REMEDIAL INVESTIGATION REPORT
ST. JOHNS LANDFILL
PORTLAND, OREGON

Executive Summary

The St. Johns Landfill (SJLF) a closed, municipal solid-waste landfill owned and managed by Metro. It is located near the Rivergate Industrial District in north Portland, Multnomah County, Oregon, and is situated within the boundary of the Smith-Bybee Wetlands Natural Area. The landfill encompasses an area of approximately 240 acres and is situated on a floodplain near the confluence of the Columbia and Willamette rivers. Much of the surrounding area is used for industrial and commercial purposes.

Before its development as a landfill, the site was an unnamed wetland and seasonal lake that was part of an extensive, interconnected network of lakes, marshes, wetlands, and sloughs. The SJLF boundaries are currently defined by the Columbia Slough to the south and west, the North Slough (an arm of the Columbia Slough) to the north, and the Smith Wetland to the east.

Numerous environmental investigations and assessments of SJLF have been completed over the past several decades, and they have helped to characterize the physical and chemical characteristics of the SJLF. This current Remedial Investigation (RI) report is the result of studies conducted by Metro, in cooperation with the Oregon Department of Environmental Quality (DEQ), under a consent order in accordance with Oregon Administrative Rule (OAR) Chapter 340, Division 122.

This RI report, which includes risk assessments of human and ecological health, presents the results of environmental studies conducted between 2005 and 2010. The scope of this RI is to determine the nature and extent of potentially hazardous substances in soil, sediment, groundwater, and air at the site. The Risk Assessment (RA) determines whether contaminants in these media pose an unacceptable current or reasonably likely future risk to potential human and ecological receptors.

ES.1 Remedial Investigation

Field activities were conducted to determine the physical characteristics and the nature and extent of hazardous substances in the study area, and to assess potential mechanisms for contaminant migration and release. Analytical data for each environmental medium were evaluated. Table ES-1 summarizes the data collection efforts completed as part of this RI.

The SJLF RI was conducted using an iterative, “observational approach” to data collection. This method of investigation used initial assessment data to generally characterize the nature and extent of contamination and then—through a stepwise process—identified areas where additional data were necessary to provide greater resolution. Investigations for some media, such as sediment, were conducted in several iterations. Following is a summary of the RI evaluations in each medium of interest.

ES.1.1 Air

Landfill gas is produced by the biological degradation of buried waste; it consists primarily of carbon dioxide, methane, and trace levels of other constituents. The rate of landfill gas production is declining steadily (the landfill stopped receiving waste in 1991). Emissions are projected to decrease to half their current rate over the next 5 years. Virtually all landfill gas from the SJLF is captured by a gas collection system, and is either sold to the Ash Grove Cement Company for offsite use as alternative fuel, or combusted onsite in a flaring facility. All air emissions from the site are regulated under an Oregon Title V Operating Permit issued by DEQ. Under the Title V permit, Metro conducts quarterly monitoring of the entire landfill surface for possible releases of landfill gas that may occur through tears or other openings in the geomembrane cap, or from under the edge of the geomembrane. No subsurface pathway for gas migration exists outside the boundary of SJLF because of the presence of shallow groundwater around its perimeter.

Gas composition data from the SJLF flare inlet, characteristic of site gas, were used in assessments of potential risks from incidental or accidental exposure to landfill gas.

ES.1.2 Soil

When the SJLF was closed in 1991, a final cover system (which included a layer of imported topsoil) was placed over the entire landfill, and the site was revegetated. Currently, access to the landfill is limited to authorized personnel. Contaminants of interest (COIs) detected in the landfill surface soil included arsenic, barium, lead, mercury, vanadium, zinc, 4,4-DDE, 4,4-DDT, dieldrin, and polychlorinated biphenyl (PCB) Aroclors 1254 and 1260. Samples from stormwater sedimentation basin soil showed arsenic, barium, lead, vanadium, and zinc, while perimeter (intertidal) samples showed arsenic, barium, lead, vanadium, zinc, and PCB Aroclor 1242. Generally, COIs were present in low concentrations. The absence of similar COIs, or the presence of COIs at relatively low concentrations, in stormwater sedimentation basin soil samples indicates that erosion of soil from the landfill is not contributing COIs to sediment in surface water adjacent to the SJLF.

ES.1.3 Groundwater and Pore Water

Groundwater elevation data of groundwater in the study area indicated leachate mounding in the landfill, with leachate elevations declining slowly over time. Groundwater in the Upper Overbank Silt (OBS) showed a radial flow gradient pattern because of the leachate mounding above it. Groundwater in the Lower OBS flows horizontally to the northeast and northwest, with some seasonal variation. Deeper groundwater in the Columbia River Sand/Pleistocene Gravel (CRS/PG) formation flows to the north and northeast, with little seasonal variation.

Groundwater moves relatively slowly through the OBS, with average horizontal velocities estimated to be approximately 0.29 feet per year (ft/yr) in the Upper OBS (with little seasonal variation) and approximately 0.03 ft/yr in the Lower OBS. The average horizontal groundwater velocity estimates in the CRS/PG ranged from 18 ft/year in the wet season to 32 ft/year in the dry season.

Vertical groundwater flow gradients are generally downward in the study area, with the exception of seasonally upward flow in the vicinity of the North Slough during the dry season. Wet season vertical groundwater velocities between OBS and CRS/PG well pairs range from 0.004 ft/year (upward) to -0.052

ft/year (downward), with an average velocity of -0.015 ft/year (downward). Dry season vertical velocities range from 0.048 ft/year (upward) to -0.030 ft/year (downward).

Indicators of possible impacts to groundwater quality from the SJLF were evaluated for the 2006–2008 period by comparing concentrations of leachate indicator compounds (such as dissolved oxygen, chloride, and total organic carbon) with background concentrations. Landfill leachate effects were observed in most Upper OBS wells, as well as in all Middle OBS wells located between the landfill and surrounding surface-water bodies. Lower OBS wells located between the southwestern side of the landfill and the Columbia Slough also showed leachate effects. Leachate effects appear to dissipate with depth; constituent concentrations generally decrease with increasing depth of wells. Leachate indicator concentrations show generally stable or decreasing trends over time, as would be expected for a closed and capped landfill.

The evaluation of 2006 through 2008 groundwater-quality results indicated a number of COIs exceeding aquatic Screening Level Values (SLVs), including general chemistry constituents nitrate, ammonia, total dissolved solids, and cyanide; a number of inorganic constituents; intermittent detection of semivolatile organic compound (SVOC) bis(2-ethylhexl)phthalate (a likely laboratory contaminant); and both aromatic and aliphatic volatile organic compounds (VOCs).

Inorganic constituents, including iron and manganese, were evaluated and found to be present at higher concentrations in the Upper OBS wells than the landfill leachate wells. These elevated concentrations may be the result of naturally occurring reducing conditions commonly found in the Upper OBS, or they could be the result of reducing conditions caused by landfill leachate. Elevated concentrations of certain other dissolved constituents in groundwater (such as arsenic, iron, and manganese) may also be related to geochemically reducing conditions associated with wetlands and/or the SJLF.

The distribution of VOC constituents by geologic unit indicates that aromatic compounds were primarily detected in the Upper OBS, while aliphatic VOC constituents were primarily detected in the CRS/PG. Few VOCs of either class were detected in the Lower OBS. This distinction strongly indicates the absence of a link between the SJLF and VOCs present in the CRS/PG. The highest VOC concentrations for tetrachloroethene, trichloroethene, and cis-1,2-dichlorethene (aliphatic VOCs) were detected in monitoring well (MW) G-8C, which is screened in the CRS/PG and is located upgradient of the landfill. VOCs in deep groundwater are likely related to a regional plume, rather than impacts from the SJLF.

Pore water and seep water were also sampled in discrete locations around the landfill perimeter. In general, pore water samples revealed fewer metals exceeding the aquatic SLVs than shallow groundwater samples. Ammonia, barium, iron, and manganese were frequently detected above surface water aquatic SLVs, though these compounds are also commonly higher in naturally occurring reducing conditions. Two polynuclear aromatic hydrocarbon (PAH) compounds were also detected in pore water above the aquatic SLV II, with benzo(a)anthracene detected in Transects 1, 2, and 3 and benzo(a)pyrene detected in Transect 1.

Seep water samples from both the West Mud Flat and Blind Slough showed the presence of few contaminants. No organic compounds or metals were detected above the DEQ SLV II in seep water samples from either location, and only lead slightly exceeded the aquatic SLV at the West Mud Flat seep.

Interpretation of pore water data around the SJLF is complex because of the diurnal tidal and seasonal surface water level fluctuations. However, the prevailing gradient of groundwater is generally downward (indicating little or no discharge of pore water to surface water), and the transmissivity of shallow soils and sediment is relatively low. Generally, contaminant concentrations in seep water suggest that leachate impacts from the landfill to pore water are nominal.

ES.1.4 Sediment

Samples of surface and subsurface sediment were collected in surface water adjacent to the landfill, including the North Slough, the Columbia Slough, and Blind Slough. Data from these samples were supplemented with analytical results from City of Portland Bureau of Environmental Services (BES) samples collected upstream, downstream, and adjacent to the landfill. COIs identified in sediment near the SJLF include metals, PAHs, organochlorine pesticides, and PCBs. In general, the organic COIs have low solubility in water and are unlikely to be mobile in the environment unless adhered to mobile particles. Sediment particles in the subsurface are not mobile unless the overlying surface layer is eroded or disturbed.

Surface sediment at most locations around the landfill is, in general, relatively unaffected by COIs. Higher concentrations of COIs were measured in somewhat deeper sediment, notably in the 2- to 4-foot depth interval (and to a lesser degree, the 4- to 6-foot interval). Significant concentrations of COIs generally were not present in zones deeper than 6 feet.

Concentrations of nearly all COIs in nearly all locations were no more than 10 times slough background concentrations. Similar ranges of concentrations were detected upstream of the landfill, and there was no systemic indication that the landfill was a significant source of contamination to sediment in the slough; sediment samples collected by BES did not indicate increasing concentrations downstream from the landfill, nor decreasing concentrations upstream from the landfill. Concentrations of COIs downstream of the SJLF are generally lower than those upstream, which indicates that any possible impacts associated with the landfill are localized.

Sediment data indicated that COIs in sediment are not the result of groundwater flow through sediment nor the result of current seeps or any current or ongoing source. Rather, contamination appears to have occurred historically, and it appears to be at least in part from upstream sources.

Concentrations of COIs in sediment, though elevated in discrete areas above background levels, are generally not present at high levels that would trigger a preference for treatment under OAR 340-122-090, do not occur in patterns that would suggest a defined source, are isolated beneath relatively clean surface sediment, and are unlikely to become mobile.

ES.2 Human Health Risk Assessment

The Human Health Risk Assessment (HHRA) presents an evaluation of the potential for adverse human health effects that may be associated with chemicals detected in the vicinity of the SJLF. Although this HHRA produces numerical estimates of risk, it should be recognized that these numbers may not predict actual health outcomes because they are based largely on hypothetical assumptions. Rather, the risk

estimates are intended to provide a frame of reference for risk management decision making. Actual risks are likely to be lower than these estimates.

Potential human health risks associated with COIs detected in the vicinity of the SJLF were evaluated for each of the following exposure scenarios:

- Current and Future Site Worker Scenario (landfill area only)
- Current and Future Onsite Visitor/Recreational User Scenario (landfill area only)
- Current and Future Offsite Recreational User/Angler Scenario (adjacent slough areas)
- Hypothetical Future Scouring Scenario (adjacent slough areas)

The results of the HHRA indicate that there are no unacceptable risks for current or future onsite workers, visitor/recreational users, or a hypothetical future scouring scenario. The risk estimates for fish consumption indicate that consumption of fish caught near the SJLF may pose a significant risk to consumers. This risk is driven by the elevated concentrations in fish tissue of bioacccumulative organic compounds, notably PCBs. Concentrations of these compounds appear to be similar throughout the Lower Slough and the contributions of upstream and landfill sources cannot be clearly defined. This conclusion is supported by the Oregon Public Health Division's February 25, 2010, decision to issue a fish consumption advisory for the entire Columbia Slough based on the PCB concentrations found in the carp tissue samples that were used for this HHRA.

ES.3 Ecological Risk Assessment

Potential risks to birds, mammals, fish, benthic organisms, and vegetation were evaluated for possible effects from the SJLF. Risks posed to ecological receptors are within acceptable levels for birds, mammals, and vegetation that use the upland and riparian areas on and around the landfill. Evaluation of the aquatic and benthic communities within the Columbia Slough resulted in the following findings:

- Sediment concentrations for several chemicals of potential ecological concern (CPECs) are elevated in some areas of the Columbia Slough adjacent to the SJLF and exceed levels that may be toxic to some sediment infauna. It has not been conclusively determined, however, whether the landfill represents a source for these constituents, or what portion is (or may have been) contributed from other sources to the Columbia Slough.
- A City of Portland study showed that total PCBs and total DDX[1] in tissues of fish caught within the lower Columbia Slough are above levels protective (when consumed by raptors) of bird eggs. However, the levels of these COIs in tissues from fish collected adjacent to or downstream of SJLF were determined to be below levels in fish collected at nearby upstream locations, indicating that the source of the COIs is widespread. COI concentrations appear to be similar throughout the Lower Slough and the relative contributions of upstream potential landfill sources cannot be clearly defined.

[1] Dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyltrichloroethane (DDT), collectively.

ES.4 Conclusions and Recommendations

The results of the RA indicate that potential risks posed by the SJLF to human receptors are within acceptable ranges, and that—with limited exceptions—potential risks posed to ecological receptors are also within acceptable ranges.

The possible contribution from the SJLF to potential ecological risks is not (nor is it likely to be) clearly determined because analytical data, though extensive, do not provide consistent indications of the origin of the COIs creating the risk. This fact notwithstanding, Metro is committed to implementing actions that will be protective of human health and the environment, will minimize possible current and future risk, and enhance habitat value, consistent with its responsibility for overall management of the Smith and Bybee Wetlands Natural Area, within which the SJLF is located.

To address these potential risks, Metro proposes to evaluate—through a Focused Feasibility Study (FFS)—measures that would minimize environmental risk, while also considering restoration and enhancement of habitat, consistent with Metro's management objectives for the Natural Area. A feasibility study work plan will be developed to evaluate areas and media of elevated risk, and may include areas with elevated concentrations of contaminants that can be effectively treated or managed as a part of the Smith and Bybee Wetlands Comprehensive Natural Resource Plan.