

# San Jacinto River Waste Pits Superfund Site Technical Document Review: Public Health Assessment (PHA) October 30, 2012

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## What is the purpose of Public Health Assessment (PHA)?

Agency for Toxic Substances and Disease Registry (ATSDR) and the Texas Department of State Health Services (DSHS) performed this evaluation to determine if people may have been exposed to hazardous substances from the Site and whether that exposure would be harmful to human health.

## What is the history of the San Jacinto River Waste Pits (SJRWP) Site?

The SJRWP were used from the mid-1960s to the mid-1970s for the disposal of paper mill wastes. Paper mill waste from the 1960s and 1970s is known to have contained high levels of dioxins and other chemicals as a result of the chlorine bleaching process then in use.

The DSHS Seafood and Aquatic Life Group (SALG) routinely collects fish, crabs, and other aquatic life samples from bodies of water across Texas and analyzes them for various contaminants of potential public health concern, such as mercury, polychlorinated biphenyls (PCBs), pesticides, and, occasionally, dioxins. In July 1995, the Houston Ship Channel Toxicity Study reported unexplained, high concentrations of dioxins in sediment samples in the vicinity of the San Jacinto River where it flows under the I-10 Bridge. Section 303(d) of the Clean Water Act requires all states to identify waters that do not meet, or are not expected to meet, applicable water quality standards. For each listed water body that does not meet a standard, states must develop a total maximum daily load (TMDL) for each pollutant. The Texas Commission on Environmental Quality (TCEQ) is responsible for ensuring that TMDLs are developed for impaired surface waters in Texas. Because of the elevated levels of dioxins found in fish and crabs, the Houston Ship Channel system was placed on the §303(d) impaired surface waters list, and the TCEQ initiated a TMDL project.

In 2005, the Texas Parks and Wildlife Department (TPWD) became aware of what appeared to be a number of waste pits located in a sandbar in the San Jacinto River, immediately north of the I-10 Bridge. TPWD contacted the TCEQ in April of 2005 and asked that the area be evaluated as a potential threat to aquatic resources and human health. In the summer of 2005, TCEQ began sampling from the waste pits Site under their Preliminary Assessment/Site Inspection (PA/SI) program. The site inspection report, including sampling information, data analysis and other background information, was completed in early 2007.

The SJRWP Site was proposed to the US Environmental Protection Agency's (EPA's) National Priority List (NPL, sometimes called the "Superfund" list) on September 19, 2007, and was officially added to the NPL March 19, 2008. In January 2010, the EPA posted warning signs and erected a fence to restrict Site access, and released the Remedial Investigation/Feasibility Study (RI/FS) work plan. The Potentially Responsible Parties (PRPs) began the field investigation shortly thereafter. The PRPs implemented a time critical removal action (TCRA) at the Site, beginning in Feb 2011 and finishing in July 2011. The TCRA included capping the waste pits north of I-10, installing fence, and more warning signs.

## **What chemicals of concern (COCs) were considered for the PHA?**

This PHA specifically assessed the human health effects of polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs).

Chlorinated dibenzo-p-dioxins (CDDs) are a family of 75 different compounds commonly referred to as polychlorinated dioxins. For example, the CDD with four chlorine atoms at positions 2, 3, 7, and 8 on the dioxin molecule is called 2,3,7,8-tetrachlorodibenzo-p-dioxin or 2,3,7,8-TCDD. 2,3,7,8-TCDD is one of the most toxic of the CDDs to mammals and has received the most attention. Thus, 2,3,7,8-TCDD serves as a prototype for the CDDs. CDDs with toxic properties similar to 2,3,7,8-TCDD are called "dioxin-like" compounds.

2,3,7,8-TCDD is one of the most toxic and extensively studied of the CDDs and serves as a prototype for the toxicologically relevant or "dioxin-like" CDDs. Based on results from animal studies, scientists have learned that they can express the toxicity of dioxin-like CDDs as a fraction of the toxicity attributed to 2,3,7,8-TCDD. For example, the toxicity of dioxin-like CDDs can be half or one tenth or any fraction of that of 2,3,7,8-TCDD. Scientists call that fraction a Toxic Equivalent Factor (TEF). For the purpose of this PHA, DSHS calculated the total TCDD toxicity equivalents (using the TEF) for each sediment or fish tissue sample, based on the unique mixture of PCDDs and PCDFs present in the sample.

## **Have ATSDR and DSHS collected new data for this PHA?**

No, the assessment is based on the existing data sets:

- Seven sediment samples collected from 1 to 8 feet below the surface of the water for submerged locations, by TCEQ on July 12 and 13, 2005
- Fish and crab sample data collected near the Site by the DSHS SALG in February-April of 2004,
  - seven fish (2 blue catfish, 2 spotted sea trout, 1 hybrid striped bass, and 2 red drum)
  - two blue crab specimens collected at the tidal portion of the San Jacinto River immediately upstream of the I-10 Bridge
- Sediment sample data collected from the San Jacinto River, Houston Ship Channel, and Upper Galveston Bay by the University of Houston as part of the TMDL study of dioxins
  - 210 sediment samples collected from 84 different locations between 2002 and 2005.

The sediment samples were grouped into five categories based on location:

- 1) *San Jacinto River Waste Pits (SJRWP) Site*: 9 samples.

- a. Eight of the nine samples had a TCDD TEQ concentration of more than 1,000 picograms per gram (pg/g).
- b. The average TCDD TEQ concentration for the nine Site samples was 15,594 pg/g (range: 80.9 –34,028 pg/g).
- c. TCEQ's upstream and downstream "background" sediment TCDD TEQ concentrations for the four samples averaged 1.85 pg/g (range 1.27 – 2.77 pg/g).

2) *Down-stream from the SJRWP Site in the San Jacinto River, Houston Ship Channel, or Upper Galveston Bay* (59 samples): average of 13.8 pg/g (range: 0.739 – 86.2 pg/g).

3) *San Jacinto River in the immediate vicinity of the SJRWP Site* (31 samples): average of 82.2 pg/g (range: 2.00 – 573 pg/g).

4) *Houston Ship Channel above (west) of its confluence with the San Jacinto River* (62 samples): average of 65.7 pg/g (range: 4.90 – 857 pg/g),

5) *Upstream from the SJRWP Site or up various tributaries to the San Jacinto River, Houston Ship Channel, or Upper Galveston Bay* (56 samples): average of 16.0 pg/g (range: 0.759 – 103 pg/g)

## **What are possible sources of dioxin in the environment?**

CDDs (mainly 2,3,7,8-TCDD) may be formed during the chlorine bleaching process used by pulp and paper mills. Dioxins and dioxin-like compounds can be found in the world at low levels in air, soil, water, sediment, and in foods such as meat, dairy products, fish, and shellfish. CDDs are released to the environment during combustion of fossil fuels (coal, oil, and natural gas) and wood, and during incineration processes (municipal and medical solid waste and hazardous waste incineration). Dioxins accidentally released into the environment can also originate as by-products of various industrial processes, such as metal smelting and refining and manufacture of chlorinated chemicals. They are also generated through various natural or man-made combustion activities such as forest and brush fires. Dioxins are found at their highest levels in soil, sediment, and in the fatty tissues of animals.

## **What are the exposure routes and scenarios considered in this assessment?**

Substances were released from the SJWP and entered the environment. Humans and plants and animals are exposed to a substance only when they come in contact with it. They may be exposed by breathing, eating, or drinking the substance or by skin contact. If you are exposed to chemicals of potential concern (COPC), many factors determine whether you'll be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. An individual must also consider the other chemicals you're exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

CDDs do not dissolve easily in water; most of the CDDs in water will attach strongly to small particles of soil or organic matter and eventually settle to the bottom in sediment. CDDs may also attach to microscopic plants and animals (plankton) which are eaten by larger animals that are in turn eaten by even larger animals. Some of these compounds are difficult for the animals to break down, usually

increase at each step in the food chain. This process, called biomagnification, is how concentrations can build up in larger fish. Therefore, there were three exposure routes identified:

- 1) Involuntary ingestion of contaminated sediments;
- 2) Dermal absorption of contaminants through skin contact with sediments;
- 3) Ingestion of fish or crabs containing elevated levels of contaminants from the Site.

There were six exposure scenarios that were evaluated to consider how people would be exposed to the contaminants:

- 1) Subsistence fisherman, fishing on-site 5 days per week, 52 weeks per year for 30 years;
- 2) Weekend fisherman, fishing on-site 1 day per week, 52 weeks per year for 30 years;
- 3) Sporadic fisherman, fishing on-site 12 times per year for 15 years;
- 4) Child of a subsistence fisherman, who starts goes to the Site beginning at age 3 and continues through age 50 (47 years);
- 5) Child of a weekend fisherman, who starts goes to the Site starting at age 3 and continuing through age 50 (47 years,);
- 6) Child of a sporadic fisherman, who starts goes to the Site starting at age 3 and continuing through age 35 (32 years);

Under all six scenarios, fishermen or their children were assumed to get contaminated soils or sediments on their hands and forearms, leading to both skin (dermal) and mouth (eating) exposures.

Sediment ingestion rates for each Site visit were assumed to be 200 mg/day for children ages 3 through 5 years. After age 5, the sediment ingestion rates were assumed to decrease each year until age 20, when the dose was assumed to be 100 mg/day by age 20. For adults, sediment ingestion rates were assumed to remain constant at 100 mg/day from ages 20 through 50 years.

It is also assumed that dioxin-contaminated fish and/or crabs are caught during each visit and are later eaten, leading to additional oral dioxin exposures. The assumptions employed in calculating the various risk estimates for this health assessment should be considered “conservative” to “extremely conservative.” The highest exposure group is intended to represent the reasonable maximum exposure (RME) for the Site and should not be interpreted to represent any existing population or group of people (known or suspected) who frequently visited the Site.

## **What are the non-cancer effects of dioxin exposure?**

ATSDR has noted that chloracne as an indicator of exposure to high concentrations of TCDD and dioxin-like chemicals. Chloracne is a severe skin disease characterized by acne-like lesions that generally occurs on the face and upper body. Exposure to excess amounts of dioxin may also cause muscular pains, sleepiness, loss of appetite, headache, increased perspiration, changes in thyroid function, and increased susceptibility to infections. However, none of these health effects have been reported to DSHS, or are suspected to have actually occurred in individuals as a result of contact with contaminants from the SJRWP Superfund Site. It is not suspected because even in the worst-case scenario, exposures at this Site are below the levels that are likely to produce any significant risk of clinically apparent adverse effects.

## What are the cancer effects of dioxin exposure?

Several studies in humans suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in humans. According to the EPA there is sufficient evidence that 2,3,7,8-TCDD is an animal carcinogen but there is not sufficient evidence that it is a human carcinogen. The U.S. National Toxicology Program (NTP) listed TCDD as known to be a human carcinogen in the January 2001 addendum to the Ninth Report on Carcinogens. Cancer health effects that are suspected, but not yet confirmed to be associated with dioxin exposures in humans include soft-tissue sarcoma, non-Hodgkin's lymphoma, respiratory cancer, prostate cancer, and multiple myeloma.

## Were residential health surveys conducted for this PHA?

No. Since groundwater, airborne and surface water exposure pathways were not found to be significant, and thus eliminated, no health surveys were needed for residents of Channelview or Highlands. People who fall into one of exposure scenarios do not necessarily live in the communities closest to the Site, they can be from anywhere else in Houston. Therefore, analysis of health outcome data from the neighboring communities would not have provided any significant insights.

## Have any seafood advisories been issued near the Site?

Yes, the following advisories are in place:

***The Houston Ship Channel and all contiguous waters upstream of the Lynchburg Ferry crossing, including the San Jacinto River below the U.S. Highway 90 bridge.***

**Contaminants of Concern:** Dioxin, organochlorine pesticides, and PCBs

**Species Affected:** Blue crab (dioxin), catfish (dioxin, organochlorine pesticides and PCBs), all other species of fish (organochlorine pesticides and PCBs)

**Consumption Advice:**

1. Persons should limit consumption of blue crab and all species of fish from this area to no more than one (1) eight-ounce (8 oz) meal per month.
2. Women who are nursing, pregnant, or who may become pregnant and children under 12 should not consume any blue crab or any species of fish from these waters.

***The Houston Ship Channel and all contiguous waters downstream of the Lynchburg Ferry crossing and Upper Galveston Bay north of a line drawn from Red Bluff Point to Five Mile Cut Marker to Houston Point.***

**Contaminants of Concern:** Dioxin and PCBs

**Species Affected:** Blue crab (dioxin), catfish (dioxin & PCBs), spotted seatrout (dioxin & PCBs)

**Consumption Advice:**

1. Adults should limit consumption of blue crab, catfish, and spotted seatrout to no more than one (1) eight ounce (8 oz) meal per month.
2. Women who are nursing, pregnant, or who may become pregnant and children under twelve (12) years old should not consume any blue crab, catfish, or spotted seatrout from this area.

For more information on seafood advisories, please see the Galveston Bay Foundation website:

[http://galvbay.org/advocacy\\_seafood.html](http://galvbay.org/advocacy_seafood.html)

## What are some of the community health concerns and questions?

*Why were water wells not considered in the health risk factor? I have learned the Highland neighborhood relies on household wells for their drinking water.*

The dioxin attaches strongly to sediments, clays, and sands, so they are not free to move significantly with groundwater flow. Compacted clays under areas near the Site form an impermeable barrier to the movement of water. For this PHA, water wells were not considered to have any significant possibility of dioxin contamination from the SJRWP Site. Subsequent shallow groundwater sampling confirmed that dioxin was not detected in shallow groundwater samples collected from the vicinity.

*What was considered the 'immediate vicinity of the Site?'*

The nearest residential neighborhood is in Channelview, TX, ½ mile west of the Site, and is not considered to be in the immediate vicinity of the Site. Highlands, TX, is ½ to 1 mile east or northeast of (and across the river from) and is not considered to be in the immediate vicinity of the Site, either.

*Would San Jacinto River flooding its banks be a problem for residential wells?*

During most flooding events, water from the banks of the river flows into the river and towards the Gulf. However, in big hurricane events with the effects of storm surge, flood waters might move towards the banks of the river and some of the contaminated sediments from the Site may have become suspended in the storm-surge waters. However, there would be massive dilution of these suspended and contaminated sediments into millions (or possibly billions) of gallons of salt water, the vast majority of which made its way back into the gulf as the storm-surge subsided. The small amounts of residual, highly-diluted, dioxins would be filtered by attaching to near surface organic soil, before reaching the water that is used to supply a residential well.

*How about negative health impacts including increased cancer risk from living near the SJRWP?*

Since ambient air, groundwater and surface water pathways were found to be non-significant, living close to the Site does not in itself imply exposure to Site contaminants nor to cancer risks or other negative health impacts, unless the individual (in addition to living near the Site) also consistently engages in one of the identified risky behaviors such as regular oral ingestion of Site sediments, regular skin contact with Site sediments, or regular ingestion of fish or crabs from the river or ship channel.

*What about contact with contaminated water via flooding, recreational use of the river as well as eating contaminated fish and crabs?*

According to the results of the Dioxin TMDL Project by University of Houston, even if a person was drinking 2 liters of contaminated water, with highest measured dioxin concentration, per day for a 70-year lifetime, the possible increased risk for cancer would be only 0.00066%. Periodic swimming or other recreational use of the river would produce far lower levels of exposure than drinking 2 liters of

the water per day. Fish and crabs tend to accumulate dioxins in their tissues and deliver a much higher dose to people who consume them. Therefore, fishing advisories have been in effect for these waters for years.

### *What is the effect of the dust from the contaminated sediment (at low tide or time of drought) on residents or fishermen?*

Since part of the Site was covered with thick vegetation, small trees, and heavy undergrowth part with muddy sediments prior to the Time Critical Removal Action (TCRA), even at the lowest tide and under drought conditions, inhalation of blowing dust from the Site was not considered to be a significant pathway of exposure either for distant residents or for fishermen at the Site.

### *Does the Health Assessment consider the childhood obesity issue and possibly reevaluate the consumption rate for children?*

While it is true that children eat more food, drink more fluids, and breathe more air in proportion to body weight than do adults, this factor has already been taken into account by the method used by DSHS to calculate the child's fish consumption rate. An exposure dose is written in terms of weight of contaminant to weight of person. So, if a child is 20% overweight and that child eats 20% more fish than the normal-weight child, the exposure dose, in mg/kg body weight, is the same as for the normal-weight child.

## **What are the results of PHA (Evaluation of Cancer and Non-Cancer Risk for the Site)?**

- Dioxins were detected in sediments at the SJRWP Site at concentrations that would cause unacceptably high possible risks for cancer and non-cancer adverse health effects for both adults and children under the subsistence fisherman exposure scenario and for children under the weekend fisherman scenario for both oral and dermal exposures. Therefore, **recurring oral and/or dermal exposures to sediments from this Site for periods of one year or longer could harm people's health.**
- Dioxins have been detected in fish and crabs caught near the SJRWP Site at concentrations that could cause unacceptably high possible risks for cancer for all but the sporadic-fishermen-and-their-children exposure scenarios. Therefore, **dioxin exposures through eating fish and crabs caught near the SJRWP Site for periods of one year or longer could harm people's health.**
- Surface water near the Site is brackish and not being used for drinking water purposes. The nearest residence is approximately ½ mile from the Site. Since dioxins do not dissolve well in water and are tightly bound to sediments, contamination of surface water is not likely to pose a significant health hazard.
- Because of the nature of the contaminants, their low volatility, their high affinity for soil particles, and the high vegetation coverage on the Site – leading to low likelihood of windblown dust – the airborne route was not considered a significant pathway of exposure at this Site.
- Dioxins were detected in off-site sediments at the location of a former sand mining operation. Since it is not known that the dioxin concentrations in the sand that has been mined or not, it is not possible to suggest whether or not past or present exposures to sand coming from sand mining activities near the SJRWP Site could harm people's health.

- Although two of the surface impoundments are inundated with water from the San Jacinto River and Site contaminants were likely being washed downstream to some extent during high water flow periods, sediment samples collected downstream have not shown any clear evidence of significant off-site migration of dioxins from the SJRWP Site. However, the extent of transport of dioxin-contaminated sediments off-site has not yet been adequately evaluated. Therefore, DSHS and ATSDR cannot conclude whether or not past or present off-site migration of dioxin-contaminated sediments could harm people's health.

## Uncertainties Associated with the Risk Assessment Process

Cancer and non-cancer risk assessments are affected by a wide range of uncertainties including:

- Dioxin concentrations in sediment or fish used in the exposure dose calculations.
- The quantity of sediment assumed to be ingested by a child or an adult during each visit to the Site.
- The percent of ingested sediment that is assumed to be absorbed into the body.
- The quantity of sediment assumed to be adhering to each square centimeter of skin exposed to Site sediments.
- The percent of dioxin which contacts the skin that is assumed to be absorbed into the body.
- The quantity of fish or crabs assumed to be ingested by a child or an adult following each visit to the Site.
- The assumed body weight of each exposed individual.
- The assumed frequency of visits to the Site.
- The assumed number of years that the exposures continue.

## What Recommendations were made in the PHA?

DSHS and ATSDR made the following recommendations with regard to the SJRWP Site:

1. The SJRWP Site should remain securely fenced to reduce if not eliminate unauthorized access to the Site by individuals who do not understand the issues with the contaminated sediments.
2. The signs posted around the area of the pits warning individuals to avoid contact with soil or sediments from the Site should be checked periodically and replaced if they disappear or become defaced.
3. The current fishing advisory issued by the SALG at DSHS should continue in order to minimize exposures to potentially hazardous levels of dioxins in fish or crabs caught near the SJRWP Site.
4. The EPA should continue their thorough evaluation of the SJRWP Site to determine the full extent of the contamination, not only for dioxins but also for other potentially hazardous contaminants.
5. Off-site sediments in downstream locations should be more thoroughly evaluated to determine the extent of off-site migration of contaminants from the Site.
6. Efforts should be made to determine greater details of the sand mining operation, including when sands were mined from the area adjacent to the pits with respect to when wastes were

disposed of in the pits, where mined sands have been distributed, and if possible, obtain sand samples for dioxin measurements.

7. All sediments at the SJRWP Site with significant levels of dioxins or other hazardous contaminants should be removed and disposed of properly.