand mining operation and processing of related sediments extended to the “upland sand separation area” to the west of the northern impoundments, potentially affecting soils in that upland area.

- Information on dioxins and furans in background sediments with high fines and organic carbon fractions is a data gap.
- There was a difference between the reported TEQ_{DF} concentrations in catfish and crab from Cedar Bayou compared to other offsite areas, so Cedar Bayou may not reflect actual background conditions. Therefore, additional background sampling is needed.

What About South of I-10?

The area of the southern impoundment was used by third parties for disposal of construction, storm and assorted debris after it was used to dispose of paper mill wastes. Solid wastes are reported to be more diffuse than in the north, with any paper mill waste buried under the surface. No solid sludge was ever visible at the surface in the south impoundment in historical aerial photographs.

In March 2011, a soil investigation was conducted in the area south of I-10. Samples for dioxin and furan analysis were collected from 13 locations. In the surface soil, reported TEQ_{DF} values are generally much lower than those reported in surface soils from the impoundment area north of I-10. The highest reported TEQ_{DF} concentration in surface soil was 31.1 ng/kg. In subsurface soils TEQ_{DF} values decrease from their maximum value with depth within each of the soil cores, except in two borings (SJSB001, SJSB007), which could mean that the lower extent of the contamination has not been identified in those two locations.

The highest reported TEQ_{DF} concentration in the south impoundment is nearly 17 times lower than the highest TEQ_{DF} in the north, and that most reported TEQ_{DF} concentrations are more than 100 times lower than the maximum TEQ_{DF} in the north impoundments.

Summary of Data Gaps, Southern Impoundment

- Need additional information on dioxin and furan concentrations in surface and subsurface soils within the southernmost part to better describe the nature and extent of contamination in that area, and to enable an exposure assessment for workers that may be digging in that area.
- Need concentrations of dioxins and furans in groundwater of this area.