What is a Baseline Human Health Risk Assessment (BHHRA)?
A Baseline Human Health Risk Assessment (BHHRA) for a Superfund site evaluates the potential threats of the hazardous materials to human health if no remediation actions are taken (baseline conditions), and helps identify cleanup levels that would protect the human health from those risks.

Risk models in the BHHRA are based on hypothetical exposure scenarios under baseline conditions, and cannot be used to determine actual exposures of individuals, or to identify any actual adverse health effects from any exposures.

Why do a BHHRA?
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 that "characterizes the current and potential threats to human health and the environment" [40 CFR §300.430 (d)(4)]. Results of the BHHRA provide risk managers a reference point to compare risk reduction levels achieved from the selected clean up alternatives with the no-action alternative. This document describes the current and potential risks to human health. The current and potential risks to the environment are addressed separately in the “Baseline Ecological Risk Assessment” for the project.

What are the Baseline Conditions at the Site?
A cap, comprised of a geotextile fabric (as well as an additional impervious geomembrane for the above-water Western Cell) and covered with rocks, is now in place, and additional waste material from the Site is not being released. However, for many years before the cap was installed, waste material was being released. For the area north of I-10 and aquatic environment, baseline specifically means environmental conditions that existed immediately prior to implementation of the cap. For the area of investigation on the south of I-10, baseline refers to the current condition.

Chemicals of potential concern for human health
Chemicals listed below might pose risks to human health and were measured in the previous investigations conducted at the Site, and therefore are included in this BHHRA.
What are the Exposure Scenarios That Were Evaluated?
For the area north of I-10 and aquatic environments the humans potentially exposed would be recreational and subsistence fishers, recreational visitors, and trespassers. Prior to cap installation, fishers were observed in the area of the northern impoundments and under the I-10 Bridge, on both sides of the channel. Fishing access points in the area include the RV trailer parks on the east side of the river north of I-10 and a public access area at Meadowbrook Park to the west. Recreational activities, other than fishing, include picnicking, walking, bird watching, wading, and boating. These activities were also observed prior to the installation of the cap. Signs of trespassing have also been reported under the I-10 Bridge. For the trespassing scenario, trespassers were assumed to have intermittent exposure of a shorter time than the fishers and visitors exposure scenario.

Since the area south of I-10 is developed and managed for commercial and industrial activity, industrial workers and trespassers are the human receptors with the highest potential for exposure in this area.

What is an Exposure Unit?
An exposure unit is an area within which people go, and if in that area they could be exposed to harmful chemicals (by being in contact with contaminated soils, sediments, water, fish, etc.). Exposure units are selected to separate high risk areas from low risk areas, so that the highest risk areas can be addressed first.
For north of I-10

In this BHHRA, for sediments, five shoreline beach areas were identified as exposure units.

- Beach Area A — the shoreline to the west of the shipping berth on the property west of the impoundments;
- Beach Area B/C — the eastern shoreline of the sand separation area and the shoreline between the sand separation and west side of the impoundments;
- Beach Area D — the shoreline on the east side of the channel under the I-10 Bridge, and downstream; and
- Beach Area E — the shoreline of the river channel at the southeast corner of the waste impoundments.
For catfish, clams, and crabs, three fish collections areas (FCAs) were identified.
For soils, the entire area north of I-10 was identified as the only exposure unit.

Risk assessors created exposure scenarios using combinations of these exposure units. For example, a fisher at Beach Area A could have contact with sediments there, and catch fish from FCA2/3.

**For South of I-10:**
There is a single exposure unit for workers or trespassers in the western part of the area south of I-10.
What is an Exposure Pathway?
An exposure pathway is the way that a person could be exposed to chemicals, such as drinking contaminated water, breathing chemicals in air, and eating contaminated soil or food.

What Exposure Pathways Were Evaluated for the Area North of I-10 and Aquatic Environments
Fishers and visitors could be exposed to chemicals from the Site by:

- Eating fish, shellfish (for fishers only),
- Eating chemicals in sediment, and soil, or drinking water
- Skin contact with chemicals in sediments, soil, and water
- Breathing chemicals in air

The report also noted that someone trespassing would be exposed the same as a visitor or fisher, but they would probably not be there as long or as often as a visitor or fisher.

What Exposure Pathways Were Evaluated for the Area South of I-10?
Commercial and construction workers and trespassers in this area could be exposed to chemicals from the Site by:

- Eating chemicals in soils
- Skin contact with chemicals in soils
- Breathing chemicals in air

Similar to the area north of I-10, breathing the chemicals was considered less likely than eating or touching the chemicals.

Data used in the BHHRA
In order to evaluate the human exposure and risks, risk assessors evaluated chemical data for sediments, fish, shellfish, and soil.

Sediment
People could be exposed to surface sediment in accessible shoreline areas of the Site. The BHHRA evaluated sediments covered by 2 ft. of water or less for direct contact. Sediment samples from the 0-to 6-inch depth increment from five shoreline beach areas were collected to use in the assessment.

Fish and Shellfish
Catfish fillet data were used to estimate exposures from eating finfish, because catfish usually have higher concentrations of dioxin and furans than other similar kinds of fish. Edible crab and clam tissue data were used to estimate exposure from eating shellfish.
Soil
The BHHRA analyzed soil that fishers and recreational visitors in north of I-10, workers and trespassers in south of I-10 might touch. To evaluate the exposure of fishers and visitors in the north of I-10, surface soil data collected at:

- 0” to 6”
- 0” to 8”
- 0” to 12”
- 0” to 24”

Because commercial and construction workers might come in contact with deeper soils, in the south of I-10 soil data was collected from:

- 0” to 6”
- 6” to 12”
- 12” to 24”
- 2’ to 4’
- 4’ to 6’
- 6’ to 8’
- 8’ to 10’

What are Toxicological Criteria?
The effect that a chemical has on human health is dependent on how much of that chemical a person is exposed to. For example, iron is an essential nutrient, if you don’t have enough it can cause anemia. But, iron can also be dangerous if too much accumulates in the body, causing problems like liver damage. **Toxicological criteria** is a risk assessment term that describes how much of a chemical might cause a health concern.

There are two types of concerns that are considered, cancer and non-cancer effects. Some chemicals have both cancer/non-cancer effects. For those chemicals that might cause cancer, toxicological criteria are developed using the results of the toxicological studies. For chemicals may have non-cancer health effects, toxicological criteria are based on the negative health effects possible at the lowest doses.

Skin contact and eating contaminated fish are the most significant exposure routes. However, there is no skin contact—specific toxicological criteria available for the COPCs for the site, so the risk assessment followed EPAs guidelines on how to adjust the oral criteria for how easily the skin can absorb the chemical, and use that for the skin contact value.
How Does the EPA Evaluate Cancer Effects?

Based on rates from 2008-2010, 40.76% of people born today will be diagnosed with some type of cancer at some time during their lifetime. USEPA evaluates the potential for individual chemicals to cause cancer in humans. To assess the potential, USEPA typically develops Cancer Slope Factors (CSFs). CSFs are used to estimate the risk of developing cancer, corresponding to a lifetime of exposure at the levels estimated in the exposure assessment. The CSF is often used to calculate what dose would result in a one-in-a-million extra risk ($10^{-6}$ risk) or a one-in-a-hundred-thousand extra risk ($10^{-5}$ risk). For this BHHRA, threshold total daily intake values and CSFs from an extensive review of previous scientific studies were used in estimating the potential cancer effects of dioxins, furans, PCBs, and heavy metals.

How does the EPA Evaluate Non-Cancer Effects

For long term exposures (over 7 years), EPA creates a chronic reference dose (RfD), which is a concentration where an individual could be exposed daily exposure without an increased risk of adverse effects during a lifetime. For shorter term exposures, (between 2 weeks and 7 years), EPA creates a subchronic RfD, which is an average daily exposure at which no adverse health effects occur. EPA also has data for acute (short-term) exposures. Exposures of trespassers to the chemicals in south of I-10 were evaluated using subchronic RfDs. For this BHHRA, RfD values from EPA’s databases and publications were used in estimating the potential non-cancer effects of dioxins, furans, PCBs, and heavy metals.

What are the Results of the Risk Characterization?

Risk characterization provides an overall assessment of potential cancer and non-cancer risks for the area north and south of I-10 and aquatic environment.

The area north of I-10 and Aquatic Environment

The following describes the risks associated with two scenarios

Scenario 1: Recreational fisher, subsistence fisher, and recreational visitor scenarios assumed exposure to sediments within the 1966 impoundment perimeter and Beach Area E under baseline conditions (immediately prior to the cap) in combination with consumption of fish or shellfish from adjacent FCAs or soils:

Non-cancer Hazards

For all three potential exposed populations, direct contact to sediments in Beach Area E accounted for over 98 percent of the highest exposure that can be reasonably expected to occur and cause reproductive and developmental problems, prior to the cap installation. Completion of the cap installation in July 2011 made sediments at Beach Area E inaccessible for direct contact by humans, and should eventually result in lower chemical concentrations in catfish and clams caught in this area, substantially reducing risk in this area.

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**Cancer Hazards**
All the scenarios calculated dioxin cancer hazard higher than zero, but not big enough to indicate cancer effects would have occurred before the cap was placed. Even using “worst-case” assumptions (like using the maximum dioxin and furan concentrations for all exposure scenarios), the results indicate that reproductive or developmental adverse health effects or cancer were unlikely.

Based on the risk assessment calculations, none of the other COPCs pose a significant risk to potential recreational fishers, subsistence fishers, and recreational visitors.

**Scenario 2: Hypothetical recreational fisher, subsistence fisher, and recreational visitor scenarios that assumed exposure to sediments at other areas (outside of the 1966 impoundment perimeter (Beach Area A, Beach Area B/C, and Beach Area D) in combination with consumption of fish or shellfish from adjacent FCAs or soils:**

**Non-cancer Hazards**
No adverse non-cancer health effects would be expected for hypothetical recreational visitors and recreational fishers as a result of contact with COPCs in sediments at Beaches A, B/C, or D and soil throughout USEPA's Preliminary Site Perimeter, and consumption of fish or shellfish from the adjacent FCA.

Non-cancer health effects were above zero only for the hypothetical subsistence fisher for direct contact to sediments at Beach Areas in combination with ingestion of catfish from the adjacent fish collection areas. For these scenarios the largest exposures were due consumption of fish; direct contact with sediments was less important. The main chemicals posing risks in fish were dioxins and furans, PCBs, and methylmercury. The risk estimates relied on a number of conservative assumptions, and it was determined that it was unlikely that non-cancer effects would have occurred before the cap was placed.

**Cancer Hazards**
It is not expected that dioxin-related cancer effects would have occurred under the baseline hypothetical recreational visitor and recreational fisher scenarios as a result of assumed contact with dioxins and furans in sediments at Beach Area A, B/C, or D and soil, and consumption of fish or shellfish from within USEPA’s Preliminary Site Perimeter.

Dioxin cancer effects were above zero for hypothetical subsistence fishers for direct contact to sediments at Beach Areas in combination with ingestion of catfish from the adjacent fish collection areas. For these scenarios the largest exposures were due consumption of fish; direct contact with sediments was less important. The risk estimates relied on a number of conservative assumptions, and it was determined that it was unlikely that cancer effects would have occurred before the cap was placed.

**Cancer Risks**
All estimated excess cancer risks for scenarios that assumed exposures to Beach Areas A, B/C, and D were within or below USEPA’s target cancer risk range.
Background Risk

Dioxins, furans, and PCBs present in catfish were also present at elevated concentrations in catfish caught in background areas designated for this risk assessment. Background conditions with respect to these chemicals contributed roughly one-half of the total potential risks under relevant scenarios. In addition, the hazards associated with background exposure to methylmercury in catfish fillets were similar or higher, indicating study area exposure is not contributing additional risk from methylmercury.

Baseline versus Post-Cap Hazards

The cap has substantially reduced potential risks for the study area.

Non-cancer hazard effects for the hypothetical recreational fisher and recreational visitor scenarios after the cap was installed are negligible. For the hypothetical subsistence fisher, post-cap exposure scenarios that assumed consumption of catfish in combination with direct contact to sediment have higher than background risks but lower than baseline (pre-cap) risks.

The post-cap cancer hazards are negligible for all of the hypothetical recreational fisher and recreational visitor scenarios evaluated. Only the post-cap exposure scenarios for the hypothetical subsistence fisher that assumed consumption of catfish in combination with direct contact with sediment has slightly higher than the background cancer risks.

The greatest hazard and risk reductions (84 to 100% reduction) resulting from the cap installation are for baseline scenarios that assumed direct exposure to Beach Area E. This was because the majority of estimated exposure for these scenarios was related to direct contact rather than to the ingestion of fish or shellfish, and because potential exposure to sediment in this area was completely restricted once the cap was implemented. For hypothetical exposure scenarios that assumed direct contact with sediments at other areas and consumption of catfish or clam, the hazard reductions resulting from the cap implementation range from 65 to 86%.

The area on the Peninsula South of I-10

Risks for hypothetical future construction workers for direct contact with soil (ingestion and dermal contact), non-cancer (reproductive/developmental) and cancer effects of dioxins and furans were non-negligible. For both the hypothetical commercial worker and trespasser scenarios, all cancer and non-cancer risks were below USEPA’s target cancer risk range and were negligible.

Conclusions

The screening levels indicated that dioxins and furans are high in sediments from the impoundments north of I-10 and that they are probably the most important risk driver at the Site. Also, eating fish and/or shellfish are important risks related to the Site.