Palos Verdes Landfill
Five-Year Review

Prepared for:

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California Environmental Protection Agency

Department of Toxic Substances Control

State of California

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NOTE

As identified in the Five-Year Review approval letter dated November 4, 2009 and the Fact Sheet dated November 2009, the Department of Toxic Substances Control approved the March 2009 draft Five-Year Year document with incorporation of Appendix K and the replacement of Appendix J page 5-4, and Appendix J Section 9. For ease of use, this version of the Five-Year Review document incorporates Appendix K and the revisions to Appendix J.

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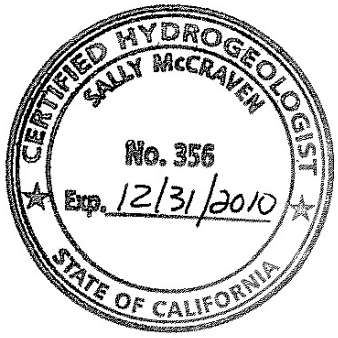

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Executive Summary

The Palos Verdes Landfill (Site) is located in Rolling Hills Estates, California, in Los Angeles County (Figure 1). Landfilling operations were conducted on the Site from 1952 through 1980. During operations, the Site accepted municipal, industrial, and hazardous wastes[1].

Volatile organic compounds were first detected in groundwater at the Palos Verdes Site in the early 1980s. As a result of the groundwater detections, a comprehensive Remedial Investigation (RI), Feasibility Study (FS), and Remedial Action Plan (RAP) were conducted and implemented. This work evaluated the effectiveness of environmental controls at the Site, health risks associated with living or working on or near the Site, and potential remedial actions. The recommended remedial measures were implemented and the Department of Toxic Substances Control (DTSC) approved the final remedial action for the Site on April 13, 1999. To verify that remedial actions continue to be protective of human health and the environment, DTSC reviews facility performance every five years.

This Five-Year Review was conducted pursuant to an agreement between DTSC (the lead agency overseeing the Site) and the County Sanitation Districts of Los Angeles County (Sanitation Districts) in accordance with United States Environmental Protection Agency (USEPA) guidelines for five-year reviews. The purpose of this Five-Year Review is to evaluate the implementation and performance of remedial actions at the Palos Verdes Landfill in order to determine if the implemented remedy is or will be protective of human health and the environment and whether remedial action objectives are being fulfilled. Due to concerns expressed by representatives from the Palos Verdes Landfill Citizens Advisory Board (CAB[2]), this Five-Year Review is considerably more comprehensive than five-year reviews typically performed for other landfills and contaminated sites. In addition, as a result of additional studies and analyses conducted to address CAB concerns, the time to conduct the review was longer than originally planned.

This Five-Year Review evaluates over 300,000 data points from routine data collection events conducted between January 1987 and December 2006. In addition, multiple special studies were conducted to further evaluate issues of concern for the CAB. The concerns that were evaluated include: potential gas migration through the landfill surface, potential subsurface gas migration at the perimeter of the landfill, emissions from the Gas-to-Energy facility, potential impacts to the Rancho Vista Elementary School, and potential contamination of cover soil. In addition, an updated Health Risk Assessment was prepared to evaluate the potential health risks associated with living or working at or near the Site.

The following findings were made by DTSC during this Five-Year Review:

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[1] It is estimated that hazardous wastes made up a small percentage (3 to 4 percent) of the total volume of wastes disposed at the Site.

[2] Previous documents refer to the Community Advisory Group (CAG).

- The groundwater containment system is effective in keeping the groundwater plumes stable. Impacted groundwater is not used for water supply. The concentrations of groundwater contaminants observed at and near the Palos Verdes Landfill are low and the total mass of groundwater contaminants is declining.
- Surface air monitoring data indicate that air quality above the surface of the landfill is better than air quality quantified during the Remedial Investigation. There is little, if any, landfill gas emitted through the soil cover on the surface of the landfill demonstrating that the extensive landfill gas control system and soil cover at the Site provide effective containment of landfill gas.
- Monitoring data collected during the Five-Year Review confirm South Coast Air Quality Management District findings that the Palos Verdes Landfill does not impact the Rancho Vista Elementary School.
- The amount of landfill gas generated by the Palos Verdes Landfill has substantially declined over time (nearly 40 percent reduction between 1994 and 2006). As refuse decomposition and resulting gas production decline, there is less potential for subsurface gas migration from the landfill.
- Data obtained from onsite and offsite soil gas studies indicate that subsurface landfill gas is not migrating from the Palos Verdes Landfill into adjacent properties.
- The Main Site is covered with a cap approximately seven feet thick comprised of low permeability soil, which is regularly inspected and maintained. This cover soil limits emission of landfill gas and direct exposure to wastes and complies with applicable State Water Resources Control Board standards for final cover.
- Data indicate that the cover soil used at the Palos Verdes Landfill is clean fill material and no contaminated soil has been used to fill low spots on the Site.
- Seepage observed within Country Hills Estates and the Country Hills Shopping Center is the result of naturally occurring hydrogeologic and geochemical conditions and is not associated with the Palos Verdes Landfill.
- Existing monitoring programs adequately assess containment facilities and remedial measures at the Palos Verdes Landfill.
- Incremental lifetime cancer risks to onsite workers, visitors, and surrounding residents are well within the acceptable risk management goals established by DTSC for all subject receptors and land uses.
- A comparison of the projected risks in this report and those previously projected during the Remedial Investigation show a decline in risks to Site users and the surrounding residents.
- Landfill slopes were analyzed and were determined to be stable and able to withstand the most severe earthquake expected at the Site.

- The Site's emergency response and health and safety plans were thoroughly reviewed and the Site was determined to be compliant with applicable rules and regulations.

Thus, the Five-Year Review found that the remedial systems are functioning properly and continue to be protective of human health and the environment. As a result, no additional remedial measures are recommended. In addition, the current monitoring systems at the Site are effective and protective; thus, no additional monitoring systems are necessary.

The attached documents detail the findings and results from the various studies conducted to review the remedial actions for the Site and to provide answers to community questions.

1 Introduction

Pursuant to the Operation and Maintenance (O&M) Agreement between the Sanitation Districts and DTSC (December, 1998), this Five-Year Review of the Palos Verdes Landfill began in 2004 (i.e., five years after the date DTSC certified the final remedial actions for the Site) and is the first in a series of reviews that will be conducted every five years. The purpose of this Five-Year Review is to evaluate the implementation and performance of environmental control systems at the Palos Verdes Landfill in order to determine if these systems continue to be protective of human health and the environment and whether remedial action objectives are being fulfilled. Remedial action objectives for the Palos Verdes Landfill defined in the RI/FS and RAP include:

1. Maintain and/or operate existing landfill control and monitoring facilities, including the landfill cover, and gas collection and groundwater containment systems; and
2. Control offsite downgradient groundwater contamination from the landfill.

2 Background

The Palos Verdes Landfill is located at 25706 Hawthorne Boulevard, Rolling Hills Estates, California, in Los Angeles County (Figure 1). As shown on Figure 2, the Site covers an area of 291 acres and is separated by Hawthorne and Crenshaw boulevards into three sections (i.e., the Main Site, the South Coast Botanic Garden, and Ernie Howlett Park).

2.1 Land Use

From the early 1900s to the 1950s, the Site was used for mining and quarrying by multiple companies. The principal products of mining and quarrying operations included diatomaceous earth, sand, and gravel.

Landfill operations began on the South Coast Botanic Garden parcel in 1952, conducted by a private operator (BKK Corporation). The Sanitation Districts operated the South Coast Botanic Garden parcel from 1957 to 1965. Planting for the garden began in 1961 as portions of the area reached capacity. The South Coast Botanic Garden is currently owned and operated by the County of Los Angeles Department of Parks and Recreation and is open to the public daily.

The Ernie Howlett Park parcel was purchased by the City of Rolling Hills Estates (City) in 1970 and operated as a landfill under a contractual agreement between the Sanitation Districts and the City. The Ernie Howlett Park parcel was operated by the Sanitation Districts from 1970 to 1979. After landfilling ceased, the parcel was subsequently developed as a park by the City. Ernie Howlett Park is currently owned and operated by the City and is open to the public daily.

Landfilling on the Main Site parcels began in 1961 and continued until December 1980. Current facilities on the Main Site include the Sanitation Districts' Gas-to Energy facility, which includes a liquid treatment facility; and modular structures associated with the

recycling center and landfill maintenance. Under a Joint Powers Agreement between the County of Los Angeles (County) and the Sanitation Districts, the County has responsibility for the ultimate recreational development and use of the Main Site. Currently, the Main Site is used for horseback riding, hiking, and other recreational uses approved by the County. Some form of recreational use of the Main Site occurs on a daily basis.

The Sanitation Districts are currently responsible for the operations and maintenance of environmental control systems at the Main Site and South Coast Botanic Garden. The Sanitation Districts also support the City's operation and maintenance activities at Ernie Howlett Park.

The historical uses of the Site are described in more detail in Appendix G.

2.2 Types and Quantities of Wastes Landfilled

During the period of operation by the Sanitation Districts, the Palos Verdes Landfill received approximately 23.6 million tons of waste materials. Approximately 18.3 million tons of wastes were disposed of in the Main Site, 3.5 million tons of non-hazardous wastes were deposited in the area that is now the South Coast Botanic Garden, and 1.8 million tons of non-hazardous and largely inert wastes were deposited in the area that is now Ernie Howlett Park. It has been estimated that approximately three to four percent of the total wastes disposed at the landfill was hazardous (Sanitation Districts, June 1995a).

The South Coast Botanic Garden and Ernie Howlett Park parcels were permitted to receive Class II wastes and accepted only non-hazardous wastes. Initially only non-hazardous and inert wastes were received on the Main Site; however, in 1964, approximately 40 percent of the Main Site was permitted to receive Class I hazardous wastes (Figure 3). The types of hazardous materials (Group 1 or Class I) accepted at the Main Site included primarily acid wastes, solvents, alkaline wastes, tetraethyl lead sludge, chemical toilet wastes, hazardous tank bottoms, oily wastes, contaminated soil, brine, pesticides, refinery wastes, and oil field and oil terminal wastes. The types and quantities of wastes landfilled at the Site are described in more detail in Appendix G.

2.3 Remedial Investigation, Feasibility Study, and Remedial Action Overview

Groundwater contamination was first discovered in the early 1980s, when volatile organic compounds (VOCs) were detected in groundwater. In response, the Sanitation Districts installed a subsurface barrier and groundwater extraction system and the Sanitation Districts and DTSC signed an Enforceable Agreement on March 31, 1988, that set forth the objectives for a Remedial Investigation (RI) and Feasibility Study (FS) of the Site.

In 1995, the Sanitation Districts completed the RI and FS for the Site in accordance with the Enforceable Agreement (June, 1995a and b). A Remedial Action Plan (RAP) that presented the design, plan, and final remedial action program for the Site was finalized in September 1995. On April 13, 1999, DTSC approved the completion of the final remedial action for the Site.

2.3.1 Remedial Investigation and Feasibility Study (1988-1995)

The RI, initiated in 1988 and completed in June of 1995, evaluated the potential for chemicals to migrate from the Site in groundwater, air, landfill gas, soils, and surface water. A FS was also completed in June 1995 and was conducted to identify and evaluate appropriate remedial alternatives for the landfill.

A comprehensive program of field investigations was undertaken as part of the RI to characterize Site conditions. Air investigations included meteorological monitoring, and sampling of ambient air, integrated surface gas, boundary probes, surface flux chambers, landfill gas, and flare emissions. The surface water and sediment investigation included surface storm and sediment runoff testing, and a surface water hydrology study. The soil investigation included soil cover sampling as well as subsurface and sediment sampling of up-canyon and down-canyon areas. Forty-four borings were geologically and geophysically logged. Groundwater sampling was performed at 29 existing monitoring wells and 21 additional monitoring wells installed during the RI. A risk assessment of impacts to human health from the landfill was also conducted as part of the RI. The FS defined the remedial action objectives and evaluated remedial technologies to control further offsite migration of chemicals in groundwater.

A landfill gas collection system was in place and operating effectively at the time the RI and FS were conducted. The RI determined that the risks from gas emissions through the cover soil and fugitive emissions were indistinguishable from background (chemicals in ambient air) or below DTSC levels of concern and that continued maintenance and monitoring of the landfill gas collection system would ensure protection of human health and the environment. Thus, no additional remedial facilities related to air were deemed necessary.

The RI/FS found that since landfill wastes were buried beneath a soil cover and since surface soils did not exhibit constituent concentrations above background levels, surface soil and runoff did not present a risk to human health and the environment. Thus, continued maintenance of the landfill cover and drainage system was the remedial action for these media and no additional remedial facilities were proposed.

The RI/FS found two areas of groundwater contamination downgradient of the Site. It was determined that contaminant concentrations were highest in onsite wells and groundwater contaminant concentrations in downgradient wells could potentially increase in the future in the absence of further remedial action. Thus, the remedial action objective for groundwater established during the RI/FS was to prevent an increase in volatile chemical concentrations in offsite groundwater downgradient from the landfill. Additional groundwater extraction wells were proposed to help achieve this objective.

The risk assessment conducted as part of the RI determined that the potential exposures and estimated risks for air, soil, surface water, and groundwater did not exceed DTSC threshold levels. Thus, the remedial action objective identified for the landfill appropriately focused on containment of groundwater contamination at the Site, continued maintenance of the landfill cover, and continued operation and maintenance of the landfill gas systems.

2.3.2 Remedial Action Plan

A Remedial Action Plan (RAP) was finalized in September 1995, which presented the design, plan, and final remedial action program for the Site. The recommended remediation for the Site included the following:

- Continued operation of landfill gas control systems;
- Maintenance of existing Site drainage structures;
- Maintenance of the existing soil cover to prevent contact with landfill contents;
- Continued operation of the Site groundwater containment system; and
- Installation and operation of five new groundwater extraction wells, two near Hawthorne Boulevard and three near Crenshaw Boulevard, to prevent any further offsite migration of groundwater contamination from the landfill.

The additional groundwater extraction wells were installed between October and December 1996 and DTSC approved the completion of the final remedial action for the Site on April 13, 1999.

3 Scope of Work for the Five-Year Review

Due to the significant public interest and concerns expressed regarding potential impacts of the Palos Verdes Landfill on the surrounding community, the work plan for this Five-Year Review was drafted with significant input from the Palos Verdes Landfill Community Advisory Board (CAB).

The main purpose of a Five-Year Review is to evaluate the implementation and performance of remedial actions in order to determine if the implemented remedy is or will be protective of human health and the environment and whether remedial action objectives are being fulfilled.

The original work plan was submitted to DTSC on May 20, 2004 and included review of the routine monitoring data collected between January 1987 and December 2003 for air and landfill gas, groundwater, storm water, and industrial wastewater. Because the methodology for health risk assessments had changed significantly since the RI, an updated Health Risk Assessment was proposed to address the question of protectiveness of the human health and the environment. In addition, soil samples were proposed to be collected to evaluate soils placed at the Site since the conclusion of the RI.

Since the initial work plan primarily relied upon existing data, a six-month schedule was proposed for completion of the Five-Year Review. Subsequent to the May 20, 2004 work plan, several special studies were requested by the CAB to collect additional data in support of an expanded Health Risk Assessment or to address other CAB concerns. This additional work included:

1. Flux chamber testing to assess gas emissions from the surface of the landfill,
2. Gas-to-Energy facility trace metal emission testing,
3. Air monitoring at the Rancho Vista Elementary School,

4. Soil sampling at the Rancho Vista Elementary School,
5. Installation and testing of multi-level soil gas probes along the most permeable subsurface transport pathways along the landfill property boundary, and
6. Installation and testing of single-level soil gas probes in the residential area abutting the northeast side of the Main Site.

The work plan also described several community involvement tasks. These tasks were expanded to provide a significant level of public participation in the five-year review process. DTSC and the Sanitation Districts worked extensively with the CAB to address potential community concerns. Detailed responses to supplemental issues raised by the CAB are provided in Appendix I and a summary of the findings is included in Section 10.

The main text of this report provides an overview and summary of the Five-Year Review findings related to the specific environmental media (i.e., groundwater, air and landfill gas, cover soil, storm water, and industrial wastewater). Included in each discussion are the results of the updated Health Risk Assessment related to the specific media. The routine monitoring data are used to evaluate performance, and the updated Health Risk Assessment is used to answer the question of whether the systems in place are protective of human health and the environment.

Detailed discussions of the data, analyses, and results are presented in attached appendices. For special studies conducted as part of this review, comprehensive descriptions of field data collection procedures and results are presented in the appendices and sub-appendices.

4 Assessment of the Groundwater Protection Systems

The groundwater protection facilities installed at the Site include systems to contain and remove impacted groundwater. Groundwater monitoring is conducted downgradient of the Site to measure the performance of the groundwater protection systems. Figure 4 shows groundwater monitoring well locations around the Site.

The primary groundwater protection facilities consist of a system of groundwater extraction wells and a subsurface groundwater barrier. Based on the pre-landfill topography, the primary pathway of groundwater flow, and the locations where groundwater contamination was found during the RI, the groundwater extraction systems have been installed in two areas; 1) along Hawthorne Boulevard (Hawthorne Plume), and 2) in the vicinity of Crenshaw Boulevard (Crenshaw Plume). The groundwater extraction wells in the vicinity of Hawthorne Boulevard draw from groundwater that has been contained behind the subsurface barrier. The groundwater protection systems and Site hydrogeologic setting are discussed in more detail in Appendices A and G, respectively.

4.1 Groundwater Monitoring

The groundwater quality data for the Site were evaluated for this Five-Year Review in several different ways in order to assess the effectiveness of the groundwater remedial facilities. Groundwater data were separated into two time periods: historic baseline

(January 1987 through June 1994) and recent (July 1994 through December 2006), to assess remedial effectiveness over time. The historic data represent baseline conditions prior to and during the installation of groundwater remedial facilities. The recent data are compared to the historic data in order to assess the ongoing effectiveness of groundwater remedial systems.

The O&M Agreement contains two criteria to evaluate trends in the groundwater quality data. Using these screening criteria, a potential increasing trend in an offsite downgradient monitoring well would be indicated if both of the following two conditions were met: 1) greater than ten percent of parent[3] VOC concentrations in downgradient offsite wells in the recent data period are above the historical maximum and 2) statistical trend analysis shows that parent compound constituent of concern[4] (COC) concentrations have increased in offsite downgradient wells since full implementation of the remedial systems in March 1997. No COCs met both of these criteria.

Three other criteria were also used to determine if the downgradient offsite plumes are expanding. These criteria include 1) visual comparison of historic and recent concentration versus time plots, 2) visual comparison of historic and recent concentration contour maps, and 3) comparison of historic and recent offsite contaminant mass.

Time-concentration charts for individual COCs for the historic (1987 to 1994) and recent (1994 to 2006) time periods are presented in Sub-Appendix A-B. Overall, the charts show most constituents in most wells are frequently not detected and trends are stable or decreasing.

Visual inspection of the 1994 and 2006 concentration contour maps (Sub-Appendix A-C) show that the offsite plumes for individual constituents appear to be stable or decreasing in size for almost all parent compound constituents of concern. In addition, the envelope of total VOCs visually illustrates the stability of these groundwater plumes (see Figures A-8 and A-9 in Appendix A).

The final criterion used to assess remedial effectiveness is comparison of the mass of VOCs in the offsite plumes in the recent and historic time periods. The estimation of the mass of the offsite plumes in 1994 and 2006 shows that the overall mass of VOCs has declined 52 percent over this time. The assessment of the groundwater monitoring data is described in more detail in Appendix A.

4.2 Health Risks Associated with Groundwater

An updated Health Risk Assessment was conducted as part of this Five-Year Review. The risk assessment, included in Appendix J, found that ingestion of impacted groundwater is not a complete pathway of exposure because groundwater in the vicinity of the offsite plumes is not used for drinking water supply. The risks associated with

[3] Parent compounds naturally degrade in the environment to one or more degradation compounds; for example, tetrachloroethylene is the parent compound of trichloroethylene. Eventually, these compounds will naturally degrade to carbon dioxide and water.

[4] Constituents of concern include volatile organic compounds and arsenic.

inhalation of vapor from the groundwater plumes[5] were assessed with other subsurface gases and are presented in Section 5.2.3.

4.3 Conclusions

The risk-based remedial action objective for groundwater is to control offsite downgradient groundwater contamination from the landfill to levels observed during the RI (historic) period or to lower concentration levels (DTSC, May 1999).

Visual comparison of the envelope of VOC detections shows almost no change in the downgradient extent of the impacted groundwater, indicating that remedial facilities are effective in keeping the groundwater plumes stable. Time-concentration charts show most constituents in most wells are frequently not detected and most trends are stable or decreasing. In addition, the estimation of the mass of the offsite plume in 1994 and 2006 also shows that the overall mass of VOCs has declined significantly over time.

These findings indicate that the groundwater remedial systems are effective in minimizing contaminants leaving the landfill and/or natural attenuation is limiting the downgradient spread of contamination.

The updated Health Risk Assessment confirmed that the current groundwater remedial systems are protective of human health and the environment.

5 Assessment of the Landfill Gas Collection and Control System

Landfill gas collection systems installed at the Site consist of vertical gas collection wells and horizontal gas trenches installed on the Main Site and South Coast Botanic Garden (see Figure 5). These wells and trenches are connected through a network of header line pipes, and a vacuum is applied to create a negative pressure gradient around each well or active trench. The gas is drawn from the refuse into the collection system thereby controlling potential surface air emissions and subsurface gas migration. These systems have been continuously operated and improved since the early 1970's.

The collected landfill gas[6] is combusted in the Gas-to-Energy facility located in the northern corner of the Main Site alongside Hawthorne Boulevard. The generated electricity is sold to Southern California Edison for use in the local power grid network. In 2006, the average net power output from the facility was 3.5 megawatts (MW). This compares with the net power output from the facility of 9 MW at the time of the RI (Sanitation Districts, June 1995a). As a result of declining landfill gas production at the Site, the existing Gas-to-Energy facility has reached the end of its useful life. The Sanitation Districts have proposed to replace the boiler system with microturbines, a fuel cell, and an ultra-low emission flare.

Landfill gas is routinely sampled at the header lines prior to conveyance for treatment at the Gas-to-Energy facility. Landfill gas sampling at header lines indicates that volatile

[5] Potential degassing from contaminated groundwater is described in Section C.7.3 in Appendix C.

[6] Typically landfill gas contains equal amounts of methane and carbon dioxide, and less than 0.006 percent volatile organic compounds (see Appendix C, Table C-2).

organic compound concentrations are decreasing and landfill gas production is declining. This is expected, since the landfill gas generation rate is usually at a maximum soon after refuse placement and then decreases over time. The amount of landfill gas generated by the Palos Verdes Landfill has substantially declined over time. As of 2006, methane levels were nearly 40 percent lower than they were in 1984. The methane levels in the landfill gas are projected to continue to decline by about 4 percent per year. VOC levels of landfill gas have also declined when compared with levels detected during the RI. As gas production declines, there is less potential for surface air emissions or subsurface gas migration from the landfill.

VOCs in the landfill gas are removed by combustion in both the boilers and flares as documented in annual source tests conducted pursuant to the South Coast Air Quality Management District (SCAQMD) Rule 1150.1. The effectiveness of the landfill gas control systems is also routinely monitored in the surface air surrounding the Site and in the subsurface gas at the Site boundaries.

5.1 Surface Air Monitoring

The surface air assessment of landfill gas containment was based on several types of routine and non-routine special monitoring. Routine ambient air monitoring, integrated surface gas testing, and boiler and flare emissions testing were used to evaluate the effectiveness of the landfill gas control system. The non-routine special studies include surface flux chamber testing and boiler and flare metals emissions testing. The non-routine special studies were used in the updated Health Risk Assessment to address concerns expressed by the CAB.

Surface air monitoring results are summarized below and are described in more detail in Appendix B.

5.1.1 Routine Air Monitoring

5.1.1.1 Ambient Air Monitoring

Ambient air monitoring is conducted upwind and downwind of the Main Site to assess potential landfill gas emissions (see Figure 6). A comparison of averages for compounds analyzed during both the recent and RI programs indicates that recent upwind and downwind sample results are similar to RI sample results (see Section B.7.1 in Appendix B).

Methane is the primary constituent of concern in landfill gas and has been used as an indicator of landfill emissions by the SCAQMD and USEPA. The statistical analyses show that methane levels at upwind and downwind locations are not different and are consistent with background levels found in an urban environment. The lack of methane emissions indicates that landfill gas emissions are well controlled at the Site.

Statistical analysis of upwind and downwind VOC concentrations indicates that no VOCs were statistically higher downwind of the Site. These findings also indicate that landfill gas is well controlled at the Site.

5.1.1.2 Integrated Surface Gas Monitoring

Integrated surface gas samples are collected from just above the landfill surface to monitor for evidence of landfill gas emissions. Figure 7 shows locations of the integrated surface gas monitoring grids[7]. Although landfill gas contains about equal amounts of methane and carbon dioxide, methane is monitored because it is readily distinguished from its ambient air background level compared to carbon dioxide and is proportionate to other potential landfill gas constituents. Monitoring is conducted by continuously recording methane levels while traversing the landfill area in a serpentine pattern. Surface gas samples are also collected to assess VOC concentrations.

5.1.1.2.1 Methane Monitoring

In order to assess the effectiveness of the landfill gas containment facilities, recent integrated surface gas monitoring data were compared to SCAQMD Rule 1150.1 Compliance Plan criteria. The data from the Main Site indicate that the action level[8] has not been exceeded. The South Coast Botanic Garden had one detection above the action level in the fourth quarter 2001. However, this detection was corrected and methane levels returned to background ambient air levels within ten days after performing maintenance to the landfill cover in accordance with Compliance Plan requirements. The Sanitation Districts have not been in violation of any SCAQMD Rule 1150.1 Compliance Plan criteria.

In addition, the recent data were compared to the RI data to assess changes in the landfill gas containment effectiveness over time. The comparison indicates that current surface air quality is better than during the RI period and that landfill gas emissions are well controlled at the Site.

A summary table of the integrated surface gas sampling results is provided in Appendix B (Table B-3).

5.1.1.2.2 VOC Monitoring

Comparison of the VOCs common to both the RI and recent data sets for the Main Site indicates that average concentrations detected in the recent time period were either less than detected during the RI period, less than the RI detection limits, or not detected in either data set. Similar results occur when comparing South Coast Botanic Garden recent and RI data. Overall, compounds decreased in concentration when comparing recent to RI data indicating improved gas control and/or reduced landfill gas generation.

5.1.1.3 Boiler and Flare Emissions Testing

Samples are collected from the Gas-to-Energy facility to assess destruction efficiency in accordance with the SCAQMD Rule 1150.1 Compliance Plan. Compliance with the Plan is demonstrated by achieving less than 20 parts per million by volume (ppmv) or greater than 98 percent by weight destruction efficiency for total non-methane hydrocarbons (i.e., VOCs).

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[7] The area that is now Ernie Howlett Park is not required to be monitored by the Sanitation Districts pursuant to the Rule 1150.1 Compliance Plan approved by SCAQMD.

[8] The SCAQMD methane action level for integrated surface gas samples is 50 parts per million by volume (ppmv). If greater methane levels are observed, actions are taken to eliminate methane from the area within the timelines specified in the SCAQMD Rule 1150.1 Compliance Plan.

Boiler and flare emissions test data for samples collected since 1994 were reviewed for compliance with the SCAQMD Rule 1150.1 Compliance Plan requirements. In all cases, the average destruction efficiencies were determined to be greater than 98 percent in accordance with SCAQMD Rule 1150.1 limits.

Recent and historic exhaust gas VOC data were compared to assess any changes in destruction efficiencies over time. For boiler emission samples, methylene chloride has a slightly higher average concentration in the recent data set compared with the historic data set; however, the recent maximum is within the range of historical data. The remaining boiler constituent averages were either 1) less in recent sampling compared with historic period averages, 2) detected below historic average detection limits, or 3) not detected in either data set.

The constituent averages for flares in the recent data set were either 1) less in recent sampling compared with historic averages, 2) detected below historic average detection limits, or 3) not detected in either data set.

5.1.2 Non-Routine Special Studies

5.1.2.1 Landfill Gas Surface Emissions (Flux Chamber Study)

Surface flux chamber[9] sampling was conducted in response to concerns expressed by members of the CAB. Flux chamber testing directly measured and quantified emissions of VOCs from the surface of the landfill. Flux chambers were sampled for methane and VOCs at ten locations across the surface of the Main Site in August 2006 to quantify surface emissions of landfill gas. Within a flux chamber, changes in the concentrations of landfill gas constituents were monitored over time. The rate of change of these constituents was used to quantify an emissions rate (or flux) for these constituents.

The flux chamber results indicated an overall lack of detectable concentrations of methane or VOCs above background levels and that there is little, if any, flux occurring from the surface of the landfill. These findings demonstrate that the extensive landfill gas control system and soil cover at the Site provide effective containment of landfill gas. The flux chamber testing and results are discussed in more detail in Appendix B (Section B.7.5).

Data obtained from this study were utilized during the updated Health Risk Assessment described in Appendix J.

5.1.2.2 Trace Metals Emissions Testing

Source tests were conducted to measure emissions of trace metals from the Palos Verdes Gas-to-Energy facility. The testing was conducted as part of the Five-Year Review to address concerns raised by the CAB that the source of trace metals detected in 2002 by the SCAQMD at the Rancho Vista Elementary School located southwest of the Site could be associated with the combustion of landfill gas at the Gas-to-Energy facility. The focus of the 2002 SCAQMD Rancho Vista Elementary School study was to measure concentrations of VOCs, trace metals, and particulate matter in the ambient air surrounding the school. The SCAQMD study concluded that the ambient levels of all the

[9] A flux chamber is a specially designed stainless steel box, open along its base, used to directly measure gas emissions from the surface of the landfill (see Appendix B for additional details).

measured species were at or below South Coast Air Basin ambient background levels with the exception of vanadium and nickel (see Sub-Appendix I-J).

In response to concerns expressed by the CAB, SCAQMD retested the ambient air at the Rancho Vista Elementary School in 2004. In a report released in April 2005 (see Sub-Appendix I-K), the SCAQMD concluded that "*measured metals concentrations were less for every compound measured in 2004 compared to 2002*". They also concluded that some of the higher concentrations of metals detected in the 2002 study were due to renovations being carried out to the athletic field adjacent to the school, which mobilized naturally-occurring metals in the soil.

In addition to the sampling performed by SCAQMD, trace metal testing was performed at the Gas-to-Energy facility (see Sub-Appendices B-C and B-D). The 2004 test program included sampling and analysis for trace metals of fuel inlet landfill gas and boiler exhaust. Representatives from the DTSC, SCAQMD, and CAB, were onsite to observe portions of the testing. The 2006 test program included sampling and analysis for trace metals from existing flares, not tested in 2004, and boiler exhaust.

Based on analysis of the data, most of the trace metals measured were not consistently detected, and those detected were measured at low levels. The trace levels detected during the 2004 study were confirmed by subsequent testing performed in 2006. Vanadium was not detected in either the 2004 or 2006 samples obtained at the Gas-to-Energy facility. Accordingly, vanadium detected by SCAQMD in 2002 at the Rancho Vista Elementary School is not related to the Palos Verdes Landfill. SCAQMD has determined through ambient air testing that the levels of trace metals measured, as well as other constituents of concern in the adjacent school area, are at ambient background levels typical for the Los Angeles Basin. The trace metal testing performed at the Gas-to-Energy facility confirms SCAQMD findings that the Palos Verdes Landfill does not impact the Rancho Vista Elementary School.

Data obtained from these trace metals tests were utilized in the updated Health Risk Assessment presented in Appendix J.

5.1.3 Health Risks Associated with Surface Air

The results of the flux chamber study and the trace metals emissions testing were used in the risk assessment to develop inhalation exposures for fugitive landfill gas emissions and Gas-to-Energy facility emissions, combined. Health risks associated with fugitive landfill gas emissions and Gas-to-Energy facility emissions were found to be well within the risk management goals established by DTSC and require no further action. As previously discussed, the Sanitation Districts have proposed to replace the Gas-to-Energy facility. The risks associated with the proposed Gas-to-Energy facility were calculated and the proposed facility was found to be at least as protective as the existing facility.

5.1.4 Conclusions

At the time of the RI/FS, active landfill gas control systems were operated on the Main Site and on the South Coast Botanic Garden. Based on the data collected during the RI/FS, the remedial action objective for landfill gas was "continued maintenance and

monitoring of the landfill gas collection system". The landfill gas control systems have continued to be operated, maintained, improved, and monitored since the RAP.

Recent routine air monitoring data were compared with data collected during the RI to document the effectiveness of the landfill gas control system and to ascertain if landfill conditions have changed over time. Results of ambient air and integrated surface gas monitoring indicate that recent air quality above the surface of the landfill is better than air quality quantified during the RI. Flare and boiler emission testing indicated that average destruction efficiencies are within SCAQMD permit and Rule 1150.1 requirements.

The updated Health Risk Assessment confirmed that the current landfill gas collection systems are protective of human health and the environment. In addition, the Health Risk Assessment concludes that the proposed Gas-to-Energy facility will be at least as protective as the existing facility.

5.2 Subsurface Gas Monitoring

The assessment of subsurface landfill gas containment was based on several types of routine and non-routine special monitoring. The routine boundary probe monitoring was used to determine the effectiveness of the landfill gas containment systems. Non-routine special sampling was conducted to address concerns raised by the CAB and included installation and testing of onsite and offsite soil gas probes to assess the potential for subsurface migration of landfill gas offsite to adjacent properties. Soil gas data obtained immediately above groundwater plumes were also used to assess potential vapor emissions from contaminated groundwater[10]. Analytical results from soil gas sampling were used to provide data for the updated Health Risk Assessment.

The subsurface gas data and analysis are discussed in more detail in Appendix C.

5.2.1 Routine Monitoring

5.2.1.1 Boundary Probe Monitoring

Subsurface gas samples are collected from boundary probes in compliance with the SCAQMD and California Integrated Waste Management Board (CIWMB) requirements and objectives. The boundary probe monitoring network is shown on Figure 8. Boundary probes are sampled to assess potential landfill gas migration offsite. Although Ernie Howlett Park is not subject to SCAQMD Rule 1150.1[11], boundary probe monitoring continues to be performed for this portion of the Site.

As described above, methane is monitored because it is readily distinguished from its ambient air background level and is proportionate to other potential landfill constituents. Monitoring is conducted by recording methane levels from each subsurface boundary probe surrounding the Site. VOC samples are also collected from the boundary probe at

[10] Groundwater plume maps are provided in Appendix A.

[11] The area that is now Ernie Howlett Park is not required to be monitored by the Sanitation Districts pursuant to the Rule 1150.1 Compliance Plan approved by SCAQMD.

the Main Site or Botanic Garden with the highest methane reading or from a random probe at the Main Site or Botanic Garden if no methane is detected.

A summary table of boundary probe monitoring data is presented in Appendix C (Table C-1).

5.2.1.2 Methane Monitoring

In order to assess the effectiveness of the landfill gas containment facilities, recent boundary probe monitoring data were compared to SCAQMD Rule 1150.1 Compliance Plan criteria. Nearly 46,000 samples were collected from the boundary probes between July 1994 and December 2006: 31,321 from Main Site, 10,564 from South Coast Botanic Garden, and 4,066 from Ernie Howlett Park. The number of boundary probes with methane detections at or above the action level[12] has been decreasing. For example, at the Main Site there were three detections at or above the action level in 2002, only one in 2003, 2005, and 2006, and no methane detections at or above the action level in 2004. Detections at or above the action level at Ernie Howlett Park occurred in two boundary probes, one probe in 1998 and the other in 2005. Installation of passive rock trenches has been effective in satisfying gas control needs at the park. Methane was not detected at or above the action level in boundary probes at the South Coast Botanic Garden in the recent time period.

A comparison of recent and historic boundary probe data indicates that landfill gas was well controlled in the historic and recent time periods. It is noted that declining landfill gas generation as the landfill ages reduces the potential for landfill gas migration. All detections of methane, at or above the action level, were remediated within timelines specified in the SCAQMD Rule 1150.1 Compliance Plan. Accordingly, there have been no violations of SCAQMD requirements.

5.2.1.3 VOC Monitoring

For each of the three landfill areas, the majority of the average VOC concentrations were either less in the recent sampling compared with the historic period, were detected at levels less than historic period average detection limits, or were not detected in either data set.

The routine boundary probe monitoring data were not used in the updated Health Risk Assessment because they were not representative of conditions along the most permeable pathways from the Site. Instead, special studies were conducted to obtain depth-specific soil gas concentrations within the potential subsurface gas migration pathways at the Site as described below.

[12] The SCAQMD methane action level for boundary probe samples is five percent. If greater methane levels are observed, actions are taken to eliminate methane from the area within the timelines specified in the SCAQMD Rule 1150.1 Compliance Plan.

5.2.2 Non-Routine Special Studies

5.2.2.1 Onsite and Offsite Soil Gas Probe Studies

To address concerns expressed by the CAB regarding the adequacy of the existing landfill gas boundary probe monitoring system, two soil gas studies were conducted to obtain subsurface gas concentrations at preferential pathways along the boundary of the Palos Verdes Landfill.

The purpose of these studies was to assess subsurface gas concentrations along the most permeable potential migration pathways from the Site and at nearby offsite residences. The types of compounds detected in offsite soil gas samples are consistent with ambient air and past offsite land use patterns documented by the California Integrated Waste Management Board's recent investigation of the Disposal Gardens (CIWMB, 2006)**,** as discussed in Appendix I. In addition, comparisons of compositional data and patterns of detections (Section C.7.4 in Appendix C) show that landfill gas has not migrated offsite.

5.2.3 Health Risks Associated with Subsurface Gas

As specified by DTSC, the results of the onsite and offsite soil gas studies were used to assess potential health risks associated with subsurface gas migration from the Site. The risk assessment considered inhalation exposures associated with indoor air inhalation of landfill gas and off gassing from groundwater. The estimated potential health risks from inhalation of vapor associated with the trace soil gas concentrations are within the risk management goals established by DTSC (see Appendix J).

5.2.4 Conclusions

The routine boundary probe monitoring indicates that there have been no violations of SCAQMD requirements and that methane detections above action levels were remediated within the timelines specified in the SCAQMD Rule 1150.1 Compliance Plan. Therefore, the landfill gas collection system is effective at controlling subsurface landfill gas migration.

The onsite and offsite soil gas studies confirmed that subsurface landfill gas is not migrating from the Palos Verdes Landfill into adjacent properties.

The updated Health Risk Assessment confirmed that the landfill gas collection system is protective of human health and the environment.

6 Assessment of the Soil Cover

The soil cover at the Site is part of the landfill gas containment system and works in conjunction with gas system to prevent landfill gas emission. In addition, the soil cover prevents direct human contact with the wastes buried within the landfill. The soil cover at the Site is maintained to ensure adequate performance. Maintenance activities have involved the placement of additional soil to repair cracks or to correct the drainage of an area that has settled. As a result of final cover maintenance activities performed since 1980, the thickness of the cover has increased. As described in Appendix I.10, the average thickness of the Main Site top deck cover is approximately seven feet. Moreover,

the soil cover at the Site complies with applicable State Water Resources Control Board standards for final cover. Soil cover data are discussed in more detail in Appendix D.

6.1 Soil Investigations

Two soil cover sampling investigations were conducted during the Five-Year Review. The first investigation, conducted in 2004, had two goals 1) verification of polycyclic aromatic hydrocarbons (PAH) detections in one area of the landfill identified during the RI and 2) assessment of recently imported soil to address concerns raised by the CAB. No semi-volatile organic compounds (SVOCs) or PAHs were detected in the 2004 soil cover samples. Metal concentrations in 2004 soil samples were generally within the range of background soil samples and within the range of values found in common soils in the United States. No evidence of PAHs was found and overall the data indicate that the imported soil is clean fill material and no contaminated soil has been used to fill low spots on the Site.

The second investigation was conducted in 2008 to verify detections of arsenic in areas sampled during the RI. As described in the Sanitation Districts' August, 2008, Technical Memorandum to DTSC (see Appendix D-A), additional soil samples were obtained in 2008 to verify arsenic results previously obtained during the RI and to support the updated Health Risk Assessment as described in Appendix J. The results of these investigations are consistent with the placement of heterogeneous natural soils as cover material at the Site. Data obtained during the RI, 2004, and 2008 cover soil sampling programs were used to conservatively estimate potential health risks associated with surface soils as discussed in Appendix J.

6.2 Health Risks Associated with Soil Cover

The risk assessment considered incidental ingestion of soil, dermal contact with soil, and inhalation of soil particles released to the air as potential exposure pathways. The estimated potential health risks associated with exposure to cover soil through these three pathways are within the risk management goals established by DTSC for the corresponding onsite land use conditions.

6.3 Conclusions

The soil sampling data are consistent with the placement of heterogeneous natural soils as cover material at the Site. Further, the data indicate that the soils imported for maintenance of the cover were clean fill material and no contaminated soil has been used to fill low spots on the Site.

The updated Health Risk Assessment confirmed that the current soils used to cover the landfill are protective of human health and the environment.

7 Assessment of Storm Water

Although DTSC does not regulate storm water discharges to the underground storm sewer system, the Palos Verdes Landfill Five-Year Review Work Plan (Todd and RBD, 2004) included an assessment of storm water because the CAB was concerned that storm

water discharges could potentially pose risks to human health and the environment. The assessment of storm water discharges is discussed in more detail in Appendix E.

As required by the National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges of Storm Water Associated with Industrial Activities (General Industrial Permit) and as described in the Storm Water Pollution Prevention Plan (SWPPP) for the Site, the Sanitation Districts have implemented structural and non-structural Best Management Practices (BMPs) at the Site to contain any leaks or spills and prevent storm water pollution. The structural BMPs at the Main Site include secondary spill containment systems and dry-weather diversion systems. Secondary containment and/or diversion structures are provided for all fuel storage areas, chemical storage tanks (at the existing Gas-to-Energy facility), and liquid (landfill gas condensate, underdrain liquid, and extracted groundwater) storage and treatment areas. Dry-weather diversion systems are designed to capture and contain up to 7,000 gallons of nuisance flow or spilled liquids in their respective drainage areas. These systems are also equipped with alarms to ensure dry-weather flows are collected and managed properly. In addition to the diversion of dry-weather discharges, these systems capture and divert some storm water discharges. The captured flows are discharged to the sanitary sewer pursuant to Industrial Wastewater Discharge Permits as described in Appendix F.

Despite the fact that storm water can mobilize particulates in natural soils, recent regulations have focused on controlling these suspended solids in addition to pollutants of concern related to industrial activities. The BMPs implemented at the Site to minimize erosion potential and reduce sediment transport include maintenance of vegetation cover, protecting storm drain inlets, providing drains on slopes, hard-armoring and soft-armoring flow paths, and the use of silt fences and sandbag check dams to slow storm water runoff and remove sediment. In addition to the structural BMPs implemented at the Main Site, the Sanitation Districts have implemented non-structural BMPs to prevent storm water pollution. These BMPs include employee training and implementation of preventative maintenance, spill prevention and response and material handling and storage procedures, and scheduling soil disturbance activities at times when potential impacts to storm water are minimized.

7.1 Routine Storm Water Monitoring

Storm water quality data collected in the historic and recent time periods were assessed to determine whether there are trends in storm water quality over time. The storm water data indicate that the current suite of BMPs is effective, and that the Palos Verdes Landfill is currently in compliance with the General Storm Water Permit for Industrial Activities issued by the State Water Resources Control Board. A summary table of storm water monitoring data and a discussion of the storm water results are provided in Appendix E.

7.2 Health Risks Associated with Storm Water

As described in the Health Risk Assessment (Appendix J), the public is not exposed to storm water discharges; therefore, this source was not quantified in the risk assessment.

7.3 Conclusions

The updated Health Risk Assessment determined that storm water discharges were infrequent and channeled offsite through the storm water drainage system, thus there is no public exposure to storm water. Consequently, there are no risks to assess. Therefore the current method for managing storm water from the Site is protective of human health and the environment.

The updated Health Risk Assessment also determined that past spills to the storm water system were infrequent and not deemed to pose a long-term hazard. Since the risk assessment is based on long-term exposures to potential contaminants, this source was not quantified in the risk assessment. Short-term exposures are subject to California Occupational Safety and Health Administration (Cal/OSHA) limits. Based upon the dilute nature of liquids generated at the Site, any short-term exposure would not exceed any applicable regulatory standards.

8 Assessment of Industrial Wastewater

Although DTSC does not regulate industrial wastewater discharges to the sanitary sewer system, the Palos Verdes Landfill Five-Year Review Work Plan (Todd and RBD, May 2004) included an assessment of industrial wastewater at the CAB's request and because the industrial wastewater discharge is the final step in the containment systems. A majority of the flow discharged to the sanitary sewer receives pre-treatment prior to discharge. The pre-treatment consists of an oil/water separator, an air stripper, and a clarifier. All wastewater from the Site is discharged to subsurface sanitary sewer lines. Wastewater is further treated at the Joint Water Pollution Control Plant in the City of Carson.

8.1 Routine Wastewater Monitoring

Wastewater generated at the Site is tested for the constituents identified in the applicable industrial wastewater discharge permits. The data were evaluated for the historic and recent time periods. Recent data are compared to the currently applicable permit limitations to assess compliance with the permits. The industrial wastewater data indicate that the Palos Verdes Landfill has not had a single exceedance of the industrial wastewater limitations for VOC or SVOCs in the recent period. The Site had sporadic exceedances of the limitations for pH, soluble sulfides, zinc, and selected pesticides; however, these issues have been resolved and the Site is currently in compliance with all of the industrial wastewater permits. A summary table of industrial wastewater monitoring data and a discussion of the industrial wastewater results is provided in Appendix F.

8.2 Health Risks Associated with Wastewater

The updated Health Risk Assessment determined that the wastewater system is fully contained and there was no potential for exposure to industrial wastewater, consequently there were no health risks.

8.3 Conclusions

The wastewater generated at the Site is contained in pipelines and is discharged from the Site via subsurface sanitary sewer lines. These systems prevent public contact with the wastewater and are operating effectively. The Site is in compliance with its industrial wastewater discharge permits.

The updated Health Risk Assessment determined that there was no exposure to industrial wastewater; consequently there were no health risks. Therefore the current method for managing wastewater from the Site is protective of human health and the environment.

9 Updated Health Risk Assessment

An updated Health Risk Assessment was conducted as part of this Five-Year-Review and is included in Appendix J. The risk assessment was conducted in accordance with California State and USEPA risk assessment guidance (DTSC, 1992; 1994; 1999; USEPA, 1989) and evaluated the potential for human health risk from constituents present at the Site. The key assumptions in the risk assessment reflect standard practice of DTSC and conservatively reflect continued current facility conditions and operations.

The risk assessment identified and assessed potential health risks associated with 48 constituents of potential concern (COPCs). COPCs were evaluated for both carcinogenic and noncarcinogenic effects. Each of the three Site areas (Main Site, Ernie Howlett Park, and South Coast Botanic Garden) and areas immediately adjacent to the boundaries of the Site were evaluated as areas of potential concern.

Future land use at the Site and in the surrounding community was assumed to remain unchanged for purposes of the assessment. Although, it is important to note that to be conservative, the assessment did not consider the reduced air emissions that will result from future implementation of the Gas-to-Energy Facility Phase II Project. Thus, the assessment overestimated risks associated with the Gas-to-Energy facility since implementation of the proposed Phase II Project will reduce the projected risks.

The assessment considered various potentially exposed populations (receptors) including onsite recreational users, onsite workers, onsite maintenance workers, and offsite residents. The assessment also considered sensitive receptors, such as children.

Receptors can come in contact with landfill contaminants by various pathways. The potential pathways evaluated in the assessment included: inhalation of suspended particulates and volatiles in outdoor air, inhalation of volatiles that migrate to indoor air, incidental ingestion of soil containing COPCs, and dermal contact with surface soils. The source of volatiles in indoor air included both subsurface migration of landfill gas and off gassing from the groundwater plumes. Exposure to storm water and industrial wastewater are not considered complete pathways because these discharges are contained and channeled to the subsurface drains.

To quantify exposures, statistically representative concentrations (maximums and averages), were estimated for COPCs in impacted environmental media in accordance with DTSC direction (DTSC, February, 2008a and b).

Risk characterization is the final step in the risk quantification process, combining the information developed in the toxicity assessment and the exposure point concentrations. Risk characterization is the estimate of potential carcinogenic and noncarcinogenic effects of COPCs over a lifetime of exposure.

Table 1 summarizes the potential health risks in terms of the incremental lifetime cancer risk (ILCR) and noncancer hazard index (HI) for the defined receptors at Ernie Howlett Park, the Main Site, the Botanic Garden, and offsite residents based on maximum exposure point concentrations.

Table 1: Summary of Health Risks - Maximum Exposure Point Concentrations

Receptors	Hazard Index (HI)	Incremental Lifetime Cancer Risk (ILCR) (Risk in a Million)
Offsite		
Resident	0.047	2.1
Ernie Howlett Park		
Maintenance Worker	0.0044	0.16
Onsite Worker	0.11	4.0
Recreational User	0.046	0.66
Main Site		
Maintenance Worker	0.0046	0.24
Onsite Worker	0.11	5.2
Recreational User	0.046	0.74
Botanic Garden		
Maintenance Worker	0.01	0.54
Onsite Worker	0.14	10
Recreational User	0.059	1.0

In accordance with DTSC direction, an alternate set of risk projections was also prepared using average exposure point concentrations instead of maximums. Table 2 summarizes the potential health risks in terms of ILCR and HI for the defined receptors at Ernie Howlett Park, the Main Site, the Botanic Garden, and offsite residents.

Table 2: Summary of Health Risks - Average Exposure Point Concentrations

Receptors	Hazard Index (HI)	Incremental Lifetime Cancer Risk (ILCR) (Risk in a Million)
Offsite		
Resident	0.045	2.0
Ernie Howlett Park		
Maintenance Worker	0.0043	0.15
Onsite Worker	0.11	3.9
Recreational User	0.044	0.64
Main Site		
Maintenance Worker	0.0043	0.23
Onsite Worker	0.11	5.1
Recreational User	0.045	0.72
Botanic Garden		
Maintenance Worker	0.0059	0.33
Onsite Worker	0.11	6.6
Recreational User	0.048	0.81

The purpose of a health risk assessment is to provide a conservative estimate of the potential for health effects from residual constituents at the Site. Therefore, the methodology used throughout the risk assessment assured that uncertainties err in the direction of health protection. Although it is difficult to quantify the uncertainties associated with all the assumptions made in the risk assessment, the use of conservative assumptions is likely to contribute to a substantial overestimate of exposure and, hence, of risk. Language suggested by the USEPA (1989) to explain the effect of using conservative assumptions in regulatory risk assessments is as follows:

> *"These values are upper-bound estimates of excess cancer risk potentially arising from lifetime exposure to the chemical in question. A number of assumptions have been made in the derivation of these values, many of which are likely to overestimate exposure and toxicity. The actual incidence of cancer is likely to be lower than these estimates and may be zero."*

9.1 Conclusions

The projected HIs are well below the typically accepted hazard index of 1 for all subject receptors. A comparison of the projected risks in this report and those previously projected during the RI (Sanitation Districts, June 1995a), shows a decline in risks to Site users and surrounding residents. The ILCRs for onsite workers, visitors, and surrounding

residents are within the risk management goals established by DTSC. In addition, the Sanitation Districts have proposed to replace the Gas-to-Energy facility. The Health Risk Assessment concludes that the proposed Gas-to-Energy facility will be at least as protective as the existing facility.

10 Assessment of Supplemental Community Concerns

DTSC and the Sanitation Districts worked extensively with the CAB to address potential community concerns relating to the Palos Verdes Landfill and nearby properties. Detailed responses to supplemental issues raised by the CAB are provided in Appendix I and the following conclusions resulted from these investigations.

- The proposed Gas-to-Energy project would not have any significant impacts on the community or on schools surrounding the Palos Verdes Landfill.
- The Site's emergency response and health and safety plans were thoroughly reviewed and the Site was determined to be compliant with applicable rules and regulations.
- The existing control systems effectively prevent underground fires at the Site. Accordingly, monitoring devices, such as carbon monoxide detectors, are not needed.
- The Palos Verdes Landfill has implemented a spill containment system and has not had an offsite spill of landfill liquids since the system was implemented.
- Seepage observed within Country Hills Estates and the Country Hills Shopping Center is the result of naturally occurring hydrogeologic and geochemical conditions and is not associated with the Palos Verdes Landfill.
- The Sanitation Districts' irrigation usage is appropriate for the plant demand at the landfill and the landfill did not contribute to the landslide that occurred in the County Hills Estates community.
- Landfill slopes were analyzed and were determined to be stable and able to withstand the most severe earthquake expected at the Site.
- The contaminants detected at the former site of the Torrance Sand and Gravel Company (also known as the Disposal Gardens) are unrelated to the Palos Verdes Landfill.
- The soil cover at the Palos Verdes Landfill is composed of clean fill material and no contaminated soil was used to cover the Site.
- The Palos Verdes Landfill does not impact air quality at the Rancho Vista Elementary School.

11 Recommendations and Follow-up Actions

11.1 Groundwater

Since the groundwater plumes are stable and no drinking water supplies are impacted, continued operations and maintenance of the groundwater remedial systems and monitoring of the offsite plumes is recommended to verify continued stability.

11.2 Landfill Gas

Continued operation, maintenance, and monitoring of the landfill gas systems are recommended.

11.3 Soil Cover

Continued maintenance of the soil cover and monitoring of surface water runoff is recommended.

12 Protectiveness Statements

In answering the questions posed for the technical assessment:

- The remedial systems are functioning as intended by the decision documents with respect to all media,
- The remedial action objectives used at the time of remedy selection are still valid, and
- No other information has come to light that call into question the protectiveness of the remedy.

12.1 Groundwater

The groundwater containment remedy is protective of human health and the environment. This statement is based on the following findings.

- Offsite groundwater contaminant levels are low.
- The extent and magnitude of the offsite groundwater plumes have remained stable or decreased.
- The mass of contaminants in the offsite plumes has declined over time.
- Under current and future conditions, there is no groundwater exposure since offsite groundwater is not used for drinking water.
- The updated Health Risk Assessment found estimated potential health risks associated with inhalation of vapor associated with groundwater degassing are within the risk management goals established by DTSC.

12.2 Landfill Gas

The landfill gas collection and control system is protective of human health and the environment. This statement is based on the following findings.

- VOC levels in ambient air samples upwind and downwind of landfill are statistically the same and comparable to local background ambient air.
- VOC levels in integrated surface gas samples are comparable to local background ambient air.
- Integrated surface gas monitoring and flare and boiler destruction efficiencies have continually been in compliance with the regulatory requirements and objectives set forth by SCAQMD.
- Surface flux chamber measurements found no detectable flux from the landfill.
- Trace metal testing performed at the Gas-to-Energy facility found that the landfill does not impact the Rancho Vista Elementary School.
- Boundary probe monitoring has continually been in compliance with the regulatory requirements and objectives set forth by SCAQMD and CIWMB.
- The potential for landfill gas migration continues to be minimized as landfill gas production declines.
- Analytical results from both onsite and offsite studies indicate that subsurface landfill gas is not migrating from the Site.
- The updated Health Risk Assessment (Appendix J) found that estimated potential health risks associated with inhalation of fugitive landfill gas emissions were within the risk management goals established by DTSC.
- The updated Health Risk Assessment (Appendix J) found that estimated potential health risks associated with emissions from the existing Gas-to-Energy facility were within the risk management goals established by DTSC. The Sanitation Districts have proposed to replace the Gas-to-Energy facility. The risks associated with the proposed project were calculated and found to be at least as protective as the existing Gas-to-Energy facility.
- The updated Health Risk Assessment found estimated potential health risks associated with inhalation of vapor associated with subsurface landfill gas (plus groundwater degassing) are within the risk management goals established by DTSC.

12.3 Soil Cover

The soil cover is comprised of clean native and imported fill and the estimated potential health risks associated with exposure to cover soil are within the risk management goals established by DTSC for the corresponding onsite land use conditions.

12.4 Storm Water

Landfill related impacts to storm water are controlled with BMPs and inadvertent spills on the Site have been mitigated through the implementation of dry-weather diversion systems. Storm water discharges are infrequent and channeled offsite through the storm water drainage system, thus there is no public exposure to storm water. Consequently, there are no risks to assess. Therefore, the current method for managing storm water from the Site is protective of human health and the environment.

12.5 Site Staffing

Currently, Sanitation Districts' personnel are onsite 24 hours per day in order to operate the Gas-to-Energy facility. If in the future the staffing is reduced to less than 24 hours per day, then a written plan should be provided to DTSC that outlines how the Sanitation Districts will respond to incidents at the Site during those times where there will not be personnel onsite.

13 References

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