Portland Harbor Superfund Site
Remedial Investigation/Feasibility Study
Round 1 Site Characterization Summary Report
EXECUTIVE SUMMARY
November 2004

INTRODUCTION AND BACKGROUND

Listed as a priority by the U.S. Environmental Protection Agency (EPA) in December 2000, the Portland Harbor Superfund Site is a high profile and complex project. The ongoing investigation has initially focused on an area of the Lower Willamette River from approximately Swan Island to Sauvie Island, north of downtown Portland.

The Lower Willamette Group (LWG) [1], a group consisting of a small portion of the 69 entities that have been identified by EPA as potentially having responsibility at the Site, is performing the study at the direction of EPA. The LWG includes ten members who, in 2001 entered into an agreement with EPA to conduct the Portland Harbor Remedial Investigation and Feasibility Study (RI/FS, the environmental investigation process used by EPA to investigate Superfund sites).

The purpose of the Remedial Investigation (RI) portion of the RI/FS is to investigate the nature and extent of contamination of sediment at the Site, characterize physical conditions that may affect movement of contaminants, and assess the potential risk that the contamination poses to human health and the environment. The Feasibility Study (FS) will help identify appropriate cleanup strategies and methods for accomplishing the cleanup. The LWG began fieldwork at the Site in the spring of 2001 and has a goal to gather information and study options for cleanup that will allow the EPA to make a cleanup decision years earlier than what is typical at a complex sediment Superfund Site.

In June 2004, EPA approved the RI/FS Programmatic Work Plan and the Field Sampling Plans for what is known as "Round 2 Sampling." The work plan sets the framework for the next phase of the environmental investigation, and the sampling plans describe what will be sampled and how. The Work Plan refers to an Initial Study Area (ISA) that is focused on River Mile 3.5 to River Mile 9.2 (roughly between Sauvie and Swan Islands). The ISA does not define the ultimate Site boundary. The ISA was a logical area in which to begin the investigation. EPA will determine the official geographic boundaries after the RI/FS is completed.

Data collection procedures needed to complete the RI/FS were approved and documented in the June 2004 Programmatic Work Plan. Sampling activities that took place prior to work plan approval were agreed upon and documented by EPA and the LWG. Sampling began in 2001, when the LWG collected data from more than 1,000 locations to help determine patterns of sediment movement in the ISA. In 2002, Round 1 sampling was conducted to further characterize the physical and biological systems in the river. These studies included limited sediment analysis and extensive collection and analysis of fish and invertebrate tissue samples - information that is critical to the ecological and human risk assessments. Round 2 sampling was started in the summer of 2004 and will continue in 2005, and involves extensive surface and subsurface sediment samples collection and analysis, surface water sampling and testing of sediments for toxicity to aquatic invertebrates. Samples will be collected within, upstream and downstream of the ISA. The information from Rounds 1 and 2 will be used to help determine the types and distribution of chemicals in sediments and water at the Site, and the potential effects on human, aquatic organisms, and wildlife.

This executive summary provides an overview of sampling activities and discusses how results will be incorporated into the overall environmental study and cleanup plan.

[1] LWG members that have signed the agreement with EPA are: ARKEMA Inc (formerly ATOFINA Chemicals, Inc.); Chevron USA, Inc; City of Portland; ConocoPhilips; Gunderson, Inc.; Northwest Natural Gas; Oregon Steel Mills, Inc.; Port of Portland; Time Oil Company; and Union Pacific Railroad. The LWG is open to additional PRPs joining the LWG and participating in funding the investigation.

Each sampling round is based on an EPA-approved field-sampling plan that describes sampling locations and methods. Together with a pre-approved quality assurance project plan, these documents comprise the sampling and analysis plan for each round of sampling.

Results from Round 1 sampling will help form a baseline from which subsequent sampling activities are determined and data gaps are identified. A detailed Round 1 Site Characterization Summary Report was submitted to EPA in October 2004.

At this point, no meaningful analysis of ecological and human health risk, or identification of appropriate cleanup actions can be completed until all critical data have been collected and the RI/FS is completed. The Round 1 Site Characterization Summary Report is intended to provide preliminary evaluation of the data, primarily to help identify any additional data that may be needed to complete the RI/FS.

ROUND 1 DATA COLLECTION ACTIVITIES

The Round 1 Site Characterization Summary Report summarizes the sampling activities and laboratory analyses for the following types of data collection that occurred during Round 1.

- **Physical system studies** (bathymetry, sediment stakes, and river current surveys). These studies evaluated how much sediment is coming into and leaving the site, the types of sediments and how the river bottom changes overtime.
- **Sediment sampling**. Sediment samples were collected in the general vicinity of where tissue samples were collected.
- **Tissue sampling** (fish, crayfish, and benthic organisms). These samples will be used in the human and ecological risk assessments.

Collection methods for each of these sampling activities followed detailed procedures approved by EPA and its partners.

Physical System Studies

An overall understanding of the physical system in the lower Willamette River is needed to develop an accurate picture of site conditions, to support the evaluation of risk (e.g., how contaminated sediment could move or where buried contaminated sediment could be exposed), and ultimately to develop and choose cleanup alternatives. Physical system studies are used to understand how sediments move in the river, where sediments are ultimately deposited, and how river currents and flood events affect the river bottom. The survey area extended from river mile (RM) 0, the convergence with the Columbia River, to RM 15.6, the upper end of Ross Island. The following physical system studies were performed during Round 1 sampling:

- Four bathymetric surveys took place January 2002, September 2002, May 2003, and February 2004. The surveys produced three-dimensional maps of the river bottom. Bathymetry was recorded over two years using new technology to produce three-dimensional images of the river bottom to measure its height and characteristics. Having this underwater map of the river bottom will help give an overall picture of how the river bottom changes from season to season
- Periodic sediment stake monitoring occurred from July 2002 to June 2004 at eight locations between river miles 2 and 9 (roughly from a mile north of Multnomah Channel to mid Swan Island). These sediment stakes measure the height of the sediment over time at specific locations. The extent of sediment erosion or accumulation at the sediment stake locations was measured by recording the height of each stake above the sediment surface for each monitoring event. These measurements provided information about how sediment moves along the shoreline of the river.

- Three surveys of the speed and direction of the water current along 16 cross-sections of the river from river mile 1 to 11 (roughly from the mouth of Columbia Slough to the Fremont Bridge) were performed. Surveys were taken on three different days in April 2002, May 2003 and January 2004.

Overall, the river bottom in both the channel and near shore areas was relatively stable during the testing period. Data indicate that sediment in the channel shows greater stability than sediment near shore. The data also indicate that riverbed elevation changes in both the channel and near shore areas are largely on the order of one foot or less. The river current survey data show river current speeds up to a maximum of 3.5 feet per second observed upstream of the ISA and lower maximum current speeds of approximately 2.5 ft/sec observed in the downstream. Notably, the tidal influence on river levels was not affected by a high-flow event in January 2004.

Sediment and Tissue Sampling

During Round 1, sediment (river and beach sediments) and tissue samples were collected throughout the ISA. Both river and beach sediment samples were collected from 0 to 6 inches below the sediment surface. The Round 1 sampling focused primarily on chemical concentrations in tissue and beach sediment samples. Only a limited number of river surface sediment samples were collected in Round 1, and most of these were samples taken from sediment at the same location as tissue samples. This information will help support the ecological risk assessment. Extensive river sediment sampling to determine the nature and extent of contamination is being conducted in Round 2.

Analytical techniques used to characterize chemical concentrations in Round 1 tissue and sediment samples followed EPA-approved procedures. River and beach sediment samples were analyzed for nearly 300 chemicals typically found in industrial use areas such as metals, polychlorinated biphenyls (PCBs), pesticides, and solvents. Biological tissue samples were also analyzed for a large number of chemicals.

Round 1 sediment and tissue collection activities included the following tasks:

- Collection of beach sediments in 20 human use areas, such as beaches or areas where transients are known to camp.
- Collection of surface sediments at 27 locations where sculpin and crayfish samples were taken, and 10 locations where benthic invertebrates (organisms that live in or on top of the river-bottom mud and sand) samples were taken. These sediment samples were taken in approximately the same locations as specimens collected for tissue sampling to help determine if there is any correlation between the location of sediment contaminants and contamination in tissue.
- Collection of 100 tissue samples from nine fish species, one crayfish species, and one clam species for chemical analysis.
- Reconnaissance survey to determine the feasibility of collecting adequate tissue from aquatic invertebrates and lamprey larvae for chemical analysis.

The collection of lamprey larvae was eliminated from the sampling program after two surveys suggested that the apparent low abundance of the larval fish at that time of year would yield insufficient quantities for laboratory tissue analyses. EPA, the Tribal partners, and the LWG are developing other methods of evaluating risk to lamprey larvae. Processes for obtaining salmon and sturgeon tissue samples for analysis are also being developed. The Round 1 sampling did not include adult salmon and sturgeon. However, the Oregon Division of Human Services did sample these migratory fish as a part of a federal grant to study fish migrating through the Superfund site.

Preliminary Assessment of Findings

Sediment and tissue chemistry results are presented in the Round 1 report primarily to provide preliminary information on the nature and extent of contaminants in sediment and tissue within the ISA, and to help identify additional data needs not already being addressed. It is premature to reach conclusions about risks to humans or the ecosystem, based on the sampling effort to date. Those important issues will be addressed in upcoming risk assessments.

Overall, however, some basic conclusions can be made. Chemical analyses revealed no unexpected results. Many naturally occurring and human-made chemicals were detected in sediments and biological life. The types of chemicals detected, and the concentrations at which they are present, are consistent with results of past sediment and biological sampling efforts.

Sediment Results

As expected, river sediments are considerably finer-grained than beach sediments. In general, concentrations of metals in the river sediment samples were similar to those in the beach samples. All of the metals analyzed were detected in at least one river sediment sample and all metals except for selenium were detected in at least one beach sediment sample. Most of these naturally occurring constituents were detected in all of the river and beach sediment samples. Most of the detected organic compounds, such as PCBs, DDT, phthalates, and PAHs were often found at higher concentrations in the river sediment samples when compared to the beach samples. Overall, relatively few pesticides were detected in the river and beach sediments. Herbicides were not detected in any of the sediment samples. Dioxins and furans were detected in all of the river sediment samples analyzed.

Tissue Results

Round 1 tissue chemistry results were reported for brown bullhead, black crappie, carp, clam, crayfish, large-scale sucker, northern pikeminnow, peamouth, sculpin, smallmouth bass, and subyearling Chinook salmon. Both whole-body tissue and fish fillet tissue samples were collected.

With some exceptions, metals occurred at relatively higher concentrations in the shellfish whole-body tissue samples (i.e., clams and crayfish) than in the whole-body fish tissues. Carp typically had relatively higher metals concentrations than the other fish species. Overall, black crappie, brown bullhead, juvenile Chinook salmon, and smallmouth bass had the lowest detected concentrations of metals in the tissue samples. The distribution of organic compounds by species was much more variable than that for metals and is likely affected by the feeding habits and position in the food chain of each species. Several organic compounds, such as PAHs, that were detected frequently and/or were detected at relatively high concentrations in sediment, were not detected frequently in tissue.

Some of the more persistent and bioaccumulative organic compounds, such as PCBs and DDT, were detected frequently in many species. PCBs were detected often in all species. The highest detected concentration of PCBs was in carp. Smallmouth bass, sculpin, large-scale sucker, and northern pike minnow also had relatively high concentrations of PCBs. Crayfish, juvenile Chinook salmon, and clams had the lowest concentrations of PCBs. DDT or one of its metabolites was detected in all of the tissue samples. Fillet-only tissue chemistry results for black crappie, brown bullhead, carp, and smallmouth bass indicated that concentrations of many chemicals were relatively similar among these species. Carp fillets had higher mercury, PCB, and DDT concentrations than the other species, although PCBs were also relatively high in brown bullhead. Overall, juvenile Chinook salmon generally had the lowest occurrences of detected concentrations of organic compounds, such as PCBs and DDT, in the Round 1 whole-body tissue composite samples. A detailed evaluation and discussion of the contaminant concentrations for each species will be provided in the forthcoming Preliminary Risk Evaluation Report.

Conclusion:

The Round 1 Site Characterization Summary Report confirms that there are contaminants in aquatic life and sediments in the lower Willamette River, similar to what could be expected in a working harbor with more than 150 years of industrial use.

Results from the Round 1 sampling activities are not used at this point in the Superfund process to make cleanup decisions or determine risk levels. Rather, the results help the LWG, EPA and its partners to take the next steps in the RI and will be used in combination with future sampling data to determine the risks, if any, posed by the sediment contamination, and the most feasible options for cleanup.

The Round 1 sampling effort provides a strong base for evaluating the physical and biological systems in the river. Results of Round 2 sampling will add substantially to the data on distribution of contaminants in sediments, and potential adverse effects on benthic organisms.

Through the risk assessment process these data, along with additional rounds of sampling results will help define the Site boundaries and ultimately lead to a feasibility study that describes the best options for river sediment cleanup.

What Happens Next:

More sampling and evaluation reports will be prepared leading up to a Draft RI/FS report in 2007. Here are some highlights:

Surface Sediment Sampling – sediment samples will be taken from the upper 12 inches of the bottom of the river. Most of the biological activity of sediment-dwelling organisms occurs in this first one-foot of sediment. Therefore, the measurement of the types of contamination and an assessment of their potential impacts on those organisms are needed for the risk assessment process.

Sediment Core Sampling – deep cores measuring up to 20 feet will be pulled out of the sediment and samples will be taken from various depths of the core. These samples will help provide information about how far down contamination might be located in the sediment.

Surface Water Sampling – testing will also be conducted on the water within the Site, as well as water coming into and moving through the Site from upriver.

Groundwater Sampling – samples of groundwater taken at or near the river's edge will provide data on whether contaminants may be entering the river from underground aquifers.

Hydrodynamic Modeling – a hydrodynamic model will integrate information about the riverbed, water flow, sediment movement and other factors and predict how the river might act in the future. This model will be important in determining the effectiveness of different cleanup methods.

These elements will be brought together is a series of reports over the next two years. These milestones include:

- A Comprehensive Round 2 Data Report and preliminary Human and Ecological Health Risk Evaluations – expected in the Fall of 2005,
- A Draft Remedial Investigation Report and the Human and Ecological Risk Assessments – expected in the Spring of 2007; and
- A completed Remedial Investigation and Feasibility Study available for public review in the winter of 2007.

A complete list and schedule of site-related activities and deliverables is available in the Portland Harbor Superfund Site Programmatic Remedial Investigation/Feasibility Study Workplan. For a copy of the workplan, contact: Judy Smith, U.S. Environmental Protection Agency, (503) 326-6994.